Chapter 1

Introduction to Rich-Prospect Interfaces

In the early stages of a new technology, people tend to think that its purpose is merely to replace and improve on something they already know. The promise of the new is thought to be quantitative: the new thing will do the old job faster, more efficiently, and more cheaply. Tools, however, are perceptual agents. A new tool is not just a bigger lever and a more secure fulcrum, rather a new way of conceptualising the world.

(McCarty 1991)

In this book, we discuss our efforts, as designers, programmers, and scholars in the humanities, to explore some theories we have about how we can improve people’s experience in working with digital collections and documents. As authors, we represent collectively a variety of educational backgrounds and research experiences in visual communication design, literary studies, digital humanities, and computer science, and we routinely work with others who bring deeper skills in these areas as well as complementary skills in other areas. We believe that the approach that we take and the results we achieve benefit from our multidisciplinary perspectives and that our work will be relevant to colleagues working in several fields.

Our strategy has been to create prototypes that reify (and refine) our theories, in consultation with the intended users of the tools. The task is complex and open-ended, since the theories could be instantiated for testing in a variety of ways. Moreover, the responses of users trying out the systems are influenced by any number of factors that may or may not derive directly from the tools. There are also diverse opinions about the best ways to consult people, ranging from controlled psychometric experiments in labs, which produce comparative statistics, to thinkaloud protocols and screen captures, which provide potentially richer qualitative data about fewer people, to in situ observational studies or documentary reports of people living with new technologies in their homes and workplaces.

Different research communities also espouse different standards with respect to appropriate numbers and kinds of participants, the nature of the introductory information participants receive, and the types of tasks or questions that yield the most useful results. From our perspective, we think it is important to recognise that we are primarily interested in formative rather than summative studies, meaning that we hope to learn what we can, then move on to the next iteration of a prototype or to the next project (this is in contrast to other objectives, such as understanding a user community or conducting an in-depth study of a production-level tool). We are also working with digital artifacts that are amenable to our revision. Although large summative studies performed under carefully controlled conditions remain
the primary interest of many publication venues, we believe that the core work consists of reifying a theory by creating an object that can be studied and revised, and in order to do that, a series of small studies is often more than sufficient. As David Sless (2004) has said, if you are someone who has built a staircase and are interested in finding out if any of the stairs creak, how many participants do you need to walk up the stairs?

In total, we have produced well over two dozen experimental prototypes, for nearly that many different communities of people and kinds of data, and we have used a wide range of existing methods for finding out if we are actually improving people’s experience in working with digital materials. Links to many of these prototypes can be found at the following URLs:

- humviz.org
- monkproject.org
- inke.org
- voyeurtools.org

Where it seemed appropriate or necessary, we have also worked on developing new research methods for studying prototype digital humanities tools (Chapter 3).

Our starting point – some 10 years ago – was the idea that retrieval systems, or search engines, are often provided to users when dedicated browsing technologies would be more congenial for the user. From a tool provider perspective, this is not surprising since search interfaces (such as the Google single box model) tend to be much easier and faster to design and develop than meaningful browsing interfaces. The danger is that the user may not realise that a more nuanced way of exploring a dataset is possible and that the dataset remains needlessly mysterious.

For people who are looking for a well-defined target document, search interfaces, based on more or less sophisticated retrieval engines, are a good solution. However, users looking for an understanding of an entire collection and how the various components comprising it interact are not well served by retrieval interfaces. The limitations of a retrieval interface become even more apparent when potentially useful information is available in the relationships between items – how they group, for instance, or whether they are sequenced in some particular way, or if they happen to be a component in some more complicated structure such as a tree or a pattern of relationships. Often this information is stored in ways that are invisible to the user, being contained, for example, in structural and semantic markup, links and anchors, relational fields, and other forms of metadata.

Valuable research has already been done to expand the range of tools and perceptual advantages available to people accessing electronic materials. The literature is impressive and constantly growing, with thousands of papers published annually by scholars at research centers like MIT, UIUC, IBM, HCIL Maryland, Carnegie Mellon, and elsewhere. We owe a tremendous intellectual debt to colleagues in the areas of human–computer interaction, visual communication design, user experience studies, library and information studies, and digital
humanities. We have attempted to recognise some of that important work in this book where appropriate, without attempting to exhaustively contextualise the relevant fields. Our perspective here is what we call experimental prototype design where we try to allow the design and HCI literature (among others) to inform the process of iteratively developing prototypes (we don’t share the same priorities as, say, developers of a widely used online store). In any case, more work remains to be done in the area of tool development in the digital humanities, especially as the number and sophistication of research projects continue to increase.

One of our fundamental beliefs is that providing the user with a wealth of well-designed visual information is better than attempting to artificially or arbitrarily restrict the amount of information provided, especially if certain features of the visual display can be easily controlled by the person using the system (and if those controls presented in an intuitive way). We have been trying to understand the conditions under which this approach is generally useful, but within localised contexts, given the necessity of working with specific people undertaking particular kinds of work with a given type of digital materials. We have also tried to learn which features of the visual display are most important to put under user control. Finally, we have been attempting to expand the range of forms that control can take.

Rich-Prospect Browsing

In many of our experimental interfaces, the home page displays a visual representation of every item in a given collection, combined with tools for manipulating the display. We call these kinds of interfaces “rich-prospect browsers,” using a term first suggested in conversation by the designer Jorge Frascara (1999). Rich-prospect browsers embody the following list of principles:

- The primary page or screen should show a meaningful representation of every item in the collection (these might consist of photos, graphical objects, or pieces of text; however, for brevity, rather than saying “meaningful representation of every item in the collection,” we’ll often opt for the word “image” as shorthand).
- The user should be able to adjust various controls in order to reorganise these images.
- Each item or image should link to more data.
- The available metadata about the images should determine the tools available, so that, for example, metadata that could produce groups should be used for grouping, and metadata about associations should allow the user to see network diagrams.
- Where possible, more than one image should be available, so that the user can choose among alternatives (Ruecker and Liepert 2004).
- The visual organisation of the images should bear meaning that is apparent
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to the user.

- The user should be able to mark the images somehow, so that it is possible to keep track of images even when they are reorganised in the display (Giacometti et al. 2008).

Rich-prospect browsers have the benefit of providing the user with a visual basis for understanding what is available in a collection. This kind of visual knowledge is particularly suitable for many collections of digital cultural objects, where a meaningful image of each item is readily available, and users may not be aware of everything that is in the collection, making searching more difficult. However, our research timeline does not typically involve the creation or digitisation stage. Although there have been some exceptions, in general, we take as our starting point the existence of a digital collection, which usually includes some metadata.

In attempting to develop our list of principles above, and in the process of assessing the degree to which they are valid, we have created a wide range of prototypes. The flagship group consists of a family of eight or nine rich-prospect showcase browsers, each one of which allows people to browse through a different kind of material. For instance, there is a browser for a collection of biodiversity projects in the city of Edmonton (Figure 1.1), another of researcher profiles at Mount Royal University in Calgary, and a third showcasing some of Edmonton’s historic buildings. As a means of introducing the concept of rich-prospect browsing with reference to some specific details, we will use the biodiversity project browser as an example. Carried out in conjunction with the City of Edmonton and the 2009 conference of the International Council for Local Environmental Initiatives (ICLEI), the biodiversity browser was a means of showcasing approximately 60 environmental projects in the Edmonton city region.

