IMAGE RETRIEVAL AS INFORMATION SEEKING BEHAVIOR? SELF-CATEGORIZATIONS OF USER
MOTIVATIONS TO RETRIEVE IMAGES

by

Timothy Michael Schlak

M.L.I.S, University of Pittsburgh, 2007

M.A., University of Pittsburgh, 2006

B.A., Wittenberg University, 2001

Submitted to the Graduate Faculty of the

School of Information Sciences in partial fulfillment

of the requirements for the degree of Doctor of Philosophy

University of Pittsburgh

2010

UNIVERSITY OF PITTSBURGH

SCHOOL OF INFORMATION SCIENCES

This dissertation was presented

by

Tim Schlak

It was defended on

November 12, 2010

and approved by

Dr. Michael Christel, Research Professor, Entertainment Technology Center, CMU

Dr. Michael Lewis, Professor, School of Information Sciences

Dr. Jung Shun Oh, Assistant Professor, School of Information Sciences

Advisor and Co-Chair: Dr. Sherry Koshman, Assistant Professor, School of Information Sciences

Co-Chair: Dr. Daqing He, Associate Professor, School of Information Sciences

IMAGE RETRIEVAL AS INFORMATION SEEKING BEHAVIOR? SELF-CATEGORIZATIONS OF USER MOTIVATIONS TO RETRIEVE IMAGES

Tim Schlak, Ph.D.

University of Pittsburgh, 2010

The primary goals of this research were to: 1) determine how amateur users of images in web environments self-categorize their interactions with images according to four proposed categories—information seeking, illustrative activity, social activity, or leisure, and; 2) identify which search strategies users rely on to find images online according to motivation.

The sample consisted of 28 volunteers drawn from the School of Information Sciences. The study was conducted in a research lab in the University of Pittsburgh's Information Sciences building, where subjects were asked to complete a pre-questionnaire, five tasks using a web browser to locate and view images, and a post-questionnaire. They were also subsequently asked to complete a blog diary of their image retrieval activities over a period of three days. The data collected included pre- and post-questionnaires, video log transcripts, and diary data. The data was analyzed using quantitative analysis, descriptive statistics and probability values.

Findings of the study show that: 1) information as a motivation is the overriding reason amateur users engage in image retrieval; 2) the other motivations vary in importance and are not always clearly delineated categories unto themselves, illuminating more about the various contexts of each motivation, and; 3) search strategy is relatively even across motivation. The

research indicates that the context of the motivation may be shaped by whether an image is being sought purposefully (information and illustration) or less purposefully (social purposes and leisure) and whether it is being used as data or as an object, especially for information and illustration as motivations and to a lesser degree for social purposes and leisure. A spectrum of search strategy was uncovered ranging from illustration with the most directed, focused search strategy to leisure, the most undirected of motivations in terms of search strategy.

A schematic was developed to illustrate the dynamic relationship between the motivations and their contexts. It offers a way of conceiving how the motivations appear on axes of purposeful versus less-than-purposeful image retrieval and data versus object. The schema will make an important contribution by charting what is an otherwise completely unknown area of image retrieval.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The present study investigates amateur users' motivations to interact with digital images in online environments and situates the user in the contexts of their behavior and interactions with images. Image retrieval scholarship in Library and Information Science (LIS) has proceeded over the past three decades by focusing on the attributes of the image, the user's image queries, and less frequently until recently, aspects of the user and her behavior. This study takes a position different from the dominant stance in the field in that it questions whether amateur users actually may have reasons to pursue images online for more nuanced purposes other than 'retrieval.'

1.1 STUDY RATIONALE

Human production of images undoubtedly goes back thousands of years. Modern pre-occupation with "exact" photographic representations of the world, however, dates back to the height of the Industrial Revolution with the daguerreotype's debut in 1839 as the first commercially viable photographic technology. And thirty years later, once available to more than society's elite as a mere novelty, image-making technologies were harnessed to dozens of applications and thousands upon thousands of images were being made. As the technologies of

image production and the sheer number of images themselves continued to grow and evolve, concern for the organization of photographic collections and their promotion eventually arose as museums, art galleries, and libraries came to occupy prominent roles in the fabric of everyday life at the turn of the 20th century. With the phenomenal popularity of cinema in the 50 years leading up to WWII, television's postwar invasion of the home and the ever-widening influence of photography as a personal and public meaning maker, the last century in the West was indisputably a visual one. In David Nolte's words, "We live in a visual world, full of information transmitted by light" (2001, p. 1). Because of a similar rise in prominence on the part of the internet over a century and a half after the first photographs, our visual world is now served by faster, broader, and more laden channels for communicating visual materials.

As long as inventors have been pioneering new image making technologies, commentators have speculated about the image's place in virtually every aspect of modern life. In the academy, technical pursuits of the image have focused on improving access to these visual materials. Within the past 30 to 40 years, computer scientists and specialists in Library and Information Science (LIS) have developed robust ways of enhancing the retrieval of images. Some have sought to enhance the availability of images by improving on methods of organization while others have attempted to improve access via technological advances. The two groups concerned with access can be divided fairly neatly along their preferred approach to retrieve an image: by an image's contents or by concepts that the image may point to. On the one hand, Computer Scientists and increasingly, researchers in Information Science, have advocated Content-Based Image Retrieval (CBIR), which focuses on the automatic processing of lower-level features such as color, shape, and texture. On the other, scholars in Library Science

have traditionally sought to enhance retrieval by improving the methods and theories of image indexing and classification. CBIR is cost-effective but has long struggled with the retrieval of images via attributes that are typically of a lower-level than the higher-level queries users put to systems. On the other, image indexing often succeeds at a higher conceptual, it is not always cost effective on a broad basis as it is labor intensive (Lewis, 1976) and requires highly specialized subject knowledge.

1.2 BACKGROUND OF STUDY

The widespread adoption of digital technologies by libraries in the 1980s and 1990s spurred renewed interest in the indexing of images and by the late 1990s, a fairly robust scholarly investigation of the image and its indexable attributes was underway. Led by Corinne Jörgensen, a handful of scholars established a solid framework for discussing image indexing with strong emphasis on the image itself. Their primary concern was establishing the basic attributes of images and, borrowing from cognitive psychology, offered a number of frameworks for understanding the image and the ways in which it is and should be indexed.

While questions of the user and his behavior are not uncommon in the extant LIS literature on the image, only recently have scholars begun to focus on the user's relationship to the image, primarily where social tagging is concerned. Nonetheless, very little is known about the user and her motivations for encountering images in a visual, online environment. This somewhat overlooked area of image retrieval could bear significantly on related areas like CBIR and image indexing. Because a more complete understanding of the contemporary user and his

activities and behaviors could offer a new dynamic for understanding the image itself, the present undertaking attempts to situate the user in the well-established field of image retrieval. This study seeks to clarify certain aspects of how users interact with images and what that interaction tells us about users' motivations to interact with images and the strengths and weaknesses of image indexing's theoretical basis.

As one of a number of approaches to the organization of image collections, image indexing is aimed at providing intellectual access to images. Along with image classification, indexing is a traditional way of assigning descriptors derived from a vocabulary to the attributes of images. Because indexing is a complex, distributed process that relies on semantic precision, the need for intellectual control in image description is paramount (Jörgensen, 1998). Other terms that refer to the assignment of textual terms to images are "cataloging" and "classification," all of which are attempts to provide structure and meaning to collections by creating "a succinct surrogate for an item" (Jörgensen, 2003, p. 71).

With the exception of those by a handful of researchers, there have not been many recent scholarly investigations into concept-based image indexing; instead, most efforts are being made in automated and semantic image retrieval. Image indexing and its proven ability to facilitate retrieval have been largely overshadowed by progress in automatic image retrieval. Nonetheless, many questions from within LIS remain unanswered, particularly where the user is concerned. Besides attributes of images, questions of human perception (Jörgensen, 1996), how users' searching and browsing of images (often fail to) align with an indexer's expertise (Bates, 1998), or the suitability of textual models for visual information (Jörgensen, 2003) have not received sustained attention in the literature on image indexing.

1.3 STATEMENT OF THE PROBLEM

Relatively little is known about the user of images. Jörgensen reports that unfortunately, most development [in image access research] is 'system-driven' rather than user-driven" (2003, p. 6). Chen and Rasmussen (1999, p. 291) state that the problem inherent in image retrieval is that we do not know why "users search for images and how they intend to use them as well as how they pose their queries." Turning the attention squarely on the user, this research addresses what Jörgensen describes as the long-ignored fundamental question of the "needs of the users of these systems" (2003, p. 6). This study joins recent others, which have focused on the user and sought to expand notions of image attributes squarely in their investigations of images in visual, digital environments.

In an exploratory study of children's assessment of aesthetic relevance in selecting books from a digital library, Reuter (2007) discovered that preserving visual properties of books in a children's digital library rather than providing text-heavy descriptions and surrogates was crucial in sparking children's book selection. Another recent study (Cox, Clough, & Marlow, 2008) concludes that Flickr's Web 2.0 participatory nature has reconfigured the user behavior of amateur photographers, who are drawn into the site to participate in fluid social exchanges that transcend the restrictive orderings of traditional photographic clubs. Van House (2007) relates an ongoing empirical study that reveals that users of Flickr are using the platform for self-fashioning, including self-expression/representation and social communication. And McCay-Peet and Toms (2009) determine that the specialist user of images (historians and journalists) seeks images for informative or illustrative purposes.

Other studies on social tagging of images indicate that users tag for a variety of reasons, including search and retrieval but also to include an aid for reconstructing the memory and context of an image (Ames & Naaman, 2007) and that they are motivated primarily by social factors such as sharing (Angus, Thelwall, & Stuart, 2008; Marlow *et al*., 2006) rather than personal benefit (Golder & Huberman, 2006; Hammond *et al*., 2005). Regardless of the motivations to tag, the very shift to user-generated metadata marks a potential paradigm shift in not only how scholars in LIS approach the image (Jörgensen , 2007) but also in how users interact with visual media in online environments, a somewhat unknown but intriguing area.

Finally, little is known about the reasons users access images across a variety of platforms. Besides Flickr (Angus, Thelwall, & Stuart, 2008; Kennedy *et al*., 2007; Ames & Naaman, 2007; Matusiak, 2006) and select digital libraries, few image platforms such as the traditional text query of images or more recently, image browsing of social image collections, have been investigated for how users interact with the systems, what motivations push users to them, or how often or seldom they use various platforms to access images. For instance, we have a substantial collection of studies on the motivations to tag that Flickr users give when questioned. Yet if this platform indeed represents a paradigmatic shift in image retrieval—one that centers the user in the generation of not only content but of metadata—then it follows that scholarly focus should be turned to other platforms of interest where users interact in similar ways with images (e.g. Facebook). Given the apparent increasing and broadening nature of images and their uses in online, visual environments and the recent scholarly focus on user tagging, the definition of image "retrieval" may no longer be beholden to the traditional text-based model that has long persevered and had long been considered necessary (Lunin, 1994). A

comprehensive evaluation of users' interaction with images in an online web environment is necessary for a more complete understanding of how humans use images since system design, image indexing, and scholarly pursuits of the image continue to operate under a somewhat impoverished understanding of the user's behavior.

1.4 RESEARCH QUESTIONS

User search behavior may not necessarily be consistently aimed at locating images to satisfy an information need. Non-LIS Theorists of the photograph and image have long focused on these objects' ability to captivate, entertain, and mediate with little concern for the image as a carrier of information. Because it has traditionally been concerned with the retrieval of information, LIS has necessarily made the image comport with frameworks developed for text-based information (Jörgensen 2003). Recent research on the user has shown that new perspectives on the image may indeed be needed as users engage with images in ways different than texts and to different purposes. That users may be engaged in activities other than Information Seeking Behavior (ISB) when they are locating and viewing images is a previously unknown area of image retrieval and may hold important ramifications for the models we rely on for image retrieval. The research questions at hand then are:

Q1. Do users self-categorize their general motivations to interact with images as information seeking, as an illustrative activity, as a social activity, or as a less-purposeful pursuit such as leisure?

Q2. Do search strategies vary across motivations? That is, do users employ different search strategies (directed, focused search, an exploratory semi-directed search [browsing], a combination of both, or do they wander) as their motivations change?

1.5 DEFINITION OF TERMS

Digital Image: An image that is either born digital or digitized via scanning from an analog photographic form.

Digital Image Libraries: a general description for any online collection of digital images, including Flickr, digital libraries such as special image collections online, and social networking platforms where images are placed and perused.

Image: Images are visual representations projected on a flat surface. In the context of this study, images are understood to include digital photographs, digital scans or reproductions of other images, visual representations and depictions created by digital means, and possibly, stills from moving images.

Image Attribute: A feature or property of an image that can be represented by an information processing system (Jörgensen, 2003).

Image Retrieval: Image retrieval typically refers to the automated process of retrieval of images from a database by low-level image attributes such as color, shape, or texture. Less frequently,

the term refers to the set of indexing activities that facilitate the description of images at higher-levels of description.

Information Seeking Behavior (ISB): This "task-based" (Kim) activity grows out of a user's perceived "anomalous state of knowledge" (Belkin, 1983) or "vague dissatisfaction" over a knowledge or information "gap" (Dervin, 1983) that leads users to formulate an information need (Taylor, 1968). With this knowledge, users execute a search to satisfy that need. Broadly defined, this behavior is what a user does to fulfill or satisfy a perceived need for information (Krikelas, 1983). In the context of image retrieval, one study's (Hastings, 1999) definition of "intellectual access" neatly summarizes Information Seeking Behavior according to rather narrow parameters: the "image searcher's ability to find and use (retrieve) the image that meets a stated need" (p 442). In this study, ISB is occasionally referred to as **Purposeful Image Retrieval**.

Leisure and Less-Purposeful Activity: In opposition to Information Seeking Behavior, this hypothesized activity is conducted by those who pursue images in an online environment without the need to fulfill a well-defined information task. Leisure as a form of retrieval comprises users' motivations to interact with images in a digital environment when they encounter images but nonetheless do not or cannot articulate an explicit information need their activity would otherwise satisfy. The concept of leisure in image retrieval is a novel one and may serve to broaden the dominant research pursuits of LIS and CS scholars. While the last two definitions have been juxtaposed to form a clear apposition, users' motivations to pursue images online may be rooted in both classic Information Seeking Behavior and in what has been

elsewhere termed a "leisure activity" (Butterworth, 2006, p. 1) and what is here also to here as "less purposeful activity."

Motivation: the incentive that causes users to pursue an image.

User Image Behavior: This novel term refers to the user's activity, conduct, and basic interaction with digital images in web environments. While studying cognitive aspects of a user's behavior with images would certainly be worthwhile, this study limits itself to investigating a user's activity and how she or he categorizes it according to criteria proposed in this research study.

1.6 SIGNFICANCE OF THE STUDY

The image itself has traditionally been eschewed in critical circles as a source of information, but in Library and Information Science, it has been harnessed to models of textual information retrieval that emphasize its contents as a type of information. This worthy focus has produced laudable results, with Content-Based Image Retrieval (CBIR) and Semantic Image Retrieval emerging as the most promising retrieval tools to satisfy the perhaps billions of users viewing images online. CBIR has historically been concerned with what is technically possible (Jörgensen 2003) and not necessarily with the needs of users. Image indexing has focused quite singularly on the image and its place in organizational systems and schemes from early subject heading systems and to the most recent thesauri.

This research project attempts to determine the activities in which image users are actively engaged. The project aims to address whether our models have led to an impartial or

even inaccurate understanding of what users are doing with images in a web environment. If users understand and report their online activities with images as something other than purposeful information seeking, the dominant paradigm for understanding images in Library and Information Science may have to accommodate newer or hitherto unconsidered aspects of user self-awareness. And these findings could potentially bear significance for not only the work being done in image indexing and social tagging but also in CBIR. The relevance of how the user categorizes her purpose could have important ramifications for the priorities of both camps, even in their current but long-standing state of separation (Chu, 2001).

An awareness of how users categorize their uses of their online interactions with images would provide valuable insight into the limitations of current image indexing, which is being pulled in three distinct directions: 1) towards automated indexing via CBIR; 2) to social tagging by the myriad users interacting with their own and others' images in online environments, and; 3) towards traditional human indexing of images by librarians, archivists, and curators. Datta, Joshi, and Wang (2008) present an extremely rich review of recent automated approaches to image retrieval but their overview is confined almost exclusively to content-based works on image retrieval. Elsewhere Jörgensen writes that one of the recent advances in image retrieval is "the realization that progress [of the research agenda] depends upon the consideration of image indexing within a larger framework that includes the image, the system, and the user (2001).

Finally, I believe that a quantitative inquiry into the theoretical underpinnings of image retrieval can benefit by broadening the fairly technical base on which it rests. Recent explorations in Information Retrieval (IR) and ISB have sought to situate these two domains in

the various contexts in which they exist both inside and outside a laboratory setting (Ingwersen & Järvelin, 2005; Butterworth, 2006). The advantage these new perspectives bring to IR is their imperative to consider the situational nature of users' intentions, preferences, and varied backgrounds as they interact *dynamically* with information in real-world contexts. This study intends to take the first tentative step towards understanding the very contexts in which amateur users encounter images and their motivations for doing so. By doing so, a fuller picture of the user of images should emerge, one that will identify the rough contours of the reasons users give to find and retrieve an image.

1.7 OBJECTIVES AND SCOPE OF THE STUDY

This project proposes the following goals within the context of online user image behavior, to: 1) understand the general contours of human motivations to interact with images; 2) explore the contexts of possible motivations and how they relate to each other, and; 3) evaluate how users categorize their activities with images vis-à-vis LIS frameworks for working with the image. This study's ultimate purpose is to chart a new framework for understanding the user in the context of image interaction.

1.8 ASSUMPTIONS

People are increasingly encountering images in distributed social platforms besides just Flickr. While these platforms may be social in nature and not centered on image retrieval but instead

promote browsing, this type of image interaction is worthy of attention because images are taking on a social dimension in distributed networks that they have never had before. In addition, this type of image interaction may also be shaping how individuals' categorize their activity.

Another assumption this project makes is that aspects of user's behavior with images can inform our understanding of image retrieval. Image indexing and CBIR have traditionally been so concerned with the image that addressing aspects of the user that do not relate specifically to attributes of images and how users perceive them will necessarily produce a perspective quite distant to the traditional views on image retrieval. Chapter 2 then reviews the traditional literature on image indexing and image retrieval within LIS in the literature review in order to revisit it in light of this study's findings.

1.9 STRUCTURE OF THE RESEARCH PROJECT

Chapter 2 presents an overview of the general research on image retrieval, including image indexing and the nascent ancillary work on user image behavior. The chapter details how the literature on image indexing has steadily pursued a textual model for image indexing to the detriment of the user. As a counterpoint to the dominant textual paradigm of image retrieval, the chapter also discusses the ways in which contemporary, empirical research into the user has investigated questions of his behavior. In the third chapter, the paper turns to research design, including methodology, data collection, sampling, and data analysis. Much of Chapter 3 is formalized into operational measures in the appendixes.

2.0 LITERATURE REVIEW INTRODUCTION

This chapter introduces prior research into image retrieval with sources drawn primarily from

LIS. The review includes articles from outside LIS but nonetheless relevant to this project. The

major themes that this literature review traces are:

- The dominant trends in image indexing towards defining 'aboutness' and image

  attributes.

- The position of Semantic Image Retrieval vis-à-vis CBIR and Image indexing.

- The relevance of user tagging as a form of image interaction.

- Image queries, the user, and the emergent user.

- Germane developments in Information Seeking Behavior.

The chapter starts by considering the mainstream literature on image indexing in order to

explain how LIS has arrived at its current model of image retrieval. The literature review

demonstrates that image indexing has often been focused on the image and its attributes and

less often on the user, who is often included in investigations of images but rarely considered as

an integral part of the world of visual documents. Because the bulk of LIS scholarship on the

image concerns indexing, the review proceeds from the accepted and established concept of

image indexing in Section 2.1 to the newer directions brought on by Web 2.0 technologies as

discussed in Section 2.2. The overview concludes by relating the usefulness of work tangentially

related to image retrieval in order to provide in Section 2.3 a better understanding of the user

and her behavior in a web environment.

The methodological procedures that this study relies on (Chapter 3) are common to

concept-based image retrieval research within the LIS community. User studies employing user

testing in controlled environments have become the dominant model of scholarship since the

1990s. Most of these studies use qualitative, non-experimental, or quasi-experimental research

designs to answer questions about which attributes users focus on, which categories they

group images into, and the usefulness of homegrown classification systems for target

audiences. This research project is justified methodologically not only because it seeks to

broaden the LIS framework for image retrieval but also because it extends established research

designs to cover new areas.

2.1 IMAGE INDEXING

Image indexing is a traditional library activity that, like classification, is aimed at organizing and

providing access to documents. As one of the many practical activities of libraries, museums,

and archives, image indexing almost certainly grew out of an immediate need to meet the

various needs users put to image collections. The tools and guidance to emerge out of these

communities of practice are thus of a practical nature. The resulting literature had for years

emphasized the practical orientation of working with photographs and images and only within

the past two decades have abstract issues of images beyond those of specific systems like

finding aids or homegrown classification systems come to the fore. As this literature has

progressed, attention has typically been placed on understanding the subject of an image—

often called "aboutness"—and in the past decade, emphasis has turned to how formalized

notions of aboutness intersect with human categories of perception and, to a much less degree,

cognition.

Research into the various stages, strategies, and structures that humans use in

perceiving images dates back to the 1960s with the oft-cited work of art historian Erwin

Panofsky (1962), who identified three levels of image interpretations: 1) Pre-iconographical, or

basic object identification such as what the image is of (a round, red object may be an image of

an apple); 2) Iconographical, or ascribing meaning to an object by determining what the image

is about (assigning the judgment "nutritious" to the apple) and; 3) Iconological, the highest and

most difficult level of description that requires subject-level expertise (associating health or

temptation with the apple) and is nonetheless difficult to deploy in a classification system

because of the ambiguity of meaning.

According to an early influential treatise, these attributions of higher level meaning are

valuable (Shatford, 1986) but are the most difficult to convey in classificatory systems and are

typically overlooked in discussions of subject analysis. The terms "about" and "of" in the

context of image indexing were introduced even earlier, however, when Shatford adopted

Charles Cutter's *Rules for a Printed Dictionary Catalog* for visual materials (1984). To enhance

the structural integrity of the cataloging objectives she pointed out (i.e. basic retrieval concepts

like access and provision for images), she later developed a more rigid categorization of visual

meaning. By adopting pre-iconographical and the iconographical as domains for classifying the

concepts "about" and "of," Shatford translated Panofsky's principles from cognitive psychology

to the work of image classification (1986). The result of her work is one of the first faceted classifications, "not of pictures themselves, but of their subjects" (p. 48). While the classification schema apparently never caught on, it asks indexers to consider the "who, what, where, and when" of a picture's subjects and assign them to three potential categories of specificity ranging from individually named people and things to kinds of things and then to abstract notions such as emotions and symbols, the latter being the higher level attributes that are often overlooked in the indexing of images.

Turner concludes that these higher level attributes are too difficult to situate in classificatory systems (1993) and feels that responsibility for iconographical or "aboutness" and iconological levels lies with the user and not the indexer. Instead, he advocates restricting the extent of indexing done on images based on the user's possible needs, which even today are poorly understood. Naming significant and readily identifiable objects in pictures is sufficient for Turner, whose emphasis on the pre-iconographical level for most images leaves the iconographical for more complete types of images such as film and video. In Turner's subsequent work, he confirmed his earlier work with research studies that showed that pre-iconographical indexing is preferable to iconographical indexing (1994) and that user search terms and expert image indexing have a high level of agreement at the pre-iconographic level (1995).

Both Shatford and Turner delineate between two types of image collections: general image collections whose users are relatively unknown and special collections that have a familiar user group. For the former, more research is necessary and for the latter, their explanations of when to be specific and when to be general ("specific of" vs. "generic of") offer

preliminary practical advice to indexers, who are the focus of their work. Revisiting the question

of the needs of the user in general image collections is an objective of this research project.

Shatford also changed the lexicon of image retrieval (Shatford Lane, 1994) by

introducing the concept of "image attributes." Replacing the awkward phrasing "subject of a

picture" with "image attributes," she transferred the initial emphasis on an image or

photograph itself to the access of such items, a move facilitated in part by the semantic nuance

that "attribute" introduces with its proximity to both indexer, user, and system. This work was

also the first to argue for special approaches to providing intellectual access to groupings of

images, which Abebe Rorissa (2008) takes up over a decade later. This work issued a call to

action that has since been answered by numerous LIS scholars, who, like Shatford and Turner,

have typically concentrated on the image and its attributes to the exclusion of the user.

In her dissertation on image attributes, Jörgensen (1995) attempts to lay a preliminary

framework for determining which image attributes should be included in access systems for

images. Her results show that the indexing of literal objects is of the highest significance to

participants (graduate and undergraduate LIS students) while human characteristics like form,

the concept of location, and color are of somewhat less significance.

Her next publication (1996) on image indexing tests whether templates for image

description are helpful to indexing. While the results suggest more participant training may be

necessary because of limitations in the research design, templates may elicit a wider range of

attributes from searchers than spontaneous term selection generates. Moreover, she points

out that more research needs to be done into questions of human perception. Besides

attributes of images, how users' searching and browsing of images (often fail to) align with an

indexer's expertise (Bates, 1998), or the suitability of textual models for visual information

(Jörgensen 2003) have not received sustained attention in the literature on image indexing.

The majority of articles on image indexing describe subject indexing practices at libraries

and archives throughout the US. As one of a number of approaches to the organization of

image collections, image indexing is aimed at providing intellectual access to images. Along with

image classification, indexing is a traditional way of assigning descriptors derived from a

vocabulary to the attributes of images. Because indexing is a complex, distributed process that

relies on semantic precision, the need for intellectual control in image description is paramount

(Jörgensen, 1998). Other terms that refer to the assignment of textual terms to images are

"cataloging" and "classification," all of which are attempts to provide structure and meaning to

collections by creating "a succinct surrogate for an item" (Jörgensen, 2003, p. 71). While the

question to which this study responds specifies "image indexing," classification and cataloging

are used interchangeably in accordance with the larger body of LIS writing on the image. All of

these concepts consist of particular: terminologies used to classify; overarching justifications

and rationales for the form and choice of terminology, and; intellectual hierarchies and

structures that frame the terminology (Jörgensen, 2003, p. 70).

2.1.1 Tools for Image Indexing

One way librarians have continued to provide value is by adhering to structured vocabulary

tools, which are designed to provide consistent and uniform descriptive terms for images.

Variously referred to as thesauri, controlled vocabularies, classification schemas, and subject

heading lists, these tools represent orchestrated attempts to introduce consistency into the

often subjective nature of image indexing, which relies on notoriously unreliable human judgment. Indexers make semantic decisions about the contents, or attributes (Layne, 1994), of images and increasingly the "uses" and "contexts" in which images are implicated in their initial creation (Schwartz, 1995) and their subsequent, post-indexed use (Fidel, 1995). Jörgensen (2003) places these tools on a spectrum where early subject heading systems represent the first attempts at producing shallow hierarchies. Classification systems grew out of these to grant subject access but offer little in the way of specifying relationships. The thesaurus approach bridges these earlier attempts as a way of articulating the relationships between item and document.

With the sheer diversity of systems for controlling vocabulary in image indexing, it is no surprise then that the solutions libraries have chosen run the gamut from the options described above to homegrown systems that have been developed for fairly specific needs and collections (Davis, 1997). Hourihane (1999), whose work surveys subject matter access in numerous collections and thesauri across the country, found that the majority of libraries use in-house descriptions, a finding confirmed the following year by McRae (2000). In addition, Ørnager (1995) came to a similar conclusion in the use of in-house indexing languages in 13 newspaper archives in Denmark.

As these tools and research results indicate, image indexing requires accurate identification of subject matter (Shatford, 1986) and of attributes and descriptors (Jörgensen, Jaimes, Benitez, and Chang, 2001). Despite this critical attention to what aspects of an image merit consideration, there is still a disconnect between the user's non-expert subject searching and the indexer's expertise in image description (Bates, 1998). Concept-based indexing has

relied on both content attributes and perceptual categories, with preference given for content based attributes in the focus of research. One of the first studies (Jörgensen, 1996) to make determinations about how we perceive images and their attributes asked image users to label images as they appear on a screen found that the labels people applied can be grouped into three classes of image attributes: perceptual, interpretive, and reactive.

To complicate matters, the form of most classificatory systems is highly hierarchical in nature, a rigidity that provides, on the one hand, the necessary organization but, on the other, tends to scatter the data haphazardly (Jörgensen, 2000) or to limit the amount of data that can be assigned to an image (Hourihane, 1999). Although they come to different conclusions, all of these works show that indexing can and does happen at different levels with different vocabularies and different systems. This abundance of forms suggests that the image as a document in libraries, archives, and museums presents unique difficulties to those who struggle to make their retrieval systems effective.

2.1.2 Schema in Image Indexing

Attempts to formalize an approach to manual image indexing are numerous; the most well known of these are the Art and Architecture Thesaurus (AAT) (The Getty, 2009) and the Library of Congress Thesaurus of Graphic Materials (Library and Congress Prints and Photographs Division, 2007). These thesauri are adapted to manual image indexing, which is often conducted on a particular or local basis for both large and small collections and for both specific and general audiences. Part of the difficulty of implementing these thesauri is that reliable (Layne,

1994) and consistent (Markey, 1984) indexing typically requires a deep-level of subject

expertise, which, while it can provide much needed structure and consistency, is expensive.

While not developed to be a complete descriptive tool like the above thesauri, the

Visual Resources Association Data Standards Committee's *VRA Core* (*Version 4.0*) grows out of

The Getty's *Categories for the Description of Works of Art*, a sister project to the AAT. Similar to

z39.50, *VRA Core* is intended for sharing information about items of visual culture. It can be

expanded as needed by extending fields. *VRA Core* has recently been mapped to other

metadata standards, although it is still hampered by its original development for the art field,

which necessitated numerous elements for surrogates. Dublin Core is occasionally applied as a

schema for image indexing but the broad nature of the general elements are often too vague to

apply them to specific types of information, including images (Winget, 2002). Its limitations to

visual resources likewise stem back to its developers, who intended it simply for "describing a

wide range of networked resources" (Hillman, 2007).

Greenberg (2001) suggests that Dublin Core, *VRA Core*, REACH (Record Export for Art

and Cultural Heritage), and EAD (Encoded Archival Description) can be used for classifying and

labeling images. The study focused on schema granularity and the categorical distribution of

elements in the examined schemas. It also demonstrated how the total number of elements

per schema (15 for Dublin Core to 60 elements for EAD) support the four goals of metadata—

discovery, use, authentication, and administration of images as information objects. By testing

the level of exhaustion each schema demonstrated in an image indexing experiment, she

determined that while the proportion of elements found in each class or category varied, each

schema contained elements that support the four goals of metadata and as such raise

questions about the "artificial domain barriers for images" and support further research into developing a class-oriented metadata schema for images.

