An Investigation of Image Users across Professions:
A Framework of Their Image Needs, Retrieval and Use

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ABSTRACT
An Investigation of Image Users across Professions: A Framework of Image Need, Retrieval and Use
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The primary objectives of this qualitative research study were the identification, description and explanation of image users’ behaviors. The research examined the image needs, the methods of image retrieval, image selection criteria, and the use of visual materials among several professional image user groups. Also explored were the difficulties these users experienced in their work with visual materials. The findings of the study provide information professionals with the fundamental details of image users’ behaviors. The research presented here should prove useful to system designers, image librarians and collection managers. The study also serves as a framework against which future research can be conducted.

Twenty participants from across four professional image user groups, archaeologist, architect, art historian and artist, were recruited for the study. The user groups were selected based on their similarly strong reliance on images of cultural materials in their work. It was believed that selecting users of similar visual materials would clarify the differences discovered among the groups. Data was collected from the participants through a survey and one-on-one semi-structured interviews and analysis was completed using case-ordered displays and the constant comparative method.

The findings of the study revealed several variations in the image behaviors of the user groups. These consisted of variations in: the reasons
behind why images were needed, the kinds of images they sought, their resource preferences, the factors used in image selection, their search techniques, how they incorporated images into their work processes and how images were used. While variation in the image behaviors across the four user groups were found, an overarching theme of frustration was discovered among all of the study’s participants. The reasons behind the frustration the image users experienced were also explored.
CHAPTER 1: INTRODUCTION

Background

Images, visual representations of the world and ideas around us, have become a pervasive presence in the 21st century. Technological advances and the growth of the Internet have increased access to an ever growing amount of visual materials. Although there has been a great deal of enthusiasm for the entry of images into the digital realm, research on image users has not seen an equally high level of support. This is not a surprising situation given that visual materials have traditionally played a secondary role behind that of the printed word (Turner, 1993; Stafford, 1996).

The user groups under investigation in this study (archaeologists, architects, art historians and artists) are understood to have a high need for images in their daily work routines. The study’s participants are further defined by having two groups of academic users (Archaeologist and Art Historian) and two groups of creative users (Architect and Artist). Many other groups could have been examined in this study, nevertheless these particular user groups were chosen for several reasons. A primary influence on participant selection was research design, as these user groups share a similar reliance on images of cultural objects to perform their work. Additionally the user groups were chosen to represent two basic kinds of work, academic and creative, supported by the use of images. The research study was designed with the intention that similarities among the academic groups and among the creative groups would help illuminate the influence of discipline on image users' behaviors. Practical
considerations also influenced the selection of these groups. The researcher’s experience with assisting these user groups within image collections and her professional connections to these groups would assist in recruitment efforts.

**Problem Statement**

Published studies which focus specifically on the image behaviors of the current study’s populations are rare and so our understanding of their image behaviors is incomplete. Several studies have looked at how critical images are as resources to these disciplines under scrutiny (Pisciotta et al., 2005; Conniss et al., 2000; Challener, 1999; Giral, 1998; Sklar, 1995; Busch, 1994; Childlow, 1991; Gould, 1988). Bradfield (1976) provides the most comprehensive treatment of the subject in her investigation of image collections within institutions of higher education in the United Kingdom. Bradfield’s study examined a variety of aspects such as the subject breadth and image quality needed in collections to support image users, the time users spent finding images and the affective characteristics which influenced users’ decisions to use an image collection. However, Bradfield’s focus was on evaluating the organization and retrieval of information from analog image collections rather than assessing users’ image behaviors. Conniss et al. (2000) also provide a broad examination of multiple user groups in an attempt to assist in system design for image users.

The justification for this study is that image users’ behaviors have yet to be studied fully. Typically previous studies have looked at a single aspect in the broader spectrum of need, retrieval and use processes associated with images and in many cases these studies were conducted with participants with limited
experience working with visual materials. Art historians are one user group that has seen a degree of research into their behaviors and their work with images. For example, Hastings (1999) identified the tools art historians would find useful for working with images in a digital environment. She found several tools, specifically those which allowed for the manipulation of digital images, such as zooming and panning, were fundamental to the use of visual materials for art historians’ purposes. In this same study Hastings discussed several different search levels which were based on the complexity of the questions the art historians asked and answered with their image queries.

The categorization of search queries is among one of the most fully explored topics in image research, but investigations of how discipline may impact users’ search queries are limited. Thus this study sought to examine the search terms used by the various professions under study here. Several earlier studies examined the use of search terms by similar user groups. Chen’s (2001) study investigates how a group of students enrolled in medieval art history courses search for images to complete a term paper assignment requiring the use of images. In this study each of the students’ queries was mapped to categorizations developed by several earlier researchers (Jörgensen, 1998; Fidel, 1997; Enser & McGregor, 1992) in order to judge the usefulness of these models to the discipline of art history. In a similar vein Armitage and Enser (1997) studied queries received by seven image libraries, each with different foci and users (academics, generalists, news personnel, civic planners, etc.). Their study offers some evidence of how user needs impact the types of queries
received by the various collections. For instance, art historians searching for images in the Witt Library were found to use the highest percentage of artists’ names across all user groups investigated by the researchers (Armitage & Enser, 1997). Knowledge about the terms these four image user groups are likely to employ to conduct their searches is incomplete.

Additional issues concerning users’ image behaviors are to be found in the complexities inherent in image retrieval. Difficulties in image retrieval can occur at a basic level. For example, users of images can have great difficulty expressing their needs in a manner running parallel to that of the print world. When the added complexity of translating one’s visual needs to textual ones is considered, a fuller appreciation for the users’ difficulties with image retrieval becomes more apparent (Goodrum & Spink, 2001; Angeles, 1999; Beard, 1991). A user may have a specific image in mind but not be able to summon the terms to retrieve it from a system or, at the other end of the spectrum, a user might have an idea in mind yet not be able to recall a known image or the terms which might retrieve images held by the system (Keister, 1994). Another area of image seeking which has seen a degree of study is the searching tactics employed in image retrieval systems (Goodrum et al, 2003; Frost et al., 2000; Frost & Noakes, 1998; Hastings, 1994). Several studies suggest that the specific needs of users groups and individual user characteristics are a major factor in the various visual information search strategies employed (Matusiak, 2006; Enser, 1993; Batley, 1988).
How image users from various domains evaluate the materials they retrieve through their queries is an additional area needing further exploration. Studies of a similar user group, historians using photographs from the Library of Congress’ American Memory photographic collection, by Choi and Rasmussen (2003 & 2002) have added to the body of knowledge surrounding image users’ criteria for judging relevance. These researchers provide evidence that relevance decisions are influenced by cognitive changes that occur over the course of the information retrieval process. An additional finding of note, which speaks directly to users’ image behaviors, is that browsing was found to be important since judgments of relevance often depend on perceptions of image content. This underscores how critical visual information can be in the search process and suggests that additional research into modes of image presentation may prove fruitful.

Each of the studies mentioned here have added to our knowledge of this topic. However, Fidel (1997) acknowledges the limited state of research surrounding retrieval for and use of images when she notes plainly that several fundamental issues in image retrieval have yet to be fully explored. Part of the difficulty researchers have faced when designing studies of images and their users is a lack of theoretical foundations upon which to base their research. Chen (2001) states that “[i]nadequate research in user studies and a lack of a theoretical background for the design and evaluation of image databases have been repeatedly mentioned as problems in the image retrieval field,” (p. 262).

1 The overlooked and fundamental questions mentioned by Fidel (1997) are: “What are the differences between image and text retrieval? What image attributes are important for retrieval? What are the characteristics of users’ queries for images?” (p. 181).
For this reason it is advisable to adopt a more holistic approach toward the problem in this study. In assuming this stance the study should provide a broad exploratory view of the problem and that this in turn may lead to the development of a theoretical model that could be used to explain users’ image behaviors. Although a single overarching model was not achieved, the study identifies several critical aspects of image users’ behaviors and sets the groundwork for future research.

**Significance of the Study**

Knowledge learned from this investigation will help to fill a gap in our understanding of users’ image behaviors. There has yet to be a thorough treatment of basic aspects concerning image behaviors, the needs of users working with images of cultural materials and how these images are utilized once found. It is important to understand the needs that drive users to seek out images as this information is critical to the development of information services, collections and systems. The ultimate use of the images also shapes the services, collections, technologies and systems required by these users.

The underlying needs driving searches for images and how the images are being used within the four professional user groups were identified. The study also provides coverage of the resources being used by these user groups, the types of terms they used when performing queries, their search strategies and how they assessed the images they are able to find. This information is useful to information professionals in multiple roles (image providers, catalogers, librarians, system designers) since it clarifies where and how these professional
users seek out images, as well as providing a view into their selection processes. Finally, the study presents findings related to the major theme of frustration which was found to influence users’ behaviors.

One area where the findings of this study might find practical application is in the development of image systems. It has been noted that image systems are essentially text-based systems with graphical features (Beard, 1991). Beard (1991), in his discussion of the development of image systems for medical applications, states plainly "[a]n image-information tool that does not help users solve their problems is worse than useless, so the requirements specification must be complete and based on a thorough understanding of the users, their situations, and their needs," (p. 601). This study’s identification and description of the basic characteristics of image users’ behaviors, such as what terms and search strategies they used, should prove useful to the development of future systems for visual materials.

As the above discussion suggests, research into image use and/or users has tended to examine a narrowly defined area or context and so the results of these studies offer up a fragmented view of users’ image behaviors. Our knowledge of basic aspects surrounding image users, such as those concerning why users need images, what methods they use to retrieve images or how images are used once found is thus still incomplete. Limited research into the different groups of image users translates to a lack of knowledge about possible variations across user groups. An account of these aspects is warranted because this understanding is critical to the development of useful systems and
retrieval methods, which are needed to cope with the ever-increasing number of images available in the online environment. The identification and description of critical aspects of image users’ behaviors which are presented here are the first steps toward providing a more comprehensive understanding. Hopefully this understanding will lead to the development of services, collections and systems adapted to the needs and behaviors of these particular image user groups.

**Research Questions**

Based on the problem statement the following research questions guided the research of this study:

Q1. What work-related information needs drive users to seek images?
   - What are the purposes for which images are needed?
   - What types of images are needed?

Q2. How do users retrieve images?
   - What resources, systems and methods are used to retrieve images?
   - What criteria are used to select images?

Q3. How are images used to support users’ work tasks?
   - How are images incorporated into their work?
   - What roles do images fulfill for users?

**Definition of Terms**

The following terms are defined below to clarify any ambiguities that may occur in the language.

*Cultural materials / Cultural objects* – this term is used to mean items and structures designed and executed through human effort and ingenuity.

*Image behaviors* – this term refers to the entire suite of user behaviors surrounding images which occur from the inception of need, through
searching and evaluation processes and continues through the use of retrieved images.

*Image indexing* – the application of conceptual terms for intellectual access to images.

*Image needs* – the reason(s) behind why a user seeks images.

*Image retrieval* – the processes involved in searching for, finding and evaluating the usefulness of images.

*Image services* – assistance provided by people and systems to help users meet their needs specific to images.

*Image systems* – in the best of circumstances these constructs provide organized and coherent methods by which to search for, retrieve, judge the relevance of and use images. These may be logically arranged analog collections of images or technical components which provide images in a digital form.

*Image use* – the ultimate use of images which were retrieved. This may be tangible (incorporated into lectures, presentations, articles and artwork) or intangible (utilized for thematic illustration, intellectual reflection or inspiration).

*Known item* – a specific instance of an item or work which the user has knowledge of prior to its retrieval.

*Relevance* – how well an image fits a user’s particular needs and use requirements. In this study relevance is presented alongside image retrieval.
Unknown item – an item or work which is not recognized as part of the user’s knowledge base.

Work task – an action or series of actions which is/are carried out in order to advance a goal associated with an individual's professional role.

Researcher’s Background

This study followed a decade of the researcher’s practical experience within two different academic image collections. The first collection included 35mm slides, a picture file and a burgeoning digital image database and was located within a small, urban art school granting degrees up to the Master’s level. The image users in this collection were generally humanities faculty, architects, designers, and fine and applied artists. The second image collection, located within a small, suburban liberal arts college granting degrees to the level of the Doctorate, contained lantern slides, 35mm slides and digital images. This collection served primarily humanities scholars and their graduate students. The constituencies served by these two collections differed, yet even the most skilled and knowledgeable of users in each encountered difficulties. The experiences of the researcher in trying to help individuals find and work with images inevitably led to, and shaped, this study.
CHAPTER 2: LITERATURE REVIEW RELATING TO VISUAL INFORMATION

Introduction

This literature review focuses on users and their image behaviors. It begins with an overview of the concept of information behavior as it involves image users and is complemented by a discussion of the larger body of information behavior research that relates to this theme. This section is followed by observations made in the literature which address images in relation to each of the four image user groups to be investigated. Next, the review turns to a discussion of the topic of users’ image needs found in the literature. After this, issues appearing in the literature surrounding image retrieval, such as query strategies, query analyses, intellectual access and relevance judgments are presented. A treatment of the topic of image use completes the literature review.

Information Behavior Research

The concept of information behaviors surrounding image users can be broken down into several areas. These include those topics surrounding the purposes for which users seek out images, the users’ methods of retrieval, how users evaluate images to make their selections, the actual use of the images which were sought and those additional influences (work tasks, affective aspects, context, etc.) that may impact upon the entire suite of information behaviors. While several researchers have been interested in users’ image behaviors, what has been published generally investigates only those issues surrounding retrieval. This focus in the research literature on the behaviors surrounding seeking and searching for information is not specific to image users, however
(Wilson, 1999). Users of images have unique needs because of the visual nature of the information they seek. Unfortunately, no research has been published which compares the information behaviors of users who seek out text and those who seek images, so any differences in behaviors are not known. What follows is a brief discussion of the broader field of information behavior research pertaining to visual information. It serves as a backdrop against which to analyze image users.

Several basic information behavior theories seem applicable as a framework for understanding information behavior relating to users of visual information. Belkin’s (1980) theory of Anomalous States of Knowledge (ASK), which states that users’ behaviors are driven by a need to rectify an information gap or uncertainty in their knowledge, seems to have some affinities to image seeking especially when what is being sought is an unknown work.² For example users might want to view Roman coins, a topic outside their area of expertise, to examine the development of hairstyles among women across time. Because of the gap in their knowledge these users are likely find themselves in a state where expressing their needs is awkward and difficult. This difficulty in expressing an information need in order to retrieve materials is exacerbated in the case of images since it requires the additional step of translating visual needs to textual terms. Using the case given above, unless the user understands the specifics of Roman numismatics (mints, reigns, individuals, terminologies surrounding hairstyles) she would likely have difficulties meeting her information needs.

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needs. It is likely that the participants in the several user groups of this study vary in terms of Belkin’s cognitive and linguistic levels. According to Belkin’s theory these variations are likely to result in different rates of success in having their information needs satisfied.

Another information behavior theory that could prove useful to explaining image users' behaviors is Bates' (1989) model of “berrypicking.” Again, this theory seems most applicable in cases when the user seeks unknown images or needs to find a known image to solidify some unclear aspect of the work. This model states that users follow a circuitous rather than a linear path in their information-seeking. Image users’ methods of browsing and artist (Bates’ author) searches would seem to have direct correlations to text-based information-seeking (Bates, 1989). Citation searches, although less directly connected in the case of images, do occur. The clearest form of citation undertaken by artists is to be found in a later work which directly references an earlier work. One example of a direct citation to an earlier work is Marcel Duchamp’s use of Leonardo da Vinci’s *Mona Lisa* as the basis for his *L.H.O.O.Q*. Citations to the works of others are oftentimes much more subtle. For example, Raphael’s *School of Athens* in the Vatican Palace contains an image of the ancient philosopher Socrates (shown wearing a drab green garment to the left of the central figures of Plato and Aristotle). Socrates’ resembles a satyr in the fresco and from this depiction it is clear that the Renaissance painter had seen and borrowed the likeness from an ancient bust of the philosopher. Less clearly related methods of information-seeking among
image users are bibliographies, abstracts and indexes. Bates’ model suggests that users develop their knowledge through the process of information-seeking. This appears to have a connection to image-seeking, with several researchers mentioning this in their observations concerning users’ image behaviors (Bradfield, 1976; Choi & Rasmussen, 2003).

Ellis’ (1989) study of the research staff and academics at Sheffield University revealed several distinct processes associated with information seeking and his framework appears to have parallels in image users’ behaviors. The individuals in Ellis’ study used a variety of processes to find information, with each of the proposed six behaviors (starting, chaining, browsing, monitoring, differentiating and extracting) having different purposes and routines. For the image seeking process starting would include the user’s beginning efforts to find an image. This might include looking in resources where the image is thought to have been seen or where the image is expected to be found.

Several of Ellis’ processes (chaining, browsing, and monitoring) were associated specifically with searching behaviors by Wilson (1999). Chaining, which includes footnote and citation tracking, does indeed occur with images if particular aspects of works (e.g., theme, style, materials, etc.) are included here as akin to textual references, as was mentioned above. Browsing, which Ellis (1989) defines as “semi-directed or semi-structured searching” also occurs among image users and in fact can be the primary means of a user’s search procedure. Monitoring, the processes associated with keeping abreast of newly

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3 See the discussion below on query formation for more information concerning individuals’ browsing habits. Additionally, the researcher’s own observations of users’ behaviors over the
released information, was an unknown factor in the users’ image behaviors prior to this study.

Wilson (1999) suggests that the processes associated with differentiating and extracting, as defined by Ellis, are not directly concerned with searching. Differentiating, the filtering of information based on the characteristics of the sources is a behavior practiced by image users. This is especially true with experienced image users, since they are typically well-versed in the sources which are the most useful to their particular needs. Identifying and selecting information from a source, Ellis’ extracting, are also aspects with parallels in image users’ behavior. However, further definition is needed since unlike text, images are sometimes retrieved merely because they are illustrations. In the case of images there is a suggestion that there is a stronger interest in the visual aspects of the work as opposed to the intellectual content and this difference suggests further differentiation is needed. While Ellis’ explication of information behaviors might not be an exact match for image searching it does offer a useful framework against which users’ image behaviors can be assessed.

Kuhlthau’s (1991) Information Search Process (ISP) model which was developed through a study of high school students’ information seeking behaviors identifies the cognitive, behavioral, and affective dimensions of information seeking. The six stage model (initiation, selection, exploration, formulation, collection, and presentation) traces the thoughts, feelings, actions years of working in image collections support the important role of browsing in the image seeking process. Some users would browse entire sections within the collection for images that were in some way interesting to them (random browsers), while other users would browse only those images by a particular artist, on a particular theme, illustrating a specific style, or of a specific building (focused browsing).
and strategies of individuals as they work through the information search processes associated with a research project (Kuhlthau, 1988). While useful in parts, the model does not appear to be descriptive of the search processes or behaviors of the image users the researcher assisted and observed during her years working in image collections. If we consider the first stage, initiation, which is characterized by thinking over the project and possible topics, feelings of uncertainty and actions such as discussing the topic and browsing, the behaviors of many image seekers are not accommodated. Searching for known images is a frequent behavior among image users and so this stage does not appear to fit these searches. The model might be appropriate for unknown item searches since the thoughts, feelings and actions from the first stage might be applicable for image users. However, the underlying reason for the experiences and actions of an individual seeking an image in this stage would seem to be more a result of retrieval issues than they are from the intellectual concerns behind the search. In other words, the image seekers’ behaviors are focused more intently on trying to develop an effective search strategy to find the image than they are on trying to understand the informational content of the image. The model seems particularly beyond the scope of image seeking behaviors in the aspects surrounding users’ thoughts and actions, since these appear to be highly dependent on the support of texts. These theoretical discrepancies were re-examined as the study progressed.

Ingwersen (1999) suggests that most information-seeking studies performed prior to the early 1990s focused on the user and intermediation of their
need. Bradfield (1976), one of the earliest researchers into users’ image behaviors, mentioned how detrimental this situation had been to the discovery of users’ actual information needs. Ingwersen (1999) goes on to discuss how a more cognitive approach to information behavior began in the early 1990s and that this resulted in theories which include factors such as situational relevance. The concept of situational relevance, introduced by Wilson (1973), concerns the importance an individual places on information. A strong connection between an individual’s concern and a unit of information creates situational relevance. Since professional image users seek out visual materials based on real work tasks, Wilson’s situational relevance seems to have a place in describing their behaviors.

A model that considers the influence of domain and work task that shares some affinities to the present study is the model of information seeking proposed by Leckie, Pettigrew and Sylvain (1996). These researchers developed their model in an attempt to accommodate the behaviors of professionals working within a variety of domains. At the heart of the model are the work roles and the resulting tasks of individuals working within a discipline. These elements of the model are considered fundamental since “… information seeking is highly related to the enactment of a particular role and its associated tasks,” (Leckie, Pettigrew & Sylvain, 1996, p. 181).

Another key aspect of the Leckie et al. (1996) model is a characterization of information needs. These needs result in large part due to professional role and its associated tasks. The researchers are careful to point out, however, that
variations in need can and do occur based upon individual variables such as age, specialization, geographic location, and complexity of information need. In this model information seeking is undertaken to assist in the accomplishment of a specific desired outcome. The path an individual takes to reach that goal is influenced by information sources and their awareness of information to meet their needs. According to this model various sources and formats of information are used based upon an individual's awareness of them. Although this model appears to be too broad to provide much depth in the explanation of users' image behaviors, its inclusion of different formats, discussion of issues concerning information use, and the contextualization of need are aspects which seem particularly important for the current study.

Another study which looked at the influence of work roles on the use of information sources was that of Huvila (2009). Using Sonnenwald’s (1999) theoretical framework, Huvila (2009) examined the information sources of individuals working within a single domain through the use of analytical information horizon maps. Huvila’s study showed that the kinds of information resources sought were directly tied to the specific tasks associated with each of the work roles that were investigated. The findings of Huvila’s (2009) study are particularly useful to the current research as they indicate how the use of visual materials varies among the various work roles within the domain of archaeology. Similarly, Abels et al. (1996) found that domain and task both influenced the use of network services (i.e., email, electronic databases, file transfer, etc.) in their study which examined their use by various faculty in engineering and science.
While several of the information behavior models presented here would appear to be broadly useful to describing image users’ behavior, even the most applicable ones need to be reworked to accommodate known item searches. Many of the image searches witnessed by the researcher in the academic image collections she worked in were undertaken for known items. However the models discussed above do not represent this kind of information need adequately. If information seeking is seen as the result of some uncertainty in the cognitive state of the user as several individuals have suggested, then image retrieval needs to be considered using an alternative viewpoint.

**Image Users**

This section provides an overview of the literature which discusses images in relation to the four groups of image users under investigation here and is ordered from the least to the most researched user group; archaeologist, architects, art historians and artists. As was mentioned earlier, the four groups were chosen for reasons related to developing a coherent and effective research design for the study and also on account of practical considerations related to recruitment.

**Archaeologists**

Studies of this user group’s information behaviors are rare. Two recent studies by the same author were found which discussed the use of images by this user group. Huvila (2009 and 2008) examined the use of information sources by archaeologists with varying work roles (academic teaching, field archaeology, antiquarian, cultural heritage administration, public dissemination,
academic research and infrastructural development) and found that alongside text-base resources visual information in various forms was sought. The most extensive use of visual information was found for the academic archaeologist involved in teaching and these materials consisted of diagrams, videos, photographs and the objects themselves (Huvila, 2009).

Several other articles have been published on image-rich systems and technologies useful for the discipline of archaeology. For example, Clark (2002) presents an overview of the Digital Archive Network for Anthropology (DANA) system which contains two-dimensional images and three-dimensional models of anthropological, archaeological and ethnographic materials alongside textual data and a suite of tools for the manipulation of the information. Potential users were broadly defined in this article and it was hoped that the DANA system would be accessed and utilized by a wide variety of users.

Marchionini (2000) evaluated the Perseus Digital Library, a valuable resource of archaeological materials and scholarship in both textual and visual formats geared toward both students and scholars, but the specifics of image needs or use among archaeologists were beyond the scope of the publication. Bearman and Spiro (1996) report on the application of multispectral imaging techniques to archaeological materials such as papyri, frescoes and ostraca.

This technique is of use to archaeologists since it makes degraded items more

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4 Huvila’s (2008) paper, although it presents some of the data collected from interviews with 25 Nordic archaeologists, is not an analysis of the archaeologist’s information behaviors. Instead the paper presents how Arendt’s theory of vita activa, which divides human activity into labor, work and action, could be applied to information behavior research. The paper discusses how this tripartite model could be used to analyze the interview transcripts, but it does not address the content of the interviews.
Another technology with a strong image focus which has seen heavy adoption among the archaeological community is Geographic Information System (GIS). However, no studies of archaeologists’ use of these systems were found. Given the existence of these systems, why there have been no studies of this user groups’ information behaviors is unclear. Since the discipline is positioned in between the humanities and the sciences archaeologists would be an ideal and interesting group to study. A study of their rapid adoption of various technologies, and the subsequent development of specific applications useful to their discipline, might shed some light on ways to help their more purely humanist peers find technological applications to support their scholarship.

Architects

Several publications on the information behaviors of architects have discussed their image needs. Chidlow (1991) discusses the typical types of information needed by architects to perform their work. She suggests that although architectural firms can be markedly different, the information needs of architects are similar when taken as a whole. Chidlow (1991) identifies the different stages in the design process, and the various resources are tied back to when images are most likely to be used and for what purposes. Images are noted by Chidlow as being used at the start of architectural projects for inspiration and also for reference purposes for particular styles. Images are noted as being used in the design stage when looking for peripheral art to complement the building and create an overall environment.
Sklar’s (1995) discussion of design students’ need for and use of images adds another layer of information regarding the working processes used with images. While these image users were not practicing architects they offer a glimpse into the working methods of architects and individuals in related design fields. She states that when these design students seek images they are generally looking for solutions to be found in the images. The types of images they seek can vary widely and include “site plans, soil surveys, census data, zoning codes and other regulatory statues, maps, drawings, and sketches,” (Sklar, 1995, p. 13). They copy, disassemble, reassemble and reconstruct the images to work through design problems and stimulate their thinking. This idea of combining several images was also noted by Bradfield (1976) who studied architects use of image collections located within an academic setting. According to Bradfield (1976) images could be used by the architects to overlay two building plans to discern differences in design, or they might trace or sketch the design for application purposes.

Architecture and design students look for images in a variety or resources that include “periodicals, books, videos, planning reports, maps, drawings, plans, and sketches,” (Sklar, 1995, p. 13). An immense amount of material is used very rapidly and they were noted as often working with the materials where they find them. While this method of information seeking appears haphazard, Bradfield (1976) found that architects typically have clearly organized and precise needs in mind when they seek images. A partial explanation for the need for massive amounts of visual material might be explained by the currently limited access to
images. Beyond the large amount of visual material consumed, the primacy of images to these users is suggested by Sklar (1995) when she states these users are “primarily visually oriented; they read, of course, but the printed word ranks far down their list of primary resources,” (p. 13). This idea of highly developed visual acuity is alluded to by other authors discussing architects.

Elliott who examined architects’ work processes (2002 & 2001) also notes that architects are less skilled verbally than they are visually and as a result these users have difficulties interacting with image systems requiring text-based queries. This author discusses a prototype image system developed for architects which helps these users perform searches by generating dynamic query previews using metadata associated to the images. The previews provided by the system allow users to visualize the contents of the system and they help users refine and broaden their search strategies. The researcher was interested in providing a system focused on architects because of their strong need for images and the lack of successful image systems to meet their needs.

Several reasons for the architects’ lack of image system use are posited by Elliott (2001). Beyond the problems architects experience with text-based queries mentioned above, the author states the desktop computer is a poor fit for architects since their working methods have traditionally depended on the use of large drafting tables and pen-based devices.

**Artists**

Although artists are acknowledged as being visually oriented and thus need many images, the studies that have been conducted typically investigate
individuals teaching in a college or university setting. This lack of research attention on the needs of practicing artists was noted by Hemmig in his thorough review of the information behavior literature on artists (2008) and in his study of their information-seeking practices (2009). Hemmig's review is useful for the overview that it presents on the range of information sources noted as useful in the various studies concerning artists' information needs, and his study offers evidence of artists' image behaviors.

From the literature that has examined the artists' information behaviors published in the last thirty or so years there are several recurrent findings. The most critical of these for the present study is the artists' strong interest in finding visual information. All of the authors who have looked at this user group have acknowledged their need for images. Among the earliest of the studies to address the information needs of artists is Toyne’s (1975) analysis of requests he received for information from art students in a newly established art library over a two month period in 1975. From this analysis Toyne (1975) found that requests for visual materials of art and non-art related topics accounted for 7.5% of the information requests of art students. This figure only accounted for visual requests for images within books, however, and so this figure is likely to have been considerably higher if all forms of media had been considered. Cobbledick (1996) in her study which examined the information needs of four artists states that while these users do seek out visual materials “no undue emphasis should be placed on images,” (p.361). The point being made was that artists were found to read more than Cobbledick believed had previously been acknowledged and
so collection development to meet their textual needs should be supported, as well.

Another common aspect of artists’ information-seeking reported through these studies is the ingrained method found among these users of browsing collections to find materials (Hemmig, 2009; Gregory, 2007; Frank, 1999; Cobbledick, 1996; Day & McDowell, 1985; Pacey, 1992). Pacey (1982) in noting that the art students use browsing quite heavily to access materials in the library, calls them compulsive browsers. Why they sought out materials was an additional question which these studies have attempted to address. Several kinds of information available through visual materials were identified as being critical to artists and these are technical processes (Hemmig, 2009; Frank, 1999; Toyne, 1977), knowledge construction (Frank, 1999) and inspiration (Hemmig, 2009; Frank, 1999; Cobbledick, 1996; Pacey, 1982; Toyne, 1977). Information associated to images was also discussed in the periodicals which were enthusiastically sought after by artists. A number of authors discussed how periodicals were heavily used by artists to maintain their awareness of current happenings in the art world (Hemmig, 2009; Frank, 1999; Cobbledick, 1996; Nilsen, 1986; Pacey, 1982).

In a discussion of the various formats of images employed by artists Bradfield’s study (1976) of institutional image collections in England found that these users were not heavy users of slides. Although Bradfield (1976) recorded that they would use images in their lectures occasionally, they generally used images in either planned or informal lectures to illustrate a simple point or
technique. For example, images might be used by them to investigate creative
techniques, such as brushwork or the development of an idea through a series of
versions. For these needs book illustrations were found to be as adequate an
image format as slides for artists (Bradfield, 1976). These findings were
reiterated by Cobbledick (1996) who found that artists’ personal collections of
materials, as well as those of public and institutional libraries, were consulted.
Challener (1999) notes that all of the artists in her study used slides in the
classroom, although she did not discuss the degree of image usage among these
users. Nevertheless an indication of how important images are to these users
can be found in the variety of formats she found they used in their teaching.
Image formats used ranged from photocopies, reproductions from books and
magazines, plaster casts, computer printouts, book plates, original works of art
and the classroom’s blackboard for sketches and diagrams (Challener, 1999).
Hemmig’s (2009) study of artists supports their use of a wide variety of
resources. He found that when artists sought inspiration through direct
observations of nature, personal life experiences, works of art seen in person,
non-art man-made objects, images in analog form (books, magazines,
photographs, etc.), moving imagery, music, the printed word, digital images and
radio among others.

Another aspect which speaks to the visual-orientation of these users is
found in Challener’s discussion of how artists’ use of images differs from that of
art historians. She found that although art historians began with an interest in the
object, these users soon moved to performing textual research. Artists, while
they might use text-based information for their information needs, are primarily interested in the visual aspects of the object. A further difference between these two groups, which has an influence on their access to images, is seen in the different rates of adoption of computer technologies. Challener (1999) found the use of computers by artists to lag behind that of art historians. While nearly all of the art historian participants in her study used a computer, only two-thirds of the artists were using this technology. She states that these users (art historians and artists) employ computer technology primarily for Web searching and for visiting various Web sites. There was some concern expressed by the participants regarding the quality of the images and the text available on the Web, but the opinions of the various user groups in this discussion by Challener were not distinguished. The differences between these two user groups, artists and art historians, in their visual resources needs were also examined by Layne (1994). Layne (1994) noted that artists need images with a much broader range of subjects when compared to their academic counterparts, who typically request specific works or types of works.

Cowan (2004) performed an in-depth study of a working artist to examine the information needs and uses associated with the profession. Driving the study was her belief that artists' information behaviors were in some way different from those of other user groups. The author notes her own bias towards artist-users prior to the study, and states that she saw information seeking as a problem-resolution or gap-filling activity when in fact it could be a “… creative process motivated by curiosity, pleasure, or feedback,” (Cowan, 2004, p. 18). Cowan
argues that research into the methods used by artists to use libraries have tended to be prejudiced towards viewing artists as disorganized and ineffective information users. Through the more clearly connected information needs and processes discovered in her study Cowan (2004) suggests it might be more productive to think about the possible gap between the ways librarians and artists think about art.

A recent research study of artists’ information needs was a survey of nearly one hundred artists conducted by three MLIS students at the University of Washington (Visick et al., 2006). Their findings offer support to many of the previously published studies on the topic: that artists use visual materials more heavily that text-based resources, that they rely heavily on browsing to find the items they seek and that they have well developed personal collections to support their needs. An additional item of note is that this study did not find a notable difference in the information use between the academic artists and the purely practice-based artists. Each group accessed the libraries which were accessible to them at equal rates (Visick et al., 2006). This is an intriguing finding since so much of the research surrounding artists’ information behavior has been within the academic setting.

Gregory (2007) conducted a survey of one hundred and sixty-five art studio faculty from universities in the southern and western United States. This study provided results concerning the resources that artists employ to find images and so these findings are germane to the current research. Google Images of other Internet sites were the primary means of image retrieval found,
with 67% of the faculty-respondents noting their use (Gregory, 2007). Various online image databases were employed by a smaller group of the faculty (16% of the respondents). Among the 16% of the respondents, the image database ARTstor accounted for 10% of the use, Wilson’s Art Museum Image Database 4% and another database such as MDID (Madison Digital Image Database) by the remaining 2% (Gregory, 2007). Beyond the results concerning the use of online resources, the study’s findings support earlier studies which have noted artists’ information-seeking method of browsing library collections. Browsing was used by 61% of the respondents in order to find materials which could provide them with the inspiration they required (Gregory, 2007).

Hemmig (2009) studied artists’ information-seeking through a model of four information uses (“inspiration; specific visual elements; knowledge of materials and techniques; and marketing and career guidance,” p. 694) developed from his literature review (2008). The results of his quantitative study indicate that artists seek information to support these four needs, but that their information needs and their use of resources are highly idiosyncratic. While the usefulness of particular resources ranked by the participants in his study was found to be variable, visual information sources were critical to these users. This was particularly evident in the findings of information needed by the artists for inspiration, for specific visual elements, and for marketing and career guidance. One information use in Hemmig’s model was not found to have a strong visual focus among the artists, and this was developing knowledge of materials and
techniques. Hemmig found that for this need social information gathering among the artists' community of practice was most important.\footnote{It should be noted that the study's questionnaire provided a list of sources to be ranked by the participant and gave them the option of identifying and ranking an “other” response. Some of the questions provided more visual response entries than others and so it is unclear what influence this variation in entries had on the findings of Hemmig's study.}

\textbf{Art Historians}

Art historians are the most well-researched user group to be included in the study. Nevertheless this situation does not mean the information seeking or image behaviors of this user group have been adequately studied. The vast majority of publications which mention image use among art historians have commented on their heavy need for visual materials. Bradfield (1976) notes that art historians were the most prevalent and heaviest users of images among the participants she studied. Similar to Bradfield, Challener (1999) also studied art historians working within an educational setting and found images to be of primary importance to them. Some sense of just how critical images are for their work can be seen in their use of a wide range of image formats and the numbers of image collections frequented to meet their image needs. The art historians in Challener's study visited the departmental slide collection, used their own personal collections, employed museum images, had slides made through the institution’s audio-visual department, used textbook sets, and made their own slides or photographs on site. Stam (1993) expanded our knowledge of art historians' image seeking behaviors with her study when she reported that museum-based users did not utilize as many images in their working practices as
those of their academic counterparts. This is suggestive of how important work roles and their associated tasks are to a user’s need for images.

Several issues beyond the heavy need for visual materials have been discussed in the literature surrounding art historians. Bakewell et al. (1988), in their investigation into the working methods of art historians state “the comprehensiveness of the collection, the inclusion of less well-known works, the scholarly acumen used in cataloguing, and the difficulty of obtaining photographs were common preoccupations,” (p. 22). Gould (1988), too, investigated the information needs of art historians and notes that beyond the fundamental importance of images to their research, there was a need for greater intellectual access through the cataloging associated with the images. This strong preoccupation among the art historians with providing intellectual access to images seems likely to result from previous difficulties experienced during their work processes when attempting to find visual materials.

While many publications have acknowledged art historians’ heavy reliance on images, few have addressed why images are needed or how they are used. This is problematic since, as Ester and Shipp state in their forward to Bakewell et al. (1988), there is a lack of understanding regarding the working processes and the systems used by art historians and this gap in our knowledge hobbles future image developments useful to the discipline. Bradfield (1976), among one of the earliest researchers of art historians, reports that these users typically choose images for educational purposes in response to pre-planned lectures. Challener (1999) discusses the use of images by art historians as a sort of springboard to
text-based research. These users tend to begin their research with an image (or a group of images) and then move on to perform their work primarily with texts. This working process, which holds the image at its center and attempts to find connections among other materials, was carefully described by the practicing art historian Brilliant (1988). The methodologies used in the discipline of art history have a strong influence over the working processes of the user group and so this is the topic discussed next.

Bailey and Graham (2000) looked at the availability of digitized images and how this may have changed the discipline of art history. From the findings of this preliminary report, the working methods appear to have been impacted only slightly. They found that contrary to popular opinion, analysis in art history still relies heavily on the tried and true traditional methods of criticism, biography, social history, formal/stylistic analysis and cultural history (Bailey and Graham, 2000). Moving beyond the discussion of methodology, these authors report the respondents to their surveys usually had negative connotations associated with things found on the Web. According to Bailey and Graham, this included digital images, which were seen to fall short of the reliability needed to support art historical investigation. The respondents felt that material on the Web lacked a level of authority that would lend them credibility. If and how this idea may have changed among art historians in the intervening years is an aspect requiring further study. Graham and Bailey (2006) report in a later article which revisited the data gathered for the original study that the art historians noted several additional problems associated with their use of digital images and these were
barriers based on lack of knowledge about resources, lack of experience searching, problems with using technology and copyright issues. This article also notes positive aspects of the art historians’ use of digital images and these were ease of use, the convenience factor (work was no longer tied to a physical location), and the speed with which images could be found and retrieved (Graham & Bailey, 2006).

Bailey and Graham (2000) also discuss the use of image databases by art historians and they suggest that the larger image databases do not receive the use they should because of the heterogeneous approach used by art historians. The authors go on to discuss how small, highly project-specific applications, tools and databases are probably more successful since they are designed with a specific set of working methods in mind. In these authors’ minds providing access to the largest amount of material and broadest user communities has a negative effect on the usefulness of the resource. A similar idea was expressed by Busch (1994) who suggests that systems developed for historians are different than most, since ambiguity needs to be taken into account. Since the interpretation of history isn’t thought of as being absolute or having only one correct truth, systems cannot return a single answer for the queries asked. According to Busch (1994) this changes the system at a very basic level.

Rose (2002), in her examination of the use of technology by art historians, noted that art historians were still reliant on print based resources for their work. She suggested that their reluctance to adopt electronic resources resulted due to a lack of in-depth scholarly resources online and the overall poor quality (or lack)
of digital images (Rose, 2002). Her survey of art historians revealed that 33% of them believed a lack of image access was the greatest barrier they faced in performing research (Rose, 2002). A slightly more recent study of the use of digital images by Elam (2007) also examined art historians’ adoption of this format. The author interviewed six art historians about their use of online materials and found them to either not use or be unimpressed by digital images. The author connected this lack of adoption to two main factors: a lack of comfort with using technology and a lack of awareness of resources. There were several other issues noted among the study’s participants which could also contribute to the lack of digital image adoption. One of the participants had developed a collection of personal slides over a 35 year period and did not have the time (or the desire) to convert these to digital images (Elam, 2007). Additional reasons of note related to a lack of digital image use among art historians were problems related to access resulting from intellectual property rights restrictions and quality (Elam, 2007). These barriers to the use of images were also found by Koo (2006) who examined the use of digital images among staff members in art museums.

**Image Needs**

One of the major under-researched areas in image studies is an account of the needs that drive users to seek out visual information. Bradfield (1976) reported that when images were sought users generally felt their need could only be fulfilled through the use of visual material. According to Bradfield needs fall into two major groups 1) those where visual matter forms the core of the subject
and so the subject’s study would not be possible without images, and 2) those where visual material is not essential but gives an added depth to the topic (i.e. images would stimulate, motivate, etc.). This suggestion appears to be supported by the findings of Pisciotta and Copeland (2003) who found two separate user groups associated with images during their comprehensive needs analysis at Penn State. The two groups are composed of individuals who have on-going needs and those who have only occasional image needs (Pisciotta & Copeland, 2003). According to these authors a user’s level of need appears to exert a strong influence over whether or not a user seeks out images.

Bradfield (1976) suggests that teaching would be impossible in some disciplines, such as those under study here, without images. The quality and range of images available were seen as being critical in these contexts, with some disciplines and users having interests that run deeper than those that can be met by general images of cultural materials. For example, x-rays of pentimenti (forms and figures that were painted over during the creative process of painting) and detailed images of creative processes might be the focus of the research rather than an image of the whole finished work.

Pisciotta et al. (2005) conducted the Visual Image User Study (VIUS) at Penn State in order to assess the needs of users of images within a large university setting. The majority of the respondents (75% of faculty and 55% of students) were found to use images for educational purposes. Through the data collected the researchers created an interconnected conceptual framework for image delivery at Penn State that consisted of teaching, independent learning
and collection management. One interesting and unexpected finding was that image use was very high among respondents in several disciplines previously thought to be only occasional users. A need for images in the earth and mineral sciences and in the discipline of agriculture was found to be unusually heavy (Pisciotta et al., 2005).

The importance of images on Penn State’s campus was also investigated by Attig, Copeland and Pelikan (2004). These researchers report that 44% of faculty and student respondents maintain personal collections of digital images at Penn State. The researchers also note that the users they studied are primarily concerned with issues surrounding content as opposed to retrieval. As they state the users at Penn State “… are less concerned with how to discover images than with whether the image library will contain relevant images at all,” (Attig, Copeland & Pelikan, 2004, p. 253). Bradfield (1976), too, noted that the degree of use an image collection received, beyond the critical user needs that absolutely had to be accommodated, was influenced by its “excellence and scope.”

Several other discussions in the literature are suggestive of how need influences use of image collections. For example, stress associated with teaching seemed to negatively impact image users’ response to collections. Bradfield (1976) found there to be a correlation between the degree to which teaching was supported by the collection and the number of complaints the collection received. The principal of least effort also appeared to be a deciding
factor with image users in Bradfield’s study (1976), since she found the distance of the collection to be a determinant in whether or not a user utilized a collection.

A study which expanded image need to discussions of specific users is Chen's (2007) investigation of museum personnel. The findings from this study offer further support to the idea that image needs vary with work task. Chen (2007) found that staff members within museums retrieve images for a variety of reasons and these needs were tied to their work role within the museum. For example, Chen notes that curatorial staff members require images for planning exhibitions, publications and lectures. Museum librarians retrieve images to meet the needs of museum patrons. Registrarial staff needs images for collection control purposes (e.g., conservation, inventory and insurance). Educational staff uses images to teach and make presentations. From this brief discussion, all located within the narrowly defined group of museum personnel, it is clear that various professional roles have very different needs. How their various needs translate into working methods has not been well investigated but several publications shed some light on this topic.

The working methods of image users were reported by Bradfield (1976). She states that users in an academic setting would ideally want to draft a lecture and then retrieve their images. Unfortunately, according to Bradfield's study, image collections were generally not able to cope with the specific needs of individual users. As a result, users would develop a lecture broadly and then turn to the collection where their needs would then be adapted to the available images. Going into this idea a bit further, Bradfield (1976) discovered that some
users were found to work well in advance of their lectures to ensure that the needed images would be available. Some users would search for their images early so they could deal with issues arising from the circulation of single copies of images. Early retrieval for images was also the case with new users to those collections studied by Bradfield (1976) since they were unfamiliar with the collection’s holdings and also because their areas and interests may not fall within the historical scope of the collection. Those individuals who knew exactly what they would select before they attempted to find images were generally those who were familiar with the collection holdings (Bradfield, 1976). The working processes identified by Bradfield were corroborated by the findings of Bakewell et al. (1988). These researchers found that their art historian participants tended to work with a visual outline before they prepared a lecture. Beyond needing to make changes in their lectures based on the availability images, the art historians in the investigation by Bakewell et al. (1988) were noted as being adept at removing, replacing or changing the order of images to improve the flow of the material presented.

Image Retrieval

This section discusses several key aspects surrounding the processes involved in searching for, finding and evaluating the usefulness of images.\(^6\) Query Formation, the first sub-section, presents an overview of the literature surrounding the core aspects of image searching. This includes information on how users form their queries, the mediation and modification of queries, keyword

\(^6\) A recent review of visual information retrieval by Enser (2008b) provides a brief overview of the research surrounding both concept-based and content-based image retrieval over the past twenty years.
vs. browse searches, and subject expertise and/or experience. The next subsection, Descriptive Analysis of Queries, reviews the literature providing detailed accounts of image queries. This includes discussions of the number of queries performed or the number of terms searched and the types of terms being used in queries. The third subsection, Intellectual Access to Images, provides a synopsis of the literature which addresses issues involved with providing access to images through the application of terms. The next section provides a brief review of Content-Based Image Retrieval. Relevance, the final subsection, reviews the literature on how users select images.

**Query Formation**

Bates (1998) identifies information retrieval as being “a core, if not the core” of information science and so this theme’s importance to image users is likely to be equally high. Recognition of the importance of information retrieval may be behind the recent research focus on image seeking behavior. Much of the research that has been done on image retrieval falls into assessments of users’ image queries. These assessments can generally be divided into those studies which discuss the search strategies of users (keyword vs. browsing, modifications of searches) and those which provide detailed descriptive analyses of users’ queries (types of information searched, numbers of queries and relative percentages of query modifications). As can be said for text-based retrievals, Bradfield (1976) found that users tend to express their requests in a generalized way even when specific items are wanted. Another interesting discovery by Bradfield was that, similar to text-based requests, users would redefine their
need more specifically when they were provided with some materials in response to their initial query. This phenomenon also seems to add support to the idea that users develop their knowledge through viewing and reflecting upon images.

Obviously queries are just as important for users of images as they are for users of print-based materials. However, in the case of queries for image retrieval users have the added difficulty of trying to express visual content with textual concepts. This difficulty seems to influence several aspects surrounding image query processes. The first aspect that seems to have had a very strong hold over image retrieval methods is the mediation of users’ queries. According to Bradfield (1976) librarians have been responsible for giving a voice to users’ needs as well as performing retrieval processes and as a result there are few objective representations of image users’ queries. The strong influence of staff on image query formation is supported by the study of image queries in the Hulton Deutsch Collection conducted by Enser (1993) which also notes the high degree of mediation that occurs during the image retrieval process. In their discussion of image collections Armitage and Enser (1996) noted that users’ queries were typically mediated by staff in five of the seven collections they investigated. Conniss et al. (2000) also noted the high use of intermediaries in their study of image retrieval.

Beyond the influence of staff on image users’ queries several publications have mentioned the modifications of image queries conducted by the users themselves. Conniss et al. (2000) found that more than one iteration of an image search were common with the exception of those individuals looking for a specific
item. Armitage and Enser (1996) suggest that users modified their queries (broader or narrower) even before interacting with the collection or its staff, based on expectations they had about the holdings or the way things were indexed. They go on to state that queries were sometimes “voluntarily couched” by the users in terms of the indexing language in use for the particular collection. Unfortunately there are no comparable studies of users’ queries for those unfamiliar with the collections or indexing utilized and so no comparative analyses can be made to clarify how strong these influences may be.

An examination of transaction logs for online image searches conducted by Goodrum and Spink (2001) showed that users performed a high number of modified queries (59.6%). Unfortunately, the researchers had no way of judging through the logs whether query modifications were changes in searches or new requests for a separate image search. In their study it was suggested that the high percentage of search reformulation may be indicative of a mismatch between the query language and visual information needs. In another study of online image searches performed by graduate students, Goodrum et al. (2003) discovered the participants changed their initial search queries frequently. No suggestions were given for the reasons behind the behavior in this study. Jörgensen and Jörgensen (2005), who investigated the search logs of image professionals, note that approximately 48% of all queries were modified (adding, eliminating, and/or changing terms). They also suggest that most term changes were to related (94%) rather than broader or narrower terms.
As was mentioned previously, retrieval of visual information is seen as more difficult than textual information for users. This is one reason why browsing seems to figure so prominently in the methods employed for image retrieval. Bradfield (1976) noted that in the slide collections she studied, when users were not able to express their needs using words they generally preferred to browse. Students seemed to have the most difficulty vocalizing problems and finding potential solutions and both of these needs were found to be most easily resolved through browsing (Bradfield, 1976). Browsing was also commonly employed in the case of image quality assessments where one image might be substituted for another based on physical excellence or lack of it. The critically visual nature of image usages means that users must be presented with a provision for viewing the materials. Beyond the importance of browsing in judging relevance, Bradfield states browsing in itself encourages the development of visual knowledge.

Angeles (1998) also discusses how useful browsing is to image users and notes that its importance in the image seeking process should not be underestimated since it often leads to serendipitous discoveries and generated creative connections and ideas. Cunningham and Masoodian (2006) found browsing to be used frequently in the image queries of individuals performing everyday image seeking and found it especially common in searches of subjective need. These researchers found that browsing was the primary method the participants used in meeting their information needs (Cunningham & Masoodian, 2006). There is support for this suggestion in the study of image
searching behaviors of users performed by Batley (1988). Batley’s (1988) investigation reports that browsing strategies, in this case meaning a hierarchical arrangement of categories which leads users to the display of images, were used more frequently than direct keyword searches.

