

The Image and the Expert User: A Qualitative Investigation of Decision-Making

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Abstract

Research on the development of image digital libraries has so far yielded little knowledge about the actual uses of rich visual content. This paper presents initial findings of a study on the decision making strategies that expert users employ in a large scale image digital library to choose and evaluate digitized photographs for specific projects. The paper establishes the foundation for the research in the literature on representation and remediation and describes the methodology of the research project, which includes two-stage semi-structured interviews with seven expert users across the spectrum of factors motivating the sophisticated, project-based use of digitized photographs. Findings presented here highlight the nature of visual expertise and the indicators of a new model of learning in visual collections.

Introduction

Image scientists and digital project managers typically share an interest in extracting the greatest digital value from the physical artifacts, on the premise that higher image quality benefits the end-user to a greater extent than its absence. In a conference dialog that continues into the published literature, scientists and digitizers more often serve as proxies for the end user. Digitization projects and products founded on the objective findings of image science or systems research alone, rather than on direct knowledge user information behavior, may privilege system and interface attributes over outcomes and impact by the users for whom the systems are designed.

The purpose of this paper is to describe the design, methodology, and some early findings of a study of how visual experts make sophisticated use of collections of digitized historical photographs. The study seeks to develop a testable model of end-user decision-making strategies as applied to large collections of digitized historical photographs. This qualitative investigation probes the strategies and methods utilized by a diverse group of expert users of public domain photographic collections housed at the US Library of Congress and made available through one of two publically available interfaces. The research project of which this report is one facet seeks to fill important gaps in the research literatures associated with the evaluation of digital libraries and the dimensions of information quality. The research is also designed to deepen the practical association between end-user needs and the development of digital collection development requirements.

Background

The online collections of the Library of Congress constitute the largest corpus of digitized cultural heritage resources in the world. The two principal collections are American Memory and the Prints and Photographs Division. American Memory has its origins in the early 1990s as the National Digital Library Program. It now unifies search and browse functions across over nine

million items from 138 discrete physical collections, 23 of which are not part of the Library of Congress. The Library of Congress' Prints and Photographs Division (PPD) holds more than 14 million items (photographs, prints, architectural documentation). The PPD Online Catalog provides access to approximately 1.2 million digitized images. It includes textual descriptions for about half of the total holdings (some images are cataloged as groups and some catalog records do not link to digitized items). American Memory, as the name implies, focuses its digital resources on American history and culture, while the digital resources of the Prints and Photographs Division have an international reach. There is very significant overlap between the two large digital collections. [1]

The Library of Congress digital programs have served as a tested for innovative research for over a decade. Among the best and most influential studies is Marchionini [2], who conducted extensive and multi-faceted usability research in the mid-1990s as part of the interface design for American Memory. Choi & Rasmussen [3] utilize American Memory for a test of search query formulation. Both of these studies treat the digital content of American Memory as fixed data for assessing system characteristics for a given population. Neither study seeks to understand the potential relationship between user behavior and the characteristics of the visual content itself. Xie [4] examines the attitudes and perceptions of users toward a set of digital library evaluation criteria, rather than detailing the user experience. Dalbella [5] deconstructs leadership behavior in the development of the National Digital Library Program as a case study in the social construction of technology. The study reported here posits the Library of Congress' online collections as enabling mechanisms for unknown and not well understood communities of users. Focusing on a single large collection of digitized photographs in part helps control for variations across systems in interface design, wild variance in digital imaging processes, and dissonant metadata models.

Review of Framing Literature

Digitization practice derives its significance from the realms of representation, remediation, and the evolving nature of the image itself in the digital environment. Mitchell [6] coined the term "pictorial turn" to describe periods in history when cultures seem to turn from words to pictures in a sudden shift of perspective. He sees in today's digitally dominated age a broad-based and intense focus on the "metaphysics of the image." From the dual perspectives of philosophy and theory, Mitchell makes the crucial distinction between the idea of the "picture" and the idea of the "image," and in doing so provides an opening to consider digitization as an act of representation. "The picture is a material object, a thing you can burn or break. An image is what appears in a picture, and what survives its destruction – in memory, in narrative, and in copies and traces in other media." (p. 16) Digitization of photographs, or any visual resource for that matter,

can be seen in this light as a transformative process of representation in which a picture becomes an image. Mitchell [7] succinctly notes that “representation is always *of* something or someone, *by* something or someone, *to* someone.” (p. 12) Representation, therefore, is primarily an intentional relationship between the maker (by) and the viewer (to), fraught with the potential for communication problems ranging from misinterpretation and misunderstanding to falsehood and forgery.