Despite Greenberg's findings, solutions like these often encounter problems when they are implemented on a local level. Myriad other issues arise when researchers consider the image inside the discipline of art history, which has a stake in image indexing. Roberts (2001), who credits AAT as a controlled vocabulary that grew out of a consensus of art history, acknowledges the difficulties of indexing art images: low-level CBIR is inadequate as it ignores vital information like basic identification and leaves historical information untouched; verbal descriptions are poor surrogates for the image while purely visual surrogates are likewise inadequate as they cannot capture historical information. And nonetheless, the databases that both camps offer struggle to provide image indexing that transcends the image to encompass concepts about the image.

Jörgensen, whose earlier work focuses on both the issues above and more specific questions of image attributes, later takes a more systematic approach to image indexing and classification. Her conceptual framework (2001) offers a visual, pyramid structure for classifying visual content attributes. Working off a large body of previous research, much of which is covered in this literature review, Jörgensen *et al* attempt to work through the complexity of indexing images with a schematic approach that visualizes a pyramid approach for classifying visual content attributes.

In order to account for the various levels of information in an image, their pyramid is divided into one category for the objects in an image—the semantic level—and one category for various other types of information such as color—the syntactic level. As one works down

from the peak of the pyramid, each level gives way to a wider level of attribute abstractions that can accommodate the level of generality or specificity of an image attribute. Preliminary results from a small indexing study indicate that the pyramid can accommodate a wide range of image attributes and possible search terms users may deploy to locate images. The study, however promising and robust, was apparently never developed further, so its viability as a superstructure that could be erected over an image indexing template (i.e. a tabulated schematic that defines metadata categories as entry points to image attributes, which are mapped to specific Pyramid levels) remains unknown.

Over the past fifteen years, numerous attempts at theorizing and formalizing image descriptions have occurred, the end result being a variety of systems, recommendations, and frameworks for image indexing. As image retrieval has gained a large context with image retrieval on the web, the need for standards remains as acute as it did in 2004 with Kherfi, Ziou, & Bernardi's (2004) call for standardization of image descriptors for web usage. Recent forays into image indexing have begun to turn attention on deficits and unknown areas in the field.

2.1.3 Developments in Image Indexing

Jörgensen lays out an ambitious research agenda for both Computer Scientists and Library and Information Science scholars in the conclusion of her 2003 monograph *Image Retrieval*. Issuing a broad call for research in practically every domain of image retrieval—including image perception and understanding, image indexing and classification, searching for and using images, and machine parsing of images—she shows the current needs felt by researchers in the

field to be acute. Several studies have recently met this challenge by addressing both the nature of visual similarity and human perception in the context of categorization.

Continuing the research into image attributes, Rorissa and Hartings (2004) investigated how people categorize images and assign them to categories in order to determine which types of attributes can be used to index image categories. Their results indicate that interpretive attributes are more likely candidates than perceptual attributes for the naming of categories into which users place sorted images. That is, interpretive attributes, or those that transcend the physical characteristics of an image to require more than basic perception to articulate or identify as defined by Jörgensen (1995), are better candidates for indexing categories of images for browsing than perceptual categories, which reflect objects, color, visual elements, and other basic physical attributes. Hollink *et al* (2004) confirm these results but come to a slightly different conclusion via their own user testing. Their results, based on an empirical study, suggest that users prefer giving general descriptions for images as opposed to specific or abstract descriptions.

Rorissa (2007) identified that both Information Retrieval (IR) and image retrieval lack an investigation into human similarity judgments. By testing Tversky's contrast model, which is based on a dichotomy of distinctive and common attributes where similarity is a measure of common attributes, this study demonstrated that a combination of common and distinctive can predict the similarity of features. The potential significance of such a study is that it would lend itself well to the development of document representation methods in a functional information retrieval environment. This work confirmed several other studies that manifest a preference for

interpretive versus perceptual attributes for categorizing images (Greisdorf & O'Connor, 2002; Laine-Hernandez & Westman, 2006).

Rorissa's most recent works return to image categorization. Like his 2007 study, two later studies (Rorissa & Iyer, 2008; Rorissa, 2008) apply basic level theory to image categorizations at the group level. To test the level of abstraction that individuals might use when labeling groups of images, whether at the subordinate, basic, or superordinate, they had users group images and then select a prototype image representative of the rest. Results indicate that image category labels typically belong to the superordinate to basic level and are interpretive yet generic.

These studies suggest that Jörgensen's research agenda (2003) is valuable as a guide to identifying and rectifying gaps in our knowledge of image retrieval, particularly within LIS. Yet it is only recently that her challenge to better understand the user and the user's needs has been heeded by those working in concept-based image retrieval. The next section reviews some of the literature on Semantic Image Retrieval, which is relevant to this study in its attempt to deal with the shortcomings of traditional image indexing.

2.2 SEMANTIC IMAGE RETRIEVAL

Semantic image retrieval is an in-vogue and promising aspect in image retrieval. As a type of hybrid of content- and concept-based image retrieval, the semantic approach has emerged as a way to bridge the semantic gap between the low-level features CBIR can easily extract and the higher level features users rely on to search and browse images and that only human indexers

are able to impart as metadata. As Enser and Sandom point out, there are actually two sections to the semantic gap that must be bridged (2006). The first exists between feature vectors in which CBIR algorithms transform digitized raw images and the interpretation of those images as generic objects that require labeling. The second is the "conceptual distance between object labeling and the high level reasoning which situates those objects appropriately within sociocognitive space" (2006, 469). Unfortunately, like the current status of the relationship between CBIR and concept-based indexing, only the first section is being addressed by researchers (Hare *et al*, 2006).

Enser and Sandom (2003) made an early attempt at a comprehensive conceptualization of the user as a means to bridge the semantic gap. Operating under earlier assumptions about the semantic gap as a lacuna in the scholarly landscape (as opposed to a gulf that separates two remote shores as it is coming to be understood), they typify users and images according to the various classes. Images are classed as documentary—general purpose, documentary, special purpose, creative, or model—while users are categorized into specific professions and matched according to image type. While there is no accompanying study or supporting data, their proposed framework represents a similar way of categorizing aspects of users (here, types) that is relevant to this project in its attempt to consider the user according to his behavior.

Only by sustained efforts on both aspects of the gap can satisfactory retrieval occur (Zhao & Grosky, 2002). With the hype around Tim Berners-Lee's (2001) concept of a "Semantic Web" still fresh, ontologies have emerged as one possible solution. According to Hare *et al*. "[t]he aim of using ontologies to describe multimedia resources is to provide well-structured information to improve the accuracy of retrieval. Semantic web technologies also facilitate the

integration of heterogeneous information sources and formats" ("Bridging the semantic gap,"

p. 6). The real promise of semantic image retrieval may lie in the next generation of the World

Wide Web. Should Berners-Lee's semantic web come to fruition, image descriptors can be

embedded in metadata schemes that are understandable by both humans and machines (Enser

& Sandom, 2006).

Moreover, a glance at all the literature on user-centered image tagging is sufficient to

realize where the intellectual activities of image indexing scholars have been focused. With the

rise of Web 2.0 technologies, tagging and user-generated content have become hot topics. The

research is also inherently more user-focused, an aspect of image retrieval that has not been

given the attention CBIR has received.

2.3 A NEW(ER) PARADIGM? TAGGING, FLICKR, AND IMAGE INDEXING

Flickr is the prototypical image sharing site. Best known for allowing users to upload their own

photos to the web, Flickr allows users to engage in "social tagging" of their own content and

that of others. It is also the new focal point for researchers of image indexing as the locus of

tagging has shifted from system to user. The new focus is centered on social tagging, an activity

known as collaborative tagging, folksonomy, or social indexing and classification. Turning the

tables on traditional indexing by making indexing a democratic and distributed process in which

anyone can engage, some have welcomed this phenomenon as a new paradigm in the larger

context of Information Retrieval (Shirky, 2005).

Popular sites for tagging include various types of media: *Del.icio.us* is the premier site for social tagging of textual online content; *Last.fm* allows users to tag songs, artists, albums, and even tracks; Y*ouTube* allows users to tag videos they upload, and; *Flickr* gives all registered users the opportunity to tag images hosted on the domain. Over a decade ago, O'Connor *et al*. (1999) investigated the usefulness of user supplied reactions to images as an access mechanism for images. They concluded that moving away from systems with image representations being accomplished in advance of the user querying the system would open new avenues and more possibilities to make documents known. A number of years later, indexing systems predicated on the notion of flexible and ongoing representations of images are now common on the World Wide Web. A novel but intriguing idea is that of Extra Sensory Perception (ESP) Game, which asks users to compete with one another as they assign descriptors to images (Von Ahn & Dabbish, 2004). With the obvious opportunities and implications for improving search by harnessing all the tag data users are ceaselessly associating with online content, these developments also raise a number of questions and concerns about the practices and beliefs long-held by those in the indexing and classification community.

2.3.1 Tagging and the User

Despite this new paradigm's promise to shift indexing away from an exclusive reliance on expert activity, Rafferty and Hidderley (2007) explore the concept of democratic indexing (i.e. user-oriented or user-generated indexing) yet relate the suspicions of information professionals who feel that self-organizational schemas like tagging are not sufficient enough to overcome their total lack of vocabulary and element control. Democratic indexing opposes traditional

expert central models of indexing by introducing a *dialogic* (i.e. in the Bakhtinian sense of a voice that carries on a dialogue with other works, parties, voices, etc.) dynamic that situates the indexing warrant in the silent agreement of users and their interpretation of images rather than in *monologic* fashion (i.e. a one way dialogue that cannot accommodate user contributions). The real boon that democratic indexing offers is that it offers a semantic flexibility to indexing that traditional indexing fails to offer. As users update tags to reflect changing meanings and the new uses to which images can be put, a system of indexing that can update a "historically contingent public view of the meanings attached to indexed documents" emerges as a viable and cheap alternative to the stable but expensive practice of expert-led indexing (p. 407).

Previously, where the bulk of image indexing was conducted by experts in hierarchical structures, social tagging has shifted the indexing of images to highly distributed and democratic platforms that encourage users to interact with images in more ways than search. The primary focus of tagging research focuses on motivations for and patterns of tagging, its relevance to search, and how users employ tags for their purposes. Motivations for individuals to tag include its help in search and retrieval of personal photos, its ability to facilitate memory and context, making photos findable by others, and social communication reasons like providing context about photos for friends and family (Ames & Naaman, 2007).

Moreover, tagging patterns of university groups on Flickr tend towards responsible and utilitarian use (Angus, Thelwall, & Stewart, 2008). Kennedy *et al* showed that community-contributed collections can be mined to accumulate knowledge about the world by extracting geographic labels from photos so users can view landmarks of areas in Flickr (2007). Bischoff *et al* demonstrate that a large percentage of tags for music, text, and image data are reliable and

can be used for search (2008). Another study shows that, on the one hand, tagging renders indexing terms into the language of users but, on the other, user-generated tags vary widely in their level of description, consistency, and accuracy and thus "do not provide a solution to the challenges of image indexing" (Matusiak, 2006, p. 283).

With the power of Web 2.0 to drive their uses, images are now being tagged as fast as they can be produced, and their larger cultural and social impacts are no longer irrelevant to library and information science. Our activities with images force them into paradigms of authority and control, which experts still feel is necessary (Raffertey & Hidderley, 2007), yet only in the paradigm of search as after-the-fact artifacts of human activity. The changes in digital image technologies have made every denizen of the cell-phone age a photographer, an indexer, and a viewer. Prior to tagging having emerged as the dominant new direction in image classification, one alternative to hierarchical image indexing proposed was the use of richly interconnected subject terms that are representations of common-sense activities (Gordon, 2001). Confirming Batley's work (1988) from over a decade earlier that users need more than one avenue of searching, he proposes browsing through links between subject terms, which can be patterned on representations of everyday activities (e.g. riding a subway, taking a shower). The relevance of Gordon's work to image indexing post-tagging is that the emphasis he places on alternatives to the relatively narrow search processes of the time grows out of an assumption that users are capable of more than one type of searching.

Indeed, people are doing far more than searching for images as information, and in the process, the popular notion of images may indeed change. Burnett states that: "To varying degrees, I believe that images are not just products, representations, or copies of reality.

Images are not the by-product of cultural activity. They are the way in which humans visualize themselves and how they communicate the results." (p. 10). What we may be standing on at the moment, then, is a paradigm shift from our traditional model of image indexing to something new; "the current paradigm is controlling the production and practice of indexing, rather than eliciting new types of indexing behaviors and new participants in the process" (Jörgensen, 2007, para. 18). Because image indexing is gradually yielding to change as images acquire an increasingly social dimension, the user of images should be a major focus of researchers in Library and Information Science.

2.4 NEW DIRECTIONS

Still other studies have focused on less traditional aspects of image retrieval. These new directions explore various aspects of the user and have little to do with user tagging. Although the attention focused on user tagging is beneficial, a subtler groundswell may be afoot. Users are engaged in more than search in social tagging platforms like Flickr. Because of our long-standing focus on the search process of image retrieval, we have ignored uses and functions of images as more than just data points that offer appeal to users as an information need that seeks fulfillment. One of the more prescient voices writing on images in digital culture argues that "[o]ne of the great errors of the modern concern for interactive technologies is the failure to understand the pure and unadulterated pleasure of simply allowing images and sounds to be in control—allowing the process to take over as in a dream" (Burnett, p.10). Applied to the context of image retrieval, these words point to the overall fixation on the image and the

myriad ways of assigning it value in a schema as a technical panacea. By relying on the image's

contents, features, and attributes as the sole factors in approaches to image retrieval, we have

assumed that users of images exist in the real-world as they do in our laboratories and are

solely interested in searching for images out of one motivation—the need to inform themselves

with visual information. Recent endeavors outside of image retrieval, however, have challenged

some long-held assumptions about the contexts in which users search and their motivations for

searching in those (potentially different) contexts.

2.4.1 Relevant Developments in Information Seeking Behavior

Butterworth (2006) looks at those who research their genealogy as a leisure activity to draw a

contrast with the users typically reported in Information Seeking and Retrieval (IS&R) literature.

While somewhat anecdotal, the research finds that motivations for search are not as explicit as

an "academic satisfaction" such as discovering some new fact but rather have to do primarily

with pleasure (p. 1). Users displayed a notable lack of intensity in researching their family

histories, leading Butterworth to conclude that it is difficult to apply the traditional IS&R

mechanisms. What makes Butterworth's research so attractive to this study is its assumption

that most information systems that are presented in the academic literature are designed in an

academic setting for users "for whom information seeking and retrieval is part of their

profession" (p. 1). The obvious critique here is that research design should necessarily attempt

to sample a population of actual users. Yet the subtle implication is that while information

seeking is within the context of the activities of university-level users, a new understanding of

the contexts in which users search is needed for better understanding IS&R.

A slightly earlier and much more comprehensive work (Ingwersen & Järvelin, 2005) provided the intellectual ground on which Butterworth stands. Ingwersen and Järvelin's monograph makes a complex and substantiated argument that IS&R must be broadened from its singular focus on a laboratory, algorithmic setting to encompass models for analyzing the context in which users undertake information tasks. Furthermore, they reason that since users' interactions with information systems are usually quite complex, information systems should be modeled on a more sophisticated architecture than one user on one information system with one simple task devoid of context aside from artificial search tasks designed for laboratory use. To them, "it seems prohibitive for the development of IR research if the IR community continues to consider the Laboratory Model in isolation of context (p. 3)"

2.4.2 Context and the User

As their arguments are germane to Information Seeking and Retrieval, the substance of their text deals heavily with technical concerns distant to image retrieval, but the general thrust of their accusation is relevant to the work done with images. Researchers of the image have made similar, oftentimes tacit, assumptions about the needs and motivations of their subjects by simply ignoring users and the possible contexts in which they operate (Jörgensen, 2003). More recently, however, several articles have emerged that investigate the purposes and ends to which users put Flickr, the most popular Web 2.0 image sharing and viewing platform.

These articles show that users are engaged in more than search when they pursue images in an online environment. One study investigates photographic hobby activities on Flickr as a form of "serious leisure that assumes a form and purpose for amateur photographs similar

to photography clubs of old" (Cox, Clough, & Marlow, 2008, para. 1). Starting with a rather surprising cultural theorist of the image—Susan Sontag—the authors carried out telephone interviews with at least 50 active Flickr members from a particular Flickr group and compared their responses to a randomly chosen sample of 50 Flickr users. While the cultural critique they offer is less relevant to this project, one general conclusion that they draw is: "because one is not generally searching for an image as such. Purposive searching would imply a specific information need, such as for a photo of a cat on a fence, and Flickr is probably more used for browsing" (para. 34). They go on to locate the main reason for Flickr's impact on the proliferation of images on the World Wide Web in its ability to draw people to photography as a serious hobby.

Less thorough is a slightly older study that postulates that Flickr is used for "life chronicling," or users keeping friends and family apprised of developments in their lives and happenings in their larger social circle (Van House, 2007, p. 2721). This study was conducted in order to determine what "ordinary" users do when they are given the opportunity to incorporate images in their everyday activities (p. 2717). The author finds that: users view their images as temporal or non-permanent means of self-expression and self-representation, and that they use the site to sustain close relationships by keeping others informed about their own lives. Although what Van House means by "ordinary" and how self-expression differs from self-representation may be unclear, her attempt to contextualize Flickr in the lives of users is an important step toward a more robust understanding of the user and her needs.

Van Dijck (2008) takes up the question of self-expression and self-representation that Van House leaves unclear by theorizing about the mutability of expressions of self via the

suddenly widespread medium of digital photography. Reasoning that digital photography has altered the landscapes of communication, identity, and memory, Van Dijck asserts that: 1) image sharing is not so much about sharing an information object but about sharing an experience; 2) the digital camera is a tool for fashioning personal identities, which are well-suited by the ability to continually recast ourselves and alter our own appearances, and; 3) visual memory is now as much a function of distributed storage as it is of personal recollection. This article is important in the context of this project in its insistence that the functions of images in distributed, online systems are changing and thus have an impact on how we understand the very concept of images, users, and systems. These concepts are more diverse and complicated than ever before, and yet our picture of the user's motivations to interact with images remains somewhat outdated, modeled on assumptions based on Web 1.0 architectures and developed according to IS&R's singular focus on task-based search.

The use of images in the context of social networks represents an even more distributed use of images to both construct a social identity online and chronicle one's own experiences. Examples of social networking sites include MySpace, Facebook, LinkedIn, etc. This aspect of the use of images involves both tagging and commenting in highly social and often localized networks that span the globe where tagging and commenting are ways of interacting with digital images. As of yet, few studies (Li *et al*, 2007; Naaman, Harada, & Wang, 2009) on either the users of images or images themselves in these platforms has been published. This lack seems rather odd as the social nature of Flickr and other Web 2.0 sites seems to be the impetus to study these image sharing sites, and none offer quite the dynamic social configuration that these social networking sites offer. And as the possibilities for the user to interact with images

increase as new Web 2.0 tools become available, so too do the contexts in which users find themselves needing to locate and view images.

2.5 IMAGE QUERIES AND THE USER

A large handful of articles has looked at user requirements, users' relevance criteria, and users' queries in a variety of contexts. These articles appeared regularly in the literature until recently, when this type of research seems to have given way to the new focus on image tagging. A number of these articles are about specific image collections—termed "archives" in several works—and represent a modest attempt to discover more about the user.

A trio of articles (Ørnager, 1994, 1995, 1996) on archivists clarification of journalists' requests for photographs determined that half of requests were of the simple kind and dealt with people as to the contents and the other half concerned themes in the images. Only ten percent of the requests were deemed complex, meaning that they required a follow-up interview. Westman and Oittinen (2006) return to journalists as a source of data a decade later and conclude most image queries deal with specific entities within a system. They also determine that some typologies employed in earlier research were too narrow to capture image needs in a newspaper context.

One such article (Armitage & Enser, 1996) presents a general categorization of user requests for images and moving images. Because it is based on the results of image queries from seven image collections, the report offers little in the way of insights into user behavior and motivations and contributes little to our understanding of user need. Rather, like many

other projects, it suggests that a schema of levels of meaning in images can be implemented into a user interface to promote better retrieval. Keister (1994) demonstrates that although differences in the queries of image scholars, health professionals, and general academic communities do exist, catalogers should pay particular attention to concrete image elements (i.e. the contents of a photo) since these comprise a significant proportion of picture requests.

Recognizing that little is known about user needs and their behavior when searching for images, Markkula and Sormunen (2000) confirm that browsing is important when searching for images in an image archive, so important that they equate it to querying or searching in terms of the prominence it should receive in the user interface for an image archive. They also report that image selection criteria depend on the particular work context, which they discovered were difficult to predict in indexing.

Batley (1988) identified four different search strategies used by university students, schoolchildren, and library staff: seeking, focused exploration, open exploration, and wandering, which Jörgensen (2003) notes parallel Bates' berry picking observations on textual information seeking behavior. Seeking approximates factual search, focused exploration is a narrow form of directed browsing, open exploration is a more open form of directed browsing not beholden to a particular focus, and wandering is undirected and unspecified. Hastings later introduced three types of search styles for images: subject searcher, browse-searcher, and text-searcher. Subject searchers rely on a preconceived classification scheme in which they use text to aid in the identification of objects. And text-searchers locate images primarily via textual information.

Chen (2001) compares user queries to those features identified in earlier studies by Enser and McGregor (1992), Jörgensen (1995) and Fidel (1997). The new image queries collected by the author were professionally mapped by outside reviewers onto the previous schemas employed by these authors. The findings indicate that while there still exists a gap between the terms a user puts into a query and the indexing terms chosen by the system designers, better design of the user interface may help users clarify their information needs in order to submit terms with more representation in a system.

Fidel's (1997) contribution to image retrieval is significant in the context of this research study. Theorizing that there are two main uses of images, Fidel postulates that when viewed as data, images are a form of information on one side of a spectrum. At the other side of the spectrum, images are viewed as objects when they are needed for illustrative purposes.

Goodrum and Spink (2001) also present their findings about image queries, but their data sources were search logs from the Excite Web search engine. They provide an impressive amount of statistics synthesized from their data and report on: 1) the number of queries and number of search terms per user; 2) image search sessions, which are measured by the number of queries per user and modifications made to queries, and; 3) image terms and the rank/frequency distribution of terms and the most frequently used terms. This study is one of the few that was completed at a time when search engines were willing to distribute their server logs, so it is valuable in presenting information that is now unavailable to the average researcher.

The sole piece of research to question users' relevance when searching for images was Choi and Rasmussen's (2003) investigation into the criteria for relevance that users report when

making relevance judgments about an image. They found that topicality was the dominant factor across all information-seeking stages but that after the search it decreased in importance as other factors such as novelty and accessibility were elevated in the user's assessment of relevance. In addition, users reported that image quality and clarity are important in terms of relevance.

Cunningham, Bainbridge, & Massodian (2004) analyze a set of queries to determine the attributes people provide to the Google Answers 'ask an expert' reference system. They use grounded theory to break down queries by a description of information needs. Metadata such as the creator of a work or date of creation trump other descriptions such as genre, color, or abstract, to name a few.

Jörgensen and Jörgensen (2005) make an interesting discovery after analyzing search logs for image queries that were submitted for a one-month period. They determined that while Boolean searching is employed very heavily by users it is largely ineffective and leads to much query modification, which to them appears not to be very thought out and largely experimental in nature. The authors recommend more support for query modification so that users gain the ability to interact with their searches in a more effective way.

In terms of system effectiveness, Al-Maskari, Clough, and Sanderson (2006) conclude that there is no direct relationship between an image retrieval system's effectiveness and the user's perceived level of happiness with it. They show that users tend to adapt to a system no matter its effectiveness.

An older study (Greisdorf and O'Connor, 2002) that nonetheless remains unique tests earlier assumptions about the user's reliance on image attributes that held that the viewer's

percepts correspond to color, shape, texture, object, location, action, and affect. Surprisingly, they found that content-based percepts (color, shape, and texture) were not used in image description by users when not given prompts. Rather, they found that users preferred more abstract categories such as object, place/location, and affect/emotion. Based on their results, they recommend that databases be constructed with more affective points of penetration besides content-level attributes.

One of the most recent studies (Pu, 2008) on users' image queries analyzes failed image queries (queries that produce zero results in a retrieval system) and finds that failed queries are of a much higher level of specificity than successful queries. Failed queries are often much longer in terms of text length than successful ones and that they are likely to be more of a conceptual (i.e. abstract, affective, emotive, etc.) nature than perceptual (object level) nature. This study's merit echoes this project's in that both strive to understand more about the nature of image users and their requests.

2.6 THE EMERGENT USER

A handful of studies have emerged in the last several years, however, to shed light on issues of users' behaviors, needs, and relevance criteria for searching for images. Cunningham & Massodian (2006) investigate what they term "everyday, casual image information behavior" (p. 198). They break image information needs down into four categories: 1) specific needs; 2) general, nameable needs; 3) general, abstract needs, and; 4) subjective needs. They point out their preliminary findings based on their research. Browsing was the primary strategy for

satisfying information needs. The number of images necessary to satisfy an information need were as follows: 6% returned no appropriate image; 50% ended in the selection of one image; 24% of the searchers retrieved more than one image, and; 20% were satisfied by simply viewing the images but not downloading them.

A recent dissertation (Beaudoin, 2009) that investigates an area of image retrieval very close to this project's domain examines users' image needs across four different disciplines: archaeology, architecture, art history, and art (creators of works of art). The study's primary focus was the information needs that drive professional users to seek images and the basic details of their image users' behaviors. Needs were shown to be dependent on work tasks, which naturally varied across specialization (academic creative users, creative image users, etc.).

While this project shares common intellectual ground with these approaches, it differs in questioning the assumption that users perceive their activities inside the category of information retrieval. For instance, Beaudoin is currently studying users' image seeking behavior and needs in a professional discipline-specific context in order to determine the information needs that drive users to seek images. Moreover, Cunningham & Massodian deconstruct image information need as a tiered category that moves from specific to abstract and subjective. This is a useful decomposition of information need, but it does not consider any wider user's self-categorizations of these levels of specificity themselves, so they are merely presumed to reflect subcategories within the larger imposed category of information need.

A recent study that shares common intellectual ground with this project is an investigation of image use within the work task model (McCay-Peet & Toms, 2009). Thirty

journalists and historians were interviewed about their image uses in academic contexts; the uses were mapped to work task stages (à la Chu and Toms & O'Brien), which include idea generation, preparation, elaboration, analysis/writing, and dissemination. The primary determination the authors sought was whether images were used for information or illustration; accordingly, which types of attributes (conceptual vs. descriptive) are most helpful at each work task stage. Information use is defined as using an image for the purpose of providing information to an individual while illustration is identified as the use of images for illustrating some aspect of a written text. The results indicate that 60% of participants report that they use images primarily for illustrative purposes, 16.7% report they use images primarily for informational needs, and 20% indicate they use images for both. They were just as likely to rank conceptual attributes as important as descriptive attributes.

Most importantly, however, they demonstrated that professional users seek out images for the purposes of illustration as objects needed for a work context whereas for information purposes users view images as data needed for a work context. This study provides a suitable initial exploration of users' needs as confined to work task stages. This research study builds on this work by expanding the framework to include everyday uses of images, particularly in how this project explores the contexts in which amateur users seek out images. Accepting their conclusion on images as object versus data, this study attempts to clarify the contextual purpose to which images are put for social and leisurely purposes along the spectrum of object and data. In addition, it proposes a novel divide between the previously studies motivations of illustration and information and the new reasons of social and leisurely purposes. Given the obvious element of desire or want that is often present in these latter motivations—an

assumption that was later supported in the results of the diary data—this study contextualizes

the given motivations and any rankings among them in both the existing contours of

motivations and in the new ones proposed in this study. The study's wider focus contributes to

the image retrieval research by generating knowledge about image use outside of specialized

contexts.

Our knowledge of the image and its attributes, approaches to indexing, the user's

queries, and finally the user's needs are quite extensive. Yet the dominant question that this

project advances remains: how does the user self-categorize her motivations to find images.

This research pushes the boundaries of what we have considered to be a retrieval process

based solely on information needs. The most important question that this literature review

entertains is: What do we know about the user's motivations based on all of this research? The

following is clear:

- Concept-based image indexing may fail to serve or align with the requirements of
  users.

- Experts feel that users prefer browsing for images as much as they prefer searching
  and that browsing may be just as effective, suggesting searching is not entirely
  effective.

- Users are motivated to interact with images in participatory, Web 2.0 platforms for a
  variety of reasons and can contribute useful labeling of their own accord.

- We know much more about image indexing, image indexing tools and schemas,
  users' participation in Flickr, and users' image queries than we do about the user
  herself.

2.7 SUMMARY

Despite the prolific number of studies in LIS on image retrieval, activities seem to be moving in disparate directions as some scholars have begun exploring semantic image retrieval and Web 2.0 technologies, others continue in the old paradigm of image indexing, while still others pursue tangential questions that fall outside of traditional image retrieval yet are no less important than other work. This literature review is timely as the Web 2.0 perspective it brings helps give coherence to a field of literature that has at times in the past several years lacked structure and direction as the field pursues new tangents. Moreover, its focus on the user and image indexing is unique in bringing these two areas into closer proximity. The next chapter addresses these areas by reviewing the research design that was chosen to address this little-explored area.

3.0 RESEARCH DESIGN AND METHODOLOGY – INTRODUCTION

The purpose of this research was to uncover, via measurement and descriptive statistics, users'

self-categorizations of their motivations to interact with images. This chapter introduces the

study's methodological approaches and considers the merits of laboratory testing. Section 3.1

explains in broad terms the choice of methodology while Section 3.2 relates the sampling

procedure and the population in question. The next two sections (3.3) present the systems

users encountered in testing and (3.4) the data collection instruments that were used. Data

analysis is explained in Section 3.5, followed by a Section 3.6, which weighs the strengths of the

choice of methodology. Section 3.7 discusses the study's limitations.

3.1 SELECTION OF METHODOLOGY

This project combined a laboratory setting with a natural setting as the primary sites for data

collection. Participants were initially tested in a laboratory setting before they provided data via

self-reported, structured diaries. Tague-Sutcliffe defines the research conducted in a laboratory

setting as a test "in which the sources of variability stemming from users, databases, searchers,

and search constraints are under the control of the experimenter" (1992, p. 469). Where this

research project relied on a laboratory setting it attempted to control only one aspect of the

users' interactions with images—the task itself. Users had free reign to direct the browser to whichever system or platform they wished to use. They were also free to report their motivations to interact with images in their diaries; their diary responses were not controlled or directed in any way aside from specifying which pieces of information to include.

3.2 SAMPLE AND POPULATION

This study relied on non-probability convenience sampling among a student population. The rationale for choosing students as the sampled population is that they regularly interact with the World Wide Web and information technologies and are thus a good potential sample of those who interact with images online. The sample size was 30 participants in order to establish a reliable confidence interval around the estimate (Czaja & Blair, 2005). Wildemuth summarizes this as "the amount of error that you can tolerate in the parameter estimates" (2009, p. 122).

3.3 CONTOURS OF STUDY DESIGN

Users were able to choose the systems that they used and were not directed to any particular system. The purpose of allowing users to determine the system was to collect data on which platforms they prefer. The researcher reviewed the recordings for each session in order to tabulate the systems subjects used for each task. This design was proposed on the assumption that subjects are able to provide retrospective and temporal assessments of their physical and mental activities on questionnaires.