Users’ subject expertise or searching experience also appears to play a role in the percentage of queries performed via browsing. Frost et al. (2000) conducted a study using an image database which allowed for searching and browsing by categories for images of art historical, anthropological or archaeological significance. Data were collected specifically to gain insight into the browse and search patterns of image users and they discovered that subject experts tended to prefer direct searching to browsing while generalists had a higher percentage of browsing strategies (Frost et al, 2000). These findings were reiterated by Frost and Noakes (1998) when they reported on a system development project for an image database to be used within the broad discipline of art. The researchers developed a Web-based system and studied participant-users’ searches in order to discover the most useful retrieval methods. Expert users were discovered to favor the use of textual information associated with the images to make their selections and so they used the direct search interface most often. Non-experts, however, were found to rely more on the images than the expert participant-users and so they would browse the images to make their image selections.

Hastings (1999) provides findings through her study of queries to a digital image system containing Caribbean paintings, which revealed just how important
the browsing function is in the querying process for image seekers. She discovered that thumbnail images were useful for answering questions in approximately 60% of searches performed by her participants. Whatever the reason for the browsing behavior, Goodrum et al. (2003) found that their participants spent a considerable amount of retrieval time browsing surrogate images and websites even before they made evaluations concerning relevance and so this retrieval method’s importance cannot be underestimated. Huang (2003) discovered personal preferences among users in the number of images they preferred to see displayed on the screen. The heavy reliance on browsing with image retrieval suggests more research is needed in the area of how they are displayed.

Matusiak (2006) also adds to our knowledge of users’ image searching methods through the findings of her qualitative study which investigated how users interacted with a digital image collection of photographs. In this study participants belonged to one of two groups, students or community members. She found the student user and the community member groups to typically use different searching methods, with the former relying predominantly on keyword and the latter on the built-in browsing arrangement of the collection. She associated the different searching methods used to the differences in Web searching skills and experience between the two groups. The author notes, however, that the searching methods evolved over the course of using the collection and she states that “[u]sers who favored browsing, explored keyword
searching if they were looking for something specific or they were pressed for time," (Matusiak, 2006, p. 484).

Other authors add to the discussions surrounding the identification of query methods of different user groups. Pisciotta and Copeland’s (2003) tripartite division of image users within the Penn State University system into the functional groups of teaching, independent learning, and collection management revealed differences among how images are searched. Images for teaching were found using fewer and more specific searches when compared with images needed for research. These authors discovered that images for research were found using a broader variety of searches than those carried out for teaching. Thus, Pisciotta and Copeland theorize that teaching needs are more often met by a known item search. Independent learners and students were found to want or need broader search features alongside well-described images in their study. From the discussion given in this section it seems likely that Batley (1988) was correct in her judgment that “… information need and individual user characteristics largely determine visual information search strategies," (p. 380).

Descriptive Analyses of Queries

An additional segment of the literature surrounding image retrieval provides detailed analysis of the query processes and the types of information being asked of the image system. The most widely cited of these studies to look at users’ query processes is Goodrum and Spink’s (2001) analysis of a transactional log of online image queries to the Excite Web site. This investigation, which predated Google Images, illustrates that at that time users
were required to include search terms which identified image formats (e.g., tiff, jpg and image). Nevertheless the study provided some basic kinds of information concerning image seeking in an online environment. This included information such as the average number of image queries (3.36) and the average number of terms per query (3.74). The heavy dependence of image users on text to retrieve their images is alluded to in further figures provided by Goodrum and Spink (2001). They note that while image users were found to be only 3% of the transactional log population, their image search terms accounted for 12% of the terms in the data set. Further analysis of the log led them to suggest that image searching produces a high number of unique searches with a high degree of specificity.

In another investigation that looked at online image searches performed by graduate students in response to a task Goodrum et al. (2003) noted that their Web searcher participants undertook an average of 2 queries per image. A discussion of the earlier findings in concert with the later study was not undertaken. A similar investigation was carried out by Jörgensen and Jörgensen (2005) through an analysis of the search logs of image professionals (in graphic design, advertising, marketing, etc.). These researchers note that the number of queries per session ranged from 1 to 29, with the mean number per search 2.1. The number of terms per query ranged from 1 to 30 (without Boolean expressions), with a mean near to 2 terms. Single term queries accounted for approximately 61% of the total, and those queries with 2 to 3 terms constituted more than 30% of the entire number of searches conducted. Jörgensen and
Jörgensen also report here that most users (76%) began their searches with a single term and this generally resulted in large numbers of returned images.

The second theme to fall under this broader heading of query analysis is the types of information being asked of the system in the users’ image requests. Frost et al. (2000), in their study of an image database containing images of cultural materials, found that searching was rarely performed on title and that artist queries accounted for 25% of the total with subject queries accounting for a slightly lower usage (20%). A more in-depth analysis of the terms used in image queries was presented in Jörgensen and Jörgensen (2005). In this study of image professionals’ search logs the researchers present the term usage as grammatical and conceptual types. Nouns accounted for the largest percentage of term type at just over 50%, adjective 18%, verb 10%, proper noun 5%, concept 8%, byline 2%, visual content 2%, date 1%, and the classification of unknown at a minimal percentage. Descriptions of terms such as these are remarkably close to another large body of literature that falls under the broader heading of image retrieval. This topic, intellectual access to images, focuses more closely on the kinds of information recorded and sought by image users and so this is the next topic to be discussed.

**Intellectual Access to Images**

Intellectual access, a purely text-based endeavor currently in the area of images of cultural materials, refers to the application of concepts and identifiers in order to make the material retrievable through some system (analog or digital). A topic of interest within the discussion of intellectual access to images is the
development and use of databases useful to the needs of image users. Although databases of online images were not available when Bakewell et al. (1988) performed their study the art historian participants they investigated were well aware of the possibilities that these systems might offer in the future. One art historian stated, “[i]f one could theoretically push a button and get information about all the occurrences of blue cloaks in 18th-century German painting and then use that as a basis to work, that would be the general best thing—the ability to cross-index information,” (Bakewell et al., 1988, p. 51) Another art historian in this study mentions how useful it would be to be able to view materials through the lenses of iconography, time, region, artist, and owner. Computerized sorting of information was a utility that offered the most promise to the art historians they examined according to Bakewell et al. (1988). Nearly twenty years have passed since this report was written and even with today’s technological advances few systems are providing this level of access. This lack of advancement in intellectual access is a topic several authors have addressed and so we turn to a clarification of this situation next.

It is tempting to say that intellectual access to images (i.e. concept-based indexing) has not seen much research owing to the difficulty of the work. Ball and Smith (1992) in their volume discussing how images can be used for social analysis, hint at just how difficult indexing images can be in the following passage, “[f]amily snapshots are regarded in a different light from photographs appearing in art galleries or those found in daily newspapers: The physical and social context in which the photograph is placed is of consequence when we
seek to make sense of the photographic image,” (p. 20). As these authors suggest, one’s point of view and knowledge about the content and/or context can exert a strong influence over the application of indexing terms. Chen (2007) discovered in his investigation within the museum setting that users had difficulties with image systems due to the various kinds of intellectual information generated and recorded for images and objects by the museum’s staff. This specialized language coupled with a lack of subject access to images found in the museum setting was noted as being problematic to users (Chen, 2007). Grout et al. (2000) also note how large this gap in language can be between the indexer and the user. Additional issues associated with providing access to the content within images fall within the realm of cognitive psychology. Human vision, cognitive processes, and aesthetics all exert a strong influence over how images are experienced and classified by individuals. While this topic is outside of the scope of the present study it should be made explicit here that images can be perceived and described variously depending on a variety of factors (e.g., visual acuity, education, cultural background, and context). 7

A host of additional problematic aspects surrounding image indexing exist. These were enumerated by Beaudoin (2007) and include a lack of universally agreed upon data to be recorded, a lack of agreement in schema, a lack of standard vocabularies and classification systems, a lack of subject indexing used

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7 A useful overview of the topic can be found in Jörgensen, C. (2003). Image Retrieval: Theory and Research. (Lanham, MD: Scarecrow Press, Inc.). Some interesting observations on the basic cognitive aspects at work behind human perception and preferences can be found in: Huang, C. (2003). The relationship of cognitive style to the perception and usage of color images—a content design consideration. Exploring Innovation in Education and Research, (ICEER), Tainan, Taiwan, March 1-3, 2003. The results from this study provide digital image system developers with critical information regarding display layouts, color-depth, and browsing processes.
in practice and a lack of user studies to assess what is critical for image retrieval. One research team, which set out to develop “an appropriate metadata infrastructure” to support a digital image library at Penn State, suggested that rather than trying to reconcile some very different data types and users among the varied image collections on campus they should work toward discerning what minimal level of data is needed for the retrieval of visual materials (Attig, Copeland & Pelikan, 2004). Bradfield (1976) also acknowledged this problem when she stated that “[n]eeds for information vary widely and art historians are the major users but other disciplines are using slides increasingly,” (p. 85). This changes the system requirements, according to Bradfield, since outside users tend to need information about the visual content within the image rather than the traditional means of access serving a collection’s customary users.

In an attempt to get a sense of the types of information needed by users during image retrieval Bradfield (1976) gathered data about their queries. The most common modes of access found by Bradfield were period, person or school. Beyond this basic level of analysis, Bradfield experienced difficulty in analyzing the query data since discussions surrounding the users’ requests could be indistinct, contradictory, inexact, etc. Particularly problematic were “… concepts and subjects … taken as themes which are not immediately recognizable as concrete nouns,” (Bradfield, 1976, p. 61). These included abstract concepts and nouns such as those of perception, love, and ecology. Nevertheless, Bradfield suggests the following categories are likely to be required by all academic users searching for images: chronology and style;
school or group; proper nouns describing the image and its creator; proper nouns describing image location, country and place, and subject descriptors; technique; and concepts of which it is a good example. This recounting of useful intellectual access points has been taken up by a number of researchers within the area of image retrieval.

Among the most prolific authors to discuss the various kinds of information used to describe and retrieve visual information is Jörgensen. Her research has centered on identifying and defining the various kinds of information used by individuals to describe images (Jörgensen & Jörgensen, 2005; Jörgensen, 2003; Jörgensen, 1998; Jörgensen, 1995). Out of this work she has developed classes of image attributes based on the conceptual groupings of the image descriptors applied by individuals in explications of what they saw and thought about the images they viewed. The most often used attributes were found to be Objects, People, Color, Story and Spatial Location. Interestingly she found that individuals varied in their descriptions of images depending on the task they were asked to complete (description while viewing an image, description for retrieval purposes, or description of an image from memory). For instance, in the searching task which asked individuals to view an image and think about how it might be retrieved Spatial Location (i.e., spatial relationship among visual aspects in an image) was the second most commonly used description compared to its fifth-ranked status in the viewing task. Jörgensen’s work has helped shed light on just how diverse visual information can be in the minds of individuals looking at and searching for images. In addition to this, her research
has provided several frameworks of use for evaluating image descriptors. This is particularly useful in discussions concerning context or domain and so we turn to this topic next.

Some researchers have noted a change in the most common access points for images within a particular context or by a specific group. This variation among image access points can be readily recognized in the study carried out by Armitage and Enser (1997) which analyzed the requests from seven picture libraries in England (National Film and Television Archive, BBC Natural History Unit, Glasgow’s Mitchell Library, Birmingham Central Library, Air Photographs Division of the National Monuments Record, Witt Library of the Courtauld Institute of Art, and the Wellcome Institute for the History of Medicine). The queries by users of the Witt Library requested images by an artist-creator nearly 11% of the time, which is at a rate higher than any other library they investigated (Armitage & Enser, 1997). Gordon (1996), too, indicated that the image search requests received by the Witt Library were predominantly concerned with retrieval based on artist. Additional well-used access points in the Witt Library were noted by Gordon and these consist of date, ownership and subject. A study which is related to those carried out in the Witt Library because of the similar interest in the analysis of art images is that of Cunningham et al. (2004). These researchers analyzed four hundred and four visual arts queries of Google Answers’ “ask an expert” service to discern the various types of image queries received. The majority of image queries contained “bibliographic” information and this data generally fell into one of five categories (artist, date, nationality,
title, and dimensions). Going beyond providing an account of the queries of users, Cunningham et al. (2004) show that users were found to have difficulty in providing exact terms for their queries (i.e. they had difficulties with artist’s names, dates, etc.). The next most often found query, “contents” consisted of formal elements in an image such as color, suggesting to the authors that a content-based image retrieval system would be useful to users.

Just how varied image users’ queries can be in a different context is made clear by Ornager’s (1995) study looking at image indexing in several newspaper image archives in Denmark. Indexing completed in the newspaper archives included the access points of named people, noted as receiving approximately 50% of all users’ image queries. Other access points to newspaper image archives noted by Ornager (1995) are background information about the photograph, the photograph’s event, mood or emotion, and the dimensions of the photograph. Complex queries (those combining more than one access point) account for approximately 20% of the queries received, according to Ornager (1995).

Also discussed in the literature concerning image access points is the variable nature of image queries within the same professional domain. Chen’s study (2007) reports on the nature of image queries conducted by museum staff. He found curatorial staff generally finds images by querying on the museum-applied accession number. Museum libraries typically have in-house designed indexing rules and tools that might influence how the cataloging or indexing is carried out, but the most popular of types of information sought are title, period,
genre, subject heading, and classification scheme (Chen, 2007). The education department usually needs help finding images and so their searches are typically mediated by library or slide library staff. Photographic studios, like curatorial staff, use accession numbers for image searching. As Chen’s publication suggests, even within a narrowly defined setting image queries could vary considerably.

The fact that image users’ queries could be highly unique and complex is not surprising given that visual information can be as rich as textual sources. Roberts (1985), in her discussion of the “ideal network” of images, suggests that the system would need to provide records that thoroughly describe and identify each work and its characteristics. Thus the record associated with a work should include information such as a full description, reports on X-rays or other analytical tests, other versions of the work and related works, the sales history, attribution history, subject analysis, exhibition record with reviews, reproduction history, and, finally, a bibliography of publications where the work has been discussed. This ideal network would also allow for the retrieval of all works by an artist, and these returns should be able to be limited by subject, chronology, and so forth. The works should be cataloged with information concerning the text or tradition they illustrate, historical or cultural events, social rituals, gestures, expressions, place depicted, and formal elements such as composition, color, shape, etc. In the end, Roberts (1985) acknowledges that this amount of information on a single work is rare and that every new publication or paper is a
potential new source. The mutability of intellectual access to images is connected to this idea.

Bearman (1988) speaks directly to this issue by declaring “that scholars see every piece of information in the record as potentially arguable,” (p. 209). This is rooted in the notion that many areas of scholarly pursuit have only fragmentary knowledge surrounding them. This fact alone makes image indexing prone to discussion, as do historical changes (geographical, political, etc.) and relationships between parts and works (altar, predella, icon, drawing, model, structure, façade, garden). Furthermore, the intellectually and interpretively charged nature of scholarly information is coupled to the personal role faculty play in the process of creating access points. Besser and Yamashita (1998) discovered when interviewing art history faculty about their image use that the faculty were fully aware of the role they fulfill in providing information for the intellectual access to images. This can clearly be seen in the words of one of their participants when discussing the generation of metadata for materials; the participant simply stated “[t]hat’s what the academic exercise is,” (Besser & Yamashita, 1998, p. 6-15). This situation is likely the chief cause of behind participant satisfaction (or lack of it) with the image indexing. Matusiak (2006) reported that the satisfaction levels with the image cataloging went down as participants’ subject expertise increased.

**Content-Based Image Retrieval**

Content-based indexing processes (i.e., automated indexing and retrieval based on formal elements such as color, line, shape and texture within images)
have made research in-roads in the direction of providing access to images through their physical properties. However, for the image user groups under discussion here the level of access which is currently available through these methods appears to be at a level which is too rudimentary to be broadly useful. This being said, some truly intriguing research is being conducted in this area that could have an application for image users of cultural materials. For instance Aisbett and Gibbon (1997) discussed a dual-natured content-based and concept-based image retrieval system under development that may prove useful to the image users under examination here. These researchers developed an image system which allowed users to assign weights to aspects of images to be searched and then combine these aspects. As a starting point to their work they state, “… the user must be able to assign relative importance to the formulae representing the things of interest, that is, they must have the option of weighting them subjectively,” (Aisbett & Gibbon, 1997, p. 101). Their application for this publication was for floor coverings and they illustrate how aspects such as materials, manufacturer, tuft sizes, pattern and color could be weighted and searched upon. In a similar study Brilakis et al. (2006) discussed how CBIR methods could be employed effectively to retrieve images of construction materials. Papers like these, although outside this study’s general area of interest, remind us of how useful content-based image retrieval methods can be in the right context and task situations. Although it was unlikely that this retrieval method had seen much use by the users in the groups under investigation here,
the usefulness of content-based retrieval in the context of their work was a topic which was evaluated in the study.

Whether or not these systems will find practical application is a topic Enser (2008a) discussed in his review of the divide between the visual image retrieval research and professional communities. This paper is similar to an earlier paper written by Enser (2000) which points to the lack of communication between the content-based and concept-based image retrieval researchers. As Graham (2004) states, “[n]ot much research has been done involving subjective measures such as user satisfaction and user acceptability,” (p. 329) with CBIR systems. This sentiment was reiterated by Datta et al. (2008) and these researchers specifically call for more research to investigate when CBIR systems would be needed, what users would hope to accomplish with these systems and how users would expect these systems to help.

Several studies have examined users’ interactions with content-based image retrieval systems. A study undertaken by Markkula et. al. (2001) examined the usefulness of CBIR methods within a newspaper photograph archive. They found that users of the archive generally searched on high level concepts relating to people and objects. Since CBIR technologies function on purely visual features they felt these systems were of limited use in searching phase of the image retrieval process. However Markkula et. al. (2001 & 2000) noted that content-based indexing would be useful to users during the later, browsing stage of image retrieval.
Discussions about CBIR technologies with the specific user groups in the current study offer some suggestions as to the potential usefulness of these systems. Literature about creative users’ interactions with CBIR systems is limited but what has been reported notes their favorable reaction. Matkovic et al. (2004a & 2004b) tested a tangible interface for a CBIR system using artists and architects among their participant-testers. Participants were asked to replicate images they had seen using two different interface techniques. The participants used one interface to draw an image through the use of a computer mouse, while the second interface required participants to use colored blocks on a table to replicate what had been seen. Through the visual abstractions of the images created by the participants, the CBIR systems retrieved visually similar images. In their study comments about the visually similar but topically dissonant images retrieved from the CBIR system were received from the artist and architect participants and they were noted as being positive in nature (Matkovic et al., 2004b).8

Another study reported by Ward et al. (2002) provides additional support for the use of CBIR systems among creative users. One artist in their study noted that she appreciated the variation that exists in CBIR retrievals. According to Ward et al. (2002) these images “… may stimulate creative thought and inspiration, and may lead the user along a different search and, ultimately, a more productive path.” Systems using CBIR techniques which allow for image searching and browsing based on formal features such as high contrast or

8 Oddly, the users’ responses to the interface were not reported when the study was published in Lecture Notes in Computer Science (Matkovic et al., 2004a).
patterns, as opposed to text, were mentioned by Dobbs (2005), a librarian at Massachusetts College of Art, as being useful to artists. He states that these systems would likely be welcomed since not all artists are equally adept at communicating verbally. Because of this situation Dobbs (2005) feels the artists would welcome this method of retrieval since they allow for purely formal searches.

Studies of users’ interactions with CBIR systems with applications in the fields of archaeology or art history are nearly unknown. One early study of the practical applications of CBIR methods in the field of art history was carried out within the Art and Art History Department on the campus of the University of California at Davis (Holt & Hartwick, 1994). Holt and Hartwick’s publication is primarily geared toward describing how CBIR methods index images and what was involved in setting up the system. However these authors do provide anecdotal evidence that the faculty felt the CBIR methods produced interesting results.  

CBIR researchers have been hard at work developing systems that could have real-world applications for these academic users. Several recent studies discuss CBIR systems which were developed with archaeological materials (Vemuri et al., 2006; Kadobayashi & Tanaka, 2005) and art historical applications in mind (Li, 2007; Stanchev et al., 2006; Barni et al., 2005; Li & Wang, 2004). These researchers see CBIR technologies as providing unique avenues for the study of cultural materials and the retrieval of those images. Barni et al. (2005)

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9 The particular discipline(s) of the faculty of the Art Department were not identified in the study. However since the faculty were interested retrieving images based on race, class and gender it seems likely they were art historians rather than artists.
state that CBIR technologies can open new areas of research in “…material analysis (and therefore dating and provenance determination), discovery and interpretation of ancient technologies, analysis of artists’ environment and mutual relationships, better knowledge of conservation materials and processes, and art dissemination and fruition,” (p. 141). For example, CBIR methods could be used to analyze the particular mark making (i.e., brush work, pen marks, etc.) of a particular artist for questions concerning a work’s authenticity.

Content-based image retrieval systems suggest that they can offer an improved level of access to images of cultural materials over what the current text based systems can offer and that new methods of analysis can be carried out. Probably the most difficult problems facing CBIR researchers are social and intellectual in nature. Chen et al. (2005) are obviously well aware of the academics’ lack of interest in adopting these system when they note the “…sharp cleavage in the academic research community between science and humanities,” (p. 245). It appears the research has reached a critical point when partnerships must be formed between scientists and humanists so that systems can be tailored to actual users’ needs.

Within the last few years there appears to be a growing recognition among the content-based image retrieval research community that an understanding of how and why users search for images is critical to their developing systems and techniques that are useful in real world settings (Kherfi et al., 2004). A way to make these systems more appealing to users seems to have led to the development of a hybrid approach where textual searches are combined with
CBIR techniques. Ferecatu et al. (2008) describe a system which allows a combination of automated techniques of expanding textual description through the application of semantically derived terms using WordNet and CBIR technology. While work toward providing useful CBIR technologies is on-going there is still a focus on the development of the system rather than on examining users’ needs. For example, Addis et al. (2003) discuss the development of a system which employs a combined approach for application in the cultural heritage sector but reactions of users were not provided. Hopefully continued efforts by these researchers will focus on image users’ needs.

Tsai (2007), in a paper using a collection of cultural materials as the basis for its analysis, provides a discussion of the ways that the two traditionally separate techniques could work together to provide richer access to images through user feedback. Tsai (2007) suggests that through feedback to the system the users would have a wider range of retrieval methods at their disposal. The argument is a compelling one as it is clear that not all users approach image systems with the same levels of experience, education, domain knowledge, needs or expectations. This idea of combining both methods of image retrieval is also discussed by Rodden et al. (2001) in their presentation of an experimental system which returns images to a text based query in a clustered fashion based on similarities found in their physical characteristics. According to Tsai (2007) and Rodden et al. (2001) systems using both methods offer advantages that cannot be achieved through single-method systems. Support for the usefulness of systems that provide access through the physical and intellectual
characteristics of images was also found in a study by Huang (2003). Huang found a combination of textual and visual aspects were used when users queried and selected images.

In his ARIST review Enser (2008a) points to the lack of user interest in using CBIR systems as a sign of how far removed the research community is from real-world applications. While there does seem to be a broad gulf between the research communities and real-world users of these systems, one application of content-based processing which has seen some interest recently is within the field of medicine. As images are frequently used within this context for diagnosis and therapy selection purposes it is a research area that could have far-reaching consequences. Müller et al. (2004) provides a review of the research conducted for the medical domain. Gonzales and Woods (2007) and Russ (2007) provide recent coverage of the research into the broader topic of content-based image retrieval.

Relevance

Assessment of relevance, in this case the suitability of an image to meet a user’s need, is an issue that appears infrequently in the literature. Several studies address the topic, however, and these typically discuss criteria used in the evaluation process and, or the impact of users’ needs. The most comprehensive study to be carried out on the topic to date is that of Choi and Rasmussen (2003). They investigated interactions concerning relevance among faculty and graduate students within the discipline of American history with images retrieved American Memory Web site. The researchers set out to
examine the criteria image users employ in decisions about image relevance and report on the relative importance of each of these criterion. Criteria mentioned by end-users in previous investigations were used in this study and these included topicality, accuracy, time, suggestiveness, novelty, completeness, accessibility, appeal of information, technical attributes (mood, color, point-of-view). They report in their findings that there was a slight difference in relevance criteria used pre- and post-test. The use of textual information about the images also was seen to differ between the pre- and post-testing. They found, however, that criteria for textual information tended not to be as important as those used for visual information in the images.

Relevance in their study was generally decided upon based on topicality, (lack of) textual information, clarity or details, or uniqueness (i.e. duplicate image or not). Another study which examined the topic of image selection criteria was that of Markkula et al. (2000). These researchers examined users of a photographic archive of newspaper images and found that they typically relied on topicality (which was sometimes supported by text within the accompanying caption), quality, currency (date of image), source of image, costs associated with using the image, the general impression of the image and other visual attributes (Markkula et al., 2000).

Choi and Rasmussen (2003) suggest that relevance decisions are influenced by the process of knowledge formation in the information retrieval process. The importance of browsing in judgments of relevance was noted here since perceptions of image content were seen as critical to the process.
Goodrum et al. (2003) support the critical nature of browsing with their findings which show that participants spend nearly two-thirds of their time engaged in browsing and examining images for relevance. Browsing and performing relevance-related assessments were noted as being the most time-intensive tasks involved in image searches (Goodrum et al., 2003).

Other mentions of relevance assessments in the literature were limited to passing comments made by a few authors. Bradfield (1976) noted that one criterion for image selection was quality. She found that images in the collections were variable in quality (color balance, black and white vs. color, blurry, scratched/marred, odd angle, glare from lighting, etc.) and this had an impact upon the users’ selection processes. The variability of relevance criteria based on task was mentioned by Bakewell et al. (1988) when they found quality to be less important when a scholar was merely trying to identify and locate the work. As a result of this situation they state that, “[e]ven the crudest kind of black and white accompanying visual would be tremendously valuable,” (Bakewell et al., 1988, p. 52). Another study, conducted by Efthimiadis and Fidel (2000), looked at the image categorization model of Fidel (1997) and noted that relevance judgments differ according to query type and that at the mid-point range of Fidel’s Data (e.g., x-rays and maps) – Object (e.g., art works) Poles the image queries required the least amount of time and effort while turning up the highest number of relevant images. Another important consideration in judgments of relevance for images, mentioned by Bakewell et al. (1988) is that in some cases what isn’t normally visible in an image might in fact be very important. For example, a
scholar or artist trying to examine the working methods of a painter may need to see the work illustrated through alternative imaging techniques such as X-rays and infrared reflectography. How these situations get played out in evaluations of relevance is unknown.

**Image Use**

Aspects concerning how images are ultimately used have not been directly addressed in the literature. When use is mentioned there is general a lack of distinction made between image users' needs and their use of images. For this study use has been defined as how images are utilized after they have been retrieved and selected. This is a somewhat artificial distinction since the process of judging the relevance of images has been shown to contribute to a change in understanding for users (Choi & Rasmussen, 2003). The development of knowledge is obviously a specific kind of use, but one that is less explicit or measurable. This idea of expanding knowledge through image viewing was discussed by Eklund et al. (2006) in their investigation of a digital image database developed to support online learning. They state that working with images directly (comparing, contrasting, organizing, analyzing, etc.) promotes understanding through reflection. These researchers go on to note that in the educational setting images were used since they provide unique content, stimulate the communication of ideas and invite discussion, analysis and group activities. This analysis of the various uses of images was echoed by Promey (1998). This practicing art historian writes about her experiences with digital images and describes the various ways images have been used within an art
history lecture hall. She discusses how images have traditionally been employed to teach students how to think visually by having them perform verbal analyses of compositions. Through the processes of viewing, reflecting and writing students develop a much firmer understanding of the visual characteristics of the work and the processes used in their creation. Promey also discusses how graphics software introduced alongside digital images has been used by her students to create compositional “transparencies” to outline major visual elements in the work. This process, too, has helped develop the students’ visual acuity. One final aspect of image use mentioned by Promey (1998) is particularly interesting to think about; she states students were more likely to go and visit the works in person due to the increased interaction afforded them through digital images.

One aspect that was not found in the literature is how specific needs are met through the exploitation of images. Pisciotta and Copeland (2003), in their publication concerning image user analyses for a campus-wide system at Penn State, group image usage within the academic setting into three categories: teaching, independent learning, and collection management. Although they report on findings related to the different retrieval methods employed by the three groups, the authors do not clarify how image use may vary. This lack of interest in end-user behaviors is notable given that the use of images by a lecturer will likely be vastly different from that of a curious citizen and a collection manager.

Complicating this matter a bit further is that each user is likely to have multiple needs. For example, Garber and Grunes (1992) discovered that images were used at three critical points (creation of initial artistic concept, preparation of
initial compositions, and initiation of the final photograph search) within the creation of an advertisement. In each phase images were used for different purposes (inspiration, idea and compositional development, and the realization of concept). One possible way to think about image use might be borrowed from discussions of humanities scholars’ utilization of resources. Brockman et al. (2001) categorized the resources used by these users into functional groups consisting of data, evidence, negative evidence, exemplars, factual, referent, theory, and absences. These categories, while far more detailed, are reminiscent of Fidel’s (1997) discussion of images which fall on a continuum from the Data Pole (images used as data, i.e. x-rays, maps) to the Object Pole (images used as objects, i.e. art work). Categorization of the types of information contained in images and the various ways images are used would provide a very useful framework for investigations of images and users.

Summary

The review of the literature presented here provides an overview of the research that has been published which has focused on users and their image behaviors. An overview of the concept of information behavior as it involves image users for this study was given. After this a presentation of the various ideas expressed in the literature surrounding image use among the study’s proposed four user groups was provided. Next, the limited discussions concerning the topic of users’ image needs found in the literature were reviewed. This section was followed by the issues appearing in the literature surrounding image retrieval. This included the topics of query formulation, query analyses,
intellectual access to images, content-based image retrieval and relevance judgments. Finally the topic of image use as it appears in the literature was presented. Seen as a whole, the review of the literature offers an evaluation of the research that has been undertaken within the realm of image users’ needs, image retrieval processes, and image use. It is clear from the review that the published material concerning users’ image behaviors has generally focused on issues surrounding image retrieval. Even with this higher degree of research coverage the image retrieval findings can be contradictory or the reasons underlying phenomena remain unexplained. Part of this lacuna in the research findings might be due to the fact that image user needs are not well understood.

User needs appear to exert a strong influence on many other aspects of the entire image seeking process, yet issues surrounding this topic have certainly not seen an equal level of research interest. This is troubling since without a fundamental understanding of the tasks they perform, the reasons behind their image needs and their preferred processes of retrieval it is not possible to provide a very useful level of access to images.

The ultimate use of images once they have been retrieved is another research area that is nearly without mention in the literature. As Bates (1998) states, information retrieval is one of most important issues within information science. However, aspects surrounding use also need to be acknowledged and addressed through research. Due to the visual nature of images aspects concerning use can be very different than those of textual materials. The physical characteristics of works and the technological dependencies of images
for exchange and visual display are critically important issues to their ultimate use. These issues are essentially untreated in the literature and so there is nearly complete gap in our knowledge. The information science community has only recently come to address the issues associated with visual information. While there have been many successful forays into discerning the phenomena surrounding image retrieval, the discipline has failed to address image users’ needs and how images are being used. This lack of understanding surrounding images has continued to make finding and using images some of the most challenging information experiences for users.
CHAPTER 3: METHODS

Rationale for a Qualitative Design

This study sought to identify, describe and understand the various human behaviors, thoughts and beliefs surrounding image needs, retrieval and use. The investigation was carried out using primarily qualitative research methods since, according to Denzin and Lincoln (2005), these methods are most appropriate when the purpose of the study is to investigate human thoughts, beliefs, behaviors, and other socio-cultural aspects. Furthermore, qualitative methods are noted as being particularly well-suited to studies concerning human behavior research since the reasoning behind human action cannot easily be revealed through the measurement of phenomena (Wilson, 1999; Krathwohl, 1997). The lack of research in the area of users’ image behaviors, particularly in the area of image needs and use, meant this study was from its beginnings exploratory in nature. A clear and thorough understanding of users’ image behaviors, thoughts and beliefs were unlikely to be achieved without detailed accounts of the participants’ points of view and their image experiences. Thus, qualitative research methods were chosen since they are considered particularly useful for providing the “thick description” necessary for understanding under-researched areas (Miles & Huberman, 1994).

In brief this study used multiple data collection methods in the form of a survey and semi-structured interview to examine the image users’ behaviors and opinions. What follows in this chapter is an account of the steps, instruments and techniques that were used to gather and analyze the data concerning users’
image behaviors. This level of detailed documentation is important since, as Wang (1999) states, “… the nature of qualitative data analysis is inductive,” (p. 67). Clear and thorough explanations of a study’s methods are indicative of the degree of care and rigor taken to analyze and present its findings. Beyond this, it is hoped that the in-depth accounts of the study’s research methods will allow for future work to be undertaken to test the findings or develop the research further.

**Assumptions and Biases**

This study would not have taken place without the knowledge and practical experience learned over the ten year period the researcher worked in image collections. Also a part of the researcher’s experience is the many years spent teaching art history at colleges and universities in the Philadelphia area. It is likely that these experiences shaped the researcher’s perspective. As Etzi (2004) states, “It is presumed that every researcher has presuppositions or biases from which he/she begins. There is no such thing as knowledge without bias or presuppositions, since any knowing or questioning for that matter is from a particular perspective,” (p. 1). An awareness and acknowledgement of the possible biases and perspectives of the researcher and a clear statement about what these may be are warranted here.

Witnessing and experiencing image users’ difficulties in finding and working with images first-hand framed the researcher’s views toward this topic. A presupposition of the researcher was that there were various challenges that faced image users. This study attempted to address those problematic issues with the hopes that this situation could be improved. The experiences that led to
the development of this study have hopefully proved useful in providing a deeper understanding of the challenges facing image users. It is hoped that the researcher’s knowledge and understanding led to an increase in the extraction of meaningful and important information provided by the study’s participants. Furthermore, the researcher’s education as an information science doctoral student and the coursework completed in research methods have helped to ensure that the study was designed to minimize participant responses that would serve her biases.

**Characteristics and Selection of Participants**

This study set out to examine the behaviors of individuals whose work is dependent on images. It needs to be recognized that the professions which were examined are not the only user groups to perform work with images. However, this study was limited to what data collection and analysis could reasonably be accomplished by one person over a period of several months. While many professions work with images it was believed that studying these four user groups (archaeologists, architects, art historians and artists) offered several advantages. The first of these advantages concerned the research design of the study. The researcher believed that the four groups’ shared interest in, and need for, images of cultural material could provide interesting insights into image users’ behaviors. By examining participants in user groups that share a need for the similar kinds of images any differences found would help clarify the impact profession has on the behaviors of image users.
The inclusion criteria for the participants in the study were further defined by the particular career paths chosen within their respective professions. Since each of these professions have multiple possible positions, the study limited the kind of work performed by each user group. The participants included in the Archaeologist and Art Historian user groups were expected to be actively involved in teaching and research at the college or university level. Thus, these two groups share a common foundation in the pedagogical and research-related work they perform.

The participants included in the study to be representative of the Architect and Artist user groups also shared a similar professional goal. These participants were included if they were producing creative works (architectural or art). The architects were included in the study if they were working, either in an architectural firm or self-employed, and paid to create architectural designs. The artists were expected to be practicing fine artists working in any media who self-identified as an artist. For inclusion in the study it was also expected that the artists were creating works that had an aesthetic purpose rather than a functional one, and that the individuals were actively exhibiting their work. Of the four user groups included in the study the artists were the only group to performed supplemental work to support themselves. While all of them self-identified as artists, two of the six participants in this group performed some form of work which diverted a part of their time from their art-making. As this paid work did not interfere with their ability to produce works for exhibition they were included in the study.
Returning for a moment to advantages of studying these four groups, there were practical considerations as well. Members of these four groups had all been users within the image collections served by the researcher in a former professional role and this meant a reduction in the amount of time spent trying to comprehend basic behaviors of users working with images. Finally, the researcher had ready access to three of the four user groups through a network of professional contacts. Participants in the fourth user group, representing the architects, were also accessed through professional contacts. These were forged during the researcher’s participation in a multi-day architectural design charrette in April of 2008.\textsuperscript{10} Involvement in this event also enabled the researcher to witness first-hand the use of images by architects during the design process. The working processes of the architects were not as well-understood as those of the other three groups under study and therefore this was considered a useful experience for the researcher.

\textit{Recruitment}

The study was submitted to the Institutional Review Board (IRB) at Drexel University in April of 2008 and approved the following month. After receiving IRB approval participants were recruited using purposeful sampling. According to Patton (2002) “[p]urposeful sampling focuses on selecting information-rich cases whose study will illuminate the questions under study,” (p. 230). Since the answers to the study’s research questions were highly dependent on examining

\textsuperscript{10} The researcher undertook a multiple day immersive architectural design experience held at Drexel University to learn more about the practices of architects during the design and presentation phases of their work. See the following link for more information about the design charrette held April 3\textsuperscript{rd}-7\textsuperscript{th}, 2008: http://www.openarchitecturenetwork.org/node/2100.
the specific work tasks and image behaviors associated with archaeologists, architects, art historians and artists, the participants were selected on the basis of their unique professional roles. More specifically, the type of sampling used in this study was stratified purposeful sampling, so-named because the individuals recruited are expected to be able provide detailed descriptions of the behaviors of several homogenous sub-groups as well as facilitating comparisons of the individuals (Patton, 2002).

The researcher recruited participants from across a variety of dimensions, such as specialization, work setting, years in profession and position in order to provide the widest possible range of experiences within each user group. Nevertheless, it was not possible to accommodate all variations that exist within each profession. One area of variation that was not about to be accommodated is gender. Although the researcher attempted to recruit male participants, the majority of the study’s participants were female (15 of 20). The two academic user groups contained only female participants. The range of variation in the participants in each group can be seen in Table 3.1. (A more complete account of each participant can be found in Appendix D).
Table 3.1 Demographic characteristics of participants by user group

<table>
<thead>
<tr>
<th>No. in Group</th>
<th>Gender</th>
<th>Education</th>
<th>Years in Profession</th>
<th>Position</th>
<th>Area</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist User Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4F</td>
<td>Ph.D.</td>
<td>15-40</td>
<td>Instructor, Asst.</td>
<td>Etruscan, Greek, Roman, Hellenistic</td>
<td>Small college &amp; large university</td>
</tr>
<tr>
<td>4</td>
<td>4F</td>
<td>Ph.D.</td>
<td>15-40</td>
<td>Professor &amp; Professor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3F 3M</td>
<td>BArch &amp; MArch</td>
<td>4-40</td>
<td>Head of Graphic Design, Designer, Architect</td>
<td>Civic, Educational, Residential, Medical &amp; Urban Renewal</td>
<td>Consultant, small to large firm</td>
</tr>
<tr>
<td>4</td>
<td>4F</td>
<td>MA &amp; Ph.D.</td>
<td>15-41</td>
<td>Instructor &amp; Professor</td>
<td>Ancient, Medieval, Renaissance, Contemporary</td>
<td>Small college &amp; large university</td>
</tr>
<tr>
<td>Artist User Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4F 2M</td>
<td>BFA-MFA</td>
<td>7-40</td>
<td>Multimedia, Painter, Printmaker, Sculptor, Mixed media</td>
<td>Figurative &amp; Abstract</td>
<td>Own studio-studio with collaborative</td>
</tr>
</tbody>
</table>

Recruitment of participants was completed using the so-called snowball or chain method (Vogt, 2005; Patton, 2002). Through this method of recruitment, colleagues known to the researcher acted as contacts for additional professionals. These colleagues identified individuals who agreed to discuss the study with the researcher. Potential participants were contacted by the researcher, typically through an email, though phone calls were also made. During the initial contact the details of participation in the study were outlined for the individual. The potential participants were asked questions to clarify the work.
they performed, their area of specialization and their work setting in order to accommodate the variations needed within the user groups. If the individual’s professional situation did not meet the inclusion criteria outlined above, or if their position was too close to others in the group, they were thanked for their time and interest in participating in the study. Their contact information was retained in case further participants were needed to complete the study.

Those potential participants who met the inclusion criteria and whose professional situation provided variation to the group were asked to participate in the study. If they agreed to participate, a time to carry out the study was arranged. A copy of consent form (see Appendix C) to participate in the study was sent in advance of the meeting in order to give them ample time to read the document carefully. The consent form was discussed with each individual and signed prior to their participation in the study.

**Saturation**

The topic of sample size in qualitative research is a subject of some debate since data richness and saturation are considered more critical than the number of participants. Patton (2002) states sample size has little connection to “[t]he validity, meaningfulness, and insights generated from qualitative inquiry…” (p. 245), and instead believes that these qualities depend more on the richness of the data collected from participants by researchers. Lincoln & Guba (1985) offer a slightly different approach to the question of sample size by suggesting that data collection should continue until information gleaned from participants becomes redundant. This study received IRB approval for a total of 30
participants. However, recruitment for the study ended at 20 participants. Recruitment was stopped for the academic user groups, those representing the archaeologists and the art historians, with four participants in each group. Data collection in these two groups had become repetitive and was corroborating the phenomena and themes that had previously been collected. This situation indicated that data saturation had been achieved. The creative user groups, those of the architects and the artists, ceased collecting data with six participants in each group. The data collection continued in the case of the creative user groups since they showed more variation in their responses. Data collection continued for the two creative user groups until no new significant findings were being revealed. This situation indicated that data saturation had been achieved for these two groups. A summary of the study’s data collection events is shown in Table 3.2.

After each interview was conducted, transcribed and analyzed, data were compared with those of other participants both within and across the study’s groups. The comparison began with the data collected from two archaeologists. Their survey and interview data when compared were found to be similar in terms of their behaviors, processes and perspectives. Next, data was collected from an artist-participant. His responses revealed several differences in processes, affective responses and behaviors when viewed beside those of the archaeologists. These were noted and the data collection moved on to an art historian whose responses showed similarities to those of the archaeologists and differences when viewed beside those of the artist. This procedure of data
collection and comparison of the behaviors, processes and perspectives revealed by the participants continued until the end of October 2008. Data collection stopped for a period of several weeks at this point to allow the researcher time to double check the patterns which had been discovered in the data and to reflect upon what had been found in the study as a whole.

Table 3.2 Summary of data collection events

<table>
<thead>
<tr>
<th>User Group</th>
<th>Date of Study</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist 1</td>
<td>31-May-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Archaeologist 2</td>
<td>4-Jun-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Artist 1</td>
<td>17-Jun-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Art Historian 1</td>
<td>15-Jul-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Art Historian 2</td>
<td>13-Sep-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Archaeologist 3</td>
<td>16-Sep-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Artist 2</td>
<td>26-Sep-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Archaeologist 4</td>
<td>10-Oct-08</td>
<td>Phone</td>
</tr>
<tr>
<td>Architect 1</td>
<td>14-Oct-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Art Historian 3</td>
<td>15-Oct-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Architect 2</td>
<td>16-Oct-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Artist 3</td>
<td>21-Oct-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Architect 3</td>
<td>28-Oct-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Architect 4</td>
<td>29-Oct-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Art Historian 4</td>
<td>17-Nov-08</td>
<td>Phone</td>
</tr>
<tr>
<td>Artist 4</td>
<td>19-Nov-08</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Artist 5</td>
<td>11-Mar-09</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Architect 5</td>
<td>9-Apr-09</td>
<td>Phone</td>
</tr>
<tr>
<td>Architect 6</td>
<td>24-Apr-09</td>
<td>Face-to-face</td>
</tr>
<tr>
<td>Artist 6</td>
<td>27-Apr-09</td>
<td>Phone</td>
</tr>
</tbody>
</table>

The data collected from the participants in the Archaeologist and Art Historian user groups had become repetitive and had not revealed new or
conflicting information for the last interviews carried out in both groups. As a result the next interview, an art historian (Art Historian 4), was used to further examine the patterns that had been identified in the earlier surveys and interviews. Although the interview provided additional depth to the concepts that had been discovered, it did not add any new important information for this group. Data collection for the academic user groups was stopped at this point.

Data continued to be collected from the participants in the Architect and Artist user groups, as their responses regarding their work with images had not yet been fully explored. The responses of the participants in the Artist and the Architect user groups showed more variation when compared to those of the other groups in the study, therefore data collection continued. Data collected in the final five interviews (3 artists and 2 architects) of the study focused on examining the behavioral and affective aspects of the users’ image experiences as these were the areas needing corroboration. The data recorded through the remaining surveys and interviews confirmed the patterns which had been witnessed in these user groups and no substantial new information was acquired. Data collection for the creative user groups was discontinued as a result of this situation.

**Data Collection**

As is common in qualitative studies, two data collection techniques were employed in order to increase the credibility and dependability of the study (Guba, 1981). This study collected data through a paper-based survey and a one-on-one semi-structured interview which was recorded using a digital voice
recorder. The study had originally been designed to include an observation of the image retrieval methods of each participant. However it was discovered during the piloting phase of the study that the observation method was unworkable for two of the groups being investigated. Informal discussions with several possible artist-participants revealed that artists’ image seeking episodes were sporadic, unplanned and sometime serendipitous in nature and therefore data was unlikely to be captured through the observation method. Although this is a somewhat unfortunate situation for the study’s design it pointed to the unique searching behaviors practiced by artists.

Architects presented a somewhat different situation concerning the observation method. While architects are voracious image seekers when the need arises,\textsuperscript{11} they appear to have the fullest schedules of the four groups. Conversations with architects during the recruitment process revealed they were hesitant to take part in the study due to the time commitment required of them for participation. As a result, the originally proposed methods of survey, observation and interview were changed to include the survey and interview methods only. As a means to ensure sufficient data was collected concerning image retrieval the initially developed interview guide was revised and additional questions (4 through 10) were added with the aim of eliciting information about the participants’ most recent image seeking behaviors and experiences. These amended changes to the methods were reviewed and approved by the Institutional Review Board at Drexel University on May 15, 2008.

\textsuperscript{11} As the researcher discovered while participating in the design charrette, images were integral to the development of the proposed structure and its presentation.
**Modes of Data Collection**

There were two typical modes used for the data collected in this study. The most common procedure was to meet the participant face-to-face at their place of work or in a public location such as library or café. One meeting took place at a participant’s house during her lunch hour. This face-to-face mode accounted for 16 of the 20 data collection events. The remaining 4 data collection events were conducted over the telephone. Individuals who were interviewed over the phone were required to return a signed consent form to the researcher before any data were collected for the study. The telephone method of data collection was carried out for one participant in each group. This mode of data collection was added (and approved by the IRB alongside the changes to the interview guide) as a way to ensure adequate numbers of participants, particularly in the Architect user group.

**The Survey Protocol**

The first data collection event consisted of an eleven question survey designed to gather data about the participants’ demographics together with preliminary details concerning their image behaviors (Appendix A). The survey recorded various facets about the participants such as the broad reasons behind their image needs, the primary resources consulted for images, the commonly employed image retrieval strategies, the frequency of the image searches they perform and the common uses for the images they have retrieved. The survey was typically filled out by hand, although several of the participants who completed the study over the phone completed the survey using a computer and
sent the document to the researcher in either printed or digital form. The participant’s survey responses were examined briefly by the researcher prior to the start of the interview in case there were items that needed clarification. The survey questions were mapped to their corresponding research questions, shown in Table 3.3, during the design phase of the study as a way to ensure a similar level of coverage and also to facilitate the data analysis process.

**Table 3.3 Matrix showing survey questions mapped to research questions**

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>RQ1 – Need</th>
<th>RQ2 – Retrieval</th>
<th>RQ3 – Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Group membership</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 – Years in profession</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 – Work tasks</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4 – Image type</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5 – Frequency of need</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6 – Favorite resource</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7 – Resources used</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8 – Search method used</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>9 – Image use</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>10 – Image use</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>11 – Tools used</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**The Interview Protocol**

Data collection for the study also included a semi-structured one-on-one interview consisting of a series of twenty questions and probes (Appendix B). As a way to ensure that each research question received adequate coverage and also as a way to structure the data prior to its collection to facilitate analysis, the interview questions were mapped to their corresponding research questions during the design phase of the study. These are presented in Table 3.4.
Table 3.4
Matrix showing interview questions mapped to research questions

<table>
<thead>
<tr>
<th>Interview question</th>
<th>RQ1 – Need</th>
<th>RQ2 – Retrieval</th>
<th>RQ3 – Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Background</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 – Work performed</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3 – Typical image need &amp; use</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 – Last image - work task</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 – Last image needed</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6 – Last image - search strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 – Last image - resources used</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 – Last image - search success</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – Last image - usual vs. unusual need</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 – Search frequency</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>11 – Known item search strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 – Unknown item search strategy</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 – Barriers to image discovery</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 – Image selection</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>15 – Image technology</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>16 – Format search</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 – Typical image use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 – Use differences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 – Tools adequate</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>20 – Improvements</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

The interview questions (and survey) were piloted during the initial phase of the study with three participants (Archaeologist 2, Art Historian 1 and Artist 1). The data collected at this time confirmed that the questions elicited information which corresponded to the research questions. Several questions on the interview and the survey were modified after the pilot for the sake for clarity. The basic content of the questions remained unchanged, however.
The semi-structured interviews, which were conducted after the participants completed their surveys, allowed direct inquiries of the participants so that data could be gathered to answer the specific research questions under investigation. As is common when using the semi-structured interview method, the researcher and the participant were free to discuss further topics which ran parallel or tangential to those provided through the interview guide (Patton, 2002; Spradley, 1979). This flexible method allowed the researcher to ask additional questions to examine specific topics discussed during the interview that needed more detailed coverage. It also allowed the researcher to explore in detail issues raised during the previous round of data analysis. This iterative process of data collection and analysis, a hallmark of qualitative research, helped the researcher to collect rich and meaningful data.

Through the interviews the thoughts, beliefs, experiences and intellectual processes underlying the participants' image behaviors were explored. The first question of the interview gathered information about the participants' level of education. It was included here rather than in the survey to familiarize the participant with the interviewing process and so increase the participant's comfort level. This in turn, it was hoped, would help them speak more freely during the interview. Questions 2 through 4 were designed to elicit information about the context of the image need and why images were used by the participants. Questions 5 through 7 were asked in lieu of the observation to collect information about the methods and resources used by participants for image retrieval. Question 8 asked about the participants' success while searching. This question
also gathered data concerning the participants’ knowledge of and interest in content-based image retrieval systems. Question 9 collected information about typical and atypical image needs.

Issues relating to image retrieval were the focus of interview questions 10 through 14. Questions 10 through 12 elicited information about the retrieval context and the participants’ search methods and strategies. Data concerning the barriers to the participants’ ability to retrieve images were collected in the next question. Question 14 sought data to clarify how participants select images from those they are able to retrieve. Questions 15 and 16, and to some extent 19, were used to examine the participants’ technological landscape since several studies of the user groups under investigation here have pointed to their limited adoption of, and proficiency with, technology (Rose, 2002; Challener, 1999).