The challenges of representational practice in art, literature, and science are age old and deeply studied. A generation of new media theorists recast representation theory as a dynamic and ongoing re-presentation of one medium in the new. Bolter and Grusin [8], in particular, argue that the near constant churning of “new media” is a culturally driven desire “... to multiply its media and to erase all traces of mediation: it wants to erase its media in the very act of multiplying technologies of mediation.” Evidence of remediation of content through new technologies is found in the repurposing of photographs as new digital collections. When justifying the creation of the digital version in terms of access to older media, those who build digital collections seek to establish the same relationship to the image as if viewing the original – technological transparency, “... but of course this is never so. The computer always intervenes and makes its presence felt in some way.” (p. 312) In the face of the failure of transparency, Bolter and Grusin see in remediation the additional complexity that occurs when new technologies “refashion the older medium entirely, while still marking the presence of the older media and therefore maintaining a sense of multiplicity.” (p. 339) The images that derive from pictures may communicate mixed messages of material and visual meaning. Our greatest concern should be on meaning judged through use.

Making meaning in the digitization of photographs begins with the materiality of photography itself. Scholars steeped in traditional photography or trained as photograph archivists run the gamut from profound skepticism to unadorned enthusiasm about the processes of digital representation and remediation. Sassoon [9] largely sees digitization as diminished meaning (“an ephemeral ghost”) resulting in a fundamental loss of tangible information value, as well as a severing of the emotional tie between photographer and viewer that derives from an original, historically situated artifact. Koltun [10] claims that a digitized photograph “leaves behind another originating document whose disposal or retention can inspire other archival debates focused around original attributes and meanings not ‘translated’ into, even distorted by, the new medium.” At the other end of the loss-gain spectrum, Mitchell [11] finds potential transcendence through digitization. “In a world where the very idea of the unique original seems a merely nominal or legal fiction, the copy has every chance of being an improvement or enhancement of whatever counts as the original.” (p. 497) Cameron [12] argues that digitized photographs are “digital historical objects” in their own right, “separate from any referent, and as an entirely new creative project the materiality argument can no longer be given pre-eminence.” The particular characteristics of digital media require that user behavior and experience become key defining principles. (p. 68)

Over a span of nearly two decades, the creation of collections of “digital historical objects” has transitioned from rarified experiment to nearly ubiquitous activity across both the commercial and the non-profit sectors. Within the cultural heritage

community of library, archive, and museum organizations, the multi-billion dollar investment in building digital collections from photographic and other cultural resources is governed by community-based guidelines and best practices developed by tightly circumscribed but overlapping networks of technical experts. [13] Guidelines specify the parameters of a rich workflow of decisions that cumulatively endow digitized photographs with properties that render meaning apart from the those embedded in the original objects. [14] Increasingly, the cultural heritage community is pressuring itself [15] to increase the scale of digitization activities, in part by revising the very guidelines that have established image quality as a primary value of digitization activity. Ross [16] notes that large-scale digital libraries are simultaneously mechanisms for delivering digital surrogates of archival holdings and new archival collections in their own right that reflect the decisions that digital curators make throughout the digitization process.

This research draws on and contributes to three streams of research: the evaluation of digital libraries, visual literacy, and the nature of expertise. The design of the investigation is informed by research on relevance judgments in a digital environment but is not cast as an extension of this research. A critical component of the overall investigation is an emerging framework for measuring information quality in the web environment [17] [18], but a full consideration of information quality dimensions in use is outside the scope of this paper, in part because the analysis of the study data is ongoing.