3.4 INSTRUMENTS OF DATA COLLECTION

This project collected two primary forms of data: 1) questionnaires that users filled out about their own backgrounds and in response to the tasks they completed, and; 2) recorded user sessions, which, as subjects completed the tasks, were captured with Camtasia Studio, a program that allowed the researcher to record video of users' on screen activity (i.e. screenshots, pages visited, keystrokes). Recordings were analyzed for verifying whether users' self-reporting of their location strategies was accurate for determining sites used by subjects and the task completion time.

Subjects were requested to come to the lab to participate in the experiment. They were first provided with a pre-questionnaire that solicited general background information and their perceptions of the tasks. The captured screenshot video files of each session were recorded continuously with Camtasia. After completing the tasks, subjects filled out a post-questionnaire that measured the level of representativeness of the tasks to their everyday image interactions.

The pilot study forced several important modifications of the study as initially proposed. Prior to running the actual study, four individuals were recruited to take part in a preliminary run-through to test measurements and research designs. Several participants expressed confusion at various points of the pre- and post-questionnaire, so slight modifications to the task and questionnaires' wording were made. These related exclusively to instructions that left subjects with an unclear sense of how to meet a task or questions expectations.

3.4.1 Pre- and Post-Questionnaires

Pre/post questionnaires were chosen as a primary survey instrument because they allow for quick and direct capture of data based on the subject's responses. Both the pre-questionnaire and post-questionnaire consisted of open- and closed-ended and rating scales intended to identify subject's perceptions of their behavior on the assigned and pre-assigned tasks. The closed-ended questions all consisted of multiple-choice answers that provided the subject with a variety of ways of categorizing their activities according to the frameworks this study advances. The rating scales in Part I of the post-questionnaire collected data on the degree to which each task represents the subjects' overall, real-world interactions with images. That is, the researcher's interest was in determining the representativeness of the search processes and not the specific topics that each task entails. The rating system consists of only four categories: 1) not representative; 2) somewhat representative; 3) representative, and; 4) most representative. Four choices are provided rather than five, thereby eliminating the comfortable middle towards which many subjects gravitate.

There is very little freely and publically available information on image search statistics. The little information available online is an excerpt from a 2006 Nielsen NetRatings list on image search engines rankings ("Web Search Statistics," 2006). Comparing this information ("Web Search Statistics," 2006) with recent search engine rankings by web.com (2009), which suggests that Google claims the lead in percentage of market share in both search (60%) and image search (45%), followed by Yahoo in a distant second (20% for search, 22.5% for image search), followed by Bing/MSN search (9-10% for both search and image search), then by Ask.com (2% for both). These are all systems that Tjondronegoro and Spink list in their 2007

49

article "Web search engine multimedia functionality." A special panel report by the Search

Engine Strategies conference (2006) indicates that Flickr, Webshots, PBase, and Fotki were the

dominant image sharing platforms in 2006. According to the panel, MySpace and Facebook

were then the dominant social networking sites with image sharing capabilities. As Facebook is

the number two site and MySpace the number 13 site of Alexa's most popular sites worldwide,

they are still worth including in the pre-questionnaire. The questionnaires list these systems in

randomized order so that the questionnaires accord with the latest available statistics on image

search.

3.4.2 Search Logs

The use of Camtasia to record participants' activities allowed the researcher to observe users'

behaviors and characteristics during image retrieval. Camtasia was configured to record URLs

visited and continuous screen shots or actions undertaken by the user. The benefit of using

search logs as a research technique is that the data enables researchers to ground their

theories and explanations in contextual observations of user behavior. This approach—aptly

named grounded theory (Glaser & Strauss, 1967; Strauss & Corbin, 1994)—has become popular

in recent studies on image information needs (Cunningham, Bainbridge, and Masoodian, 2004;

Sedghi, Sanderson, and Clough, 2008). Subjects' sessions were recorded onto a disk using a

burning utility. Collection of continuous logs allows the researcher to collect data on individual

users' behavior and processes.

3.4.3 Tasks

Users were asked to complete five tasks presented in random order. Four tasks were assigned and one was unassigned; what the subject did for the last task was up to her. The tasks were designed to communicate only the most essential of instructions to prompt users to action. They were only given a context and were asked to choose a browser from all five major browsers: Internet Explorer, Mozilla Firefox, Apple's Safari, Google Chrome, and Opera.

After completing Part I: General Background Information of the pre-questionnaire and receiving general instructions on the tasks, subjects were directed to Parts II and III of the pre-questionnaire. They received the five different tasks in random order. The four assigned tasks were designed to match possible motivations: 1) social purposes; 2) education of others; 3) leisure; and; 4) to inform. Descriptions for the assigned tasks are as follows:

1) Social Purposes: You want to show an image of either yourself or of a friend to a new acquaintance. Using an internet browser to navigate the World Wide Web, locate an image of yourself or of a close friend.

2) To illustrate an idea: You are working on an important work or academic project, the goal of which is to educate an audience on the history of computers. You need several images of computers to illustrate your ideas. Using an internet browser to navigate the World Wide Web, locate as many images as you would like up to five.

3) Leisure: You have some free time and want to view images online. Using an internet browser to navigate the World Wide Web, locate images that satisfy your desire to fill your free time.

4) To inform oneself: You have just heard about a catastrophic event in the world that may have done terrible damage to both a body of land and a group of people. You want to see images for yourself. Using an internet browser to navigate the World Wide Web, locate images that suit this purpose.

The recording for each session was reviewed to determine the systems that users chose and were tabulated to determine the popularity of each system for each motivation.

The fifth task was a non-assigned task that attempts to get users to exhibit their preferred motivation and strategy for locating images for viewing. For this task, users were free to rely on the four assigned tasks for directions but they were not directed to do so. Rather they were instructed to reflect on the system they use most frequently for viewing images and to navigate there with the web browser:

5) Take a moment to reflect on what system you use most often to view images in your own time. Go to that system and view as many images as you would like.

3.4.4 Diaries of Image Retrievals

To arrive at a more contextualized and granular analysis of users' motivations to retrieve images, subjects were asked to fill out structured diaries on a daily basis. Not only do diaries

provide a more comprehensive view of a phenomenon (Krathwohl, 1997), they allow much

deeper analysis and contextualization of the motivation categories this project advances.

A 7 day diary format would be ideal over the 1, 2, or 3 day formats because it gives an

even snapshot of behavior throughout the week, but it has lower completion rates than the

shorter formats (Butcher & Eldridge, 1990). The pilot study showed that participant completion

of the diary declined precipitously after the third day of journaling on the blog. Two of the four

participants maintained the journal until the third day. One subject failed to follow up with the

journal and the other abandoned the journal after the first day. In order to ensure a coherent

and consistent interface across all entries (Palmblad & Tiplady, 2004), subjects were given a

typed, empty template to follow for structuring their diaries, which included only the following

information:

- Date image was viewed:

- Brief description of image:

- Reason for viewing the image:

- Did you download the image? (yes/no)

Subjects were instructed to create a new entry each time they logged in. They were free to

report multiple retrievals of images in one entry.

At the conclusion of each session, subjects configured a blog with the researchers' help

specifically for them. As the blogs contained no identifying information, names for the blogs

consisted of the handle "sisimage" plus the subjects' participant numbers. Moreover, the blogs'

permissions were not open to the public but rather were only known to the participant and the researcher. This ensured total anonymity as not only was the blog invisible to anyone but the subject and the PI, no identifying information appeared anywhere on the blog. While subjects needed a valid email to configure the blog, they were instructed not to include their names anywhere on the blogs to ensure anonymity. When the subjects invited the researcher to view the blog after the initial configuration, no email, name, or contact information was displayed or transmitted. Designed in this way, the blogs were completely anonymous to everyone, including the researcher, as he only received a notification that "subject 01" has invited him to view a blog. Identification after the fact was still possible but not necessary.

3.4.5 Image Search Strategies

Participants were asked in Appendix D: Part III whether they feel the search strategies they employed in this part of the design was browsing or searching. On a cautionary note, subjects were requested to view only content that would be appropriate for all audiences when completing the non-assigned task. The goal of having users complete these tasks was to determine which image location strategies users relied on to locate images for each motivation defined in this. Borrowing from Jörgensen—who summarizes Batley's and Hastings' search strategies as a focused, specific type of search versus a looser, exploratory, browsing type of search—this project proposes the division of search strategies into the following categories, which retain Batley's wandering or most undirected search strategy:

- Specific, focused search.

- Exploratory, semi-directed search.

- A combination of specific, focused search and exploratory semi-directed search.

- Undirected search or wandering.

The first two categories parallel Bates' article (1989) on berrypicking as a model for information retrieval. Search, which still accords with the classic model of IR, is the process of the user stating an information need that is static and can be stated as "a single unitary, one-time conception of the problem" (p. 409). In this instance, the user is able to satisfy an information need by a final received set of images. Smeulders *et al* (2000) identify searching as a category that consists of textual queries that employ free text or keywords. The berrypicking style of browsing is not necessarily a casual or incidental behavior that is in contrast to directed browsing but rather, according to Ellis (1989), a semi-directed and semi-structured search that may make use of a variety of types of information and is a form of search by association (Smeulders *et al*, 2000). That is, the user is not entirely satisfied or dissatisfied by the return of a set of documents but rather proceeds upon a course that is conditioned by stimuli such as the set(s) of unique documents retrieved and feedback like the user's interaction with the set(s). In IR, stimuli include subject terms, contents pages, or lists of cited works. In image retrieval, they would include faceted classification or grouping of images, perusing an image collection by tabbing through it as through a slideshow, or by selection made from thumbnails.

After the completion of each task, subjects were asked to complete the corresponding section of Part III: Task Reflection of the pre-questionnaire (see Appendix C) in order to collect data on how closely their judgments align with the parameters for motivations that this study

advances. The post-questionnaire found in Appendix D attempted in Part I: Task

Representativeness to determine how representative each type of search is of the users' overall

interaction with images as defined by motivation (see Tasks) and as judged by the user. Part II:

Self-Categorizations of Motivations had users rank their own real-world interactions with

images according to how important they value the given motivations. It also elicited other

motivations that this study may have occluded and asks them to re-rank the importance they

assign to the motivations based on any additions. Finally, Part III: User Reflections on Image

Location Strategies established users' self-categorizations of their search strategies according to

the general guidelines for the search and browse possibilities given above.

The tasks listed above were not intended to be answer driven or direct. Each task is

generic and is only sufficiently contextualized to cause the subjects to begin pursuing images.

The use of the term task in this study parallels Vakkari's explanation of the nature of the task in

the contexts of information retrieval:

> A task is an activity to be performed in order to accomplish a goal (Hackos & Redish, 1998; Hansen, 1999; Shepherd, 1998). Tasks have been conceptualized in two different ways: first, as an abstract construction, which does not include performance (Bystrom, 1999; McCormick, 1979; Shepherd, 1998). A task, especially a complex one, may include specifiable, smaller subtasks. In the second definition, a task is viewed from a functional perspective: as a series of actions undertaken in pursuit of a particular goal by an actor. The performance of a task includes physical and cognitive actions. This performance has a recognizable purpose, beginning, and end. It consists of a series of subtasks. A task, when performed, results in a meaningful product (Bystrom, 1999; Hackos & Redish, 1998; McCormick, 1979) (p. 416).

In this study a task is not an abstract construction but a complex activity that asks users to

complete a task that entails several activities. These include assuming a context and selecting

an appropriate means for fulfilling the task, including locating an image retrieval system and to

using it either to search or browse to locate images.

3.4.6 Experiment Settings

The researcher conducted the experiments in a research laboratory in the Information Sciences Building at the University of Pittsburgh. The lab was equipped with an up-to-date Dell computer running Windows XP. The computer had the latest version of Firefox, Internet Explorer, Chrome, Opera, and Safari from which the subjects chose one in order to navigate the web. The primary investigator remained in the room but at a fair distance in order to eliminate his presence from the research area while still remaining close by for any questions or technical assistance. This was done in order to achieve the "complete observer" researcher role, which Sapsford and Jupp (1996) define as the lack of interaction with the subjects during data collection. The advantage this approach gives is that it eliminates the reactivity the participant might experience with the immediate physical presence of the user.

The researcher was present throughout the experiments to monitor and observe the sessions. The experimenter at all times: attempted to maintain objectivity; did not interfere with the search/browse process by speaking, and; made sure to maintain a sufficient distance to afford the user personal space, the perception of privacy, and to minimize the observer effect.

3.4.7 Procedures

The procedures for this study were as follows:

1. The participants were informed about the study.

2. The subjects were asked to read and sign a consent form.

3. The participants were asked to complete Part I: General Background Information.

4. Upon completion of the background information form, they were then directed to the Instructions for Tasks (Appendix A). While reading the instructions, the researcher launched the browser of choice and Camtasia Studio.

5. After reading the instructions, they were given the five different tasks in random order.

6. The subjects started their sessions and the researcher stayed quietly to the side in order to be present in the event of any technical difficulties.

7. After completing all the tasks, subjects filled out Part II: Survey of the tasks and Part III: Task Reflection.

8. Participants then completed all three parts of Appendix D, which consists of additional surveys that target task representation (Part I), self-categorizations of motivations (Part II), and their reflections on image location strategies (Part III).

9. Finally, participants were directed to Google Blogger to create a new blog. They were instructed on how to configure the blog so that they remained completely anonymous and the blog remained invisible to all but the researcher and themselves. They were given an empty template that instructed them on how to structure their blog.

3.5 DATA ANALYSIS

This study employed both quantitative and qualitative methods to analyze the collected data. Generally speaking, qualitative research is more inductive and holistic in orientation and aims to describe with great detail settings, people, and behaviors (Krathwohl, 2009). The approach seeks to generalize in a more deductive manner that brings patterns into clearer relief so the researcher can draw conclusions based on the data (Krathwohl, 2009).

The tasks and questionnaires were designed and coordinated to produce quantitative, numerical data. The rating scales and multiple choice answers produced descriptive statistics that should gave a clearer picture of the user's self-categorizations for motivations and resultant search strategies (i.e. browse vs. search). Data analysis was conducted with a statistical computer application, SPSS, to generate the descriptive statistics, which furnished the contours of users' motivations and image location strategies. SPSS yielded valuable cross-tabulations based on the pre- and post-questionnaires. Cross tabulated tables are valuable because they "provide information on the variation of the responses with various demographic and other independent variables" (Krathwohl, 2009, p. 590). The session logs were reviewed to produce additional descriptive statistics about: 1) which systems subjects used for which tasks, and; 2) participant self-categorization of image location strategies according to Bates' berry picking model.

3.6 JUSTIFICATION OF METHODOLOGY

The use of task-based testing to answer questions about user behavior are common in empirical studies on the image and the user (Jörgensen, 1995; Jörgensen, 1996; Armitage, 1996; Jörgensen, 1998; O'Connor *et al*, 1999; Hastings, 1999; Choi & Rasmussen, 2002; Rorissa & Hastings, 2004; Van House *et al*, 2005; Rorissa, 2007; Rorissa, 2008; Rorissa & Iyer, 2008) while other studies rely on user interviews (Ames & Naaman, 2007; Van House, 2007; Cox, Clough, and Marlow, 2008). Grounded theory has also been applied to studies on users' relevance assessment of medical images (Sedghi, Sanderson, and Clough, 2008) and image information needs (Cunningham, Bainbridge, and Masoodian, 2004).

The typical constructs used to evaluate the design of a research study are reliability and validity. Internal validity, also called linking power, measures the approximate truth of inferences made on causal relationships. An internally valid study controls extraneous variables that may have an influence on the dependent variable (Krathwohl, 2009). While this research does not use treatments or establish causal relationships between independent and dependent variables, the need for linking power between the subject's performance and their answers on the questionnaires is paramount. To ensure this connection and to rule out any extraneous influences on the participants' overall performance the lab setting was made to be uniform for all subjects in the study. Requirements for the subjects, the procedures aside from task randomization, and the questionnaires and tasks were all the same.

External validity concerns the inference of generality. That is, the extent to which research results from subject testing can be generalized beyond the parameters of the study. Since a study whose conclusions can only be applied to its subjects would be of little value to a

larger audience, the researcher's goal was to draw general conclusions from the collected data about similar groups operating under similar settings. This overall principle was deemed proximal similarity by Campbell (1986) and it consists of two aspects: ecological validity and population validity. The former concerns the possibility of generalizing the results to other environmental conditions while the latter is concerned with the extent to which results can be generalized to other people and/or populations. This study meets both forms of external validity in that students were recruited regardless of academic status and demographic background and were thus expected to represent the target population that they indicated according to age.

One major benefit of this study is its data collection on the everyday user's searching and browsing habits for images. Inquiries in image retrieval have primarily been limited to either the image itself or to the behavior of image professionals. Cunningham and Masoodian report that "much less is known about the everyday image information behavior of ordinary people" (2006). By using multiple sources of data—a technique often called triangulation (Wildemuth, 2009)—data validity will be enhanced and the subsequent results and conclusions will rest on valid ground.

The final issue that concerns the justification of methodology is reliability, or the "degree to which a test consistently measures whatever it is measuring" (Gay and Airasian, 2003, p. 141). Analyzing and interpreting data in a consistent fashion was a central concern as it helped to ensure the quality of the study.

3.7 LIMITATIONS

This study focused on user's motivations and, besides considering the context of image retrieval as influenced by motivation, does not generalize beyond this aspect of user image interaction. The findings do suggest, however, a number of possibilities for the image indexing, semantic image retrieval, and possibly the CBIR communities. This study was conducted in a laboratory environment where some aspects of the research design were controlled. Some tasks are uncontrolled and thus operational, or more likely to pattern true image interactions. On the one hand, given the nature of this type of mixed methodology and the high expectations of the seriousness with which users will approach each task, the laboratory environment likely closely reflected the actual environment in which users encounter images.

Additionally, one of the limitations of diaries is that the 7-day format had a slightly lower response/completion rate than the shorter formats. Balanced against the need to capture a consistent chunk of time versus the slightest improvement in response rate, this project placed greater emphasis on the consistency of timeframe.

This study also assumed that motivation as a construct of the design is a straightforward and uniform catalyst that propels users to find images in a web environment. To arrive at a conclusion, the study restricted motivation to the need to interact with images and the resultant satisfaction of a task. That is, motivation resulted in a particular type of activity so motivation is a linear form of causation. This last limitation is part of the social sciences methodological geography. As Krathwohl reminds us, "the attribution of causation is always an inference on our part" (Krathwohl, 1997, p. 131).

3.8 SUMMARY

This study's goal was to investigate how people self-categorize their motivations to pursue images in web environments. More specifically, it aimed to: 1) determine the extent to which users specify their motivations according to information, education, leisure, and social purpose, and to; 2) investigate whether the retrieval of images is driven by a factual search process or by a browsing location strategy of refinement and revision (i.e. Bates' berry picking model).

Subject testing was conducted in a lab setting in order to assemble various data sources, including video session logs and pre- and post-questionnaires. These two sources were combined with the structured diaries to enhance the data's validity. The sample, consisting of 30 volunteers, came from graduate and undergraduate students in the University of Pittsburgh's School of Information Sciences, which includes the Library and Information Science Program, Telecommunications and Networking Graduate Program, and the Graduate Information Science and Technology Program. No demographic or disciplinary limitations were used in an effort to ensure the integrity of the study's sampling procedure.

4.0 RESULTS

This chapter presents the results of the data analysis for users' self-reported motivations to retrieve images in a web environment. Both pre-questionnaires and post-questionnaires were subjected to quantitative analysis via SPSS. The blog diary entries were manually analyzed for adherence to and divergence from the proposed categories of motivation; the video logs were reviewed for additional data on search strategy, sites visited, and task completion times.

The first several sections present basic demographic and background information on the 28 University of Pittsburgh School of Information Science participants. The proposed number of participants had been 30 but two participants (nos. 1 and 3) indicated that they work with images in a professional capacity. Despite multiple attempts to screen professional users out of the study (posters seeking non-professional/amateur users, the verbal introduction to the study), two participants indicated a professional relationship to images. Their data have not been included below. Following the chapter summary that follows , the ensuing sections present the findings in the context of the two research questions.

4.1 CHAPTER SUMMARY

Research data for this study was collected in March and April of 2010. Out of 30 participants, valid data for 28 subjects was tabulated from a variety of forms—research questionnaires, video log transcripts, and blog diaries recorded by users over a three day period. Overall, the data indicates that the majority of subjects were female, highly educated, and had been retrieving images in web environments for over 10 years.

In terms of image platforms that subjects reported using, Google Images (89.3%), Facebook (82.1%), and Flickr (67.9%) were the only systems that over 50% of participants reported having used. The remaining systems were as high as 25% (Bing) and as low as zero (Fotki; see Tables 5 & 6).

Cross-tabulations of image system with this study's proposed motivations indicate an, at times, strong relationship between motivation and system, particularly where Google Images and Facebook are concerned (Tables 8-11). These results outline a sharp difference in search strategy as Google Images necessitates textual searching while Facebook does not permit textual queries but instead encourages a browse-like exploring of images.

The first of three measures of the relative ranking of motivations (Tables 12-16) indicated that informing oneself is the top reason subjects list to retrieve images in a web environment (32% average across all recent image interactions; see Table 14). The remaining motivations were all quite close, descending in order from 21.2% (entertainment) to 20.7% (social purpose) to 19.6% (illustration).

As Tables 17-20 show, subjects found the illustration task most representative (96.4%) of their overall interactions with images in web environments, followed by the information task

(92.9%), the leisure task (89.3%), the non-assigned task (85.7%), and finally by social purposes (78.6%).

When asked to rank motivations vis-à-vis one another, subjects demonstrate a preference for information as the number one motivation followed in order by illustration, leisure, and social purposes. At a deeper level, leisure's sub-categories, as proposed in this study, are somewhat equal in terms of task representativeness, with viewing aesthetically pleasing images slightly less representative according to subjects than entertainment and relaxation, which were closely matched (Table 18).

Users' categorizations of their search strategies were examined and showed to be quite varied across the search spectrum explained in the third chapter. Social purpose as a motivation had the highest response for a "specific, focused search" during the task, but that again may reflect the task context as much as search strategy. Overall, subjects indicated that they employ a combination of search strategies. These results were verified for accuracy by comparing them with the video log transcripts, which indicate a fairly high degree of accuracy (80-95% for subjects' responses to the search strategy that they felt accompanies each motivation).

The diary data underscore the prevalence of information as a motivation when subjects reflect on why they have retrieved an image. Information and leisure occasionally coincided as motivations to view an image. The blog entries suggest that the categories as proposed in this study may not coincide with 100% accuracy with the totality of real world motivations that users have to report images.

4.2 SUBJECTS' PROFILES

Besides one staff member of the School of Information Sciences, the subjects consisted entirely of students and former students in the School of Information Sciences. Table 3 summarizes the basic demographic information about each of the 28 individual participants according to their subject ID.

Table 1: Participant Profiles

Participant ID	Age	Gender	Education Level	Years Using Web To View Images
S02	50 and above	Female	undergrad	10 and above
S04	26-33	Female	doctoral	10 and above
S05	26-33	Male	master's	10 and above
S06	26-33	Male	doctoral	10 and above
S07	26-33	Female	doctoral	3-4
S08	34-41	Male	doctoral	10 and above
S09	26-33	Female	doctoral	9-10
S10	26-33	Female	doctoral	10 and above
S11	26-33	Female	doctoral	10 and above
S12	26-33	Female	master's	9-10
S13	18-25	Female	master's	9-10
S14	34-41	Female	doctoral	10 and above
S15	26-33	Female	doctoral	5-6
S16	50 and above	Female	other	10 and above
S17	26-33	Female	master's	10 and above
S18	26-33	Male	doctoral	10 and above
S19	26-33	Female	doctoral	10 and above
S20	26-33	Female	doctoral	10 and above
S21	34-41	Male	doctoral	10 and above
S22	50 and above	Female	undergrad	9-10
S23	34-41	Male	master's	10 and above
S24	18-25	Male	master's	9-10
S25	18-25	Male	master's	10 and above
S26	50 and above	Female	undergrad	9-10
S27	26-33	Female	master's	10 and above
S28	26-33	Female	doctoral	7-8
S29	26-33	Male	doctoral	3-4
S30	26-33	Female	doctoral	9-10

Table 4 shows that three subjects were between the ages of 18-25, 18 were between

26-33, three were between 34-41, and four were 50 years of age or older. 19 subjects were

female while 9 were male. All participants had at least three years of experience using the web

to view images. For both the categories of 3-4 years and 5-6 years of viewing images online,

two subjects per category reported having used the web to find images; one had used the web

for 7-8 years, seven were at 9-10 years, while the remainder, 18, had been using the web to

locate images for 10 or more years. Three of the subjects had or were earning an

undergraduate degree, eight were at the master's level, 16 were at the doctoral level, while

another declared "other." Although these subjects are meant to represent the amateur user of

images, the resulting sample population necessitates qualification of the amateur user as one,

who in the context of this study, is well educated at the post-secondary level and has been

viewing images online for many years. Nonetheless, the study assumes a target object of the

(educated) amateur user, whose motivations and behaviors can be generalized only to the

extent that internal validity permits externalizing the results. The following table and figures

offer a more thorough presentation of the subjects' demographic data.

Table 2: Frequency and Percentage of Demographic Data

Category	Sub-category	Frequency	Percentage (%)
Age	18-25	3	10.7%
	26-33	17	60.7%
	34-41	4	14.3%
	42-49	0	0%
	50 or above	4	14.3%
	TOTAL	**28**	**100%**
Gender	Female	19	67.9%
	Male	9	32.1%
	TOTAL	**28**	**100%**
Education Level	Undergraduate	3	10.7%
	Master's	9	32.1%
	Doctoral	15	57.1%
	Other	1	3.8%
	TOTAL	**28**	**100%**
Years Finding Images	1-2	0	0%
	3-4	2	7.1%
	5-6	1	3.8%
	7-8	1	3.8%
	9-10	6	21.4%
	10 or more	18	64.3%
	TOTAL	**28**	**100%**

Age Distribution of Subjects
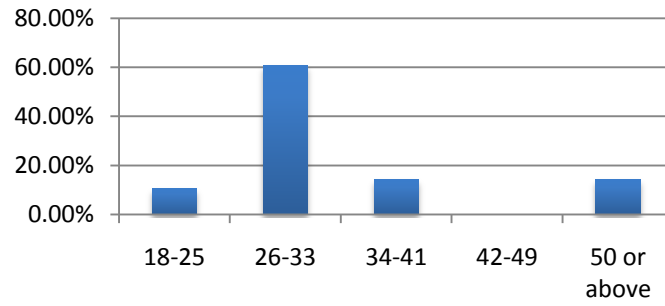
Figure 1: Age Distribution of Subjects

Gender Distribution of Subjects
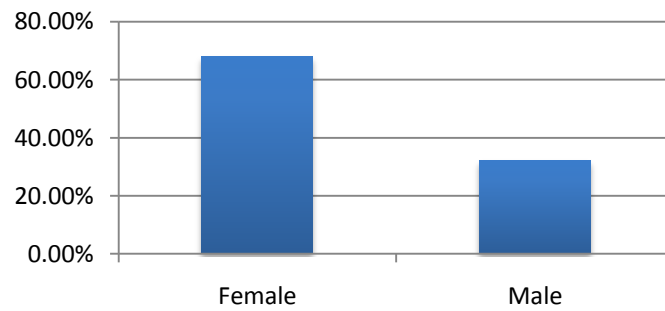
Figure 2: Gender Distribution of Subjects

Education Distribution of Subjects
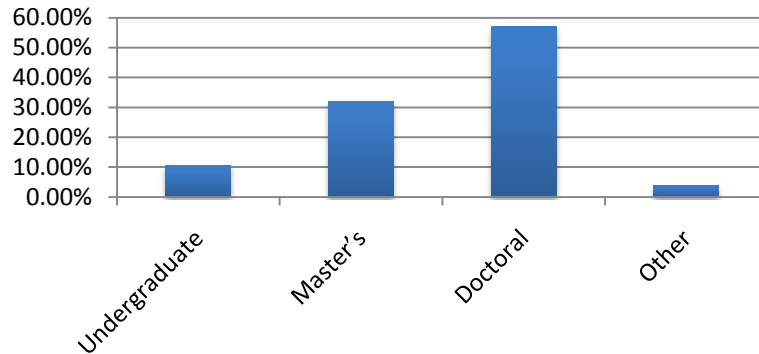
Figure 3: Education Distribution of Subjects

Years Retrieving Images Online
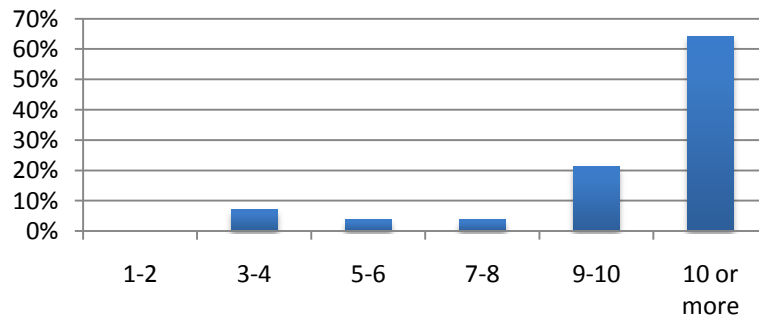
Figure 4: Years Retrieving Images Online

As Table 4 and the bar charts make clear, the subjects in the study had varying

backgrounds. Although subjects were more likely to be pursuing education at the doctoral level,

they nonetheless had diverse educational levels and varied experience locating images in web

environments. Despite the PI's hopes to recruit male participants, females still outnumbered

males over two to one. Nonetheless, the gender sampling is more representative of the overall

population than another recent investigation (Beaudoin, 2009) of the users of images (in this

case, professional) and in general, is well within the main of other image retrieval studies. The

age distribution was better than gender in that there was somewhat of a balance between the

younger and older categories. Well over half of the participants fell between the ages of 26-33.

No subjects included in this analysis reported that they worked with images in a professional

capacity. In this sense, they can be considered amateur users of images and their activities and

responses can be considered of the everyday kind in that the tasks they were asked to

complete were more representative of an amateur's use than a professional's. Subsequent

analysis reveals that none of their responses, from the recent image interactions to the blog

diary data, indicate that subjects referenced images acquired or viewed for professional

capacities. For the two professional participants whose data was expunged there were a variety

of instances of professional image use.

4.3 IMAGE SEARCH PLATFORMS

Understanding more about the photographic preferences of subjects is important to generating

a more complete picture of the amateur user of images. Certain facets of photography related

to the consumption and use of images were targeted for whether they might portend a

relationship between one's personal preferences and their motivations for retrieving images.

When correlated with motivation, these results did not yield evidence of significant

relationships besides what would be expected by chance. As such, some of the profile

information relates only tangentially to the research questions at hand and thus the data can be found at the beginning of Appendix E. The data includes subjects' responses to which web browsers they use, whether they own a digital camera, and whether have an image hosting account online.