Aspects surrounding the participants’ use of images were explored through questions 17 and 18. Questions 19 and 20 were designed to elicit responses from the participants concerning what they believed the problems and promises were surrounding their work with images.

The interviews, which were conducted with this series of 20 questions, ranged in duration from 55 minutes to approximately 2 hours and 15 minutes. The majority of the interviews were between 1 hour and 15 minutes and 1 hour and 45 minutes long. In addition to recording the verbal content of the interviews, field notes were kept to document any notable characteristics relating to the interview that were not perceptible via the audio recording (e.g., setting of the interview, interruptions, body language and facial expressions). The richness
of the data collected during the interviewing process varied from participant to participant. Nevertheless, even those participants at the more reserved end of the loquaciousness spectrum provided useful data to the analysis.

**Data Preparation**

Data collected using both methods (survey and interview) were prepared prior to analysis. The hand-written responses to the paper-based survey were transcribed verbatim using Microsoft Word by the researcher. The audio files from the semi-structured interviews which were recorded using two Olympus digital voice recorders (VN 2100 PC and WS-110) were also transcribed. The transcription process required several steps to complete. First the audio files were transferred from the digital voice recorders to the researcher’s computer. Transcription of the interviews using Microsoft Word was completed by the researcher for the first two participants in each user group and by a professional transcription service for the remaining twelve interviews. The researcher listened to all of the audio recordings during the transcription process. Interviews prepared for analysis by the transcription service were checked by the researcher by listening to the audio recording and examining the transcripts for errors and omissions. Inaccuracies that were encountered were changed to reflect what had been stated by the participant during the interview. Noteworthy non-verbal aspects recorded in the field notes and those recording audio clues to the participants’ point of view or state of mind were included in the transcript of the interviews either as setting notes at the start of the document, or as bracketed information about participant actions within the participant’s
responses. These notes provided critical clues to the participant’s emotional state about a topic and so they were used in the data analysis process.

**Data Analysis**

What follows is a description of the methods employed for the analysis of the transcribed survey and interview data. There were two broad kinds of data examined in this study. The first kind, factual data, consisted of the extraction of the direct responses of the participants. An example of this kind of data would be the participants’ responses to the question which asked about the frequency with which they need images (e.g., daily, weekly, monthly, etc.). This factual data, extracted from the responses to single or paired questions of the surveys and interviews, were examined mainly through the use of case-ordered displays (one example is Table 4.4). The data displayed in this way allowed the researcher to view the entire range of responses given by the participants concerning a focused topic. This procedure was useful for discovering the dimensions and patterns that existed in the participants’ responses.

The second kind of data, thematic, consisted of large abstract units of theme-based information which were found at various point across the transcribed interviews. An example of this kind of data would be responses that relate to the theme of access, as in the following passage.

“Before I had access to the Internet it used to be very, very difficult.”

[Architect 4, 703]

These conceptual passages were employed in the constant comparative method of data analysis used in this study.
The constant comparative method is best described as an iterative process of assigning thematic labels to words, sentences, passages or documents with the aim of developing higher conceptual categories which can be used in the development of theoretical constructs (Glaser & Strauss, 1967). Following this method, the first step in the analysis was a review of the first transcript and the field notes which recorded non-verbal information. The next step involved reading through the printed transcript several times and coding for topics. The coding used the sentence as the unit of analysis for coding, chosen since it was the easiest to distinguish, and in this way the transcript was microanalyzed. Assigned codes were listed in the margins of the document and at the end they were gathered together and entered as a list in a Microsoft Word file (Appendix E: E.1 Initial Codes). This process was repeated for the first four participants. New topics which emerged from the transcripts were added to the growing list and earlier transcripts were revisited to solidify meaning in the codes.

After the first four interviews had been coded all of the interviews that had been transcribed to date were imported into the qualitative research software NVivo 8.0 and coding was completed with its assistance (QSR International, 2007). The coding continued on each interview transcript and changes to the coding scheme (i.e., additional and adjusted codes) necessitated a recoding of earlier transcripts. Memos written by the researcher recorded these changes in the codes as well as capturing interpretations, questions and ideas for future data collection and analysis. This coding process continued through several iterations and passes through the data. While a number of interesting themes emerged
during the coding process, none of the themes which had emerged were able to explain image user behaviors in an over-arching way.

One theme, frustration, appeared consistently in the coding and ran across each of the interview transcripts. Since the frustration the users experienced clearly had an impact on their behaviors when working with images this theme was used as the central category for the research. The researcher re-examined the data to discern the main components of frustration. This was achieved by first isolating all of the coded passages with the theme of frustration and then coding for the various themes that appeared in them. The data from each of the interviews was also examined for negative evidence. While each case contained the theme of frustration, this closer examination revealed varying degrees and, or causes for this feeling among participants. After several passes through the data the coding scheme for frustration was developed (Appendix E: E.2 Coding Scheme for Frustration).

**Inter-Coder Check**

An inter-coder assessment was completed for this study in order to evaluate the reliability of the coding scheme developed by the researcher. The inter-coder check was completed late in the study to ensure that the final coding scheme was understandable and reflective of the themes found in the data. This was carried out using 25 passages which had been assigned the theme of satisfaction or frustration and one of six various sub-themes by the researcher. Eight coders were used to perform this code check. These consisted of one Ph.D. in information science, two Ph.D. students in information studies, four M.A.
or M.S. practitioners with experience in image collections and one computer programmer with a B.S. in mathematics and computing. Each coder was given an Excel spreadsheet containing the 25 passages with the codes provided in a separate column. The coders were instructed to choose two codes for each passage, one at a very gross level and the other at a finer degree of meaning. They received a Microsoft Word document with the definitions of the codes and the instructions for coding (Appendix E: Table E.3). The spreadsheets completed by each coder were returned to the researcher and these codes were copied and transferred into a separate master coding file. The inter-coder agreements were then tallied. The granular codes applied to the passages saw a 96% agreement rate across all of coders and the researcher. The six more focused themes achieved an agreement rate of 81%. These agreement rates among the coders and the researcher were sufficient according to Holsti’s (1969) reliability measure threshold of 80%.

**Member Check**

At the end of the data analysis phase the researcher sent a summary of the findings to participants in each of the four groups via email and asked if they would be willing to read and comment upon the findings (Appendix E: Summaries E.4 through E.7). The aim was to speak with one individual from each group to ensure that what was being reported was in fact a reflection of these users’ work with images. These telephone re-interviews were carried out and the comments of the participants were recorded using digital voice recorders with a telephone receiver attachment. The telephone interviews ranged from 22 to 43 minutes in
length. The members were asked a series of questions designed to elicit information about the contents of the summary (Appendix E: E.8 Member Check Interview Guide). The researcher was particularly interested in learning about topics that may have been overlooked or findings that were reported incorrectly. The guide was geared toward revealing these, but the participants did not discuss omissions or inaccuracies. Each of the participants who commented on the summary (Archaeologist 3, Architect 6, Art Historian 4 and Artist 6) confirmed the findings. Participants’ responses received during the member check interview confirmed that the researcher had been able to capture users’ experiences and working methods in the summary.

“I saw a lot of myself in the summary.”
[Archaeologist 1]

“I just read over it and think that it is spot on!”
[Architect 6]

As the researcher had set out to provide an accurate description of the image users’ thoughts, beliefs and experiences, support of the findings by the participants was a critical component in ensuring the credibility of the study.

**Limitations of the Study**

While this study attempted to broaden the discussion of image users’ behaviors by examining several user groups, it must be acknowledged that each group shared an interest in images of cultural materials and that the participants all had similarly high levels education and well-honed skills of visual analysis. Other limitations resulted from the study’s goal of providing a high-level, holistic view of image users’ behaviors and its primarily qualitative research
methodology. As the study was designed to give a broad perspective on image users’ behaviors, detailed quantitative analyses of users’ image retrieval processes and exhaustive assessments of users’ technological skills were beyond its scope. An additional limitation to the study is that it was unable to achieve a high conceptual level useful for theory construction to explain image users’ behaviors.

Several additional issues surrounding the study’s participants must be addressed here. While image users were recruited through purposeful sampling there were aspects which could not be fully accommodated in the study. For example, each user group’s domain has a large variety of specialties and these dimensions far exceeded the scope of what could be accomplished in this study. Other characteristics about the participants, such as their familiarity with technology, were not used as criteria for selection and yet these may have had an impact upon the data collected. Mention should also be made here of the lack of male participants in the academic groups.

The data collection methods employed did not include direct observations of the participants’ behaviors, and so the study had to rely on the participants’ abilities to recall processes and events and also to express their thoughts completely and coherently. An additional limitation of the study is that the participants did not have the opportunity to perform image searches with a content-based image retrieval system. Instead the participants were informed of the basic features of content-based image retrieval technologies by the researcher and asked to comment on the potential usefulness of these systems.
for the image queries they undertook. It is possible that the participants may have found them more or less useful if they had had the opportunity to directly interact with a content-based image retrieval system.
CHAPTER 4: FINDINGS RELATED TO IMAGE NEEDS

Introduction

The concept of image need, the reason behind why images are sought by users to complete their work tasks, is presented here separate from image use. Image needs and image use are theoretically discrete in terms of where they fall in the sequence of information behavior among users. Nicholas (2000) defines information need as, “… the information that individuals ought to have to do their job effectively, solve a problem satisfactorily or pursue a hobby or interest happily,” (p. 20). Need generally occurs prior to the act of seeking out images and requires a course of action that involves problem definition and reflecting on possible solutions. Image use, which follows image discovery and selection, has its own distinct series of problems and processes. Nevertheless, decoupling image needs from image use is somewhat artificial since the two are co-dependent. In practice the participants rarely made a distinction between why images were needed and why they were used in their work. As a result when participants were asked why they needed images to perform their work they typically responded with “I use images for / to …”

This chapter presents the findings associated with the first research question of the study and its sub-questions:

Q1. What information needs drive users to seek images?
   - What are the purposes for which images are needed?
   - What types of images are needed?
Stated more plainly, the findings identify what kinds of activities performed by the participants needed the support of images and what types of images were required by the participants to undertake these activities.

**Why Images Are Needed**

This section presents the findings surrounding the main research question (What information needs drive users to seek images?) and its sub-question (What are the purposes for which images are needed?). The results presented here were collected from the participants’ responses to survey question 3 (What work tasks do you complete with images?) and interview question 3 (Can you tell me a little bit about why you need images in your work?). A general picture of the participants’ image needs was discovered from survey question 3. In their survey responses the participants provided an account of the tasks they accomplished with images. As can be seen in Table 4.1 there were variations found in the work tasks of the participant groups. The responses ranged from teaching and scholarship activities to the research and presentation of architectural designs and artworks.

**Table 4.1 Work tasks completed by user group**

<table>
<thead>
<tr>
<th>User Group</th>
<th>Work Tasks</th>
<th>Specific Task Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist</td>
<td>Teaching, research and publication preparation</td>
<td>Class and public lectures, books and articles</td>
</tr>
<tr>
<td>Architect</td>
<td>Develop and create designs, renderings and presentations, perform research</td>
<td>Architectural designs and drawings, concept boards, presentations</td>
</tr>
<tr>
<td>Art Historian</td>
<td>Teaching, research and publication preparation</td>
<td>Class and public lectures, conference presentation, books and articles</td>
</tr>
<tr>
<td>Artist</td>
<td>Create works, develop proposals</td>
<td>Paintings, drawings, prints, photographs, sculpture, installations</td>
</tr>
</tbody>
</table>
There were, however, similarities to be found among the academic user groups (Archaeologist and Art Historian) and the creative user groups (Architect and Artist). Each of the participants in the two academic groups noted they utilized images for teaching. The strong role of education and scholarship in their work can be seen in the additional related tasks public lectures, publications, research and conference presentations, mentioned by participants in the academic groups.

In contrast to the findings surrounding the academic user groups, there was a focus on creating designs or artwork among the architect and artist participants. All of the artist participants identified images as useful for the creation of artworks. However, the participants in the Architect user group were not as explicit about the creative tasks they performed. Several architects (Architect 1, 5 and 6) failed to discuss being directly involved in architectural design activities in their responses and instead talked about creating presentation materials (Architects 1 and 5) and architectural renderings (Architect 6). This variation in work tasks is likely due to the positions they held within their respective firms, since each of them discussed the supporting roles they played to the project / lead architect during the interviews. There were several other commonly encountered work tasks associated with image use among the architect-participants and these had to do with the presentation of their architectural designs to clients and the general public.

12 Rendering architectural spaces, while a creative activity requiring a great deal of skill unto itself, is the process of illustrating rather than developing a design.
Table 4.2  Image Needs as Expressed by Participant

<table>
<thead>
<tr>
<th></th>
<th>Teaching</th>
<th>Research</th>
<th>Presentation</th>
<th>Identification</th>
<th>Inspiration</th>
<th>Marketing</th>
<th>Social</th>
<th>Communication</th>
<th>Documentation</th>
<th>Financial</th>
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<tr>
<td>Archaeologist 1</td>
<td>XS</td>
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<tr>
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<td>Architect 2</td>
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<tr>
<td>Architect 6</td>
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<tr>
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<td>Artist 1</td>
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<td>Artist 2</td>
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<td>Artist 3</td>
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<tr>
<td>Artist 4</td>
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<tr>
<td>Artist 5</td>
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<td>Artist 6</td>
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<tr>
<td>Total Responses</td>
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<td>7</td>
<td>1</td>
<td>12</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

X = Response from interview Q3
S = Response from survey Q3

Adding to the research findings from survey question 3 were those discovered through an analysis of interview question 3 (Can you tell me a little bit about why you need images in your work?). As Table 4.2 illustrates, the interviews provided expanded data concerning the participants’ image needs than the surveys alone. Akin to what was discovered with survey question 3, the findings associated with the participants’ need for images revealed several similarities as well as differences across the study’s four user groups. The
responses of the two academic user groups (Archaeologist and Art Historian) were closely aligned. For this reason these two user groups are addressed together below. The responses of the two creative user groups (Architect and Artist) were similar on two dimensions only. The Architects discussed a wider variety of image needs when compared to their creative participant-counterparts and the academic image users. Several single or paired participants across the four user groups suggested image needs that went unmentioned by others in the same group. Presented below are the details of the findings associated with the particular user groups.

**Archaeologists and Art Historians**

For the two academic user groups (Archaeologist and Art Historian) each participant described needing images to perform work tasks associated with their teaching (lectures to undergraduates, graduate students, their colleagues and the general public) and research (detailed examinations of the iconography, technological processes, history, stylistic influence, etc. of cultural materials to develop knowledge and understanding). Several participants in the academic user groups stressed how central images are to the performance of their pedagogy. This is clearly seen in the comment of Art Historian 4 “All courses that I teach are heavily laden with images. I work through the images,” [72-73].

Images were also needed by the archaeologists and the art historians for their research and publications. The importance of images to their research and the degree of difficulty in meeting the academics’ image needs for research is clearly apparent in the following response.
“I write articles for which I need archaeological images to illustrate them. That is the major bane of my existence.”
[Archaeologist 2, 29-30]

While part of this difficulty stems from problems associated with retrieving images, as will be discussed in the next chapter, copyright restrictions were also seen as a major impediment. Copyright challenges figured prominently in the academics’ discussions surrounding image needs for their research, as the passage below illustrates.

“When it comes to research, even though we don’t make money off of our publications, we have to purchase our images. If whoever owns it doesn’t want to give it to you, you are sunk. In Berlin they have all the Pergamon stuff and I literally had to send a letter to the curator … I literally had to have tears on the paper to get them to let me use the images.”
[Archaeologist 1, 54-59]

The critical nature of the need for images for the academics’ teaching and research can be seen in the effort expended by the participants in ensuring they have access to the required visual materials. Comments surrounding the various image processes carried out by them to meet their needs, such as tracking down the images they needed, scanning images not available in digital format and personally photographing materials, were frequent.

“For that lecture I think I had about 40 images. Probably 10-12 I had to scan fresh from a book. This was better than most topics I cover.”
[Archaeologist 3, 173-175]

The amount of time and effort expended by them in meeting their image needs, especially those for teaching since they are reflective of ongoing as opposed to

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13 Participants’ responses are provided here verbatim with the exception of hesitation words (e.g., “ah,” “um”) which were removed for increased readability.
periodic needs, was apparent in their discussions. From a number of the academic participants’ responses it is clear they did not believe the critical nature of their image needs was being recognized at an institutional level.

“The past curators have not been overly anxious to accumulate ancient images. You know I am mostly on my own. I mostly have to say to them ‘Look you need to get this one, or you need to get that one.’ Or I go to museums and take pictures and then put them in the database.”
[Archaeologist 4, 202-205]

It is clear from this passage that the majority of the responsibility for fulfilling their image needs is felt to rest firmly on the academic user’s shoulders.

**Artists**

Moving on to the responses of the creative groups, the artists sought out images to create artworks. They discussed how they needed images to perform research (here meaning the images were needed as a visual reference and, or for problem-solving aims) as well as for inspiration (concept generation and, or creative response). A need for images was expressed by all of the artists regardless of the media or the style in which they worked. However, nuanced differences were discovered in the need for images among the representational and non-representational artists. The participants working in a representational style discussed needing images in association with a research function most often. Thus images were needed to investigate how representations were achieved in a particular work, for examining the visual characteristics of things and for exploring or capturing interesting ideas.

“There’s always a backlog of questions going ‘How am I going to do this? What’s that look like?’”

In cases like this the artist needed images to answer questions such as those concerning appearance, technique and compositional arrangement. In contrast to this, the artist-participants working in a non-representational mode were less concerned with problem-solving and more focused on needing visual materials for inspiration or to develop their artistic abilities.

“Here's a specific example, it would be at Christmas time when I make my truffle boxes, because I put a different pattern on the box every year. So, I might go to my archive of images, things that I've cut out of magazines or whatever, and then I would look for shapes and things, just to inspire me to make my patterns.”

In these cases artists used images as a means of visual exploration which would move them onto the act of creation. While the underlying need was found to vary in subtle ways, all of the artists required images regardless of their preferred mode of image-making.

**Architects**

The Architect group was found to be the most complex in terms of the breadth of their image needs when compared to the other user groups in the study. All of the architect-participants noted the need for images in conjunction with presentations of their architectural designs (PowerPoint slides or printed boards presented to clients and communities) and design development (inspiration and problem solving). Presentations made to clients figured prominently in the discussions of why images were needed by the architect-participants. Images needed for presentations were believed to help develop an
understanding of the ideas behind the design of the building which benefited both the architects and the clients.

“… you really want to interview the client and you get a sense of their likes and dislikes and tastes and then you create an image boards that sort of clarify or focus what exactly are their styles and tastes and are they open to certain directions. The only way that you can know that is to show them and sort of see their reactions. … It helps them and also for the architect. It helps them understand what is possible and what the potential is and gives them a framework within which to start designing. So images are incredibly important.”
[Architect 1, 413-425]

Related to the idea of developing understanding through the presentations, images were also noted as being necessary to the architects for developing the design. In designing a space the images were needed by the architect to understand what ideas were important to the client and, or to conceptualize the possibilities for a particular project.

“In the design process, when it really has to do with creating a concept, that’s when we have to sort of open up all the suitcases of pictures and kind of understand what it is we want to do. And I think … you always have an idea. And either it’s an idea that came from the client and they want this, or it’s an idea that came from you because you were on the site and you kind of got a feeling for something like that, or it could be something really simple like the last client we had said ‘Well, we want a wood house’."
[Architect 3, 530-536]

This passage illustrates how central images are to the development of an architectural space.

Communication, conveying design ideas to clients and co-workers, was an additional image need mentioned by all of the architect-participants. The
architects discussed how information about design ideas could be more readily understood when presented in a visual form. Images presented in mock-ups or more formal printed boards or PowerPoint presentations were often noted as being needed to communicate information to clarify meaning and, at least in the early stages, to further the development of the architectural design.

“So he will send me an email and say well we need to change da, da, da, da, da … and he will write it out for me. I will have to call him and say ‘You need to fax me a sketch because I don’t know what you are talking about.’ Once you get the sketch and I can see it, it makes sense what the words were saying.”
[Architect 2, 69-73]

This passage, which describes an interaction between two architects working on a project, is an illustration of a disconnection that can occur in transmitting information between the visual and the verbal worlds. Architects clearly understand the most direct path to communicate their design ideas to others is through images.

“When I speak to people… you know what? When I speak to people, the best way an architect can speak to people is through images.”
[Architect 4, 458-460]

Communication through images could center on expressing an architect’s ideas for a particular structure. However, this was not the only way images were needed for the communication of information. It was discovered that images, especially those with specific aesthetic qualities, were also needed since they would open up lines of communication between architects and clients.

“It is more of an idea if it is drawn, or at least if it has that quality to it. There may be a lot of technology behind it that made it happen but I think it is
comforting and grounding and allows them to be able to explore it as an idea with the architect and talk about where it could go next.”
[Architect 1, 291-295]

Communicating design ideas through images was not without its challenges, however. For example, images were sometimes needed to translate the technical imagery created by architects into a more palatable form for individuals who lacked the specialized knowledge required to comprehend architectural drawings.

“In our current job we use images to sort of convey our idea to our clients in an early stage. So we will do plans and elevations and technical architecture drawings that clients usually have a lot of difficulty understanding. You know if we look at a floor plan as an architect, we understand what it is supposed to look like. Most people not trained in architecture really cannot do that and so we will look for images of say … this is how we want this window to look. This fireplace will look like this or this bathroom … that sort of thing. We will convey ideas that are too complex.”
[Architect 5, 61-67]

While images were clearly discussed as being the most direct route to conveying information about architectural designs, several architects noted that the visuals must be carefully chosen and appropriate to the need and the audience.

“Images are very powerful to people and they can represent a lot of thing to people. So, in a way you have to be very careful with them. Whenever possible you have to sort of tailor your presentation to your audience.”
[Architect 1, 33-35]

Several additional reasons relating to image needs, for research and for marketing purposes, were mentioned by a majority of the architect-participants.

Gathering images relating to a specific geographic location, such as those
reflecting a community’s or neighborhood’s history and inhabitants were
commonly discussed by the architects.

“I did all this research into the history of Patterson. It was a very industrial city. It was the industrial center in 19th century. … There were textile mills there for silk. Silk factories. What was fascinating is that I was finding this whole series of images. I was finding this whole series of colored postcards from the 19th century of the insides of the factories and the landscapes of Patterson.”
[Architect 1, 109-118]

Problem-solving was an additional need which drove individuals to seek out images. When architects had questions concerning architectural forms, techniques or materials they often mentioned looking for images to find a solution.

“I had the idea that I wanted a railing that was as minimalistic as possible. So, I didn’t want a railing, is what it was. … But, I really went looking … to see how other people solved the problem very simply.”
[Architect 3, 812-825]

Marketing, generating interest in their designs among potential future clients, was discussed in association with their image needs by the majority (5 of 6) of the architects. Images needed to support the architects’ marketing aims were typically generated in-house and self-referential.

“I am going on this photo shoot tomorrow for a project that is nearly complete. It is an all-day shoot with an architectural photographer. We will be using those images to create various marketing materials to show the project. … The photography is really the only way that we can show our work to prospective clients. They go on a Web site, they go into brochures, the go into proposals…”
[Architect 1, 2-15]
While the images needed for marketing were generally of their own designs and created by firm staff, they varied widely in content. These images could range from photographs and architectural renderings of completed and in-process projects to charts and diagrams which outlined their work processes.

“There are these Requests for Qualifications, RFQs that come out. We get them and then we show them these are our qualifications, these are the things we have done. It is a lot of work. Most of the times it is images. Images of finished products. Images of in-progress work. And then also, diagrams of how we work. So, it is not necessarily images and photos of buildings. It is also flow-charts and very diagrammatic images that explain how we work, how we design, and there’s numerous other things. Fee structures, schedule… all of it. It is very visual-based,” [Architect 6, 77-85].

The findings presented here suggest image needs are highly dependent of work tasks. For the two academic user groups images were needed to complete the primary work tasks associated to their profession – teaching and scholarship. The Architects and Artists had a similar overlap in images needed for information gathering (i.e., research) and for their work or design development purposes. The similarities found among these two creative user groups end there, however. The architects also noted they needed images for the presentation of their design ideas, for communicating with colleagues and clients, as well as for marketing their completed and in-progress projects.

**Anomalies in Participant Responses**

This section presents image needs that were expressed by only one or two of the participants in their specific user group. A few interesting outliers relating to image needs appeared in the data during the analysis and these
appear to be tied to nuanced differences in work tasks among the participants.

For example, Archaeologist 4 mentioned she needed images to help with the identification of objects.

“In the summer, for instance when I was on this excavation [and] I was having to identify coins and I was using a number of books, but I did have internet access. … So, I could do a lot of work online, as well… and yet when it came in really handy was one time a student had found one of the earliest coins ever made in the world. One time… hah, I make it sound like one time… [laughs]. It was pretty amazing. I went to tea once and they dropped this coin in my hand and said, ‘What is this?’ And so, that isn’t the period I study, but I could go to the web and figure out what it was.”
[Archaeologist 4, 88-100]

She was the only archaeologist in the study who was actively involved in excavation. Whether this finding is the result of an actual different need for images based on work task is unknown and warrants further investigation.

Another anomaly in the needs of a particular participant group was found in the data associated with Artist 4. She mentioned having to put together presentation proposals as an additional reason why she needed images.

“I also find images often on the web, if I need to generate proposals. So… if I need, you know, a lawn or a tree or whatever, and I don’t have my own photo, which is another reason I take images, is to kind of take an image of a site and then place a proposal on that site. … But, if I need any of those things like an umbrella, I find an umbrella. I drag it off the computer.”
[Artist 4, 207-215].
As the only artist in the study creating large-scale sculptural installations it is likely that the work tasks associated with realizing this form of creative expression was responsible for this variation in the findings.

Beyond the teaching and research needs expressed by all of the participants in the group, Art Historian 4 was the singular participant to note she needed images for communication purposes.

“In other words, it’s either a historical survey or a set of images that relate to one another through theme, that I collect and then use in my lectures and in discussion with students.”
[Art Historian 4, 74-76]

Why this art historian was the only one to mention communication in relation to her image needs is unclear. It may be related to the fact that she was the only art historian-participant in the study involved in teaching or co-teaching interdisciplinary courses. It seems likely the resulting variation in the depth of knowledge of students within the interdisciplinary courses would require a modified pedagogical method when compared to the other art historian-participants. This variation could also be explained by having a participant who was more aware of the various needs she had for images. Whatever its cause, this anomaly in the art historian-participants’ image needs requires further investigation.

Among the Architects group there were three underlying reasons why images were needed which were mentioned by a pair of participants or a single participant. I have named these distinctive reasons social, documentation and financial. In the first category, social, Architect 1 discussed needing images
which would engage the individuals living in the communities where the firm’s
design projects were taking place.

“… going to community meetings and showing them
what you are going to be doing and why and sort of
get people excited and invested in it.”
[Architect 1, 158-160]

Architect 4 also mentioned the importance of including images which have
strong social element to them. These images, which show an understanding of
the cultural heritage of the neighborhood, were needed to connect the individuals
who lived and worked in the community to the architectural project.

“Because you can go and you might be taking
pictures of the wrong things. Understanding what
those images are. Oh, he understands my
neighborhood. That little space between two
buildings… you walk by and all of a sudden you see
some lawn chairs kind of set up there. Oh, there is a
tradition in this neighborhood that is important. I want
to take a picture of that. Those kind of images… they
relate to people immediately.”
[Architect 4, 1087-1092]

Both of these architects were the only architect-participants who worked within
firms designing civic structures such as public schools and churches. It seems
likely that the discussions of a social nature surrounding their image needs was a
result of the unique work tasks associated with structures so strongly connected
to the communities in which they were situated.

Documenting their work through photographs was a reason given by a
single participant in the Architects group in response to the interviewer’s question
concerning why she needed images in her work.

“We always take photographs, because very often
we’ll use those photographs to present a particular
concept. But, that’s all very dry and that’s after the design has taken place. … I would say that images are used rather during the design process. They are also, of course, one could say, used as documentation.”
[Architect 3, 521-528]

From the tone of this passage it seems likely that the documentation of their work is such a basic necessity that it is unlikely to warrant much thought in terms of the images the architects noted they needed. The passage suggests her critical need for images centers around the design process and not in providing a visual record of the work being done. This need to record their architectural designs for documentation purposes through photographs differed from the marketing purpose for project photographs mentioned by the architect-participants since the former was not undertaken for financial reasons.

Financial aspects, in this case estimating the costs associated with an architectural project, were noted by a single architect in his discussions of why he sought out images.

“Yeah, so let’s say we have this idea in our mind about this particular kind of cabinet. So we will go and look online typically… although I would say that there are a few manufacturers that we usually use and so we would go to their online catalog and look through and say “Ok, this is the cabinet that we want.” We will download that picture and include it when we give it to the contractor for the cost estimate.”
[Architect 5, 87-92]

As he further explained it, the images were needed by the contractor to create cost estimates for the project. It is noteworthy that the only architect to mention costs in tandem with image needs was the sole participant working within a firm that designed high-end residences as opposed to those designing more
traditional suburban and urban residences, or large civic or institutional structures.

**Types of Images Needed**

This section presents the various types of images the participants identified as being needed in the performance of their work and answers the research sub-question – What types of images are needed?. Data analysis was carried out using participant responses to survey question 4 (What types of images do you usually find yourself needing?) and the interview questions which asked about their experiences retrieving images (5, 9, 11, 12, 13 and 17, see Appendix B for the interview questions). For the purposes of this study type of image is defined as a category of visual material that coheres around a broad underlying theme or media. The categories which are presented below were developed from the responses of the participants.

As can be discerned in Table 4.3 the participants discussed needing images from across a multitude of dimensions: medium (painting, architecture, photography, ceramics) theme (landscape, apocryphal scene, Isis), aesthetic, artistic and technical processes (composition, vaulting, printing), formalist bent (color, line, form) and authorship (images they themselves had created). For the analysis the types of images noted by the participants in the surveys and interviews were brought together in one list and these entries were combined when items were conceptually similar. For instance, appliances and vehicles were combined and are counted as a single type of image need. In other instances the image need expressed by the participant was highly specific and
so it was folded into a broader category (i.e. Etruscan jewelry became Jewelry, a child of the broadest category Craft Objects). Several of the recurrent terms posed challenges to the data analysis process. For example, a number of the participants used generic terms such as photos, photographs or photography in discussions surrounding the types of images they needed, while others offered highly specific terms to delimit needed items such as needing a historical photograph of an event or a photograph of a cityscape. When these more specific items were encountered they were listed under the category for media mentioned alongside the needed image(s).
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</table>

Grayed areas indicate all participants in group identified needing images of this type in their work.
While the specific examples of the images needed by the participants showed variability, the types of images were found to fall into a limited number of categories. Several types of images were noted as being needed to perform their work by the majority of the participants in the study. These included photography (19 of 20 participants), art (18 of 20 participants), architecture (17 of 20), landscapes (14 of 20), people (13 of 20), physical characteristics, e.g., images illustrating color, shape, texture (12 of 20), artistic and design processes, e.g., compositional ideas, materials (11 of 20) and maps or other diagrammatic displays (11 of 20). The need for images they themselves had created, e.g., sketches, photographs, artwork were also mentioned by a majority of participants, all of them within the creative user groups (12 of 20). Several types of images were found to be used by at least half of the participants in each group. These image types are architecture, art, landscapes, people and photographs. These findings suggest there are particular types of images that are broadly needed by the all of the professions included in this study.

Preferences were found among the participant groups, however, with several types of images being needed by all participants in a particular user group. All of the Archaeologist user group members (4 of 4) noted they needed images of architecture (i.e., structures such as buildings and bridges), art (specifically paintings and sculpture) maps, and craft objects (specifically pottery). All of the architects (6 of 6) in the study identified architecture, artistic and design processes, landscapes, photography, physical characteristics and their own images as being needed. The responses from the art historian
participants showed conformity in their need for images of art, craft objects, photography, and themes (i.e., iconography, biblical scenes, decorative motifs, etc.). Finally, the artists’ responses indicated that they all needed the images of advertisements and mass media, photography and the imagery they themselves created.

Similarities in the types of images needed among the academic users and among the creative users were discovered. All of the participants in the Archaeologist (4 of 4) and Art History user groups (4 of 4) shared an interest in images of craft objects, with only a lone architect-participant noting a need for these as well. The Architect and Artist user groups also showed their image needs to be distinct from the other groups. These participants were the only ones to discuss a need for their own images. An additional type of image noted by nearly all of the participants in the creative groups (11 of 12) and only once by an academic user (1 of 8) was that of physical characteristics.

In several cases there were single participants who noted a particular type of image was needed in their work. A few examples of unique image need entries among the study’s participants are anatomy (under themes), gladiators (under people), jewelry (under craft objects) and tattoos & tattooing (under art). In each of these unique entries the image type was central to the work being conducted by the participant. For example, Artist 2 (a figure painter) needed images of anatomical structures to complete his paintings. Archaeologist 1 needed images of gladiators to give an undergraduate lecture on Roman arenas.

Another interesting finding is the art historians’ interest in images which are representative of a particular style (i.e., formal characteristics of a work intimately related to the time in which it was created). This sub-category was folded into the parent category Art during the analysis.
in Pompeii. Archaeologist 3, a scholar of ancient jewelry, needed images of jewelry to prepare a publication on Etruscan ornament. Art Historian 4 needed images of tattoos & tattooing for her course on body art. These findings suggest that a number of individuals within these professions have image needs which are highly specific, personal and critical in nature.

The findings presented here point to image types that are broadly needed by archaeologists, architects, art historians and artists. These image types, architecture, art, landscapes, people and photography, served as a sort of common ground for image needs between the four groups. Additional guidance for collection development to meet the needs of the specific user groups are suggested through the findings. All of the archaeologists needed maps, plans and other diagrammatically presented forms of visual information alongside images of craft objects. All of the architects needed images of artistic and design processes, physical characteristics and their own images. All of the art historians needed images of craft objects. All of the artists needed advertising and popular culture imagery, examples of physical characteristics and their own images. These findings clarify that among the four user groups under study there is a common body of images needed by all and that particular groups of image users have needs that are unique.

**Frequency of Image Need**

While not directly related to the first research question which asked What information needs drove users to seek images?, findings related to the frequency of the users’ image needs enhances our understanding of their behaviors. The
survey responses for Question 5 (Approximately how often do you find yourself needing images?) were analyzed alongside the interview responses to Question 10 (Where are you typically when you search for images and when does this occur? In other words, where are you when you look for images and do you generally do this as the need arises, on a set schedule, or so on?).

**Table 4.4 Frequency of image need by participant**

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<th>Weekly</th>
<th>Monthly</th>
<th>Other</th>
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<tr>
<td>Architect 5</td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Architect 6</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art Historian 1</td>
<td></td>
<td></td>
<td>X1</td>
<td></td>
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<tr>
<td>Art Historian 2</td>
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<td>X</td>
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<tr>
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<td>X</td>
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<td>X</td>
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<td>X</td>
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<tr>
<td>Artist 6</td>
<td></td>
<td></td>
<td>X2</td>
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<td><strong>Total Responses</strong></td>
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<td>2</td>
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</table>

X1 – Daily to weekly depending on teaching load.
X2 – Daily at times but typically once a month.

As Table 4.4 illustrates, the participants in this study were frequent users of images with more than two-thirds of them (14 of 20) responding they found
themselves needing images on a daily basis. All of the archaeologist-participants (4 of 4) noted they needed images on a daily basis and they recounted specific period(s) of time set aside in their schedules to meet their image needs. Several participants within the Architect, Art Historian and Artist user groups provided responses that suggested they needed images less frequently than once a day. For example, in their survey responses several of the architect-participants noted they needed images on a weekly basis.

During the interviews several architect-participants clarified the situation and noted their image needs could vary in frequency depending on the project(s) they were working on and the various stages within the process. Presentation preparations often resulted in deadline-driven work and it was during this period that the architects’ image needs were most critical and frequent.

“…probably once every two weeks and when there is a deadline it is every day. So it fluctuates depending on what meeting I am preparing for or any other project that I am working on.” [Architect 6, 277-279].

Two of the art historian-participants provided survey responses that suggest their image needs could be less frequent than on a daily basis. This situation appears to be tied to the number of courses being taught. Art Historian 3, whose survey response indicated she only needed images on a weekly basis, was focusing her efforts on finishing her dissertation and so was the only participant among her group not actively teaching at the time of the study. Art Historian 1, an instructor whose teaching load varied from one semester to another, discussed how her image needs were highly dependent on the number
of courses being taught and whether or not the needed images were already in
her possession.

“I tend to search for images when I need them and it is usually… well, depending on the lecture… if it is a new lecture I will start working on it on the weekend prior to the lecture.”
[Art Historian 1, 177-179]

When the needed images were part of her collection the work associated with
preparing the lectures was limited to modifying previously used slides or the
creation of new slides. As would be expected, if the images required for the
lectures were not in the participant’s possession, fulfilling the need consumed a
greater percentage of her time and effort.

The amount of time spent on collecting images needed to teach a new
course could begin months in advance of the first class meeting and run through
the entire period the course was being taught.

“I started in June, and I pretty much snapped pictures every time [I went] to Atlantic City. And then I just loaded them all into PowerPoint and then I bought some books that I found in maybe July, and made them into PowerPoint images as well. … Even this weekend [in December, at the end of the fall semester] I was taking images off the web, because I took the students to Atlantic City for the weekend.”
[Art Historian 6, 193-201].

This situation, a sustained and constant need for images, was a topic also
discussed by a majority of the artist-participants. The artist-participants
described their need for images in a manner akin to an obsession. For example,
they frequently noted they always look and collect, or categorize images.

“I’m starting to learn as I get older, I am always looking for something new. I have an appetite for the
visual and I’m just … I wanna look at this, I wanna look at that, and you know, oh look at that, oh look how they put that together, oh look at that space. Well, why does that space look so spatial? Because it’s basically a flat rectangle I’m looking at, you know, what made it give me that feeling for space? And, so it just oscillates all the time. I mean, it’s like there are so many categories, if you will, in my head that I’m always looking for new little tidbits to throw in each category.”
[Artist 2, 58-66]

When asked why she needed images, one participant replied simply “I’m addicted to them.” [Artist 5, 62].

Two of the artist-participants indicated a need for images that was typically less frequent than on a daily basis. One of the artists noted she rarely had a formalized need for images. While she stated she might need images to develop and submit proposals for site-specific installations of her work, she typically didn’t seek out images for creative purposes. According to her assessment the images that influence her work have typically become part of her visual knowledge through serendipitous discoveries as opposed to a direct need.

“My own work is sort of just, you know, leafing through magazines, or whatever. I don’t seek out specific images usually.”
[Artist 4, 236]

In her survey response Artist 6 noted she needed images on an irregular basis ranging from daily to once a month. The reason behind the wide variation in the frequency of her image needs is unclear. With the exception of Artist 6, images were noted as being needed by the users in this study on at least a weekly basis by 19 of the 20 participants. In the majority of cases (14 of 20) the need was on
a daily basis. The findings relating to the frequency of image needs point to the vital role images play in these participants' work lives.

**Discussion of Image Need Findings**

This chapter's findings focused on answering the first research question – What information needs drive users to seek images? The beginning of the chapter presented the findings specifically related to this question and the sub-question – What are the purposes for which images are needed? Similarities in image needs were found among the academic user groups (Archaeologist and Art Historian) and among the creative user groups (Architect and Artist). The archaeologists and art historians shared a similar need for images to support their professional activities of teaching, research and scholarship. For the architects and artists images were needed to assist in the development of their creative designs or artworks. The artists needed images to perform research and for inspiration during the creative process. The architects, who discussed the widest variety of image needs when compared to the other studied users, needed images for research and inspiration purposes, presentations of their work, to communicate their design ideas and as a way to stimulate conversation with their clients. The architects also needed images for marketing purposes since images of the architects’ in-process and completed projects were needed to advertise their designs to potential future clients.

There are connections between the findings on image need in this study and what has been discovered through earlier research. Differences in need were discovered among the different user groups in this study, which lends
support for Chen’s (2007) finding that image need varies by professional role, as seen in his study of museum personnel. As similarities were found in the present study among different image user groups (academic user groups and the creative user groups), work role by itself does not appear to be a sufficient factor by which to define image need. Work tasks do not appear to be more descriptive of users’ image needs since these too are unable explain the variation that exists. For example, images are not always needed to support the work task of teaching. While work role and work tasks allow a rough estimation of who might be interested in images and what work they are supporting, they are not fully descriptive of users’ image needs. A more nuanced analysis of need which considered domain area could provide a higher degree of explanation for image users’ behaviors.

Another aspect of note in the findings of users’ image needs was how difficult it was for them to meet those needs. This was especially the case among the academic users’ discussions. The archaeologists and art historians noted they spent a great deal of time and effort in trying to meet their needs and that they sometimes encountered barriers in the process. In these challenging situations, where their image needs were not satisfied, the participants experienced frustration. The reasons behind the participants’ inability to meet their image needs will be discussed in more detail in chapter 7 which presents the barriers which influence image users’ behavior. However, it is useful to address here users’ image needs and their resulting frustration in the context of previous studies. Bradfield’s (1976) study found that the nature of the need
underlying users’ image seeking was related to their degree of satisfaction with image collections. Collections that were primarily teaching resources received the highest number of user complaints. It is not known why the academic users’ image needs in the present study created such a high level of anxiety when compared to the statements of image needs by the creative image user groups. The frustration they experienced suggests that certain image needs translate to a higher degree of stress for individuals and systems. It seems that the time constraints involved in teaching, coupled with the somewhat freer working methods (e.g., reduced need for images of specific works, typical modifications to images, etc.) of the artists and architects are likely the cause, but further research is needed to clarify this situation.

The types of images the participants sought were also examined in this chapter. These findings relate directly to the research sub-question – What types of images are needed? The findings suggest the types of images most broadly needed by these user groups. These included photographic images (19 of 20 participants), art (18 of 20 participants), architecture (17 of 20 participants), landscapes (14 of 20 participants), people (13 of 20 participants), physical characteristics (12 of 20 participants) and their own images (12 of 20 participants). Few guides to collection development for visual materials have been published and so comparisons cannot be made. When the needs of particular image user groups are considered, the situation is somewhat improved and so comparisons can be made between previous research and the present study’s findings.
This study showed that user group membership influenced the types of images that were needed by participants. Each user group identified a unique set of image types that fulfilled their information needs. All of the archaeologist-participants focused their image needs on architecture, art, maps (plans, charts and diagrams) and craft objects (ceramics, figurines, jewelry, etc.). Huvila (2009) found that the academic archaeologists needed diagrams, videos, photographs and the objects themselves. There was a clear need for diagrammatic images as well as images of objects in both studies. Photographs were not explicitly mentioned by all of the archaeologists in the present study, but there was a clear need for them voiced by 3 of the 4 individuals. Video and other moving image media were not specifically studied in the present study, and so no comparisons can be made.

The architects all noted a strong need for images of architecture, artistic and design processes, landscapes, their own images (design sketches, architectural renderings, architectural details, etc.), photography and physical characteristics (textures, patterns, colors, etc.). Sklar (1995), who examined the needs of students of architectural design, is the only study to identify the kinds of images examined by architects. Sklar noted that the students showed a strong interest in diagrammatic images (maps, site plans, soil surveys, census data, zoning and regulatory information) and drawings or sketches. While there is some overlap between the two studies, the needs of Sklar’s image users appear to be narrower than those of the practicing architects. The cause of this
difference is unknown, but it may be the result of the variations in the work accomplished by the students and practicing architects.

The present study found that all of the art historians needed images of art, craft objects, photography and theme-oriented images (e.g., Judith and Holofernes, pietà, self-portraits, etc.). Oddly the types of images needed by art historians have received little attention in the literature. Bakewell et al. (1988) in their publication about the working processes of art historians offer some suggestions as to why their image needs have not been closely defined. These authors examined several cases and in these each individual sought out images that were highly unique (18th century German painting, Roman coins and medieval French architecture). The participants’ need for highly unique images was a situation encountered among all of the user groups in the present study however, and not just among the art historians. Therefore it seems unlikely that the art historians have more specialized needs than other user groups.¹⁵

Layne (1994) notes difficulties in discussing the image needs of art historians are based in part on the fact that images do not have a clear citation history that can be followed like those for text resources. However she does suggest that art historians need specific instances of artworks as well as types of artworks. While this analysis is somewhat limited it does corroborate the need for images of art found in the present study, as well as describe the variation in the degree of specificity of the required items (e.g., Disputa by Raphael, Italian

¹⁵ The importance of the users’ unique needs should be mentioned here again. Several participants in the study noted image needs that were entirely unique and yet critical to the work they were performing (e.g., Archaeologist 2 - Etruscan jewelry, Architect 1 - Saint Catherine of Siena, Artist 2 - anatomical studies, Art historian 4 - tattoos and tattooing).
High Renaissance frescos, painting). This situation was not unique to the art historians, however, since this variation was found among all four user groups in the present study.

All of the artists who took part in the present study indicated they needed advertisement and mass media images, their own visual works and photographic imagery. Bradfield (1976), although not specifically addressing the image needs of artists, stated that in the collections she studied artists required images to examine artistic techniques and to develop ideas through multiple versions. While the second need is not explicit enough in meaning to compare with the findings here, the first suggests that artists need images to investigate technical processes. Frank (1999), Layne (1994) and Toyne (1977) also identified images of technique as being important among artists or art students. The present study found that two-thirds (4 of 6) of the artist-participants discussed a need for images of artistic and technical processes. Layne (1994), who examined artists together with art historians, also noted that artists need images of art, objects, people, creatures, places (i.e., landscapes) and emotive imagery and that they needed a much broader range of subjects than their academic counterparts. While the image types mentioned by all of the artist-participants in the present study (advertisement and mass media images, photographs, and their own images) were not on Layne’s list of needed visual information, most of the individuals in the Artist user group noted they needed images that agree with the list of image types provided by Layne (1994). These consisted of the artists’
need for images of art (5 of 6 participants), people (4 of 6 participants) and places (landscapes – 4 of 6 participants).

The above discussion of the types of images needed by users suggests a standardized classification scheme might be useful for images. Comparisons of users’ images needs across various studies are difficult without a list of this kind. Since the use of image collections is dependent on whether or not the collection contains what users require, it is remarkable that so little has been done in the area of users’ need assessments. ¹⁶ Bradfield (1976) noted that the “excellence” and scope of a collection, in other words the collection’s ability to meet or exceed users’ needs, was related to the degree of use a collection received. As will be discussed in the next chapter, most of the participants in this study used images from beyond the confines of professionally developed collections. This raises the question of whether or not collections are being bypassed because they do not contain the images the users need. ¹⁷ Attig, Copeland & Pelikan (2004), who examined the best points of access to images by Penn State University’s users, discovered that the primary concern of the image users in their study was not how they would find it, but rather whether the content they needed was available. As the present study found, image availability is of one of the main challenges users face in meeting their image needs.

¹⁶ One publication published by ARLIS/NA in 2000 and edited by Whiteside, Born and Bregman, Collection development policies: for libraries & visual collections in the arts, provides the collection development policies for nine visual resources collections but neither the idea of core collection materials nor the variations of collection holdings based on their user communities are addressed in the publication.

¹⁷ Another very real problem for image users is collection discovery since the majority of professionally developed image collections and image databases are not presently open to Web search engines. There has been some work in this area recently with discussions among the museum community to allow the image content in their databases to be open to Web searching.
Additional findings presented in this chapter were concerned with the frequency with which these image users sought out images. It was found that nearly three-quarters of the participants needed images on a daily basis. The remaining users noted they needed images on a weekly basis or that their needs varied depending on their work schedule or the status of their work projects. For example, the academic users noted that when they were teaching their image needs were on-going, while images needed for research and publishing were episodic and so could vary in intensity and frequency. All of the user groups in this study would have been classified as “constant image users” according to Pisciotta and Copeland (2003), who investigated Penn State University’s image user community and divided users into two groups based on the frequency of need (constant and occasional). However, the findings of the present study indicate that the specific task being performed was more descriptive of how frequently users needed images.
CHAPTER 5: FINDINGS RELATED TO IMAGE RETRIEVAL

Introduction

There are a number of areas within image retrieval which are research-worthy. However, for this study the research was driven by a single over-arching question – How do users retrieve images? The research was focused further by the sub-question – What resources, systems and methods are used to retrieve images? Several sections of this chapter, Resource Selection, Search Techniques, and Content-Based Image Systems, present findings which directly address these research questions. The section on Resource Selection discusses the general findings on what sources are used and factors influencing their selection. The general findings related to the participants’ search strategies and use of search terms are presented in the section titled Search Techniques. Findings related to the participants’ knowledge of and interest in using systems which would automatically index on the physical features within images are presented in the section Content-Based Image Systems. Next is the section titled Factors that Influence Image Selection, which presents the findings associated to the research sub-question – What criteria are used to select images? The final section of the chapter, Case Studies of Known and Unknown Image Queries, provides an account of the specific resources and search techniques used in the participants’ known and unknown item queries.

Resource Selection

Two survey questions (SQ6 and 7) drew out information concerning the resources used by the participants to find images. One question (SQ 6) required
a brief written response while the other question (SQ7) asked participants to rank a list of resources in order of preference. For the sake of clarity each of the questions will be introduced alongside the presentation of their findings. Presented first are the findings related to the participants’ resource preferences. These findings are followed by findings associated with the self-identified favorite resources of the participants.

**Participants’ Ranking of Image Resources**

Survey question 7 (What types of resources do you use to find images?) gathered responses about the various kinds of image resources used by the participants and their preferences. The question presented the participants with a list of possible choices of resources (books, analog image libraries, image databases, personal collections and Web sites) as well as providing them the option to write in their own entries. They were asked to rank the resources according to how important each resource was believed to be to the performance of their work. While the majority of individuals ranked one selection for each number (1 through 5), the instructions appear to have been unclear to several participants who applied the same number to multiple resources.

As can be seen in Table 5.1 several facets were examined through this question. These consisted of the preferred image format (online or analog) and the level of use of personally owned, created and, or experienced images. The overall findings point to a preference for online resources among the Archaeologist, Architect and Art Historian user groups. The Artists preferred print-based and other analog resources. The Artist user group was also found to
prefer using images from their personal collections. The Architect user group also showed that their own collections of images play an important role in the performance of their work.