Evaluation of Digital Libraries

The extent to which decisions made during the digitization of visual resources affect their uses is unknown, in part because the knowledge gained from user-oriented evaluations of digital libraries is incomplete and inconclusive. Puglia and Rhodes [19] review digitization practice in the cultural heritage sector and conclude that future progress depends in part on turning significant attention to the relationship between digitization guidelines and user behavior. “It is a little humbling to look back and admit that we are still asking many of the difficult questions that we were asking over a decade ago.” Saracevic [20] reviews over 80 empirical studies of digital library users and finds that only four studies are based on collections of digital images – all of which focus largely on the retrieval effectiveness of the image delivery system itself. Saracevic concludes that a fundamental tension between the perspectives of digital library creators and digital library users. “In use, more often than not, digital library users and digital libraries are in an adversarial position.” (p. 6) While not explicitly seeking to bridge this tension, this research seeks to fill a very large gap in the understanding of the mechanics of use in visual collections.

In a separate study, Saracevic [21] examines 64 empirical studies of how users of digital systems judge the relevance of the results they obtain. In addition to his insight that relevance studies primarily inform how *undergraduates* judge relevance, Saracevic finds that only one study in the past 20 years has anything of merit to say about the use of digitized photographs or other images. In that study, Choi and Rasmussen [3] explore the formulation of queries to search the collections of the American Memory digital library, by working with graduate students and faculty in history departments from three Pittsburgh area universities. With this

particular group of users, content domain expertise and prior experience with using the digital image collections of the Library of Congress are important indicators of expertise. The authors suggested that the findings of the study could help influence the design of indexing systems for visual resources, but their study was not designed to inform the creation of the digital resources themselves.

Matusiak [22] also focuses on search and retrieval strategies in an image-based context. The work compares the strategies of undergraduates and the general public, finding strong evidence for distinctive mental models within the two groups. The research stops well short of investigating how either keyword searching or browsing relate to the ultimate choice of relevant visual objects. Weedman's [23] exploratory study of retrieval relevance in image-based research project, based on a single case, finds that the artificial separation between relevance and actual use "circumscribes understanding of both." (p. 376) These studies, along with nearly all digital library research in visual collections to date, treat the visual image as a fixed, controlled object of retrieval, rather than as objects whose fluidity and variability are themselves factors in the use equation. Research is needed that starts with the assumption of a relevant search and proceeds to explore the decision making strategies and criteria governing the ultimate selection of visual resources for use in a specific context. A joint NSF/DELOS working group on digital imagery [23] highlighted this type of end-user evaluation, but stopped quite short of specifying viable investigative strategies. Their report encouraged research projects that "explicitly aim at developing context-dependent and context-sensitive evaluation techniques."

Visual Literacy

In the context of the "pictorial turn" described by Mitchell, the capabilities of humans to find meaning in the visual is a particularly challenging issue. For 40 years, the research field of "visual literacy" has attempted to define, measure, and enhance understanding and learning via visual media of all forms. Building on pioneering work to define a set of visual competencies and skills, Braden and Hortin [25] suggest that visual literacy has two aspects: the ability to understand images and the ability to use them. Barry [26] elaborates on the element of understanding images to incorporate an "awareness of the logic, emotion, and attitudes suggested in visual messages." Barry's evocation of the emotional reaction to the visual object is an important element in her definition. Interpretation of the relevance of an image and its appropriateness for a given application are subjective judgments that may have measurable components.

Messaris and Moriarty [27] argue that the most critical elements of visual literacy are the activities that make picture-based media a means of communication. For Barry, too, "image use" itself is directly related to the production of new images, where both understanding and use require "a quality of mind developed to the point of critical perceptual awareness in visual communication." (p. 6) Dallow [28] takes the communication elements of visual literacy a step further by arguing that "the practices of looking [the gaze] inform our lives beyond our perception of images *per se*." (p. 92) Images are not merely objects but are elements in social activity and the interaction between people. The meaning invoked by visual objects can only be understood by "taking account of the practices that participants

deploy to build the social worlds that they inhabit and constitute through ongoing processes of action." This is a very strong argument for considering use within the context of the social communities of the user. More specifically, Chauvin [29] identifies a special sub-category of "media literacy" that includes the understanding of the processes, techniques, and purposes used by those who produce visual media. For purposes of this study, Chauvin's concepts seem to capture most succinctly the knowledge of media required to make effective use of digitized photographs. Understanding use of systems or collections of digitized photographs must relate to the uses to which images are put.