Certain other aspects of subjects' preferences, however, are important to substantiating the motivations themselves. The types of image search platforms that users rely on for image retrieval are important for beginning to situate the motivations in their given context. For instance, because of the number of images limited to what individual pages and friends offer on their pages, Facebook invites a completely different, more browse-like experience of images from Google Images, which necessitates textual queries that require a certain degree of semantic precision. The former would seem to be an excellent candidate for exploring less-than-purposeful image retrieval while the latter for purposeful retrieval as a form of ISB.

Tables 5 & 6 lists the frequency with which each image search system or platform (e.g. Google Image Search) was listed, its relative rank as expressed as the mean score it received in relation to the other search systems subjects reported, and the various other search systems reported by subjects. These figures reflect the percentage to which subjects reported using an image search or hosting platform in general. They do not indicate how recently participants may have used a system. For example, the following table makes clear that 89.3% of the subjects in this study use or have used in the past Google Images as a tool for locating and/or viewing images.

Table 3: Frequency of Image Platform Usage

	Google		Facebook		Flickr		Online DLs		Yahoo	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Yes	25	89.3%	23	82.1%	19	67.9%	7	25%	7	25%
No	3	10.7%	5	17.9%	9	32.1%	21	75%	21	75%
Total	28	100%	28	100%	28	100%	28	100%	28	100%

Table 4: Frequency of Image Platform Usage Continued

	MySpace		Ask.com		Bing		Other	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Yes	3	10.7%	3	10.7%	1	3.6%	1	3.6%
No	25	89.3%	25	89.3%	27	96.4%	27	96.4%
Total	28	100%	28	100%	28	100%	28	100%

Well over 80% of subjects reported having used Google Image and Facebook to locate images. Compared with systems in the bottom three quarters of this section, these systems are over three times more likely to be used by users to locate images. Given that they exist at polar ends of an assumed spectrum between a textual-based form of image retrieval (Google Images) that is ideal for information retrieval on one end and a system (Facebook) that forces users to browse on the other end, these results point towards: the validity of both a browse-like search strategy for images and; of social purposes and leisure as motivations in their own right alongside information and illustration.

Flickr joins Google Image and Facebook as one of three image platforms that users report having used. Flickr, with its ability to accommodate both search *and* browse, joins Facebook as an important tool in the amateur users' arsenal for viewing images. As previous

research has associated Flickr quite strongly with leisure as an activity in its own right (Cox, Clough, & Marlow, 2008), this result tangentially supports the inclusion of leisure as a motivation unto itself and of browsing as a possible search strategy that may serve leisure as a motivation. Beyond Flickr, however, the remaining systems demonstrate a precipitous decline in popularity among subjects. This is not to be unexpected as many of these search platforms are not category leaders like Google, Facebook, or Flickr but instead occupy marginal market space (e.g. Yahoo).

There were no reported uses of Fotki or PBase. These figures, listed in descending order by usage percentage, indicate that Facebook as an image retrieval and viewing platform is a close second to Google, which one might assume tells us is more likely to be involved in image retrieval for information's sake given its text-based retrieval. To test this assumption, cross tabulations for recent image interactions (Pre-questionnaire II) were run for the systems used and the motivation for retrieving the image in question. There is a strong correlation between the system(s) that participants listed as having used and their motivation for viewing the image. The following tables give a more complete perspective on the relationship between system and motivation. Users reported retrieving an image and they were asked where they retrieved it (column) and what the motivation for retrieval was (row).

Table 5: Cross-Tabulation of Motivation According to System (Image 1)

Motivation	Online DL	Flickr	Yahoo	Google	Facebook	Other	Total
To see others/self (social)	0	0	0	1	5	0	6
To illustrate an idea	0	0	1	4	0	0	5
To inform yourself	0	1	1	2	1	4	9
To entertain oneself	0	0	0	3	2	1	6
Other	1	0	0	0	1	2	4
TOTAL	1	0	2	10	9	7	28

With an assumed alpha value of .05 for all correlations in this study, this cross-tabulation

demonstrates a statistically significant relationship at p = .012 (X^2 [20, N =28] = 37.015, p < .05)

between motivation and system used in recent image interactions. These results would seem to

show that rather than having no relationship to the system used, motivation might seem to be

a decent predictor of which system subjects will use. However, given that Google Images,

Facebook, and Other were far more likely to be used over the other options, what these strong

correlational results suggest is that for these systems used, Facebook tends to be used for social

and leisure more than other reasons, Google Images receives more even use across motivation

with a preference towards illustration, and Other is more likely to be used for the purposes of

informing oneself (3 out of 7 were news sites such as bbc.com). Rather than indicate that

motivation and system are perfect predictors, these results point towards a more theoretical

difference that emerges later in the data, that of purposeful motivations (i.e. illustration and

information) and less-than-purposeful ones (i.e. leisure and social purposes). That illustration

and Google are closely related, as are Facebook and social purposes, implies that for some

motivations, there is a given context around the motivation in which users undertake image

retrieval tasks. The question of context is taken up again in chapter 5.

Table 6: Cross-Tabulation of Motivation According to System (Image 2)

Motivation	Yahoo	Google	Facebook	Other	Total
To see others/self (social)	0	1	3	2	6
To illustrate an idea	1	3	0	0	4
To inform yourself	0	6	0	2	8
To entertain oneself	0	1	2	1	4
Other	0	0	0	2	2
TOTAL	1	11	5	7	24

For this cross tabulation, the p-value is likewise statistically significant at $p = .045$ (X^2 [12, $N = 24$] = 21.351, $p < .05$). In this instance, we see that where Google Images and Facebook are concerned, they are quite good predictors of motivation. This is particularly true when one separates the motivations according to purposeful retrieval versus less-than-purposeful motivations. When users seek images for either information or illustration purposes, the data indicate that they turn to Google. When they seek images for social or leisurely purposes, they are more likely to visit Facebook.

Table 7: Cross-Tabulation of Motivation According to System (Image 3)

Motivation	Online DLs	Flickr	Google	Face-book	Other	Total
To see others/self (social)	0	0	0	3	0	6
To illustrate an idea	1	1	3	0	1	6
To inform yourself	3	0	4	0	2	9
To entertain oneself	0	0	0	3	1	4
Other	0	0	1	0	0	1
TOTAL	4	1	8	6	4	23

The p-value is not significant at .071 (X^2 [16, $N = 23$] = 24.917, $p > .05$). Although the p-value is not significant, the results tell the same story as above—social purpose and leisure are associated with Facebook while Google Images with information and illustration. Finally, the results for image 4, which has the fewest number of responses, is as follows.

Table 8: Cross-Tabulation of Motivation According to System (Image 4)

Motivation	On-line DLs	Yahoo	My-Space	Google	Face book	Other	Do Not Recall	Total
To see others/self (social)	0	0	1	0	2	1	0	4
To illustrate an idea	0	1	0	2	0	0	0	3
To inform yourself	1	0	0	2	0	1	0	4
To entertain oneself	1	0	0	1	2	0	1	5
Other	0	0	0	1	0	0	0	1
TOTAL	2	1	1	6	4	2	1	17

For this last cross tabulation the p-value is not significant at .576 (X^2 [24, N = 24] = 22.053, p > .05). Although the data are more distributed according to system, it is also clear in this table and in the previous three that Facebook is an extremely important site in the subjects' list of online image retrieval tools. While the contexts between why and how users retrieve images via Google Images versus Facebook certainly differs, it is clear that not only do subjects' motivations play a role in the sites they use, they also frequently report using systems that one might not immediately associate with image retrieval as a form of information seeking behavior (ISB). Table 9 presents aggregates the previous tables into one tabulation, which confirms the general trend of Google Images and Facebook as the main platforms split by motivations.

Table 9: Aggregated View of Recent Image Interactions

Motivation	Online DLs	Yahoo	My-Space	Goo-gle	Face-book	Other	Do not Recall	Flic-kr	Total
To see others/self	0	0	1	2	13	3	0	0	19
To illustrate an idea	1	3	0	12	0	1	0	1	18
To inform yourself	4	1	0	14	1	9	0	1	30
To entertain oneself	1	0	0	5	9	3	1	0	19
Other	1	0	0	2	1	4	0	0	8
TOTAL	7	4	1	35	24	20	1	2	93

Moreover, subjects' responses point to a difference in image retrieval search strategy, where users interact quite frequently with images via textual queries on Google Images and browsing strategies on Facebook.

Table 11 lists descriptive statistics for each image search system. Google Images far outpaced the other systems as the top choice for image retrieval but Facebook was a somewhat close second, followed by Flickr in third. The top three received over 20 affirmative responses while the bottom nine were far less likely to be ranked as important . The remaining choices were represented to a much less degree in the subjects' responses, with none showing more than eight positive responses. That is, there is a 60% drop in responses from Flickr at number three to Online Digital Libraries at number four.

Table 10: Image Search System Rank

System	Rank	Number	Highest Rank	Lowest Rank	Mean Rank
Google Images	1	25	1	3	1.36
Facebook	2	23	1	4	2.13
Flickr	3	19	1	9	3.11
Online DLs	4	7	1	9	3.57
Yahoo	5	7	1	6	3.57
MySpace	6	3	2	5	4.0
Bing	7	1	4	4	4.0
Ask.com	8	3	1	7	4.67
AP DL	9	2	4	4	4.0
Altavista	10	1	4	4	4.0
Fotki	12	0	0	0	0
PBase	13	0	0	0	0

Overall, these results give strong evidence for Google Images' importance to users as a search platform. As it necessitates a textual search style that later permits browsing is addressed in the next chapter for its implications for search strategy. Facebook, which *de facto* requires browsing with search limited to locating an entity's profile, is also a vital site to the amateur users' everyday interactions with images.

4.4 RESEARCH QUESTION 1

Research Question 1: Do users self-categorize their general motivations to interact with images as information seeking, as an illustrative activity, as a social activity, or as a less-purposeful pursuit such as leisure?

The following tables present the breakdown of the reasons or motivations that subjects listed for viewing the first image in a series of up to four that they recalled viewing. Table 12 presents the frequencies and percentages for each response to the pre-questionnaire item asking respondents to list details about their last, pre-session interaction with images. The survey contained three additional questions identical to the first except that the presentation of system options was randomized. The additional responses to the remaining three interactions follow in the subsections below.

Table 11: Image 1 Motivations

Motivation/Reason	Frequency	Percentage
To inform yourself	9	32.1%
To see an image of yourself or others in a social platform	6	21.4%
To entertain or enjoy oneself	6	21.4%
To illustrate an idea	5	17.9%
Other	2	7.1%
TOTAL	28	100%

Among the most commonly cited motivation, that of informing oneself (*n*=9, 32.1%) was mentioned by nearly one-third of participants. The remaining motivations of social purposes (*n*=6, 21.4%), entertainment (*n*=6, 21.4%), and illustration (*n*=5, 17.9%) were fairly evenly represented. The other motivations were "help answering reference query" and "news." While the former could certainly be an instance of illustration and the latter of information, the explanation lacked any additional context. For instance, was the subject looking at the image as part of reading the news as a form of information or leisure? The subjects obviously felt as if the proffered categories were insufficient, so their choices were respected.

Table 12: Image 2 Motivations

Motivation/Reason	Frequency	Percentage w/ no response	Percentage w/o No Response
To inform yourself	8	28.6%	33.3%
To see an image of yourself or others in a social platform	6	21.4%	25%
To entertain or enjoy oneself	4	14.3%	16.7%
To illustrate an idea	4	14.3%	16.7%
Other	2	7.1%	8.3%
No response	4	13.3%	-
TOTAL	24(28)	100%	100%

Table 13 (and 14, 15) shows two percentages: 1) is the total percentage of all subjects (n-28), including those who gave no response, and; 2) the percentages with those who gave no response excluded from the overall calculation. As four subjects could not recall a second image, the total response rate decreased by 13.3%. Results are listed for both the percentages including no response and the percentages with no responses withheld. Again, information as a motivation emerged as the dominant reason motivating users to locate images online. Social purposes (*n*=6, 23.1%) remained the second most prevalent motivation while illustration and leisure/entertainment (*n*=, 19.2%) were identical and secondary to information. Illustration (*n*=4, 15.4%) slipped to information, although only one response separated social purposes and entertainment from illustration. Other motivations included: "I pasted it to Facebook as it related to an article I was commenting on," and "To refer to other peoples' photo skills." These responses were left as "Other." Additional tabulated information about the relationship of image search or hosting system to motivation as well as individual descriptions of each recalled image can be found in Appendix E.

Table 13: Image 3 Motivations

Motivation/Reason	Frequency	Percentage w/ no response	Percentage w/o No Response
To inform yourself	9	32.1%	39.1%
To illustrate an idea	6	21.4%	26.1%
To entertain or enjoy oneself	4	14.3%	17.4%
To see an image of yourself or others in a social platform	3	10.7%	13%
Other	1	3.6%	4.3%
No response	5	17.9%	-
TOTAL	23(28)	100%	100%

Only 23 out of 28 could recall a third image, so the data reflect the difference. Once again, information garners the most responses (*n*=9, 36%) while illustration (*n*=6, 24%), entertainment (*n*=4, 13.3%), and social purposes (*n*=3, 20%) represented the second, third, and fourth motivations respectively. The other motivation listed by a subject was: "trying to locate the album locally in Pittsburgh, is on iPhone." Again, this explanation reveals very little motivation for retrieving the image or album in question. Additional tabulated information about the relationship of image search or hosting system to motivation as well as individual descriptions of each recalled image can be found in Appendix E.

Table 14: Image 4 Motivations

Motivation/Reason	Frequency	Percentage w/ no response	Percentage w/o No Response
To entertain or enjoy oneself	5	17.9%	29.4%
To inform yourself	4	14.3%	23.5%
To see an image of yourself or others in a social platform	4	14.3%	23.5%
To illustrate an idea	3	10.7%	17.6%
Other	1	3.6%	5.9%
No response	11	39.3%	-
TOTAL	17(28)	100%	100%

Interestingly, information in the final image recalled by participants slips to second (4=5, 23.5%) to entertainment (*n*=5, 29.4%) while social purposes (*n*=4, 23.5%) and illustration (*n*=3, 10.7%) dropped to their lowest out of all four responses. These figures are likely less indicative of any overall patterns as Tables 12-14 as the "no response" rate more than doubled. With fewer responses, the differences between motivations appear greater even as the numerical difference remains close (i.e. the four motivations are consecutively ranked with only one

response separating each consecutive motivation). When the percentages of use are averaged

for all four responses, the results are as follows:

Table 15: Averaged Ranking of Motivations for Recent Image Interactions

Motivation	Image 1	Image 2	Image 3	Image 4	Average
To inform yourself	32.1%	33%	39.1%	23.5%	32%
To entertain or enjoy oneself	21.4%	16.7%	17.4%	29.4%	21.2%
To see an image of yourself or others in a social platform	21.4%	25%	13%	23.5%	20.7%
To illustrate an idea	17.9%	16.7%	26.1%	17.6%	19.6%
Other	7.1%	8.3%	4.3%	5.9%	6.4%
TOTAL	100%	100%	100%	100%	100%

Clearly, information as a reason to retrieve images is the leading motivation in the subjects'

most recent image interactions. The other three motivations—leisure, social purpose, and

illustration—all carry the same relative weight (21.2% - 19.6%) as secondary motivations to

information. Additional tabulated information about the relationship of image search or hosting

system to motivation as well as individual descriptions of each recalled image can be found in

Appendix E.

4.5 TASK REPRESENTATIVENESS

Table 50 presents the frequencies for how representative subjects found each task of their daily

interactions with images (see post-questionnaire Part I). These results measure the extent to

which users found a task representative of their overall interactions with images.

Users were asked to indicate whether a task was "not representative," "somewhat representative," "representative," or "most representative." The following table gives their responses. These results are listed according to the order in which they appear in the post-questionnaire rather than in descending order by percentage. This is done in order to respect the logical presentation of the wording in the post-questionnaire.

Table 16: Task Representativeness

	Social Task		Illust. Task		Leisure Task		Info. Task		Non-As. Task	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Not Rep.	6	21.4%	1	3.6%	3	10.7%	2	7.1%	4	14.3%
Some. Rep.	4	14.3%	7	25%	6	21.4%	10	35.7%	12	42.9%
Rep.	10	35.7%	13	46.4%	14	50%	9	32.1%	7	25%
Most Rep.	8	28.6%	7	25%	5	17.9%	7	25%	5	17.9%
Total	28	100%	28	100%	28	100%	28	100%	28	100%

Reading the chart from left to right, one row at a time, social purpose garners the highest "not representative" response while illustration emerges as the least likely to be "not representative." The next category, "somewhat representative," shows that information leads this indicator while subjects do not feel as tepidly about social purpose as they do of the others. Interestingly, leisure emerges as the leading motivation when subjects consider how representative the leisure task was of their overall interactions with images. Information was last in terms of the "representative" degree. And for "most representative," social purposes was most likely to remind subjects of their overall interactions. In general, the percentages are fairly well distributed across the degrees of representativeness, suggesting that the tasks were quite close in terms of representativeness as a measure of a task's relative importance. Yet these measurements do not tell the entire story.

To produce a more sharply delineated measurement of whether the task was representative or not, "not representative" was kept separate while "representative," and "most representative" were conflated into one category named "representative to some degree" and "somewhat representative" was excluded. The following table gives a more general view of whether a task was representative or not.

Table 17: Task Representativeness When Representative Categories Are Conflated

	Social Task		Illust. Task		Leisure Task		Info. Task		Non-As. Task	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Not Rep.	6	21.4%	1	3.6%	3	10.7%	2	7.1%	4	14.3%
Rep.	18	75%	20	95%	19	86%	16	89%	12	75%
Total	24	100%	21	100%	22	100%	18	100%	16	100%

Although it lacks granularity and simplifies the nuances of the previous table, this table gives a clear indication of which tasks are "not representative" and which were representative or highly representative. Subjects responded that illustration is almost completely representative to some degree, followed closely by information and leisure. Social purpose and the non-assigned task as motivations are apparently not as indicative in subjects' minds of their overall interaction with images. Yet, as chapter 5 makes clear, these results in general are as much a measurement of task design as they are of tasks of this nature. That is, it is difficult to determine whether participants were responding to whether one of these particular tasks was representative of their overall behavior, despite attempts in task design to clarify the difference. Or whether the task was abstracted by participants to a general level where Task S was representative of all their social interactions with images. For example, it is not possible to determine whether subject 2 referring to the exact context and activities of the illustration task

or simply to illustration as a motivation when responding to this question. As such, the findings of this part of the research design are later qualified in the context of the study itself.

4.6 TASK REPRESENTATIVENESS MATCHED TO MOTIVATION CATEGORIES BY SUBJECT

In Part II of the Post-Questionnaire, participants were asked to match their self-perceived motivation to the motivational categories this research explores. What follows are the tabulated results of their responses for the question asking participants to indicate which reason best matches their categorization of the motivation that underlies each task. In the following table, the tasks as presented to the subjects are matched to the task representativeness figures to reveal more about task design. The following table presents subjects' own categorizations of the structured tasks that they encountered in the research session and later evaluated.

Table 18: Task Representativeness Matched to Motivation

	Social Task		Illust. Task		Leisure Task		Info. Task		Non-As. Task	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Information	1	3.6%	15	53.6%	2	7.1%	21	75%	10	35.7%
Illustration	4	14.3%	12	42.9%	-	-	5	17.9%	2	7.1%
Social Purp.	19	67.8%	-	-	3	10.7%	1	3.6%	4	14.3%
Leisure	4	14.3%	1	3.6%	23	82.1%	1	3.6%	12	42.9%
Total	28	100%	28	100%	28	100%	28	100%	28	100%

Overall, the subjects showed a fair amount of agreement with the tasks as construed in this study. Where there was disagreement is perhaps the most telling indicator of the proximity between illustration and information as categorical motivations. The relationship between

these two has been shown to be close (McCay-Peet & Toms, 2009) in that they are the main reasons for professional image retrieval, separated by their contextual usage. That amateur subjects do not discriminate sharply between illustration and information may point to the closeness of these motivations in purposeful image retrieval and to a perceived difference with less-than-purposeful image retrieval.

These results also indicate that when users are engaged in image retrieval for leisurely, informational, and social purposes they are more likely to think of their actions as precisely what they are. Leisure is the strongest category at 82.1%, a finding that is bolstered later by the fact that users are more likely to engage in undirected search or wandering for this explicit purpose, which was articulated in the task instructions as a way of filling free time. In this instance, task design may have encouraged wandering as the context did not specify or intimate any specifics relating to search strategy whereas the other tasks did. That illustration is more likely to be understood by subjects as information indicates that they may not perceive a significant difference between these two motivations. Whether the information is for data or object purposes, such a nuance may be inaccessible or irrelevant to subjects when they distinguish between motivation. After all, it is highly unlikely that amateur users regularly spend time pondering the reasons they retrieve images.

Nonetheless, subjects were also asked to decide how they categorize their leisurely image interactions according to another level of detail that accounts for the purposes of entertainment, relaxation, and viewing aesthetically pleasing images. When subjects indicated that their understanding of a task corresponded with leisure, they were asked to further refine their answer according to the three additional sub-categories, regardless of whether the task

was actually designed to represent leisure. Table 20 presents the results to Part II: Task

Reflection of the post-questionnaire.

Table 19: Task Motivation Breakdown for Leisure Subcategories

	Social Task		Illust. Task		Leisure Task		Info. Task		Non-As. Task	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Entertain.	2	40%	-	-	8	34.8%	-	-	4	33.3%
View Aesth.	1	20%	1	100%	6	26.1%	1	100%	6	50%
Relaxation	2	40%	-	-	9	39.1%	-	-	2	16.7%
TOTAL	5	100%	1	100%	23	100%	1	100%	12	100%

In general, it seems subjects have a fairly even view of the motivations, except for the

non-assigned task where they indicated that relaxation for the non-assigned task was not the

reason they undertook the task. This is understandable as subjects were not asked to relax for

this study but were rather responding to tasks in a controlled research environment.

4.7 RANKINGS OF MOTIVATIONS

The following tables present detailed views of the rankings that participants assigned to each

motivation.

Table 20: Rankings of Motivations by Participants

Motivation	Average	Standard Deviation
To inform myself	2.11	1.423
To illustrate an idea	3.18	1.634
To entertain myself	3.18	1.335
To view aesthetically pleasing images	4.07	1.562
To interact socially with others	4.11	1.641
To relax	4.39	1.618

These figures are not true averages since each response the participant made was influenced by another answer in the same series (i.e. by selecting "to illustrate" as number one means that no other motivation can be ranked as number one) and thus not random or independent. These averages do indicate, nonetheless, the overall position that the motivations occupy with respect to each other. That is, this is not to say that because a certain motivation ranks as number one and another at number four that the latter is four times less important than number one. The following table presents a more detailed view of the motivations, one that reports the total number of indexed rankings each motivation received. For instance, information was ranked 12 times as the most important reason subjects retrieve images in a web environment. It was ranked as the second most important motivation by 9 participants and so on.

Table 21: Detailed View of Rankings of Motivations by Participants

Inform	Illustrate	Social Purposes	Relax (L)[1]	Entertain (L)	View Aesthetically Pleasing Images (L)	Total
1 x 12	1 x 5	1 x 3	1 x 2	1 x 4	1 x 1	27
2 x 9	2 x 7	2 x 3	2 x 3	2 x 5	2 x 2	29
3 x 3	3 x 3	3 x 2	3 x 2	3 x 6	3 x 0	16
4 x 2	4 x 7	4 x 6	4 x 5	4 x 8	4 x 12	40
5 x 0	5 x 3	5 x 8	5 x 7	5 x 5	5 x 5	28
6 x 2	6 x 3	6 x 6	6 x 9	6 x 0	6 x 8	28

When the leisure categories are combined, the new category changes the complexity of the differences in importance between motivations. The following tables give a different

---

[1] (L) denotes leisure. These are the subcategories of leisure.

perspective on the ranking of leisure vis-à-vis the other motivations. For example, leisure was

ranked as number 1 an aggregate 2.33 times.

Table 22: Detailed View of Rankings of Motivations - Aggregated Leisure Categories

Inform	Illustrate	Social Purposes	Leisure Aggregate	Leisure Average
1 x 12	1 x 5	1 x 3	1 x 7	1 x 2.33
2 x 9	2 x 7	2 x 3	2 x 10	2 x 3.33
3 x 3	3 x 3	3 x 2	3 x 8	3 x 2.67
4 x 2	4 x 7	4 x 6	4 x 25	4 x 8.3
5 x 0	5 x 3	5 x 8	5 x 17	5 x 5.67
6 x 2	6 x 3	6 x 6	6 x 17	6 x 5.67

Table 24 returns the discussion to the averages of each motivation's rankings. The figures to the

right are the total rankings for each motivation averaged to produce a mean score. For

example, "to inform myself" was ranked on average 2.11 when all the rankings for this

motivation as presented in the previous table are averaged.

Table 23: Rankings of Motivations by Participants

Motivation	Average
To inform myself	2.11
To illustrate an idea	3.18
Leisurely purposes	3.88
Social purposes	4.03

In order to provide smaller granularity of data on how subjects categorize sub-categories of

leisure as a motivation, one that is admittedly broad, users were initially asked to rank the

proposed sub-categories of leisure along with the more general motivations sans leisure, which

is represented by its sub-categories. This was done to get a more general idea of the relative

importance of these more detailed motivations. Overall, they appear to be less important to

subjects than the main motivations, but sufficiently important to produce an aggregate leisure

ranking that outranks social purpose.

Subjects were also asked to think of other reasons they may retrieve images online and

then to re-rank all motivations in light of their contributions and in addition to the existing

motivations. The following table presents these results.

Table 24: Other Motivations and Rankings by Participants

Motivation	Frequency	Rank	Average Rank
Creative purposes	7	1, 2, 2, 3, 3, 4, 4	2.7
Work related	1	1	1
Shopping	1	3	3
Voyeurism on Facebook	1	6	6
TOTAL	10	-	2.90

The averages listed in Tables 24 and 25 are not intended as a true mean as each ranking is

dependent on the rank assigned to another response to the same question. Instead, it is meant

to show the aggregate relationship of one to the other with respect to the number of responses

each received. For instance, "creative purposes" would seem to be less significant than "work

related" as the former's average is 2.7 while the latter's is 1. The former received 7 responses,

however, to the latter's 1 response. As a few subjects accorded "creative purposes" a ranking

that would otherwise be second to "inform myself," it appears to be a legitimate motivation

that escaped the categorizations laid forth in this study. It would appear to be closest to

"viewing aesthetically pleasing images," which suggests a passive role to images while "creative

purposes" indicates a more active role of viewing images for inspiration for one's own work with images and photos.

4.8 IMAGE LOCATION STRATEGIES – RESEARCH QUESTION 2

Research Question 2: Do search strategies vary across motivations? That is, do users employ different search strategies (directed, focused search, an exploratory semi-directed search [browsing], a combination of both, or do they wander) as their motivations change?

The following five tables present the frequencies and percentages of how participants characterized their search strategies according to the models provided in this research study.

Table 25: Search Strategy Responses

	Social		Illustration		Leisure		Information		Non-Assign.	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Specific	20	71.4%	10	35.7%	5	16.7%	6	21.4%	6	21.4%
Exploratory	1	3.6%	6	21.4%	3	10.7%	10	35.7%	5	17.9%
Combination	6	21.4%	12	42.9%	9	32.1%	11	39.3%	10	35.7%
Undirected	1	3.6%	-	-	11	39.3%	1	3.6%	7	25%
Total	28	100%	28	100%	28	100%	28	100%	28	100%

In order to provide a form of comparison for the subjects' responses to their categorizations, the Camtasia video logs were reviewed in light of subjects' responses. Where a search strategy was identical to one that preceded it but was marked differently by the subject, the categorization of the incorrect strategy was noted to compile data on the degree of accuracy of their responses. This was a problem exclusive to "specific, focused search," which subjects marked quite frequently when in fact they would engage in substantial browsing of

images in Google Images. Google Images would lead to another site, usually an image gallery, where they would explore images through browsing options. In these cases, they would proceed to the next task and conduct an identical search. It is a fairly straightforward phenomenon to correct as the responses in question were generated by searches that employed text searches, followed by ample browsing of links and images that lead well beyond the original site (i.e. Google Images), oftentimes multiple times per task. Given the amount of time that passed between the computer session and the post-questionnaire (i.e. 15-60 minutes), such mis-categorizations are to be expected. The table below presents accuracy of search strategy responses.

Table 26: Search Strategy Response Accuracy

	Social	Illustration	Leisure	Information	Non-Assigned
Accurate	22/88%	23/92%	24/96%	23/92%	21/84%
Inaccurate	3/12%	2/8%	1/4%	2/8%	4/16%

These data indicate an approximate 84-96% accuracy rating of responses.

4.8.1 Camtasia Video Logs

The subjects' subjective responses to search strategy were compared to the video logs for accuracy. Each log was reviewed for whether the respondents' answers roughly paralleled their search strategy as categorized by the primary investigator, as well as for the completion time for each task and the main sites used. Of the 28 valid subjects, only 25 video logs were successfully made. In two of the three instances where Camtasia failed, subjects accidentally

halted towards the end of the recording during the session while the other instance was due to

P.I. error.

Average times for each search session are presented in the following table. The social

purpose task where users were asked to locate an image of themselves or a friend was by far

the fastest. This result is discussed in chapter 5 as a possible anomaly resulting from the more

clearly defined task rather than owing to the nature of the task in general. The other three tasks

that represent the study's proposed motivations were fairly close in their average completion

time.

Table 27: Average Task Completion Time

Task	Average Time (mm:ss)
Social Purpose Task Time	1:46
Illustration Task Time	4:22
Leisure Task Time	4:29
Information Task Time	4:41
Non-Assigned Task Time	5:56

The logs also make clear which sites are being used most often with which motivation.

While Google Images was by far the most popular choice, Facebook emerges as the dominant

platform associated with the retrieval of images in social contexts. The sites listed in the

tabulations below were the primary sites visited by subjects. The results do not include the

various tangential sites that subjects may have visited as a secondary destination after

conducting a search. For instance, if a subject went to Google Images, as they often did, and

searched for "Chile Earthquake," they would have found dozens of images that lead away from

the popular search engine's image retrieval tool. With very few exceptions, they followed an

image and then returned to browse more on Google Images or concluded the task at that point.

On occasion, they would stumble onto an image from a gallery where they might view a

number of images before returning to Google Images or moving onto the next task. And from

time to time, they would stumble onto an image from Flickr, where they would then proceed to

conduct the same or very similar search.

Table 28: Sites Used for Social Task (Video Log Transcripts)

Site	Frequency	Percentage
Facebook	14	56%
Google Images	7	28%
Google	2	8%
Kodakgallery.com	1	4%
Linkedin.com	1	4%
Total	25	100%

When subjects used more than one image platform for a task, they used Google Images (n=1),

Google (n=1), Flickr (n=1), and Facebook (n=1)**.** Table 30 presents similar data for the illustration

task.