The showcase browsers implement a type of faceted browsing (Spiteri 1998) and each relies on the metadata that are specific to the collection, so that for biodiversity projects, the user can group by any of the following criteria, or by any combination:

- project type
- ecological areas
- status
- project lead
- what groups are involved
- biodiversity threats
- methods

To return briefly to the subject of “images” in rich-prospect browsing, note that it is not necessarily straightforward to represent something as complex as a biodiversity project with a picture or graphical object. Some projects have taken a photo of a representative landscape. Others have chosen to identify themselves with a logotype. Ideally, the representations should be meaningful for the users, but
one of our studies (Giacometti et al. 2008) suggests that putting the representation under user control is not as important as it might at first seem. People seem to be able to treat the representations as signifiers for the items they access.

Note too that in cases where a project falls into more than one category, the image gets duplicated, since the goal is not to have a set of mutually exclusive categories, but rather, to allow the user to see within each category what projects are included (obviously, the less duplication of images possible, the better). Returning to the ungrouped display removes the duplicates, which only appear when necessary to display a particular grouping.

Using the Biodiversity browser, people with no knowledge of the projects being done in Edmonton can quickly get a sense of their range and scope. They can recognise with a few button clicks what groups are involved in supporting the projects, what kinds of biodiversity threats are being confronted, and who is leading the work. They can see at the push of one button, and without leaving the screen, the relative proportion of projects within each category. Furthermore, they can begin to understand (or at least speculate) how the people who created the metadata for the collection construed the material. For example, in terms of

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1 The buttons on the left are toggles that allow the user to group the projects. More than one grouping criteria can be applied at the same time. Here all groups are shown, but the user can focus on one group by clicking the header, at which point the others minimise (without entirely disappearing) to the bottom of the screen. Design by Michael Lewcio.
biodiversity threats, the largest group of projects in Edmonton deal with habitat destruction, fragmentation, and degradation – a category that sits alongside climate change, extirpation, and invasive species. A person examining the topic of biodiversity stewardship for the first time would not necessarily guess that these were the kinds of threats that would be listed, or that these were the terms used.

In general, any prospect-based interface should address three fundamental questions for the user; these questions relate to the affordances of the interface and the tools that are provided with it:

- What am I looking at? (Chapter 4: meaningful representation)
- Why would I want to look at it? (Chapter 3: the study of new affordances)
- What can I do with it? (Chapter 2: affordances of prospect)

**Research Life Cycle**

Our approach to research involves a life cycle that is not necessarily unique, but because it is a product of our interdisciplinary approach and the realities of our funding structures, it might be worth pointing out explicitly. In general terms, we have a design phase, a prototype phase, and a production phase. We try to carry out user studies in all three phases. We try to publish or present results in all three phases. Each phase typically requires a minimum of a year, although with many of the prototypes we have been iteratively progressing for two or three times that long (in some cases there’s a renewal of the life cycle with what is partly a continuation of an existing project and partly a new endeavour).

The process often begins with some aspect of what in the business community is called a SWOT analysis: Strengths, Weaknesses, Opportunities, and Threats (Freisner 2010). Given any of these four aspects of a situation, we look at a given area of interest to one of the potential team members. This might be in the form of a domain interest or a research problem. For example, we started looking at visualisations for decision support systems when some of our colleagues in engineering approached us with a series of problems they had been addressing related to making and coordinating decisions in a multi-modal environment. Alternatively, the starting point might be derived from observing an existing trajectory in interface design and thinking of its limitations. An example here is our work on a new kind of timeline that can support multiple conflicting witnesses as well as the concept of subjectivity. It is not unusual for other researchers to be following a similar trajectory, so that for the timeline project, we were able to work with Johanna Drucker and Bethany Nowviskie, whose earlier temporal modeling project produced a wealth of theoretical and practical groundwork.

The real start to the project is a planning meeting where we familiarise ourselves as a team (we often have new collaborators, such as colleagues, clients, or research assistants), we revisit the overall objectives of the project (often described in a grant
propose that led to funding for the project), and we set out tentative timelines and collaborative practices (project governance, modes of communication, and so on).

The next step is often an environmental scan (Albright 2004) and a literature review. An environmental scan proceeds by collecting examples from the internet, combining a series of searches with further investigation of the backlog of visualisation and interface examples sent over time by colleagues. The result is both a subset of selected examples and a report that describes the range. Since not all of the important design innovation is associated with the academic literature, an environmental scan helps us to spot relevant work being done outside the academy. Interestingly, existing environmental scans tend to be easier to find for non-academic projects since academics are not always in the habit of making their preparatory research publicly available. Having realised this more recently, we have become more diligent in making available the full trace of our research work, most often published through a wiki or ticket-tracking system (such as TRAC).

Associated with this activity, we sometimes include the development of personas and scenarios (Cooper 1998). A persona is a written description of a potential user, highlighting specific attributes such as experience and reasons for wanting to use the system. Normally, three or more personas will be necessary, in order to cover a sufficient range of potential users. However, it is important not to multiply personas to the point that they are difficult to remember and use in discussion. It is also a good rule of thumb to avoid giving them comic names, which is often an initial impulse but can tend to become distracting over time.

A scenario, sometimes also referred to as a use case, describes a circumstance of use, typically written as a set of steps that form an outline of the task. The level of detail should be sufficient to include all steps, but not so specific as to constrain the implementation of each step. For example, a typical scenario might begin with “step 1: John opens a file” rather than “step 1: John goes to the File menu and chooses Open.” The former version allows any number of mechanisms for opening files, including double-clicking a data file, pushing a button, or choosing a menu option, while the latter version assumes files will be opened only from a file menu within a running application.

The design phase itself usually involves a dozen or more iterations. The politics of design, programming, users, and domain experts become central at this time, as each contributor brings her own background and practices. For example, the domain experts may feel that some particular aspect of the information should be emphasised, while the users express their primary interest in something else. The designers may suggest an approach that the programmers feel will be unnecessarily difficult to implement, while the programmers may have design ideas of their own that seem to the designers to be visually uninspiring. No one agrees on where the bar should be set for ease of use. We negotiate that terrain and end up with a set of sketches. These might be static drawings or sequences of sketches to suggest how the interaction works, or they might be interactive animations with no real data on the back end. We believe that the importance of the design phase cannot be overstated. The involvement of visual communication designers on the research
team results in a completely different kind of prototype than would be possible
with computer programmers working without designers (we have made it a sine
qua non of our projects to integrate a design perspective). No matter how immersed
in visual culture the programmers might be, the designers are specialists in visual
culture, and the results they are capable of producing through that specialisation
show a significant attention to detail that is not otherwise possible (similarly, there
are technical aspects that may not be fully understood by the designers). There are
innumerable difficulties, however, in finding and training appropriate designers,
since they need to learn how to work with computer programmers so that the
interaction is positive, fruitful and efficient. Similarly, the programmers need to
be open to the idea that design is valuable, time-consuming, and difficult. This
awareness can be difficult to establish, since programming education often ignores
design entirely, or worse yet, gives it a cursory treatment.