Research to measure visual competency within a dual framework of interpretation and use have produced mixed results. Messaris [27] focuses on the ability of viewers to detect visual manipulation, yet he argues that visual competency tests must not be confounded by measurements of the participant's abilities to verbalize what they see. Prosser [30] argues, instead, that verbalization techniques are reliable proxies for visual competencies; but this line of research has not yet led to the development of instruments for visual competencies that can be administered verbally. The research reported here involves the interplay of digitized photographs and their associated textual descriptions. The heart of the project, however, is the visual object itself and how expert users are able to verbalize what they see in terms of visual content, technical characteristics, and contextual factors. The research may help advance the visual literacy toward field-based, verbally grounded measurements of the components of visual judgment.

Expertise

The concept of human expertise is multi-faceted and complex, the subject of significant investigation, especially in the domains of artificial intelligence and machine learning. How expertise is constituted and how it is exercised depend upon the specific domain. This research project accepts as a point of departure Hoffman's [31] definition, which he bases on the traditional terminology of Medieval era craft guilds. An expert is "*the distinguished or brilliant journeyman, highly regarded by peers, whose judgments are uncommonly accurate and reliable, whose performance shows consummate skill and economy of effort, and who can deal effectively with rare or 'tough' cases. Also, an expert is one who has special skills or knowledge derived from extensive experience with sub-domains.*" Hoffman's definition contains three important and possibly measurable components. First, the definition acknowledges that expertise is in part socially constructed and validated through community judgment. Second, expertise demands high levels of technical skill and efficiency, as well as the capability to recognize and deal with exceptions to a rule. Third, the definition incorporates focused experience as one of several components, but not necessarily the most important one.

Following on Mitchell's distinction between picture (artifact) and image (representation), the use of digitized historical photographs may require expertise in two separate but perhaps distinctly different domains of knowledge. The first domain is knowledge of photographs and the context of photography. The second domain is knowledge of digital imaging technologies and

processes. The parameters of neither domain are well articulated in terms of user requirements.

Derived from experience collecting and handling historical photographs housed at the George Eastman House, Bruce [32] proposes a framework of specialized knowledge required to curate, preserve, and provide service on historical photographs (Fig. 1). He identifies thirteen sub-domains of knowledge that cumulate to define expertise in the larger domain of photographic history.

The Bruce model of photographic expertise contains thirteen sub-domains of knowledge. Applying Mitchell's picture-image distinction, it appears that six of these domains relate clearly to the materiality of the photograph as a picture.

- Antique Photographic Processes
- Appropriate Techniques of Chemical Analysis
- Characterization of Commercial Photo Materials
- Documentation of Physical Condition
- Optical Perspectives
- Physical Analysis of Photographic Types

The remaining seven of the components of knowledge relate most directly to the image and its social context.

- Biographical Knowledge of Particular Image Makers
- Characteristics of Particular Collections
- History of Art
- History of Photographic Equipment
- History of Photography
- Social History Relevant to Image Subject
- Working Methods of Particular Artists

Research Questions

What we know about the use of large collections of digitized photographs in specific contexts is dwarfed by what we do not know. Beyond assessing relevance judgments in the context of search and retrieval, the research literature provides little guidance on how to model user decision making strategies for visual information in information environments where the source material itself is a variable in the equation of use. Given the general absence of user-oriented evaluation of image-based digital libraries and significant questions about the relationship between visual interpretation and the use of visual resources, this research project explores how diverse users with variable expertise generate meaning from digitized photographs. In the context of specific, tangible information products, the research examines the nature of the relationship between visual expertise and strategies for deciding which items from a search result set to include in their products.

First, what is the nature of visual expertise as it is applied in the field in narrowly constrained circumstances? The constraints imposed by this study include photographic content as the media of study and the exploration of the use of digitized photographic content through the intermediation of one of two clearly articulated image delivery systems with distinct user interfaces. Second, what is the relative importance of visual content in determining the choice of individual digitized photographs for consideration in a given project? Third, in the decision to use or not use a given digitized photograph, what role is played by the technical characteristics of digitized photographs that derive from the processes of their digital conversion? The investigative approach is also designed to generate data that might suggest a

relationship between visual content and technical characteristics. In order to pursue these interrelated questions, it is necessary to establish the context within which decision making takes place. The research explores how to operationalize this context in terms of the group affiliation of the user, the function of and audience for an envisioned product, and the methodological processes that underlie the user's investigation of the visual resources.