Table 29: Sites Used for Illustration Task (Video Log Transcripts)

Site	Frequency	Percentage
Google Images	16	64%
Google	7	28%
Wikipedia	1	4%
PITTCat (Univ. of Pgh's OPAC)	1	4%
Total	25	100%

97

For the illustration task, when participants went on to use another search platform in a given task, they used Flickr (*n=1*), Google Images (*n=2*), Google (*n=2*), a news site (*n=1*), and Google Books (*n=1*). The same information is presented below for the leisure task.

Table 30: Sites Used for Leisure Task (Video Log Transcripts)

Site	Frequency	Percentage
Google Images	12	48%
Flickr	5	20%
Google	2	8%
Fender.com	1	4%
Lanebryant.com	1	4%
Funp.com	1	4%
Slashdot.com	1	4%
Carnegie Galleries	1	4%
Nhl.com	1	4%
Total	25	100%

When subjects sought out images on a secondary platform, they were as follows: Flickr (*n=3*), Google Images (*n=1*), Flickr (*n=1*), and lonelyplanet.com (*n=1*). And when they turned to a third search or image hosting platform, they went to a news site twice (*n=2*). Below, this information is provided for the information task.

Table 31: Sites Used for Information Task (Video Log Transcripts)

Site	Frequency	Percentage
Google Images	16	64%
News site	3	12%
Cnn.com	2	8%
Google News	2	8%
Google	1	4%
Yahoo	1	4%
Total	25	100%

The secondary sites subjects visited to complete the tasks included Flickr (n=2), Google (n=2),

Google Images (n=1), a news site (n=1), YouTube (n=1), and yahoo (n=1). Finally, the same

figures for the non-assigned task were:

Table 32: Sites Used for Non-Assigned Task

Site	Frequency	Percentage
Google Images	12	48%
Flickr	6	24%
Facebook	3	12%
Google	3	12%
Pitt Digital Libraries	1	4%
Total	25	100%

When users turned to other sites in order to complete the non-assigned task, they turned to:

Google Images (n=2), Wikipedia (n=1), and Yahoo (n=1). These data show the absolute

centrality of Google Images to search for all motivations aside from the leisurely task, in which

it still emerged as the second most popular choice after Facebook emerged as the leader.

4.9 DIARY RESULTS

In total, 22 out of 28 participants or 79.6% of all subjects entered some data in their diary

responses. These 24 subjects described exactly 100 images in their three days of completing the

blog diary. The average number of images viewed and chronicled in the diary over three days

was 3.91 images. 42.5% of all entries were made on the first day, 40.2% on the second, and

17.2% on the final day of the diary. Of those who wrote in their diaries, the average number of

days of journaling were 2.3 as some participants stopped chronicling their activity after the first

or second day.

Table 33: Diary Descriptive Statistics

Total Number Who Completed Participated	22 (of 28; 79.6% participation rate)
Total Number of Images Journaled	86
Percentage of Entries on First Day	42.5%
Percentage of Entries on Second Day	40.2%
Percentage of Entries on Third Day	17.2%

Participants were asked to indicate in their dairies whether they viewed multiple images

or only single images that day. They were instructed to describe whether the image(s) they

included in the diary were viewed singly or as a group of multiple images. Overall, 42 of the 92

responses, or 47.1%, were viewed singly while 50 (52.9%) of the blog entries were for multiple

images. Individual entries can be found in Appendix F, which contains the full-text descriptions

and motivations as given by participants. Where possible, the motivations were coded

according to keywords listed in the motivations. These keywords are intended as a form of *ad*

hoc appear as justification for viewing an image. The coding done and the statistics produced

may exhibit less reliability than the more formal statistics presented above. They are simply

meant to give a more coherent sense of meaning to the extremely varied responses. The rough

groupings are important not in so much as they confirm or contradict earlier findings, but

rather they demonstrate the extent to which the categories proposed in this research study

oftentimes appear insufficiently boundarized as some descriptions of motivations straddle two

categories. Coding in this instance is more of an exercise in locating the difficulty that assigning

these motivations value in this study's hierarchy than it is in demonstrating some statistical

finding about how a given research contour affects the research questions. Moreover, the diary

data gives a needed dose of granularity to the data. For this reason, they are valuable as low-

level granular touchstones but not at a higher level of synthesis that could complement the

previous tabulated results. The context—whether a users "needed" or "wanted" an image—

becomes much clearer after considering the data. The question of context in the diary data is

addressed in more detail in chapter 5.

These codings were assigned on the basis of keywords listed in the individual diary

response. Where a particular trigger was present, it was matched with an existing motivation.

For instance, where subject number 29 described the reason that prompted him to view

pictures of exotic bugs as "just killing time," the coding was a simple exercise of determining

that this instance belongs under the "leisure" category. Where, however, the motivation for

interacting with images was vague enough or seemed to belong to two different categories, a

combined label was assigned. Online shopping and browsing of commodity products such as

shoes and dresses presented this problem on a consistent basis. While associating online

shopping with leisure and pleasure is to skirt the edges of Marxist criticism about libidinal

investments in pleasure and leisure, it is not an unfair conflation as a substantial amount of

critical scholarship in the humanities substantiates the link between shopping and individual

subjectivity. That is, there are a variety of scholarly perspectives that account for consumer

society and commodities in the fashioning of self and the (often libidinal) pleasure associated

with self-construction as manifest in consumption and shopping (Kelly, 1991; Campbell, 1998;

Rappaport, 2001).

At the same time, it is impossible to ignore the obvious information-driven needs behind the subjects' characterization of their motivation. For example, subject 10 indicates that (presumably) "girls need more shoes for coming summer [sic]" so she looked at an "image of some shoes." It is easy to recognize the information need explicit in this summary of activities. But the plural use of "girls" for a singular person's use exists in the broader context of a social vernacular that simplistically and unfairly equates women with shopping, a register of speech that cannot be divorced from common advertisements that tacitly associate shopping with pleasure. For these somewhat convoluted reasons, information and leisure were coded as equivalents where an unmistakable leisurely subtext emerges to exist side-by-side with information needs.

The data in the following table also provides additional, much needed low-level granularity to the categories that have been proposed in this research study. Where information is presented as a uniform category in the questionnaires and the literature hitherto, here it takes on a much more continuous shape according to a spectrum with information and illustration on one end and leisure on the other. In particular, information and leisure seem to be closely related categories despite the semantic distance that would seem to come between them. What is important to note is that information again emerges as the leading motivation.

Table 34: Diary Motivations Coded According to Motivation

Motivation	Frequency	Valid Percentage
Information	28	37.8%
Information/Leisure	16	21.6%
Social Purpose	10	13.6%
Illustration	9	10.2%
Leisure	8	9.1%
Unclear	3	3.4%
Total	74 (14 could not be coded)	100%

What follows are the most telling examples of the occasional fluidity of the categories this study relies on, categories that are shown in the diary responses to abut one another and often yield to one another.

Table 35: Ad Hoc Coding of Diaries into Liminal Category

ID	Description	Reason	Coding
10	Image of Philadelphia	Go travel in Philadelphia	Info/ Leisure
17	wedding photos of classmate	entertainment and knowledge	Info/ Leisure
24	Series of in-game photos from hockey game	Missed the game, was looking for pictures while reading about it.	Info/ Leisure
25	Image of shoes	Wasting time/making future decisions	Info/ Leisure
26	Colisee de Rimouski, an ice hockey arena in that city	While reading about the Pens-Canadiens upcoming matchup, I came across the term "Rimouski Oceanic player," and had no idea what it meant. I had a hunch the player was Sydney Crosby and my hunch was correct. I further searched Google for that exact string of words and came to information about Rimouski, a city in Quebec. I found an image of Colisee de Rimouski, an ice hockey arena in that city. I found interior and exterior photos of the arena. I also found a lovely photo of Legpage Park of Rimouski.	Info/ Leisure

By combing through the data looking for additional ways of grouping them out of the 88 total responses, 31 could be further interpreted: shopping ($n=8$, 9.1% of total), entertainment often associated with sports ($n=6$, 6.8%), travel ($n=5$, 5.7%), and wasting time ($n=4$, 4.4%). This evidence suggests that the boundaries erected around motivations for the purposes of this study may from time to time simply be inappropriate to apply to certain situations. For instance, viewing images of a vacation destination in some instances may neither be entirely information gathering nor wholly a leisurely pursuit.

It is important to note that of the 86 total entries where the information was recorded, the image(s) was only downloaded nine times, or 10.2% of the time. These results, as well as the antinomies uncovered by the diary results, are discussed in greater detail in the next chapter.

5.0 DISCUSSION AND CONCLUSION

This research investigation has sought to provide a more complete picture of the motivations people report for accessing images in web environments and their self-described search strategies for locating them. In the next three sections, a thorough chapter summary is given followed by the presentation of the major findings for the two research question from the previous chapters. These questions are as follows:

1. Do users self-categorize their general motivations to interact with images as information seeking, as an illustrative activity, as a social activity, or as a less-purposeful pursuit such as leisure?

2. Do search strategies vary across motivations? That is, do users employ different search strategies (directed, focused search, an exploratory semi-directed search (browsing), a combination of both, or do they wander) as their motivations change?

In section 5.4.2, a model based on the empirical results of chapter 4 is presented (Figure 5) with the aim of providing a more coherent and visual understanding of the major findings of this study. Following the model, the implications and limitations of this study as well as future directions for further research follow in the concluding sections.

5.1 CHAPTER SUMMARY

This study began with four categories of motivations that might spur users of web images to view and/or retrieve them. Locating images as a form of information seeking was posited as the dominant reason to view images according to both assumptions made in the literature on image retrieval. The remaining three categories were pieced together from various works in image retrieval and information seeking. Image retrieval as a motivation-based activity was postulated within a model where users self-report their own categorizations of reasons to locate images as: an informative or illustrative activity (McCay-Peet & Toms, 2009), as an activity predicated on social purposes (Van House, 2007), or; as a leisurely pursuit (Von Ahn & Dabbish, 2004; Butterworth, 2007; Cox, Clough, & Marlow, 2008).

28 subjects completed five tasks and provided responses to dozens of questions associated with image retrieval patterns of self-categorization during the task, questionnaire, and diary components of the data collection stage. As their responses were tabulated and arranged in a variety of ways, multiple categorizations of their responses can be made. Taking the most obvious measures of their self-reporting of motivations, the results for Pre-Questionnaire Part II: Survey of Recent Image Interactions, Post-Questionnaire Part I: Task Representativeness, Post-Questionnaire Part III Section B: Self-Categorizations of Motivation, and the diary results, indicates a varied picture of the motivations that users self-report when asked to reflect on the reasons they locate and view images in web environments.

The categorizations for Survey of Recent Image Interactions indicate a strong preference among users for using the web to locate and view images for the purposes of informing oneself (32% average over all four images), and almost equal preferences for social and illustrative

purposes (20.7% and 19.6% average for all four images respectively), and much less preference for leisurely purposes (12.1% average), and still less for "other purposes" not captured within this study's categories (6.4% for all four images). In summary, these data indicate that information is at the forefront of the amateur users' motivations to retrieve images and that upon further consideration, information is the most stable or evenly represented among the motivations. These figures are discussed in the following sections as they require qualification to account for the various contexts and potential anomalies when aggregating the data across all four images.

The responses to Task Representativeness tell a different story in that users do not find similar relationships between their self-reported motivations and how representative they found each task. Illustration tops the list in terms of task representativeness at a combined total of 96.4% with information at 92.9%, leisure at 89.3%, non-assigned at 85.7%, and social Purpose last at 78.6%. Granted, as much as they attempt to provide perspective on the degree to which users find a relationship between the activity and the motivation, these numbers also provide a measure of the degree to which the questionnaires align with their own understanding of the categories this study imposes, if not more so. That is, while they may furnish insight into users' categorizations of task representativeness, they also give a perspective from which to gauge how accurately users feel the study's contours overlap with the reality against which they measure these categories. Nonetheless, the ensuing discussion clarifies the relationship between information and illustration and explores the relationship of this duo vis-à-vis the other two motivations. The results indicate that illustration and information are similar in that users engage images for these reasons out of need while social

purposes and leisure relate more to less-than-purposeful retrieval, an important and as yet

unknown distinction in image retrieval scholarship.

In the same way, Self-Categorizations of Motivation from the post-questionnaire

measure the relative ranking of each motivation in relation to the other motivations.

Information is the obvious leading motivation at an average ranking on a scale of 1-6 at an

average of 2.11, illustration at 3.18, leisure at 3.88, and social purposes at 4.03. Again, these are

not true averages as each individual ranking is influenced by the need to mark another as more

or less important in terms of numerical evaluation. Instead, these give an internal view of the

position each motivation occupies with respect to one another and the relative relationship

across all rankings. And what they indicate confirms the previous observations in Survey of

Recent Image Interactions and Task Representativeness is that, generally speaking, information

is the dominant motivation followed by illustration, social and then leisurely purposes as the

general order in which users self-report their activities. In addition, the relationships between

motivations, particularly the differences in purposeful versus less-than-purposeful contexts, are

explored further prior to conceptualization in a schematic of image retrieval's contexts (Figure

5).

As mentioned in chapter 4, external variables such as whether a subject maintains an

image hosting account appear to have little to no impact on the motivations that individuals

report. While an occasional p-value was under the statistically significant threshold (*p-value* >

.05; *a* = .05), there were ample, unreported instances of high values above .9. Given the lack of

any legitimate reason why one set of values in particular is high while another is low, there is

little evidence to suggest that these measures are nothing more than the result of a fair distribution of statistical results.

While information may emerge as the leading reason for locating and viewing images, illustration occupies an important role as its second and oftentimes surrogate category. Information emerges as the dominant motivation, but further investigation into the data indicates that the relationship is less than one of a clean binary. This relationship and the proximity that McCay-Peet & Toms (2009) assume when trying to segregate the two according to a work task model confirm the overall similarity with which users may understand these categories and thus motivations. Additional synthesis reveals that these motivations typically entail a more comprehensive context in which need and fulfillment are more clearly explicated than social purposes as a motivation and to an even lesser degree, leisure. Much more comprehensive consideration is given to this interesting relationship in the sections that follow.

Search strategy, which is the subject of the second research question, is somewhat even across all motivations. There was slight deviation from the general range constituted by the results where social purposes emerged as the most "specific, focused search." Contrary to expectations, this finding indicates that users rely on systems like Facebook to conduct specific searches. As Facebook does not enable the searching of images but instead encourages browsing, an explanation for this result was found in both task design and in task completion. Users were given an explicit task for what might possibly be a less articulated activity than information or illustration. That they could easily solve—as evident in the task completion time and search strategy result—points to the possibility that the task construction may have pointed them in a direction contrary to the context of this motivation. In addition, registered

Facebook users know the site layout and location of specific images, so they may conceive of their browsing as searching due to an intimate familiarity with the features and contents of a finite set of image documents. Nonetheless, a spectrum of search strategy was uncovered, ranging from illustration as having the most directed, focused search strategy (withstanding social purposes) to leisure, which is the most undirected of motivations in terms of search strategy.

Turning to the blog diary data, we see the importance of information as a motivation in the user's self-reporting of motivation when they are in their natural environment. While the coding is admittedly *ad hoc*, it is useful in understanding not only how one motivation occasionally yields to another or even becomes a hybrid motivation with another thrown into the mix. It is also useful for understanding how information emerges as the dominant motivation to a greater degree than other motivations. Likewise, illustration appears to occupy much lower relevance in terms of the users' self-reported blog diary data, as does social purposes to a slightly lesser degree.

The results, especially the video log transcripts, indicate that regardless of search strategy, users are very frequently able to find what they are looking for online. In general, they self-report a preference for a combination of search and browse and overall they are fairly accurate in assessing their own search strategies.

The video log and diary data help to contextualize the various antinomies that the quantitative data evidence, and provide the kind of nuance that is often missing from such data. They help to confirm and contradict various conclusions and as such, provide opportunities to qualify the findings in light of actual human observation. In addition, they aid

111

in providing a more complete, human picture of the phenomenon at hand and help to constitute the lower level granular perspective that analyses like this often lack. As the two major conclusions to emerge from the data analysis are that: information is the dominant motivation in image retrieval while other motivations occupy shifting places in relation to information and to each other depending on the question being asked and; 2) that search strategy is somewhat consistent across the board for motivation, it is important to consider the various inconsistencies and antinomies that emerge when lower ranked motivations are brought into the picture of the first research question. The data add a lower level of granularity to motivations' dimensions, especially where the differences between motivations' contexts are considered. Both the quantitative data and the more qualitative data are instrumental in considering the question at hand from both a macro and a micro perspective.

Overall, results indicate that for the amateur user, information is the dominant motivation in image retrieval, followed by illustration, then by social purpose, and finally by leisure. Yet, as detailed contextual analysis of the diary results indicates, these categories do not always represent perfect delineations of motivation as information and leisure often emerged as occasionally distinct but often related motivations. Implications, limitations, and directions for further research follow the presentation of major findings for the two research questions.

5.2 PRESENTATION OF MAJOR FINDINGS FOR RESEARCH QUESTION 1

Research Question 1: Do users self-categorize their general motivations to interact with images as information seeking, as an illustrative activity, as a social activity, or as a less-purposeful pursuit such as leisure?

5.2.1 The First View - Recent Image Interactions

Returning to the Survey of Recent Image Interactions with a finer focus, a more detailed picture of users' motivations emerges. With 100% of participants recalling their most recent image interaction, informing oneself garners 9 responses or 32.1% of the total. Leisure and social purposes are identical at 6 (21.4%) while illustration (n=5, 17.9%) remains the lowest of the four specified categories. As one progresses through the data, however, a different pattern emerges. Information rises in prominence (from 32.1% to 39.1%), illustration increases (from 17.9% to a low of 16.7% to a high of 26.1%), social purposes varies up then down (from 21.4% to 13% only to repeat again), and leisure falls only to rise again (from 21.4% to the mid teens and then to 29.4%).

While the overall picture to emerge is of information as the dominant motivation followed by social purposes, illustration, and then leisure, it is worthwhile to note that as the variables change as the subjects' ability to recall their recently past interactions with images wanes, certain variables emerge more prominently versus others. Information holds relatively true according to a slight increase from the lower to upper thirties before falling to the low to mid twenties as the number of no responses more than doubles from previous tables. This suggests that information as a motivation is more consistently present in subjects' minds than

the other motivations when they reflect on the reasons they accessed images online recently.

That is, the consistency of this measure is greater than that of the others, indicating that users

may have an ongoing need to view images for information purposes. Moreover, their recall

favors information as a motivation, suggesting that it is not only a steady need but one that

factors most prominently in their minds when they categorize their motivations.

The rest of the motivations tell a different story. As subjects' ability to recall their recent

interactions recedes and/or they have fewer recently viewed images to report, the trajectories

of motivations across images recalled varies much more unpredictably. On the one hand, the

averages across motivation are roughly equivalent to the frequencies of the motivations for the

first two images recalled, implying that the full response of all 28 subjects for image 1 and 24

for image 2 are perhaps more balanced than the third and fourth responses, which would have

been given by those with either better recall or more recent images to recall from memory. On

the other hand, it is impossible to know whether greater memory recall is equivalent to having

more images to recall in this particular instance because a poor memory does not indicate

whether someone views fewer images than someone with a better memory.

5.2.2 The Second View - Task Representativeness

What is perhaps the most contradictory set of statistics to emerge from this project's data set is

task representativeness. Illustration is the leading motivation among all others when users are

asked to reflect on how closely a given task represents tasks they encounter in the real world.

This finding contradicts the previous findings, where information is by far the most frequently

recalled reason for locating and viewing images online. Given information's prevalence at the

top of most every other measure, it is somewhat surprising that illustration emerges as the leading motivation. Illustration is followed by the information task, leisure task, non-assigned task, and social purpose task.

As mentioned previously, however, task representativeness in this study measures task and questionnaire design at least as much as the questions this study attempts to answer. This means that while some subjects may have thought they were determining how closely their everyday image interactions are measured by the immediate context (computers, in this case) of the task, others may have assumed they were being asked to measure how closely the task in general (again, illustration) represented their everyday image retrieval activities.

One possible reason for illustration's place at the top of the motivations is in the wording of the task. Users were asked to imagine a very specific context (a class project) and a specific need (images of computers). Given the large contingency of master's and doctoral level students, the task may very well have more closely mimicked the types of activities students engage in for coursework than the other tasks, which varied in levels of specificity. Illustration may be one of the most specific tasks, along with social purposes, as they are given a context (class project) and a need (find images of computers). Indeed, the only other task that stipulates a type of need to urge subjects on is the information task, which asks users to imagine a context (catastrophic event) in which to view images that they *want* to see out of curiosity. The difference between needing to view images and wanting to in terms of assumed task also comes into play for the social task and the leisure task. This reasoning may also explain why the non-assigned task, which theoretically should have had 100% task representativeness (i.e. subjects were essentially asked to complete an image task that is most representative of

their everyday image activities), did not emerge as the leading motivation. Had they been compelled to by a given task, the results may have been different.

If this is the case, it suggests that image retrieval is frequently a contextual activity that is driven by a specific need. If this is not true, it indicates that future research into this area should ensure a consistent level of task complexity, which necessitates both a context and a need for image retrieval. Moreover, one should not discount the potential influence that the restriction limiting images viewed to ones "that would be appropriate for all audiences" played. By reminding subjects of the fact that they are not in their real-world setting, it may have affected their behavior towards less realistic uses of images.

Nonetheless, the results of these figures point to the possibility that illustration as a motivation shares an important commonality with information: as motivations, they both compel users to view images out of need rather than want. While one can argue that human beings have a distinct social need to view images of others simply by pointing to the ancient phenomenon of image making according to personal likeness, it goes without saying that the desire to view images for social purposes is also an important consideration of how and why we view images. Ever since photography's shift from the domain of the professional in the early to mid 19th century to a amateur hobby in the late 19th and early 20th century as a leisure activity (Sontag, 1973), image making and image viewing have been associated with leisure and pleasure. And as there is little in the way of explicit compulsion as dictated by need in leisurely and pleasure activities, it likewise stands to reason that the leisure task may not have resonated with subjects like those that specified a need.

The inverse of this may be true as well in that leisure may not be the clearest expression of the idea to subjects. Take, for example, the relatively high ranking of leisure's sub-categories (relaxation, entertainment, and viewing aesthetically pleasing images) vis-à-vis the other motivations in Part II: Task Reflection of the post-questionnaire. Once framed as an activity unto itself for pleasure's sake, subjects were able to rank the sub-categories individually almost to the degree of illustration. The two motivations whose contexts are the least specific in terms of expressing a need—relaxation and entertainment—actually succeed in communicating an entire activity absent need. Given that the sub-categories are more specific than leisure in general, subjects may have been able to evaluate these less-than-purposeful motivations more fairly in light of purposeful image retrieval. It is important to keep in mind, however, that these contingent conclusions are as much judgments of the tasks as they are of the way people view the tasks and what their views may tell us about their relationship with images in web environments.

5.2.3 The Third View - Self-Categorizations of Motivation

The findings of this measure—that information once again emerges as the leading motivation—do not come as a surprise. In all measurements except the last, information leads the others by a significant margin. In this case, it is from nearly twice as likely to six times as likely to be ranked as the number one rating by participants when compared with the other motivations. What is surprising is that the remaining motivations are ranked differently from the previous relationships described above. In this instance, information's cousin, illustration, garners a high

ranking that once again contradicts the findings of recent image interactions, where it was superseded at various points by all other motivations.

While this part of the survey was not randomized so that each participant was presented with the same blank options to be ranked, illustration was the fourth option of the six and was nestled amongst the leisurely options of relaxation, entertainment, and the viewing of aesthetically pleasing images. Had information been followed by illustration and so on, it would have given cause for concern, but as it is, it seems the rankings reflect the serious consideration each participant gave to the task.

Nonetheless, these rankings require additional explanation. This section of the survey was designed to rank all motivations relative to each other, including the more detailed motivations of relaxation, entertainment, and the viewing of aesthetically pleasing images. In order to arrive at the aggregate ranking of leisure as a category, these subcategories were combined in order to yield a meaningful average in relation to the rankings of the other motivations. As the averages are not entirely true measures of a central tendency, they do not indicate any independent ranking, but rather demonstrate the relative importance participants assigned to them vis-à-vis other motivations. Nonetheless, they yield insight into the relationship between information and illustration and thus return the conversation to the potential preferential role that purposeful image retrieval occupies in users' categorizations of motivations when they are asked to consider simultaneously the role that less purposeful image retrieval plays in their rankings.

This distinction is an important one that may hold bearing for the binary that McCaay-Peet and Toms (2009) try to separate in their work-task model. Similar to how they conclude

that descriptive and conceptual image attributes are used evenly in the retrieval of images for both information and illustrative purposes, these findings point to the importance that need may have in the image retrieval context. If information and illustration are linked in an axis where on one side images retrieved for the purpose of informing oneself are data and on the other images for illustration are objects, then the interpretation of these findings suggest that relative to such an axis is a relationship between leisure and social purposes that diverges on the lines of desire instead of need. The conceptual relationship between need-based and desire-based image retrieval is considered later in this section.

5.2.4 The Fourth View – Diary Data and Motivations

The diary entries, besides confirming once more that information is the leading motivation, provide a more contextual basis for considering the question of users' motivations to retrieve images in web environments. Whereas the questionnaire results provide a succinct perspective on outright motivations as formulated in this research study, the diary data helps to qualify the category formulations themselves. Subjects' responses and explanations of their motivations can be contextualized in the participants' own descriptions of their image retrieval activities in web environments. Moreover, considering the implications of the subjects' image retrieval contexts and needs observed in their own words is the most direct way of aligning research question 1 with the larger literature on the motivations discussed in the literature, primarily information and illustration. By juxtaposing these motivations from the image retrieval scholarship alongside the diary data, the ground is laid for exploring the other two motivations—social purposes and leisure—as an extension of the scholarly work on users'

motivations in image retrieval. Most importantly, the similarity of social purposes and leisure as motivations to the contours of a work task model where context, need, and the nature of the image use (as data or object) is shown by the diary data to be somewhat uncertain when compared with the clarity of the dynamic between information and illustration. As the codings assigned to each description are *ad hoc*, this discussion confines itself to situating the most obvious responses in natural categories and exploring the ways in which other responses disrupt the neat categorization this study and others assume when considering motivation, whether for professionals or amateurs.

Work task in studies (Fidel, 1997; Efthimiadis and Fidel, 2000; Markkula and Sormunen, 2000; Westman and Oittinen 2006) of professionals has been shown to play an important role in how professionals retrieve and use images, particularly where image attributes are concerned. While this study is less concerned with image attributes, it does recognize the importance of how users categorize and provide an explanation for their search. The information and illustration tasks that are explained in the diaries are often influenced in terms of a work or need context.

What follows are illuminating examples culled from the data responses. The examples below are the most obvious and unambiguous as to motivation, although some ambiguity persists, especially with the social purpose and leisure examples. These selections are not meant as a sub-sample from which to draw conclusions but rather as exemplary examples that demonstrate the contextual differences separating each motivation. In addition, they help to increase the depth of detail that the data have hitherto provided. Some examples for illustration are:

- I located 2 images [image of an illustration of the Memex machine] that would later be used in class presentations (S03).

- I needed an image of myself for an assignment (s12).

- Needed to send it [picture of self] to someone else for a press release (s29).

In these examples, need figures prominently. The action verb in the last two is suitably "need" while in the first, need is reserved for a later use. This need helps them frame their explanation of the reason they located and viewed the image. It is clear that need plays not only a motivational role but also a discursive role in how users categorize and relate their interactions with images. Turning to information, these implications are confirmed. Examples for information include:

- I should check out areas so I know where it is I would like to live [in South Florida as preparation for an upcoming move] (s2).

- To figure out ways for my sister to get out of Paris (s14).

- Needed to verify my recipe was okay [by viewing image of food] (s25).

Likewise in these examples, need figures prominently. Each need is embedded in a work task context of sorts that has a definite end. In each instance, there is an action to be completed, an action that is partly or wholly completed by viewing images. These six examples

also confirm Fidel's findings that images used for information purposes are categorized as data while those used for illustration are objects. In the illustration examples, the images are being saved or used as boundarized objects, or files, for communicating to someone else or for later use. A similar use of images is found in subjects' descriptions of using images to illustrate an album cover with Pandora radio (subject 17) and iTunes (subject 12). For information purposes, the images are being used to verify or extract information for some other necessary purpose. For instance, a few examples related to the need to visually identify an object or fact, ostensibly due to an initial lack of textual vocabulary with which to describe it in a search engine. Subject 20 thus viewed a "picture of Sidney Crosby's winning goal of the Olympics" because she "couldn't remember whether Canadiens were home/which color uniforms they wore" (Coded motivation: information). Or subject 29 looked at "images of flowers" because "she had to identify a type of flower to know its name so [she] could look up how to care for it" (Coded motivation: information).

Viewing images as part of keeping up with the news is an oft reported motivation by participants, one that is coded as information. Examples include:

- "Interested in the news and to follow the developments" was the reason that led subject 18 to view "photos of the strike by students at the University of Puerto Rico."

- Subject 23 viewed an image of an "aerial view of oil leak in [the] Gulf of Mexico" for the purposes of "news/information."

- Three of subject 23's entries relate to looking at images in the news for the purpose of "news/information/curiosity."

In the context of viewing images for staying apprised of recent developments, the news as a source of information is a context unto itself. Subject 23 suggests the subtext to this aspect of information as a motivation when he lists "curiosity" as an auxiliary reason for viewing these images. The progression from news to information to curiosity even alludes to a hierarchy where the news as a general and ongoing goal is substantiated by the need for information, which is propelled by curiosity.

The blog diary entries also provide valuable insight into the nature of image retrieval for leisurely and social purposes. Whereas the context associated with information and illustration motivations were often need-based, it is less clear when leisure and social purposes are the reason for locating and viewing images. As no one has yet to consider leisure and social purposes as motivations in image retrieval, this study lacks a proper theoretical context for understanding the uses of images for these purposes. No clear-cut distinction emerges from the data between images used for social purposes and images used for leisure as either objects or data. The diary present an excellent opportunity to explore the possible theoretical contours of image retrieval as a need versus desire undertaking and as a data versus object oriented activity, all as ways of considering and investigating the contexts in which image retrieval is taking place from the in-depth point of view afforded in the diary data. Social purpose and leisure, according to the most obvious examples which here are considered as prototypical instances of their motivations, differ from each other in somewhat significant ways, which are explored below in respective analyses of the selected data.

What they have in common, and in contrast to information and illustration motivations, is that when compared they lack an overriding context in which image retrieval activities are begun and finished. Some examples for image retrieval as social purpose include:

- I wanted to see what my old friends look like these days (s8).

- [To] remember a recent party [I] looked at photos of friends on Facebook (s12).

- Wanted to see pictures of my niece's birthday party (s16).

- Hadn't looked at a picture [of my parents] in quite some time, so I thought I'd go to my mom's Facebook page (s18).