The first findings to be discussed below concern the online resources used by the participants. After this the findings relating to the use of analog resources are presented. In the context of this study analog resources mean tangible media (photographs, photographic slides, books and magazines) or actual works (paintings, buildings, sculptures, etc.). The final discussion in this section looks at the responses surrounding the participants’ use of images within their own collections, irrespective of format.

**Online Resources**

Participant responses were collected through survey question 7 for two online resources, image databases and Web sites and are presented in Table 5.1. When the results of their ranked preferences were tallied online resources were found to figure prominently in the resources employed by a majority (12 of 20) of the participants across three user groups: Archaeologist (3 of 4), Architect (6 of 6) and Art Historian (3 of 4) users. These resources were seen as far less important by the majority of participants in the Artist group with only two (of 6) participants ranking them highly.
Table 5.1 Type of resource preferred by user group

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<thead>
<tr>
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<th>Online</th>
<th>Analog</th>
<th>Personal</th>
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<tbody>
<tr>
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<td>Image Databases</td>
<td>Web sites</td>
<td>Collections/libraries</td>
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<tr>
<td>Number of responses</td>
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<td>19</td>
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</table>

Image databases were seen as being important to nearly all members of the Archaeologist (3 of 4), Architect (4 of 6) and Art Historian (3 of 4) user groups with over half (11 of 20) of the respondents noting it as the most or second-most...
important resource for their image needs. When looking across all of the groups it is clear that image databases were not seen as being as important by the Artist group, although one participant (of 6) ranked these highly.

Nearly mirroring the findings for image databases were those found for Web site resources. Web sites were seen to be an important resource by the majority (13 of 20) of participants overall, and by the majority of participants in the Archaeologist (3 of 4), Architect (5 of 6) and Art Historian (3 of 4) groups. Web site resources were not ranked highly among all of the participants in the Artist group. While two (of 6) artist-participants ranked it as their most important resource for finding images, the remaining members (4 of 6) of this group scored it as third or below in terms of importance. The cause of the split in ranking among the artists is an unknown and intriguing anomaly which calls out for additional investigation.

**Analog Resources**

Several kinds of analog materials were accounted for in the list of survey responses for question 7. These responses consisted of books, magazines and analog collections of visual materials (photographs and photographic slides). Additional responses were received in the data collected through the participants’ own written-in responses to this question. Analog resources, while still holding some importance to these user groups’ image seeking, were seen as being only modestly important and so were ranked at third or below by the majority (11 of 20) of participants in the study. One exception to this was found and that was
the high score given to book resources by the majority (5 of 6) of participants within the Artist group.

When the responses of the participants in all four user groups are examined it is clear that analog collections of visual materials (photographs and photographic slides) were not seen as being a highly important resource to their work. A single participant (Art Historian 4) ranked these in second place in importance with the majority of participants (14 of 19) placing analog collections in fourth place or below.

The usefulness of books for the participants’ image needs saw an even distribution of the ranked importance. There appear to be personal preferences at work among the responses of the various participants since the rankings could range from 1 to 5 within a single group. However, when the votes are examined by group it is clear that among all the participant groups in the study the strongest preference for books was found among the artists. The majority of artist-participants (5 of 6) ranked books as their most important or second-most important resource in their image seeking efforts. The architect-participants, too, were cohesive in their opinion of books, which was lower than that of the artist, with each members’ (6 of 6) ranking of them falling in third place or below.

Related to books, in that they are printed matter, was the written-in response of magazines given by Architect 5 and ranked as his second-most important resource. Although the responses to survey question 7 do not record this, the use of magazines among theArchitect group’s participants was strong,
with the majority (5 of 6) noting how magazine images played a role in their work during the interviews.

“Whether it’s a design magazine or it’s a book on architecture or it’s a book on whatever it is… historical. It can be a variety of things. And then reading an article even in the newspaper or in a magazine will give me ideas, or you will see an advertisement for something like a tile company or a stone foundry. And so, that sends you off on tangents…”

[Architect 1, 882-886]

The cause of the omission of magazines in their survey responses is unclear. It may be because this resource type was conceptually linked to books. Another reason for the omission may be that the wording of the survey question presupposes that the participant would be performing a direct search for an image as opposed to general browsing behaviors. Through the interviews it was discovered that magazines were commonly used in the architects’ casual information gathering processes. The architects noted they would often keep abreast of what was occurring in the field and make serendipitous discoveries when browsing magazines.

Another written-in response gathered from the survey was the entry “museums”, reflecting the use of actual artwork by the participants. Two artist-participants (of 6) noted that they were resources which they found important for their image needs, albeit to a limited degree (ranked at third and fifth place). The museum response for image resources raises a point that needs to be mentioned. Surrogate images formed much of the conversation in this study since reproduced images are so easily accessed, exchanged and used with
modern technologies. However, the visual materials used by the participants in the study could range from actual items and experiences to surrogate images. Actual works, imagery found in museums, galleries and within the personal collections of the participants, were discussed in the interviews of participants in the Archaeologist (4 of 4), Art Historian (4 of 4) and Artist (4 of 6) user groups. While the architect-participants did not discuss looking for images within a museum or gallery setting it needs to be remembered that their main area of interest is architecture. As a result, instead of discussing works within a museum, the majority of the architects (5 of 6) mentioned looking at actual structures during the interviews.

**Personal Resources**

The two sections above examined the format of the image resources used by the participants. This section investigates the use of resources already in the possession of the participants. Personal collections were on the list of entries the participants ranked in survey question 7. Additional responses relating to personal resources were given through written-in entries by the participants.

A majority of the participants (15 of 20) noted their personal image collections were useful resources to their work. While the ranking of the importance of this resource was modest (ranked at third or below) among the participants in most user groups, nearly all (5 of 6) of the artists saw it as their most or second–most important resource. This suggests that for artist-participants the images in their personal collections are critically important. Related to the use of personal image collections is the importance of images
created by the participant. Five participants (of 20) noted the importance of these resources through written-in responses. It was discovered that personally created imagery was ranked as an important resource by several of the architect and the artist participants in the study but by none of the academic image users. Of the participants that recorded this resource, three (of 5) ranked it as second in importance. Again, this finding is suggestive of the importance of materials in the possession of image users. It is useful to note here that it is likely the survey responses for personally created imagery would be higher if it had been on the list of entry responses given under survey question 7.

One last resource, a single written-in response “observational” reflecting first-hand visual experience, was mentioned by a sole participant (Artist 3) in the study. The importance of looking at the world around the participant, although not recorded here in the survey’s responses, was mentioned during the interviews by a number of the architects (4 of 6) and artists (5 of 6). Because of this discovery it is likely that direct personal engagement with visual stimulus in their daily lives plays an important role in what they perceive as image seeking among these two user groups.¹⁸

**Participants’ Favorite Image Resource**

In order to discover the resources which were preferred, the participants were asked to provide a written response naming their favorite to survey question 6 (If you had to name one specific image resource as your favorite, what would it

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¹⁸ Again, it is possible that the number of participants to rank this resources as important to their image seeking would in fact be higher had it been included in the list of options for survey question 7.
As can be seen in Table 5.2 the responses of the participants were varied and ranged from image databases, search engines, Web sites and personal images, to printed materials such as books and magazines. Nevertheless, several interesting patterns were found.

**Table 5.2** Favorite image resource by user group

<table>
<thead>
<tr>
<th></th>
<th>Online</th>
<th>Analog</th>
<th>Personal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Google Images</td>
<td>Commercial images</td>
<td>ARTstor</td>
</tr>
<tr>
<td><strong>Archaeologist</strong></td>
<td>T-2</td>
<td>R-T</td>
<td>1-1-1</td>
</tr>
<tr>
<td><strong>Architect</strong></td>
<td>3-3</td>
<td>1-1</td>
<td>1-1</td>
</tr>
<tr>
<td><strong>Art Historian</strong></td>
<td>4-1</td>
<td>1-1</td>
<td>1-1</td>
</tr>
<tr>
<td><strong>Artist</strong></td>
<td>1-1</td>
<td>1-1</td>
<td>3-1</td>
</tr>
<tr>
<td><strong>NUMBER</strong></td>
<td>9-3</td>
<td>2-2</td>
<td>1-1</td>
</tr>
</tbody>
</table>

T for teaching  
R for research

The findings here illustrate there was a preference for online resources among the majority of participants in the Archaeologist (3 of 4), Architect (5 of 6) and Art Historian groups (4 of 4). The preference for commercial (ARTstor, Dreamstime, Viewport, ArchVision) and in-house developed (MDID) online image databases was found only among the Archaeologist (3 of 4) and Architect (3 of 6)

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19 The term favorite in this survey question implied the most useful and frequently used resource by the participants. In some cases the participant identified several “favorites.” Dual answers were based on what the image was used for in the case of the response of Archaeologist 4, or whether or not the participant was able to find what was needed in a particular commercial image database (Architect 3 and Architect 6).
user groups. ARTstor is included as a unique entry in Table 5.2 since it was noted by more than one participant. The other commercial image databases mentioned by the participants were all unique instances given by a single individual. The reason why none of the art historian-participants identified image databases as their favorite resource is unclear and warrants additional research.

Instead of an image database all of the participants (4 of 4) in the Art Historian group were unanimous in their selection of Google Images as their favorite “resource.” This brings up a key issue that needs to be made explicit here; half of the participants identified a search engine as their favorite resource. It is clear from the art historians’ selection of Google Images as their favorite resource that while they were keen on using online resources, there was no single outstanding resource they could point to meet their image needs. Google or Google Images was also noted as being the favorite resource among the majority (4 of 6) of the architect-participants. From these findings it is apparent the majority of users within these three groups are searching for images online through image databases and, or search engines.

Showing the opposite trend, a preference for analog resources, were the responses of the majority of the artist-participants (4 of 6). While two individuals in this group (of 6) identified online resources (Google Images and Flickr, respectively) as their favorite, the remaining artists noted their preference for printed materials (books, magazines and personal photographs).

Since use of resources is tied to availability it should be noted here that all of the academic users had institutional access to ARTstor. For more information about these image databases please see: ARTstor - [http://www.artstor.org/index.shtml](http://www.artstor.org/index.shtml), Dreamstime - [http://www.dreamstime.com/](http://www.dreamstime.com/), ArchVision - [http://www.archvision.com/](http://www.archvision.com/) and MDID - [http://mdidnews.blogspot.com/](http://mdidnews.blogspot.com/).
Two individuals in the study, both from the creative user groups, noted their favorite resource was related to personal images. Artist 3 noted her own photographs as her favorite resource. Architect 2 noted the experience of looking at the world around her was her preferred resource.

**Search Techniques**

This section presents the findings relating to how participants retrieved images. The specific search strategies they used to find images and the types of terms used in the queries are offered and discussed. Several interview questions were asked to elicit information about the participants’ searching behaviors. The analysis examined the participants’ responses about how they formed their queries, why they chose particular methods and the search terms they employed.

**Search Strategies**

Participants generally discussed searching for images online using one or two keywords. These keywords could represent a single kind of information about the desired image (i.e., words in the title, or the name of an artist or architect) or, if the participant believed the search might require a more focused search, a combination of terms using conceptually different pieces of information (i.e., words in the title and the name of an artist or architect). Many participants discussed performing a preliminary search in order to judge how broadly or narrowly they should formulate a query. The images returned in response to their initial query were found to be useful to modifying subsequent searches. If too many images were returned, the participants discussed using additional
terms in their queries. When too few items were returned they generally opted for fewer terms. The participants also discussed another way their search methods were modified. They noted how their knowledge of the contents and cataloging, or indexing, of images within a particular resource would influence the way they performed their searches. A more detailed discussion of their search strategies is presented below in the case studies of known and unknown image queries.

**Informal Browsing**

In addition to performing known and unknown item queries casual information gathering was mentioned by the participants as a way they found images. This form of informal image retrieval involved browsing various resources as opposed to focused searching. Although informal image browsing was mentioned by participants in all user groups, it was a particularly prevalent behavior among the individuals within the Architect and Artist user groups.

“"I am always on some different types of networks for images and news and I will just save things ... Like a pack rat." [Artist 1, 142-144]"

A common activity mentioned by the creative user groups’ participants during the interviews was active browsing for imagery. A desire to save the images of interest they discovered through casual browsing was typically encountered in their responses.

“I will get a whole stack of them [magazines] and I will sit and I'll just go through the pages and whatever I see that's stimulates whatever, I will just pull that out and I will get a whole stack of those. And then I will cut out the thing that I wanted and then I will get like a
big sketch book and I'll arrange the shapes. They sort of relate to one another."  
[Artist 5, 126-130]

This was the case even among the participants who acknowledged that the images were not expected to be retrieved again.

“I always think that, even with images that I tear from magazines or things, that I'm interested in keeping because they are inspiring. I never ever look at them. … I keep them and I put them in a filing cabinet and I never look at them.”  
[Artist 4, 105-111]

Why the images were not used again was not a line of questioning pursued in the interview and so the reason behind this behavior is unknown.

Another interesting discovery was the influence of the format of the resource on informal browsing. When asked about possible differences between how he finds images in analog as opposed to online resources Architect 5 clearly saw a less direct approach to image retrieval.

“If I am looking for an image online I already know what it is I want to find. Like I am looking for a product, but in a magazine I am doing more casual [searches] and browsing. Kind of looking at the layout of the images and not really searching for something.

(Interviewer) Would you ever go to a magazine for a particular search?

No, I mean we have magazines that come into the office. You know, like a design magazine, and people will put a little sticky note down on a page they think is interesting.”  
[Architect 5, 511-518]

As was mentioned above, serendipitous image discoveries played a role in the image retrieval efforts of the participants. In some cases these unexpected
images were found when performing formal queries, but the participants noted their serendipitous discoveries more frequently alongside their casual image-seeking behaviors.

“When I do browse I tend to find some interesting things that I wasn’t necessarily looking for.”
[Artist 1, 177-178]

Whether the image was needed at that moment or at some unknown point in the future it was clear that the usefulness of chance discoveries were recognized by the participants.

“I am always looking at stuff. I am always cataloging. What comes to mind is whenever I am walking around or wherever I am, I am always taking note of my environment around me. It is just that is the language I work in. It is the language I absorb. I am always sort of like taking in different ideas. Thinking hey that is neat, or oh, I wouldn’t have done it that way. I like the proportion of that… that’s neat they way they juxtaposed these two textures or materials or whatever next to each other. And then as stuff comes up I say ok, I remember when I saw such and such. I try to recall, where did I see that?”
[Architect 2, 372-380]

Responses to image retrieval questions by the participants in the Architect and Artist user groups often began “I am always looking...” From this acknowledgement it is clear the participants in these user groups have become accustomed to using their skills of visual analysis beyond their workplace settings. Their awareness of, and openness to imagery around them in their everyday activities blurs the distinction between their personal and work-related image seeking.
None of the participants in the study were using content-based image retrieval systems to search for visual materials. The participants who took part in the study had little or no knowledge of this method prior to the discussions within the context of the interview. Content-based image retrieval systems were discussed as a part of interview question 8 (What about if there were a system available where you could search on things like color and shape? Do you think you might use this sort of system to find images?). The basic concepts behind these systems were explained to the participants and possible useful searching scenarios were given.

Table 5.3  Interest in CBIR systems by user group

<table>
<thead>
<tr>
<th>User Group</th>
<th>Yes</th>
<th>No</th>
<th>Maybe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architect</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Art Historian</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artist</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

As can be seen from Table 5.3, the participants’ responses varied according to user group. There was no support for the adoption of CBIR systems among the two academic user groups while the two creative groups were interested in them with varying degrees. The Architect user group was the most interested in the development and use of these systems. Nearly all (5 of 6) of the architect-participants agreed they would be useful to their work. Several of them expressed a great deal of enthusiasm for a system of this nature.
“I think that would be one of the greatest things!”
[Architect 1, 521]

The architects saw immediate applications to the work they did and nearly all of them noted how useful such a system would be to help them find the materials they needed in the construction and finishing processes. There was some concern, however, expressed by Architect 1 that a system of this kind would have to contain a large body of images for it to be truly useful.

One participant in the Architect user group noted he did not believe this type of system would be useful to the searches for images conducted within his firm since they worked on high-end residences. Selection of materials for these homes was done in-person and there was an aspect of prestige that accompanied the selection process.

“When people do really high-end residential stuff it is not just about the look of these carpets. So people will buy these carpets that cost something like $10,000, which is insane. I could see if it was the most beautiful carpet ever made, but they want to say that ‘Oh, this is so and so’s design carpet.’ I think it is more about boasting rights.”
[Architect 5, 229-236]

This finding suggests additional constraints beyond physical appearance influence the manner in which architects search for images.

The participants in the Artist user group were split in their interest for a content-based image query system. Half of the participants in this group supported their use, two individuals were uninterested and one said she might use them. Of the artist-participants who supported the use of these systems there was an interest in them for compositional and aesthetic explorations.
“Especially when I want to paint with really bright colors … I want to look at what they look like together. I don’t care what the subject is, I want to look at what the colors look like next to each other in different intensities so I can do some of that just by looking and I don’t have to waste the paint.”
[Artist 6, 540-544]

Of the two artists who were not interested in content-based image retrieval systems, one noted she would not adopt such a system for finding images for reasons related to the personal enjoyment she received when browsing through magazines.

“I don’t think I would. I like just actually leafing through.”
[Artist 5, 218]

The other artist-participant who was not interested in searching in this way noted how foreign this work-practice would be for him.

“I am not a designer and that isn’t the way I work anyway. I am not the type to need say three red balloons. I don’t need it for that kind of use.”
[Artist 1, 207-209]

This was not a surprising response from him given that the content of the work he produces relies heavily on news, events and candid photographs as opposed to more purely formal issues such as color, line and shape.

One artist-participant was undecided about whether or not she might use a content-based image retrieval system. Although she was interested in the idea of performing searches in this way she noted computer-based queries were not very appealing.

“Probably. I guess. I mean, it depends on how… I mean, all of these are really time-saving, but in the
long run they’re not. And so I find myself very bogged down in computer searches that I don’t enjoy.”
[Artist 4, 542-545]

This idea that the effort involved in searching for images with a computer was less than ideal was also discussed by Artist 3, who thought these systems might be helpful. The responses of these two participants, alongside the artist who would rather browse magazines for images, make a strong case for ensuring systems are designed that are easy to use, helpful and also enjoyable.

The academic users noted they were not interested in using these systems because the physical characteristics within an image are not useful for the kinds of searches they perform.

“I can’t think of any shape or color that draws all those [images relating to Isis] together.”
[Archaeologist 4, 348-349]

The archaeologist-participants discussed how they typically search for images that vary widely in appearance due to variations in media. For example, in the passage above Archaeologist 4 discussed searching for ancient images of, or relating to the Egyptian goddess Isis and how this query could recall images that were widely different from one another from a formal standpoint. Temples erected in honor of Isis were just as interesting to her as items such as sculptures of Isis and pottery that bore images of Isis.

The participants in the Archaeologist and Art History user groups noted their heavy reliance on text-based information accompanying an image in their queries.

“I know these things in a different way. I am looking for a label that would be either the name of the person
in the portrait, or is it a statue or a relief... or is it in Cairo or in Rome.”
[Archaeologist 3, 261-263]

An additional reason behind the lack of interest in the content-based image query systems was based on the fact that academic users tend to conduct known item searches.

“No, because I would only want... I mean, when I search usually I'm looking for something very specific.”
[Art Historian 3, 440-441]

In the case of these participants text was seen as the most direct retrieval method for images.

The findings here suggest that individuals who are likely to adopt these systems are primarily concerned with the physical characteristics of the image. Thus, color, shape, line, composition and texture play a large role in their work processes. The participants who were less likely to perform this kind of query were those who were more concerned about illustrating themes and looking at items from a specific location. Because of their more theme- or place-based focus the non-adopter participants do not feel these systems would offer advantages for their primarily text-based searches.

**Search Terms Employed**

One aspect examined regarding the participants’ searching behaviors was the types of terms used to find images. The interview responses of the participants were examined for the terms they employed in their image queries. These terms were pulled together and an analysis of the terms led to the development of a basic schema for the categories used in the queries. Nine
categories of terms emerged from this analysis and these were *Title* (of work or structure), *People* (named historical or mythological individuals or groups, generic individuals), *Location* (named geographic places or museums or collections), *Theme* (concept-based subjects such as science, death) / *Thing* (object-based subjects such as grass, lagoon), *Chronological Period* (Victorian, Renaissance), *Style* (Impressionist, Post-modernist), *Media* (sculpture, marble), *View* (showing a specific part of a structure, or an image taken from an exact location), and *Specialized Terms* (such as numbers applied by museums or scholars to identify specific objects). Each discrete response given by a participant was assigned to a single category.

### Table 5.4

Types of terms used to perform known and unknown image queries by user group

<table>
<thead>
<tr>
<th></th>
<th>People</th>
<th>Title</th>
<th>Theme / Thing</th>
<th>Location</th>
<th>Period</th>
<th>Style</th>
<th>Media</th>
<th>View</th>
<th>Special terms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Archaeologist</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
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<td>1</td>
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<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Architect</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Art Historian</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
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<tr>
<td>Unknown</td>
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<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Artist</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Unknown</td>
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<td>1</td>
<td>4</td>
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<td><strong>Total</strong></td>
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<tr>
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<tr>
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<td></td>
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<tr>
<td>Combined</td>
<td>27</td>
<td>21</td>
<td>20</td>
<td>18</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
As can be seen in Table 5.4 several categories were found to be used most frequently across the known and unknown queries. The most heavily used categories were *People, Title, Location* and *Theme / Thing*. One category, *People*, was found to be broadly useful across both known and unknown item searches. While these four categories were the most frequently employed across the two types of queries, a variation in the frequency of use was generally found based on the particular kind of search (known or unknown item) being performed.

A majority of the participants were found to search by named people (such as artists, architects, historic personages, mythological individuals) and generic figures (e.g., children, families, businessmen, skateboarder) across both known (14 of 20 participants) and unknown (13 of 20) item queries. The next category, *Title*, was found to be the next most frequently used type of search. However, the frequency of this category’s use was tied to the type of search being performed. Searches were performed on *Title* frequently for known (16 of 20) items, while only modestly for unknown (5 of 20) items. The next category in the series of those with high rates of overall usage, *Location*, was found to be roughly equal for both known (8 of 20) and unknown (10 of 20) item queries. The category *Theme / Thing* showed nearly the exact opposite trend found with the category *title*. The theme / thing category was used modestly (6 of 20) for known item searches and frequently (14 of 20) for unknown item queries. The specific findings related to term type are discussed in more detail separately below in the sub-sections titled Known Item Queries and Unknown Item Queries.
Factors Influencing Image Selection

This section presents the findings relating to how participants chose the images they would use from those images retrieved in their queries. Finding images was only one part of the retrieval process and so the participants noted a number of factors that guided them in their image selection. Interview question 14 (Can you walk me through how you typically select the images you use from the images you are able to find?) was asked to elicit selection criteria from the participants. Several aspects relating to selection figured prominently in the discussions of the participants and these are discussed below.

Table 5.5 Selection criteria by user group

<table>
<thead>
<tr>
<th>User Group</th>
<th>Quality</th>
<th>Topicality</th>
<th>Physicality</th>
<th>Aesthetics</th>
<th>History</th>
<th>Credibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Architect</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Art Historian</td>
<td>4</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Artist</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

As can be seen in Table 5.5 four main criteria were found in the responses surrounding the selection processes of the image users in this study. The four most frequently noted factors are here named Quality, Topicality, Physicality and Aesthetics. Two other factors, History and Credibility were mentioned by a limited number of participants.

One factor, Quality, was uniformly recognized as important to image selection and based on the degree of excellence in the visible characteristics of
the image surrogate. All of the study’s participants noted this factor in their discussions of image selection. Questions about appropriateness for use were based on the size of the image, the color (or lack of it), brightness, contrast, and clarity (i.e., the image was clear and in-focus).

“But accuracy in color, accuracy in form, whether I can see good detail. Color over black and white almost always, because I am using it to paint. … That is helpful especially if I am going to print it off. If I am going to print it off to use it as a reference then it is really helpful. I will get better detail.”

[Artist 6, 345-352]

Issues relating to color in the participants’ discussions about criteria were frequently encountered. It was clear from their responses that there were levels of quality that were required in order for the participant to use the image. The degree of quality needed would vary depending on why the image was needed and how the image would be used. For example, if a painting was needed merely for identification purposes a small black and white reproduction might suffice. However, if the same painting was desired for close study or a high end publication it would need to be available in color and be large enough to show fine details.

A majority of the study’s participants (16 of 20) from across all four user groups noted Topicality in their discussions about how they select images. The intellectual content within the image was found to be an important factor in their selection process. This criterion was concerned with the following questions about the images’ suitability. Is it representative of the item desired? Is it appropriate to the need and use? Is it the type of image (i.e., a map, a plan, a
reconstruction, an x-ray) that is desired? And, how accurate is the representation of the item? For the majority of the participants the content within the image being sought would determine whether or not the image would be used.

“It obviously has to include the things that I want in it. … I have to have the things in it that I’m going to be trying to make a point about,”

[Archaeologist 4, 701-707]

Why this one basic criterion, that the image was of the desired item or theme, was not identified by all participants is unknown. It is possible that it was considered so rudimentary that its use was implied.

The next factor, *Physicality*, was identified by a majority of the study’s participants (14 of 20) from across three user groups: Archaeologist (4 of 4), Architect (5 of 6) and Artist (5 of 6). This selection factor was dependent upon the point of view of the camera/recording device and whether or not the scale of the image could be discerned. The criteria used here, beyond those surrounding issues of scale, are those which are related to the view and angle of the shot, whether the whole item is represented or it is cropped, and the composition of the image (i.e., the arrangement of items within the frame of the camera).

“If it is a landscape shot or something, what is going to orient them the best or what is going to be the most typical view. … I will take an aerial view, most of the time, because it will show them more or show them where something lies in relation to the land. Sometimes a couple of different views of something. I’ll show an aerial view of a temple and then show a detail of the façade, or the columns, or something like that.”

[Archaeologist 3, 475-481]
These aspects were considered critical since point of view had a strong influence upon how readily a viewer could discern what was represented in the image.

*Aesthetics*, the final factor to be mentioned by a majority of the study’s participants (14 of 20), was identified by users in all four groups (Archaeologist - 3 of 4, Architect - 6 of 6, Art Historian - 1 of 4 and Artist - 4 of 6). This factor is associated to the artistic qualities causing an image to be most appealing and appropriate to the need. The criteria used here were based on how compelling, interesting or fitting an image was for a particular situation. Other aspects included within this factor had to do with the quality of light, time of day, type of weather, and aura of place represented in the image.

“Is it a cloud-filled sky or a cloudless sky? Is the sun in the sky or a bird in the sky? Is it closer to sunset, midday, morning? ... So, for this particular project with the church and parish center, we wanted it to have a certain quality to it. A softness to it and a pastoral quality that we were trying to create to serve as a backdrop for the rest of the project.”
[Architect 1, 1295-1304]

Although the creative user groups were the most vocal about aesthetic concerns in their selection process, the academic users also described using “lovely” and, or “compelling” images. This was particularly the case in the images used in their teaching since they believed the students would be more apt to be interested in the material if it were illustrated in an attractive or catchy manner.

Two other factors, *History* (3 of 20) and *Credibility* (2 of 20) saw only limited mention among the study’s participants. The factor *History* was used to describe a need for non-contemporary images since they provided a view of an
item across time. This factor was mentioned by single participants in each of three groups (3 of 20, Archaeologist, Art Historian and Artist).

“Sometimes I do early [views] … when we were talking about Pompeii is a good example. It’s kind of interesting to go back and say this was dug up in 1705 or something like that. Or, this is what the excavations were and that’s why we don’t have this kind of information that we’re looking for today.”
[Archaeologist 4, 719-722]

*Credibility,* a criteria discussed by two (of 6) participants from the Architect user group, was used to assess the trustworthiness of an image or item. In judging the credibility of an image the text and graphics of a web site and, or the number of images a participant was able to find of a particular item were discussed as being used in the evaluation. In many cases the item of interest was a product, such as a finish material or an appliance.

“I remember looking at all these web sites for all these different sail companies, and awning companies and stuff like that … there may have been ones one there that were just as usable as the ones we ended up going with but their web site was funky… just like how well presented is the information presented both graphically and verbally? … A lot of times… it [the Web site] is sort of stepping stone for talking to someone at the company. So how easy is it to find a phone number on the Web site? Do they answer their phones? It is reliability and how credible is the company behind the images?”
[Architect 2, 599-617]

When looking across the ways the various criteria were applied in the selection process there are several patterns to be discovered in the findings associated to particular user groups. The most clearly different pattern in the study was seen in the limited criteria used by the participants in the Art Historian
user group. While the four main criteria across the study were found to be

*Topicality, Quality, Physical and Aesthetics*, the art historians never noted factors
associated to shot angle, and only one (Art Historian 4) discussed aesthetic
issues in her selection process. In contrast to this, the participants in the
Archaeologist, Architect and Artist user groups showed themselves to typically
assess retrieved images according to all four of the main factors. Another
pattern found was that the infrequently used Credibility criteria was only
mentioned by participants in the Architect user group and this suggests the role
of manufacturer and, or product reliability in their work.

**Case Studies of Known Item Queries**

The findings presented in this section examine the resources used by
participants when performing known item searches. The findings given here are
based on the responses of participants to interview question 11 (How do you find
an image of a work you know about?). In recalling known item queries the
participants generally discussed specific structures or works (e.g., *Parthenon*,
*The Last Judgment* by Michelangelo) or specific objects of which there may be
several instances (e.g., ancient bust of Cleopatra, dishwashers). One architect-
participant noted looking for images relating to the history of a specific kind of
structure in a particular location (textile mills in Patterson, NJ) in response to the
question.

Presented below are several critical aspects of searching for images. The
first findings to be discussed are the resources used by participants when they
performed their known item queries. This is followed by a presentation of the
findings surrounding the search strategies employed to retrieve known images.

This section ends with an examination of the categories of terms which were used by the participants to find known items.

**Resources Used**

As can be seen in Table 5.6, when looking at the format of the resources to find known items, it was discovered that half of the participants (10 of 20) will turn to online resources exclusively, although in differing degrees depending on user group membership.

**Table 5.6**

| Format of resource used to perform known item queries by user group |
|-------------------------|------------------|------------------|
|                         | Online Only      | Analog Only      | Online & Analog |
| Archaeologists          | 2 of 4           | 0 of 4           | 2 of 4          |
| Architects              | 4 of 6           | 0 of 6           | 2 of 6          |
| Art Historians          | 2 of 4           | 1 of 4           | 1 of 4          |
| Artists                 | 2 of 6           | 1 of 6           | 3 of 6          |
| **Total**               | **10 of 20**     | **2 of 20**      | **8 of 20**     |

The Architect user group was found to be the most apt to search for a known item using online materials exclusively (4 of 6). This was followed by the two academic user groups (Archaeologist - 2 of 4 and Art Historian - 2 of 4). The Artist user group (2 of 6) was the least likely to use only online sources when seeking out known items. Following closely behind the online only search was the blended method of searching using both online and analog resources (8 of 20). From these findings, it can be seen that 90% of the participants (18 of 20) in the study noted the use of online resources for retrieving known items alone or with print-based materials. Two participants, one from the Art Historian and the
other from the Artist user group, discussed only analog materials in performing this kind of search. When examining how many resources participants mentioned alongside their known image queries the majority (17 of 20) noted using from one to three sources.

**Table 5.7 Resources used to perform known item queries by user group**

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<th>Online</th>
<th>Analog</th>
<th>Own</th>
<th>Others</th>
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<td>Internet (unspecified)</td>
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<tr>
<td>Books &amp; Magazines</td>
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<td>Manufacturer / Store</td>
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In terms of the details surrounding the most frequently cited resources used by the participants in their known item searches, there was a nearly even split among online and analog materials. The participants provided differing levels of granularity in their discussions surrounding the resources they used and this makes comparisons across resources somewhat cumbersome. Their responses are recorded in Table 5.7. As can be seen in this table the most often recalled resource used for known item searches among the participants (10 of 20) was print-based media (books and magazines). The domain of participant appears to have played a role in the selection of analog materials to perform
known item queries with the lowest use among the Architect (2 of 6) and highest among the Artist (4 of 6) user groups.

The selection of print-based media was followed closely by online resources, with the unspecified Internet (9 of 20) and the search engine Google (9 of 20) being the most often recalled online “resources” used by the participants. Again there was an indication found that among the four user groups the artist-participants were the least likely to turn to online resources. While Google Image was discussed by only a few participants (4 of 20), it is possible that several individuals used the resource but did not distinguish it verbally from Google. Commercial, in-house and freely available online image databases were also mentioned by a number of participants (5 of 20) from across three user groups (Archaeologist – 2 of 4, Architect 1 of 6, Art Historian – 2 of 4) when recalling how they found known items. This suggests that while the participants prefer to use online resources they are not using databases to the same degree as search engines and other online resources.

Analysis of the responses given by individuals within the various user groups revealed a few interesting patterns. For instance, the three of the five responses received for database usage to find known items came from the participants in the Archaeologist user group. The reason why the archaeologist-participants were more likely to use databases is not clear and warrants further exploration. Another pattern discovered was a high use of print-based resources among the artist-participants (4 of 6). This finding supports those found with the artists’ preferred and favorite resources, discussed above.
Similar responses about resource selection for known item queries were found across the four user groups. Knowledge of particular resources and what each contained was mentioned as the reason behind a resource’s selection or omission by a large number of the participants (11 of 20). Reflecting the amount of time they spend devoted to the task of image-seeking, participants in each user group discussed the process of selection or elimination of resources based on their knowledge or prior experience.

“I knew it’s not in the [institution] collection, so I wasn’t going to MDID. And, all of the slides that I was looking at anyway that were in ARTstor were from [institution]. So, my only option was Google at that point. And, there are these two guys who’ve done a great job at Bassae. There’s one guy who pitches a tent and lives there in his excavations. There’s a website but it’s about the site. It’s not about the sculptures. The sculptures are long gone into the British museums. You can see everything he’s doing to the structure, but Jenkins book certainly isn’t online [and] so I couldn’t use [it].”

[Archaeologist 1, 607-615].

In this case the participant was seeking architectural sculptures from an ancient structure at Bassae. In this passage she discussed the analog collection at the institution she works at and how the holdings within this collection influenced her decision whether or not to check the institutionally supported database MDID. In her mind, if the analog slide didn’t exist in the institution’s collection the image would not be available in the online database developed at the school where she taught. She then turned to ARTstor for the items she sought and was only able to turn up unwanted images from Bassae that had been added by her home institution. At this point she gave up on ARTstor and performed a search of the
Web using Google. Through the Google search she found a site on the desired subject, but it contained none of the images of the architectural sculptures at Bassae. Mentioned at the end of the above quote is a book by a particular author, not yet available online, which contains the images she needs. This one case illustrates the complexity of image searches that should be among the easiest to perform, known items, and also the preference for finding images already scanned and available in the online environment.

While half of the participants showed a preference for finding online images, printed materials figured prominently in many participants’ image searches. In many cases (10 of 20), particularly among the academic user groups, the participants discussed specific analog resources useful to their known image searches. The distribution of the participants’ responses in this instance is Archaeologist (3 of 4), Architect (1 of 6), Art Historian (3 of 4) and Artist (3 of 6).

Some participants suggested they would go directly to analog resources containing a needed image if they felt an attempt to find it online would be unsuccessful.

“Well, in all likelihood if I know all of that information it is because I have seen it published somewhere. So I would go back to that publication if it is something not likely to be digitized. That is the surest thing.” [Art Historian 2, 387-389].

In addition to using analog materials to retrieve known images, participants also noted they used these resources to assist them in finding terms to help them in the retrieval process.
“Sometimes I'll flip open a book and look.

(Interviewer) To find more specific information?

Yeah… It will help me retrieve it then.”
[Archaeologist 4, 560-568]

Here the participant would extract the terms found in the text that might be helpful in forming an online query. This was done not just as a way to find terms, but also as a way to replicate the terminology of the scholarship. The use of these scholarly terms was believed to provide focused and useful terms for online queries. Interestingly, even in this use of analog resources a preference for utilizing online resources to find known images can be seen. Finding online images would generally reduce the effort required of the participant to prepare the images for use.

Continuing this thread concerning the preference for format it will come as no surprise to learn that even when there was an expectation that online resources would not meet their needs, some participants suggested they would look online first to assess what is available.

“Probably what I would try to do is see if I could find something on the Internet, depending on what it’s for, that was as good of quality as what I know exists in a book that I have access to. And if I can, I'll definitely use that. If I can't, then I'll scan it.”
[Art Historian 3, 701-703]

If the image isn’t available online or the quality of the online image is not high enough, this participant noted she would track down a known publication and scan it for her purposes. While a preference for finding images online existed
among some participants, a desire to find a particular image could lead participants to search within print-based materials.

“If I knew that specific [information about an image] I guess I would know if I had it. Like, that would be the first question. Do we already have a book like that? Otherwise I would definitely use the Internet as the first step.”
[Architect 3, 1377-1379]

Having to use images from analog resources was viewed as an obstacle by some participants. Format issues made the effort involved in readying the images for use more challenging. How quickly the individual turned to analog resources seems to be based on their knowledge of and, or tolerance for scanning. Interestingly, even when support staff was available to perform this work participants did not always take advantage of their services.

“I should have taken my Jenkins book, gotten out of my stupid chair, walked down the hall, gone down the stairs and put it in Tom’s hands and said ‘Would you please scan this image and email it to me?’ And he would have done it. I could have been doing something else in the meantime.”
[Archaeologist 1, 616-620]

As the passage above indicates, the inability to find things online when they were aware of published images was particularly frustrating to participants.

The format of the resource chosen for image searches by participants was found to be tied to the perceived popularity of the image being sought or the degree of detail needed.

“Either the stuff that I want are old chestnuts … like here is a quick view of the pyramids and look they are still standing from when Cleopatra walked by. I don’t need detail. Or [stressed], I need something with so much detail … I need the left west wall of the inside of
the funerary temple of …. That is where I would look in a book.”
[Archaeologist 3, 370-374]

Images of well-known subjects were generally seen as being easily discovered using online resources, while those of obscure items were believed to be far more challenging to find and so they would require the support of printed publications. However, even when the images were of well-known subjects or structures sometimes a problem was noted in their not being able to retrieve the “right” image online.

“Even if I were to say the Barcelona Pavilion, in Spain, you can’t exactly find exactly what you need … You can’t control it. Maybe that’s it. And maybe that would be worth the effort if it was to get something that was more comprehensive. I think, other than that, for these quick images … then it’s fantastic. But, for something that’s really in-depth … the resource isn’t there.”
[Architect 3, 391-403]

In this case the participant was commenting on potential requirements where she may need an image of a specific architectural element, or a shot of the structure from a particular angle, or an image of high enough quality for professional printing purposes. None of these, she feels, will likely be met through online resources and instead she would turn to books to track down these images.

Of the four user groups in this study discussing their known item queries, analog publications were again found to figure most prominently among the participants in the Artist user group. However, none of the artist-participants’ responses clarified why they relied more heavily on analog resources in performing these searches. While four of the artists mentioned their collection of
art books in answering this question, they were certainly not the only participant
user group in the study to have extensive print-based personal libraries. The
interest in tangible materials exhibited by the artists in searching for known items
appears to be tied to how they use images and this will be discussed in more
detail in the next chapter, Findings Related to Image Use.

Search Strategies Used

This section examines how participants perform known item searches. The
findings presented here were amassed from the responses given to
interview question 11 (How would you find an image of a work that was known to
you?). Several interesting search strategies and phenomena emerged from the
responses. These had to do with the various approaches taken when
formulating their search queries, the difficulties they encountered with the
“cataloging” associated with images, the effort involved in finding the desired
images and how likely participants were to seek out specific works.

The participants noted various tactics they might take in seeking out
particular images and these could range from the use of a simple single term
“Parthenon” to complex combinations of search terms “Citicorp Center subway
station at base”. Several of the archaeologist-participants discussed limiting the
complexity of their known item searches to be sure to find the desired image.

“Well, I've learned with them to keep it as simple as
possible and put a comma and either the site or, if it's
a famous building, the famous building.”
[Archaeologist 1, 522-523]

This simple search approach was the result of the quality of indexing or
cataloging associated with the images they sought. After performing a simple
search to assess the potential number and kinds of items available, the query might then be reformed with additional terms.

“So I would want to see how it goes and after an initial survey if I understand how they are organizing their images, I might do a more detailed search.”
[Archaeologist 2, 214-216]

The combination of several terms across various categories was noted as a way to try to focus the recalled images by several participants in the various user groups. This more complex search technique was used when the participant wanted to limit the returned images (or links to images) to only those that were closely related to the desired item.

“I would use the name [of the individual] and then qualify it if I know maybe by the museum or some other word like tetradrachm if I am looking for coin portrait.”
[Archaeologist 3, 348-350]

By combining terms in this way the participants attempted to reduce the time and effort involved in looking through the images returned in the retrieval process since, as the participant below states, there could be a high number of superfluous items retrieved.

“‘Citicorp Center’ and then I would put ‘subway station at base’ or I would put ‘Saint Mark’s church at base.’ … If I know about it I will try to put in all the information I know about it that will get me to that photograph that I want … and try to do it with as much brevity as possible. Because if I enter the wrong word in that could be fifty wasted images. And that is another thing that is difficult about finding images … having to sift through all of them. You can’t just put in Newark, New Jersey. Because people… here is a picture of my family, here is my dog, lost cat, Newark, New Jersey.”
[Architect 4, 664-680]
Looking through daunting numbers of retrieved images, while not limited to known item queries alone, was an often noted difficulty the participants faced. Issues arising during retrievals for known items were seen as being caused by problems with the cataloging, indexing and, or text associated to the images. The majority of the participants discussed search strategies which showed them to be fully cognizant of the terms and the variations needed to perform searches for the different kinds of materials they sought.

“[I]f I am looking for a painting by a particular artist I would probably search using the artist’s name and a word from the title or the title. Something like that but if it something like an architectural monument, an ancient one, I would probably just type in the structure’s name. If its ceramics, I might enter the vase painter’s name or the potter or the Beazley vase number because that tends to be how Classical vases are cataloged. If all else fails I might try a stylistic search. Site name searches tend to be too broad.”
[Art Historian 1, 202-208]

However, even the most stable kinds of information related to an image, such as words in the title, could be an obstacle to finding the desired item(s).

“Sometimes the title doesn’t work and sometimes you just have to type in the artist and hunt a little bit.”
[Art Historian 3, 707-708]

Again, this is suggestive of the time and effort involved in having to look through a number of retrieved images when a specific, titled item is wanted.

Several participants discussed the variations encountered in the text associated with online images across various resources and the challenges that resulted from this situation.
"There are a lot of ways that, you know, keywords are used in a very sophisticated way in stock photo sites. … It's easy to find images in a site like that using keywords. On the Internet, you can get so many results you'd never expect or imagine. It can be a little bit more difficult. And even things like Flickr can be challenging because, you know, it's all the individuals are putting up their images. How they title their images that, you know, keyword them, and allow you to find them. So, you have to kind of be creative and navigate through Flickr and the categories and like the different groups to find images related to what it is that you're looking for. So, depending on the tool that you're using you have to modify the way you use it."

[Architect 1, 849-862]

The craftiness and adaptability required of the participants in seeking images is not limited to variations in online resources. Participants, particularly those in the two academic user groups (Archaeologist and Art Historians), noted the use of search terms which were gleaned from the scholarly literature. Using these highly specific terms in image queries was believed to be helpful in finding a desired item. These kinds of terms were also viewed as being useful to a search strategy to find less well-known materials.

“[I]f I were going to go look at Google just using words, at that point I will be specific enough so that I will go to the house in Pompeii where I know a piece is published or something like that. Because the scholars will have published it under that kind of specific information.”

[Archaeologist 4, 550-553]

In this instance the participant’s use of the scholarly query terms was felt to increase the probability of finding the desired item since, if there was an image available, it would likely be known through a scholarly publication.
Another finding of note related to text associated with images and the archaeologists and art historians’ search strategies is their tendency to use the local language of the materials being sought. As one participant clearly stated, performing searches using terms in the native language where the materials were located or discovered offered certain advantages.

“I have gotten in the habit of going with whatever the local language is. So if it were something in France I would try to put it in French. There are wonderful files of groups that excavate ancient shipwrecks and they are house with an academic group in France. So if I search on the French version of the name I am sure to get the real original thing. I have found a lot of the Italian Web sites, they offer English… if you push a button… but if you type on the Italian version, that was the first one they posted and it probably has more images or information.” [Archaeologist 3, 359-366]

As the findings above suggest searching for images online through the associated text is challenging and this is the case even when the individual performing the query is knowledgeable within the domain and the image being sought is a known item. Further complexities are encountered with unknown image searches.

An additional topic to be discussed relating to the known item search strategies of the participants was the use of directed browsing as opposed to direct keyword method of online image retrieval. Browsing to retrieve known items was discussed by two participants (Architect 5 and Art Historian 1) in the study. In the case of Architect 5 he had been tasked by the lead architect of a project to search for images of appliances by a particular manufacturer often used by the firm.
“Typically if I am doing a search for something it is very specific. Say for example, a dishwasher. So I will go to the manufacturer’s web site and then click on dishwashers and they will have [links to] different series from high-end to low-end.”

[Architect 5, 182-184]

The site he used, as he described it, was essentially a catalog of the manufacturer’s available products arranged as a series of links leading to various appliance types (i.e., dishwashers, ovens, etc.) with the separate appliances divided into different pages according to price range and then finally by finish. It should to be stated here that the architect performed a keyword search of the Internet using Google to find the site of the manufacturer and the appliance desired and he then followed a series of links.

The art historian also noted she browsed through a set of links at a frequently used Web site to find the images she wanted.

“I went to the Beazley Archive and I noted that they had added a new series of early photographs of archaeological sites. That one I drilled through a series of links. I saw it had several ways to access these collections. I think it was by photographer, by collection, by site name, and by monument. There was an option to browse the entire thing. I think I first looked by photographer which wasn’t very useful … After this, I looked by site. So I looked at the entire list of what they had, which wasn’t too long and I saw that it did have the Treasury of Atreus.”

[Art Historian 1, 127-140]

After browsing the Beasely Archive’s Web site this participant (Art Historian 1) noted that she used the title of the structure, Treasury of Atreus, to perform a query with Google Images. She did this to find contemporary images to compare to the early photographs of the structure. As these two search scenarios
suggest, even when browsing for images, the keyword method was typically employed at some point in the query process by participants to find known items. In these two cases the direct keyword method was used as a way to enter the information matrix (Architect 5) or to perform a parallel query (Art Historian 1).

Print resources familiar to the participants were also browsed to retrieve the desired images. Finding the general area where the images were expected to be located in a resource and then leafing through pages was a noted method of discovery used by the participants. Looking through the table of contents or the index of the book to discover the image through its title or subject was also a method employed.

“In a printed book, well, I guess… mostly of the books I use, I know them. So I know oh, there is an image of that in so and so’s book since that is where I learned about it from or he discussed that topic. Then it is just a matter of leafing through it or looking through the index. Medinet habu … mostly with the book I would probably flip through the pages.”

[Archaeologist 3, 571-576]

As was discussed above in the section on resources, printed matter figured prominently in the known item searches of the artist-participants and several of them noted browsing through books to find images.

“Usually that meant I’d go to the library, get some books on the guy, flip through some things.”

[Artist 2, 704-705]

A few final comments need to be made concerning the artist-participants and the performance of known item searches. During the discussions surrounding this form of image retrieval, several artist-participants noted they “…

21 Medinet habu, the name commonly given to the Mortuary Temple of Ramesses III, is an archaeological site on the West Bank of Luxor in Egypt.
can’t imagine ever wanting to see a specific one [work],” [Artist 4, 949]. Instead they might be interested in looking at the work of an artist or images of a particular type of thing (e.g., media or objects). This finding in itself is significant since it suggests artists do not commonly seek out specific works.

The above findings indicate that the most common method of image retrieval employed by the participants when they were searching for known items was online keyword queries. These could range from simple searches of a single term to combinations of various kinds terms such as work title and artist’s name. Browsing was an additional search method to be utilized by several participants in the study’s various image user groups, but even these were conducted in tandem with keyword searches. The artist-participants, since they rely more heavily than the other groups on print resources, were typically found to retrieve images by leafing through the pages of a book. Of the four user groups the Artist group was the least likely to perform searches for known items and instead preferred to search more broadly for works by a particular artist or object type.

**Terms Used**

When participants were asked to recall how they performed a search for an image of a known item a preference for particular categories of terms was found. The nature of the terms given by the participants varied from the basic (e.g., artist and title) to highly specific (e.g., Cerveteri and Barone). As can be seen in Table 5.8 the majority of participants across all user groups employed *Title* terms (16 participants of 20) and named individuals or entities (*People* - 14
of 20) in their known item searches. Location terms (8 of 20) and Theme / Thing (6 of 20), while employed less frequently, were found to have been used across all of the user groups. Several categories saw modest use among the participants searching for known items. Categories used by participants in two user groups include chronological Period (3 of 20), Style (3 of 20), Media (2 of 20) and View (2 of 20). A single art historian-participant noted the use of highly specific vocabulary represented by the category Specialized Terms (1 of 20).

Several of the user groups were found to have preferences for the categories of terms they employed in their known item searches. For example, each of the archaeologist-participants noted they would attempt a known item search using terms in the title of the work or structure. The participants in the Art Historian group all noted their queries for known items would be undertaken utilizing the names of artists or architects. Each of the artists mentioned they would use artist and, or title in finding images of known works. The clear preference for term categories seen in the other user groups was not discovered among the architects. The lack of a focused preference for this form of search among the architects is carried over into the distribution of their responses across the various term categories. Their known item query responses fell across eight of the nine categories and were the most disbursed among the groups. The terms given by the Art Historian and Artist groups fell in six categories each, while those of the Archaeologist group were the least varied at five categories.
Table 5.8 Search terms used to perform known item queries by user group

<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>People</th>
<th>Location</th>
<th>Theme / Thing</th>
<th>Period</th>
<th>Style</th>
<th>Media</th>
<th>View</th>
<th>Special terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Architect</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Art Historian</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Artist</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>14</strong></td>
<td><strong>8</strong></td>
<td><strong>6</strong></td>
<td><strong>3</strong></td>
<td><strong>3</strong></td>
<td><strong>2</strong></td>
<td><strong>2</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>
Case Studies of Unknown Item Queries

Data concerning the participants' unknown item searches were gathered through their responses to interview Question 12 (How would you find an image of a work that was unknown to you?). The types of images being sought by the participants when they recounted an unknown item query were typically those where they searched for a general subject (e.g., gladiators, Susannah at her bath), an object type (e.g., Greek weapons and armor, churches, driveways, shapes, drawings), or things associated with a place (e.g., finds from Bronze Age Pompeii, an artist's work done in Spanish villages).