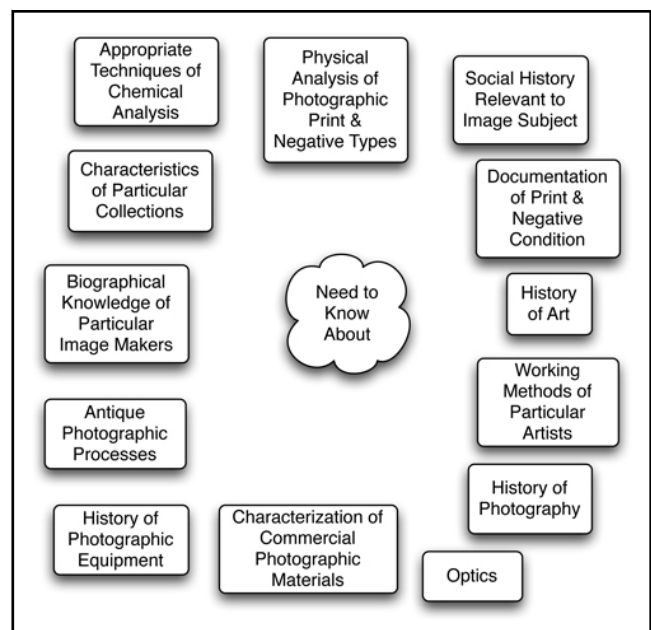
Methods

In his review of two decades of research on eliciting knowledge from experts, Hoffman [31] concludes that a combination of documentation analysis, task analysis, and thinking out protocol analysis is the most effective overall approach. This research project adapts this strategy by conducting two-stage semi-structured interviews with expert users, supplemented by an independent analysis of the content and context of the source materials consulted by the users for specific projects with defined outcomes. The locus of research is individuals who have made significant use of digitized photographs that they selected from either the Library of Congress's American Memory or Prints and Photograph digital collections.

Identification of Study Group

The investigator identified seven individuals from an initial list of twenty users provided by the curators of the Prints and Photographs Division. The initial request to the PPD staff was intentionally vague, encouraging the curators to identify potential participants for an independent study, based on the following general criteria: (1) significant use of the digitized photographic holdings of the Library of Congress within the past eighteen months; and (2) work that has recently produced a tangible product (books, scholarly articles, motion pictures, complex websites, online exhibitions, etc.) likely to be credited in part to the Library of Congress. The selection of interview participants was not

Figure 1. Specialized knowledge of photographs and photography



random but rather reflects the knowledge of the PPD curators about ongoing or recently completed projects. The findings of the interviews have no predictive power for the general population of the users of the Library of Congress or any other large digital collection. Instead the interviews constitute raw material for a rich set of case studies, where individual experience provides elements of a general model of expert use. The power of the research derives from the analytical methods.

The investigator chose the seven participants as potential components of a categorization model of expert use of digitized photographs. The emergent model is an adaption of previous research findings by the author [33], informed by a model of user types developed to supplement digitization guidelines developed by the Colorado Digitization Project (CDP). [34] Both the original Conway and the CDP user categorizations envision user populations with discrete roles and with distinctive characteristics and needs. The Conway model identifies four clusters: scholars (including students), avocational researchers, professional researchers, and personal researchers. The CDP model of users includes five groups that are similar to those of the Conway model: scholars, students, hobbyists, business community, and casual users. The principal factors distinguishing the three clusters of expert users are group affiliation, the nature of the product(s) generated by the research, and the rigor of the methods employed in the research project.

Figure 2 illustrates a synthetic model of expert users where roles are not discrete but overlapping, reflecting how multifaceted experience accumulates to create expertise and where a given research investigation may indeed serve multiple purposes for a given user. The model excludes casual users or researchers whose work does not involve the creation of tangible products. The model collapses students into the overall category of scholars. The figure locates the seven interview participants on the model in terms of their location after the completion of phase one of the interview process.

The seven participants vary widely in terms of demographic characteristics. Three are female; four are male. Their ages range from 30 to 67 years old. The participants work and live east of the Mississippi River in five separate communities. The curatorial staff of the PPD contacted each potential interview participant by email and provided with an overview of the research project prepared by the investigator. Follow up email correspondence by the investigator responded to questions about the research project and obtained permission for a first-phase interview.