Following (or in delayed lockstep to) the design phase is a programming phase,
where a prototype using actual data is created. The goal of the prototype is to allow
a more interactive user study, where people can use a working (if preliminary)
system. At this point, there are often trade-offs around what components get built,
and it is important to keep the dominant project objectives in mind. A prototype is
not a production system, so it may actually be missing many of the components
that we know are essential in a production system (or even in a planned subsequent
prototype), simply because there is nothing to be learned currently from their
presence. It is fairly well understood, for instance, that a production system needs
a search function and a help system. These two components are not necessary
parts of an experimental interface prototype. On the other hand, they are pieces
that users will miss if they are not included in a more widely distributed system.
If we leave these pieces out, the people responsible for the user study need to be
skillful enough to acknowledge their absence and enable the users to move on
to the affordances we are interested in examining. However, in some cases, it is
simpler just to include a rudimentary version of these kinds of components, so that
the user study is easier to conduct. In analysing the results, we put comments about
these features into the category “already well understood.”

The third research phase is development. In some cases, what we have learned
from the designs is sufficient, and we can stop there. At other times, we proceed to
a prototype, or better yet, to a set of prototypes. More rarely still, we think that it
would be worthwhile to create a working system that is reliable and robust enough
for people to use outside the explicit context of a user study. For researchers,
development is fraught with peril, first because creating a production system will
typically consume five times the resources required for a prototype, and second,
because although production software can be seen both as a scholarly activity and
as a kind of service to the community, if it comes with a research agenda, that
aspect is not primary to the project. We therefore have to remember that we aren’t
in the software business – we are in the research business. However, it occasionally
happens that development environments seem worth the resources they require,
and we undertake them. If they are planned properly, they can continue to be the
basis for user studies, and can also be a source of information gathered from a large community of users.

The aspects of this research approach that are probably most unusual in the context of tool development in the humanities are the lengthy design phase, combined with the focus on involving visual communication designers as part of the research team. Typically, academic researchers in human–computer interaction (HCI) or human–machine interaction (HMI) will have been educated as computer programmers or engineers rather than as designers, with the result that design often takes the form of hasty scribbles on the back of an envelope. There is also a well-justified fear of vaporware, or software that is described before it exists, resulting in an urgency in the HCI research community to get to a phase that is publishable. The concern is that anyone can imagine a perfect piece of software, but a working prototype demonstrates that it is more than a concept, that the idea has already been reified in a form amenable to testing. We feel on the contrary that imagining a perfect piece of software in detail is much harder than it sounds, that the design phase is worth pursuing on its own merits, and that the sketches produced by a visual communication designer are a form of reification or embodiment of an idea that is worth discussing at that stage, both from the theoretical perspective and as the basis for initial conversations with users. In other words, the design is a deliverable, just like the working tool. In support of this approach, the design community has a tradition of paper prototyping as the basis for user studies (for example, Helmer-Poggenpohl 1999) and there are parallel arguments made for the value of early user feedback on sketches by researchers in information studies (for example, Dillon 2001).

What is the motivation for placing this unusual emphasis on the design phase? We believe that the aesthetic quality of an interface design typically translates into a part of the Gestalt perception of not just the interface, but instead of the project as a whole. An interface is public relations. Our research life-cycle therefore places an emphasis on design as one of the areas of ongoing research, interwoven with prototyping and production, with user studies taking place in all three areas.

Users

In order for an item to be represented in a meaningful way, it is desirable that the designer be familiar with the types of people who will be using the system (if possible), and understand both how they will immediately perceive what they see, and how in the process of working with the interface they will construct an understanding from the materials they have available. It is equally necessary for the designer to understand the nature of the material itself, since the construction of meaningful representations must occur with respect to the contents of the collection.

It is now widely recognised that to design anything is to be involved in an act of communication, and that to communicate effectively requires some common
terrain that is recognised by both interlocutors. Language itself is such a terrain, but is only part of the larger environment that also includes the presuppositions of the various parties, their personal experience, the public history of which they are a part, and so on (for example, Frascara 2006). In order to properly “position” a design for a particular audience, the designer needs to be immersed in the visual language of that audience. Immersion in visual culture is not typically a part of the user study process, although there are strategies, such as cultural probes (for example, Gaver et al. 1999), where visual information can be collected from a user community, and help to inform subsequent design work.

It is also important to note that a user is not the same person with the same requirements under all conditions. In fact, even within a single session, using the same collection within the context of the same overall task, a person may adopt different strategies as appropriate for different phases of the task.

**Tradition of User Study**

In the field of industrial design, the recognition of user input has a relatively long history. The Environmental Design Research Association (EDRA) was founded in 1969 to promote better understanding of product users and to help inform the design process. In visual communication design, on the other hand, recognition of the central role of the user has been slower to emerge, although it has been growing, and various methods for involving the user have either been developed from first principles or imported from the social sciences (Frascara 1997, pp. 33–59). However, in spite of this affirmative stance, in practice the actual interactions between the designer and the end user are often limited in what might be called a product relationship: something is designed and then handed over as a sealed product to the user; no interaction is possible as the communicative process is unilateral.

**Difficulties of User Study**

Designers may need to know about the intended users of a system, but there are often no such people readily available. For example, in designing a textmining tool for literary scholars, it would be best to find professors or graduate students with research projects that rely on the available collections, and have those people spend the additional time necessary to work with a prototype in carrying out their project. However, professors and graduate students often have more pressing commitments that preclude this kind of engagement. Users who are available for testing may play the part of the end user, but the role is contrived for the purposes of the study and the integrity of the results are likely compromised. Designers may want to know about the intended users, but in some organisations it can happen that the design brief (the document outlining the project) assumes that someone else will be responsible for letting them know what they need to know. It may even be the case that management of the project (especially outside the academic context)
requires limiting the contact of the designers from the end users. Typically, this will be done in order to prevent one of the most serious problems a project can face – namely, scope creep, wherein the bounds of the design are modified or expanded as the project proceeds. Serious scope creep can result in a project that can never be completed, or at least never completed within the constraints of available time and budget. Equally problematic can be the relationship between designers and programmers, who need to negotiate, ideally in consultation with the users, not only what needs to be done but also what form it can and should take. In general, the more attention paid to the details of design, the better the outcome, but it is also true that some designs are easier to implement than others, even though they may be of equal quality from the design perspective. Finally, designers may have users available for study, but may simply not have the time or the expertise to find out what is necessary.

From the perspective of identifying users, if the system being designed is a new system in any substantial way, there may not be an existing body of users to draw upon. For example, in creating a tool that allows humanities scholars to visualise a more sophisticated understanding of time than is possible using a conventional timeline, it would be best to recruit participants who have been working with timelines and expressing frustrations at their limitations. If there are users, they may feel that they do not have the expertise necessary to contribute to the design of an interface – that the work is in the domain of the expertise of others, namely the interface designers.

The result is what Mitchell (1993, p. 36) and others have referred to as “the applicability gap,” where the usability information that is available is either not appropriate or not used by the designer when the work of creating or refining the design happens.

Given the sometimes overwhelming problems of finding and understanding actual users, many studies make use of study participants who happen to be available, such as students or administrative staff. This approach has the value of at least involving actual people interacting with the designer’s ideas. Another strategy, even less connected to actual user-centered design, but very useful as a way of managing client expectations, is the creation of user profiles (or personas), where fictitious people are substituted for actual users (Fleming 1998, pp. 8–9). Discussions of user needs can then be held in the context of the characteristics and needs of the hypothetical person, which serve to reduce the chances for deadlock which sometimes arise between the designer and the client, because there is a third party (albeit a fictitious one) to be referenced in any decision. Since this third party is an invention of the project team, it can be given whatever characteristics seem appropriate to the task at hand. For example, in a project where the team is interested in working within the W3C guidelines for accessibility, it might be useful to introduce a persona named “Ann” who would like to be able to iteratively construct Boolean queries for her project on the history of tobacco. Ann is a 23-year-old graduate student from the Maritimes who suffers from visual impairment and uses screen-reading software. This strategy of raising important criteria
through some characteristic of one of the personas is recommended by experts such as Jordan (2003).