Presented below are the findings associated with the participants' unknown item queries. Examined first are the resources used in finding unknown items. This is followed by a discussion of the search strategies the participants employed in their searches. The findings related to the categories of terms used by the participants in their unknown item queries are addressed at the close of the section.

Resources Used

The basic findings relating to the format of resources used in unknown item queries, which can be seen in Table 5.9, are not markedly different from those of known item searches conducted among these user groups. Half of the study's participants (10 of 20) noted they used a blended method of both online and print-based resources in trying to meet their unknown image retrievals. The choice of a blended method of searching for unknown items saw different levels of use among the study's four groups. The participants in the Archaeologist user
group used this method exclusively, while the Architect (2 of 6) and Art Historian (3 of 4) user groups showed a preference for online resources. Half of the artist-participants (3 of 6) noted a blended method of searching for unknown items.

**Table 5.9**  
Format of resource used to perform unknown item queries by user group

<table>
<thead>
<tr>
<th></th>
<th>Online Only</th>
<th>Analog Only</th>
<th>Online &amp; Analog</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Archaeologists</strong></td>
<td>0 of 4</td>
<td>0 of 4</td>
<td>4 of 4</td>
</tr>
<tr>
<td><strong>Architects</strong></td>
<td>4 of 6</td>
<td>0 of 6</td>
<td>2 of 6</td>
</tr>
<tr>
<td><strong>Art Historians</strong></td>
<td>3 of 4</td>
<td>0 of 4</td>
<td>1 of 4</td>
</tr>
<tr>
<td><strong>Artists</strong></td>
<td>2 of 6</td>
<td>1 of 6</td>
<td>3 of 6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>9 of 20</td>
<td>1 of 20</td>
<td>10 of 20</td>
</tr>
</tbody>
</table>

A number of participants (9 of 20) across three user groups (Architects 4 of 6), Art Historians (3 of 4) and Artists (2 of 6) noted they used online resources exclusively when searching for unknown items. A single (of 6) participant from the Artist group noted she would use books exclusively to perform unknown images searches. Again, the findings from this study point to a high use of online resources for image retrieval among these user groups. Also comparable to the findings of the known item searches is the discovery that 75% of participants (15 of 20) identified between one and three resources as useful when they attempted to find unknown images.
Table 5.10
Resources used to perform unknown item queries by user group

<table>
<thead>
<tr>
<th>User Group</th>
<th>Online</th>
<th>Analog</th>
<th>Own</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Internet (unspecified)</td>
<td>Google</td>
<td>Google Images</td>
<td>Google Maps</td>
</tr>
<tr>
<td>Archaeologist</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Architect</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Art Historian</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Artist</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NUMBER</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

The findings related to the most commonly used resources in these searches are nearly a reflection of those discovered with the known item queries. As can be seen in Table 5.9 the most often noted kind of resource (9 of 20) among the participants is print-based publications. While all groups noted their use, the participants in the Archaeologist (4 of 4) and Artist (3 of 6) user groups showed a stronger preference than the other two user groups (Architect - 1 of 6 and Art Historian - 1 of 4). Google and unspecified Internet resources follows close behind with each receiving a slightly lower mention in the responses across all four user groups (8 of 20). Google Images was identified as useful by several participants in all but the Archaeologist user group (5 of 20) and Google Maps was mentioned by a single participant, an architect. When viewed together as a suite of tools for finding unknown images, over half of the study’s participants (14
of 20) noted they would use Google, Google Images or Google Maps. The artists in the study did not show their use of these to the same degree as the other three user groups in the study. Only one artist (of 6) noted the use of the Google search engine. The remainder went unmentioned by the artist-participants.

Use of image databases, commercial or otherwise, were mentioned by 20% of the participants from across two user groups in association with performing unknown item queries. When viewed against the results found for the use of image databases for known item queries it shows their use drops in half when participants performed unknown item searches. Why the use of image databases drops when participants perform unknown queries is unclear. However, several academic users suggested that online image databases do not replicate the breadth and depth of imagery that was previously available to them in analog collections and so this may account for the decrease in their use among participants in unknown item searches. As can be discerned in the following passage the expectation among users was that image databases, in this case the institutionally developed MDID system, are not yet rich enough to be useful to complex searches.

“We had more a quarter of a million slides, and while many were duplicates this is a much reduced number. When I look up an artist like Rembrandt or Rubens I am amazed at how few images there are. There might be 50.

(Interviewer) And in the slide collection itself?

There would have been several hundred.”
[Art Historian 2, 568-576]
Obviously, the finding that databases are not as heavily used when unknown searches are being performed is an intriguing one requiring further investigation.

Two notable findings from the responses of the participants associated with their unknown item queries were the increased reliance on asking others and on the use of library or collections-based materials. Four individuals from across three user groups (Archaeologist – 1 of 4, Architect – 2 of 6 and Art Historian – 1 of 4) noted they would seek out the help of others – colleagues, friends and, or family members in trying to find unknown items. This method of seeking out unknown items is noteworthy since it went almost unmentioned in seeking known items (1 of 20 participants).

An increased mention of the use of library collections was found when the participants were asked about performing unknown item queries. Eight of the study’s twenty participants from across all four user groups noted the use of library collections for unknown items. When performing known item queries only two participants, one from the two creative user groups, mentioned the use of collections or libraries. Library collections appeared to be most heavily used by the Archaeologist user group (3 of 4) and the least used by the art historian-participants (1 of 4) when performing unknown item searches. The finding that library collections are mentioned frequently when participants discussed unknown item queries is suggestive of the important reference role they play for users. In fact, libraries were noted by several participants in tandem with reference works they needed to perform their work.
“So, if I don’t know what it is, I do tend to go to
databases where I might at least get kind of a
nudge. I mean … a printed book that is essentially
a database. There are certain databases you can
use and electronic databases haven’t quite caught
up with the printed databases yet, interestingly
enough.”
[Archaeologist 4, 584-611]

In this case the archaeologist was referring to the multivolume set *Corpus Vasorum Antiquorum* which publishes images of ancient Greek vases from over
one hundred different museums. Libraries were not seen as a domain solely
suited to the academics, however. Participants in the Architect and Artist user
groups noted their use when they needed to find images. Several artists
mentioned visiting public libraries when their own personal collections did not
contain the books with the desired image(s).

“I’m getting ready to order a Canaletto book just so I
have one in my hand. … I’d try to get my hands on it
to see it. I’d go to a library, a catalog, I guess Google.
You know, some, by hook or by crook, how could I
track it down and my get my eyes to see it?”
[Artist 2, 875-883]

In some cases a barrier to library use was access, as can be seen in the
response of this architect-participant.

“We have summer interns from [a university]
sometimes and so they have access to the libraries
and we have asked them ‘Can you find a book on
this? Can you find this book?’ and you know …
sometimes these books can be hundreds or
thousands of dollars. It is a great resource.”
[Architect 6, 567-570]

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22 The CVA resource does in fact have an online database of images as of this writing (SEE: [http://www.cvaonline.org](http://www.cvaonline.org)). However, the database does not at this point reflect the complete printed history of the publication. The digitization of the 250 fascicles which are currently out of print is ongoing. A number of fascicles, which are still in print, appear as though they will not be digitized.
While a number of individuals in the study mentioned libraries in their unknown item queries the Archaeologist user group alone appeared to turn to this resource in a way that could be classified as a group supported behavior. For the majority of the archaeologists (3 of 4) it was clear they believed the best way to find an unknown item was by utilizing library resources. This is supported by this participant, who clearly states that online resources are of limited use when performing unknown item queries.

“That would be a good old fashioned bibliographic search. Tracking down different footnotes. I am in the process of completing that particular type of research where I had a bunch of objects and I knew there were about a million out there and it is just a matter of tracking down as many as I can that are illustrated. Google doesn’t help. Flickr can’t help. That is just library work.”
[Archaeologist 2, 261-265]

Why the archaeologist-participants were the only user group to turn to the library as a matter of course in performing unknown item searches is unclear. It may have to do with breadth of resources (e.g., excavation reports, published studies of material analysis, museum catalogs, journals from parallel disciplines, etc.) needed to perform the work.

Additional support for this group’s library-centered searching can be seen in the finding that print-based resources figure prominently in the archaeologist-participants’ unknown image searching behaviors. Each of the archaeologist-participants noted the use of books and other printed matter in their discussion of searching for unknown images. The Archaeologist user group was, in fact, the only one in the study to have all members identify the use of analog materials in
their unknown image searches. Even the participants in the Artist user group, which showed a heavy dependence on printed matter in their responses for interview question 11 (about known item searching), and survey questions 6 and 7 (about preferred and favorite image resources), were more limited in their responses for unknown items. This is an intriguing discovery deserving of more investigation.

There were several additional findings which revealed patterns among participants in a single or a paired user group. For example, half of the participants in both the Archaeologist and the Art Historian user groups noted their use of museum web sites when they were seeking unknown information. Although none of the participants in the creative user groups mentioned museum Web sites when searching for unknown items, the academic users readily recalled specific museum resources that might provide the images they sought.

“Well, I would certainly go for anything archaeological to the major museums, the British Museum, the Louvre, and the Vatican. The Vatican’s Web site is really very good. Because they have great images and you can zoom on them.”
[Archaeologist 2, 272-274]

Other findings were discovered among specific user groups. For example, a majority of the participants in the Archaeologist and the Architect user groups noted their use of an online resource in finding unknown items. For the Archaeologist user group Google was the most often cited (3 of 4) online resource among the participants. The participants of the Architect user group were found to use Google Images most frequently (4 of 6). For the artist-participants the most often noted resource (4 of 6) used to find unknown items
was the unspecified response “the Internet.” Books which had previously been so integral to their searching for images were only recalled by half of the artist-participants when they discussed their unknown image searches.

**Search Strategies Used**

The findings presented in this section are focused on the techniques the participants used to find unknown images. Discussions concerning how the participants formed their search queries provide insight into the various strategies they employed. Beginning searches for unknown items with basic terms was a commonly noted strategy employed by the participants.

“I would start with the very most basic and just keep going until I have tracked it down. I have done that a number of times. I am quite the sleuth.”

[Artist 6, 268-269]

This method was not the only strategy employed, however, since just as with known item queries the participants knew from previous experience with resources that they had to modify their technique to retrieve materials suited to their needs. For example, Archaeologist 1 would change her search strategy from basic terms with ARTstor to more specific term queries of Google.

“I go from most general to less general, more and more specific. Because, I’ve found that if I’m really, really specific for ARTstor I will get zero images. And with Google I try to be as specific as possible and still have something come up.”

[Archaeologist 1, 710-712]

As she states, she modifies her query based on the likelihood of what images are expected to be retrieved by a particular resource. This finding is suggestive of retrieval problems relating from too much (Google) and too little (ARTstor) visual
content. A portion of the difficulties she encounters with searching may also be related to the difficulties inherent in providing intellectual access to images (e.g., depth of cataloging, variations in term usage, etc.).

Related to the variations in terms used to search for unknown items are difficulties which arise because the participant lacks a deep level of understanding surrounding the particular images being sought. In these cases forays into text-based resources were sometimes carried out to learn more about a particular topic. These queries could be performed using known print resources or online by querying a search engine.

“I might go to Google first to try and get, not necessarily the image, but more information about it to search ARTstor or even… Flickr. Depending on what it was.”
[Archaeologist 2, 243-245]

These searches to find more information about an unknown item or topic of interest could lead to various iterations of the search using several resources. Through this process some of the recalled text-based resources might contain images useful to the participant.

“I guess I would try the Web if I felt I had a detailed enough set of keywords. I saw a reference to a site, you know how Vesuvius destroyed Pompeii … Well, around 2000 BC it destroyed a predecessor which was a Bronze Age village. It was only recently discovered. I saw a mention of this and it said Bronze Age Pompeii. So I searched on the Web on that and just from a text search on Google I got a reference to the name of a scholar. This was a news item where a scholar was talking about that. I could then go to the library Web [site] and pull up an article from JStor or another journal using the author’s name. I was able to find that article. The article had a snapshot, it was
"in Antiquity, and a drawing of the site."
[Archaeologist 3, 382-391]

Discussing her search a bit further it was noted that she would continue to search for additional images in the future. In this way she would monitor the availability of images of the site by periodically searching for newly published material. As she learned more information about the topic she added new terms to her searches.

"I then searched on the name Poggio Marino of the site to see what I could get. … I am going to be searching again soon to see if anything new has been posted. Sometimes if you search a year afterward something will come up. Some really specialized study."
[Archaeologist 3, 394-398]

This finding suggests that users that have an ongoing interest in a specific topic will monitor the field for new terms and images in a way similar to that seen with text-based materials.

While not all of the participants mentioned performing searches in the future to learn more about unknown items, queries of this nature were not limited to the academic user groups. Participants in the Artist and the Architect user groups mentioned the importance of staying abreast of what was occurring within their respective domains. This could be carried out by performing queries for images of the work being produced by others, as is the case below.

"Why do I want to see the pictures or objects or whatever they are [of contemporary artists]? Because that’s my life. … I’m compelled. I’m fed by it. I’m part of the continuum. And it influences me and it’s quite inspiring."
[Artist 4, 2296-2305]
Alternatively, participants noted that they monitored visual information through online publications which arrived via the participants’ email service.

“There’s something interesting that’s happening now in Europe and it’s a website which is germanarchitects.com. It was really cool for us. And, they’re part of World Architects. They send out a newsletter by email. Once a week for German Architects, definitely. I think World Architects is probably the same. And, there you get a little write up. They showcase certain things around the world. It’s really cool. … In terms of looking at the new things, that’s a great platform.”
[Architect 3, 1428-1436]

Since all of the participants in this study work within domains that are based on visual materials it is interesting to find that available images (and their companion text) are actively monitored.

Another discovery that parallels findings in the text-based information behavior research is the difficulty participants experienced in trying to form their search queries. Translating a purely visual request into useful terms was noted as being challenging by several of the participants. This could be the case even when the individual was fully aware of what was being sought.

“I didn’t even know what it was called at first. … When I first started looking for this and had this idea, ‘permeable driveway’ was not in my vocabulary. I had the mental image in my head, and I knew what it was that Michael was intending here. So, I started searching for lawn and grass and, you know, driveway. … and when you find images on some of the sites, and Dreamstime does it, it shows you the keywords that are tagged with that image. And you can see the word ‘permeable’ and I go ‘Oh! That’s the word!’ And then that opened up other possibilities for me.”
[Architect 1, 769-782]
This passage indicates how useful the indexing of image content can be to the querying process. Using the now-known term the participant went on to reformulate the query.

The importance of the text accompanying images to the search process can also be seen in the discussion of searching for a possible unknown item.

“If I didn't know the name of the tele-presence I would probably use some keyword like video-conferencing or teleconferencing or something like that. I would probably use a term that had some association with it in my mind. Then [I would] try to find it through Google. Google search engine is easy and it has the images tab so you can search something and then search the web and then images.” [Architect 6, 307-311]

Because image searching was largely performed through keyword searches the ability to toggle between information presented in a text-based and image-based manner was found to be useful in performing searches of unknown items.

As a number of the passages above suggest, searching for unknown items required several iterations of queries developed to produce more precise retrievals. Through this process the terms utilized in the search could be modified based upon the retrievals which are closer to the desired item.

“It’s sort of an evolutionary process when you are in it because you just start with what you know and you start with where you are, and what you find will help you refine your search and send you off in certain directions.” [Architect 1, 788-791]

The development of the search through the process is clearly expressed above by Architect 1. Browsing through the information encountered during the search
process was noted as leading to useful discoveries when participants performed unknown item queries.

“Sometimes it [the search] will send you off in a direction you didn’t even think of … and, you know, you end up finding a solution that you didn’t realize.”
[Architect 1, 795-796]

Serendipitous discoveries were discussed alongside the participants’ unknown item queries, however they were more commonly encountered outside of the formal search process as was discussed above in the section titled Informal Browsing.

An individual’s point of view or area of interest could also influence the particular path chosen when searching for unknown images.

“I guess what it is, is that when you attack a question from a certain point of view, you have a bias or an interest, and that interest is what you follow. So, you tend to follow that information more diligently than you might follow something else. If you were more interested in form, you’d go that way. If you were more interested in style, you’d go that way...”
[Art Historian 4, 765-770]

This finding is reflective of situational relevance, as described by Wilson (1973). This theory suggests that individuals seek out particular kinds of information based on the degree of overlap found between their concern(s) and the available information.

A final aspect of note relating to unknown item retrievals concerns the lengths to which participants would go to find the images they sought.

“Chances are if I did see it somewhere… even if it was an advertisement on a billboard and I couldn’t remember what the company was or really what it
Interestingly half of the study’s participants (10 of 20) suggested that through their perseverance in searching an unknown item would eventually be found.

Several notable findings relating to the participants’ unknown item queries were discovered. A preference for simple keyword searches was discovered. However, while basic search terms were preferred, the participants used prior experience with resources to modify their search behaviors. A lack of expertise surrounding the topic of the image being sought was noted as being a difficulty which faced the participants when they performed unknown item queries. One way the participants tried to cope with their lack of knowledge in a particular area was to seek out the assistance of others, typically their colleagues. An additional difficulty was seen in the participants’ attempts to translate a visual need for an unknown item into terms useful to the query process. Query development through various iterations was commonly discussed by the participants performing unknown item searches. Also interesting was that participants in each of the user groups described conducting ongoing searches for images in order to keep up with the current scholarly or creative production.

**Terms Used**

When asked about how they would find unknown items the participants provided a variety of terms. However, the terms supplied by the participants were found to fall within a limited number of categories. As Table 5.10 illustrates the most often used term category across the four user groups was Theme /
Table 5.11
Search terms used to perform unknown item queries by user group

<table>
<thead>
<tr>
<th>Theme / Thing</th>
<th>People</th>
<th>Location</th>
<th>Title</th>
<th>Period</th>
<th>Style</th>
<th>Media</th>
<th>View</th>
<th>Special terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Architect</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Art Historian</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Artist</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>13</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Thing* (14 of 20 participants). This category was followed by terms used by the participants in each of the four user groups associated with *People* (13 of 20), *Location* (10 of 20) and *Title* (5 of 20). A few categories were used infrequently to search for unknown items and these are chronological *Period* (2 of 20), *Style* (2 of 20) and *Media*. The remaining categories, *View* and *Specialized Terms* were not used.

A shift in the preferred term categories used for image queries was found between the known and unknown items. The most frequently used category *Theme / Thing* for unknown item queries (14 of 20) was found to be at a rate over double that of known item queries (6 of 20). The opposite trend was found in the use of terms relating to the *Title* with unknown item queries (5 of 20) being noted far less frequently than in known item queries (16 of 20). The switch in the frequencies of these two term categories among the known and unknown item queries is illustrative of how widely image users’ searching behaviors can vary depending on what kind of search is being performed.

A few categories of terms showed little variation in employment between unknown and known item searches. Terms relating to people and location were among the most frequently used categories in both kinds of searches. The *People* category was useful to both unknown item (13 of 20) and known item (14 of 20) queries. *Location* terms were noted as being an important manner of discovering unknown (10 of 20) and known (8 of 20) images. The provision of information concerning location of a work within a museum or collection was noted as being a barrier to access in the online environment, however.
“I always tell my students that the one thing you need to know is where it is located. What museum, what collection it is in. Frankly that isn’t much use in this digital kind of searching. It used to be pretty much infallible. Usually things on the web are not labeled by their location, unless of course you are searching on the Web site of that particular location, of the museum itself.”
[Art Historian 2, 411-416]

One last observation needs to be made here concerning the limited number of categories searched when seeking unknown items. The number of term categories used by each of the groups in their unknown image queries was six (Archaeologists and Architects), five (Art Historians) and four (Artists). The archaeologist-participants used an additional category of terms when performing unknown item queries when compared to known item searches. The other three user groups (Architects, Art Historians and Artists) showed a more limited use of categories in the searches they performed for unknown vs. known items.

No term categories were used by every member of a particular user group when performing unknown item searches. However, a few patterns were discernable. A preference was shown for terms relating to Theme / Thing by the architect-participants (5 of 6) in their responses about their unknown item queries. A majority of the artists (5 of 6) showed a preference for terms relating to People in their unknown image searches.

Discussion of the Image Retrieval Findings

This chapter identified resource selection, search strategies and image selection as critical factors in the image retrieval process. After providing a foundation in the basic factors of image retrieval, case-based studies were
presented on known and unknown item searches. These case-based studies help to illustrate the various factors influencing the image retrieval process.

The resource preferences among the participants revealed three of the four user groups prefer the use of online materials. The majority of the participants in the Archaeologist, Architect and Art Historian groups noted their preference for online image databases and/or images found through Web sites. Comparisons of these findings with earlier studies are difficult because the archaeologists' and architects' image behaviors and use of technology have received limited attention. The existing literature addressing archaeologists' information behaviors presents a conflicting picture. Some literature illustrates that the discipline of archaeology has embraced technological tools (Clark, 2002; Marchionini, 2000; Bearman & Spiro, 1996) and yet when academic archaeologists' information behaviors are examined in the literature it appears that at least for textual information they still favor printed analog materials (Huvila, 2009). While Huvila's (2009) study examines and supports the strong use of images by academic archaeologists, it remains silent on the resources they employed to find visual materials.

A few studies have been published of architects' information behaviors (Sklar, 1995; Chidlow, 1991; Bradfield, 1976). However as these were completed many years ago their discussions are limited to analog materials. Because of this they offer no comparison to the current study's findings for the architects' preference for online image resources. A more recent study of architects' use of images carried out by Elliott (2002) suggested that this user
group had not yet embraced digital images or Web-based image searching. The current study found that architects were heavily dependent on digital images, the Web and technology and these findings indicate that a marked shift in the working processes of the profession have occurred in the intervening years between the two studies.

The use of digital images by art historians has been relatively well examined in recent years, but these studies offer a contrasting view to the present study’s findings. Bailey and Graham (2000) examined art historians’ use of digital images and found these users had negative connotations associated with items found on the Web. The art historians felt that materials found on the Web lacked authority. These researchers also report a lack of interest in using image databases among the art historians they surveyed (Bailey & Graham, 2000). Rose’s (2002) survey study presented similar findings, with the majority of her art historian respondents noting a lack of in-depth scholarly resources and a lack of useful images. A more recent study by Elam (2007) also suggests that art historians have not fully embraced digital images in their work practices. Elam notes, in her limited study of six art historians, that their lack of digital image adoption was the result of a lack of comfort with technology and limited awareness of resources. However a recent study suggests that art historians look more favorably upon the use of digital images. The art museum staff Koo (2006) examined felt that the use of digital images offered various advantages over the use of analog materials. Why divergent findings have been found among the several studies is unclear. It may be that Elam’s (2007) study and the
present study were conducted after a watershed moment in the art historians’ acceptance and adoption of digital images.\textsuperscript{23} It is an inconsistency that requires additional study for clarification.

The Artist user group presents an entirely different picture than that of the other three user groups in the study. Although two artist-participants noted that image databases and/or Web sites were important to their image seeking, there was a marked preference for print-based resources among the majority of the artists.\textsuperscript{24} The Artists also preferred using images from their personal collections. These two findings concerning artists’ heavy use of print materials and their own personal libraries is supported by the study of artists’ information-seeking behaviors reported by Cobbledick (1996). However conflicting findings about artists’ preference for online vs. print resources have been reported in recent


\textsuperscript{24} One artist (Artist 1), who ranked Web sites as most important, chose books as the next most important resources for his image needs. This is understandable as he works primarily with images provided through news-related Web sites. The other artist to rank online resources highly used a computer to work with images in her paid position.
studies. Gregory (2007) found that sixty-seven percent of the artist-respondents noted they accessed images through Google Images (or other Internet sites). Visick et al. (2006) also found there was a strong preference for, and use of, online resources among the artists they examined. These two recent studies seem to suggest a trend toward the increased use of online resources among artists. It is interesting that the current study’s findings do not appear to corroborate the studies of Gregory (2007) or Visick et al. (2006). Part of the discrepancy may be the result of the methods Gregory (2007) and Visick et al. (2006) used to examine the artists’ behaviors. Both of these studies examined artists through online surveys and this method would predispose the respondents to be comfortable with the use of online materials and computer technology.

Personally developed image collections were found to play an important role in the work-related image behaviors of all four of the study’s user groups, with three-quarters of the participants noting their use. Previous studies to examine image users suggest this is a common practice. Attig, Copeland and Pelikan’s (2004) survey of the user community on Penn State’s campuses found that forty-four percent of faculty and student respondents maintained personal collections of digital images. As has been mentioned previously, information regarding the image practices of academic archaeologists and practicing architects are limited. No supporting evidence for this practice can be noted for the archaeologists. However Elliott (2002) found that all of the architects interviewed during the study noted they had their own personal collection of images and that these could contain several hundred images. A number of
studies of art historians and artists corroborate the present study’s findings regarding the use of personal collections. Challener’s (1999) study of art historians reported they used their personal collections of materials and made their own slides or photographs. Elam (2007) also found personally developed image collections among art historians and she notes that the one academic art historian in her study was hesitant to move into the digital realm because she had developed a sizable personal slide collection over the course of 35 years.

Personal collections of resources were found to be the most heavily used by the artist-participants. This finding is supported by CobbleDick (1996) who notes in her study that personal collections of materials were maintained and consulted by the artists. A more recent study by Visick et al. (2006) also found that artists have well-developed personal collections supporting their needs. Another form of personal material discussed by the participants was those images they had created themselves. These personally created images were noted as being critical to the work processes of several architects (2 of 6) and one artist (1 of 6) in the present study. Discussions of the use of personally created imagery were not discovered in the literature addressing the artists’ or the architects’ information behaviors.

In the discussions of their search strategies the participants were found to shape their queries based on their knowledge, access to particular resources, the time they had available for the task, the need for particular images and how the images would be used. Through this preparatory process participants defined potentially useful known resources, possible search terms and criteria to be
employed in the selection process. When print-based resources were employed, participants typically noted they used prior knowledge to locate an image within a particular text. Browsing the text or using the book’s index was noted as being employed if it was a less well-known source. For online searches, keyword querying was the predominant method employed. Again, the participants’ prior knowledge was noted in the selection of resources and terms to be used in their queries. The participants discussed the development of search terms through resources available in either analog or online formats. This could happen as a specific and discrete activity carried out to discover more pertinent search terms or as natural part of the search process itself. In a few instances directed browsing was noted by participants and this was based on the use of links on Web sites.

Detailed analyses of these particular image user groups’ methods of image searching are lacking in previous studies. However several earlier studies report findings which are useful for comparison. These earlier studies report that the method used to search for images online was found to be associated with subject expertise or searching experience. Participants who possessed subject knowledge and/or searching experience were shown to prefer keyword searching over browsing methods (Cunningham & Masoodian, 2006; Matusiak, 2006; Pisciotta & Copeland, 2003; Frost et al., 2000; Frost & Noakes, 1998). Pisciotta and Copeland’s (2003) study of the Penn State University system offer a more nuanced discussion and suggests that teaching needs are met by keyword searches performed with a few highly specific terms. A wider variety of searches
were performed for images needed to support research, and students and independent learners performed the broadest searches for images in terms of both keywords used and methods of searching (Pisciotta & Copeland, 2003). These findings support those discovered with the academic user groups in the present study. When the academic users performed searches for images to be used in their teaching they tended to use one or two specific keywords to find a known item. When they searched for images for their research, which meant they tended to be searching for unknown items, they described using broader keywords first, followed by browsing of the retrieved images. The creative user groups’ image search methods are not addressed in Pisciotta and Copeland’s (2003) study. They differed from the academic image users in the present study as far as the extent to which they found their images through informal browsing.

The participants in the creative user groups were found to commonly perform informal browsing for images. The participants tended to prefer the use of print-based materials to support this activity. These unplanned forays could sometimes lead to serendipitous discoveries and the participants noted that images discovered through informal browsing could provide useful or even novel information to support their work. The heavy use of browsing to search for images is well documented among artists (Gregory, 2007; Visick et al., 2006; Frank, 1999; Cobbledick, 1996; Day & McDowell, 1985; Pacey, 1982). Support for this type of image seeking among the architects is alluded to in the study of design students’ by Sklar (1995) who notes they use vast amounts of material
quickly and in the spot where the images are found. Elliott (2002) also found the architects looked through magazines for images they could use in their projects.

Additional findings presented in this chapter were those related to the kinds of terms the participants recalled using to search for images. An analysis of the participants’ responses revealed nine categories of terms had been used to search for images. These categories are Title (of work or structure), People (named historical or mythological individuals or groups, generic individuals), Location (named geographic places, museums or collections), Theme (concept-based subjects such as science, death) / Thing (object-based subjects such as grass, lagoon), Chronological Period (Victorian, Renaissance), Style (Impressionism, Post-modernism), Media (sculpture, marble), View (showing a specific part of a structure, or an image taken from an exact location), and Specialized Terms (such as numbers applied by museums or scholars to identify specific objects).

Four categories were found to be the most heavily used and these are People, Title, Location and Theme / Thing. While these four categories of terms were found to be broadly useful, variation in the frequency of their use occurred based on the kind of search (known or unknown item) being performed. When a comparison between the present study’s findings and earlier investigations is made, it is clear that there is little consensus across the studies about the kinds of terms being used to search for images.
Table 5.12
Comparison of types of terms used to perform image queries

<table>
<thead>
<tr>
<th></th>
<th>Color</th>
<th>Date / Period</th>
<th>Dimensions</th>
<th>Location</th>
<th>Nationality</th>
<th>Objects</th>
<th>People</th>
<th>Spatial Location</th>
<th>Special Terms</th>
<th>Story</th>
<th>Style</th>
<th>Subject</th>
<th>Technique / Media</th>
<th>Title</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bradfield (1976)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Choi and Rasmussen (2003)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cunningham et al. (2004)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Jörgensen (2003)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Current Study</td>
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<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

X – identified as useful
X – most frequently used in present study

Table 5.12 illustrates the variation found among several studies which have investigated image users’ search terms. The only universally acknowledged type of term to be applied across all of the studies is the term representative of information pertaining to *People*. Another type of term that was identified as being useful by four of the five studies was *Date / Period*. This type of term was identified as being a useful search term by participants in the present study, but it was not one of the more frequently used types of search terms. This is in direct contrast to the findings of Choi and Rasmussen (2003 & 2002) where date was seen as the most important textual descriptor among their study’s

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25 The top five classes of image attributes used for searching are included in the list of term types in Table 5.12. These image attributes were taken from Jörgensen’s (2003) Table 5.4 on p. 207.
participants. The prominence of date in Choi and Rasmussen’s study may indicate the particular searching behaviors of the user group examined (faculty and graduate students of American history) and, or because the participants were asked by the researchers to assess the usefulness of information concerning date for their making relevance judgments about photographs. The remaining types of terms which were the most frequently mentioned by the participants, Location (in the geographic or holding institution sense), Subject (corresponding to the term type Theme / Thing) and Title, were not uniformly mentioned by the other researchers. Part of the variation in the types of terms identified by the researchers may be due to the different searching behaviors and needs of the specific user groups under investigation. Whatever the reason for the term variation the findings of these studies point to the fact that no consensus exists among researchers about what constitutes the minimal types of data needed to provide access to images. This fact alone clarifies that image users’ retrieval methods have yet to be adequately explored.

The study also examined the participants’ interest in using content-based image retrieval systems as this has been noted as being an under-researched area (Datta et al., 2008; Enser, 2008; Graham, 2004; Kherfi et al., 2004). The present study found that individuals who showed interest in these systems are primarily those, like the two creative user groups in this study, concerned with the formal characteristics of an image (i.e., color, shape, line, composition and texture). Half of the artist-participants and the majority of the participants in the Architect user group were interested in using a system that would allow them to
search for images by their physical features. The current study’s findings that there is some interest in these systems among creative users is supported by the work of Matkovic et al. (2004b) and Ward et al. (2002).

In the present study the architects clearly had an interest in retrieving images using CBIR techniques. This is probably the result of their spending a great deal of their time searching for materials to fit a particular project. Studies have been conducted that examine the effectiveness of CBIR methods for retrieving images of construction and finish materials, however no user interaction or input was discussed in these investigations (Brilakis et al., 2006; Aisbett & Gibbon, 1997). Because of the architects’ willingness to adopt this mode of image retrieval they would be an ideal group to study in order to increase the usefulness of CBIR technologies for real world applications.

None of the participants in the two academic user groups (Archaeologist and Art Historian) expressed interest in using these systems. These participants were found to be most comfortable searching via text and more concerned about illustrating themes and, or looking at items from a specific location. They could see no application for these systems in their current work practices. This finding is opposite that reported in an early study of art historians at the University of California at Davis (Holt & Hartwick, 1994). It is unclear why the art historians had different reactions toward CBIR technologies. It may be the result of the direct interaction with a CBIR system provided to the users during the study by Holt and Hartwick (1994), or perhaps because of the novelty of the CBIR approach at that early date. Whatever the cause of the dissimilar findings, it is
clear that the usefulness of CBIR systems among the academic community has not been adequately explored.

This study’s findings point to receptive user communities among creative individuals and non-adopters of content-based image retrieval methods among the academic user groups. Direct examinations of these user groups’ interactions with CBIR systems would be extremely useful. Additional user-centered research is sorely needed to clarify when these systems are most useful to image users and what advantages CBIR methods can provide over concept-based image retrieval. Findings based on actual image users with real world retrieval tasks would be valuable for discovering the further refinements needed to create systems which are useful and usable among these user groups.

The study turned toward the findings related to image selection after an investigation of the systems used by the participants. Four main factors were found to influence image selection among a majority of participants across all of the study’s four user groups. These factors were those surrounding quality, topicality, physical features such as shot angle and scale, and aesthetic characteristics. Two additional selection factors which were used infrequently were discussed. The first of these lesser used factors, seen in the selection processes across the Archaeologist, Art Historian and Artist user groups, related to historical imagery (e.g., viewed across time or states). The last selection factor which was used only by a few of the architect participants concerned the credibility of the image.
The findings of the present study are supported by the investigations of relevance criteria among image seekers of reported by Choi and Rasmussen (2002) and Markkula et al. (2000). Choi and Rasmussen (2003) found that topicality figured most prominently in the judgments of their participants with additional criteria relating to accuracy (accurate representation of item needed), completeness (shows needed details), time frame (appropriate time period of image), and accessibility (can gain access and download image) figuring prominently in their selection processes. Markkula et al. (2000) noted several selection criteria important to image users within an archive of newspaper photographs. The selection criteria they reported consist of topicality, quality, currency (date of image), source of image, costs associated with the use of an image, aesthetic aspects of the image and particular visual attributes found in the image.

The most common search strategy for known images across the study was online keyword queries. These could range from simple searches of a single term to combinations of various term types such as words from the title and the artist’s name. Browsing Web site content for links to additional material was a further method utilized, albeit less frequently, by several participants in the study. However, it should be noted that even these searches were begun with keyword searches of a search engine. The artist-participants, who were found to rely more heavily than the other groups on print-based resources, noted they generally retrieved images by leafing through the pages of a book. Also of interest is the finding that the artist-participants perform broad searches for works
representative of an artist’s oeuvre or a particular media (e.g., drawing, printmaking, etc.) rather than focused known item queries. The artists differed from the other image user groups in the study because of their freer approach to performing image queries.

Analysis of the participants’ unknown item queries revealed several interesting findings. Basic search terms were preferred for these searches. However the participants were found to modify their search behaviors based on prior experience with particular resources. While participants discussed search strategies similar to those of know item queries (i.e., performing simple online keyword searches), the development of their queries through various iterations were more commonly discussed and more complex. Several difficulties with performing unknown item searches were acknowledged by the participants. A lack of expertise about the image being sought and its domain were recognized barriers. An additional barrier was found in the need to translate a visual need for an unknown item into search terms that would produce useful retrievals. This was noted as being especially problematic in an unfamiliar domain. Participants would attempt to increase their knowledge about unknown items through the search process. This was accomplished through parallel searches for text that could be mined for useful information and terms, through resources known to the participant, and by asking other individuals for assistance in finding the desired item. The development of their queries through the performance of searches witnessed in the present study supports the similar finding reported by Choi and Rasmussen (2002). Another interesting discovery concerning unknown items
was that participants in each of the user groups described conducting ongoing searches for images in order to keep up with current scholarly or creative production. This situation is discussed in the next chapter, Image Use.
CHAPTER 6: FINDINGS RELATED TO IMAGE USE

Introduction

This chapter presents the findings surrounding how the study’s participants used images in their work. The single over-arching research question driving the investigation here asked - How are images used to support users’ work tasks? Examining the roles images fulfilled for their users and how images were incorporated into their work underpinned the broader research question. In other words, the research sought to clarify what users did with the images they discovered and why images were used by the participants.

As was stated at the start of the chapter presenting the findings on image need, need and use are closely related. For example, if an individual needs images for teaching (i.e., for a lecture presentation), the use of those images will never stray from that original pedagogical purpose. In order to make the two aspects distinct from one another the findings associated with image use have been limited to what participants did with images after they had been retrieved. Nicholas (2000) defines information use similarly and states that it occurs “… at the more visible end of the information-seeking process—the information the individual actually uses or consumes,” (p27). The first section of this chapter, Work Tasks and Work Products, examines what the participants did with the images they retrieved. The following section, Functional Role of Images, examines why the participants used images in their work.

26 Images once retrieved could be used to meet additional needs, however. This is stated here to clarify that for each use scenario a specific need underlies it.
Work Tasks and Work Products

The various work tasks performed with images by the various user groups in the study were given in the chapter on image need, but they are reviewed here briefly in order to provide a foundation for the more detailed discussion which follows on how and why images were incorporated into the participants’ work. In the analyses associated with image needs it was discovered that the user groups sought out images for particular kinds of work tasks associated with their professions. The work tasks most closely aligned with the Archaeologist and the Art Historian user groups were found to be teaching, research and publication. For these groups images were broadly needed to illustrate their lectures and their scholarly publications. Images were also needed by the academic users to perform research, the results of which would feed back into their teaching and publishing. The Architect and Artist user groups shared a need for images to help them develop their creative works. Both of these groups needed images to assist them in the creation process, for problem-solving and also for inspiration. The Architects were also found to need images to support a number of additional work tasks and these were associated with presenting and marketing their architectural projects and opening up lines of communication about their designs.

As a way to investigate the various ways images were used in their work and the kinds of work products being produced, the participants were asked to provide responses to survey question 9 (Once you have found the images that interest you, what do you typically do with them?) and survey question 10 (How
do you incorporate images into your work?). The responses were examined and the findings of this analysis are presented below.

**Table 6.1 Processes and products of image use by user group**

<table>
<thead>
<tr>
<th>Process</th>
<th>Archaeologist</th>
<th>Architect</th>
<th>Art Historian</th>
<th>Artist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalog</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut and paste</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Download / save / collect</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Import into software</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspiration / theme</td>
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<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Manipulate</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Model for artwork</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>Print</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>Reference / research</td>
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<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Scan</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Archaeologist</th>
<th>Architect</th>
<th>Art Historian</th>
<th>Artist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architectural design / Artworks</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Boards (concept, presentation)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Contractor booklets</td>
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<td></td>
</tr>
<tr>
<td>Lecture / presentations</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>Marketing material</td>
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<tr>
<td>Renderings</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Research / Publications</td>
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<td></td>
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</tr>
</tbody>
</table>

**Archaeologists**

Images used to support teaching figured prominently in the archaeologists’ responses, with each participant focusing on digital image processes and lecture presentations. As can be seen in Table 6.1, the archaeologists answered they downloaded, saved or scanned images in response to question 9. Teaching was the predominant response to survey question 10 which aimed at discovering how the images were used in the participants’ work products. Through the participants’ responses (see Appendix E.4 for verbatim responses) it was discovered that in most cases lectures were presented through the use of
presentation software. Two participants (Archaeologists 1 and 4) employed PowerPoint and one (Archaeologist 2) used ARTstor’s Offline Image Viewer. One individual responded she would use image in “projections during lectures,” [Archaeologist 3, survey Q10]. This was clarified further during the interview when she revealed she did not use presentation software. Instead she named her image files with sequential numbers corresponding to her lecture notes, saved them within a folder and opened each image file singly as she progressed through her lecture. One participant (Archaeologist 4) in the Archaeologist user group noted that beyond using images in her teaching she would also use them in her research and publications.

Architects

The architect-participants provided more varied responses to questions 9 and 10 than the previous group. As can be seen in Table 6.1, their responses to survey question 9 went beyond downloading and saving images and instead included processes which would prepare digital images for their ultimate use. The responses here ranged from discussions of how images would be adjusted, collected, printed and, or imported into software. The responses to survey question 10 were varied and ranged from how the images would be used in work products (Architects 1, 3, 4 and 5), how they were used conceptually for the design (Architects 2, 3 and 4), how images were used to perform background research for a project (Architect 4), and how they would be employed in digital image processes (Architect 6). The majority of the participants, however, discussed work products in tandem with how they would incorporate images into
their work. These ranged from “concept boards, marketing materials, website” [Architect 1], to “renderings” [Architect 3], “presentations” [Architect 4], and booklets of printed images used by contractors in developing cost estimates for a project [Architect 5]. The variation in the architect-participants’ responses to question 10 is likely due to their more complex image needs.

**Art Historians**

The art historian-participants provided responses to survey questions 9 and 10 which were similar to those found within the Archaeologist user group. Like the archaeologists, the art historians focused on downloading, saving and copying processes associated with digital images in survey question 9. While all of the participants in this group mentioned they used images in presentations in their responses to survey questions 9 and 10, only two (Art Historians 1 and 3) identified these specifically for classroom use. Like the responses seen in Archaeologist user group which discussed presentation software for question 9, the majority of the art-historian participants (3 of 4) identified PowerPoint as the software they used in their presentations. One participant (Art Historian 2) indicated she would project images as a part of a slideshow. Her response was clarified during the interview and it was discovered she was using the freeware MDID (Madison Digital Image Database) to project images during her lectures.

Several participants discussed other ways images would be used in their work. One participant (Art Historian 3) stated she used PowerPoint to organize her images when she performs research. She noted she used images in books when she was writing her research presentations and papers, as well. As was
the case with the other academic user group (Archaeologist), images were mentioned by a single participant (Art Historian 2) in the context of publication. A variation among the responses of the two academic user groups (Archaeologist and Art Historian) was seen in the reduced focus on teaching by the art historians. The reason for this variation is unclear.

**Artists**

The participants in the Artist user group provided varied responses to survey question 9 and yet similar responses to one another for survey question 10. The majority (4 of the 6) of the artist-participants (Artists 2, 3, 4 and 6) discussed using images to create their own imagery in response to question 9. Responses from half of the participants focused on the processes associated with using digital images. For example, Artist 1 discussed saving images to his hard drive for later use and artists 4 and 6 said they would manipulate digital photographs. Three participants (Artists 2, 5 and 6) discussed how images were used as reference information. Supporting the important reference role of images is the response of one participant who stated he would “draw it to hopefully add it to my mental reference bank,” [Artist 2, survey Q9]. The varied responses received from the artist-participants for question 9 centered on the way images were used in their personal creations, digital image processes and as references.

In their responses to question 10 all of the artist-participants discussed how they would use images in the creation of their own works. There was a strong element of image as reference to be found in their responses. Some
noted how they would use images “as models for artworks” [Artist 1] while others stated the parts of the images would be “distorted or somehow changed” [Artist 6] and used in their work. Why the artists’ responses are more varied than those of the other participants in the case of survey question 9 is unknown. It is possible however that the divergent responses reflect the varied image formats they used in their work.27

The Functional Role of Images

The following section discusses the findings relating to the participants’ responses to interview questions 17 (Can you walk me through how you typically use images?) and 18 (Does your use of images for your own research differ from the ways you might use them in the classroom/in the studio?). When participants were asked to discuss their image use they would provide responses concerning their work tasks and, or work products. After they had discussed their image use in this concrete way additional questions were asked concerning why they used images for the particular tasks they had just described. For example, if a participant stated images were used for teaching, additional questions would be asked to investigate the reason behind their use in teaching. Questions of this nature were clearly more difficult for the participants to respond to. Some participants provided clearly articulated explanations behind their image use,

“Not easily. What we need to do is bring our laptops into the classroom. I will have downloaded the OIV [ARTstor’s Offline Image Viewer], but I am not very comfortable with it.”

[Archaeologist 2, 395-397]

27 The artists were found to be the most dependent on analog materials. See the previous chapter on Image Retrieval for a discussion of the resources used by artists and how these were found to differ from those of the other participant groups.
whereas others continued to discuss their work tasks and products.

"With the classroom I am projecting them using MDID. I am putting them into a slide show in a sequence. That often includes images that I have downloaded myself and added to the database…"

[Art Historian 2, 552-554]

The central role of the image in the work of these participants seemed to obscure their ability to discuss the basic reasons behind why they used images in their work.

**Table 6.2 Functional role of images by user group**

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<th>Heavy</th>
<th>Moderate</th>
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<tbody>
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<td>Creative idea</td>
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<td>Communication</td>
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<td>Inspiration</td>
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<td>Cognitive recall</td>
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<td>Critical thinking</td>
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<td>Proof</td>
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<td>Translation</td>
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<td>Trust</td>
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| Archæologist | 4    | -       | -       |
| Architect    | 4    | 6       | 5       |
| Art Historian| 4    | -       | 1       |
| Artist       | 3    | 6       | 4       |
| Total        | 15   | 12      | 7       |

The analysis of the responses of the participants to these questions revealed a wide variety of reasons behind why images were used in their work. As Table 6.2 shows there were two reasons identified by a majority of the participants (11 or more participants of 20), three were given by a moderate number of participants (5 to 9 participants of 20), and a number of reasons were identified by a limited number of participants (4 or fewer participants of 20). The most often recounted reason among the participants (15 of 20) was developing
knowledge and this was followed by developing a creative idea (12 of 20).

Reasons recounted by a moderate number of participants were that images were used for communication (7 of 20), for inspiration (7 of 20), and for increasing cognitive recall (5 of the 20). Several additional reasons given by a limited number of participants included using images for developing critical thinking (4 of 20), as proof (2 of 20), to help translate verbal information (2 of 20), for engaging students (2 of 20), to connect with people (2 of 20), to create emotion (2 of 20), for marketing purposes (2 of 20) and to develop trust (1 of 20).

The use of images for developing knowledge was a reason identified by many participants in all of the study’s user groups. However, other patterns were found in the participants’ responses with several showing parallels among the majority of participants in a single user group or by a pair of user groups. As can be seen in Table 6.2 two functional uses for images (Inspiration and Creative Idea Development) were discussed by a number of the participants in the Architect and Artist user groups. The majority of the participants (5 of the 6) in the Architect user group also discussed communication in their use of images, while only single participants in the other groups recognized this use. These were the major patterns to be found in the data concerning image use by the study’s participants. Presented below are the participants’ discussions of why the images were used by them in the performance of their work. Their discussions of the different reasons underlying the use of images are presented from most to least frequent.
Knowledge

The most often discussed reason (15 of 20) for using images was to develop knowledge. This reason was discussed across all four user groups. An increase in knowledge could be achieved through the examination of an image by the participant, or the image could be used by them to increase understanding among other individuals (e.g., students, clients, co-workers, etc.).

“… all those [gathered] images inform you. Then those images can be used and manipulated to make a presentation. And then that presentation is shown to the client. … It [the presentation] is for our benefit, so that we can do it. But then it informs the client to what our process was and kind of brings them onboard.”
[Architect 4, 997-1006]

The important role of information transferred through images was clearly understood and appreciated by the majority of the architects (4 of 6). Knowledge held by the clients was considered critical in the design process and images played an important role in drawing this out as the following passage indicates. In this case the clients had been shown a series of renderings illustrating the design being developed for a new medical laboratory facility.

“They [the clients] will say … For instance in this last proposal that we did there was a coal plant right near it. ‘Oh, there is a window,’ … I mean a huge glass wall right in the corner. ‘We don’t want it.’ It is that sort of thing with the client and you need to respond to that as well, and so it isn’t just the design partners saying ‘No.’ You get multiple input into the image and how to change it.”
[Architect 6, 671-675]

As this example suggests, critical knowledge was exchanged among the individuals involved in this project through the use of images.
A broad range of topics were discussed by the participants in tandem with the use of images to increase knowledge. These ranged from investigations into historical events, geographic locations, cultural contexts, styles, people, themes and design choices to various artistic and architectural techniques and processes. Although all of the academic user group participants acknowledged the important role of images in their pedagogy, they were the most taciturn in their responses surrounding how they employed images to increase knowledge. The few passages that delve a bit deeper into this issue tended to focus on developing an awareness of historical or thematic issues through the use of images.

“...I am trying to develop their visual and verbal-textual vocabulary of the particular time period or works that we are looking at.”
[Art Historian 1, 355-357]

The Architect user group was more forthcoming in their discussions surrounding the use of images to support knowledge construction. Like the academic user groups, the architect-participants also indicated a strong historical interest in the context of developing knowledge.

“You discover these little details and these little compositions of elements and use of materials that just gives you a window into how they were seeing the world a hundred years ago or seven years ago, and it’s fascinating.”
[Architect 1, 1442-1445]

Here the participant discussed how he had absorbed, during an exploration of an in-process project location, various architectural details. All of this gathered information was then fed back into the development of the project. This was
done since, beyond meeting the functional needs of a structure, the architects noted they needed to explore the structure’s context (historical, social and architectural). In their architectural explorations the architects discussed examining aspects such as the styles of the surrounding structures, the heights of the surrounding facades, the commonly employed materials, the location of public transportation facilities, etc. A number of aspects needed to be considered during the development phase and visiting the site and taking photographs for later reference were considered part of the foundation research done for a project.

A subset within the knowledge category was the use of images by participants for problem-solving aims. The way forms were arranged and technical processes were commonly investigated topics. The artist-participants discussed the problem-solving use of images most frequently. While they indicated they would view the works of other artists in their quest, they would accept information in any form in their pursuit to find an answer.

“It’s all about information. It’s very utilitarian. It’s tool-like for the most part. I mean, I look at paintings just because I like to look at them. They are just nice. But, when I’m in search mode to solve problems, they are all the same. You know, a newspaper ad, an ad in a magazine, a picture from art history, a picture in post-impression. It’s all the same. I’ve got a question. I’m looking to answer it.”