Phase One Interview

A doctoral student research assistant conducted Phase One telephone interviews of approximately 45 minutes in duration. Each interview was recorded and the results transcribed. The phase one interview introduced the research project, obtained background information on the training and experience of the participant, and identified one or more potential ongoing or recently completed projects by the interview participant. Sufficient detail on each project was obtained to permit the investigator and the research assistant to assemble and analyze extant documentation on the project, prior to the Phase Two interview.

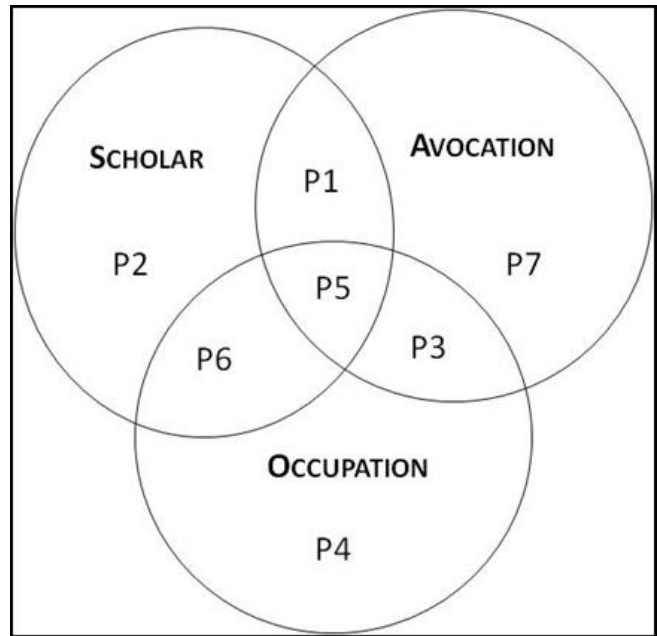


Figure 2. Interview Participant Categorization

Phase Two Interview

The investigator conducted individual face to face interviews with each of the seven participants. Each interview took place in the residence or office of the participant, chosen by the participant as the location where most of the investigative work took place. Each participant was provided in advance of the interview with a one-page general interview protocol that identified the topical areas and general order of the interview. Participants were asked not to prepare for the interview other than to read through the protocol document and to assemble any relevant documentation on the project that was identified in the Phase One interview. The length of the interviews varied from 2.5 hours to 4.5 hours. Each interview was recorded and the results transcribed for qualitative coding.

Each interview began by eliciting information on the background, training, and visual research experience of the participant and then worked in a semi-structured fashion through three major components: (1) self-assessment of expertise with photographic materials and digitized photographs; (2) overall decision making strategies for the identified project; and (3) an assessment of the visual, technical, and contextual characteristics of individual digitized photographs selected for inclusion in the project. Each interview concluded with an open-ended discussion of the participant's experience working with Library of Congress staff and in the online environment of the Library of Congress's collections.

The Phase Two interview made use of two data gathering instruments. The first instrument reproduced the Bruce model of photographic knowledge. Interview participants were invited to rate their own expertise for each of thirteen knowledge domains on a scale of one to three, where the highest score signifies expertise. In the interview, participants were given time to qualify their scores and explain why they chose a particular score. The second

instrument was used to elicit ratings of the importance of technical characteristics of individual images in the decision to use the image in a given project. For the initial three interviews, the instrument was applied to a mix of images chosen by the participant and the interviewer in sequence. For the final four interviews the instrument was used as a discussion guide to explore the importance of technical characteristics in a general decision-making model.

The analysis of the outcomes is proceeding in three stages. The first stage consists of the creation immediately after the interview of a journal entry that records summary impressions of the interview outcome and transcribes any numbers or proper nouns from notes that might be useful in transcribing the interview recordings. The second stage consists of analyzing the data recorded on the two interview instruments. The third stage, just getting underway, is an analysis of the interview transcripts using “grounded theory” methodologies described and promoted by Charmaz and others. [35]

The techniques in grounded theory analysis are an effective methods for extracting systematic knowledge on research

Initial Findings

In-depth interviews were completed only two weeks prior to this writing, so this paper presents findings on two topics derived from the interviewer journal entries, a first reading of four interview transcripts, and an analysis of the data instrument on photographic knowledge. Related findings will be reported at IS&T’s Archiving 2009 conference and published subsequently.