Some studies, however, are based on projects where the actual users have been involved in an iterative design that responds to their feedback with revisions to the system. An example of such a project is the Alexandria Digital Library (ADL), which consists of a geographic database containing a variety of information about various points on the surface of Earth. Researchers with the ADL worked extensively with three target user groups: Earth scientists, information specialists, and educators (Hill et al. 2000, p. 250). The partial list of requirements that derived from these users has eight categories, which are extensive enough that they might be used as a general summary of system features: search functions, session management, result display, user workspace, holdings visualisation, user help functions, usability features, and data distribution.

The ADL researchers emphasised that the design of a system for use by a particular community is essentially different from the design of a system that will showcase its own capabilities. These differences include both content and interface (Hill et al. 2000, p. 257). For example, the team might be tempted to provide a range of image manipulation functions, with no real sense of which manipulations might be most important to the user community. As a result, the controls for those manipulations may not find a prominent place in the interface. It is interesting to note, however, that in spite of the nature of the content and the extensive user participation, the ADL is not an example of a project that provides the user with prospect on the contents of the collection.

**Interface Aesthetics**

The aesthetic knowledge and perspective of artists and designers have either largely been ignored by researchers working with experimental interfaces, or else have contributed in a manner that has not been subject to direct analysis (Bardzell 2009). Whether working with basic web interfaces to text archives, or with projects that combine text and images, or with dynamically interactive experimental prototypes, researchers have the opportunity to extend their understanding through including the study of interface aesthetics alongside more traditional measures of performance and preference.

The significance of the visual is sufficiently evident in all of these cases that aesthetic factors become intrinsically woven with issues of functionality (Dillon 2001, Petersen et al. 2004). For instance, Udsen and Jørgensen (2005) provide a summary of recent studies in interface aesthetics and create a taxonomy of four approaches: the cultural, the functionalistic, the experience-based and the technofuturistic. Ngo et al. (2002) offer a model of interface aesthetics consisting of 14 distinct characteristics: balance, equilibrium, symmetry, sequence, cohesion, unity, proportion, simplicity, density, regularity, economy, homogeneity, rhythm, and order and complexity. Bertelsen and Pold (2004) suggest adapting the process
of art criticism for use in criticising interface aesthetics, using the following categories: stylistic references, standards, materiality and remediation, genre, hybridity, representations, and challenges to expectations and developmental potentials. Hallnäs and Redström (2002) propose the noun “expressional” as a counterbalance to the adjective “functional,” with the former term suggesting the components that go into the continuing presence of the designed computational object in everyday life. Fishwick et al. (2005, 2006) discuss the complex effects of art on computing.

We address the issue of graphic design contributions to visualisation research by emphasising what Frascara (1997) calls “the aesthetic function of design.” We argue that aesthetic function is a composite that includes attracting viewers, holding their attention, and compelling their trust and respect. Design, in other words, is of utmost importance in expressing both the value and legitimacy of digital cultural heritage materials.

Previous studies have shown a significant relationship between perceived aesthetic quality and perceived usability for a variety of cultures. In Japan, Kurosu and Kashimura (1995) found that apparent usability correlates more strongly to aesthetic aspects of the interface than to actual usability. Tractinsky (1997) replicated their results in Israel. Karvonen (2000) takes this line of reasoning further in her Scandinavian study of the relationship between trust and design, finding that people tended to rate web sites with a clearly professional design quality as being more trustworthy than more vernacular sites. On the other side of the debate, however, it might be argued that there is an anti-aesthetic subtext in certain research areas, since effort spent to engage readers through visual appeal (and its related functionality) might be understood as effort lost to more essential research outcomes.

In any case, the connection between graphic design and academic research has implications for the ongoing need for improved communication between the academic and non-academic worlds; one need only consider the number of technology incubators and commercial research parks at campuses, especially in North America. Several strategies are required at different levels, including public information campaigns, academic contributions to popular media, and a significant presence of the academic in the community. In this context of the academic as a public intellectual, one potential role that design has to play is in visually rewarding the reader of research results. Pujol (2001) points out that the visual qualities of professional design are one of the key signifiers by which we distinguish the individual voice from the institutional. If someone hand-letters a sign to advertise a garage sale, we understand the sale as an amateur activity. If that same person employs graphic design skills and produces a glossy poster, we may interpret the same event, at least until we arrive at the site, as a professional rather than amateur activity.

In brief, the graphic quality of a tool’s design, particularly in the areas of visualisation and information design research, can contribute both to the results obtained from user study, and to the reception of those research results. Careful
attention to the details of graphic presentation can have a significant impact on the perceived value of a digital collection, the function of a visualisation system, the research results available from analysis of visualisations, and the dissemination of findings both within the academic community and for the larger public audience.

*The Aesthetic Experience*

Our focus on the aesthetic function of interfaces is in conversation with a considerable body of literature dealing with aesthetic theory, which ranges from the classical interest in discussing aesthetic factors, such as symmetry and balance, to postmodern questions about the cultural role of the aesthetic and the reasons for embracing instead the anti-aesthetic, particularly in fine art (for example, Carroll 2001). From the perspective of perception and response, some theorists focus in particular on the aesthetic experience, which is generally understood to be a form of emotional reaction to a perceived object (Dufrenne 1973).\(^2\) A connection is commonly made between this emotional reaction and its purported function in situating and “civilizing” us:

The value of beauty, then, is that along with human contact it enables us to break out of the otherwise impregnable spiritual isolation to which every one of us is born and to feel ourselves at home in the world. Beauty and friendship enable us to get outside ourselves and to live as we ought to live, in concord with the world we are part of, and to feel ourselves part of it. (Pye 1978, p. 102)

Whether or not the perceived object needs to be a work of art *per se* is open to debate. Dufrenne (1973) takes it as a given for the purposes of his analysis, while Carroll (2001) challenges the assumption that there is any intrinsic connection, pointing out that many works of art are intended to promote other kinds of responses, and that in any case, the interpretive response is often as central as the aesthetic.

For some researchers, the aesthetic experience is a form of seduction. Khaslavsky and Shedoff (1999) discuss the seductive experience, breaking the process into three phases – enticement, relationship, and fulfillment – which translate into a range of requirements that must be met at different points in the interaction between the user and the object.

Finally, a variety of theorists have attempted to operationalise the study of aesthetic experience, whether in its relation to art or to interfaces. Munro (1956), for instance, suggests an empirical approach using semantic differentials, similar to studies in other branches of sociology and psychology. Attempts have also been made to factor the aesthetic experience into its components. For example,

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\(^2\*) In a related discussion, Höge (1990) connects the aesthetic and affordances, making the observation that one of the features of a painting or image is that it does not provide the affordances that its subject matter would provide.
Jennings (2000) defines the aesthetic experience as occurring when a person is consciously engaged in an activity that is immersive, pleasurable, unique, and personally rewarding.