Need surfaces as a parallel and equal subtext to the motivation in only the first example where social purpose shares common ground with information. The desire to interact socially with others in a mediated digital environment is motivated by gleaning information about the physical appearance of old friends. In this instance, the image is being used as a form of data and not an object. But whether the following examples are being used for the purposes of gleaning data or are being viewed as objects in and of themselves is difficult to determine. The user who viewed an image of a recent party for the purposes of remembering may have been trying to recall visually a detail from the event. Or, the participant may have been viewing the image as a succinct encapsulation of the event, not for documentation or verification but as an object and touchstone that spurs reminiscing—or in the subject's words, remembering. Similar divergent explanations can be offered for the subject who viewed images of a niece's birthday party. The last example is equally difficult to pin down in terms of the data or object question. It

is unclear from the explanation whether the subject seeks out images of his parents for gleaning data about them or for the purposes of remembering. The guidance that the blog diary task provided was insufficient where the social purpose motivation is concerned as users did not think to furnish additional details about the deeper data versus object context in which they seek out images. That is, when users reflect on social purpose motivations, they may not have mental access to a readymade context that would delineate between data and object use as may be the case with information and illustration. This implication suggests that when users seek out images for social purposes, it may be for viewing images as a form of data or as objects embedded in an online social context.

Where context is concerned, the last three examples differ from the first six in that the context for image retrieval is not as specific or concrete as for the previous two motivations discussed. That is, the information context is a social need to interact with others through the mediation of digital images in web environments. So the descriptions of motivation tend towards more vague assertions of need rather than an explicit task to be accomplished. Moreover, need is to a certain degree supplanted by desire, but as these are selective examples from an *ad hoc* coding system, it is difficult to ascertain the relative importance of desire over need.

Nonetheless, it is clear from the examples that the explanations of motive are either worded less clearly or definitively than for illustration and information. Where the dominant action verb in information and illustration examples is "need," the verb's resolution is often found in a context, such as finding an image "for a class" project. Returning to social purposes, the verb in question is sometimes "want" and its resolution is tacitly suggested in the context.

Regardless of the verb ("want," "remember," or an activity where the subject had not done something in "quite some time"), the completion of that act or the fulfillment of a desire can be found in general in the context of the image retrieval. Thus, subject 16 "wanted to see pictures of [a] niece's birthday party" so she sought them out. Or in the spirit of the vagueness that pervades this motivation, subject 23 viewed an "image of [a] friend " out of "personal interest." Likewise, subject 25 "wanted to see family" so he viewed an "image of [his] brother's family."

The clearest examples of image retrieval as leisure all contain some variant on "wasting time." Aside from the last example, which is dual coded as information and leisure, the following examples are interesting variants on leisure:

- This morning I killed some time finding pictures of the Bahamas. I've always wanted to go there on a vacation (s8).

- Subject 29 viewed "pictures of exotic bugs on Flickr" while "just killing time."

- Subject 25 looked at an "image of [a] watch" as part of "wasting time."

- Subject 25 also looked at "images of shoes" as part of "wasting time/making future decisions."

These examples, while not exhaustive of leisure, all imply a general context of looking at some image(s) in particular but for no particular reason aside from the last example, which is tied to decision making in the future, leisure, and possibly to shopping, which might be one of the "future decisions" to be made. The motivation for viewing images is in some sense simply for the sake of viewing them. It is a way to fill one's time with a less-purposeful activity rather

126

than with one that is necessary and yields a result. That is, there is no evidence in these examples of a need to interact with images; rather, these users express in the main the desire to engage in an activity that is expressly devoid of need. Consequently, there seems to be little need to view images as a form of data. Images are located and viewed as objects to distract them. This is not to say that they do not extract data from them, as the last example suggests quite the opposite. But as leisure objects, the images are placed in a context where their primary value to the subjects is realized when the images are viewed.

As with images viewed for the purposes of illustration, the images are being put to a purpose where they are needed as whole or total instances of a compelling visual context. In the case of this study's tasks and the diary results, the narrative for illustration was a class or work project. What makes the above examples leisure is that they lack any distinct context outside of pleasure besides the appeal to engage in image viewing for its own sake. Take, for example, subject 28's explanation as to why she viewed "essie nail color"—"leisure." While this may be the only overt instance where the previous data collection session explicitly affected the subject's description of motivation by supplying a readymade category, it is telling that the category itself is sufficient to capture the complexity of this aspect of image retrieval.

The wording of these examples gives further evidence that images are being used for leisurely purposes as objects. In the last three examples, the image viewings are expressed as subject-object activities. For subjects, it is easiest to express their leisurely activities in terms of viewing images. Their descriptions to the images viewed, as directed in the diary instructions, indicate a lack of any context aside from the assumed one of "viewing" in the activity itself. So the lack of context is assumed as subjects often describe the images in a matter of fact manner.

127

For example, subject 18 viewed "photos of Deftones performing at the Vive Latino festival in Mexico City" and described the reason simply as "Entertainment." Or consider subject 29's explanation of why he viewed "images of newest Trek bicycles—Felt like looking at latest models, but not for any reason like buying them." Each instance explains the activity as a natural occurrence that requires no justification aside from pointing out that the activity occurred. Moreover, the bicycle example suggests that subject 29 sees the leisurely activity of viewing images as a category of image retrieval that is mutually exclusive of need. That is, at the very least, the motivation appears to be less important than the need to explain what the motivation is not.

Yet many entries cannot be delineated one from the other so neatly as with the many examples above. In some cases, information and leisure coincide as motivations according to the coding applied to the diary data, particularly when the explanation involves shopping online or future travel plans. As information factors heavily into the subjects' explanations of their motivation, it is not surprising that these instances oftentimes contain clear contexts in which the activities are begun and finished. Some examples are:

- Subject 10 viewed "image of Philadelphia" because she may "go travel in Philadelphia."

- Subject 17 viewed an image of "sunglasses Rayban [sic]" for the explicit purpose of "shopping."

- Subject 25 "missed the game, [so] was looking for pictures [from a "series of in-game photographs from hockey game"] while reading about it.

As expected of a hybrid category like this, these are much more varied in their context and wording. Their context is more akin to the information context where an image is situated in an information need, it is viewed in fulfillment of that need, and it is often described in that information context. Where it begins to cross the boundary to leisure—and consequently the boundary between leisure and information begins to erode—is the express purpose of these activities, which are leisurely by nature. In these examples, leisure has subcategories that furnish a ready-made information context that is informed by a need. Where it is shopping or travel, the subject knows which types of images need to be viewed and then proceeds to do just that.

Here we also have confirmation of images being needed for data purposes rather than as objects. So a distinction can be drawn between images viewed for viewing's sake (images as objects) and images viewed for information's sake (images as data). The shift that each motivation undergoes is a two-way shift, where information accommodates leisure as an outward motivation and where leisure gains a need-based motivation in contrast to pure leisure where subjects fill time with image viewing.

But there are also examples where information and leisure occasionally exist side-by-side and the relationship between them takes on a different form than evidenced by the previous examples. Two instances where this is the case include:

- Subject 17 viewed "wedding photos of classmate" for the purposes of "entertainment and knowledge."

- Subject 17 also looked at images of "kim chi [fermented cabbage dish]" for the same purposes, "entertainment and knowledge."

- "I looked for stories/images of the [Pens-Canadiens] matchup. I found images at the NHL.site [sic] of various Pens' and Canadiens' players playing against each other in previous games." The subject's reason for seeking these images and stories was because she was "excited about the Pens-Canadiens (Habs) first game tonight" (s26).

Subject 17's responses suggest that one can view images as a form of data and as leisure objects in a complementary fashion. The need for data does not necessarily rule out or trump the pleasure of viewing images that Cox, Clough, and Marlow (2008) associate with the amateur photographer's interest in (digital) photography and Flickr. The last example indicates that information retrieval (locating textual stories online), image retrieval, information, leisure, and even excitement can all coexist as motivations. Whether they are all operative simultaneously or one gives way to another as one motivation becomes ascendant over another is unclear.

Where information and illustration motivations are almost all abundantly clear in the coding—aside from where information and leisure appear together—social purposes and leisure are somewhat more tenuous as to the codings assigned them. On the one hand, the examples chosen for this discussion have been fairly obvious and the implications implicit in each response were just as obvious. On the other hand, a number of examples are not as clear, as are the implications that one can draw from them.

- Subject 10 viewed an "image of some actors" and the explanation of motivation was given as related to something "which talked about these actors" (Coded motivation: leisure).

- Subject 17 viewed a "picture of [a] friend" and the explanation of motivation was given as "friend with child in pool for first time" (Coded motivation: social purpose).

Finally, a few entries were simply unclear but are still noteworthy for how they stretch the boundaries of the motivations advanced in image retrieval and extended in this study:

- Subject 20 viewed a "picture of a fighter jet" because she "wanted to associate [a] picture of wasteful government project with the plane (F-22?)" (Coded motivation: information/illustration).

- Subject 29 looked at "images of suicide bombing in Iraq" because he "wanted to see the carnage" and for purposes of "voyeurism" (Coded motivation: unclear).

The first example contains an obvious need—to associate a concept with a visual expression or reference—and can be viewed as both an instance of illustration and information. It is unclear whether the association was made by adding visual information to the concept or by expressing that idea visually. Subject 29's response is perhaps the most macabre example for its brutal honesty in linking a transmuted pleasure with the potential scopophilia of certain motivations that exceed the consideration of context given in this research study. But the subject's concept is not an inappropriate characterization of the image retrieval activity as the participant's main desire in viewing the pictures is in seeing "the carnage." This is not by any

means a new motivation, as sites like rotten.com and celebritymorgue.com have for years made a business of offering visitors to these sites the opportunity of viewing others' misfortune. Based on the subject's categorization of voyeurism alongside carnage, it is not a stretch to assign pleasure to this image retrieval activity. Whether it is leisure is less clear; therefore it is left as unclear.

In image retrieval contexts, our motivations can be divided into two broad categories: 1) need-based image retrieval, which is well-described in the literature and which is treated in detail here, and; 2) desire-based image retrieval, which is introduced here for the first time and explored in similar detail. As a way of putting the totality of amateur users' activities that extend beyond those of the professional, this is a helpful division that is made to speak generally about how these motivations and their contexts change across motivation. Nonetheless, like all attempts to structure real world realities into academic frameworks, it is never totally complete, as the diary data reveal the occasional proximity between information and leisure as motivations. Figure 5 accommodates the most obvious collation of motivations— information/leisure.

The information and illustration motivations represent the next level of specificity of motive for need-based retrieval with people using images as data when pursuing images for information's sake. For illustration, users seek out images as objects that they can save for later use (e.g. communicate to others, incorporate in a project, or use them to illustrate a music album in iTunes). The use of images for information and illustrative purposes is overwhelmingly conducted in a context of need, one that users can readily describe.

Leisure and social purposes are more difficult to separate as they do not divide as neatly as information and illustration according to a data versus object paradigm. Instead, leisure is a desire-based activity while social purposes is perched between desire and need-based retrieval. In addition, leisure tends towards an object-based pattern of use when it is evident, but this finding is best understood as an initial step to better understanding this motivation. Social purpose as a motivation is often described in terms of both need and desire in that it is usually embedded in a more definitive context than leisure as a motivation (see Figure 5).

5.2.5 Summary to Research Question 1

The framework of image retrieval that emerges accounts for leisure and social purposes as motivations and suggests the broad outlines of each motivation. The results of this study indicate that information is the overriding motivation of image retrieval among amateur users, followed by illustration, and alternatively by social purposes and leisure. When users engage in image retrieval according to its dominant motivation, they do so in a clear context of need and task completion. Likewise, when users pursue images in web environments for the purposes of illustration, an activity that they do somewhat less frequently than for informational purposes, they can readily identify the context of need and the images that fulfill that need. Yet when they locate images for leisurely and social purposes, they are unable to describe the context and the task in the same easy terms that characterize their understanding of information and illustration as motives. Generally speaking, preliminary results indicate that the less an image retrieval activity is need-based, the less clear the context, the less clear as to whether it is used

as data or an object, and the more likely users are to report motivations of social purposes and leisure.

5.3 PRESENTATION OF MAJOR FINDINGS FOR RESEARCH QUESTION 2

Research Question 2: Do search strategies vary across motivations? That is, do users employ different search strategies (directed, focused search, an exploratory semi-directed search [browsing], a combination of both, or do they wander) as their motivations change?

Based on the subjects' self-reported categorizations of their image search and location strategies, search strategies vary significantly according to motivation. The strongest indication of strategy was specific, focused search for social purposes. The least focused or specific search comes from the leisure task. A combination of the first two options ("a specific, focused search" and "an exploratory, somewhat directed browse-like search") is the most consistent indicator of strategy, with the low (21%) being almost exactly half of the high (42.9%) and the other percentages in the mid to upper thirties.

In this study, social purpose is the most directed of tasks in both positive measures (71.4% reporting a focused search) and in undirected assessments (only 3.6% indicating an undirected search or wandering). In light of the other results, the social purpose task results for search strategy may reflect the explicit nature of the instructions as much as search strategy. The Camtasia video logs show time and again that users knew exactly how to fulfill the task and proceeded to do that by finding an already known image. The average time to complete this

task confirms this: it took well over two times as long for users to complete the next quickest task—the social purposes task was completed on average in 1:46 while the illustration task in 4:22. The social purpose task certainly reflects an aspect of interacting with others in a social way by viewing images, but its somewhat sharply defined context and well-articulated need may not encompass the broader, need *and* desire-driven nature of image retrieval for social purposes that the diary logs suggest. In this sense, more undirected search or wandering would be suspected, or at least greater representation of "an exploratory, somewhat directed browse-like search" (3.6%). Nonetheless, the data indicate that when users know what they are looking for, they manage to find it. Only 2 searches out of the 125 captured in the video logs were unsuccessful, one of which was corrected on another platform.

Where social purposes may deviate from what might be expected, leisure as a retrieval motivation is more often undertaken with a strategy that users characterize as "undirected search or wandering" (39.3%). It is the polar opposite of social purposes for this measure and also the most representative of the group. This is the first time these motivations deviate to any significant extent, raising the possibility of a less-than-perfect match of task conceptualization to reality where social purpose is concerned. Users demonstrate a pattern for search strategy that common sense would tell us to associate more leisurely browsing—much less directed search and more wandering.

The results for illustration's search strategy indicate that users retrieve images with a directed strategy in mind and with zero need to engage in undirected search or wandering. When looking for images for illustration purposes, people are apt to engage in a search that is

focused and specific in nature, providing further evidence that the context of the search is well-formulated with a need and an image or images that can satisfy that need.

The findings for information's search strategy lead us in another direction where a browse-like, exploratory search is more prevalent than a focused search, except when users employ a combination of the two. And when locating images for information's purpose, people are more likely to employ a browse-like strategy when compared with finding images for the purpose of illustration. This finding indicates that while the context of the retrieval may be clear, the way of finding the needed image(s) is not as explicit as with illustration as a motivation.

Overall, two separate results together indicate an important finding. The video log transcripts indicate that Google Images is the dominant tool for locating images online while the search strategy results suggest that users prefer a combination of search and browse for most motivations. These two findings together suggest a relationship as Google Images requires a targeted word search (specific, focused search) followed by browsing and scrolling through images to find the relevant one. Once users clicked on an image, they occasionally perused farther by viewing the original page but more often returned to Google Images to continue browsing. Given Google Images' predominance as the platform of choice for image retrieval for all tasks but one (leisure), its search and browse interface for images likely coincides with the preferred search and browse method employed by users. These findings indicate that a text-based search interface is adequate for almost all users and contexts, including data and object-based motivations and purposeful and less purposeful retrieval. Paradoxically, social purposes stands alone as a fairly specific and directed search motivation that is not well served by a text-

based interface but rather by the more browse-like platform of Facebook. One interesting

possibility that explains this paradox is that Facebook, which dictates how users navigate their

site and is thus relatively straightforward and easy to browse, is perceived as a search platform

when subjects are asked to reflect on their activities therein.

Further statistical analysis of the data related to search strategy shows that social

purposes withstanding for the above mentioned reasons, illustration forms one end of a search

versus wander spectrum that is completed at the other end by leisure. At the one extreme,

image retrieval for leisure is largely an undirected wandering and to a lesser extent a

combination of the search and the browse strategies. At the other, illustration is a motivation

carried out by a directed search when focused search is not complemented by an exploratory

browse-like search. In between are the motivations of information as a fairly balanced category

that skews towards a browse-like search and of the non-assigned task, which trends towards a

specific, focused search that is generally eclipsed by a combined strategy.

5.4 CONCLUSION

In this section, an aggregate conceptualization of the rankings is given, one that accounts for

the variations of the rankings throughout the various measures. A tabulated summary of the

rankings by each of the three measurements is presented below followed by a schematic that

accounts for the contours of motivations.

5.4.1 Aggregate Rankings of Motivation

Table 36: Aggregate Rankings of Motivation

	Recent Image Interaction	Task Representativeness	Self-Categorization of Motivation
1	Information	Illustration	Information
2	Leisure	Information	Illustration
3	Social Purpose	Leisure	Leisure
4	Illustration	Social Purpose	Social Purpose

The following implications can be deduced from the hierarchies above:

- Information is predominantly a more common motivation than illustration.

- Illustration is represented higher and/or more often than leisure and social purpose, yet is closer to leisure and social purposes than to information in terms of importance.

- Leisure consistently ranks higher in terms of importance as a motivation than social purpose.

These findings indicate that the hierarchies of motivations when users' assign importance is: 1) information; 2) illustration; 3) leisure, and; 4) social purpose.

Yet it is obvious that there are a number of antinomies in this array of data. Information is the leading motivation except when superseded by illustration and illustration precedes leisure in importance except for Recent Image Interaction (see Table 37). As discussed earlier, illustration leads information for a question that is as much an indicator of task design as it is of task representativeness. As an aggregate across all four recent image interactions, illustration

emerges as the least represented motivation. But for any given image recalled by participants, it was equal to one of the other motivations excluding information. That is, for the first image, it was tied with social purposes as the least representative and for the second image it was recalled at a higher rate than leisure (see Appendix E). For the third image, it was the second most recalled motivation while for the fourth, it was the second most important motivation tied with leisure. So while it may have been subsumed when tabulated with the aggregate data, its relatively low importance may be explained by its inconsistency as a recalled motivation.

5.4.2 Proposed Model of Motivations' Contours

The theoretical paradigm of information in image retrieval as data-driven versus illustration as object-driven is revisited and expanded with the empirical results and findings of this study. The relationship between these is charted in a conceptualization of the motivations according to context. The schematic is then followed by discussion of the implications and limitations of this research project as well as of future research.
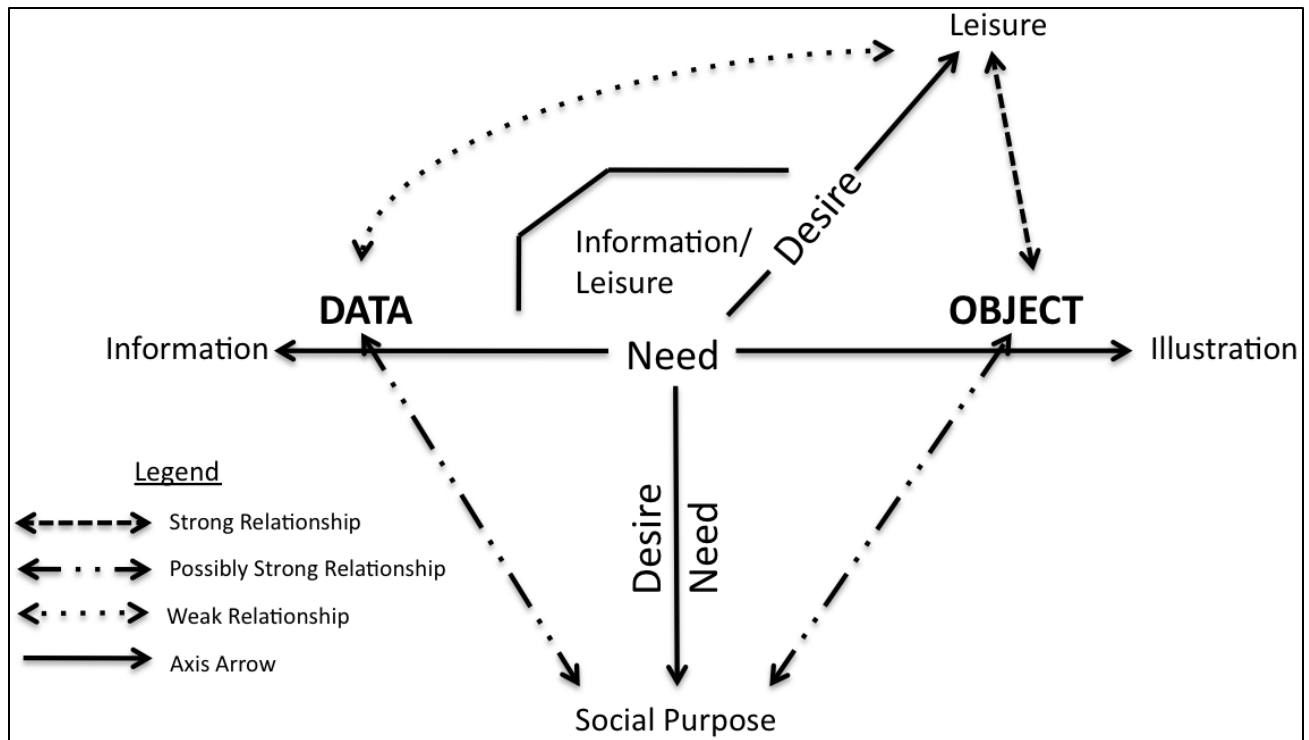
Figure 5: Model of Image Retrieval Motivations According to Need vs. Desire and Data vs. Object

The schematic in Figure 5 introduces a new perspective on the dynamics of the types of

categorizations users make of their own motivations. The conceptualization shows how two

contexts, image as data versus object and image as need versus desire, exist in relation to one

another and also the relationship of each motivation to another according to their inherent

differences. These dynamics are juxtaposed on axes of data/object and need/desire. To

accommodate the dualistic nature of the social purpose motivation as part desire- and part

need- based and part data- and part object-driver, the north-south axis is perched

perpendicular to it and arrows connect express the possibility of a strong relationship, which

could in future investigation turn out to also be weak. Leisure is situated at an angle from the

north-south perpendicular because results indicated that its context was object-driven more so than data-driven.

The visualization affirms that social purposes as a motivation partially shares common ground with information (as data-driven) and illustration (as object-driven) while illustration and leisure are alike in that they too share common ground as an activity that is object-bound. As leisure is not object- or data-driven to the extent of illustration and information, it intersects the division at an angle, indicating strong yet not total semblance in the match. Its distance from data is intended to demonstrate a weak relationship between leisure's context and data-driven image retrieval. And as information and leisure emerged as an occasional conceptual pair from the diary data, that relationship has been preserved as an enclosed space between the motivations. The weak relationship indicated by the arrow above this space does not relate to the conflated motivation of information/leisure. Rather, the context of information/leisure as a motivation trends towards data-driven retrieval of images, so it is situated in a relationship with the data portion of the east-west axis.

To strengthen the theoretical foundation of the model, the exemplary diary answers were mapped to its axes to contextualize the schematic. Figure 6 presents the same relationships between motivational contexts but includes the clearest examples from the diaries as a way of demonstrating the diary data in quasi scatter plot fashion. As these diary examples are least ambiguous textual representations of motivations in the subjects' own words, figures 5 and 6 are intended not as absolute expressions of a real world construct but are rather *de facto* conceptualizations of what the most articulate and closely matching diary entries portend about the relationships between motivations. That is, their succinct

141

encapsulation of each motivation is the most representative, so the previous and the following

diagram should be understood as the clearest articulation of each motivation rather than the as

the most accurate reflection of a real world concept. As the diary data and the varying results of

the three measurements of motivations' rankings show, image retrieval motivations as tested

in this research study are difficult to triangulate and segregate at a deep contextual level.

Information/Leisure

-Subject 10 viewed "image of Philadelphia" because she may "go travel in Philadelphia."

-Subject 17 viewed an image of "sunglasses Ravban [sic]" for the explicit purpose of "shopping."

-Subject 25 "missed the game, [so] was looking for pictures [from a "series of in-game photographs from hockey game"] while reading about it.

Leisure

-This morning I killed some time finding pictures of the Bahamas. I've always wanted to go there on a vacation (s8).

-Subject 29 viewed "pictures of exotic bugs on Flickr" while "just killing time."

-Subject 25 looked at an "image of [a] watch" as part of "wasting time."

Information

-I should check out areas so I know where it is I would like to live [in South Florida as preparation for an upcoming move] (s2).

-To figure out ways for my sister to get out of Paris (s14).

-Needed to verify my recipe was okay [by viewing image of food] (s25).

Illustration

-I located 2 images [image of an illustration of the Memex machine] that would later be used in class presentations (S03).

-I needed an image of myself for an assignment (s12).

-Needed to send it [picture of self] to someone else for a press release (s29).

Social Purpose

-I wanted to see what my old friends look like these days (s8).

-[To] remember a recent party [I] looked at photos of friends on Facebook (s12).

-Wanted to see pictures of my niece's birthday party (s16).

-Hadn't looked at a picture [of my parents] in [...] some time, so I [went] to my mom's Facebook page (s18).

Figure 6: Exemplary Responses That Populate and Inform Figure 5

5.4.3 Implications

This study had two purposes. The first was to determine the extent to which users self-categorize their motivations to retrieve images in web environments. The findings indicate that image retrieval by amateurs is first and foremost an information or data-oriented activity, followed by the other motivations to lesser degrees. In answering this question, the study necessarily sought to clarify what the relationships between these motivations are, particularly where context is concerned. The second purpose of the study was to identify the dominant search strategies that accompany the motivations. The results show that image retrieval is more often than not a context-driven activity that relies on a variety of search strategies, depending on motivation.

People have long searched for and viewed images since before the appearance of the internet and the World Wide Web. As photographs were scanned and images born digital, image retrieval has become an increasingly complex set of activities that scholars have typically studied by the residual signs of an activity (i.e. image attributes) rather than the contexts or purposes of that activity. This study joins several others in questioning the degree to which motivations vary and in exploring the contexts in which users undertake or complete image retrieval activities. The study finds that with amateur users there is an additional dynamic that must be accounted for in how social purpose and leisure as motivations diverge from information and illustration. Despite previous studies' strengths in giving new perspectives on the professional user, the amateur user has remained relatively unknown to the degree that important considerations like "do users retrieve images for reasons other than need?" consist of and are there specific reasons for doing so.

The findings of this study make clear that the amateur user diverges significantly from the professional to the degree that non-purposeful or less-purposeful motivations become a factor in users' decisions to seek out and view images in web environments. It also offers a broader perspective on image retrieval itself by expanding the notion of image retrieval as a need-driven activity to one that is pursued for reasons like, in the users' words, "I wanted to " view images or "I felt like" looking at images. In addition to providing a deeper understanding of why amateur users pursue images in web environments, the study and subsequent model also further our knowledge about how these new motivations co-exist with each other as one of the primary underpinnings of image retrieval.

From a system design viewpoint, it might be advantageous for systems to support not only need-based context image retrieval but also to better support desire-based retrieval. Image retrieval systems are often designed to accommodate text-based queries that result in images. Given the findings of this study and the conceptual and semantic boundaries in the different motivational contexts, the text-based strategy can serve information, illustration, social purpose, and leisure motivations with varying degrees of accommodation. One area where these systems may be less than ideal, however, is the user's satisfaction with exploratory, browse-like search for leisurely purposes. It is interesting to note that users are engaging in leisurely image retrieval largely on text-based retrieval tools when they are not using Facebook for this purpose.

Moreover, given the secondary and often tertiary importance assigned by subjects to Flickr as an image retrieval platform by the test subjects, it casts into doubt the larger question of Flickr's primary significance to image retrieval scholarship today. Many recent articles about

image retrieval on the web have centered on the importance of (types of) image attributes when users interact with images in Flickr, either through tagging, uploading, or viewing. While the types of activities they are engaging in on Flickr may be relevant to image retrieval in general, the system itself may not be as relevant as its more social Web 2.0 cousin Facebook. Second only to Google Images as a platform that users rely on to find images, Facebook is used almost 15% more for the purposes of image retrieval than Flickr. Given Flickr's amazing growth and popularity as an image platform as a Web 2.0 darling, Facebook's relative importance in image retrieval cannot be overstated. It is used as a resource for image retrieval only seven percent less than Google Images, which is far and away the image retrieval tool of choice among the amateur user. It is important to remember that the distance from Flickr (67.9% of subjects report using it) to the next platform (Yahoo at 25%) is far greater than any difference between the top three platforms mentioned above.

At its most general level, this study is an attempt to explore the degree to which image retrieval is patterned on assumptions about Information Seeking Behavior. That information is the leading motivation across all indicators demonstrates the degree to which users retrieve images as forms of data. As illustration is information's contextual pair as a motivation with its emphasis on the image as object, it too is not terribly far from the image as information as it is being used to convey some type of information. Yet where need ends and desire begins in image retrieval is an interesting boundary, one that this study has begun to elucidate in some detail. The most theoretical implication for image retrieval is that it is not always an information-based undertaking outside of professional contexts such as work tasks. For the amateur user, to the degree that this study can generalize, image retrieval is a multi-variate

146

activity with many contours beyond what is known—mainly, social tagging on Flickr and the

amateur users' motivations to do so. On the one hand, such studies typically investigate

democratic indexing as it relates to image attributes. On the other, several studies have

recently targeted the professional user and motivations and contexts for retrieval. The gap this

leaves is between image attributes and motivations beyond information retrieval. By providing

a more coherent context in which to understand less-than-purposeful image retrieval, this

study opens the door to other explorations of how these other motivations relate to image

attributes.

Researchers in image retrieval increasingly attempt to incorporate the concept of

motivation when investigating work context. Expanding context beyond the confines of work

and need requires studying how people whose patterns and behaviors of use vary to a

significant degree in order to generate more data about how people use images in various

situations for various purposes. As shown in this study, their categorization of their search and

browse habits change as they switch from motivation to motivation, suggesting that each

system must be capable of accommodating the change they bring. The schematic presented in

this study can be used as a theoretical paradigm for segmenting user behavior according to

motivation as a way of accommodating search strategy.

The findings of this research call into question of what we have in mind when we say

'image retrieval.' As almost all scholarly work on the user of images in Library and Information

Science has focused on professional uses of images for primarily information purposes and

secondarily for illustration reasons, it is fair to assume that image retrieval for motivations

outside of the pre-existing two provides insufficient means for capturing the totality of behavior

that the moniker 'image retrieval' brings to mind. While the results of this study represent

merely preliminary steps in new directions, they remain promising areas for exploration. Prior

to the internet and World Wide Web, image retrieval was confined to physical images, usually

photographs, located in repositories of some kind. Image retrieval in LIS had no concern for

how individual people relate to photographs besides what attributes might be relevant in a

work context. The Web has produced other instances of users searching, locating, and viewing

images that oftentimes have little to do with information or illustration. Web 2.0 platforms like

Flickr and Facebook have expanded what users can do with images. These changes are most

certain to continue in the future, so further permutation of what amateur users do with images,

why they do it, and how they do it will only increase as a relevant question for scholars to

pursue. In the context of this study, will social purpose and leisure increase as motivations to

seek out images in web environments? And how might such a change affect information and

illustration, or the search strategies that users rely on to find images? These questions and

others are addressed in greater detail below in section 5.4.5: Future Research.