Validating Expertise

Six of the seven interview participants were able to complete the Bruce photographic knowledge instrument successfully, all of them with enthusiasm and great interest in the topics raised. The interview transcripts will yield a nuanced understanding of how experienced image-based researchers define the types of knowledge that are most useful in working with digitized photographs. In the interim, Table 1 reports the self-assessment ratings by the participants. Following Mitchell’s distinction between picture and image, the table groups self-assessments by knowledge particular to the material nature of photographs and by knowledge particular to the social/intellectual context of image

Table 1. Participant Self-Assessment of Picture-Image Knowledge

Picture Domain		P1	P2	P3	P4	P5	P6	P7	Mean
Antique Photographic Processes	Picture	2	1	1	1	3	3	1	1.7
Appropriate Techniques of Chemical Analysis	Picture	1	1	1	1	1	1	1	1.0
Characterization of Commercial Photo Materials	Picture	1	2	1	2	1	1	1	1.3
Documentation of Physical Condition	Picture	3	1	1	2	2	1	1	1.6
Optical Perspective	Picture	2	1	1	2	1	1	1	1.3
Physical Analysis of Photographic Types	Picture	1	2	1	2	2	2	1	1.6
Mean		1.7	1.3	1.0	1.7	1.7	1.5	1.0	1.4
Image Domain									
Biography of Particular Image Makers	Image	3	3	3	3	3	3	2	2.9
Characteristics of Particular Collections	Image	3	3	2	3	3	2	1	2.4
History of Art	Image	1	1	2	2	3	2	1	1.7
History of Photographic Equipment	Image	2	3	3	2	2	2	1	2.1
History of Photography	Image	3	3	2	3	3	3	1	2.6
Social History Relevant to Image Subject	Image	2	3	3	3	3	3	1	2.6
Working Methods of Particular Artists	Image	3	3	3	3	3	3	1	2.7
Mean		2.4	2.7	2.6	2.7	2.9	2.6	1.1	2.4

problems whose underlying theory is under-developed. The analytical technique identifies patterns of meaning through the iterative, line by line extraction of concept terms. This method is particularly useful for semi-structured interviews where participants are encouraged to use their own descriptive terms, instead of being prompted by the wording of questionnaires or other discussion guides. The term “grounded” refers to the process of developing testable hypotheses from the interview data itself, rather than using interview data to test pre-established theories. Given the relative weaknesses of visual-based user research, grounded theory provides for a great degree of analytical flexibility.

making. The table presents mean scores by knowledge domain and by participant.

The table shows clear distinctions in self-assessments between picture knowledge and image knowledge. The knowledge of users about the material aspects of photographs is barely above the minimum, on average. Expert researchers who work largely in the online environment have not mastered the complexities of darkroom processes present or past in order to choose and make use of digital representations. Participant 1 is a collector of particular photographic media and is most interested in acquiring artifacts in very good condition. Participant 4 is a formally trained photographer who is not presently practicing the craft. Participant 5 possesses a graduate degree in the history of photography whose

major interest is the context of the photograph's creation, rather than its technical properties.

Each of the expert users interviewed is working within the biographical constraints of individual image makers and this particular knowledge ranks high in all cases. The interview participants also have acquired and find extraordinarily useful knowledge of the historical and social context into which particular photographers or their subjects fit. It is important to note that only one of the seven participants is a formally trained historian pursuing research in which a theory of historical evidence is of paramount importance.

The seven participants varied quite strikingly in their experience working with original photographs that are central to their projects. Four of seven participants work exclusively with the digitized photographs. They have never seen or handled any of the photographs incorporated in their project; three of these participants have never set foot in the Library of Congress; one expressed surprise that physical access is even possible. The other three participants have made extensive and detailed use of the original photographs and state in various ways that seeing and touching the photographs is an important part of the project. In the course of the interviews, the participants were queried directly about the relevance of the 13 knowledge domains for the use of photographs as digital objects. None was able to articulate a single knowledge domain that applies more distinctively to digitized photographs than to the original artifacts themselves. Indeed, five of the seven participants noted explicitly that their ratings of self-knowledge applied equally to the artifacts and their digital representations. This tentative finding requires validation from the interview transcripts.