**Related Factors**

There are a number of factors that are not strictly aesthetic in nature, yet are associated with the aesthetic, and are influenced by it. These include discernibility, legibility, meaningful and efficient arrangement of visual elements, and logical structure for navigation. The aesthetic, however, is not intrinsically reliant on these factors. That is, each factor can be successfully addressed in either an aesthetic or non-aesthetic way.

The first two factors are those typically discussed in the context of the design of public signage systems. The factors are whether the sign can be seen – whether it is discernible – and once it has been discerned, whether or not it is legible. In both these cases, the choices made by the designer will have an aesthetic dimension. There are instances of signage which are wonderfully discernible against their surroundings, and which are hallmarks for legibility once they have been discerned, for instance, by the anxious traveler. However, it is not essential that in order to meet these criteria, the signage also be beautiful. The aesthetic is possibly a component, but is neither necessary nor sufficient for the signage to perform its function.

A parallel instance occurs in the design of web pages: the suggestion is often made by designers that part of their work consists in establishing a meaningful arrangement of the visual elements, an efficient arrangement of the menu items and other working parts, and a logical structure for navigation. Certainly these aspects of web design are within the purview of the designer. However, as in the case of signage, it is certainly possible to make a web page that features meaningful placement of items, clear navigation, and efficient arrangement of menus that is nonetheless not aesthetically successful. Design can be mechanical and uninteresting, not to mention the potential pitfalls of poorly used features, such as an annoying and encumbering background pattern, a blinking text, or a distracting animated image.

Although the aesthetic can be a component of design decisions that also affect performance, the aesthetic and the functional have also often been disassociated. For instance, in many practical discussions, the two concepts are placed at difference poles, with the somewhat pejorative term “decorative” replacing the more positive connotations of the word “aesthetic.” The aesthetic in these cases is almost invariably considered a kind of luxury or indulgence, that can be dismissed until the real work is complete, and added on as a sort of icing or final polish to a project that might just as well do without the extra expense and complication.

Function and aesthetics are also occasionally linked, as in Frank Lloyd Wright’s famous modernist formulation “form follows function.” The principle here is that a particular kind of aesthetic – one with a minimal or absent amount of ornamentation
– can be seen as deriving from meeting performance requirements. The futuristic, streamlined look of the designs by Raymond Loewy or R. Buckminster Fuller provide good examples.

However, the various factors that involve the aesthetic can be logically identified, and the aesthetic component separately discussed. For example, it is reasonable to think of good typographic practices as involving an aesthetic component. Page layout is often described in terms of balance and harmony, both of which are aesthetic principles, but these attributes also contribute to the usefulness of the page as an object for sustained reading.

However, as in the earlier examples given for electronic media, it is also possible to have a printed page that serves very well as an object for sustained reading, which is not balanced or harmonious. One thinks, for instance, of pages created using a mechanical typewriter, where the conditions of production were not of the kind that could privilege considerations of experimental modification to line length or sophisticated adjustments of leading, and where font choice was minimal or non-existent. Nonetheless, for two centuries people were able to read typewritten pages, which in fact represented an improvement on readability in many cases, as compared with hand-written manuscripts. So although it is possible to associate aesthetic value with page design, it is not reasonable to say that the aesthetic is intrinsic to the success of the page of text. Our expectations and aesthetic preferences evolve along with available technologies. Matters become more complicated, of course, where pages combine both text and image, and various forms of scholarly apparatus increase the complexity still further.

Confidence

Our proposal is that the aesthetic functions are not necessarily those functions that are typically conscious, intentional, or telic. That is, they don’t refer to the grosser acts of accomplishing a task. Instead, the aesthetic function is to provide the viewer, or in the case of visualisation research the experimental participant, with implicit associations to the notions of quality and attention to detail. The primary aesthetic function in visualisation research is therefore to inspire confidence, which results in a number of advantages to the researcher, the participant in the research (or eventually the user of the system), and the larger community that receives and assesses the results.

This larger function of inspiring confidence can be divided into three sub-functions, related respectively to trust, willingness, and satisfaction.

Trust

Trust is a factor in associations; it deals with the relationship between the user and the designer. In most cases, however, the designer won’t be present when the user is interacting with the interface. It is therefore necessary for the designer to take measures to help instill a sense of trust through the mediation of the interface.
The opposite of trust is mistrust or fear. Trust can become an issue for people using a visualisation tool or computer interface when they fear that their time will be wasted, that they won’t get their tasks completed properly or at all, or that the experience will be unpleasant. They may fear potentially nasty surprises, or inaccurate or misleading results. They may fear the lack of control associated with not clearly knowing what is going on. These are all reasonable fears, and they can be mitigated or even forestalled to the point that they never arise, through the provision of various aspects of the design intended to increase cognitive reassurance.

Cognitive reassurance can be provided in a variety of ways, but some of the factors that should be included are the ready availability of help and the provision of an environment that seems appropriate to accomplish the task. Some informed users want to feel that the designers are familiar with current best practices. In some cases, where best practices change rapidly, it may happen that a particular design does not represent current best practice (or perhaps the designer has justifiable reasons for varying from best practice). However, even in these instances, if the design represents a previous best practice that the user can identify, there is a degree of reassurance possible. For example, the metaphor of the typewriter pervades word-processing technology, with keystrokes producing type on a page, even though there is actually no ink or paper.

A similar case can be made for the visual position of the design. Does it accommodate somebody’s visual culture? Ideally, it should be positioned for the visual culture of the user; however, if there has clearly been attention paid to positioning it within some visual culture, that may be sufficient to indicate that the designer had some kind of user in mind (Cyr 2010, Lim 2010). In some cases a tool is deliberately designed to be more universally applicable, which is likely to require some compromises with respect to cultural specificities.

Whether the cues are in the form of adoption of best practices or in the choice of visual position, or both, the goal should be to impress the user with every aspect of the tool. If everything about it looks considered, and it is clear that a reasonable allocation of resources has gone into its development, then the effect on the user will be to increase trust in the people responsible, which may include the designer, the researcher, and the developer.

A related set of cues have to do with the provision by the designer of visible indications that the interface or visualisation system has been created in consultation with the relevant domain experts. These visible indications work in both directions: from the content expert to the designer and from the designer to the content expert. In this context, one indication of the professionalism of the researcher or developer who has the ultimate responsibility for the design can be the high level of professionalism apparent in the design. The aesthetic quality of an interface design typically translates into a part of the Gestalt perception of not just the interface, but instead of the project as a whole. An interface is public relations.
Willingness
While trust implies a relationship between the designer and the user, willingness is a factor that reflects the user’s internal state during the task. At a basic level, the question is whether or not the user is willing to take on the task at all, given the tools at hand. Subsequently, the question becomes to what extent the user is willing to persevere.

Perseverance is important throughout a task, but is particularly significant when the user perceives that something has gone wrong. The user’s willingness to engage in troubleshooting has to be predicated on the belief that the investment will be rewarded with success in overcoming the difficulty. During troubleshooting, the user invests time and effort without necessarily receiving immediate benefit, based on confidence in a later benefit. Good aesthetic function demonstrates that the designer is trying to pack in rewards whenever rewards are possible.