5.4.4 Limitations

This study's main purpose was to offer a new and original perspective on the phenomenon of

image retrieval by amateur users in web environments. To gain knowledge of the research

problem, user testing was conducted in an experimental laboratory setting where the settings

and conditions of the research sessions are controlled. This control provides, in part, the

internal validity that no research study can be without, meaning that the design of this study

was intended to prevent or minimize bias from survey, settings, etc. The advantage of using the

experimental method over other types (e.g. observational) is that variables and measures can be aligned in ways that generate meaningful results (e.g. occasionally strong correlations, straightforward descriptive statistics that point back to research questions).

The compromise made by all researchers conducting research is that the gain in internal validity often comes at the expense of external validity, or the ability to generalize inferences from the study to a larger population. This investigation was undertaken in a laboratory setting using a sample size that is very close to the minimum for similar types of research in image retrieval. Yet the sample, like so many other studies in Library and Information Science, was composed largely of students enrolled in degree-granting programs that typically assume a high level of expertise with IT and search upon graduation if not upon matriculation. This may certainly decrease the level of generality of the findings of this study. At the very least, it necessitates understanding that in the context of this study, amateur user is taken to mean the educated amateur user. Given that this is a typical refrain in research studies in the field, it is not an uncommon limitation. The lack of generality can, in the future, be addressed by a more representative sample size, one that more closely mimics the contours of the general population. For a project that attempts to speak for the amateur user, this is a future necessity, one that can be overcome with greater financial resources. Nonetheless, this study does at times rely on data collected from a more natural setting—daily blog diaries where participants recorded their image interactions in a natural setting after the performance of the phenomenon in question.

Another possible limitation is that in order to achieve internal consistency of measures, motivations were categorized with sharp boundaries. As the blog diaries make clear at times,

users do not necessarily arrive at the same exact categories when describing their interactions. The blog diary points to the need for even greater granularity of data around the categorizations of motivations. This may be solved in the future by additional testing of the validity of the proposed categories, especially social purpose and leisure, which have seen much less scholarly scrutiny as they lie outside of the purview of the professional user as a subject.

Finally, task design may have resulted in tasks that were not entirely uniform in terms of the contexts presented to the subjects. As this type of research for image retrieval is entirely new, this consideration was difficult to foresee. Yet as a limitation, it may also be a reflection of the variation of task context across motivation. This is not to say that task design matched any such variation evenly, but that with different contexts (e.g. need versus desire, data versus object) for different motivations, a way of achieving parity in task design is also a way of reinforcing internal validity. In such a case, subjects' may be tested more closely according to their own understanding of motivation, so it might be possible to achieve an enhanced understanding of human categorization of image retrieval activities across a variety of motivations.

5.4.5 Future Research

The findings of this study suggest that people view images in web environments for reasons including but also beyond information and illustration. The results indicate that motivations indeed differ and they begin to shed light on the contexts that characterize image retrieval according to motivation or task. While the outlines of context are now somewhat clearer,

particularly for social purposes and leisure, the role of context in how individuals self-categorize a motivation remains obscured. Moreover, whether people are using images as objects or data is an important constituent of context (McCay-Peet & Toms, 2009), a dimension that in future research needs to be explored in much more detail for the motivations of social purpose and leisure.

The video logs indicate that users frequently find Google search engine to be an acceptable starting point for image retrieval, which was a completely unexpected result. As users occasionally find no need to differentiate between text search platform and image search system, the differences in how users approach these and the different contexts in which one might be useful could potentially be a useful area for exploration. That image retrieval starts from time to time at the exact same point as textual searches is a surprising finding. The impact this could have on motivation and even on search queries themselves might be telling enough to warrant additional investigation.

Additional investigation is also necessary in order to excavate the relationship of the proposed motivations to each other and existing motivations. As these are relatively new directions in image retrieval, the lead time between publication of new results and their incorporation into the major models in a field may be significant (Mosteller, 1981). As new image retrieval behaviors emerge (e.g. tagging, sharing in new platforms, annotating, semantic image retrieval) and scholars take note (Jörgensen, 2007), more studies on the basic differences in what has hitherto been considered a monolithic subject can provide additional implications for the design of information systems in general web environments. As Web 2.0 continues its radical re-envisioning of how users find and interact with information, images, and other

objects in web environments, image retrieval scholars will have increasing opportunities to study the intersection of what have been traditional motivations and activities (i.e. information and illustration) with new and as yet unforeseen image retrieval phenomena (i.e. social search). As motivations change, users' search strategies may well adapt to accommodate the types of activities in which images are needed *or* desired.

A deeper, more nuanced understanding of image retrieval, one that accounts for more than just the professional user in controlled and well-understood contexts, is vital if we are to continue developing better image retrieval systems that increasingly support user interaction.

APPENDIX A

TASK INSTRUCTIONS

GENERAL INSTRUCTIONS OF TASKS

In a moment you will start your session for five different tasks: four assigned tasks and one non-assigned task.

Please keep the following in mind as you complete the session:

- You will have ONE HOUR to complete your session.

- You may decide the amount of time per task you wish to allot.

You should assume that you are involved in a real world situation for each task. Please act as normally as possible.

DESCRIPTIONS OF ASSIGNED TASKS

TASKS

Note: Tasks will be given in random order. The description of each task will be removed prior to testing. You do not plan to copy and paste any images, you simply plan to locate them.

Task S. The task to test users' method for locating images for social purposes:

- You want to show an image of either yourself or of a friend to a new acquaintance. Using an internet browser to navigate the World Wide Web, locate an image of yourself or of a close friend.

Task IL. The task to test users' method of locating images for the purpose of illustrating an idea:

- You are working on an important work or academic project, the goal of which is to educate an audience on the history of computers. You need several images of computers to illustrate your ideas. Using an internet browser to navigate the World Wide Web, locate as many images as you would like up to five.

Task L. The task to test users' method for locating images for the purpose of pure leisure:

- You have some free time and want to view images online. Using an internet browser to navigate the World Wide Web, locate images that satisfy your desire to fill your free time.

Task IN. The task to test users' method for locating images for the purpose of informing:

- You have just heard about a catastrophic event in the world that may have done terrible damage to both a body of land and a group of people. You want to see images for yourself. Using an internet browser to navigate the World Wide Web, locate images that suit this purpose.

Task N. This is a non-assigned task:

- Take a moment to reflect on what system you use most often to view images that would be appropriate for all audiences. Go to that system and view as many images as you would like.

APPENDIX C

PRE-QUESTIONNAIRE

Subject #: _____
Location: _____
Date: _____

PART I: GENERAL BACKGROUND INFORMATION

What is your age?   ❑ 18-25   ❑ 26-33   ❑ 34-41   ❑ 42-49   ❑ 50+

What is your highest educational level?

❑ Undergraduate   ❑ Graduate (Master's)   ❑ Graduate (Doctoral)
❑ Professor   ❑ Post-doctorate   ❑ Other

What is your gender?

❑ Female   ❑ Male

How many years have you been using the web to view images?

❑ 1-2   ❑ 3-4   ❑ 5-6   ❑ 7-8   ❑ 9-10   ❑ 10+ years

How often do you use the web to view images?

❑ DAILY   ❑ WEEKLY   ❑ MONTHLY   ❑ NEVER

Are you currently working with images or photographs in a professional capacity (i.e. your work was performed on a paid basis for money)?

❑ Yes   ❑ No

Do you own a digital camera?

❏ Yes   ❏ No

If you checked yes above, how many years have you owned a digital camera?

❏ up to 1 year   ❏ 1-3 years   ❏ 4-5 years   ❏ 5+ years

Do you have an account or membership with a web-based image hosting system (e.g. Flickr, Snapfish, Picasa, PBase, Troiki etc.)

❏ Yes   ❏ No

How long have you had this account or membership? If you have multiple accounts, please base your answer on the system you have used the longest.

❏ up to 1 year   ❏ 1-3 years   ❏ 4-5 years   ❏ 5+ years

Which browser do you use most frequently?

❏ Google Chrome   ❏ Internet Explorer   ❏ Mozilla Firefox
❏ Safari   ❏ Opera   ❏ Other: _____

Which of the following do you use to view images (check all that apply)?

❏ Flickr   ❏ Yahoo Image Search   ❏ Fotki
❏ Bing Image Search   ❏ Online Digital Libraries   ❏ Facebook
❏ MySpace   ❏ Google Image Search   ❏ PBase
❏ Ask.com   ❏ Other: _____   ❏ Other: _____
❏ Other: _____   ❏ Other: _____   ❏ Other: _____

Please rank each item you checked above according to the frequency with which you use it, listing them in order from most frequent to least frequent:

1._____

2._____

3._____

4. _____

5. _____

6. _____

PART II: SURVEY OF RECENT IMAGE INTERACTIONS

Think back to the last three or four images that you can recall viewing online, making sure to recall only images that would be suitable for all audiences. Please answer the following questions about your encounters with these images:

1st Image
Brief description of image(s):_____

The system(s) or platform(s) that returned the image(s) (check all that apply):

❑ Fotki   ❑ Online Digital Libraries   ❑ Flickr
❑ Ask.com   ❑ Yahoo Image Search   ❑ Bing Image Search
❑ MySpace   ❑ Google Image Search   ❑ PBase
❑ Facebook   ❑ Other: _____   ❑ Do not recall

Please check the most appropriate reason why you selected that image to view?

❑ To see an image of yourself or others in a social platform
❑ To illustrate an idea
❑ To inform yourself
❑ To entertain or enjoy oneself
❑ Other:_____

▪▪

2nd Image
Brief description of image(s):_____

The system(s) or platform(s) that returned the image(s) (check all that apply):

❑ Ask.com   ❑ Yahoo Image Search   ❑ Facebook
❑ Bing Image Search   ❑ MySpace   ❑ PBase
❑ Online Digital Libraries ❑ Google Image Search   ❑ Flickr
❑ Fotki   ❑ Other: _____   ❑ Do not recall

Please check the most appropriate reason why you selected that image to view?

❑ To inform yourself
❑ To entertain or enjoy oneself
❑ To illustrate an idea
❑ To see an image of yourself or others in a social platform
❑ Other:_____

158

3rd Image

Brief description of image:_____

The system(s) or platform(s) that returned the image(s) (check all that apply):

☐ Flickr   ☐ Yahoo Image Search   ☐ Fotki
☐ Bing Image Search   ☐ Online Digital Libraries   ☐ Facebook
☐ MySpace   ☐ Google Image Search   ☐ PBase
☐ Ask.com   ☐ Other: _____   ☐ Do not recall

Please check the most appropriate reason why you selected that image to view?

☐ To inform yourself
☐ To see an image of yourself or others in a social platform
☐ To entertain or enjoy oneself
☐ To illustrate an idea
☐ Other:_____

▪▪▪

4th Image

Brief description of image:_____

The system(s) or platform(s) that returned the image(s) (check all that apply):

☐ PBase   ☐ Google Image Search   ☐ MySpace
☐ Fotki   ☐ Yahoo Image Search   ☐ Flickr
☐ Facebook   ☐ Online Digital Libraries   ☐ Bing Image Search
☐ Ask.com   ☐ Other: _____   ☐ Do not recall

Please check the most appropriate reason why you selected that image to view?

☐ To see an image of yourself or others in a social platform
☐ To entertain and enjoy oneself
☐ To illustrate an idea
☐ To inform yourself
☐ Other:_____

END OF PRE-QUESTIONNAIRE
THANK YOU

APPENDIX D

POST-QUESTIONNAIRE

Subject #: _____

Location: _____

Date: _____

PART I: TASK REPRESENTATIVENESS

Out of all your interactions with images in a web environment, how representative was this task of your overall interactions with images?

Task S: Locate image(s) of either yourself or an acquaintance to show to a friend

❑ Not representative
❑ Somewhat representative
❑ Representative
❑ Most representative

Task IL: Locate image(s) for a work or school project on the history of computers

❑ Not representative
❑ Somewhat representative
❑ Representative
❑ Most representative

Task L: Locate image(s) to fill free time

❑ Not representative
❑ Somewhat representative
❑ Representative
❑ Most representative

CONTINUED ON NEXT PAGE

160

Task IN: Locate image(s) for a current topic like an event in the news

❑ Not representative
❑ Somewhat representative
❑ Representative
❑ Most representative

■■

Task N: Locate image(s) on the system used most often and of your choosing

❑ Not representative
❑ Somewhat representative
❑ Representative
❑ Most representative

Part II: TASK REFLECTION

Instructions: Place a mark in the checkbox for each category that best represents your understanding of the task.

Task S:
Which description of the task best matches your understanding of the activity you just did:

❑ Information   ❑ Illustration   ❑ Social interaction   ❑ Leisure

If you checked leisure, which of the following best matches your understanding of leisure in the context of this activity:

❑ Entertainment   ❑ Viewing aesthetically pleasing images   ❑ Relaxation

▪▪

Task IL:
Which description of the task best matches your understanding of the activity you just did:

❑ Information   ❑ Illustration   ❑ Social interaction   ❑ Leisure

If you checked leisure, which of the following best matches your understanding of leisure in the context of this activity:

❑ Entertainment   ❑ Viewing aesthetically pleasing images   ❑ Relaxation

▪▪

Task L:
Which description of the task best matches your understanding of the activity you just did in the context of this activity:

❑ Information   ❑ Illustration   ❑ Social interaction   ❑ Leisure

If you checked leisure, which of the following best matches your understanding of leisure:

❑ Entertainment   ❑ Viewing aesthetically pleasing images   ❑ Relaxation

Task IN:
Which description of the task best matches your understanding of the activity you just did:

❑ Information   ❑ Illustration   ❑ Social interaction   ❑ Leisure

If you checked leisure, which of the following best matches your understanding of leisure in the context of this activity:

❑ Entertainment   ❑ Viewing aesthetically pleasing images   ❑ Relaxation

----

Task N:
Which description of the task best matches your understanding of the activity you just did:

❑ Information   ❑ Illustration   ❑ Social interaction   ❑ Leisure

If you checked leisure, which of the following best matches your understanding of leisure in the context of this activity:

❑ Entertainment   ❑ Viewing aesthetically pleasing images   ❑ Relaxation

PART III: SELF-CATEGORIZATIONS OF MOTIVATIONS

Section A:

Please rank the following reasons that you might have for viewing images in a web environment from most important to least important by ranking. The most important would receive a 1, the least important a 6.

A. _____ To relax

B. _____ To inform myself

C. _____ To entertain myself or others

D. _____ To illustrate an idea

E. _____ To view aesthetically pleasing images

F. _____ To interact socially with others

▪▪

Section B:

What other reasons do you have for locating images online that are not listed above, if any? In none, do not complete Section C below. Please list any you can think of and then complete Section C below:

G. _____

H. _____

I. _____

▪▪

Section C:

Where would you rank the reasons you listed in Section B in the rankings given in Section A, from **most important to least important**? Rank them by using their letter designations.

_____

_____

_____

_____

_____

_____

_____

_____

PART IV: SUBJECT REFLECTIONS ON IMAGE LOCATION STRATEGIES

For each task below, which location strategy do you think you used most:

-Search, meaning that one or more of the following is true:
- You know exactly what you are looking for and will know it when you see it.
- You have a very good idea where to find it (a particular system or platform).
- You have a very good idea how to find it.

Browse, meaning that one or more of the following is true:
- You do not know exactly what you are looking for, although you may have a general or vague idea of what you are looking for and may not know it when you first see it.
- You do not have a good idea where to find it although you may have a vague or general idea of where to find it.
- You do not have a good idea about how to find it, although you may have a general or vague idea of how to find it.

Task S: Locate an image of either yourself or an acquaintance

❑ A specific, focused search
❑ An exploratory, somewhat directed browse-like search
❑ A combination of the first two options above
❑ Undirected search or wandering

Task IL: Locate images to illustrate an idea for an academic project on computers

❑ A specific, focused search
❑ An exploratory, somewhat directed browse-like search
❑ A combination of the first two options above
❑ Undirected search or wandering

Task L: Locating images to fill free time

❑ A specific, focused search
❑ An exploratory, somewhat directed browse-like search
❑ A combination of the first two options above
❑ Undirected search or wandering

Task IN: Locate images for a current topic like an event in the news

- ❑ A specific, focused search
- ❑ An exploratory, somewhat directed browse-like search
- ❑ A combination of the first two options above
- ❑ Undirected search or wandering

Task N: Locating images on the system you use most often

- ❑ A specific, focused search
- ❑ An exploratory, somewhat directed browse-like search
- ❑ A combination of the first two options above
- ❑ Undirected search or wandering

<div align="center">

END OF POST-QUESTIONNAIRE
THANK YOU

</div>

SUPPLEMENTARY DATA

Table 36 lists the frequency and percentage of digital camera ownership among the 30 research

subjects who participated in this study. Camera ownership was not an underlying factor in the

motivations that users self-report to locate images online. Overall, 25 subjects, or 83.3% of the

participants, reported owning a digital camera.

Table 37: Digital Camera Ownership

Digital Camera Owned?	Frequency	Percentage
Yes	24	85.7%
No	4	14.3%
Total	28	100%

Of those who own cameras, over half have owned them for five or more years (14 subjects, or

56%), 20% for 4-5 and 1-3 years (5 subjects for each category), and 4% (1 subject) reported

owning the camera for one year or less. These figures do not contradict a recent statistic by the

Consumer Electronics Association (2009) that indicates that over 77% of all US households own

a digital camera.

Table 38: Years of Digital Camera Ownership

Years Owned	Frequency	Percentage
1 year	1	4.2%
1-3 years	5	17.9%
4-5 years	5	17.9%
5 or more years	13	46.4%
Total	24	100

The above table demonstrates a fairly predictable distribution of years of camera ownership.

Table 38 presents the frequency and percentage of those who have a web-based image hosting account (e.g. Snapfish) and the years that they have subscribed. Like digital camera ownership, subjects' personal interactions with digital images in online environments in ways that are not search/recall-based may relate to the motivations subjects report. The frequencies and percentages of subjects who belonged to an image hosting service were: 18 out of 28 (or 64.3%) reported that they had an account while the remaining 10 (35.7%) did not have an account.

Table 39: Hosting Service

Account	Frequency	Percentage
Yes	18	64.3%
No	10	35.7%
TOTAL	28	100%

Two have had their account for one year or less (11.1% of participants), 11 have had it for 1-3 years (61.1%), four for 4-5 years (22.2%), and one for five years or more (5.6%).

Table 40: Years of Membership

Years of Membership	Frequency	Percentage
1 year	2	11.1%
1-3 years	11	61.1%
4-5 years	4	22.2%
5 or more years	1	5.6%
TOTAL	18	100%

Table 9 shows the web browsers that users report using most often. No one listed Opera or any

other browser other than Chrome, Internet Explorer, Firefox, or Safari as their main browser.

Table 41: Web Browsers Used

Web Browser	Frequency	Percentage
Google Chrome	4	14.3%
Internet Explorer	8	28.6%
Firefox	14	50%
Safari	2	7.1%
TOTAL	28	100%

The following tables give breakdowns of the subjects' responses about their recent image

interactions.

Table 42: Frequencies and Percentages of Systems Used In Recent Image Interactions (Image 1)

System	Frequency	Percentage
Google Image Search	10	35.7%
Facebook	8	28.6%
Other (see Table 23)	6	21.4%
Flickr	1	3.6%
Yahoo Image Search	2	7.1%
Online Digital Libraries	1	3.6%
TOTAL	28	100%

Table 43: Frequencies and Percentages of Other Systems Used in Recent Image Interactions (Image 1)

Other System	Frequency	Percentage
nhl.com	1	3.6%
Newspaper website	1	3.6%
BBC News	1	3.6%
eBay	1	3.6%
Webpage	2	7.2%
Cnn.com	1	3.6%

Table 44: Frequency and Percentage of Other Responses for Motivation (Image 1)

Other	Frequency
Help answering reference query	1
News	1
To reference others' Photoshop skills	1
TOTAL	3

Table 45: Cross Tabulation of System and Motivation for Image 1

	Social Platform	Illustrate an Idea	Inform Oneself	Entertain/Enjoy Oneself	Other	Total
Online DLs	0	0	0	0	1	1
Flickr	0	0	1	0	0	1
Yahoo	0	1	1	0	0	2
Google	1	4	2	3	0	10
Facebook	5	0	1	2	0	8
Other	0	0	4	1	1	6
Total	6	5	9	6	2	28

Table 46: Individual Responses to Recent Image Interactions (Image 1)

ID	Description	System	Motivation
	Art/landscape		
24	Mountain landscape	Google	To entertain
2	A fancy page border found on Google Images	Google	To illustrate
	News		
29	Image of oil spill in gulf	Other (cnn.com)	To inform
21	Volcanic ash from Iceland	Google	Other (news)
5	Whale that was in SeaWorld Incident	Yahoo	To inform
18	Photos of a strike at a university (student strike)	Other (Newsp Site)	To inform
	Shopping		
25	Image of watch on eBay	Other (eBay)	To entertain
19	Photo of a product	Google	To entertain
	Social		
30	Picture of my father on Facebook	Facebook	Social
4	Anniversary pictures of friend's family	Facebook	Social
20	An acquaintance	Facebook	Social
16	Picture of family	Facebook	To entertain
17	Friends profile pic on Facebook	Facebook	To entertain
13	Photos of friends' vacation	Facebook	Social
28	Two girls in a photograph	Facebook	Social
	Sports		
26	NHL Hockey Playoff Photos	Other (webpage)	To inform
27	Diagram of US military strategy	Facebook	To inform
11	Japan scene sports	Google	To illustrate
12	Still photo from Penguins hockey game	Other (nhl.com)	To inform
22	Tiger reunion (golf)	Google	To entertain
	Miscellaneous		
6	Photograph of the librarian S.R. Ranganathan	Yahoo	To illustrate
7	Picture of Galveston Island Texas	Google	To inform
9	Audi TT (Car)	Flickr	To inform
15	Timeline for historical project	Google	To illustrate
10	Clef (?)	Google	To illustrate
23	Scanned illustration from chapbook in library special collection	Online DLs	Other (Help)
27	Diagram of US military strategy	Facebook	To inform

The categories in this table (e.g. "Art/Landscape") represent an additional grouping of image

descriptions at the level of basic content analysis. The purpose of grouping them thusly is

merely to demonstrate possible relations between images, systems, and motivations. The

groupings are *ad hoc.* As such, they are neither definitive nor exhaustive.

Table 47: Frequencies and Percentages of Systems Used in Recent Image Interactions (Image 2)

System	Frequency	Percentage w/ No Response	Percentage w/o No Response
Google Image Search	11	39.3%	45.8%
Other	7	25%	29.2%
Facebook	5	17.9%	20.8%
Yahoo Image Search	1	3.6%	4.2%
No response	4	14.3%	-
TOTAL	28	100%	100%

Table 48: Frequencies and Percentages of Other Systems Used in Recent Image Interactions (Image 2)

Other System	Frequency	Percentage
BBC News Site	1	3.6%
Photo Blog	1	3.6%
Gizmoto	1	3.6%
Picasa	1	3.6%
Snapfish	1	3.6%
Themoth.com	1	3.6%
Private website	1	3.6%
TOTAL	6	25.2%

Table 49: Frequency and Percentage of Other Responses for Motivation (Image 2)

Other	Frequency	Percentage
I pasted it to Facebook as it related to an article I was commenting on	1	4.17%
To refer to other peoples' photo skills	1	4.17%
TOTAL	2	8.34% of all 24 responses

Table 50: Cross Tabulation of System and Motivation for Image 2

	Social Platform	Illustrate an Idea	Inform Oneself	Entertain/Enjoy Oneself	Other	Total
Yahoo	0	1	0	0	0	1
Google	1	3	6	1	0	11
Facebook	3	0	0	2	0	5
Other	2	0	2	1	2	7
Total	6	4	8	4	2	24

ID	Description	System	Motivation
	Landscape/art		
15	Night view (sic) of Pittsburgh	Other (No response)	Other (To refer)
	News		
4	Chili earthquake	Google	To inform
	Shopping		
19	A product image	Google	To inform
	Social		
2	Images of son in China	Other (Snapfish)	Social
17	Friend with her children	Facebook	To entertain
23	Tagged image of friend at a social event	Facebook	To entertain
27	Child's birthday party	Facebook	Social
13	Photos of friends	Facebook	Social
25	Image of relative on Facebook	Facebook	Social
26	Family photos	Other (Picasa)	Social
	Misc		
5	Pittsburgh Pirate Parrot	Google	To inform
6	Photo of National Archive Building - Wash DC	Yahoo	To illustrate
7	Picture of a kind of vegetable	Google	To inform
12	Photo of storyteller broth wolf	Other (themoth)	To inform
11	Chinese herb	Google	To illustrate
18	Images about e-records management projects	Google	To inform
30	Picture of a wound online for diagnostics	Google	To inform
20	An unknown person	Google	Social
21	Stephen Hawking	Other (BBC News)	Other (I pasted)
24	Drawing of the mechanical Turk	Google	To illustrate
28	Tuberose	Google	To inform
14	Image of a landmark	Google	To inform
8	Picture of the iPad	Other (Gizmoto)	To inform

Table 52: Frequencies and Percentages of Systems Used in Recent Image Interactions (Image 3)

System	Frequency	Percentage w/ No Response	Percentage w/o No Response
Google Image Search	8	28.6%	34.8%
Facebook	6	21.4%	26.1%
Online DLs	4	14.3%	17.4%
Other	4	14.3%	17.4%
Flickr	1	3.6%	4.3%
No response	5	17.9%	-
TOTAL	28	100%	100%

Table 53: Frequencies and Percentages of Other Systems Used in Recent Image Interactions (Image 3)

Other System	Frequency	Percentage
Google Maps Streetview	1	3.6%
LOC Website	1	3.6%
Online Store	1	3.6%
Regular Google Search	1	3.6%
TOTAL	4	14.4%

Table 54: Frequency and Percentage of Other Responses for Motivation (Image 3)

Other	Frequency	Percentage
Trying to locate the album locally in Pittsburgh, is on iPhone	1	4%
TOTAL	1	4% of 25 responses

Table 55: Cross Tabulation of System and Motivation for Image 3

	Social Platform	Illustrate an Idea	Inform Oneself	Entertain/Enjoy Oneself	Other	T1otal
Online DLs	0	1	3	0	0	4
Flickr	0	1	0	0	0	1
Google	0	3	4	0	1	8
Facebook	3	0	0	3	0	6
Other	0	1	2	1	0	4
Total	3	6	9	4	1	23

Table 56: Individual Responses to Recent Image Interactions (Image 3)

ID	Description	System	Motivation
	Shopping		
9	Dress	Other (online store)	To entertain
	Social		
12	Family photo	Facebook	Social
18	Family photos	Facebook	To entertain
17	Friends' children	Facebook	To entertain
25	Image of another relative on Facebook	Facebook	Social
26	Friends' Photos	Facebook	Social
29	Photo of relative's cat	Facebook	To entertain
	Miscellaneous		
2	Photos of famous people in info sci	Google	To inform
4	Historical picture of Chinese emperor	Google	To inform
5	E.J. Josey (Librarian)	Online DLs	To inform
6	Photograph of a chair from LOC Working Memory Project	Other (LOC)	To illustrate
7	Streetview of Orlando, Florida	Other (Google Maps)	To inform
8	Fender Guitar Amplifier	Other (Regular Google Search)	To inform
11	Movie stars	Google	To illustrate
15	Photo of African American history	Online DLs	To illustrate
13	Photos of school project/website	Google	To illustrate
14	Image of a map	Google	To inform
19	Book cover title	Online DLs	To inform
21	Album cover for Graham Central Station Funk album	Google	Other (trying)
23	Image of Jone/Laughlin steel company from historic Pittsburgh website	Online DLs	To inform
24	Image of Cory Doctorow at EFF Pioneer Awards	Facebook	To illustrate
27	Map of NY Thruway	Google	To inform
28	Bowling ball	Google	To illustrate

Table 57: Frequencies and Percentages of Systems Used in Recent Image Interactions (Image 4)

System	Frequency	Percentage w/ No Response	Percentage w/o No Response
Google Image Search	6	21.4%	35.3%
Facebook	4	14.3%	23.5%
Other	2	7.1%	11.8%
Online DLs	2	7.1%	11.8%
Do Not Recall	1	3.6%	5.9%
MySpace	1	3.6%	5.9%
Yahoo Image Search	1	3.6%	5.9%
No response	11	39.3%	-
TOTAL	28	100%	100%

Table 58: Frequencies and Percentages of Other Systems Used in Recent Image Interactions (Image 4)

Other System	Frequency	Percentage
Blog	1	3.6%
Regular Google Search	1	3.6%
TOTAL	2	7.2%

Table 59: Frequency and Percentage of Other Responses for Motivation (Image 4)

Other	Frequency	Percentage
Trying to find exact dosage for dogs of a certain weight (iPhone)	1	5.9%
TOTAL	1	5.9% of 17 responses

Table 60: Cross Tabulation of System and Motivation for Image 4

	Social Platform	Illustrate an Idea	Inform Oneself	Entertain/Enjoy Oneself	Other	Total
Online DLs	0	0	1	1	0	2
Yahoo	0	1	0	0	0	1
MySpace	1	0	0	0	0	1
Yahoo	0	2	2	1	1	6
Google	2	0	0	2	0	4
Facebook	1	0	1	0	0	2
Other	0	0	0	1	0	1
Total	4	3	4	5	1	17

Table 61: Individual Responses to Recent Image Interactions (Image 4)

ID	Description	System	Motivation
	Art/landscape		
18	Photos posted by artists through Twitter	Do Not Recall	To entertain
27	Picture of Santa Fe/Sandia Mountains	Facebook	To entertain
15	Image of Florida scene	Yahoo	To illustrate
	Shopping		
8	Fender Guitar Amplifier	Other (Regular)	To inform
	Social		
7	Wedding pictures of a friend	Other (blog)	Social
9	My friend's baby	Facebook	Social
13	Photos of family	Facebook	Social
17	Friend's kids	Facebook	To entertain
29	Image of family	MySpace	Social
	Sports		
25	Image of Ben Roethlisberger	Google	To inform
	Miscellaneous		
2	Photo of Broadway show "In the heights"	Google	To illustrate
5	Pitt Year Book 1950s	Online DLs	To entertain
11	Japanese shrine	Online DLs	To inform
14	Photo of a person/writer	Google	To inform
19	Photo of hotel building	Google	To entertain
21	Screen capture of Frontline Flea & Tick container	Google	Other (trying)
23	Suspect image from news article	Google	To illustrate