[Artist 2, 1485-1490]

The artists commonly discussed using images to examine the appearances of things. This desire to investigate something visually could apply to any subject -- flowers, a mother holding a baby, a rib cage, a landscape, a Japanese print, etc.
What was similar, however, was the use of images to better comprehend some visual characteristic.

As the above passages indicate, knowledge development through the use of images was used by the academics for intellectual aims whereas the creative participants spoke about using images in order to increase their understanding of the visual realm. Participants noted they might gather images that might be useful at a later date, or they could seek out imagery to assist them with projects currently in-process. The development of ideas surrounding works in-progress was a specific use of images discussed by the creative participants and this will be presented next.

**Creative Idea**

Only the two creative user groups mentioned this reason behind their image use. All of the participants in the Architect (6 of the 6) and Artist (6 of the 6) user groups discussed the important role images played in the development of their creative ideas. Images could serve as the conceptual backbone of their creations or assume a more supportive role, as this artist thoughtfully stated.

> “Mostly the images that I have are works in progress to serve as either that idea itself or as a compliment [to] whatever concept I am developing.”
> [Artist 1, 398-401]

In the case of the architect-participants the development process consisted of finding a concept, reflecting upon this to solidify the idea, establishing the design and then realizing the project through increasingly specific imagery. As a means of working through this process from concept to realization images were used and created.
“I have to work through it internally before I can come up with something that makes sense to take to the client. So it is a matter of taking ideas and working though it all in my head and then making sense of it and then being able to come up with something cohesive and then present the image to the client…”

[Architect 2, 787-791]

The development of an idea was discussed by the participants in these groups as being a cyclical process requiring several rounds of image viewing and modification.

“It will start out with one of the partners doing a sketch… a hand-drawing… really quick. ‘Build this.’ And we translate that into a 3-D model and then print it out and show it to him. ‘Is this it?’ ‘No, no, no, no,’ and then he will sketch back over the image we have just printed out. It is very much a back and forth, iterative process.”

[Architect 6, 599-602]

As these passages indicate images were critical for this development process among the creative user groups (Architect and Artist).

**Communication**

The power of images to communicate information was recognized by a moderate number of participants (7 of the 20) in the study across three of the four user groups. However, nearly every participant in Architect user group (5 of 6) identified communication alongside their image use. Communication through the use of images played an important role for the architects and it could range from clarifying complex information about design concepts to notifying a community about a project they were working on, as is the case below.

“It is very good to inform the public. So the client can then, in a press release, use an image that we have given them to go to the newspaper or the local cable
TV [station] so people can see what the new school is going to look like.”
[Architect 4, 1034-1036]

Images could also be used by the artist-participants for communication purposes. It is widely recognized that all works of art communicate some message, even if it is only the highly personal view of an individual. Interestingly only one artist recognized that he communicated through the use of images. In this case the artist was working abroad with language skills that did not include words to discuss highly technical processes needed to manufacture his artistic works.

“... images serve as a communication device because very often I can't explain what I am trying to get at in words…”
[Artist 1, 385-386]

He used images of processes to indicate what he wanted completed. Through the use of those images the artisans identified immediately what it was the artist wanted accomplished. One art historian, too, recognized the role of images in the communication process. However, she used images as a means of stimulating conversation among students within the classroom setting.

**Inspiration**

Only the two creative user groups mentioned this use of images in their work. Half of the architect- (3 of 6) and the majority of the artist-participants (4 of 6) discussed their use of images for the inspiration they provided. The participants generally discussed this form of image use in the context of beginning the creative process.
“I usually have a little spark of inspiration or a color combination that I have to make, for some reason. Or shape, that I have to put on something. And then I would look at it and look at other things like it and then I would draw on my own.”
[Artist 5, 629-634]

In their discussions surrounding the use of images for inspiration there is a sense that the image(s) motivated the participant to decide on a particular creative path.

**Cognitive Recall**

Images were used by a quarter of the participants (5 of the 20) from across three user groups to aid in the retention and recall of information. Half of the archaeologists (2 of 4) and one art historian (1 of 4) discussed that images were used since they were believed to solidify abstract information in the minds of their students. Information became much more memorable when presented alongside strong imagery. As one faculty member stated, many of her students did not have an intellectual grounding in basic facts about the ancient world. As a result of this situation she used images as a way to create cognitive hooks for the students to hang the unfamiliar information on.

“I show Philip of Macedon. There is his tomb and all this gold stuff. Then I have friends who have done a reconstruction of his head from the bones that were found in his tomb. He had one eye at this point from the siege of Byzantium. All of a sudden this color image of this guy looking at them... and they all remember that.”
[Archaeologist 3, 113-118]

Problems with recalling information were not limited to students, however. Two of the artist-participants also noted they used images as an *aide-mémoire*.

Information about the appearance of things contained in the image was recorded
using photography or through hand-sketches and then used in their work at a later date.

“Once in a while, if it is my own photograph, I will use it pretty much exactly as it is. In that case it is because of the memory problem.”
[Artist 6, 497-498]

This use of images is the final functional role of images noted by at least one-quarter of the participants. The remaining uses for images were discussed by a limited number of individuals.

**Critical Thinking**

Four participants from across the two academic user groups (2 of 4 archaeologists and 2 of 4 art historians) discussed how images were used in their teaching to develop their students' critical thinking skills. This could happen as a normal part of the lecture process, as was the case in the following example.

“I show the image, and then I ask questions. 'What do you see? What do think?'”
[Art Historian 3, 1120-1121]

This was done as a way to increase the students' visual and intellectual interaction with an image which would then hopefully lead to a deeper examination and contemplation of the material. A more formal use of the images to develop their critical thinking was discussed alongside testing students' knowledge.

“[I will] have them explicate the picture. They will have to identify, give me the title, name, date and place but also why I am showing them that image.”
[Archaeologist 3, 594-596]
The testing process would consist of showing a series of images and the students were expected to closely scrutinize the images, provide identification information and give analyses of the materials. In this way the depth of learning achieved by each student could be assessed.

**Emotion**

Two participants from across two user groups, one architect (of 6) and one artist (of 6), mentioned that they would use images as a way to create emotion. Although neither discussed this aspect in an in-depth way, it was clear they chose specific images to “create a mood” [Architect 1, 1410]. Architect 1 discussed how images were used to express a spiritual quality in a parish center that had been designed by his firm. In the case of the artist, she discussed the way she used images for a personal rather than professional purpose. She recalled a case when she used images to create a humorous work. The work also served to connect people, and is discussed below.

“One year I was going to my class reunion, oh, let me rephrase that… I was not going to my class reunion. I have two cousins that I graduated at the same time with from the same school. None of us were going. This was the same year that the Charlie’s Angels movie came out and so I took the Charlie’s Angel image from my daughter’s CD and put our heads on all of those lovely bodies. And I really did a good job and sent an 8 by 10 to the reunion stating that we were on a job for Charlie and that we couldn’t make it. So that is how I might use it for humor. They said that they put it out where people registered. They knew us, they definitely knew us. Let me tell ya, we looked better than we ever did.”

[Artist 6, 518-527]
Engage Audience

Two participants from across the two academic user groups, one archaeologist (of 4) and one art historian (of 4), noted they would use images to keep their students engaged in the classroom. On the one hand images were used to keep the students alert and interested in the material being covered.

“It is really the engagement factor. … I am looking at my notes for the lecture and thinking, ew it has been a while since there has been an image. I will think they have been looking at this one for a while I should change it and wake them up.”

[Archaeologist 3, 108-110]

On the other hand the images were used as a way to have the students personally interact with the course content.

“I try to show the image and start with them. So, I want to get them engaged. I want to give them enough background information that they can make connections from the image to the history.”

[Art Historian 3, 1130-1131]

In both cases the images were used to focus the students’ attention on the concepts being covered in the course.

Marketing

Only participants from the Architect user group mentioned marketing alongside their image use. Two of them (of 6) noted images were used in this way. Since the architects’ future work was noted as being dependent on images of work they had already completed, it was not surprising to see a financial focus for the use of images expressed among the architect-participants.

“At the end of a project we have a professional photographer come in and take pictures of the
finished products. … They go up on the firm’s website. They tend to be for like marketing.”
[Architect 5, 564-570]

What was more surprising was that only two architects or the five who noted needing images (see Table 4.2) for marketing discussed using images in this way. Why this anomaly occurred in the data is unclear. It may be that the architects understood the need for the images that would be sent along to the individuals responsible for advertising their designs, but that their own work tasks did not revolve around using image to create marketing materials.

Proof

Only participants from the Archaeologist user group (2 of 4) mentioned using images to support their research arguments.

“I had an idea from this ancient text that I was reading and I thought ‘I bet ya I can carry this through.’ And then, my illustrations are basically illustrating the argument.”
[Archaeologist 4, 1148-1150]

When used in this way images were evidentiary in nature. This required the images have specific characteristics that set them apart from images used in for other purposes.

“… for my publication work I need mug shots. … For me to prove in my publication the date of the object or it came from this other city. I have to make a very bland case… a measurement kind of thing.”
[Archaeologist 3, 625-627]

These images were very different from those she used in her teaching, which she described as being far more visually appealing and “artsy.”
**Social Connection**

Two of the study's participants, one each from the Architect (of 6) and Artist (of 6) user groups, recognized an additional way images were being used. They used images to make connections to people. In the examples that were recalled images could be used as a way to bridge the gap between individuals with close personal or disparate relationships. They could include highly personal and humorous exchanges, as can be seen in the following case recounted by one of the artists.

“My daughter and I will send images back and forth to each other that are crazy composites of maybe pictures of us… [laugh]. All sorts of crazy stuff like that. They can be really funny.”
[Artist 6, 511-513]

A desire to connect to people on a personal level was expressed by one of the architects when asked about how he used images. He saw them as a way to relate to individuals within the community where his designs would be constructed.

“There is no other way that you could show that better… a couple guys sitting in front of the barbershop playing dominos. Having images like that… that is your community. We all understand images like that. When they talk about a picture is worth a thousand words… it is worth a million, if used right.”
[Architect 4, 1098-1101]

In both of these cases it was an interest in closing a gap that existed in the physical or psychological states of people that caused them to seek out and use images.
**Translation**

Only participants from the Architect user group (2 of 6) discussed how they used images to translate verbal information into a visual form. This typically had to do with conceptual ideas expressed by clients to the architect in the beginning stages of the design.

"Here is me taking the words you used and translating it into something that could be buildable."

[Architect 2, 792-793]

For example, the client might suggest the theme of an island paradise for a structure. The architect would need to interpret the verbal cues of the client and translate that into an image of what they believed met the desires of their clients. This could be done through gathering images and showing them to the client, or the architect might use these images alongside a design developed from this imagery. The images would then be used by the architect to assess how close the design had come to the clients’ idea.

**Trust**

One final use for images, developing a sense of trust, was discussed by a single architect (of 6). While this use is closely associated with a use of images for connecting to people, it was so specific that it warranted its own discussion. This architect recalled a use of images in a presentation made to community members. His firm designed schools within an urban setting and so there was a need to get support from the individuals living in the surrounding neighborhoods.

"Understanding what those images are. Oh, he understands my neighborhood. That little space between two buildings… you walk by and all of a sudden you see some lawn chairs kind of set up
there. Oh, there is a tradition in this neighborhood that is important. I want to take a picture of that. Those kind of images... they relate to people immediately. Oh, you understand my neighborhood. I trust you. You've done the research. You know us.”

[Architect 4, 1088-1094]

Through his use of images he wanted to convey that he cared about and understood the needs of that particular community. This passage also indicates how important background research is for architects. This relates back to the first functional use for images, knowledge development, discussed above. With this final use of images the discussion of the functional role of images has come full circle.

**Discussion of the Image Use Findings**

The findings presented in this chapter address the third research question – How are images used to support users’ work tasks? The first section of the chapter, Work Roles and Work Tasks, examined the data to answer the research sub-question – How are images incorporated into their work? Through the analysis it was discovered that the two academic user groups (Archaeologist and Art Historian) identified teaching as the work task most closely associated with their image use. Images were also identified as being used in the tasks associated with research and publishing, albeit by a single participant in each group. Lecture presentations were the predominant work product linked to their use of images, but the production of articles and books were also mentioned.

Unlike the academic users, the creative participants’ work tasks and products did not run parallel to one another. The Architects identified performing background research, designing and creation (consisting of conceptualizing,
developing and realization stages) as the work tasks related to their image use. To assist them in their design efforts they used images produced by them or their colleagues. Work products noted by the architect-participants as incorporating images were renderings, presentations, concept boards, contractor booklets and marketing materials. As an interesting aside, the architects never mentioned the actual, physical structure being designed.

Finally, the Artist user group discussed performing several work tasks in association to their image use. These consisted of performing background research (which were discussed as visual examinations and problem-solving) and the processes associated with creating artwork. The work products produced through the use of images by artists were preparatory studies and the artworks they created.

The work tasks and products being completed by these image users are not well covered in the literature. While studies of these particular groups sometimes indicate the tasks these users perform in their professional roles, the connection between image use and work tasks or work products is seldom encountered in the literature. This is unfortunate given the amount of time and effort these participants spend finding and preparing images to support their work. Since this study found that participants’ ultimate use of images had an impact upon the specific characteristics of the images they required, a fuller understanding of work task and work processes are needed.

The second section of the chapter, The Functional Role of Images, addressed the research sub-question – What roles do images fulfill for users? A
wide variety of uses for images were discovered among the participants in this study. Before moving on to the specific findings on image roles a discussion of how Fidel's broad model of images fits with what was discovered is warranted. Fidel's model is described as continuum from Data Pole (i.e., x-rays, maps) to Object Pole (i.e., art work) with the majority of the images being used falling somewhere in between the two extremes. In this study the participants tended to speak about images in a data-oriented fashion even when they were discussing items created for purely aesthetic reasons. While the participants spoke about and appreciated the aesthetic aspects of images, their main concern when looking at images was the information contained in them. For example, one architect (Architect 3) mentioned how she used images of balconies by other architects to work through an idea she had for rooftop terraces atop a series of urban flats being designed by her firm. The image as an aesthetic object did not interested her. She needed visual information of how others had solved this problem in a way that matched the image in her mind’s eye. Among the participants in this study there was a focused interest in inspecting the information contained in the images rather than aesthetic concerns.

The most pervasive role for why images were used in their work, mentioned by 15 (of 20) participants across all four groups, was that of developing knowledge. Participants and/or other individuals working with them were noted as being the beneficiaries of the knowledge received from the images. The use of images for knowledge development has seen a degree of support in the literature. It was the most often identified functional role in the
literature addressing image use and users. Eklund et al. (2006) found in the academic setting that the use of digital images in online coursework promoted understanding through reflection. Promey (1998) also acknowledged that the use of digital images within the context of the discipline of art history developed students’ understanding of the visual aspects of works and the processes used in their creation.

A number of studies of creative users also identified knowledge development through the use of images. Sklar’s (1995) study of architecture students found that they used a variety of images to work through design problems and stimulate their thinking. Studies of artists have also found that they use images for knowledge construction. These studies show two specific kinds of knowledge development carried out by the artists with the use of images: the investigation and development of artistic techniques (Frank, 1999; Layne, 1994; Toyne, 1977; Bradfield, 1976); and the monitoring of current happenings within the field. Artists maintained an awareness of what was being produced and exhibited through images and their accompanying text (Frank, 1999; Cobbledick, 1996; Nilsen, 1986; Pacey, 1982).

The creative user groups (Architect and Artist) shared several additional uses of images – the use of images to develop creative ideas (12 of 20) and the use for the inspiration (7 of 20) they could provide. Using images for developing a creative idea, in other words the conceptual basis for the work, was not discussed in the literature examining the architect or artist user communities. Sklar (1995) notes that architecture students use images to stimulate their
thinking but it is unclear from this whether the conceptual basis for the work or the impetus to create is meant. Numerous authors have noted the use of images for the inspiration they provide. Chidlow (1991) found that images were used at the start of architectural projects for inspiration. Artists were also found to be inspired through viewing images (Hemmig, 2009; Gregory, 2007; Frank, 1999; Cobbledick, 1996; Pacey, 1982; Toyne, 1977).

Using images for communication purposes was found in every group except the Archaeologists. While only a single participant from the Artist (1 of 6) and Art Historian (1 of 4) groups noted this image use, nearly all of the Architects (5 of 6) identified the important role images played in communicating ideas. The use of images for communication purposes was also found by Eklund et al. (2006) in their investigation of a digital image database developed to support online learning. According to these authors the use of images stimulated the exchange of ideas in the students’ online discussions. Use of images in this way appears to be poorly recognized since additional coverage of communication through the use of visual materials was not discovered in the literature.

Cognitive recall was also mentioned by participants in three of the four groups. The Archaeologist (2 of 4), Art Historian (1 of 4) and Artist (2 of 6) groups all mentioned using images to help them recall latent information. While this does not appear in the literature on image use, the domain of human cognition has seen several studies assessing the strength of visual memory (Kosslyn, 2007; Morris & Stephen, 1974; Standing, 1973; Paivio, Rogers & Smythe, 1968; Shepard, 1967). As Jørgensen (2003) states “… experiments
indicate that memory for pictorial material is very high," (p. 45). Morris and Stephen (1974) found that images help in recall because of their ability to provide order to disconnected material. The increased recall achieved by pairing images with concept and fact-based data would therefore be especially important for individuals without a scaffolding of background information on a topic.

The academic participants (Archaeologist – 2 of 4 and Art Historian – 2 of 4) were the only ones to mention the use of images to develop critical thinking skills. Promey (1998) noted that the use of images by art history students developed their ability to perform analyses of visual materials. Her article was the only one discovered that directly addressed the idea of developing powers of critical analysis through images. Functional roles of images that were mentioned by few participants (two or fewer) include: to create emotion, to engage students, for marketing, as proof, for social connections, for translation of a verbal/textual idea to a visual one and to create trust. The lack of literature addressing these particular functional roles of images suggests that these uses are secondary in importance to the wider body of image users.
CHAPTER 7: KEY EMERGENT THEME: FRUSTRATION

Introduction

Unlike earlier chapters where responses to specific questions were analyzed, this chapter presents findings from across the entire corpus of data. The transcribed interviews were examined for underlying themes which would help explain the image behaviors of the participants. One major theme emerged and that was frustration. Participants discussed frustrating experiences working with images at length during the interviews. The frustration the participants experienced was found to be connected to a series of barriers. These consisted of barriers to access, barriers to availability, difficulties due to the amount of time and effort needed, financial issues and technological obstacles. The barriers the participants encountered exerted a significant influence on their image behaviors and caused them varying degrees of stress and aggravation. Presented below are the various barriers experienced by the participants and the coping mechanisms they used in an attempt to lessen the negative impact these obstacles had on their work.

Barriers

Several kinds of impediments to the participants' work with images were found. These ranged from difficulties in retrieving images, impediments due to the amount of time and effort required, financial constraints, and problems encountered due to technology. Each of these was connected to the feelings of frustration experienced by the participants.
Barriers to Access

Barriers to access were those impediments the participants faced in gaining access to resources. The participants identified access to a broad and deep collection of well-described and high-quality images as the ideal situation for their professional image needs. Unfortunately this situation does not currently exist for these user groups. Several barriers to access were found among all four of the user groups, although as a group the artists expressed fewer frustrations in connection to access.

All of the academic participants in both groups were united in their feelings of frustration surrounding a lack of access to the image resources they needed for their teaching, research and publication. In their discussions about access the faculty noted a lack of support for image resources.

“I've never had access to all the resources, visual resources that I need. And so I've always had to beg.”
[Art Historian 4, 946-948]

This feeling was expressed by the academic users regardless of their institutional affiliation. As the passage above indicates, faculty at small liberal arts colleges struggled to gain access to appropriate resources for their work-related needs. This situation was also found among those individuals teaching in large research universities. In her discussion of image resources, one art historian-participant lamented about the lack of breath of coverage in the institutionally supported digital image database (MDID) used for teaching. When she compared the content of the database to that of the previously used analog
slide collection it was clear she felt she had lost a wealth of imagery in the transition from analog to digital images.

“We had more than a quarter of a million slides, and while many were duplicates this is a much reduced number. When I look up an artist like Rembrandt or Rubens I am amazed at how few images there are. There might be fifty.”
[Art Historian 2, 568-571]

All of the participants in the academic user groups had access to ARTstor. Out of these eight participants only three noted they were using this resource regularly (2 archaeologist and 1 art historian-participant). The five participants noted they did not use ARTstor for a variety of reasons. These included a lack of coverage.

“The stuff that I am after, they have the basics that would be in Janson [a standard art history survey text]. They have a lot for Renaissance and Modern. For ancient art they will have the best known items from general works but usually not anything stranger. I am almost always going for something out of the way.”
[Archaeologist 3, 196-199]

Another reason was the degree of difficulty they experienced using it.

“Because when we got ARTStor it was really hard to use.”
[Art Historian 3, 578-579]

A lack of knowledge about its online availability was another reason given for its lack of use.

“Well, I know they are doing demonstrations now ... And I dismissed it because I was thinking oh, well, you’re going to have to go to the image lab in the Art History Department to use it, and I’m never going go there. I can’t go there. And I don’t know if it’s even
available on the Internet.”
[Art Historian 3, 617-621]

The majority of the architect-participants (5 of 6) also expressed frustration in gaining access to images and noted a lack of suitable in-house resources useful to their needs. In the case of the architect-participant who worked on a contractual basis she saw her lack of access to image resources, especially current ones, as a disadvantage she would not face if she worked within a firm.

“I don’t have the resources of a large firm with a product library and all that stuff so I rely more on what I can find on the net.”
[Architect 2, 823-825]

Although she believed finding images was less challenging for her colleagues working within a firm, those architect-participants also felt hindered by a lack of image resources. While the architects working within a firm may have had an adequate collection of manufacturers’ catalogs at their disposal for things like finish selections and appliances, they noted the firm lacked resources such as reference materials relating to historical styles and current publications addressing architectural design.

“You know, there’s a wall of books in the library…but it’s so old. I haven’t even touched it.”
[Architect 1, 1397-1398]

Some artists discussed having access to various image resources but not finding them sufficient to the work they performed. As the following indicates this could sometimes be a reflection of the content held within the resource rather than a lack of access.

“I haven’t used Getty Images, because I usually like to stay with something that is more general that doesn’t
get too specific into arts and such. So, Google is usually good as is Flickr for that reason because they aren’t at all subject specific.”
[Architect 6, 158-161]

Other issues relating to access were mentioned by the participants. One of these relates to the dispersed nature of the Internet and how this impacted users’ ability to discover useful resources. One difficulty users experienced was a clear place to access materials they might be interested in.

“I think that what happens is that there isn’t really a clear place to search. I know that that’s strange, right? You go on the Internet, but the Internet… My god! What is that?! You know?”
[Architect 3, 1857-1859]

Since the Internet lacked a degree of coherent organization participants expressed a degree of frustration in association with trying to find items that would previously be co-located within a single resource. Another participant discussed not being able to find online resources she knew existed. In the case of this archaeologist she had seen an online resource mentioned several times in messages posted to a Flickr group for ancient materials but she had not been successful in her attempts to find it online.

“They’re massing it somewhere, but I can’t figure out how to get access to it. … I know that they keep track of stuff on Flickr, but I don’t know … because I’ve never been able to pull it up.”
[Archaeologist 4, 1204-1209]

As the above accounts indicate, many of the participants in this study struggled with a lack of accessible resources. The energy they had to expend in trying to find images added to their feelings of frustration, as will be seen below.
Barriers to Availability

Moving on from the topic of access to resources onto that of the availability of images, the participants described having varying degrees of success in finding the images they needed to perform their work. When they found useful images quickly and easily in the format they preferred they were highly satisfied. They experienced frustration when they were unable to find the images they needed in a usable form. Discussions about not being able to find images because they were unavailable were found among all of the user groups, but they were more commonly encountered among the Archaeologist, Architect and Art Historian groups. For the academic participants (Archaeologist and Art historian user groups) these situations were by and large limited to trying to find images available online of rare and under-researched items. Nevertheless sometimes participants experienced difficulties in trying to track down what they believed were canonical images.

“I certainly had this running theme of 'I can’t believe I can’t find this image.’ I would say what is most frustrating is when I am trying to get some image for class and I am teaching history and I feel like for those classes I am looking for major monuments.” [Archaeologist 2, 284-287]

The lack of images available online was believed to be domain dependent in the minds of the archaeologist-participants. Three of the four archaeologists mentioned the lack of interest in their domain as having a negative impact upon the availability of images. In this case the participant discussed how she was at a disadvantage when compared to her colleague teaching 19th century French art history.
“There aren’t a great deal of ancient images on the web. It tends to be, again, modern and contemporary. I know that Professor Stewart says to me ‘I know you can get just about anything off the web,’ but I can’t.”
[Archaeologist 4, 213-216]

In the case of the Architect user group the participants mentioned frustration in association with being unable to find specific detailed images or images of a quality high enough to be useful. However, finding images to adequately illustrate a design idea were also mentioned when recalling challenging retrievals.

“There are a lot of times where it gets frustrating. I have this idea, you know, for a type of something or a material and I just can’t find what I am looking for.”
[Architect 2, 267-269]

The artist-participants were the least likely to encounter difficulties tracking down images. This is apt to be the result of their infrequent requests for specific works. On those occasions when they sought out particular images they too were frustrated by the difficulties they experienced. In this case the artist was looking for an image from a scene in the move The Nightmare on Elm Street. She was unsuccessful in her attempts to find a usable image in both online and print resources.

“I couldn’t find the doomed school bus anywhere.”
[Artist 3, 1106]

The image she was able to find was unusable due to its small size and so in fact the image with the specific qualities she sought did not exist.

Several reasons behind the lack of available images caused frustration for the image users in the study. These reasons generally fell into the following
categories: rarity, detail and quality. Each of these situations presented problems for the participants’ ability to find useful images and so they are discussed here.

**Rarity**

The ability for participants to find images was often tied to the uncommon or unpopular nature of the things they sought. If the images being sought were of rare, under-researched, less popular, peripheral or unknown items it was believed this would influence their ability to find images. For example, one of the artist-participants tried to track down images of a particular kind of iris and encountered difficulties. When asked about why she felt she had faced this challenge the artist indicated that this particular flower was a rare variety and so fewer images of it would exist.

“Think it was mainly that there weren’t very many out there and so then you had to hit the exact thing.”
[Artist 6, 315-316]

Another reason given for a limited availability of images was the lack of popularity for a particular topic.

“The funny thing is that in the past my courses are so specific, like the Etruscans, yes, there are some images but you know Google images files, but not always a lot. For a more popular subject such as Cleopatra or Greek history, there is a wealth of material.”
[Archaeologist 3, 163-167]

This idea, a lack of images due to their less commonly explored themes, surrounded all but the most well-known topics. This was particularly evident in
the discussions of the academic participants (Archaeologist and Art Historian user groups).

“And more true of things that are less well-studied. It’s easier to find almost anything from the Italian Renaissance. So, it’s easy to find almost anything Italian that’s 15th or 16th century, but Medieval things are a whole lot more difficult to find and Byzantine things, I think, are even more difficult to find.”

[Art Historian 4, 1222-1223]

Obscurity of a particular artist was also found to present some difficulties to finding images. One of the art historian-participants, interested in contemporary female artists, discussed how finding images of their work was challenging because these artists had not received the critical attention required to make their work more visible.

“I would say that the artists that I’m working on are not as well-represented in general as other artists.”

[Art Historian 3, 712-713]

The underlying reason here for the lack of available images was that there were fewer of them to be found. This limitation was not always the reason why the participants were unable to find the images they sought, as will be discovered in the next section.

**Detail**

In addition to rarity the participants discussed not being able to find images because of the specific nature of the images they sought. These needed images could range from those which were highly detailed, illustrations of particular views and, or a series of images of the same item. Images which showed a specific section of a work or detailed images which allowed for in-depth
analysis were found to pose greater difficulties in retrieval for the participants.

“I need something with so much detail. I need the left west wall of the inside of the funerary temple of … That is where I would look in a book.”
[Archaeologist 3, 372-374]

Print-based publications were consulted when these types of images were needed since the participants felt these resources would provide images with a higher level of detail than those they were able to find online.

“More often than not you are going to find different images than you find on the web and you are going [to] also find detailed drawings which is a huge help. You would never find that on the Internet.”
[Architect 6, 331-333]

The specific details visible in these images were considered critical to the participants’ understanding. It is clear in the passage above that this participant believed the Internet would provided only a limited portion of the visual information she would find useful to her work. A related issue to finding detailed images was the shot characteristics of the recorded item. Participants discussed needing images of an item taken from a particular angle or needing a view of the whole or part.

“I might be looking for something extremely specific and I can’t find it. It isn’t that I can’t find an image of it, but that I can’t find the proper image of it … the right angle, or the entire piece of the image I am looking for.”
[Architect 6, 619-621]

Participants also desired multiple images of, or related to the same work and these images too were noted as being a difficult to find. A single work seen
across its history or through its various states were the most frequently expressed need associated to multiple images of a single item.

“You want an example before the war, an example after the war, before the restoration or after the restoration.”
[Art Historian 4, 1173-1174]

Even images of commonly encountered items could be difficult for the participants to find since they required that the image contain specific characteristics such as the type of light, the colors or the scale of things shown in the image. These aesthetic characteristics were more commonly discussed by the individuals in the creative participants (Architect and Artist user groups).

“The scale of the clouds or … you can change colors, but a lot of it is scale. A lot of it is light quality; some of it was, you know, like sun rays coming up and when you put it behind it was a bit too much.”
[Architect 1, 604-606]

Aesthetic aspects could also be considered a function of quality when the characteristics of the retrieved image interfered with a participant’s ability to use it for their required purpose and so this is the topic we turn to next.

**Quality**

The participants were often frustrated by the low quality of the images they were able to find online. Quality issues relating to the text-based descriptions and the visual characteristics of images were found to be problematic to the participants’ ability to find and use images. In the participants’ discussions of inferior quality there was a focus on their personal efforts in attempting to remedy the inadequacies in the images they found. In the quality issues relating to the description of the images, the participants commented on the need to increase
and correct the text-based information, as well as trying to find a way to bridge
the semantic gap between their own knowledge and that of the image providers.
Faulty aspects of the physical characteristics of the images were found with the
most often discussed issues relating to the size, resolution, color / hue and shot
composition.

Inaccurate text-based information associated with images discovered on
the Web was discussed by the majority of the academic participants
(Archaeologist - 3 of 4 and Art Historian - 3 of 4) and this was noted as creating
additional work for them since they would need to check the images against
print-based sources for identification purposes.

“They haven’t got a clue, which means that I have to
go back and forth between my publications and make
sure I know what I’m doing, because one cubiculum
can look like another. So, yeah, that’s an issue.”
[Archaeologist 1, 254-256]

Other participants discussed how they tried to cope with the poorly
described images by finding Web sites dealing with the desired material and
seeing if there were images associated to the text.

“Interestingly I typically go to Google first and perform
a plain old search. Not Google Images. Because a
lot of time people don’t label their pictures very
accurately, so I go to some written things first and see
if I can find a bunch of images from a source and then
I can download them.”
[Archaeologist 4, 221-225]

Inaccuracies in the descriptive text associated with images were not
limited to those images found on the open Web. The participants also discussed
problems with the information in institutionally developed and commercially
available image databases. There was a sense of frustration that their expertise and scholarship were not being employed in the indexing and cataloging process. Furthermore, additional frustration was experienced when the participants notified content providers about issues and their submissions received no action or acknowledgement.

“I think what needs to happen is the source of information for this is people like me. And yet, we are not part of the creation system. So, I don’t know who the people are who run ARTstor. I suspect that they are digital librarians and people who have special education in doing this kind of thing, but [they] are not cognizant of the details of the monuments and the art. … I can email them but it doesn’t mean that there’s interaction between us. Somebody may read it. Somebody may not. They may pay no attention to it. And I think what needs to happen is they should stop everything they are doing at this point, and set up a system where they are actually participating with those of us who are the users, the specialist users, about redesigning out the problems that they have now and creating what goes on in the future. They are just going to spin their wheels if they continue to leave us out of the process. … So, the whole system, the way it’s being done, top down from them to the user, when the user is the one that has the knowledge, is very, very frustrating, very damaging.”

[Archaeologist 1, 769-786]

Text-based information associated with images was identified as being more broadly problematic in the participants’ ability to discover the images they needed. Frustration was experienced when participants were not able to find an image because of the way they or the system described the item sought.

“A few times I have stumbled on an image, you know I will search on something specific and I won’t be able to find the image and if I search for something else, sometimes I will be able to find it. It is a week later and there it is. I wasn’t searching for the right, using
the right terminology … or the image isn’t named correctly. Something completely… out of what you would search on.”

[Architect 6, 627-631]

While the descriptive information connected to images was noted as creating problems for the participants, this issue received less attention than that of the quality of the reproduction of the image. There were several key aspects that the participants looked for in relation to the visual qualities of images. These had to do with the size of the image, its resolution, color / hue and shot composition. There was a general sense of frustration at the lack of quality in the images found online among all of the participants. This was partly the result of the time and effort the participants spent searching for higher quality images and the processing or manipulating of images that had to occur due to issues of quality.

“I mean, it really does have a lot to do with quality and I don’t like to, I really prefer not to mess with them.”

[Art Historian 3, 368-369]

The participants were sometimes unable to find images with higher quality and so they used what they felt were inferior representations of those works.

“In fact, I even used in that course some images [of architecture designed by Robert] Venturi, even though the images are pretty crappy, because there’s not much on casinos out there.”

[Art Historian 4, 682-684]

An image of limited size in terms of its dimensions was one aspect that the participants discussed alongside inferior quality. Since participants needed images for the visual information contained in them, images which were too small were generally considered unusable.
“You get these thumbnails. You finally find something you want and the largest you can get it is the thumbnail. You try all these other tasks to try to make it bigger … like by spreading it out and it gets pixilated. You can’t use it. So, you need these huge files, actually. That is what they have to be.”

[Architect 4, 868-870]

A topic related to the size of an image is its resolution. Images which have been scanned at a higher resolution can be manipulated in ways that a lower resolution image cannot. So, for instance, if the architect in the passage above had found a small image which had been scanned at a high resolution he may have been successful in increasing its size dimension without having the image become indistinct. Beyond size and resolution being a function of the visibility of information, these aspects relating to quality decided whether or not an image could be used for a particular purpose.

“Usually when you are on Google Images or something and you’re just searching around, you find low resolution images. It’s fine for certain things, like image boards or whatever, but to actually integrate it into something that you have to print, that needs to be high resolution. You need good quality images.”

[Architect 1, 627-631]

Additional frustrations related to quality noted by the participants were those surrounding color and hue. Poor color reproductions or issues with an image being too bright or too dark were considered barriers to use. This was particularly the case with the painters who were interested in examining an artist’s technique or the appearance of objects.

“There’s not a lot of color out on him just yet. There’s a catalog raisonné for like 250 or something, or 350. I don’t know how big the images are but there’s only
Finally, the way an item had been captured within the frame of the camera could also be considered an issue of quality. Cropping out areas that were critical for their purposes was a frustration expressed by the participants.

“It’s the church that was hard. They didn’t have really a lot of them. They had like two pictures. They were not that great. One’s really cut off. You don’t even see the steeple.”

[Artist 3, 551-552]

It is clear from passages like these that the frustrations surrounding quality that the participants experienced in finding images was directly related to what the images were to be used for. When images were needed merely to quickly identify a work or for gleaning general kinds of information, quality was less of an issue for the participants.

“Usually they are pretty low quality, but a lot of what we use them for is sort of in-house reference, or for the contractor. Yeah, if I were doing something that was more presentation quality, it might be more frustrating.”

[Architect 5, 598-600]

Frustration with the quality of available images was increased when the participants needed to use the image to perform detailed examinations, or to use it for research and publishing.

Overload

The next aspect to be presented, overload, concerns the frustration the participants expressed in having to cope with too many images. The overarching theme discovered here was that the participants felt unable to limit the number of
images which were retrieved through their queries. There were several forms of overload discussed by the participants and these ranged from having to try to deal with too many images of the correct item to having too many random images recalled in a query.

Overload could result from too many images being returned of the correct item, but without a readily accessible image of the desired view.

“What is most frustrating to me is, in ARTstor for instance, that I would get a detail view without ever getting an overall view that I could show to a general audience.”
[Archaeologist 2, 287-289]

In the case of this participant it seems likely that a more organized and rational presentation of images associated with a single work would help to reduce the frustration this user experienced.

In another case, the participant described not being able to create a useful search to recall images of specific figures from a large architectural monument with many carved figures.

“I might just have to put in ‘Pergamon Altar’… there were some very interesting figures in the round that came from the roof and another group of figures in the round that come from the hypothetical ash altar (I think they don’t come from within the building). I can't imagine any way I could make those come up without looking through all of the Pergamon Altar [images] in ARTstor.
[Archaeologist 1, 539-549]

Other frustrating experiences were described by participants in the context of retrieving multiple images of the same or very closely related images of the identical object. While many of the participants expressed the ease with which
they could browse images there was an indication that this type of activity was tolerated only in certain circumstances.

“It is too repetitive. There shouldn’t be 600 plans of the Parthenon. There should be 4 or something. There is a lot of sifting that has to go on and I find that time-consuming and annoying. ... 200 plans from the same book. It is far too repetitive. That is more of a frustration than not being able to find an image.”
[Archaeologist 2, 436-444]

Having to look through multiple identical images or images that were too closely related was considered a tedious waste of their time and effort. Again, a way to organize the retrieved images, perhaps through hierarchical clustering of images with similar visual characteristics, may help reduce the frustrations the users experience in this situation.

Participants also discussed their frustration in having too many random images recalled when they performed searches for visual materials.

“That is another thing that is difficult about finding images. Yah, having to sift through all of them. That is what I said about you can’t just put in Newark, New Jersey. Because people … here is a picture of my family, here is my dog, lost cat, Newark, New Jersey.”
[Architect 4, 678-680]

Interestingly, one participant in the study described a situation when multiple images of the same item would be considered a benefit rather than a frustration.

“It is a 3-dimensional object that I am trying to pick and so more pictures will help me decide what it is. Also, more pictures tells me that it wasn’t just release[d] and it has been around a while. So it isn’t a brand new product that no one has ever tested.
[Architect 5, 394-396]
The positive connotations with multiple images he felt may be related to the specific work tasks he performed within his architectural firm. Part of the responsibilities of his position involved selecting products to be used in architectural projects. When he discovered multiple images of the same product they reassured him that the item he selected would be a reliable choice.

*Time and Effort*

Another broad reason behind the frustration felt by the participants was the time and energy they spent performing their image activities. The most often cited reason for the frustration they felt was the time and effort they expended in finding images. Several other aspects associated to their work were noted as being burdensome by the participants and these consisted of tracking down and requesting images needed for publication, creating and processing images, and organizing images.

Nineteen of the twenty participants in the study discussed frustrating experiences in relation to spending too much time and effort trying to track down images they needed to perform their work. The exception to this was Architect 5, who stated he rarely experienced difficulties in finding images. As he described it, this was likely the result of his searching for appliances and products. He mentioned that he might experience more difficulties in finding things at the start of a project when more conceptual images were required, however. “You know, early on, when we are just doing over all searches for the look and feel of stuff that could take a little more doing,” [216-217]. Several factors contributed to the frustration the participants felt in working with images. The first of these was the
all-encompassing nature of finding images. Half of the participants from the academic (Archeologist - 2 of 4 and Art Historian - 2 of 4) and nearly all of the participants from the creative (Architect - 5 of 6 and Artist - 5 of 6) user groups described how they were constantly looking for images.

“I'm always collecting images for both teaching and publication.”
[Art Historian 4, 84-85]

Although the participants did not express frustration alongside the description of their relentless image seeking, the extent of their behavior suggests the time and effort involved was draining.

“I am always scanning things. I always need to be looking at something.”
[Artist 1, 101-102]

Frustration related to time and effort was encountered when participants discussed having to look through multiple sources to retrieve the image that was desired.

“I probably looked first off in ARTstor, and then did a Google search and then after that probably Beazley [Archive] to see if there was any mention of arktoi. ... So I would have looked there. Even though Beazley might not illustrate the vase, usually it will tell you where the vases are held with that iconography on them. Then I could go to the museum’s web site and see if I can find them there. I might also do a Flickr search to see if a tourist might have gone into the museum and gotten an image of it.”
[Art Historian 1, 255-263]

A related activity, switching between multiple formats when seeking images, also produced frustration related to time and effort for the participants.

“And sometimes I don’t even feel like getting out the survey book to remember, you know, what might be a
good opportunity. I might just say, well, if I’m on the Internet I might as well use the Internet."
[Art Historian 4, 490-492]

Another challenging aspect of image retrieval for the participants, because it took so long, was the difficulty they had in selecting terms they could use in queries to retrieve images in the online setting. This was a particularly frustrating experience in the case of known item searches.

“It’s time-consuming. I would... if I could go to ARTstor and get just the images I want and look at them on the screen and not have to fight their labeling system. If things were really well-labeled and completely labeled, instead of just having them copy the images and put them in the program without refining the information, I would probably spend half the time I’m spending with ARTstor. As far as Google goes, again, if I could do like an advance search with them and actually have three or four boxes that I can put keywords in. Instead of spending the time, I could spend like a third of the time.”
[Archaeologist 1, 217-229]

The participants tried to cope with not being able to retrieve the desired images on the open Web by browsing through recalled images and following various links that might bring them closer to the desired image. If this did not achieve the desired result they noted modifying the search by changing search terms they employed.

“So it is usually looking up keywords and then trying a bunch of the different hits and seeing if they are what I am looking for. Yah, usually when I can’t find what I am looking for I go back and change the keyword and say, ‘Ok, let’s try a different this or a different that.’ I would try to think about different options that would help me get back around to get where I wanted to go.”
[Architect 2, 527-532]

Finally, when the participants discussed their inability to find images more than half of them (11 of 20; archaeologist - 3 of 4, architect - 3 of 6, art historian -
2 of 4 and artist - 3 of 6) noted this was at least in part due to their own lack of knowledge, skill and, or effort.

“No, it isn’t that it isn’t available but that I am not looking in the right place. Maybe I need to get my butt away from the computer and go to the library. And go talk to the librarian who knows what is in. The reference section for whatever… you know, pick your topic.”
[Architect 2, 587-588]

While the degree of frustration they experienced could vary according to the difficulty of the search, the fact remains that the majority of the participants felt they spent far too much time and effort looking for images. Why so many of them felt their own inadequacies played a role in their inability to find images is an interesting discovery deserving more critical attention.

The participants all spent a great deal of time and effort creating and readying images for their use. This ranged from requesting, scanning, identifying and manipulating images to creating images of their own through analog or computer generated processes. All of the participants in the Archaeologist and Art Historian user groups discussed how they scanned and manipulated images to be used in their work. The academic participants generally avoided performing this kind of work if it was possible to do so.

“I did learn how to scan. I went over to Visual Resources and they taught me how to scan and Tom taught me all these things. But that’s… talk about time-consuming. I don’t like to do that.”
[Archaeologist 1, 633-635]

As this passage indicates the academic participants (Archaeologist and Art History user group members) typically were annoyed at having to carry out
these tasks. Part of this frustration was connected to the fact that they did not feel they were being adequately compensated for the time and effort to do what they saw as additional work, that went far and beyond what they considered appropriate to their positions.

The Architect and Artist user group participants generally had a higher tolerance for performing these kinds of tasks, probably because these processes were considered central responsibilities of their positions. However, even these participants also discussed frustrating experiences with creating imagery because of the time and effort involved. This architect-participant discussed how after he had spent a great deal of time and energy trying to find the right image for his need, he abandoned the search and created an image.

“You know, I spent easily an hour and a half looking for that and I found pictures of it, but nothing was right. I couldn’t even distort it in Photoshop in perspective to make it lay in right. So, I ended up creating a grid in 2-D that was right, and then I found an image of grass that was just sort of in perspective in the right kind of, roughly, right perspective. You know, so the grass that was furthest away was just basically green, and then the foreground was not so big that it would… because I was going to be distorting this… so, it’s a lot that goes into finding the right image. And then I took this grid that I had made of the concrete part from Illustrator, brought it into Photoshop, and distorted it in a perspective to roughly match the grass. And then they were still separate but I could manipulate them together. I put it into the perspective of the view, the rendering. And so I was able to crop it in and crop the edges and clean it up and then make that semi-transparent so it was very muted. It worked, but that probably took three hours, that process. Just to get the grass in.”

[Architect 1, 680-694]
Financial Barriers

There were five issues concerning finances and working with images that caused feelings of frustration for the participants. These frustrations were connected to copyright fees, technological expenses, compensation for expertise, a lack of funding and the cost of supplies.

Half of the study’s participants (10 of 20) discussed how the use of copyright images was a financial burden. This sometimes led to their limiting the number of images they used, or to abandoning their projects altogether. The academic image users (Archaeologist and Art Historian user groups) appear to have felt the impact of this more strongly than the creative image users (Architect and Artist user groups) and so their discussions surrounding copyright were more animated. They explained that while they made little or no money off their publications they needed to purchase costly images to support their research often without receiving outside financial support.

“I have no grant, I am beyond being a graduate student since I graduated. They wanted $30 for every image and a copy of my book for each image. My book sells for $60. It is true that my author’s fee was less, but I think I wanted five photographs from them. That is a lot of money.”
[Archaeologist 1, 71-75]

The architects described how when they needed to obtain high quality images for creating their presentations and marketing materials they sometimes needed to turn to commercial images which could be prohibitively expensive.

“You need good quality images. So, a lot of stock photograph sites are very expensive and we can’t

28 These participants were Archaeologist 4 of 4, Architect 2 of 6, Art Historian 2 of 4, and Artist 2 of 6.
afford to spend hundreds of thousands of dollars on a picture of the sky.”
[Architect 1, 631-633]

The artists also commented on how copyrighted images were a frustration since access barriers prevented them from being able to see and use the images. One artist, who incorporates multiple images into her artwork, discussed how she was unable to gain access to images beyond the thumbnail size and so had to abandon her project idea.

“They wouldn't let you take anything, because it's all cost. Like, I think you have to pay for all images like that.”
[Artist 3, 1056-1057]

Eight individuals noted the technology they used in conjunction with their work with images was costly and that this expense could pose problems for them. 29 In the case of this archaeologist she discussed how the university’s administration balked at the costs associated with maintaining a locally developed image database to support the curriculum.

“They were shocked at how much information MDID used. I mean how much server storage space MDID used.”
[Archaeologist 4, 893-894]

She went on further to state that part of this hesitancy was based on the university’s support for ARTstor. The university’s administrators believed that ARTstor contained all of the images the faculty needed for teaching.

Six of the participants, two from the Archaeologist, Art Historian and Artist user groups, expressed frustration surrounding the compensation (or lack of)

29 The participants were Archaeologist - 1 of 6, Architect - 3 of 6, Art Historian - 2 of 4, Artist - 2 of 6.
received for image processes and services. Among the academic user groups (Archaeologist and Art Historian) the participants showed frustration in association with having to process and manipulate images. They saw these kinds of tasks as beyond their job responsibilities and they resented having to spend the time doing what they saw as uncompensated work.

“Every now and again I’ll use Photoshop to clean something up, but not a whole lot because it takes too long. I think I would use it probably a whole lot more if I had time or if I were paid to.”
[Art Historian 4, 900-902]

The artist-participants expected that they would perform these sorts of tasks as a part of their professional activities and so they did not note their frustration here. They did, however, discuss their annoyance at having to hire professionals to help them create images.

“Everything’s expensive, no matter how much I make from something. You have to get it professionally photographed. You have to show it.”
[Artist 3, 2609-2611]

Six participants, two in the Archaeologist, Architect and Art Historian user groups, commented on a lack of funding being a barrier to their working with images. The archaeologists commented on the lack images of within the domain and suggested that this was due to a lack of financial support.

“There is no money in posting this kind of stuff. A lot of the stuff is readily available and indexed it is driven by science. Where this is money to pay to scan and index.”
[Archaeologist 3, 647-649]

Interestingly the art historian-participants did not mention a lack of support for images within their field. Instead these users discussed how the low level of
institutional support was behind the problems they experienced in finding and gaining access to images.

“Sometimes it is just so draining. Working at an institution where there isn’t a lot of institutional support for the arts, no surprise there, it can be a real headache. I just wish something could be done to help alleviate that situation for those of us who don’t have a half a million images at our disposal through an institution…”

[Art Historian 1, 429-433]

Lending support to the idea that a lack of funding creates issues for image professionals is the observation made by one of the architects. He stated that he rarely had difficulties finding images and that this was due to the fact that he typically searched for appliances.

“… it is probably because I am looking for products usually. Something that is made for people to make money.”

[Architect 5, 339-340]

He did not face the obstacles experience by the other participants because the images he sought out were those kinds of things that were placed on the Internet for commercial purposes.

Half of the artist-participants (3 of 6) discussed how working with and creating images was costly. They discussed having to pay for materials and services so that they could create and present their work.

“It’s going to cost a lot of money to try to develop all this.”

[Artist 3, 1879]

As the above discussion illustrates financial considerations created feelings of frustration among many of the participants in the study. When they
attempted to find, work with and create images they encountered financial barriers at various junctures. Each of these barriers impeded their professional activities.

**Technological Barriers**

While all of the participants in the study used computers and found them useful in performing some aspects of their image-related work, technological issues were found to cause frustration for the participants. Difficulties due to a lack of technological skills, issues with handling image files and the negative consequences of adopting technology were the most frequently discussed technological aspects.

A quarter of the participants in the study noted they lacked well-developed computer skills or facility with technological devices or systems.30

“I was giving a job presentation and I wanted to give a presentation about something specific that was new. I was writing something new, and I had just seen an artist’s work at a conference, and it was Internet-based… and, I didn’t know how to capture that.”

[Art Historian 3, 806-809]

For individuals who work with images regularly, their lack of confidence in their own technological skills is noteworthy.

Technology was also frustrating to nearly half (9 of 20) of the study’s participants due to the time or effort involved in working with it. A variety of reasons were given. One of these frustrations resulted from having too many options because of advances in technology.

30 These were 1 of 4 Archaeologist, 2 of 6 Architect, 1 of 4 Art Historian and 1 of 6 Artist user group members.
“My biggest time consuming dilemma is editing my photographs if I’m doing photography, because with these tools I can make every photograph a good photograph. Which is way too many photographs. … I mean, in the old days you had the slide, you threw it out. It was blurred. But, I’m using blurs, so it doesn’t matter. So, this is horrible. I have so many!”
[Artist 4, 1720-1728]

The amount of psychological and physical effort involved in using technology also caused frustration for the image users.