At yet another level, there is the issue of morale, which is related in part to the influence of the environment over time. Morale is in some sense “willingness writ large,” and the details that can encourage willingness can also support morale. As Pujol (2001) points out, it is important to consider the change in user experience with repeated exposure to the same design. Novelty and amusement can rapidly turn into repetition and irritation, as fashionable trends indicate in any number of fields, and interface design is no exception. However, it is also possible for the designer to create an environment where the attraction of the interface can persist and even grow through repeated exposure. An example of a repetitive task is the use of Google as a search engine, and though the aesthetic of the main screen is generally minimalistic, the occasional appearance of different logos is a good example of providing some additional engagement (see http://www.google.com/logos/).

Satisfaction
Satisfaction can be derived from several different kinds of pleasurable experience, which may function individually or in harmony. Such pleasure can be understood as occurring at three levels: in the tool as effective and attractive; in the high visual quality of the result of the process of using the tool; and in the fact that the project looks more polished when the findings are presented or published. (Additionally, satisfaction may be indirectly associated with a tool based on the quality of derived work that emerged from use of the tool; however, too many factors enter into play with such secondary levels of satisfaction.)

In its extreme form, this value can result in interfaces that are in some senses autotelic – they can become an end in themselves for some users, who find their characteristics sufficiently compelling to make the system worth further attention, outside the context of any particular research task. For some members of the design community, the development of artifacts that can provide autotelic experiences is understood as one of the inevitable evolutionary consequences of a competitive marketplace (Jordan 2000), where tools that are merely functional are eventually
replaced by tools that are functional and also easy to use; these tools in turn are replaced by those that are functional, usable, and also a source of pleasure.

**Tools, Experiments, and Theories**

In late 2008 and early 2009, the digital humanities community briefly turned its attention, in a discussion thread entitled “Thing Knowledge” on the Humanist Discussion Group listserv, to a question that we consider to be significant for the work we are discussing in this book, namely, what do we believe an experimental interface, a prototype, to be? The possibilities can be loosely categorised as tools, experiments, or theories.

First, recognising that many interfaces serve other ends, we can discuss them as tools. That is, the analysis of an interface can rest on how effective it is in providing an affordance for people carrying out a given task. This metaphor has been particularly useful in the commercial design of interfaces as products. As mentioned briefly above, in the industrial design community (Jordan 2000), there is a spectrum that describes the phases in the design of tools, where the early contenders in the marketplace can survive simply by being functional. They are adequate, because of their historical moment, if they can get the job done. However, once competition arises, the next phase is usability. A tool that is both functional and easy to use will eventually win if placed in competition with a tool that is functional but difficult to use. However, time continues to move on, and eventually, when the merely functional tools have all been replaced by tools that are both functional and usable, a third form of tool will emerge – one that is functional, usable, and pleasurable. In this case, the designer has introduced some aspects of the tool that will reward a more nuanced analysis that includes all three levels of performance. This might be considered a type of Maslow’s pyramid of needs for tools.

There are complexities to this somewhat idealised pattern. One is the tendency for people who have learned something with difficulty to persist in its use. Another is the cost-benefit ratio of replacing a working tool with another one just on the basis of the second one being easier to use. A third is with forces of marketing and market-share where design considerations can sometimes be less of a determinant than other forces. A fourth is the added degree of usability or pleasure that the tool can afford, and how that relates to the cost of the tool in comparison to other tools. An example is the Alessi Juicy Salif Citrus juicer, a kind of aluminum spider, designed by Philippe Starke in 1990, that took the domestic kitchen by storm. It was a luxury item, costing two orders of magnitude more than its competition, while performing at the same level of functionality, or arguably even slightly poorer, since it lacked an inner ring to catch seeds and pulp. But it was successful because it introduced pleasure into an area that had stagnated for decades at the stage of usability.
Another way of looking at tools comes from sales and marketing, where they produce what are known as “feature, function, benefit” sheets. A feature is a component of the tool. For example, a laptop might come with a remote control. A function is what the remote control can do – it allows someone to operate some of the laptop’s software at a distance. For people who primarily use their laptops for design or spreadsheets or word processing, this function may seem absurd. But the benefit is for people who, for example, use their laptop as a part of their home entertainment system. A remote control allows those people to control audio and video at a distance – they can hook their laptop to their large screen TV and watch digital movies, sitting on the couch with their feet up on the coffee table (potential factors of pleasure facilitated by the tool). In the right context, the feature not only makes sense, it seems essential. The point here is that it is necessary for the design team who created the product, and by extension the salesperson who vaunts its capabilities, to know all three aspects of the tool: what it is, what it does, and why people might want it. As sales guru Kim Hoyer (2000) puts it: “once the pile of benefits is as high as the stack of money, you have the right conditions for a sale.”

An alternative way of thinking about prototypes, a different metaphor, is to see them as experiments. This metaphor is most commonly used in interface design within the sciences. The purpose of an experiment is to test a theory, typically by helping to generate evidence around some contestable aspect or implication of the theory, strengthening one competing interpretation over another. This is different from the prototype as a tool in two significant ways. First, an experiment is a process that achieves some result. We use a tool, but we run an experiment, implying that it takes place over time, that it has inputs and outputs. Second, no one expects an experiment to work in production mode for many people over an extended time. It is set up and run for a specific purpose, and once the results are in, the experiment can be set aside.

An experiment is also distinct from an experimental apparatus, which is a tool for doing experiments. A working microscope is not an experiment. However, it is possible that a new kind of microscope can be experimental, in the sense that it will need to be subjected to discussion and analysis for its prospective role as a tool. Many, if not most, of the prototypes that we have worked on, and that are created in human–computer interaction programs, are of this kind.

A third approach is to see a prototype not as an experiment, but instead as the reification or embodiment of a theory or idea. In this case, the prototype is not an object in the service of a theory, whether that might be as an experimental apparatus or as an experiment, but instead the visual form of an idea (we believe that all prototypes are the embodiment of one or more implicitly or explicitly expressed theories, but it is not always the expression of the theory that is most important). These kinds of prototypes are most commonly seen emerging from new media programs and fine arts departments, although in some cases they are created by more traditional departments of computing science. Taylor et al. (2009), for instance, describe an interactive digital display where images of jellyfish react to various features of a singer’s voice.
We have argued (Galey and Ruecker 2010), that it is possible not only to consider a prototype as the embodiment of a theory, but further, to treat that embodied theory as though it were an argument that can be read and evaluated, in much the same way that we read and evaluate scholarly articles. Just as we look for an argument to be contestable, defensible, and substantive (Booth, Colomb, and Williams 2008), so we can look for these aspects in a prototype, in effect reading it as a contribution in the ongoing scholarly activity of thinking through making prototypes. This approach is distinct on the one hand from the descriptive paper that is sometimes pejoratively referred to as “me and my project” and on the other hand from the user study report that treats the prototype as a sort of side effect of the primary research activity, which consists of studying how people work with a given technology.

One advantage of emphasising the interface as reification of a theory is that it can help counteract the tendency to see interfaces – even experimental interfaces – as existing entirely for the purpose of serving some other agenda, such as allowing more people to access an existing affordance or providing a faster means of carrying out an action that is already well accepted. Although interfaces often do serve other agendas, it is also possible to consider them as objects of hermeneutic interpretation in their own right. Experimental interfaces in particular are in the privileged position of serving as a means of focusing attention on the larger intellectual and cultural issues that they and their associated collections of digital cultural heritage intersect.