Modes of Visual Inquiry

One of the major goals of this exploratory research is to begin constructing a testable model of visual decision-making within the context of large and complex collections of digitized photographs. Initial findings from the interviews suggest that "mode of inquiry" could be a useful concept for integrating the visual components and the technical requirements of the digitized photographs selected for a given purpose. Preliminary analysis of four transcripts from Phase Two interviews yields three distinctive modes of inquiry.

Discovery: In the "Discovery" mode, expert researchers seek to obtain from individual digitized photographs visual information that no one has ever seen or noted before the discovery. New discoveries are judged and evaluated in the context of the community or communities within which the researcher shares information. Sometimes discoveries may be of general interest, but the communication of discoveries within the peer-group ["being the first one there"] is the primary value. The technical requirements for the discovery mode of inquiry exaggerate the importance of very high resolution. For discoverers, a digital image of a historical photograph should resolve the grains of silver in the negative or print before pixilation sets in. Discoverers are willing and able to manipulate the image data to reveal visual information possibly hidden in high density areas of the photograph. Discoverers privilege digital images created from original camera negatives and are indifferent to the polarity of the displayed version. Three of the seven interview participants (P1,

P5, P7) could be characterized as primarily working in the discovery mode, one exclusively so.

Storytelling: Expert users in the "Storytelling" mode of inquiry consider digitized photographs as pieces of a puzzle that when assembled in just the right way tell stories visually, evoke an emotional reaction from the community within which the stories are shared, and/or supplement the textual historical record in some substantive ways. Storytellers may pursue their work from a scholarly, occupational, or avocational perspective, or some combination of these three categories of experts. The image as a whole is the object of study, rather than the details of any particular piece of the image. Composition and emotional resonance of the subject matter as represented digitally take precedence over either the artifactual values of the original object or the explicit technical characteristics of the digital image. Cropping the borders of an original photograph in the process of digital conversion diminishes the value of an image more seriously than any other technical characteristic. More explicitly than researchers in the discovery mode, storytellers place significant value on the co-existence with the image of metadata derived from the original source photograph or from the photographer. Such metadata may prove ultimately to be partially inaccurate, but the combination of original description and a compelling visual image represented as a whole object define the point of departure for storytellers. Two of the seven interview participants (P3, P6) work primarily in the storytelling mode.

Landscaping: Experts working with digitized photographs in the "Landscaping" mode" view the image as a window on historical space and time. Digitized photographs may serve primarily as mnemonic devices, as illustrations for a primarily textual narrative, or as a lens on events and activities that took place beyond the view of the camera itself. Formal histories that treat photographic evidence as a point of departure for an archival record-based inquiry share the landscaping mode with research that may be focused on the social environment of the photographers, or their particular working methods. For landscapers, the context of the photograph or its sequence of creation carries more weight than either visual composition or any particular details evident in the photographs themselves. For landscapers, the source of the digital image (original negative, print, intermediate) is often secondary to the visual and technical context of multiple images. Such context is often derived from metadata associated with the images or physically scribed on the original photographs or negatives. For landscapers, the technical characteristics of the digital images become significant only at the point of creating a product whose technical requirements are strict. For example, a user may notice or care about the characteristics of the image when negotiating a book contract or transferring images for use in a documentary film. Two of the seven interview participants (P2, P4) work primarily in the landscaping mode.

Further Analysis

Each of the seven interviews conducted for this project is simultaneously data for the construction of a model of expert use and a situated case study in the development of an image based product that relies heavily if not exclusively on the use of digitized photographs. The next steps in the analysis of the gathered data involve the construction of seven highly structured case studies that expose the elements of the interview within the context of

specific projects. Each project examined is context specific in that it is grounded in the use of a particular subset of digitized photographs drawn from American Memory or PPD Online Catalog. Decision making strategies and image analysis techniques can be seen as intensely related to the specific nature of the project, but possibly representative of projects with a similar character.

The interview data and the associated documentation on each interview is raw material for the development of a model of expert decision making that takes into account both the visual character of images and the technical characteristics of the digitized photos themselves. Interview participants have used a variety of terms to refer to similar intellectual constructs. Grounded theory analysis enables the researcher to reconcile seemingly disparate concepts across multiple interview sessions.

This research project is just beginning to yield results. The greatest value of the findings may be the formation of a nuanced understanding of the use of visual materials by people who have made it their business/mission to be really good at what they do.

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