“I will have downloaded the OIV [ARTstor's Offline Image Viewer], but I am not very comfortable with it. Probably because I have done all of this right before class and so I don’t have a lot of experience with it. And I don’t really know how to show the images best. I know you can zoom in on details, but I never really need to do that. So, I guess I end up having to walk back and forth to change the images. I don’t have a remote and I don’t like that. Then my computer will go to sleep or maybe the server will flicker. It is just a pain! I am not saying slides were perfect but that [it] definitely cuts down on the number of images I use in the classroom. I might only use them once a week instead of every day.”
[Archaeologist 2, 395-404]

Feelings of frustration related to technology were found even among participants who were fully cognizant of how time-consuming and effort-filled tasks had been in earlier periods of their careers when the current technologies were unavailable.

“I mean, especially if you are as old as me and you would have to do things by hand. You would have to draw the whole thing out and before it was done you would have to have the whole thing drawn and then you would have to make a print of it. Then you would have to have it run through the printer, and get it and try it several times to get it to the right speed to get it right where you want it and you were used to doing things at that speed. Then when you got a computer.
Boop and you sent it to the plotter and it was done. Well, first when it was done… you would send it to the plotter and the paper would move this way and the pens would move that way. You would say ‘Oh my God, isn’t that quick!’ and then it got ‘Oh my God, it is so slow!’”

[Architect 4, 1129-1138]

Performing professional work with digital images requires computing equipment with a high level of processing power and memory. The large size of the image files that the participants worked with caused frustrations because they were cumbersome to manipulate, move and store. The architect and the artist-participants experienced the most frustration associated with modifying and exchanging digital images. In this next case the artist expresses the frustration she experienced when working with the large digital image files she created.

“I mean, these are like… some of them are like Tiffs that are like, getting up there, like huge number of layers… So, they might be like 90 megabytes!”

[Artist 4, 1534-1536]

As can be imagined, the participants experienced difficulties when trying to transfer or open files of such vast magnitude.

“There are limitations to download and upload speeds and accessing things can be challenging. Getting things to people can be challenging.”

[Architect 1, 1507-1509]

The academic users (Archaeologists and Art Historians) were not immune to experiencing difficulties when trying to work with image files. In this case the participant discussed having to determine which materials she would save because of the amount of storage space consumed by the image files that accompanied the text of her dissertation.
“I was finding with my dissertation was getting so unwieldy and the flash drive... I still had like, you know, max[imum] 250 something meg[abyte] flash drives. So, it wasn’t taking all the images. So, then I had to make decisions, you know, as I was backing up.

[Art Historian 3, 1010-1012]

Negative consequences associated with technology and working with images created feelings of frustration that were discussed by nine of the study’s participants (Architect – 4 of 6, Art Historian – 3 of 4 and Artist – 2 of 6). The architect-participants were the most vocal about the negative feelings they experienced in the increase of technology in their working lives. Their frustrations were generally related to the loss of hand-drafting.

“No, there is very little hand drawing anymore. It is CAD [Computer Assisted Design]. It is too bad. I miss it. I was probably among the last of the architects to learn hand-drafting. The field has entirely turned around in the last 10 years.”

[Architect 2, 471-473]

The architects discussed how with the loss of hand-drafting came increased expectations of them to produce computer generated renderings. This was doubly frustrating since the architect-participants understood that computer generated architectural renderings required a level of detail that could go beyond what was required for that phase in the design.

“20 years ago you wouldn’t have done that as an architect. You wouldn’t have shown a rendering of the exterior of the house. You would have shown a line drawing and the person would have imagined it, or not. You know, however, but they would have

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31 Interesting perhaps is the fact that the two architects who did not voice this frustration were relative new-comers to the domain of architecture. It is likely they had no professional experience prior to the adoption of these technologies.
accepted it in that way. And I think part of where we are today is that there is an expectation."
[Architect 3, 733-738]

One of the artist-participants also experienced feelings of frustration associated with needing to create computer generated proposals to succeed in gaining financial support to realize her large-scale environmental sculptures.

“So, it’s marketing and the flashier it is or the more it catches the eye, the better. … It’s unfortunate that you have to use this tool to market your idea when a simple drawing, which is so much faster, would really send the same information.”
[Artist 4, 582-586]

Having to waste valuable time and effort on creating computerized renderings when hand-drawing was believed to be just as effective was a frustration this artist and the four architects shared in common.

Three of the four art historians also noted they experienced feelings of frustration associated with spending considerable time and effort on technology. These participants lamented over developing collections of 35mm slides that were no longer being used.

“I had my own collection, but I gave them up. I threw them away not too long ago. I didn’t have that many of them so it wasn’t a big loss, but it was a major outlay in terms of time when I first created them. So that was kind of… one of those slap to the faces. You spend all that time and they don’t work. They become obsolete.”
[Art Historian 1, 305-309]

One of the art historian-participants noted that alongside the loss of the tangible slides was a decrease in the care taken in the development of digital
image collections. According to her assessment of the situation the virtual nature of digital images meant that they were essentially disposable.

“I think there was that kind of attention given when the great slide collections were built, but I think this is a whole new world. A whole new approach and it is a world of throw away images.”
[Art Historian 2, 206-208]

A lack of importance associated with images because they are in a digital form is an idea that was also expressed by one of the artists.

“I feel like, now that I have a digital camera, I'm lazy. I don't print them. I upload them and I leave them on my computer. They end up staying there for a while, and then I don’t draw from them.”
[Artist 3, 1805-1808]

Because digital images have no tangible manifestation this artist found she lacked printed photographs of her daily life for about a four year period. This situation was doubly troublesome to her since she recognized she had stopped adding new imagery to the collection of images she used to create her artwork.

The ethereal nature of digital technologies presented additional challenges for several artists since their work processes remain rooted in the physical world.

“Yeah, and then also the physical-ness of a photograph versus like, paper or computer. I mean, how do you draw from a computer screen?”
[Artist 3, 2328-2329]

Artists found they still needed to print things in order to use them in their work and this activity detracted from what they saw as an advantage to working on the computer. Printing things was a frustration even for the artists who worked directly on the computer to create digital artwork.

“I print kind of the preliminary ones and often, even
just to edit them, I have to look at them. Having them on the screen isn’t good enough. Which is really annoying because you’re just wasting stuff.”
[Artist 4, 1305-1307]

This tension between needing a tangible thing to achieve the potential of the digital realm was a thread that ran through each of these technological aspects. Each of the participants appreciated the advantages that technology could provide them. However, they also experienced difficulties in working with images due to technology.

**Coping Mechanisms**

The participants in the study discussed ways they tried to cope with the barriers they faced when working with images. The most common way that these user groups tried to overcome these challenges was to create their own collection of personal materials. The academic users noted they did this through finding things online in the open Web, by purchasing commercially available images and by photographing works themselves during their travels.

“I add images that I’ve taken in museums, that I’ve taken while I’ve traveled, [and] that I’ve collected over the years.”
[Art Historian 4, 444-447]

Scanning images found in printed publications they have sought out was another method of dealing with a lack of suitable image resources.

“They are not there, and so I do have to go to books at that point and I also make sure that I get a lot of books when I’m traveling around. Especially ones with nice color pictures.”
[Archaeologist 4, 284-286]

The architect-participants too developed several ways to cope with the
lack of image resources in their workplace. One method of coping discussed by
the architects was the use of their own personal materials or resources belonging
to their colleagues.

“A lot of people in the office they have books at their
desk and so they would say ‘Do you want to look at
that architect?’ Oh of course!”
[Architect 6, 330-331]

Collecting images of designs they found interesting, often unrelated to the current
projects they were working on, was another common activity mentioned as a way
to alleviate the problems caused by a lack of useful resources.

“We’re building a library, in effect, in the hopes that
these things are just on file.”
[Architect 3, 1140-1141]

The artist-participants, too, noted they attempted to cope with a lack of
access to resources through the development of their own personal collections.
All of the artists discussed having a personal collection of resource material at
their disposal. Some of the artists noted their own personal collection was richer
for their needs than those available to them through their local public libraries.

“In a lot of ways for my specific interests it [his book
collection] is better than my regional library. If I want
to branch out into things I don’t really look at that
often, then I’ll go to the Smith County Library.”
[Artist 2, 315-317]

To access resources not in their personal collection factors such as distance,
time and effort were weighed against the need for the image(s).

Participants discussed trying to compensate for the variable quality of text-
Based information associated to images by performing additional queries with
changed search terms. Sometimes this meant performing broad searches with
additional time spent looking through a large number of images that were retrieved.

“Sometimes the title doesn’t work and sometimes you just have to type in the artist and hunt a little bit.”
[Art Historian 3, 707-708]

The participants tried to lessen the frustration they experience when too many images are retrieved through the use of additional terms in their search queries to focus their efforts. This method was not always successful.

“Like, I give you a name, I give you a date, I give you the city… aah! If I ask for a city in Pennsylvania and specific guy, I don’t need to know about some guy in San Francisco. I don’t even know about some guy in Texas whose name might only be one of the two names. Are you kidding me? What, do I got nothing to do with my time? Sitting here twiddling through and scroll through ten thousand… ah! Oh god!”
[Artist 2, 1319-1324]

The above passages point to the difficulties the users experienced in retrieving the images they needed to perform their work. One way they coped with the difficulties they experienced was to perform multiple iterations of a search. Another method employed was to develop personal collections of material.

Discussion of the Theme of Frustration

Frustration was found to be the result of the barriers participants experienced in gaining access to resources, finding useful images, the time- and effort-consuming nature of performing image-related tasks, financial constraints and technological challenges. Finding images was a major source of frustration for these users, and participants encountered barriers to performing their
professional duties because they lacked access to useful resources. The participants described preferring digital materials, but relying on print resources because of the limited number of functional images available to them online. This is similar to Koo’s (2006) study which examined the use of digital images by art museum professionals. Koo found these professionals felt the number of available images was inadequate to their needs. Elam’s (2007) study of several art historians revealed that these academic users had difficulties with finding images because they lacked an awareness of resources. While the current study’s participants were aware of major online image resources, secondary image collections such as those associated with smaller institutions were not as well known or used. Rose (2002), also in a study of art historians, noted that a lack of in-depth online scholarly resources meant that art historians continued to be reliant on print-based materials. Thirty-three percent of the art historians in her study noted a lack of digital images as the greatest barrier they faced in performing their research (Rose, 2002).

Beyond a lack of appropriate online resources, barriers to finding available images were defined as issues with the rarity (few, if any, images available), highly detailed nature (particular views, close-up details, multiple images) and quality (size, resolution, color, cropping) of images. Quality was particularly critical when images were required for publishing and research purposes. Barriers to the use of digital images relating to quality, both in the physical characteristics of the images and their accompanying cataloging, were also found to cause frustration to art museum staff (Koo, 2006) and art historians
(Rose, 2002). These findings relating to poor image quality and cataloging weaknesses reiterate what Bakewell et al. (1988) found in their study of art historians in the pre-digital image era.

Information overload was another key problem discovered in the study. The need to sift through too many retrieved images was found to hamper participants’ ability to find images in the online setting. Users were frustrated when too many images of the desired item were retrieved and when too many random items were recalled. Information overload or having to cope with too many digital images appears not to have been directly addressed in the literature to date. However, Bailey and Graham (2001) allude to this problem in their discussion of art historians’ tendency to avoid databases with large numbers of images. These authors posit that these large image databases are not used because of the heterogeneous approach taken in their development. They suggest that art historians are more apt to appreciate smaller projects with a particular focus since their tools and cataloging would be better suited to their working methods. The focused scope of projects would also limit the number of images contained within them and in effect only contain images that could potentially be useful to their users. Although Bailey and Graham (2001) do not explicitly acknowledge the problem of information overload in their article, it is likely that they were aware of difficulties this situation posed to the art historians.

The time and energy the participants spent in finding, selecting, creating/processing and organizing images with a lack of what they felt were appropriate skills, knowledge and technologies also caused frustration. Searching for images
consumed a great deal of their time, with participants discussing searches across multiple sources and formats. Selection was also considered a tedious task because of information overload and the high number of low quality images. Scanning and manipulating (cropping, color / hue correction, rotating) and/or creating images for their later use consumed much time and effort. This was in part due to technological tools that the participants felt were unpleasant to use and required too much of their time. The participants’ frustration in association with the time and effort needed to work with images is an interesting contrast to the findings presented by Koo (2006). Koo’s examination of art museum professionals found that digital image use was seen as an advantage because of the time and effort savings they provided. The reason for the contrasting findings of the two studies is unknown.

Additional aspects related to image work caused frustration for the participants. A number of participants discussed barriers to publishing because of the costs associated with procuring copyrights to images. This is supported by Rose’s (2002) study of art historian image users. Acknowledgement of the copyright frustrations felt by many who need and use images in their work came in the form of a short policy document published the Max Planck Institute for the History of Science (2009). This paper called for the loosening of copyright restrictions for images used for scholarly purposes.

Financial constraints also caused frustration for the participants in the present study. Finances were viewed as a fundamental issue behind the lack of support for participants’ access to, or work with, images at the institutional,
organizational and domain level. Koo’s (2006) study echoed the negative influence of financial costs on the use of digital images among art museum professionals.

The present study also found that technology caused frustration for the participants. While the participants appreciated the advantages technology could provide, they also experienced negative consequences in relation to their adoption of technology. Technological problems in manipulating, saving, storing and exchanging image files caused frustration. These findings parallel those presented by Koo (2006) who noted that “[t]echnical problems in accessing, viewing, and using digital images are barriers to their use,” (p. 90). Additional technological barriers noted by Koo (2006) were associated with a lack of computing hardware and software, technical staff and training in the art museum setting.

The difficulties these participants face when trying to perform their work with images resulted in the development of coping mechanisms. Participants modified the way they perform their searches as a way to cope with too many or too few images being retrieved. The high number of modified image queries found in other studies of individuals searching for images appears to support the findings of the present study (Jörgensen and Jörgensen, 2005; Goodrum et al., 2003; Goodrum & Spink, 2001; Conniss et al., 2000). As a way to cope with the frustrations they experience in finding images, participants were found to have developed personal collections of materials to meet their needs. The strong role of personal image collections among the participants in this study is supported by
several studies which have examined similar user groups (Elam, 2007; Visick et al., 2006; Attig, Copeland & Pelikan, 2004; Challener, 1999; Cobbledick, 1996).
CHAPTER 8: CONCLUSIONS, DISCUSSION AND IMPLICATIONS

Summary of the Findings

The findings of this study show that professional role has a marked but uneven impact on image users’ behaviors. It was discovered that work task and domain are better able to explain image users’ behaviors. This study’s research questions were focused on answering questions in three main areas of users’ behaviors: those surrounding image needs, image retrieval and image use. Viewing the findings across these three areas allows for a comparison of basic facets of image users’ behaviors. What follows is a brief summary of the study’s findings.

The first research question was aimed at discovering the underlying information needs which drive users to seek images. Image needs were found, not surprisingly, to be tied to the professional role, work tasks and domain of the participant. For the academic user groups in the study, archaeologists and art historians, their image needs were driven by their primary work responsibilities of teaching, research and publishing. In contrast, the creative user groups in the study, the architects and artists, needed images for research and inspiration purposes to design structures or create aesthetic works. The architects were found to have additional images needs. These included images needed for design presentations, for communicating design ideas with co-workers and clients, and for marketing purposes.

The next research question pertaining to image needs was aimed at discovering what types of images were required by these user groups. Five main
categories of images were found to be broadly useful to the four user groups in the study. At least half of the participants in each of the user groups noted they needed, in order of usage from highest to lowest, photographic images (of varying subjects), images of art (primarily sculpture and painting), architecture, landscapes (of named and un-named places) and people (specific named individuals, as well as types). Additional images were needed by the two creative user groups and these were those that illustrated physical characteristics (e.g., shape, color, texture) as well as those images they had authored themselves.

When the needs of each user group were viewed independently, a distinctive set of image types was found. Each of the archaeologists noted a need for images of architecture, art, maps and objects. Architects were found to require images of architecture, artistic and design processes, landscapes, physical characteristics, photographic images and the images they authored. Art historians need images of art, objects, photography and themes. The artists were found to need advertising and mass media imagery, photographic images and the images they authored themselves.

The frequency with which these image users sought out images was also examined in the study and it was found that nearly three-quarters of them needed images on a daily basis. The remaining users noted they needed images on a weekly basis or that their needs varied depending on their work schedule or the status of their work projects. The academic users noted that when they were teaching their image needs were on-going. However images
needed for research and publishing were episodic and could vary in intensity and frequency.

Moving on to the research question which asked about how users retrieved images, findings related to the resources, systems and search methods were presented. It was found that the majority of the participants in the study preferred to find images using online resources. However, this finding did not hold true for all four groups. As a general rule, the Artist user group was found to prefer analog media. This is likely the result, as several artists discussed, of their need to have a tangible image in front of them while they work.

When the participants discussed the searches they performed, the findings related to resources shifted slightly. For instance, when the participants discussed their known item searches print-based resources were found to have been used by half of them. The architects were found to be the least likely (2 of 6) to use print sources, while the artists were the most likely (4 of 6). When performing unknown item searches it was discovered that all of the archaeologists relied on print-based resources alongside online resources, while the three other groups showed a slight decrease in print media used for unknown items. This decrease is possibly due to the awareness of the participants of the contents of their own well-developed personal collections. The findings related to resources suggest that the majority of participants would prefer to find things online but they cannot and so they resort to print sources.

Beyond using online search engines and print-based materials the participants discussed using several image databases. These could be
commercial image databases developed to offer stock photos for a fee or those developed to meet academic needs. The archaeologists were found to be the predominant users, but even among this group the databases were not unanimously used. The academic participants discussed various problems they had with image databases and these were a lack of broad and deep content, technological difficulties with trying to use them and a lack of awareness about accessing them over the Web.

The participants in the study had little or no knowledge of content-based image retrieval systems. When the principles behind these were explained and scenarios given, the participants in the Architect user group were found to be highly interested in them. The artists were evenly split into adopters and non-adopters, or possible adopters. Participants in the academic group were found to be uninterested in using these systems since they did not feel they could retrieve images efficiently using only the images’ physical characteristics.

Participants were found to form their image queries primarily based on their knowledge of the item being sought and their access to particular resources. While the exact method they might employ was found to be influenced by the particular resource they chose to use, the typical method used for online searches was found to be keyword with either a single term or combined terms of different kinds (e.g., title term and location term). Search terms were developed using prior knowledge, through searches performed before or during the image query. While a basic keyword strategy was used for both known and unknown
item searches online, unknown item searches were found to be more complex and required more modifications and iterations.

Unknown queries were found to be challenging for several reasons. These reasons were noted as being the lack of domain expertise needed to retrieve the unknown items and also because of the participants' inability to produce the “right” term to describe their visual need. Unknown item searches were found to involve the assistance of other individuals more frequently than those for known items. A need to stay abreast of current happenings in their particular domains was found among all the user groups and this necessitated that the participants perform ongoing searches of unknown items. An additional item of note relating to image queries was that artists were found to rarely perform searches for specific known works and instead discussed searches for works of a particular artist or medium.

In addition to performing keyword searches online some users were found to employ informal browsing to find images. This strategy was employed primarily by the creative user groups. These participants were found to prefer the use of print-based materials when they performed informal browsing. Directed browsing of Web pages through a series of links was another strategy which was used to find images online, but its use was discussed less frequently than the other strategies by the participants in the study.

An analysis of the participants’ responses revealed that nine categories of terms were used in their queries. These categories are Title (of work or structure), People (named historical or mythological individuals or groups,
generic individuals), Location (named geographic places or museums or collections), Theme (concept-based subjects such as science, death) / Thing (object-based subjects such as grass, lagoon), Chronological Period (Victorian, Renaissance), Style (Impressionist, Post-modernist), Media (sculpture, marble), View (showing a specific part of a structure, or an image taken from an exact location), and Specialized Terms (such as numbers applied by museums or scholars to identify specific objects). From these, four categories were found to be the most heavily used. These are People, Title, Location and Theme / Thing. While these four categories of terms were found to be broadly useful, variation of their use occurred based on the kind of search (known or unknown item) being performed and the domain of the image user.

The study also set out to answer the question which asked what criteria participants used to select images. Four main factors were found to influence image selection among a majority of participants across the study’s four user groups. These factors were those surrounding quality (i.e., image size, clarity), topicality (i.e., of the desired item), physical features (i.e., shot angle, scale), and aesthetic issues (i.e., fittingness, compelling). Two additional selection factors, historical imagery (e.g., viewed across time or states) and credibility, were used infrequently and discussed by only a few participants.

The final research questions were aimed at discovering how images were used to support users’ work tasks. The analysis revealed that for the two academic user groups (Archaeologist and Art Historian) teaching was the main work task associated with their image use. Lecture presentations were the
primary work product created with images, but images were also used in the academic users’ publications. The architects and artists were found to use images to perform background research and also for developing ideas which would help them with their various creative projects. The architects turned out a multitude of work products which used images: renderings, presentations, concept boards, booklets and marketing materials. The artists used the images to produce preparatory studies and artworks.

The last research question was focused on discovering what roles images fulfill for users. In other words, the study sought to understand the underlying reasons why participants used images. Thirteen various roles were discovered and these are, in order of highest to lowest usage: knowledge development, creative idea development, communication, inspiration, increase cognitive recall, develop critical thinking, create emotion, engage students, marketing, proof, make social connections, translate verbal information and develop trust. The use of images to develop knowledge, their own or that of others, was the most frequently discussed reason with three-quarters of the participants noting this reason behind their use of images. All of the architects and artists in the study mentioned they used images to help them in the development of their creative ideas, but this usage went unmentioned by the academic users. The creative users were also the only ones to mention the use of images for the inspiration they could provide. Communicating ideas through the use of images was an additional reason given by participants and although three of the groups (Architect, Art Historian and Artist) noted this motive, the architects were the
most apt to use images for this purpose. Using images to recall information was another reason mentioned by several participants in all but the Architect user group. The final reason to be mentioned with any regularity was the use of images to develop critical thinking skills. This was discussed by half of the academic users but by none of the creative users.

The final chapter of findings presented in this study addressed the overarching theme of frustration that was found among participants all four of the study’s user groups. The frustration these image professionals faced resulted from several barriers. These included access to serviceable resources, finding the images they needed in a usable form, and the time and effort needed to perform image-related tasks. Financial constraints and technological challenges were additional barriers which also contributed to their feelings of frustration. The most pervasive cause of frustration for the participants was found in association with retrieving the images they needed to perform their work. The issue of overload, having to examine too many retrieved images, was also found to hamper participants’ ability to find images in the online setting. The difficulties these participants face when trying to perform their work with images resulted in their development and use of coping mechanisms. Participants were found to modify the way they perform their searches as a method of dealing with having too many or too few images retrieved. Three-quarters of the participants were found to develop personal collections of materials to meet their needs in order to by-pass the challenges they face finding images.
Discussion and Implications of the Study

The findings of this study have important implications for the individuals and systems supporting image users. When viewed broadly the findings of this study suggest that the basic characteristics of image users’ behaviors are not markedly different from the information behaviors of more purely text-focused users. Like users interested in the printed word, image users seek out material in response to a need with these needs varying dependent on the task being addressed, the domain and additional individual variables. Also similar is that image users typically seek out the visual materials they need by following a path that is familiar to them. They choose the route requiring the least amount of effort which will provide them with an image that is “good enough.” When the need for a particular image is critical, however, they will expend a great amount of time and energy in the search process. Finally, like users of textual material, these users were found to seek out and use images for several reasons with knowledge construction being the principal goal noted. While users of text and images share these basic similarities in their information behaviors, several unique characteristics were found among the image users. These are presented below through a discussion of the theories of information behavior pertinent to professional image users. Suggested improvements to assist image users based on the study’s findings are given at the end of this section.

Several traditional text-based theories of information behavior were found to be descriptive of image users’ motivations and processes, but only under certain circumstances. For example, Belkin’s (1980) theory of Anomalous States
of Knowledge (ASK) was found to apply in the case of image users only when the need driving the retrieval was for an image which was unknown or incompletely recalled or understood. Since many of the images sought by the professional images users were for known items, a need to rectify an information gap or uncertainty in the user’s knowledge was not a rationale behind the retrieval. This was particularly the situation among the academic users who retrieved specific known images. Nevertheless the ASK theory does apply if we extend the need to close an information gap or uncertainty beyond the image seeker him or herself to the individuals who are the ultimate recipients of the image content. The academics’ students and the architects’ clients are two of these extended groups that were found to benefit from the information contained within the retrieved images.

Another aspect of Belkin’s ASK theory, the idea that users with higher cognitive and linguistic levels will have a higher rate of success in resolving their information gap, does not fit well with what was discovered in the study. First, it was found that the academic users were just as likely to have difficulties with search terms as were the creative users. Even when the search terms fell within their particular areas of expertise the academic users discussed developing a list of terms to be used in their image queries through investigations of additional online or print-based resources. Furthermore the study found that the creative users were generally successful in finding images to meet their needs. This finding appears to be related to the specificity of the queries being performed by
the academic (i.e., specific known item) and creative (i.e., an example of an artists’ work or a kind of object) user groups.

Image users’ needs were found to be dependent on their work tasks and domains and so Wilson’s (1973) theory of situational relevance is useful for describing professional image users’ behaviors. The various image users described needing specific images based on the task being accomplished. While Wilson’s theory is generally applicable to image users’ behaviors, these users’ ideas concerning relevance were found to be more complex than those of purely text-oriented users. Image users’ were found to judge relevance based on a host of criteria beyond that of the information contained within the image. Topicality, the match between the information contained in the image and the information needed by the user, was undoubtedly an important criterion used in relevance judgments among these image users. However a number of additional criteria based on the visual and physical characteristics of the image were found to be important to the users. Image clarity, color, contrast, aesthetic characteristics, shot angle, cropping to show details and so forth all played an important role in the users’ judgments of relevance. Thus an image may contain the correct information but it may be visualized in a way that renders it unsuitable for use. Since these additional characteristics were found to exert a strong influence over whether or not an image would be used a modification of Wilson’s theory of situational relevance appears to be warranted.

Bates’ (1989) discussion of the circuitous rather than linear information seeking paths of users also applies in part to the image users’ behaviors. The
image professionals were found to move among various resources in the pursuit of finding what they sought and they discussed modifying their searches based on the knowledge they developed through the search process. Both of these are suggestive of the meandering route described by Bates as opposed to an organized linear course of information retrieval. However Bate’s theory is more difficult to reconcile with image users’ behaviors when the various means of access available to users who seek out visual vs. textual information are considered. Bates discusses how users search on multiple kinds of information (e.g., author, citation, bibliographies, indexes, and abstracts) to retrieve what it is sought. When the richness of the bibliographic and descriptive information available to users seeking text is compared to that of image users it is clear that seekers of visual information are at a decided disadvantage. The breadth of image seekers’ routes is restricted due to the limited range of information available to perform their searches (e.g., they cannot trace citation histories, or even discover closely related works). It also means that the length of the image seeker’s journey increases because their route lacks the specificity needed to quickly retrieve the image(s) sought (e.g., the seeker must examine all images of a particular site or type of object since visual content is not fully described in accompanying textual records). While the image users were found to be adept at using various resources and developing their searches through term selection

32 An author (artist-creator) search is the only commonly known and available point of access for image users among Bate’s list. Also on Bate’s list were indexes. Although indexes for cultural materials exist, their general usefulness is hampered by their limited scope (e.g., iconography of medieval Christian art - Index of Christian Art, http://ica.princeton.edu/), their difficult organizational principles, their erudite vocabularies and, when they are available online, their sometimes restrictive access policies.
and modifications, their image forays were frustrated by the limited amount of information available in both visual and textual forms. If the analogy to Bate's theory is pushed a bit further it is likely that the image users would find the berries unripe after their long journeys.

Two information behavior models were found to more closely describe the image users' actions. These are Ellis' (1989) identification and description of the various stages of the search and selection processes among information seekers, and Leckie, Pettigrew and Sylvain's (1996) model that considered the influences of professional roles and work tasks, individuals' characteristics, and the awareness and availability of resources on the information seeking process. Although neither of these models provides a complete account of image users' behaviors they do help explain various aspects of their information seeking. Ellis' model clarifies the various stages and processes involved in image retrieval, while Leckie, Pettigrew and Sylvain provide an expansive information seeking model that includes contextualizing factors influencing the search.

The stages of the information seeking process discussed by Ellis (1989) were found to closely adhere to the behaviors of the image users during their retrieval processes. They noted they began the querying process by developing a strategy they would use and this corresponds to Ellis' starting phase. When the search was underway the image users were found to perform queries on tangential aspects of the original item sought through its theme, object type, style, material, creator and so on. Although image users are not currently able to perform direct citation searches, the tangential searches they performed are
reflective of Ellis’ chaining. Ellis’ browsing phase was found to be critical to the image seekers in every search instance since each image had to be viewed to be assessed. Browsing was also found to be a primary means of seeking among the creative image users. The need to examine what was occurring in one’s field through images and their accompanying texts was found among the image users and this seeking process reflects Ellis’ monitoring phase.

Moving on to Ellis’ phases which discuss selection, the image users were found to employ practices associated with differentiating and extracting. Image users were found to be adept at identifying various situations where one image of a work might be preferred over another based on what was contained in the image and how it was represented. This corresponds to Ellis’ differentiating. Examining images for extracting information from them was also a behavior found among the image users. However the extracting phase seems to be limited to only those items which are needed for the information contained in them. Known item queries do not appear to fit well in this last phase of Ellis’ model, unless the model can be extended to the recipients of the information as was discussed above. Ellis’ (1989) model is useful for explaining the various stages of the search process among image users and also for pointing out that these users’ behaviors while seeking are clearly similar to those of the purely text-based users. Ellis’ model is not, however, very helpful in explaining why information seeking occurs among users.

The Leckie, Pettigrew and Sylvain (1996) model, which considers various contextualizing factors in information seeking, can be used to answer questions
concerning the reason(s) behind users’ image searches. The model consists of nesting factors associated to professional position which influence the needs underlying information seeking. The broadest level of the model is professional position and this is followed by a particular work role within the profession. Each work role has a series of work tasks associated to them and the performance of these tasks is further refined by the outcome to be achieved through the tasks and the particular characteristics of the individual performing in that work role. In their model individual variables such as years in the profession, area of specialization, etc. are all considered factors influencing the information need. Information sources, too, are considered in this model with their availability and the seekers’ awareness of them shaping the ultimate success of the information seeking process.

This model of the information seeking of professionals fits well with what was discovered in this study. The participants in the study discussed their various image needs and these were found to be dependent on the work role and work tasks of their positions. A clear example of this at the role level is seen among the architects who were rendering rather than designing architectural spaces. The former sought out images of materials and appliances while the latter required conceptual images. It is clear that the images being sought by the participants were directly tied to the tasks being performed to achieve a specific outcome. What influence individual variables had among the participants is difficult to assess because of their limited numbers in the four groups. However it is clear that differences existed in the images that were needed and these were
often tied to the specialization of the participant (e.g. anatomy images for figure painter, Etruscan tombs for the Classical archaeologist, etc.). An additional strength of this model for describing image users’ behaviors is that the need for known images are easily accounted for based on an individual’s work role and work tasks.

The inclusion of sources of information in the model of Leckie, Pettigrew and Sylvain is particularly useful in the case of image users since much of their frustration resulted from a lack of access to, and availability of visual information. While a lack of awareness of secondary sources of information was found among the image users, as a group they were well versed in the various sources of information available to them within their own domains and they showed proficiency and perseverance in seeking out information. Therefore some responsibility for their lack of awareness of sources should be placed on the information providers’ shoulders rather than on those of the seeker. One way that this exchange of useful information can be accomplished is through an increased level of research into and communication with image users by information professionals. This discussion should take place within the context of the study’s implications, however, and so the remainder of this section contains suggested ways information professionals can improve image users’ interactions with visual information.

Many of the challenges the image users faced in this study are fundamental aspects that could be resolved through increased attention by information professionals. Because little research has been published on image
users’ behavior the basic nature of their information practices are nearly unknown. The research conducted in this study suggests there are several critical areas where information professionals can be most helpful to image users. These critical areas are image content, processing and management practices for digital images, methods of image access, quality controls and digital image databases. Advancements in each of these areas are dependant on communication between the providers and the users of images and so ways to increase information exchanges across the two groups should be encouraged. In the past human intermediaries would assist image users in finding, acquiring and using visual information and the image users would in turn help the intermediaries decide what materials were needed, how to best describe and organize images for retrieval and what criteria determined their usefulness to users. In this way the two groups learned from each other in a symbiotic way. The current study found that image users rarely spoke to information professionals. The lack of human intermediation means that those previously useful exchanges of information have ceased to exist among the image users and the image providers. The development of new means of communication among the two groups would be helpful in remedying the difficulties the image users encountered. This idea should be kept in mind during the following discussion of the critical challenges facing image users.

The first and perhaps most critical challenge facing image users is the lack of access to, and the availability of visual content. Codified collection development practices for visual materials do not exist and so there is no gauge
against which to judge holdings of an institution or a database. The findings of this study suggest that five broad categories of images should form the core of any collection that serves professional image users in these four domains. These include images of art, architecture, landscapes and people alongside photographic imagery of a wide variety of subjects. Differences in the categories of images needed by each domain were found and obviously these variations should influence the selection of images for a particular user group. Because of the lack of attention paid to providing image users with sufficient content they were found to use print publications to meet many of their needs even though they preferred to use online resources. An even clearer indication that there is a real need for additional image content is the finding that three-quarters of the participants in the study were actively developing their own collections to avoid future retrieval problems.

There are several ways that information professionals could assist these image users in creating, managing and preserving their personal image collections. The majority of the participants in the study felt deficient in their technological skills and so information to help them with their ever-increasing image collections is needed. These image users need clearly written instructions about the various useful technologies associated with images. This includes information written in lay terms surrounding the hardware and software used for image processes, useful methods of image file manipulation and file saving suggestions. These users would also benefit from assistance in archiving their image files. Several participants in the study were not performing any form of file
archiving for the personal images they had accumulated. Finally, information professionals need to offer ways to help them manage their personal images for later retrieval. These aspects were found to be particularly pressing for the creative user groups since their image files were rarely saved in a way that allowed them to be easily retrieved. As personal image collections grow in size the image users’ ability to find the images they seek become more difficult. At the very least information professionals should develop simple systems that provide an organized visual display of images based on some basic dimensions of the image files (title, date of image, applied tags, or predominant physical features).

Related to their personal collection building efforts is the realization among the participants that they are probably replicating the work of others in their image processing and management efforts. The users in the academic user groups discussed that they would welcome the opportunity to contribute to and use a large image collection shared across many institutions. It is not inconceivable to think of an online database of images that could take advantage of the knowledge, image collections and expertise of professionals who work with images and do it in an easy to use and low, or no cost way. Since users in this study with their own collections of digital images have experienced difficulties trying to find and archive their personal items, there is an added incentive for them to upload their images to an online site that could provide both organizational and archival support. While some creative individuals might have intellectual property rights concerns with sharing their images, there are ways to
limit access to protect these from misuse or alternatively to provide revenue streams to the images’ creators. Given the currently available technologies, the popularity of services such as Panoramio and Flickr, the participants’ broad use of the Internet, it would be possible to assist these users in managing their personal images in the online setting. Online systems have the added advantage of allowing content users to apply terms and descriptions to images. Whether the user supplied information is available to others or only to the individual user its strength is in the supplemental level of access provided to the visual information. As access to images was noted as being a challenge for most image users, efforts toward improving image retrievals would be welcomed.

Continuing on with a discussion of image access, the most often used categories of search terms in the study consisted of title, people, location, theme / thing. One of the most important findings of this study was the high use of subject terms (concept-based for theme, and object-based for thing) particularly when users performed unknown image queries. Subject terms are infrequently applied to images in practice within the collections used by the four user groups in the current study and so this points to an important way that access can be enhanced. The application of subject terms alone or with semantically linked terms to images is likely to enhance access. Two user groups were found to have specialized needs that went beyond these four basic categories of image terms. Art historian users noted they sometimes searched using terms related to style, while archaeologists suggested they sometimes searched by period. Thus six categories of terms, title, people, location, theme / thing, style and period,
suggest the lowest common denominator of search terms among the four groups in the study. These suggest the kinds of information that should be provided and searchable for images among these particular groups.

Another aspect related to access that must be mentioned here was the high incidence of incorrect or incomplete information associated with images. While the users were generally forgiving of minor inaccuracies, frustrations mounted when users had to perform multiple queries to find an item, when they were forced to perform additional work to ensure the proper identification of the image recalled, and when their prior efforts to have the errors or omissions remedied by the image provider went unheeded. Other term-based difficulties were encountered when broad terms, such as icon or amphora, were applied to a large number of images without the use of additional terms to distinguish one example from another. This situation was particularly frustrating when the search was for a particular work rather than general type. The user might only be able to retrieve the needed item by closely examining hundreds of images all similar in appearance.

Findings concerning how these users search for images suggest that additional tools to assist them in term discovery would be useful. Participants discussed the difficulties they had in finding the “right” terms to describe the images they sought. While this was found to have several underlying causes, a method of displaying semantically related terms for users to select from could prove useful. This might be done in tandem with clusters of images recalled with the semantically related terms. These additional images might be displayed only
when the cursor is moved over a particular term of interest and so provide additional nuanced differences between related terms. A combination of the methods used in concept- and content-based image retrieval systems may also hold promise in providing increased access to visual materials.

The findings surrounding content-based image retrieval systems show strong support for the development of these systems for particular image user communities. The architects were found to be very interested in these systems and could see immediate applications to their work. Although only half of the artists could imagine how these systems could benefit their work, their interest in these suggests they too might find content-based image retrieval systems useful. The academic user groups found these systems foreign to the way they think about and use images and so it seems unlikely that these systems would find widespread adoption by them. Nevertheless, it is conceivable that new methods of assessing cultural materials would make CBIR methods more interesting to the academic users. For example, art historians could trace the development of the horizon line in landscape paintings, or examine the use of a particular hue. Archaeologists might find them useful for comparisons all vases of a particular shape or look at the history of a particular motif. Both of these would have at least a traditional grounding within the scholarship of the domain and thus they might have a higher rate of acceptance. The development of useful CBIR systems appears to be dependent on user-centered studies of how these methods are best utilized and adopted in practice.
Quality was found to be the primary criterion used for selection by all of the participants who took part in the study and so its importance to image users cannot be understated. Images utilized for research, printing and publishing had the highest requirements for image quality and so they were considered unusable if their quality fell below a certain threshold. A comparable situation with textual resources would be PDF files that were poorly scanned and difficult to read. Since quality was the critical deciding factor for image selection it is clear that visual materials provided to these user groups need to be carefully processed. It is notable that such a basic issue as image quality was found to be a major source of frustration for these user groups.

Some final implications of the study’s findings concern the impact of the restrictive nature of intellectual property rights, the limited use of image databases, and the predominant use of images for knowledge construction among these user groups. Beyond the difficulties associated with the image quality needed for publication purposes, an additional issue was found in relation to publishing and the academic users. These users felt scholarship (and their own scholarly progress) was being hobbled by the reproduction rights fees and difficulties in tracking down the copyright holders for images they wanted to use. The implication of this situation is that advancement of knowledge in image-rich domains moves as a much slower rate than that in other non-image dependent domains. An examination of the consequences of a freer exchange of images among these professional user groups needs to be undertaken.
Online image databases were found to receive limited use by the image users in the study. The users suggested that the reason behind their limited use of the databases was that these information systems did not yet contain the depth and breadth of content they needed. This situation could also be indicative of several additional issues beyond limited content. The first issue is that the usability of the available image databases may not be well-suited to the users’ technological skills. Financial barriers were also found to be associated to the limited use of image databases, and potential image users were not particularly well-informed about the range of databases available to them. From these findings it is clear that image database providers need to show image users that they provide a professional level of service through consistently high level of image quality, expertly applied descriptive information, and content depth and breadth that meets their needs. Furthermore they must provide system features that cater to the particular technological strengths of their users. If image database providers are able to achieve these goals it is unlikely they will remain outside the purview of professional image users.

This study found that images were used for knowledge development and that this use was not limited to the academic groups. The development of knowledge was in fact the most frequently discussed reason for the use of images across all of the participants in the study. If images are used to generate understanding, as this study’s findings suggest, why have images not been afforded the same intellectual weight as text? It is a question that requires some introspection on the part of information professionals. Beyond knowledge
construction, this study found that images are used for a variety of reasons and that images support many tasks among even a limited group of users. Knowledge concerning how visual literacy impacts our understanding of the world around us is incomplete, but there are clear indications that visual acuity has far-reaching repercussions.\textsuperscript{33} If, as the age-old adage states, a picture is worth a thousand words, the lack of support afforded images and their users means many of those words go unheard.

**Directions for Future Research**

This study investigated image users' behaviors in an exploratory way as a theoretical model with which to examine their actions does not yet exist. A number of critical issues were uncovered through the findings of this study and it is clear that several require additional examinations at a greater level of detail. Most obvious is that future work should test the findings of this study through investigations of larger groups of users through qualitative and quantitative methods. Additional studies should be designed to examine: groups of users in other image-dependent domains; variation among users in a single domain; the systems needed to support the work of image users; the technological support required for image-related processes; and the critical issues uncovered surrounding image quality.

The expansion of this research into additional domains (i.e., medicine, law enforcement) could lead to the development of a typology of users to provide

\textsuperscript{33} Researchers at Brigham and Women’s Hospital in Boston found that medical students who had undergone a course in art observation increased the number and overall accuracy of their clinical assessments of patients significantly. See Naghshineh et al. (2008) for the findings published in the *Journal of General Internal Medicine*. 
information professionals with the specific details of user groups’ image needs, their methods of retrieval, their critical selection criteria and their particular uses of images. This typology could be used to create a backdrop of common characteristics found among all user groups. This sort of research would help develop systems that were specifically geared toward meeting the needs of expert users, while at the same time they would help shape systems that were broadly useful to many types of image users. In a similar vein, examinations of user behaviors among multiple individuals within a single domain would help develop our understanding of the possible variations that can exist among similar image users.

An area of research which could lead to improvements in access to images is the close examination of why image users do and do not use image databases. They were not well adopted by the participants in this study, with only the archaeologists mentioning their use with any frequency. The reasons behind why image users do not find them useful for their purposes should be explored. Is it because the required content is not available in them, as several participants noted? Or is this situation a result of their inability to retrieve their desired images from databases quickly and easily? Are there problems with the way images are displayed in these databases that limit their usability? There are many questions concerning image database usage among these professional user groups that remain unexplored. Since three of the user groups in this study preferred to search for and use digital images, ways of improving users interactions with image databases will have far-reaching results.
An additional area which may be related to these user groups’ low use of image databases is a comprehensive study of their use of technology. Several of the study’s participants noted that they found image databases cumbersome to use. Discovering whether this situation is the result of usability issues with these systems, or these image user groups’ self-expressed low technological skills, would go a long way in trying to answer basic questions surrounding their image behaviors.

The fact that artists were found to prefer the use of print-based resources is an intriguing discovery that should also be examined more closely. From the findings of the present study it appears as if the artists prefer print-based materials since this format is better suited to their work processes. However, there were artists in the study who used computers to find and work with images. The reason for this variation among the artists would be valuable information to discover. At a minimum an investigation of this topic would identify the most useful format of information delivery for these users.

A topic related to artists’ preference for print-based media is the study’s two creative user groups’ reliance on informal image browsing to support their work. Current image systems do not accommodate this kind of image retrieval well. It is possible that future research into the browsing habits of creative users could reveal some universal behaviors. The use of image systems that combine content-based and concept-based image retrieval methods for informal browsing should be tested among creative user groups. It would be helpful to discover if users searching on a particular term (e.g., railings) with image returns clustered
on the basis of visual similarities would find this sort of retrieval stimulating and useful.

Two aspects which were found to greatly influence the image users’ behaviors that need additional research are technical constraints and quality issues. Users frequently discussed technology-based problems they encountered in trying to work with, save, archive, move and share images and so the development of a standard set of tools to facilitate their work would be helpful. Quality, an aspect of information use that has fewer ramifications with textual material, was found to be a critical characteristic of usability for image users. Examinations of what constitutes usable image quality for specific uses are warranted. These two aspects, technical constraints and quality requirements are in many ways inter-related. Technical issues with handling large image files were problematic for users and yet these users need high quality images (which translate in part to large file sizes). Since the technological constrains and quality issues of working with images are not as problematic for information users of text-based materials they present unique opportunities for future study.
REFERENCES


----- (1975). Requests at Falmouth School of Art. ARLIS Newsletter. 24, 7-9.


APPENDICES
APPENDIX A: Data Collection Instrument – Survey

1. With which group do you identify most closely? (Choose one.)
   Archaeologist   architect   art historian   artist

2. How many years have you been associated with this group you identify?

3. What work tasks do you complete with images?

4. What types of images do you usually find yourself needing? (For example, images of pottery, cornices, Degas’ pastel drawings, etc.)

5. Approximately, how often do you find yourself needing images? (Choose one.)
   Daily       Weekly       Monthly       Other (please specify)

6. If you had to name one specific image resource as your favorite, what would it be?

7. What types of resources do you use to find images? (Please rank in order of importance, using 1 as most frequently used to 5, least frequently used.)
   Books
   Image libraries (analog collections-slides, photographs, etc.)
   Image database(s)
   Personal collection
   Web site(s)
   Other(s) (please specify)

8. Please describe briefly how you go about looking for images when you are using your favorite resource.

9. Once you have found the images that interest you, what do you typically do with them?

10. How do you incorporate images into your work?

11. Which tools and technologies do you use to work with your images?
APPENDIX B: Data Collection Instrument – Interview Guide

Greetings – do this off tape. Give date and time at start of recording.

Ethnographic explanations – several discussions about the project have taken place prior to the interview meeting. An in-depth and detailed account does not need to be given.

The following need to be re-stated:

- **Project explanations** – the project focuses on the participant’s image experiences and how images are found.
- **Question explanations** – do this alongside questions when warranted. State at outset the participant should feel free to discuss anything that parallels the general topic of the project.
- **Recording explanations** – mention that the study is confidential and that participant’s identity will be protected.

**Interview Questions**

**TRANSITION:** I will begin by asking you some general questions about your work and your background. Then I will ask you a series of questions about why you need images and how you go about finding them. The study is trying to gain a better understanding of users of images and so you should feel free to discuss anything that comes to mind in response to the questions asked.

1. Can you tell me a little about your educational background?

2. Could you please tell me what type of work you perform and what your specific interests are in the field you work in?

3. Can you tell me a little bit about why you need and use images in your work?

**TRANSITION:** Think back to the last time you needed an image or images.

4. Could you please describe for me what you were working on when you needed the image or images? **PROBE (if not discussed):** Can you talk about the task you were working on? Why did you need an image or images in this instance?

5. What image or images were you looking for the last time you needed to locate an image for something you were working on? About how long ago was this?

6. How did you go about finding what you were looking for (in other words did you search for the image using a specific word or name, did you look for the image under a general heading, or …)?

7. What resources did you use to find the image or images (did you use personal or library materials and were the images found in books, databases, photographic collections, or …)?

8. Were you able to find what you were looking for? **PROMPT:** What about if there were a system available where you could search on things like color and shape? Do you think you might use this sort of system to find images?

9. If you think back to other times you have needed images how typical was this image need? **PROBE (if it wasn't highly typical):** Can you give me examples of more typical situations?
TRANSITION: Now I will ask you some more general questions about how you go about finding images.

10. Where do you typically go to find your images and when does this occur? In other words, where do you look for images and do you generally do this as the need arises, on a set schedule, or so on?

11. How do you find an image of a work you know about? In other words, if you were looking for a work you knew of and you knew the title, date, name of the creator, media or some combination of these, how would you generally try to find the image?

12. How would you find an image of a work that was unknown to you? In other words, if you were looking for a work you had seen or had been told existed, can you describe how you might find that image?

13. Now I would like you to think back to the last time you had difficulty finding an image, or were unable to find an image. Can you take me through the steps you went through in trying to find the image? What barriers prevented you from finding the image? Were you ultimately successful? Why or why not?

14. Can you walk me through how you typically select the images you use from the images you are able to find? PROMPT: for instance, do you look for images in color over black and white, aesthetic or historical views?

15. Can you list the technologies and formats you currently use for your image needs? In other words do you use 35mm slides, digital images, still photography and so on, and what systems are in place to support these? PROMPT: are there others?

   Are you saving your image files to CDs, flash drives or external drives for an extra back-up. Do you back-up your image files? If you do, how?

   Also, I was curious as to whether or not you might know of or use an electronic archive / repository on campus (or elsewhere) for your images? Do you see the images you have amassed as having enough value (however you want to define that) to warrant placement in an archive / repository?

16. Do the methods you employ to find images in these various formats different from one another? If they do, how and why?

17. Can you walk me though how you typically use images (in the classroom/in the studio)?

18. Does your use of images for your own research differ from the ways you might use them (in the classroom/in the studio)? If yes, how do you use images for that? (NOTE re: RESEARCH: Although research for archaeologist and the art historian user groups has more formal connotations, I believe the architect and artist user groups perform image research to develop their visual vocabulary.)

19. In your experience, are the currently available tools adequate for finding and using images? In your opinion, what would improve your ability to work with images?

20. Is there anything else you think I should know about your image needs, how you search for images, or your use of image for your work? Is there anything else you would like to discuss surrounding images?

   Thanking and taking leave – thank subject for participating and stop the tape.
APPENDIX C: Informed Consent Form

Subject's Initials

Page 1 of 3

Drexel University
Consent to Take Part
In a Research Study

1. SUBJECT NAME: ____________________________

2. TITLE OF RESEARCH: An investigation of image users across disciplines: A model of image needs, retrieval and use

3. INVESTIGATORS' NAMES: Dr. Eileen Abels, Principal Investigator
Joan E. Beaudoin, Co-investigator

4. RESEARCH ENTITY: College of Information Science and Technology, Drexel University

5. CONSENTING FOR THE RESEARCH STUDY:
This is a long and an important document. If you sign it, you will be authorizing Drexel University and its researchers to perform research studies on you. You should take your time and carefully read it. You can also take a copy of this consent form to discuss it with your family member, attorney or anyone else you would like before you sign it. Do not sign it unless you are comfortable in participating in this study.