**Interface or Lesson?**

In general, we don’t subscribe to the belief that an interface is a good means of educating people. For example, if a successful textmining interface for literary scholars has to teach the people who use it what textmining is all about, then either it will be very difficult to use such an interface, or else the years typically necessary to educate a textmining expert have been frivolously wasted by people who could have learned what they needed to know simply by using the right interface. What an interface can do is to make the user interactions with the system as straightforward as possible, by providing, for example, visual forms that represent underlying processes (Ruecker et al. 2009). The aesthetic function also has a role to play here.

The interface designer still needs to decide how much the interface will need to inform the user about the underlying system. The answer is perhaps going to differ based on the nature of the task and the sophistication of the interface. No one expects to know how the Google retrieval algorithms work, since they are proprietary to Google, and it would seem strange and irrelevant for the Google interface to mention that online materials were retrieved using some particular algorithm. The interface to Photoshop, on the other hand, offers the users basic information about how they can expect its algorithmic manipulations of images.
to perform, comparing them to roughly equivalent darkroom techniques such as burning or dodging. Further along the spectrum is Excel, where users can directly access and manipulate many of the equations via the interface.

As part of the process of deciding how much the interface needs to communicate about its underlying behavior, the designer needs to know what the users can reasonably be expected to know about the system when they first encounter its interface. In the digital humanities community, for example, there is a research stream that uses techniques that were originally developed and popularised by John Burrows. For this community, it is sufficient to indicate, using the domain-specific jargon or shorthand, that Burrows’s Delta was the analytical approach taken. Only in modifying Delta or in the choice of certain of the parameters of Delta is it necessary to say more. Such conventions assume that everyone using the interface will be familiar with the kinds of algorithms being used. It is not well advised to attempt to bootstrap less informed users into the same group as expert users by employing the interface as an educational tool. An interface which responds to every user request with a lecture on Burrows’s Delta will intimidate naïve users and irritate expert ones.

An ideal interface needs simultaneously to make the underlying processes easy or even pleasurable to use, and to suggest to the user what those processes might be. There are people who feel that command-line interfaces are the high-water mark for human–computer interaction, and every graphical element beyond the command line is superfluous and wasteful. All the interesting work happens on the back end, so why waste computing power on graphics that have nothing to do with the analytics? We believe on the contrary that the command line is too opaque – that it conceals too much behind shorthand function names, cryptic filenames, and single-character switches. Nearly all of our prototypes are graphically intensive, attempting not only to trigger the processes behind the scenes, but also to help the user conceptualise what is going on. The result can be a system that seems to have more graphical analogies for underlying processes than is sometimes the case, even in typical GUIs.

Finally, there is the need to communicate as clearly as possible what the underlying processes are intended to produce. For example, in a supervised classification system, whether using Naïve Bayes or Support Vector Machines, or any one of a dozen other possible approaches, the purpose of the system is to take a set of classes predefined by the user, and find the features those classes have in common, then use the feature sets to add more candidate documents to each class. For a person using such a system, the interface should make clear that the activity of creating “training data” for the supervised classification process consists of defining a number of classes and assigning representative items to them. That is, the minimum that the interface needs to communicate is the appropriate activity or set of activities available to the user, and the outcome to be expected from carrying out each activity. Much less important is that the user have a full understanding of how each of the classification algorithms work.
Design Transferability

One of the consequences of our emphasis on the design phase of software is that we are well positioned to think about the various domains in which a particular type of design might be deployed, producing good conditions for what has been called “design transferability” (Chow and Ruecker 2006). We do not necessarily produce a single design for a particular set of people working on a given task, but instead, we produce a family of prototypes which are related neither by users nor topic area, but instead by a set of design ideas that have been created to work with a specific set of conditions. Our best example is the showcase browsers, where we began with pill identification for seniors (Given et al. 2005, 2007), then moved on to conference delegates (Ruecker et al. 2006), researchers, historic buildings, biodiversity projects, text collections (Giacometti et al. 2008), electron microscope images of wasp-wing features, and engineering textbook diagrams. The felicity conditions that these showcase browsers have in common are:

- hundreds of images
- good metadata for use in grouping items
- a community of people interested in getting an overview of the information and in seeing it grouped in various ways

Similarly, when we were working on the Watching the Script (WtS) project, which was intended to allow people reading plays to think simultaneously about the blocking, we realised that there were many situations where a limited group of people (that is, in WtS, the actors), were moving within a constrained space (that is, a stage), for a prescribed period of time (that is, the duration of the play). We subsequently created designs for a stylised football field and for traffic planning (Sinclair and Ruecker 2006), although these were not fully developed into prototypes. In addition to the benefit for the new context of drawing on previous experiments, another advantage of the transfer is that each new context can help lead to further insights about the tool for the previous contexts.

Design transferability is concerned with leveraging existing assets, in the form of design and prototype software, into new research areas. But it is not about one prototype working in a general way – each of the transferred designs within the family serves a single, situated group of people who have a given task or set of tasks. An alternative approach is to design a system that is general in nature, working with any kind of data but applying the same functions to it. An example of this approach is our Mandala Browser, which allows people to easily create complex queries on an XML file or files by working with a visualisation of the query process. Unlike the showcase family, the design of the Mandala does not necessarily change for every application, although new features may be indicated. For example, in producing a version of Mandala for use with existing collections, it proved useful to modify the system to dynamically query the Application
Programming Interfaces (APIs) rather than reading all the data into the Mandala’s own datastore.

Having a single application is a much more common approach, in part because the early phases of the software market have paralleled the early phases of industry, where it was acceptable for reasons of efficiencies of cost to mass produce a single product. However, design of all kinds has become increasingly customisable, and people often expect to see individual variation that is expressive of corporate culture or personal identity. On the web, for instance, we would find it strange to learn that people did not produce individually designed web pages, or personalise their Facebook accounts (in a web context, it is common to develop variant skins or templates to correspond to different contexts). However, because prototypes are more complicated and costly, we typically don’t think of them in the same way. With a family of designs, transferred between domains, we are not only able to take advantage of previous assets that we’ve already developed, but what we are able to learn from each project helps to inform the next one.

Digital Cultural Heritage

Cultural preservation, and management of cultural heritage materials, through the creation and maintenance of digital collections has been, and continues to be, a central occupation of many libraries, museums, galleries, and archival collections. Whether we are dealing with text, photographs, art, audio or video recordings, 3D virtual models, or hybrids, the social, cultural, and political implications of the digital record are evolving rapidly. So too are the affordances we see emerging from the existence and accessibility of the digital cultural archive, with experiments ranging from the crowdsourced transcription of Jeremy Bentham’s letters (Terras 2010) to the Library of Congress’s folksonomic tagging trials with Flickr Commons (Springer et al. 2008).