APPENDIX F

DIARY RESPONSES

Table 62: Blog Diary Responses and Figures

ID	#	Description	Reported Motivation	Coded Motivation	Play	
2	Multiple	University of South Florida and surrounding areas.	I should check out areas so I know where it is I would like to live.	Information		
5	Multiple	Pictures of Pittsburgh casino		-		
5	Multiple	Potential flood spots in Pittsburgh		-		
5	Multiple	Pictures of my old fraternity		-		
5	Single	Baked goods someone had prepared		-		
5	Single	Flowchart image about 'how to succeed' by a librarian		-		
5	Multiple	I was bounced all over the net when I begin to follow links about Cory Haim's death. I saw slide shows on MSN, entertainment and gossip sites also had numerous images. Facebook also ad my entire network of friends sharing world wide web links of Haim.		-		
5	Multiple	I viewed Big East tournament image slideshows and pics on Espn 360		-		
5	Multiple	I viewed several images of a friend's family in different settings.		-		
5	Multiple	I was in a lab and my friend logged onto Facebook and began sharing images with me. They detailed the events, location and whom we were looking at.		-		
6		NO IMAGES VIEWED		-		
6	Single	I located an image of an illustration of the Memex machine.	I located 2 images that would later be used in class presentations	Illustration		
6	Single	I located an image of the information scientist Vannevar Bush. I located this image using a Google Image search using the keywords "Vannevar Bush." The image appeared in the first page of results.	I located 2 images that would later be used in class presentations	Illustration		

6		NO IMAGES VIEWED		-		
7	Multiple	TODAY I AM TRYING TO FIGURE OUT WHICH FEDERAL TAX FORM I SHOULD USE. I WAS CONFUSED WITH 1040EZ AND 1040NR-EZ. SO I USE GOOGLE IMAGE TO VIEW HOW THEY LOOK LIKE AND WHAT'S THE DIFFERENCE B/W THESE TWO FORMS. I ALSO TRIED TO FIND SOME SAMPLES FOR TEACHING HOW TO FILL OUT THE FORM. AT LAST, I USED GOOGLE TO SEARCH THE OFFICIAL FORMS AND DOWNLOAD FORM.		Information		
8	Multiple	I went looking for images of electric guitars today.	Because I'm in the market and wanted to compare pictures of different models	Information	Shopping	
8	Multiple	Today I looked at pictures of high school classmates.	I wanted to see what my old friends look like these days.	Social Purpose		
8	Multiple	This morning I killed some time finding pictures of the Bahamas.	I've always wanted to go there on a vacation.	Leisure	Wasting time	
10	Multiple	image of some shoes	girls need more shoes for coming Summer	Information/Leisure	Shopping	
10	Single	Image of some actors	which talked about these actors	Leisure	Entertainment	
10	Single	Image of Philadelphia	Go travel in Philadelphia	Information/Leisure	Travel	
11	Multiple	Japanese temples dating from the Nara (710-794), Heian (794-1195), Kamakura (1195-1333) and Muromachi (1333-1460) periods are often very beautiful and there is a large number of them clustered around the ancient capitals of Nara, Kyoto and Kamakura	May travel to Japan	Information/Leisure	Travel	
11	Multiple	The famous shrine, officially known as Itsukushima Shrine, is no stranger to the forces of nature.	Would like to travel to Japan	Information/Leisure	Travel	
12	Multiple	Looked at photos of friends on Facebook.	remember recent party	Social Purpose	Memory	
12	Multiple	Viewed many pictures of Chinese cars	Husband wants to buy car, so I look at cars on the web.	Information	Shopping	
12	Multiple	Found pictures of Chinese music albums.	I need to show picture in iTunes.	Illustration	Entertainment	
13	Single	I went to Facebook to find the photo I was looking for because I didn't take the picture, but a friend did	I needed an image of myself for an assignment	Illustration		
13	Single	The image was a view of an open book, laid flat on a table with pages sticking up and fanned about.	I was searching for images for a class assignment.	Illustration		
14	Multiple	Models of IL instruction.	To gain a better understanding/visual representation of existing models.	Information		
14	Multiple	Landscape of Alaska.	Planning a family trip and wanted to get a look at the landscape and the various attractions.	Information/Leisure	Travel	

14	Single	Map of Paris-France	To figure out ways for my sister t0 get out of Paris.	Information			
15		No Data Entered					
16	Multiple	New pictures of my niece	I viewed these images because these pictures are of another month of her life	Social Purpose			
16	Multiple	images of shoes	To make a purchase	Information/Leisure	Shopping		
16	Single	Image of my nieces birthday party	wanted to see pictures of my nieces	Social Purpose	Shopping		
17	Single	sunglasses RayBan	Shopping	Information/Leisure			
17	Single	picture of sister's dog	Entertainment	Leisure	Entertainment	Knowledge	
17	Multiple	wedding photos of classmate	entertainment and knowledge	Information/Leisure	Entertainment	Knowledge	
17	Multiple	kim chi (fermented cabbage dish)	entertainment and knowledge	Information/Leisure			
17	Single	Picture of friend	Friend with child in pool for the first time	Unclear			
17	Single	Album cover: The Strokes	On Pandora radio	Illustration	Entertainment		
18	Multiple	Photos of the strike by students at the University of Puerto Rico	Interested in the news and to follow the developments. Did not download the image.	Information			
18	Multiple	Photos related to the controversy over the new immigration law in Arizona. It included pictures of public rallies and public expression against the bill.	Following current news, and interest in this particular issue.	Information			
18	Single	Photo of students rally at a strike at the University of Puerto Rico.	Part of reading and following current news.	Information			
18	Multiple	Photos of Deftones performing at the Vive Latino festival in Mexico City.	Entertainment	Leisure	Entertainment		
19		No Data Entered					
20	Single	Picture of fighter jet	Wanted to associate picture of wasteful government project with the plane (F-22?)	Information/ Illustration			
20	Single	Picture of my parents	Hadn't looked at a picture in quite some time, so I thought I'd go to my mom's Facebook account.	Social purpose			
21	Single	Picture of Sidney Crosby's winning goal of the Olympics	Couldn't remember whether Canadians were home/which color uniforms they wore.	Information	Verification		
21	Single	Pictures of loaves of bread	I have begun making my own bread and wanted to know if my bread looks ok.	Information			
22		No Data Entered					
23	Single	Image of 2nd friend.	Personal interest.	Social purpose			
23	Single	Image of friend	Personal interest.	Social purpose			
23	Single	Aerial view of oil leak in Gulf of Mexico.	News / information.	Information			

23	Single	Image of Plaza Theatre in Bloomfield from 1936.	Share with others	Illustration	Sharing	
23	Single	Image of Times Square bombing suspect's house.	News / information / curiosity.	Information		
23	Single	Image of suspect in Times Square bombing case	News / information.	Information		
23	Single	Image of boy looking through gate in Pakistan.	News / information.	Information		
24	Multiple	Series of in-game photographs from hockey game	Missed the game, was looking for pictures while reading about it.	Information/Leisure		
25	Single	Image of food	Needed to verify my recipe was ok	Information	Verification	
25	Multiple	Images of car	Am wondering which one to buy	Information/Leisure	Shopping	
25	Multiple	Images of car parts	Need to verify quality with picture	Information	Verification	
25	Single	Image of friend	Wanted to see if he's put on weight	Information	Verification	
25	Single	Image of watch	Wasting time	Leisure	Wasting time	
25	Single	Image of shoes	Wasting time/making future decisions	Information/Leisure	Wasting Time	
25	Single	Image of a small town	Needed to see what a certain area looks like	Information		
25	Single	Image of brother's family	Wanted to see family	Social Purpose		
25	Single	Image of blazer	Upgrading wardrobe	Information/Leisure	Shopping	
25	Single	Image of nieces	To see family	Social Purpose		
25	Single	Image of spouse	To see family	Social Purpose	To get details	
26	Multiple	Found images at New York Times website. Found image of the car and an image of Mayor Bloomberg and other officials speaking at a podium.	I wanted to get details about the undetonated car bomb that was found in Times Square	Information		
26	Multiple	Shitake mushrooms	I wanted to learn about shitake mushrooms, their benefits and what they looked like. I wanted to buy them for a recipe. I found pictures of them.	Information		
26	Multiple	Colisee de Rimouski, an ice hockey arena in that city	While reading about the Pens-Canadiens upcoming matchup, I came across the term "Rimouski Oceanic player," and had no idea what it meant. I had a hunch the player was Sydney Crosby and my hunch was correct. I further searched Google for that exact string of words and came to information about Rimouski, a city in Quebec. I found an image of Colisee de Rimouski, an ice hockey arena in that city. I found interior and exterior photos of the arena. I also found a lovely photo of Legpage Park of Rimouski.	Information/Leisure		

26	Multiple	I looked for stories/images of the two teams' matchup. I found images at the NHL site of various Pens' and Canadiens' players playing against each other in previous games.	I'm excited about the Pens-Canadiens (Habs) first game tonight.	Information/Leisure		
27	Multiple	Card catalog search	Looking for images of card catalogs	Unclear		
27	Multiple	Cowboys, cowgirls, horses	Searching for older images of cowboys, ephemera	Unclear		
28	Single	air travel liquid container	Get information	Information		
28	Single	Coach bag	Personal information	Information		
28	Single	Essie nail color	Leisure	Leisure		
28	Multiple	Hong Kong map, traveling information ex. food, mall, etc.	Planning a vacation.	Information/Leisure	Travel	
28	Single	Pedicure, manicure	Personal information	Information		
28	Single	Pitt commencement map	Personal information	Information		
29	Multiple	Pictures of exotic bugs on Flickr	Just killing time	Leisure	Killing time	
29	Multiple	Pictures of vampires	Needed them for a PowerPoint slide	Illustration		
29	Single	Image of self from Flickr	Needed to send it to someone else for a press release	Illustration		
29	Multiple	Images of flowers	Had to identify a type of flower to know its name so I could look up how to care for it	Information		
29	Multiple	Images of suicide bombing in Iraq	Wanted to see the carnage/voyeurism	Information	Voyeurism	
29	Multiple	Images of newest Trek bicycles	Felt like looking at latest models, but not for any reason like buying them	Leisure	Shopping	
30		No data entered				

BIBLIOGRAPHY

Alexa. (2009). The top 500 sites on the web. Retrieved on December 28, 2009 from http://www.alexa.com/topsites.

Al-Maskari, A., Clough, P., & Sanderson, M. (2006). Users' effectiveness and satisfaction for image retrieval. *Proceedings from The LWA 2006 Workshop*. Hildesheim, Germany, 84-88.

Ames, M. & Naaman, M. (2007). Why we tag: Motivations for annotation in mobile and online media. *Proceedings from CHI 2007*. San Jose: ACM, 971-980.

Angus, E., Thelwall, M., & Stewart, D. (2008). General patterns of tag usage among university groups in Flickr. *Online Information Review* 32(1), 89-101.

Baca, M. (2000). Introduction to metadata: pathways to digital information. *Getty Publications.*

Bates, M.J. (1998). Indexing and access for digital libraries and the Internet: Human, database, and domain factors. *Journal of the American Society for Information Science*, 49(14), 1185-1205.

Bates, M.J. (1989). The design of browsing and berrypicking techniques for the online search interface. *Online Review*, 13, 407-424.

Batley, S. (1988). Visual information retrieval: Browsing strategies in pictorial databases. (Unpublished doctoral dissertation). University of Aberdeen, Aberdeen, UK.

Beaudoin, J. (2009). An investigation of image users across professions: A framework of their image needs, retrieval and use. (Doctoral dissertation). Available from Dissertations and Theses Database. (UMI No. 3388703).

Beaudoin, J. (2009). An investigation of image users across disciplines. A model of image needs, retrieval and use. *Proceedings from the American Society for Information Science and Technology*. Columbus, OH. 45(1), 1-5.

Belkin, N.J. (1980). Anomalous states of knowledge as a basis for information retrieval. *Canadian Journal of Information Science*, 5, 133-144.

Berners-Lee, T., Hendler, J. Lassila, O. (2001, May). The semantic web. *Scientific American Magazine.*

Biederman, I. (1981). On the semantics of glance at a scene. In M. Kubovy and J. Pomerantz (Eds.), *Perceptual Organization* (pp. 213-253). Hillsdale, N.J.: Erlbaum Associates.

Bischoff, K., Frian, C.S., Nejdl, W., & Raiu, R. (2008). Can all tags be used for search? *Proceedings from CIKM '08*. Napa Valley, CA: ACM, 203-212.

Burnett, R. (2005). *How images think*. Cambridge, MA: MIT Press.

Butcher, R. & Eldridge, J. (1990). The use of diaries in data collection. *The Statistician*, 39, 25-41.

Butterworth, R. (2006, June). Information seeking and retrieval as a leisure activity. *Workshop on Digital Libraries in the Context of Users' Broader Activities*, Chapel Hill, NC.

Campbell, C. (1998). Consumption and the rhetoric of need and want. *Journal of Design History*, 11(3), 235-246.

Campbell, D.T. (1986). Relabeling internal and external validity for applied social scientists. In W. Trochim (Ed.), *Advances in quasi-experimental design and analysis* (pp. 67-78)*.* San Francisco: Jossey-Bass.

Chen, H. & Rasmussen, E. (1999). Intellectual access to images. *Library Trends*, 48(2), 291-302.

Choi, Y. & Rasmussen, E.M. (2003). Searching for images: the analysis of users' history. *Information Processing and Management*, 38, 695-726.

Chu, H. (2001). Research in image indexing and retrieval as reflected in the literature. *Journal of the American Society for Information Science and Technology*, 52(12), 1011-1018.

Consumer Electronics Association. (2009). *Digital imaging: A focus on sharing.* (Press Release). http://www.ce.org/Press/CurrentNews/press_release_detail.asp?id=11674.

Cox, A.M., Clough, P.D., & Marlow, J. (2008). Flickr: A first look at user behavior in the context of photography as serious leisure. *Information Research*, 13(1).

Cunningham, S.J., Bainbridge, D. & Masoodian, M. (2004). How people describe their image information needs: A grounded theory analysis of visual arts queries*. Proceedings from the Joint Conference on Digital Libraries 2004*, 47-48.

Cunningham, S.J., & Masoodian, M. (2006). Looking for a picture: an analysis of everyday image information searching. *Proceedings from the Joint Conference on Digital Libraries 2006*, 198-199.

Czaja, R. & Blair, J. (2005). *Designing surveys: a guide to decisions and procedures*. Thousand Oaks, CA: Pine Forge Press.

Datta, R., Joshi, D. Li, J. & Wang, J.Z. (2008). Image retrieval: Ideas, influences, and trends of the new age. *ACM Computing Services*, 40(2), 1-60.

Davis, E.T. (1997). A prototype item-level index to the Civil War photograph collection of the Ohio Historical Society. (Unpublished master's thesis). Kent State University, Kent, Ohio.

Dervin, B. (1983, May). An overview of sense-making research: Concepts, methods, and results to date. *International Communications Association Annual Meeting*, Dallas, Texas.

Efthimiadis, E.N. & Fidel, R. (2000). The effect of query type on subject searching behavior of image databases: An exploratory study. *Proceedings from The 23rd Annual International ACMSIGIR Conference on Research and Development in Information Retrieval*. New York: ACM Press, 328-330.

Ellis, D. (1989). A behavioral approach to information retrieval system design. *Journal of Documentation*, 45(3), 171-212.

Enser, P.G.B. & Sandom, C.J. (2007). Facing the reality of semantic image retrieval. *Journal of Documentation*, 63(4), 468-481.

Enser, P.G.B. & Sandom, C. (2003). Towards a comprehensive survey of the semantic gap in visual image retrieval. *Proceedings from The International Conference on Image and Video Retrieval*. *Springer*, Berlin, 2728, 291-299.

Ericsson, K.A. (2001). Protocol analysis in psychology. In N. Smelser and P. Bates (Eds.), *International Encyclopedia of the Social and Behavioral Sciences* (pp. 12256-12262). Oxford: Elsevier.

Fidel, Raya. (1994). User-centered indexing. *Journal of the American Society for Information Science* 45(8), 572-576.

Gay, L.R. & Airasian, P. (2003). *Educational research: Competencies for analysis and applications*. Upper Saddle River, NJ: Prentice Hall.

Glaser, B. & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine Publishing.

Golder, A.G., & Huberman, B.A. (2006). Usage patterns of collaborative tagging systems. *Journal of Information Science*, 32(2), 198-208.

Goldstein, B.M. (2007). All photos lie: Images as data. In G.C. Stanczak (Ed.), *Visual Research Methods: Image, Society, and Representation*, (pp. 61-82). Thousand Oaks, CA: Sage Publications.

Goodrum, A. & Spink, A. (2001). Image searching on the Excite Web search engine. *Information Processing and Management,* 37, 295-311.

Gordon, A.S. (2001). Browsing image collections with representations of common-sense activities. *Journal of the American Society for Information Science and Technology*, 52(11), 925-929.

Greenberg, J. (2001). A quantitative categorical analysis of metadata elements in image-applicable metadata schemas. *Journal of the American Society for Information Science and Technology*, 52(11), 917-924.

Greisdorf, H. & O'Connor, B.C. (2002). What do users see? Exploring the cognitive nature of functional image retrieval. *Proceedings from The 65th Annual Meeting of the American Society for Information Science and Technology*. Ed. E.G. Toms. Medford, NJ; Information Today, 383-390.

Hare, J.S., Lewis, P.H., Enser, P.G.B., & Sandom, C.J. (2006). Mind the gap: Another look at the problem of the semantic gap in image retrieval. In Chang, E.Y., Hanjalic, A. & Sebe, N. (Eds.), *Proceedings of Multimedia Content Analysis, Management and Retrieval 2006* (pp. 60730-1-607309-12), San Jose, SPIE Vol. 6073.

Hare, J.S., Sinclair, P.A.S., Lewis, P.H., Martinez, K., Enser P.G.B. & C.J. Sandom. (2006). Bridging the semantic gap in multimedia information retrieval: Top-down and bottom-up approaches. *Proceedings from Mastering the Gap: From Information Extraction to Semantic Representation – 3rd European Semantic Web Conference*, Budva, Montenegro.

Hastings, S.K. (1999). Evaluation of image retrieval systems: Role of user feedback. *LIBRARY TRENDS,* 48(2), 438-452.

Hastings, S.K. (1994). An exploratory study of intellectual access to digitized art images. (Unpublished doctoral dissertation). The Florida State University, Tallahassee, FL.

Hill, L.L. & Greg, J. (2004). The Alexandria Digital Library Project: Metadata development and use. Retrieved December 30, 2009 from http://www.alexandria.ucsb.edu/.

Hillman, D. (2007). Using Dublin Core. *Dublin Core Metadata Initiative*.

Hollink, L., Schreiber, A.T., Wielinga, B.J., & Worring, M. (2004). Classification of user image descriptions. *International Journal of Human-Computer Studies*, 61, 601-626.

Hourihane, C. (1999). *Subject classification for visual collections: An inventory of some of the principle systems applied to subject classification*. Columbus, OH: Visual Resources Association Bulletin.

Internet News. (2006). Web search statistics. Retrieved on December 28, 2009 from http://www.websearchguide.ca/netblog/archives/004810.html.

Ingwersen, P. & Järvelin, K. (2005). *The turn: Integration of information seeking and retrieval in context.* The Netherlands: Springer.

Jörgensen, C. (2007). Image access: The semantic gap and social tagging as a paradigm shift. *Proceedings from Classification Research Workshop*. Retrieved on April 15, 2009 from http://arizona.openrepository.com/arizona/handle/10150/105339.

Jörgensen, C. & Jörgensen, P. (2005). Image querying by image professionals. *Journal of the American Society for Information Science and Technology*, 56(12), 1346-1359.

Jörgensen, C. (2003). *Image retrieval: Theory and research*. Lanham, MD: Scarecrow Press, Inc.

Jörgensen, C. (2001). Introduction and overview. *Journal of the American Society for Information Science and Technology*, 52(11), 906-910.

Jörgensen, C., Jaimes, A., Benitez, A.B., & Chang, S. (2001). A conceptual framework and empirical research for classifying visual descriptors. *Journal of the American Society for Information Science and Technology*, 52(11), 938-947.

Jörgensen, C. (1999). Access to pictorial material: A review of current research and future prospects. *Computers and the Humanities*, 33, 293-218.

Jörgensen, C. (1998). Attributes of images in describing tasks. *Information Processing & Management*, 34(1), 161-174.

Jörgensen, C. (1996). Indexing images: Testing and image description template. *SIS 1996 Annual Conference Proceedings*.

Jörgensen, C. (1995). Image attributes: An investigation. (Doctoral dissertation). Available from Proquest Dissertations and Theses Database. (UMI No. 9625856).

Keister, L.H. (1994). User types and queries: Impact on image access systems. In R. Fidel, R.B. Hahn, E.M. Rasmussen & P.J. Smith (Eds.), *Challenges in Indexing Electronic Text and Images* (pp. 7-22). Medford, MJ: American Society for Information Science.

Kelly, J.R. (1991). Commoditization and consciousness: An initial study. *Leisure Studies*, 10(1), 7-18.

Kennedy, L., Naaman, M., Ahern, S., Nair, R., & Rattenbury, T. (2007). How Flickr helps us make sense of the world: Context and content in community-contributed media collections. Proceedings from *MM '07*. Augsburg, Germany: ACM, 631-639.

Kherfi, M.L., Ziou, D. & Bernardi, A. (2004, March). Image retrieval from the World Wide Web: Issues, techniques, and systems. *ACM Computing Surveys*, 36(1), 35-67.

Kim, J. (2008). Modeling task-based information seeking on the web: Application of information seeking strategy schema. *Proceedings of the American Society for Information Science and Technology*, 44(1), 1-13.x.

Krathwohl, D.R. (2009). *Methods of educational social science research: The logic of methods.* Long Grove, IL: Waveland Press Inc.

Krathwohl, D.R. (1998). *Methods of educational & social science research: An integrated approach.* 2nd ed. New York: Longman.

Krikelas, J. (1983). Information seeking behavior: Patterns and concepts. *Drexel Library Quarterly*, 19, 5-20.

Laine-Hernandez, M. & Westman, S. (2006). Image semantics in the description and categorization of journalistic photographs*. Proceedings from The 69th Annual Meeting of the American Society for Information Science and Technology,* Austin, Texas.

Layne, S.S. (1994). Some issues in the indexing of images. *Journal of American Society for Information Science*, 45(8), 583-588.

Lewis, E.M. (1976, November). Visual indexing of graphic material. *Special Libraries*, 4, 518-528.

Li, R., Bao, S., Fei, B., Zhong, S., & Yu, Y. (2007). Towards effective browsing of large scale social annotations. *Proceedings from the World Wide Web* 2007. Banff, Alberta, Canada, 943-952.

Library and Congress Prints and Photographs Division. (2007). *Thesaurus of graphic materials*.

Lunin, L.F. (1994). Analyzing art objects for an image database. In R. Fidel, R.B. Hahn, E.M. Rasmussen & P.J. Smith (Eds.), *Challenges in Indexing Electronic Text and Images* (pp. 57-74). Medford, MJ: American Society for Information Science.

Markey, K. (1984). Interindexer consistency tests: A literature review report of a test of consistency in indexing visual materials. *Library & Information Science Research,* 6(2), 155-177.

Markulla, M. & Sormunen, E. (2000). End-user searching challenges indexing practices in the digital newspaper photo archive. *Information Retrieval*, 1, 259-285.

Matusiak, K.K. (2006). Towards user-centered indexing in digital image collections. *OCLC Systems & Services: International digital library perspectives*, 22(4), 283-298.

Mosteller, F. (1981). Innovation and evaluation. *Science*, 211, 881-886.

McCay-Peet, L. & Toms, E. (2009). Image use within the work task model: Images as information and illustration. *Journal of the American Society for Information Science and Technology*, 60(12), 2416-2429.

McRae, L. (2000). Indexing images for subject access: Controlled vocabularies in the VISION Project. *Art Documentation*, 19(2), 4-9.

Naaman, M., Harada, S., & Wang, Q. (2009). *Context data in geo-referenced digital photo collections. Proceedings from the 12th Annual ACM International Conference on Multimedia 2004*. New York, NY, 196-203.

Nolte, D.D. (2001). *Mind at light speed: A new kind of intelligence.* New York, NY: Free Press.

O'Connor, D.B., O'Connor, M.K., & Abbas, J.M. (1999). User reactions as access mechanism: An exploration based on captions for images. *Journal of the American Society for Information Science*, 50(8), 681-697.

Ørnager, S. (1996). View a picture: Theoretical image analysis and empirical user studies on indexing and retrieval. *Swedish Library Research*, 2(3), 31-41.

Ørnager, S. (1995). The newspaper image database: Empirical supported analysis of users' typology and word association clusters. *Proceedings from 18th Annual Special Interest Group Conference on Research and Development in Information Retrieval*. Seattle, WA, 212-218.

Ørnager, S. (1994). The image database: need for innovative indexing and retrieval. *Knowledge Organization and Quality Management*. Indeks Verlag, Frankfurt, 208-216.

Palmblad, M. & Tiplady, B. (2004). Electronic diaries and questionnaires: Designing user interfaces that are easy for all patients to use. *Quality of Life Resaerch,* 13(7), 1199-1207.

Panofsky, E. (1962). *Studies in Iconology*. New York: Harper & Row.

Pu, H.T. (2008). An analysis of failed queries for web image retrieval. *Journal of Information Science*, 34(3), 275-189.

Rafferty, P. & Hidderley, R. (2007). Flickr and democratic indexing: Dialogic approaches to indexing. *Aslib Proceedings: New Information Proceedings*, 59(4/5), 397-410.

Rappaport, E.D. (2000). *Shopping for pleasure*. Princeton: Princeton University Press.

Roberts, H.E. (2001). A picture is worth a thousand words: Art indexing in electronic databases. *Journal of the American Society for Information Science and Technology*, 52(11), 911-916.

Rorissa, A. (2008). User-generated descriptions of individual images versus labels of groups of images: A comparison using basic level theory. *Journal of Information Management*, 44, 1741-1753.

Rorissa, A. & Iyer, H. (2008). Theories of cognition and image categorization: What category labels reveal about basic level theory. *Journal of the American Society for Information Science and Technology*, 59(9), 1383-1392.

Rorissa, A. (2007). Relationships between perceived features and similarity of images: A test of Tversky's contrast model. *Journal of the American Society for Information Science and Technology*, 58(10), 1401-1418.

Rorissa, A. & Hastings, S.K. (2004). Free sorting of images: Attributes used for categorization. Proceedings from *The 67th ASIS&T Annual Meetings: Vol. 41*, 360-366.

Rosenblum, N. (2007). *A world history of photography*. (4th ed.). New York: Abbeville Press Publishers.

Sapsford, R. & Jupp, V. (1996). *Data collection and analysis.* London: SAGE Publications.

Sedghi, S., Sanderson, K., & Clough, P. (2009). A study of the relevance criteria for medical images. *Journal of Pattern Recognition*, 29(15), 2046-2057.

Shatford, S. (1986). Analyzing the subject of a picture: A theoretical approach. *Cataloging & Classification Quarterly*, 6(3), 39-62.

Shatford, S. (1984). Describing a picture: A thousand words are seldom cost effective. *Cataloging & Classification Quarterly*, 4(4), 13-30.

Shirky, C. (2005). Ontology is overrated: Categories, link, tags. Retrieved from
        http://www.shirky.com/writings/ontology_overrated.html.

Smeulders, A.W.M., Worring, M. Santini, S., Gupta, A., & Jain, R.C. (2000). Content-based
        retrieval at the end of the early years. *IEEE Transactions on Pattern Analysis and
        Machine Intelligence*, 22(12), 1349-1380.

Smith, J.R. & Chang, S.F. (1995). Tools and techniques for color image retrieval. *Storage
        and Retrieval for Image and Video Databases: Vol IV*. *Proceedings from Society for
        Imaging Science and Technology.*

Smith, J.R. & Chang, S.F. (1994). Transform features for texture classification and discrimination
        in large image databases. *Proceedings from IEEE International Conference on Image
        Processing: Vol 3*. Austin, TX, 407-411.

Sontag, S. (1977). *On photography.* New York: Picador.

Strauss, A., & Corbin, J. (1994). Grounded theory methodology: An overview. In N.K. Denzin
        and Y.S. Lincoln (Eds.). *Handbook of qualitative research* (pp. 273-285). Thousand Oaks,
        CA: Sage.

Swain, M. & Ballard, D. (1991). Color indexing. *International Journal of Computer Vision*, 7(1),
        11-32.

Tague-Sutcliffe, J. (1992). The pragmatics of information retrieval experimentation, revisited.
        Information Processing & Management, 28(4), 467-490.

Taylor, R. (1068). Question negotiation and information seeking in libraries. *College and
        Research Libraries*, 29(3), 178-194.

The Getty. (2009). *Art and architecture thesaurus.*

Tjondronegoro, D., & Spink, A. (2007). Web search engine multimedia functionality. *Information
        Processing and Management*, 44, 340-357.

Turner, J.M. (1993). Subject access to pictures: Considerations in the surrogation and
        indexing of visual documents for storage and retrieval. *Visual Resources*, 9,
        241-271.

Turner, J.M. (1994). Indexing "ordinary" pictures for storage and retrieval. *Visual Resources
        X*, 265-273.

Turner, J.M. (1994). Indexing "ordinary" pictures for storage and retrieval." *Visual Resources*,
        10, 265-273.

Turner, J.M. (1995). Comparing user-assigned terms with indexer-assigned terms for storage and retrieval of moving images. *Proceedings of the ASIS Annual Meeting 1995.* 32, 9-12.

Tversky, A. (1977). Features of similarity. *Psychological Review*, 84, 327-352.

Vakkari, P. (2003). Task-based information searching. *Annual Review of Information Science and Technology*, 37, 413-464.

Van der Waal, H., L.D. Courpie, E. Tholen, & Vellekoop, G. (1985). *ICONCLASS: An Iconographic Classification System*. Amsterdam.

Van Dijck, J. (2008). Digital photography: Communication, identity, memory. *Visual Communication*, 7(1), 57-76.

Van House, N.A. (2007). Flickr and public image-sharing: Distant closeness and photo exhibition. *Proceedings from Computer/Human Interaction 2007.* San Jose, CA, 2717-2722.

Van House, N. Davis, M., Ames, M., Finn, M. & Viswananthan, V. (2005). The uses of personal networked digital imaging: An empirical study of cameraphone photos and sharing. *Proceedings from Computer Human Interaction 2005*.

von Ahn, L., Dabbish, L. (2004). Labeling images with a computer game. *Proceedings from the SIGCHI Conference on Human Factors in Computing Systems.* Vienna, Austria, 319-326.

Wang, P., Hawk, W.B., & Tenopir, C. (2000). Users' interaction with World Wide Web resources: an exploratory study using a holistic approach. *Information Processing and Management*, 36, 229-251.

Web.com. (2009). Search engine statistics. Retrieved on December 28, 2009 from http://www.submitawebsite.com/blog/search-engine-stats.html.

Westman, S. & Oittinen, P. (2006). Image retrieval by end-users and intermediaries in a journalistic work context. *Proceedings from Information Interaction in Context, IIiX*. Copenhagen, Denmark, 102-110.

Wildemuth, B.M. (2009). *Applications of social research methods to questions in Information and Library Science*. Westport, CT: Libraries Unlimited.

Winget, M. (2002). Intellectual Access to Images: An overview. Retrieved on April 17 from http://www.unc.edu/~winget/research/mini_lit_review1.html.

Zhao, R. & Grosky, W.I. (2002). Bridging the semantic gap in image retrieval. In
T.K. Shih (Ed.), *Distributed Multimedia Databases: Techniques and Applications* (pp. 14-
36). Hershey, PA: Idea Group Publishing.