6. PURPOSE OF RESEARCH:
You are being asked to participate in a research study. The purpose of this study is to learn about why people need images, how they go about finding images and how images are being used. You have been asked to participate in this study because you are a faculty member in archaeology or art history, or because you are a practicing architect or artist. We will be conducting a total of two one-on-one sessions. We are seeking information from individuals who use images to perform their work. You may withdraw from the study at any time and you may choose to respond to only some of the questions posed.

7. PROCEDURES AND DURATION:
This study requires two one-on-one meetings.

- The first meeting will last for approximately two hours. At the first meeting you will fill out a survey which will ask some questions about your background and image use. After the survey you will be interviewed about your experience with images and how you go about finding images. We are looking for your thoughts, ideas, experiences and opinions and so anything that you want to say is correct and useful to us. The dialogue will be tape recorded by the researchers and hand-written notes will also be taken.

- The second meeting will last for approximately one hour. You will be asked to find images you need to perform your work. You will be asked to describe what you are doing as you find images. Your dialogue will be tape recorded by the researchers and hand-written notes will also be taken.

8. RISKS AND DISCOMFORTS/CONSTRAINTS:

Version 2
There are no known risks associated with this research. You will not be associated directly with comments you make.

9. **UNFORESEEN RISKS:**
Participation in this study may involve unforeseen risks. If unforeseen risks occur, they will be reported to the Office of Research Compliance.

10. **BENEFITS:**
There may be no direct benefits from participating in this study.

11. **ALTERNATIVE PROCEDURES:**
An alternative is not to participate in this study.

12. **REASONS FOR REMOVAL FROM STUDY:**
You may be required to stop the study before the end for any of the following reasons:
   a) If all or part of the study is discontinued for any reason by the investigator, or university authorities.
   b) If you fail to adhere to requirements for participation established by the researcher.

13. **VOLUNTARY PARTICIPATION:**
Participation in this study is voluntary, and you can refuse to be in the study or stop at any time. There will be no negative consequences if you decide not to participate or to stop.

14. **RESPONSIBILITY FOR COST**
Participation in this study will be of no cost to you.

15. **CONFIDENTIALITY:**
In any publication or presentation of research results, your identity will be kept confidential, but there is a possibility that records which identify you may be inspected by authorized individuals such as representatives of the institutional review boards (IRBs) or employees conducting peer review activities. You consent to such inspections and to the copying of excerpts of your records, if required by any of these representatives.
15. CONSENT:

- I have been informed of the reasons for this study.
- I have had the study explained to me.
- I have had all of my questions answered.
- I have carefully read this consent form, have initialed each page, and have received a signed copy.
- I give consent voluntarily.

Subject's Initials

[Signature]

Page 3 of 3

Subject

Date

Investigator or Individual Obtaining this Consent

Date

List of Individuals Authorized to Obtain Consent

<table>
<thead>
<tr>
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<th>Title</th>
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<th>24 Hr Phone #</th>
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<tr>
<td>Eileen Abels</td>
<td>Principal Investigator</td>
<td>215-895-6274</td>
<td>301-651-9491</td>
</tr>
<tr>
<td>Jean Beaudoin</td>
<td>Co-Investigator</td>
<td>215-886-1489</td>
<td>484-744-0983</td>
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APPROVED

OFFICE OF REGULATORY RESEARCH COMPLIANCE

Protocol No. 17341-1-1

App. Date 05-14-08

Exp. Date 01-08-09

Version 2
APPENDIX D: Demographic Characteristics of Participants

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Table E.1 Initial Codes

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<td>Training</td>
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<td>Image retrieval</td>
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<td>Levels of success</td>
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<td>Reasons for use of resource</td>
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<td>Confidence</td>
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<td>Exemplars</td>
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<td>Effort</td>
<td>Previous experience</td>
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<td>Unknown item search</td>
<td>Visual memory</td>
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<td>Sketches and preparatory drawings</td>
<td>Illustrations</td>
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<td>News and current events</td>
<td>Term searches</td>
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<td>Search modifications</td>
<td>Historical ideas</td>
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<td>Maps</td>
<td>Social connection</td>
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<td>Major monuments</td>
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<td>Memory jogs</td>
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<td>Hardware</td>
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Table E.2 Coding Scheme for Theme of Frustration

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<th>CODES</th>
<th>DEFINITION</th>
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<tr>
<td>Frustration</td>
<td>Issues and aspects that create distress, lack of satisfaction, inability to find things to fit their needs, spending too much time and effort</td>
</tr>
<tr>
<td>Access &amp; Availability</td>
<td>How accessible are the resources and images? Do the images exist? Can the images be found? Copyright restrictions, depth of knowledge needed to retrieve image, popularity or obscurity of topic, <strong>Quality is an availability issue in the codes (for both satisfaction and frustration)</strong>.</td>
</tr>
<tr>
<td>Time &amp; Effort</td>
<td>The amount of time needed to complete a task, deadlines, being pressed for time, how long tasks take to do, tasks which are time-consuming, Energy required of the participant to make the image fit their need, process and amount of work involved in finding and preparing images.</td>
</tr>
<tr>
<td>Financial</td>
<td>Costs, money, lack of financial support (because of budgetary constraints, institutional or discipline-related limitations), costs of technology, paying for goods, services and supplies</td>
</tr>
<tr>
<td>Technological</td>
<td>Computing hardware and software – desktops, laptops, external devices, scanners, programs. Issues with large image files, many image files, speed of transferring, computer memory</td>
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**Table E.3 Code Definitions and Instructions for Code Check**

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<th>CODES</th>
<th>DEFINITION</th>
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<tr>
<td><strong>STEP ONE:</strong></td>
<td>Read passage and choose either Frustration or Satisfaction</td>
</tr>
<tr>
<td><strong>Frustration</strong></td>
<td>Issues and aspects that create distress, lack of satisfaction, inability to find things to fit their needs, spending too much time and effort</td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>How quickly and easily they can find and, or prepare images, enjoyment, happiness, finding good or perfect images</td>
</tr>
<tr>
<td><strong>STEP TWO:</strong></td>
<td>Assign one of the following codes. Assign the one that seems to be the best fit. In some cases two or more of these might work. Just choose what you feel is the closest one.</td>
</tr>
<tr>
<td><strong>Access &amp; Availability</strong></td>
<td>How accessible are the resources and images? Do the images exist? Can the images be found? Copyright restrictions, depth of knowledge needed to retrieve image, popularity or obscurity of topic, <strong>Quality is an availability issue in the codes (for both satisfaction and frustration)</strong>.</td>
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<tr>
<td><strong>Time &amp; Effort</strong></td>
<td>The amount of time needed to complete a task, deadlines, being pressed for time, how long tasks take to do, tasks which are time-consuming, Energy required of the participant to make the image fit their need, process and amount of work involved in finding and preparing images.</td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td>Costs, money, lack of financial support (because of budgetary constraints, institutional or discipline-related limitations), costs of technology, paying for goods, services and supplies</td>
</tr>
<tr>
<td><strong>Technological</strong></td>
<td>Computing hardware and software – desktops, laptops, external devices, scanners, programs. Issues with large image files, many image files, speed of transferring, computer memory</td>
</tr>
<tr>
<td><strong>Social Connections</strong></td>
<td>Images connecting people to other people, developing community, trust, use of manipulated photos for humorous exchanges, using reactions of people to clarify project design, informing the public, generating excitement &amp; buy-in among people, tailoring presentation based on audience, showing understanding of culture or community</td>
</tr>
<tr>
<td><strong>Creativity</strong></td>
<td>Creating images, designs, artwork, designing rich PowerPoint presentations for class lectures</td>
</tr>
</tbody>
</table>
E.4 ARCHAEOLOGIST USER GROUP SUMMARY

NEED

Work Tasks Needing Images
Teaching, research and publication preparation were the three areas needing the support of images for archaeologists. Teaching was the primary reason for needing images and it is an ongoing need. Research and publishing efforts also create a need for images, but this is an episodic rather than ongoing need.

Image Types
While there were some variations seen according to individuals, images of art (predominantly painting and sculpture), architecture, diagrammatic images (maps, plans & charts), and objects (specifically pottery) were the primary categories of images needed. A need for images of people (historic and mythological) was common. Photographic images were found to play an important role in their work.

Frequency of Image Need
The archaeologists frequently need images on a daily basis to perform their work. This can vary depending on teaching load and the state of in-progress research.

RETRIEVAL

Image Resources
Preferences - A preference for online resources for images was noted among 75% of the archaeologists in the study. Analog and personal image resources were preferred by the remaining 25% of the archaeologists.

Used - There was a nearly equal split between digital and print-based resources when the archaeologists described their methods of finding images. Popular monuments were seen as easily found online, but less well-known things and detailed or specific views would generally require the use of print-based materials.

Search Terms Employed
The most often used terms to search for items were those from the title or the location (geographic / museum). This was followed by terms relating to people (named, mythological and type – e.g., gladiators) and themes or things (e.g., death or weapons). A few searched using terms related to chronological period or style. Sometimes terms describing the particular view needed (e.g., east, interior) would be employed.

Informal Browsing vs. Directed Searching
Although archaeologists clearly use their visual acuity in their work and daily lives, there was little evidence for casual browsing to discover images. While they might browse through a web site or a printed resource, the searches they perform are focused on finding specific items or kinds of items.

Content-Based Image Retrieval
None of the archaeologists expressed support for the use of systems which search using the physical characteristics within the image.

Image Selection
Critical factors influencing image selection were found to be based on topicality (i.e., image represents the desired items), quality of the image (i.e., clear, resolution, size, color vs. B&W), the physical characteristics of the image (i.e., camera angle, issues of scale, cropping). Aesthetic criteria (i.e., visually pleasing) were also mentioned as important in the selection process by 75% of the archaeologists in the study. Needing an image from an earlier period in history (e.g., late 19th century view) was also noted as playing a role in image selection, but to a limited degree.
Search Strategies
Online searches are typically performed with single or combined keywords. Searches are modified based on the items retrieved. More specific terms sometimes gotten through the scholarly literature are used to provide focus to a search. Broader terms are used when too few items are returned or when the desired image is not found. Periodic searches are performed to check for newly published images.

USE
Work Processes and Products
The primary work tasks surrounding images for the archaeologists were processing images to be used in their lecture presentations. To support their work the archaeologists discussed processes associated with digital images (scanning, downloading, saving and organizing images) and processes associated with presentations (selecting, arranging, creating “slides” and lists of images). Images were also found, manipulated or created to support their research and publishing.

Roles of Images
Images were primarily used by the archaeologists to develop knowledge in their students, but they were also used for personal intellectual reflection and growth. There were several other reasons mentioned by 50% of the archaeologists and these were increasing cognitive recall among their students (i.e., visual hooks to hang facts on), developing their students’ critical thinking skills and providing visual evidence for hypotheses. Images were also used as a way to increase students’ engagement with the course material.

THEMES
Several key themes surrounding archaeologists’ work with images emerged during the study. These can be divided into positive (Satisfaction) and negative (Frustration) aspects.

Satisfaction among archaeologists was found…
1. When they were able to find good quality images of the items they desired online quickly.
2. In association with the use of digital images since they require little physical effort. Finding images online reduces the need to travel to a physical location. There is no physical manifestation of the image and this means they can be shared and transported easily. Digital images are more flexible and can be found online or scanned for last minute updates to lectures.
3. In association with the creativity involved in putting together presentations created with PowerPoint. The ability to use multiple images together, add interesting backgrounds and provide information alongside the images were advantages.
4. In connecting to others through images. Archaeologists discussed contacting colleagues to discuss their research and to share images.

Frustration among archaeologists was found…
1. When they were unable to find good quality image of the items they desired within a reasonable amount of time.
   - Difficulties finding images were encountered when the items sought were uncommon, unpopular, or they required a high level of detail or a specific view.
   - Image quality, too, was noted as being a barrier.
2. When too many items were found.
   - Difficulties were found with too many unrelated images were retrieved.
   - When the correct image is found but the wrong view or detail is shown.
   - When too many of the same image in varying sizes and qualities are retrieved.
3. Because they spend too much time and effort finding, processing and organizing images to perform their work.
4. When they lacked sufficient skills to work with technology.
5. Due to financial issues related to access to high quality images and copyright.
6. When technological difficulties were encountered (transferring or saving image files, incompatible file types, software problems or complexities, etc.)
E.5 ARCHITECT USER GROUP SUMMARY

NEED

Work Tasks Needing Images
The development and illustration of architectural designs through drawings, models and presentations were the most critical tasks needing images among the architects. All architects needed images to perform research (image used as a reference, or for problem-solving), for inspiration (concept generation / creative response) and to communicate about project designs with colleagues and clients. A majority (85%) of the architects also noted they needed images for marketing.

Image Types
All of the architects needed images of architecture, design processes (e.g., layout ideas, techniques), landscapes, photographs of a wide variety of themes, purely formal aspects (e.g., examples of color, shape, line, etc.) and personal images they had created. Images of art, appliances and vehicles were needed by a majority of the architects. The architects had the broadest image needs when compared to the other user groups in the study.

Frequency of Image Need
Architects need for images was found to vary greatly across the group. While most need images on a daily basis (66%), a few stated they might need images on a weekly (17%) or monthly (17%) basis depending on the project they were working on and its stage of development.

RETRIEVAL

Image Resources
Preferences – The architects reported that they preferred online resources and, or the images they created themselves. The preferred online resources were commercial image sites, and the search engine Google, or Google Images.

Used – When the actual searches they performed were discussed the architects’ preference for online resources to find their images stayed true. Several architects noted they might use a combination of online and print-based materials for some of their image searches.

Search Terms Employed
The most often used terms architects used to search for images were those related to themes or things (e.g. spirituality or shells) and people (named architects and types – e.g., children). This was closely followed by the use of terms from the title and terms for the location depicted (geographic place name). A few architects searched using terms related to the time period (e.g., late 19th century), style, or media (e.g., stainless steel).

Informal Browsing vs. Directed Searching
In addition to performing direct searches for needed images, architects use informal browsing to discover images. Looking at their surroundings as well as browsing through print-based materials (predominantly magazines) is an on-going process that provides them with a supply of useful and imagery.

Content-Based Image Retrieval
A majority of the architects (84%) expressed support for the use of systems which search using the physical characteristics (i.e., line, shape, color, texture) within the image.

Image Selection
Critical factors influencing image selection among all the architects were found to be based on the quality of the image (i.e, clear, resolution, size, color vs. B&W) and aesthetic criteria (i.e., visually pleasing). A majority noted they selected images based on topicality (i.e, image represents the desired items) and the physical characteristics of the image (i.e., camera angle, issues of scale, cropping). Several architects discussed judging the credibility of an image based on the information and its presentation on Web sites.
Search Strategies
Online searches were typically performed with single or combined keywords. Combined terms were used as a way to limit the number of random images retrieved. Searches are typically modified and redone based on the items retrieved and words found accompanying images were noted as being useful to reformulate their searches. Difficulties with finding high enough quality images were prevalent among the architects. Searches to find images of current or recently completed architectural projects are conducted regularly by the architects in order to stay abreast of what is being produced.

Work Processes and Products
The primary work task supported by images for the architects were the creative processes involved in designing and illustrating those designs. The architects discussed processes associated with digital images (creating, scanning, collecting, downloading, modifying, saving, printing and organizing images) and analog images (creating, modifying and organizing) which prepared them for their ultimate use in renderings, concept boards, presentations and marketing materials.

Roles of Images
Images were used by all architects to develop creative ideas (i.e., conceptual framework). This was closely followed by a majority of the architects who noted the use of images to communicate an idea, and for developing knowledge amongst themselves, their clients and colleagues. Half of the architects used images for the inspiration (i.e., creative path selection) they provided in the design process. Several architects noted how images were used for marketing / financial reasons. A few other roles for images were mentioned albeit infrequently. These are images which are used to develop a sense of trust and social connection with clients.

THEMES
Several key themes surrounding architects' work with images emerged during the study. These can be divided into positive (Satisfaction) and negative (Frustration) aspects.

Satisfaction among architects was found...
1. When they were able to find good quality images of the items they desired online quickly.
2. In association with the use of digital images since they require little physical effort. Finding images online reduces the need to travel to a physical location. Digital images are more flexible.
3. In association with the creativity involved making their own designs.
4. In connecting to others through images. Architects discussed contact between colleagues (and others) through the images used in presentations.

Frustration among architects was found...
1. When they were unable to find good quality image of the items they desired within a reasonable amount of time.
   - Difficulties finding images were encountered when the items sought were uncommon, copyrighted, or the desired image required a high level of detail or a specific view.
   - Image quality, too, was noted as being a barrier with image size being a major issue.
2. When too many items were retrieved online.
   - Difficulties were found when too many unrelated images were retrieved.
   - When the correct item is found but the wrong view or detail is shown in the images.
   - When too many of the same image in varying sizes and qualities are retrieved.
3. Because they spend too much time and effort finding, processing and, or organizing images.
4. When they lacked sufficient technological skills and knowledge to retrieve things efficiently.
5. Due to financial issues related to access to high quality images and to the costs associated with image-making.
6. When technological difficulties were encountered (transferring or saving image files, incompatible file types, software problems or complexities, printing issues, etc.)
E.6 ART HISTORIAN USER GROUP SUMMARY

NEED

Work Tasks Needing Images
Teaching, research and publication preparation were the three areas needing the support of images for art historians. Teaching was the primary reason for needing images and it is an ongoing need. Research and publishing efforts also create a need for images, but this is an episodic rather than ongoing need.

Image Types
While there were some variations seen according to individuals, images of art (predominantly painting and sculpture), objects (pottery, manuscripts, etc.), illustrations of themes (i.e., iconography) were the primary categories of images needed. Photographs of varying themes, too, were commonly needed.

Frequency of Image Need
Art historians need images on a daily to weekly basis to perform their work. This can vary depending on teaching load and the state of in-progress research.

RETRIEVAL

Image Resources
Preferences - A preference for online resources for images was noted among 75% of the art historians in the study. Google or Google Images was the preferred method of finding images online. Print-based image resources were preferred by the remaining 25% of the art historians.

Used - There was a nearly equal split between digital and print-based resources when the art historians described their methods of finding images. Popular monuments were seen as easily found online, but less well-known things and detailed or specific views would generally require the use of print-based materials.

Search Terms Employed
The most often used terms to search for items were those related to people (named, mythological and type – e.g., saints). This was followed by the use of terms from the title. Terms associated with location (geographic / museum) and themes or things (e.g., resurrection or plants). A few searched using terms related to style. Sometimes terms were used that were reflective of highly specialized terminology (e.g., catalog raisonne numbers).

Informal Browsing vs. Directed Searching
Although art historians clearly use their visual acuity in their work and daily lives, there was little evidence for casual browsing to discover images. While they might browse through a web site or a printed resource, the searches they perform are focused on finding specific items or kinds of items.

Content-Based Image Retrieval
None of the art historians expressed support for the use of systems which search using the physical characteristics (i.e., line, shape, texture) within the image.

Image Selection
Critical factors influencing image selection were found to be based on the quality of the image (i.e., clear, resolution, size, color vs. B&W), the physical characteristics of the image (i.e., camera angle, issues of scale, cropping), topicality (i.e, image represents the desired items), quality of the image (i.e, clear, resolution, size, color vs. B&W) and aesthetic criteria (i.e., visually pleasing. Needing an image from an earlier period in history (e.g., late 19th century view) or at various points in time were also noted as playing a role in image selection, but to a limited degree.

Search Strategies
Online searches are typically performed with single or combined keywords. Searches are modified based on the items retrieved. More specific terms, sometimes gotten through the scholarly literature, are used to provide focus to a search. Broader terms are used when too few items are returned or when the desired image is not found.

**USE**

**Work Processes and Products**
The primary work tasks surrounding images for the art historians were processing images to be used in their lecture presentations. To support their work the art historians discussed processes associated with digital images (scanning, downloading, saving and organizing images) and processes associated with presentations (selecting, arranging, creating “slides” and image lists). Images were also used to support their research and publishing.

**Roles of Images**
Images were primarily used by the art historians to develop knowledge in their students, but they were also used for their own personal intellectual reflection and growth. Another reason for using images was mentioned by 50% of the art historians and these was developing their students’ critical thinking skills. Using images to communicate ideas, increase cognitive recall among their students (i.e., visual hooks to hang facts on) and to increase students’ engagement with the course material were mentioned by 25% of the art historians.

**THEMES**
Several key themes surrounding art historians’ work with images emerged during the study. These can be divided into positive (Satisfaction) and negative (Frustration) aspects.

**Satisfaction among art historians was found…**
1. When they were able to find good quality images of the items they desired online quickly.
2. In association with the use of digital images since they require little physical effort. Finding images online reduces the need to travel to a physical location. There is no physical manifestation of the image and this means images can be shared and transported easily. Digital images are more flexible and can be found online or scanned for last minute updates to lectures.
3. In association with the creativity involved in putting together presentations created with PowerPoint. The ability to use multiple images together, add interesting backgrounds and provide information alongside the images were seen as advantages.
4. In connecting to others through images. Art historians discussed contact between colleagues (and others) to discuss their research and to share images.

**Frustration among art historians was found…**
1. When they were unable to find good quality image of the items they desired within a reasonable amount of time.
   - Difficulties finding images were encountered when the items sought were uncommon, copyrighted, or the desired image required a high level of detail or a specific view.
   - Image quality, too, was noted as being a barrier with image size being the major issue.
2. When too many items were found.
   - Difficulties were found with too many unrelated images were retrieved.
   - When the correct image is found but the wrong view or detail is shown.
   - When too many of the same image in varying sizes and qualities are retrieved.
3. Because they spend too much time and effort finding, processing and organizing images to perform their work.
4. When they lacked sufficient skills to work with technology.
5. Due to financial issues related to access to high quality images and copyright.
6. When technological difficulties were encountered (transferring or saving image files, incompatible file types, software problems or complexities, etc.)
E.7 ARTIST USER GROUP SUMMARY

NEED

Work Tasks Needing Images
Creating artworks (paintings, sculptures, prints, photographs, drawings, etc.) was the most critical need for images among the artists. Developing proposals for commissioned artworks, mentioned by 50% of the artists, could also drive a need for images. Performing research (image used as a reference / problem-solving) and inspiration (concept generation / creative response) were other image needs expressed by the artists.

Image Types
All of the artists needed images of popular culture and, or advertising, photographs of a wide variety of themes, and images in the form of their own creations. Images of art, architecture and purely formal aspects (e.g., examples of color, shape, line, etc.) were needed by most artists in the study.

Frequency of Image Need
Artists’ need for images was found to vary greatly across the group. While most need images on a daily basis, a few stated they might need images on a weekly or monthly basis depending on what they were working on at the moment.

RETRIEVAL

Image Resources
Preferences – The study found the majority (67%) of the artists preferred print-based resources and, or the images they created themselves. Several artists (33%) preferred to use online resources.

Used - There was a nearly equal split between digital and print-based resources when the artists described their methods of finding images. Personal collections of print-based resources were consulted by the majority of the artists when seeking a known image. Unknown images saw more online searches.

Search Terms Employed
The most often used terms to search for items were those related to people (named, mythological and type – e.g., children). This was closely followed by the use of terms from the title, from the location depicted (geographic) or the place where the work is displayed (museum) and themes or things (e.g. happiness or trains). A few artists searched using terms related to the time period (e.g., late 19th century) or the media (e.g., drawing) employed in the creation of the work.

Informal Browsing vs. Directed Searching
In addition to performing direct searches for needed images, artists use informal browsing to discover images. Looking at their surroundings as well as browsing through print-based materials is an on-going process that they noted provided them with an endless supply of useful imagery.

Content-Based Image Retrieval
Half of the artists expressed support for the use of systems which search using the physical characteristics (i.e., line, shape, texture) within the image. The other half was a mix of non-users and possible users of these systems.

Image Selection
Critical factors influencing image selection were found to be based on the quality of the image (i.e., clear, resolution, size, color vs. B&W) and the physical characteristics of the image (i.e., camera angle, issues of scale, cropping). Topicality (i.e., image represents the desired items) and aesthetic criteria (i.e., visually pleasing) were also used by the artists to select their images. Needing an image from an earlier period in history (e.g., late 19th century view) or at various points in time was also noted as playing a role in image selection, but to a more limited degree.
Search Strategies
The artists noted that they typically did not seek out particular works and instead they might look for works by a particular artists or images of particular kinds of things. When they search for images of known artists or items, leafing through the pages of a print-based resource was the preferred method of searching. When they search for images of unknown items many of the artists move to the online setting alone, or in tandem with searching print-based resources. Online searches were typically performed with single or combined keywords. Searches are modified based on the items retrieved.

USE

Work Processes and Products
The primary work supported by images for the artists were the creative processes involved in making art. The artists discussed processes associated with digital images (scanning, downloading, modifying, saving, printing and organizing images) and analog images (modifying, organizing and filing) which prepared them for the artists' use (even though several mentioned the images may never be retrieved again).

Roles of Images
Images were used by all artists to develop creative ideas (i.e., conceptual framework), and this was closely followed by the number of artists who noted the use of images for inspiration (i.e., creative path). Half of the artists discussed using image to develop their knowledge about a particular thing or aspect. 33% of the artists noted that images could be used as a memory aid to recall the way things appeared. A few other roles for images were mentioned albeit infrequently. These are that images are used to communicate an idea, to create an emotion, and to create social bond with other individuals.

THEMES
Several key themes surrounding artists' work with images emerged during the study. These can be divided into positive (Satisfaction) and negative (Frustration) aspects. Satisfaction among artists was found…
1. When they were able to find good quality images of the items they desired quickly.
2. When their personal image preferences were met. Artists had personal preferences for either print-based (norm) or online resources. This preference was also related to the need for the image. Digital images were preferred for digital artwork, while analog images were preferred for artworks created with tangible media.
3. In association with the creativity involved making their own images / artworks.
4. In connecting to others through images. Artists discussed how they enjoyed the connection with other individuals through images. These could include their own images as well as those of other artists.
Frustration among artists was found…
1. When they were unable to find good quality image of the items they desired in their preferred format within a reasonable amount of time.
   - Difficulties finding images were encountered when the items sought were uncommon, copyrighted, or the desired image required a high level of detail or a specific view.
   - Image quality, too, was noted as being a barrier with image size being the major issue.
2. When too many items were found.
   - Difficulties were found with too many unrelated images were retrieved.
   - When the correct image is found but the wrong view or detail is shown.
   - When too many of the same image in varying sizes and qualities are retrieved.
3. Because they spend too much time and effort finding, processing and, or organizing images.
4. When they lacked sufficient skills to work with technology.
5. Due to financial issues related to access to high quality images, to the costs associated with goods and materials related to image-making.
6. When technological difficulties were encountered (transferring or saving image files, incompatible file types, software problems or complexities, etc.).
E.8 Member Check Interview Guide

Thank participant for taking time to speak with me about what was found.

1. Did you find any of the content of the summary noteworthy or perplexing?

2. Did you find any of the information contained in the summary a shock?

3. Was there anything in the summary that you feel was inaccurate and should be changed?

   If yes - Could you please explain what you feel are the inaccuracies?

4. Were there any areas in the summary you felt did not fully explain your work with images?

5. In the section on themes which discussed positive and negative aspects of working with images, are there additional items that should be added or removed?

6. Is there anything about you work with images that you feel needs to be added to the summary?

   Thanking and taking leave. Again, thank the participant for taking part in the study.
APPENDIX F: TABLES USED IN DATA ANALYSIS
Table F.1  What work tasks do you complete with images?

<table>
<thead>
<tr>
<th>Work Task</th>
<th>Survey Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeologist 1</td>
<td>Teaching, PowerPoint for class lectures</td>
</tr>
<tr>
<td>Archaeologist 2</td>
<td>Teaching, publication, Class preparation / instruction; Article illustration</td>
</tr>
<tr>
<td>Archaeologist 3</td>
<td>Teaching, public lectures, publications, Illustrations for lectures to college classes and public. Small numbers of illustrations for published books and articles.</td>
</tr>
<tr>
<td>Archaeologist 4</td>
<td>Teaching, research and publication, Teaching, research and publication</td>
</tr>
<tr>
<td>Architect 1</td>
<td>Create presentations, Create concept/image boards, collage / montage.</td>
</tr>
<tr>
<td>Architect 2</td>
<td>Create designs and realize renderings, Architectural design, architectural drawings</td>
</tr>
<tr>
<td>Architect 3</td>
<td>Create designs and realize renderings, communicate ideas, Designing, renderings, conveying ideas</td>
</tr>
<tr>
<td>Architect 4</td>
<td>Create designs and presentations, research, Design research, context and historical research, design development, presentations</td>
</tr>
<tr>
<td>Architect 5</td>
<td>Research, create presentations, a) Product research in the office (ex. finding a certain style fireplace, or appliance, etc.) b) Choosing products, finishes, etc, for client presentations c) Getting familiar with a new project’s neighborhood</td>
</tr>
<tr>
<td>Architect 6</td>
<td>Realize renderings, Perspectives, plans and sections of buildings and their interiors</td>
</tr>
<tr>
<td>Art Historian 1</td>
<td>Teaching, research and inspiration, Teaching, research, idea generation, inspiration</td>
</tr>
<tr>
<td>Art Historian 2</td>
<td>Teaching, publication, Writing books and articles. Teaching art history courses</td>
</tr>
<tr>
<td>Art Historian 3</td>
<td>Teaching, conference presentations, research, publications, Create class lectures; research and write articles, papers, dissertation, create conference presentations</td>
</tr>
<tr>
<td>Art Historian 4</td>
<td>Teaching, public lectures, conference presentations, publications, Class lectures, publications, public lectures, conferences</td>
</tr>
<tr>
<td>Artist 1</td>
<td>Create works, Inspiration/source materials for my art work and to piece together rough sketches for future works</td>
</tr>
<tr>
<td>Artist 2</td>
<td>Create works, Paintings, drawings</td>
</tr>
<tr>
<td>Artist 3</td>
<td>Create works, Drawing and printing</td>
</tr>
<tr>
<td>Artist 4</td>
<td>Create works, develop proposals, I make images, drawing, printing, photography. I use found images to generate proposals for artwork.</td>
</tr>
<tr>
<td>Artist 5</td>
<td>Create works, Drawings, computer art, photography</td>
</tr>
<tr>
<td>Artist 6</td>
<td>Create works, Mostly I manipulate photographs with Photoshop and eventually do watercolor paintings of them.</td>
</tr>
</tbody>
</table>
Table F.2  Types of Images Needed – Survey Responses

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertisements</td>
<td></td>
</tr>
<tr>
<td>Aerial views</td>
<td></td>
</tr>
<tr>
<td>All / Anything / Everything</td>
<td></td>
</tr>
<tr>
<td>Appliances</td>
<td></td>
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<tr>
<td>Archaeological sites</td>
<td></td>
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<tr>
<td>Architectural drawings</td>
<td></td>
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<tr>
<td>Architectural elements</td>
<td></td>
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<tr>
<td>Architectural plans</td>
<td></td>
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<tr>
<td>Architecture</td>
<td></td>
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<tr>
<td>Art</td>
<td></td>
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<tr>
<td>Bridges</td>
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<tr>
<td>Candid images</td>
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<tr>
<td>Cars</td>
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<tr>
<td>Charts</td>
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<tr>
<td>Cityscape photography</td>
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<tr>
<td>Coins</td>
<td></td>
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<tr>
<td>Color</td>
<td></td>
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<tr>
<td>Context photos</td>
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<tr>
<td>Drawings</td>
<td></td>
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<tr>
<td>Drawings Existing</td>
<td></td>
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<tr>
<td>Drawings Mechanical</td>
<td></td>
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<tr>
<td>Feelings</td>
<td></td>
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<tr>
<td>Figures</td>
<td></td>
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<tr>
<td>Film / Video stills</td>
<td></td>
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<tr>
<td>Graphic design</td>
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<tr>
<td>Historic photos</td>
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<tr>
<td>Ideas</td>
<td></td>
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<tr>
<td>Installations</td>
<td></td>
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<tr>
<td>Installations Landscape</td>
<td></td>
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<tr>
<td>Landscapes</td>
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<tr>
<td>Magazine images</td>
<td></td>
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<tr>
<td>Maps</td>
<td></td>
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<tr>
<td>Materials</td>
<td></td>
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<tr>
<td>Monuments of art history</td>
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<tr>
<td>Newspapers</td>
<td></td>
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<tr>
<td>Objects</td>
<td></td>
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<tr>
<td>Paintings</td>
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<tr>
<td>Patterns</td>
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<tr>
<td>People</td>
<td></td>
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<tr>
<td>Photography</td>
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<tr>
<td>Photojournalistic images</td>
<td></td>
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<tr>
<td>Plans</td>
<td></td>
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<tr>
<td>building</td>
<td></td>
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<tr>
<td>site</td>
<td></td>
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<tr>
<td>Portraits</td>
<td></td>
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<tr>
<td>Pottery / Vases</td>
<td></td>
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<tr>
<td>Prints</td>
<td></td>
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<tr>
<td>Products</td>
<td></td>
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<tr>
<td>Public art</td>
<td></td>
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<tr>
<td>Reconstructions</td>
<td></td>
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<tr>
<td>Satellite images</td>
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<td>Sculpture</td>
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<td>Shapes</td>
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<td>Site photos</td>
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<tr>
<td>Space</td>
<td></td>
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<tr>
<td>Texture</td>
<td></td>
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<tr>
<td>Trees</td>
<td></td>
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<tr>
<td>Typography</td>
<td></td>
</tr>
<tr>
<td>Volume</td>
<td></td>
</tr>
</tbody>
</table>
Table F.3  Types of Images Needed – Interview Responses

<table>
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**Italicized numbers** indicate the image type was noted as being needed by all participants in one or more user group.  
**Grayed areas** indicate the image type chosen by all participants in a user group.
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### Table F.6 Terms Used in Known Item Queries

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<td>Parthenon frieze; East frieze + Parthenon; Telephos frieze + Pergamon</td>
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<td>Archaeologist 2</td>
<td>Parthenon</td>
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<tr>
<td>Archaeologist 3</td>
<td>Historical person + museum; Historical person + qualifier such as tertradrachm; Modern place name + part of tomb name (e.g., Cerveteri + Barone)</td>
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<tr>
<td>Archaeologist 4</td>
<td>Title + location (ancient find spot or museum)</td>
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<tr>
<td>Architect 1</td>
<td>Patterson; Patterson + Industrial; Patterson + history; Patterson + 19th century</td>
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<tr>
<td>Architect 2</td>
<td>Title; Style; Date</td>
</tr>
<tr>
<td>Architect 3</td>
<td>Title + location; Architect</td>
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<tr>
<td>Architect 4</td>
<td>Citicorp Center + view (e.g., subway station at base); Citicorp Center + interior</td>
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<tr>
<td>Architect 5</td>
<td>Manufacturer's name + product (+ sometimes material such as stainless steel)</td>
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<td>Architect 6</td>
<td>Tele-presence; Tele-presence + Sysco Systems</td>
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<tr>
<td>Art Historian 1</td>
<td>Title + artist or architect; Title; Beazley vase number; Style</td>
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<tr>
<td>Art Historian 2</td>
<td>Artist</td>
</tr>
<tr>
<td>Art Historian 3</td>
<td>Artist; Artist + title</td>
</tr>
<tr>
<td>Art Historian 4</td>
<td>Artist; Title; Skyscrapers + Chicago; <em>Taj Mahal</em> + Atlantic city; Style</td>
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<tr>
<td>Artist 1</td>
<td>Title; Artist; Museum (combination of these)</td>
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<td>Artist 2</td>
<td>Artist; Artist + title; Artist + title + period of oeuvre; City + museum</td>
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<td>Artist 3</td>
<td><em>Freddie Kruger, Nightmare on Elm Street, Doomed School Bus</em> + photograph</td>
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<td>Artist 4</td>
<td>Artist + title</td>
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<td>Artist 5</td>
<td>Artist; Title; Artist + title</td>
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<td>Hybridizer; Title (e.g., <em>Bumble Bee Deelite</em>)</td>
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### Table F.7 Terms Used To Perform Unknown Item Queries

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<td>Type of artifact or artwork; museum (e.g., The Vatican, British Museum)</td>
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<td>Bronze Age Pompeii; author-researcher; Poggio Marino (site name)</td>
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<td><strong>Archaeologist 4</strong></td>
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<tr>
<td>Etruscan temple; 5th century B.C.E.</td>
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<tr>
<td><strong>Architect 1</strong></td>
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<td>Lawn and driveway; grass and driveway; permeable driveway</td>
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<td><strong>Architect 2</strong></td>
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<tr>
<td>Type of building (e.g., church) + town name</td>
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<td><strong>Architect 3</strong></td>
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<tr>
<td>Descriptive terms (e.g., urban terrace with families)</td>
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<td><strong>Architect 4</strong></td>
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<td>“Whatever known clues”: place name; architect; title of building</td>
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<td><strong>Architect 5</strong></td>
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<td>Descriptive terms (e.g., stair, glass, rail) + sometimes style (e.g., modern)</td>
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<td>Video-conferencing; tele-conferencing; architect</td>
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<td>Museum or collection; medium; iconography; book title where it may be found</td>
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<td>Subject (e.g., Susannah at her bath); word in title (e.g., Susannah); artist; museum or collection</td>
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<td>Artist; exhibition; gallery or museum</td>
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<td>“Term which is close to desired item”; dog and saint; name of the saint and greyhound</td>
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<td>Location (e.g., context of work/thing); Ideas about intent of artist/creator of thing sought; company name</td>
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### Table F.9  Verbatim Image Use Responses

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<th>Survey Question 9</th>
<th>Survey Question 10</th>
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<tr>
<td><strong>Archaeologist 1</strong></td>
<td>Download them into a specific file [folder] on the desktop</td>
</tr>
<tr>
<td><strong>Archaeologist 2</strong></td>
<td>Download to file</td>
</tr>
<tr>
<td><strong>Archaeologist 3</strong></td>
<td>Scan and catalog by type</td>
</tr>
<tr>
<td><strong>Archaeologist 4</strong></td>
<td>Save them to my pc and insert them into a PowerPoint or document.</td>
</tr>
<tr>
<td><strong>Architect 1</strong></td>
<td>Integrate into renderings, presentations</td>
</tr>
<tr>
<td><strong>Architect 2</strong></td>
<td>Set aside in “personal collection” and use as needed</td>
</tr>
<tr>
<td><strong>Architect 3</strong></td>
<td>Collect them in an image library</td>
</tr>
<tr>
<td><strong>Architect 4</strong></td>
<td>Import to Sketch-Up, AutoCAD, Photoshop, etc. for development</td>
</tr>
<tr>
<td><strong>Architect 5</strong></td>
<td>I usually print it out and put it in the job folder for reference later when we need to start getting specific with what we’re putting into a project</td>
</tr>
<tr>
<td><strong>Architect 6</strong></td>
<td>I usually adjust them to fit in the image. Scale the figure, tone down the contrast and ghost the image and make it slightly transparent</td>
</tr>
<tr>
<td><strong>Art Historian 1</strong></td>
<td>Save them to a folder for future selection.</td>
</tr>
<tr>
<td><strong>Art Historian 2</strong></td>
<td>Download</td>
</tr>
<tr>
<td><strong>Art Historian 3</strong></td>
<td>Cut and paste them into a PP file.</td>
</tr>
<tr>
<td><strong>Art Historian 4</strong></td>
<td>Save them to hard drive, put into PowerPoint presentation</td>
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</table>
Table F.9 Verbatim Image Use Responses, continued

<table>
<thead>
<tr>
<th>Artist</th>
<th>Use for future retrieval</th>
<th>Use as models for artworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artist 1</td>
<td>Store them on my hard drive for future retrieval</td>
<td>Use as models for artworks</td>
</tr>
<tr>
<td>Artist 2</td>
<td>Sometimes it just answers a visual question; other times I may draw it to hopefully add it to my mental reference bank.</td>
<td>When I invent a figure composition, the compositional idea dictates whether I have enough info in own mental data bank to accomplish it.</td>
</tr>
<tr>
<td>Artist 3</td>
<td>I draw them or print them</td>
<td>Work them into drawings</td>
</tr>
<tr>
<td>Artist 4</td>
<td>My own photography I use in manipulated photography, straight photo, mixed media and drawing / painting.</td>
<td>I use photography in my 2D work in all media.</td>
</tr>
<tr>
<td>Artist 5</td>
<td>Use them for reference or to spark an idea.</td>
<td>Draw, paint, use computer</td>
</tr>
<tr>
<td>Artist 6</td>
<td>See #3 above - Mostly I manipulate photographs (mine and those I can obtain with Creative Commons licensing &amp; permission) with Photoshop and eventually do watercolor paintings of them.</td>
<td>Often I use portions of them distorted or somehow changed to suit what I want to paint</td>
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Table F.10 Reasons for Image Use by Participant

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<th></th>
<th>Knowledge</th>
<th>Critical thinking</th>
<th>Cognitive recall</th>
<th>Engagement</th>
<th>Proof</th>
<th>Communicate</th>
<th>Emotion</th>
<th>Inspiration</th>
<th>Translation</th>
<th>Creative idea</th>
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CURRICULUM VITAE
Joan E. Beaudoin
169 Greenwood Ave., B2 • Jenkintown, PA 19046
HOME: 215.886.1489 • CELL: 484.744.0983 • EMAIL: jeb56@drexel.edu
http://www.pages.drexel.edu/~jeb56/

EDUCATION

Doctor of Philosophy, Information Studies ♦ College of Information Science and Technology, Drexel University, Philadelphia, PA ♦ 2009
Dissertation Title: An investigation of image users across professions: A framework of their image needs, retrieval and use.
Dissertation Chair: Dr. Eileen Abels

Master of Science, Library and Information Science ♦ College of Information Science and Technology, Drexel University, Philadelphia, PA ♦ 2005
Management of Digital Information

Master of Arts, Art History ♦ Tyler School of Art, Temple University, Philadelphia, PA ♦ 1997
Thesis Title: A preliminary investigation of early agricultural terracing in the Mediterranean – the terraces on the island of Pseira, Greece.

Bachelor of Fine Arts, Art History ♦ Massachusetts College of Art Boston, MA ♦ 1989
Graduated with Departmental Honors.

TEACHING AND RESEARCH INTERESTS
Content representation, digital libraries, digital preservation, information behaviors, use of technologies by humanities scholars, visual information access and retrieval

FELLOWSHIPS AND AWARDS

Laura Bush 21st Century Librarian Fellowship ♦ Institute of Museum & Library Services ♦ 2005-2009
Total funding in excess of $100,000. Fellowship to cover tuition, living expenses and conference travel while pursuing doctoral studies at Drexel University’s College of Information Science & Technology.

Drexel University Research Day Award ♦ Best Poster, Graduate Humanities & Social Sciences ♦ 2008
$500 award granted for the poster titled “An investigation of image users across disciplines: A model of image needs, retrieval and use,” presented at a university-wide event showcasing the research of its students on April 22, 2008.

Marguerite Guilfoyle Fund for Academic Achievement ♦ Massachusetts College of Art ♦ 1989
$1500 award granted to a graduating senior in any discipline based on academic excellence.
RESEARCH EXPERIENCE

Research Assistant ♦ CLiMB – Computational Linguistics for Image Metadata Building ♦ 2007-2008
Principal Investigator: Dr. Judith L. Klavans. Drexel Liaison: Dr. Eileen Abels. Funded by the Mellon Foundation. Provided insight into the culture and work processes of image catalogers. Recruited image catalogers for user studies. Conducted testing and feedback of systems developed to support the project’s efforts. Project website: http://www.umiacs.umd.edu/~climb/index.html

Co-Investigator ♦ Image Indexing ♦ 2006-2008
Principal Investigator: Dr. Katherine W. McCain. Unfunded project. Developed an online survey to investigate the application of terms to a series of art images and documentary style photographs by individuals with varying levels of subject expertise and indexing experience. Designed survey, recruited participants, analyzed data and prepared results for presentation.

Research Assistant ♦ System for Doctoral Students ♦ 2006
Principal Investigator: Dr. Xia Lin. Working in tandem with a team of Institute of Museums and Library Services Research Fellows, investigated needs requirements for a system to support scholarly communication among doctoral students enrolled in the College of Information Science and Technology at Drexel University. Performed content analysis of doctoral student usage of Blackboard. Participated in focus group data collection events. Prepared summary report of activities of the team.

Research Assistant ♦ Historic American Roads Postcard Collection ♦ 2005-2006
Principal Investigator: Dr. Katherine W. McCain. Project supported financially by the Institute of Museums and Library Services. Developed a metadata scheme, cataloged and scanned postcards, and archived digital image files to be used in an online collection of historic postcards showing early automobile routes in the Mid-Atlantic region.

TEACHING EXPERIENCE AND DEVELOPMENT

Instructor ♦ College of Information Science and Technology, Drexel University, Philadelphia, PA ♦ 2008
Taught courses to graduate students in library and information science both face to face and online.

INFO511: Information Resources and Services II ♦ Course introduces fundamental concepts concerning information, its users, resources and systems and the role of the information professional. Topics covered include reference resources and services, user needs and information behaviors, and information description, compaction and synthesis. Course content and assignments are designed to provide practical skills-based learning experiences through subject indexing, writing abstracts and reviews of information resources, and performing reference transactions for the Internet Public Library.

INFO622: Content Representation ♦ Course provides an overview of issues surrounding the information surrogation of text and non-text based resources. Themes investigated consist of subject analysis, metadata, human and machine-based indexing, concept maps, controlled vocabularies, classification systems and
information visualization. Course content is reinforced through assignments which include evaluating subject indexing of documents, indexing a series of images with controlled vocabularies, and developing a thesaurus.

**Teaching Assistant** ♦ College of Information Science and Technology, Drexel University, Philadelphia, PA ♦ 2008
Supported Dr. Katherine W. McCain in lecture preparation, introduced discussion topics and graded assignments for a graduate level course (INFO622: Content Representation). Course content was delivered online using the Blackboard system.

**ADDITIONAL TEACHING EXPERIENCE**

**Adjunct Instructor** ♦ Rosemont College, Rosemont, PA ♦ 1993-Present
Instructed undergraduate students in survey courses on Western art (ARH-0175/6: Visual Culture of the West I & II), American art (ARH-0238) and ancient art (ARH-0230: Art of the Ancient World: Greece & Rome). Developed and conducted an undergraduate seminar on gender studies in the ancient world (ARH-0231: Painted Ladies: Woman of the Ancient World). Course content was delivered via face to face and online methods.

**Adjunct Instructor** ♦ Philadelphia University, Philadelphia, PA ♦ 1993-1995
Taught undergraduate survey courses (ARTH-101 and ARTH-102 - History of Western Art I & II) covering the history of Western art from the Paleolithic era to the present.

**Instructor** ♦ CoMAD, Drexel University, Philadelphia, PA ♦ 1994
Conducted an undergraduate art history lecture course (ARTH 103: History of Art III: Early to Late Modern Art) on art of the late 19th century to the mid 20th century.

**Instructor** ♦ Tyler School of Art, Temple University, Elkins Park, PA ♦ 1993
Conducted an undergraduate art history lecture course on works produced during the Paleolithic period through the High Renaissance (H-ART 1955: Art History of the Western World I).

**PROFESSIONAL EXPERIENCE**

**Head, Digital Media & Visual Resources Center** ♦ 2002–2005
Bryn Mawr College, Bryn Mawr, PA
Developed strategies for integrating the use of digital media alongside analog media. Formulated and implemented policies and procedures for the center. Coordinated and performed cataloging and classification of the collection. Performed collection development. Prepared annual and special reports. Supervised and evaluated staff.

**Associate Director, Digital Media & Visual Resource Center** ♦ 1997–2002
Bryn Mawr College, Bryn Mawr, PA
Management of daily operations within the center. Position responsibilities included: supervision, training and evaluation of staff, maintenance of departmental server and hardware, software upgrades, database conversion, image cataloging and archiving, collection development, statistics, budget preparation. Created authority records to facilitate database development. Established cataloging, image production and digital image archiving guidelines.
University of the Arts, Philadelphia, PA
Responsible for collections management of 200,000 slides and 40,000 picture file images. Job duties included: improvement and maintenance of collections, design and implementation of digital image database, cataloging, circulation, database development, supervision of student workers, statistics, and budget preparation. Executed a complete inventory and condition report of the slide collection.

Archaeological Technical Assistant ♦ 1991–1993
Temple University Department of Art History, Philadelphia, PA and Pseira, Greece
Supervised a surveying team. Additional duties included: creation of topographical site maps, editing manuscripts and illustrations for publication.

Appraisal Clerk ♦ 1991-1993
Freeman/Fine Arts, Philadelphia, PA

Registrarial Assistant ♦ 1988-1990
Fuller Museum of Art, Brockton, MA
Participated in the inventory of the permanent collection: measured, described, photographed, documented, and conducted condition reports of objects. Maintained object files. Contacted artists and lenders for exhibitions. Assisted in installation and maintenance of exhibitions. Researched objects on loan.

PUBLICATIONS: REFEREED JOURNAL ARTICLES


PUBLICATIONS: REFEREED CONFERENCE PROCEEDINGS


**PUBLICATIONS: UNREFEREED JOURNAL ARTICLES**


**CONFERENCE PRESENTATIONS, POSTERS AND WORKSHOPS**


“Specters in the archive: Faculty digital image collections and problems of invisibility,” Mid-Atlantic Regional Archives Conference, Silver Springs, MD, November 9, 2008.

“The influence of domain knowledge, indexer experience and image type on image indexing,” Mid-Atlantic Digital Library Conference, Bucknell University, Lewisburg, PA, July 9, 2008.


INTERNSHIPS AND PRACTICA

Library Assistant ♦ Jenkintown Elementary School ♦ 2007-Present

Institute of Museum & Library Services Intern ♦ Free Library of Philadelphia, Print and Picture Collection ♦ 2006

PROFESSIONAL AFFILIATIONS AND SERVICE

ALA (American Libraries Association) ♦ 2007-Present

ALISE (Association for Library & Information Science Education) ♦ 2007-Present

ARLIS/NA (Art Libraries Association of North America) ♦ 2000-Present

ARLIS/NA DVC (Art Libraries Association of North America - Delaware Valley Chapter) ♦ 2006-Present

ASIST (American Society for Information Science & Technology) ♦ 2005-Present

Treasurer ♦ SIG VIS ♦ 2008-Present

VRA (Visual Resources Association) ♦ 1995-Present

Session Organizer and Chair ♦ Visual Resources Association Annual Conference ♦ 2007
Mentor ♦ Visual Resources Association Annual Conference ♦ 2005

VRA PC (Visual Resources Association - Philadelphia Chapter) ♦ 1999-Present

Chair ♦ 1999-2001
Listserv & Web Site Manager ♦ 1999-2005