What we contribute to the discussion is the specific value of creating rich-prospect browsing interfaces to online collections of digital cultural heritage materials, particularly for the cases described in this book. Rich-prospect browsing interfaces do not reify a theory about a specific kind of users or a particular kind of data. They represent a theory about a set of conditions involving users, data, and metadata, where the collections are of the right size (that is, hundreds or thousands of items, but typically fewer than tens of thousands), have the right conformation (that is, with rich metadata), and are readily represented at the item level. This particular set of conditions comprises the vast majority of digital cultural heritage collections. While the contents of this book may not address the particular complexities of any given project, the principle of design transferability suggests that many of our design approaches can easily be adapted for a wide range of needs.
Research and Development

It might be useful here to add a word of caution about the fundamental nature of experimental interface research, based on experience with a wide range of projects. It can sometimes happen that people mistakenly believe that experimental interface design, especially insofar as it involves visual communication designers and computer programmers, is a form of development or production activity. In software and on the web, there is a spectrum of activity from the conventional to the advanced to the experimental (“experimental” is used here in the sense of innovation rather than in the sense of conducting controlled experiments). Many domain-based projects are not interested in experimental or even advanced issues, but instead require a well-designed database that feeds data to an attractive interface that conforms to contemporary best practices. What we are discussing in this book are systems that are primarily experimental, although in some cases merely advanced, that have taught us a variety of lessons that can hopefully help to inform the next generation of best practices.

Outline of the Book

Following is a brief synopsis of the remaining chapters.

2. I See What I Can Do: Affordances of Prospect

One of the primary ways in which prospect-based interfaces are important is that they provide new affordances that are not found in other kinds of interfaces. An affordance is an opportunity for action in the environment of a given perceiver. The idea was formulated by James Gibson as a way of attempting to find an alternative position in psychology to the schools of behaviorism and mentalism. Gibson felt that, because biological organisms are immersed in an environment, their methods of perception and cognition are directly related to activity in that environment. To distinguish in a somewhat arbitrary way between mental awareness and subsequent action was therefore to miss the point: perception is fundamentally coupled with action. That it is coupled with action in a given environment by a particular creature results in some additional complexity in the theory, which has been one of the grounds for subsequent discussion by researchers in ecological psychology. By placing the significance of the perceptual event in the relationship between the organism and its environment, Gibson emphasised that it is more helpful to examine perception as part of the dynamic process of interaction than it is to see it as a set of discrete steps.

In order to help make the case that prospect-based interfaces provide affordances not found in other kinds of interfaces, one approach is to look at Gibson’s concept of affordances as it is currently understood both in the computing science community and among the ecological psychologists who have built on Gibson’s work. By
examining how affordances have come to be understood, studied, and measured in other areas, it is possible to suggest methods for studying and measuring the affordances of prospect-based interfaces.

Affordances can be complex, taking forms that are nested or sequential, or they can be relatively straightforward. They are distinct from functions, however, in that affordances tend to be multivalent, because human ingenuity can often find more than one opportunity for action when examining an object. Djajadiningrat et al. (2000), in discussing the connection between interaction and aesthetics, describe this multivalence as “richness of actions.” Functions, on the other hand, are often defined independent of the perceiver, and are for the most part unitary. This chapter begins by examining the literature from ecological psychology for insights into the nature and purpose of affordances, in an attempt to open the discourse of interface design to include digital artifacts that can be readily used for multiple purposes.

The other theme of this chapter is prospect. Prospect is a view of the world where enough information is available for the perceiver to understand the terrain and have a sense of what it affords, without necessarily seeing all the details. The idea derives from the habitat theories of Appleton (1975), who was generalising from comments made in European studies of landscape painting. There is a variety of new opportunities for action that can be made available to users of digital collections through rich-prospect interfaces. These new affordances are based on the direct visible presence of information about the contents, structure, and other significant features of a collection, such as how it was understood by its developers, how it has been organised, and, in some cases, how it has been encoded with additional interpretive material that is not contained in the actual text.

The discussion includes the composite affordances that are related to prospect, and examines some of the reasons for interpreting prospect, not as implying a relatively literal digital implementation of the landscape metaphor, but rather more broadly as a set of strategies for providing collection insight through meaningful representation of every collection item.

It is in the details of the metadata for actual collections that the principles of rich-prospect interface design come into contact with the kinds of constraints and conditions that need to be addressed as an intrinsic part of the design process. Complicated as they may be, these details serve to test, validate, and refine the concepts in a way that is otherwise impossible.

3. Is This Thing Working? The Study of New Affordances

Having provided some information on how new affordances can be created through rich-prospect interfaces, this chapter introduces the problem of category error, which is a fundamental difficulty in studying new affordances. Category errors occur when two items are compared which simply cannot be compared: apples and oranges; fish and fowl; thermonuclear devices and rubber mice. Since new affordances are not directly comparable to existing affordances, some methods other than comparison under controlled conditions need to be adopted to study
them. A strategy is outlined for substituting the comparison of affordance strength for the comparison of affordances, and a vector model of affordance strength is developed and explained. The chapter concludes with a variety of examples of user studies of the new composite affordances of rich-prospect interfaces.

4. I Never Forget a Face: Meaningful and Useful Representation of Items

This chapter deals with some issues that are slightly more technical in nature – namely, the need to find a means of representing every item in a collection in some way that is both meaningful and useful to the end user. Various strategies are available, including manually providing a set of keywords for each document, automatically generating representations from pre-existing indexes or tags defined in SGML or XML, and drawing on library classification processes such as those used in facet analytical theory. The discussion also outlines the characteristics of good candidate collections for rich-prospect interfaces, which should be of a certain size, with documents of an appropriate length, and a fairly high degree of homogeneity. Finally, we conclude with a summary of the kinds of insights that are made possible through the meaningful representation of collection items.

5. Invisible Intelligence: Textual Markup for Digital Collections

Markup systems such as eXtensible Markup Language (XML) can be used to define customised tagsets, so it becomes possible for people to insert invisible intelligence in the text, including interpretive material. The original purpose of text tagging is to facilitate retrieval through applying what is essentially a controlled vocabulary of tags. However, the presence of tagging in a collection provides an opportunity for designers to make the tagged material visible to the users of the collection, in ways that will provide greater prospect and all its related advantages. The chapter addresses several issues related to collections with markup, including levels of interpretation provided by tagging; the possible new opportunities for action provided by a rich-prospect interface to the tagset (or schema or document type definition); and the possible value of having some form of prospect on the actual tagging of the documents. It also examines several related issues, including the role played by visual culture; the relationship between rich-prospect interfaces and complexity; and how rich prospect relates to the concepts of constraint and natural mapping. This chapter might be summarised as a response to the question: why is prospect on the markup, as opposed to prospect on the contents, potentially useful? The answer relates in part to the kinds of information that the user might obtain by having prospect on the tagset, and how these kinds of information might be applied in understanding and accessing a collection. It also relates to the question of how the user is able to gain confidence with using a collection through having various assurances of what the collection contains, as well as assurances about how it has been understood by the people who created it,
and how that understanding might translate into various approaches to accessing the materials.

6. The Design of New Interface Tools

Once the items in the collection are visually available in some form to the person accessing the material, some of the perceptual advantages are immediately present. However, these advantages can be extended through the provision of tools that are associated with the rich-prospect display. These rich-prospect tools allow people to modify the structure of the display through processes such as searching, subsetting, grouping, and otherwise arranging the items. This chapter discusses the design issues involved in creating an appropriate set of rich-prospect interface tools, including the provision of interaction histories, where the user of the interface has the opportunity not only to draw on the previous work of other users, but also to store the results of the current session for possible access by subsequent users.

7. Conclusions

The final chapter draws together the various threads of the discussion, providing a summary of the significant advantages to be gained by applying rich-prospect interface strategies to digital collections. It reiterates the important practical consequences that derive from having designers think in terms of affordances instead of in terms of functions, lists some of the design issues involved, and reinforces the lessons learned from examples based on the prototype interfaces.