

# Understanding the Everyday Use of Images on the Web

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## ABSTRACT

This paper presents a qualitative study of domestic Web-based image use, and specifically asks why users access images online. This work is not limited to image *search* per se, but instead aims to understand holistically the circumstances in which images are accessed through Web-based tools. As such, we move beyond the existing information seeking literature, and instead provide contextual examples of image use as well as an analysis of both how and why images are used. The paper concludes with design recommendations that take into account this wider range of activities.

## Author Keywords

Image search, domestic, photowork, Web use, field study, diary study

## ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

Despite widespread use of images on the Internet [1, 7, 20], little is known about people's behavior or motivations when accessing images via the Web and in the course of everyday life. There are studies on image search, but these tend to focus on innovations in the technology itself [e.g. 8, 19] or the performance of different techniques as assessed by various kinds of objective measures such as the relevance and ranking of returned images given a set of keywords [e.g. 2, 20]. Further, in characterizing the behavior in question as image "search", this, in itself, makes implicit assumptions about what users are doing. In this paper, we want to show how a deeper exploration of what people do with images, and why they access them from the Web, goes beyond simple notions of search. We want, instead, to put on-line image use in the broader context of users' activities and intentions. We choose a domestic context here to reflect the fact that Web use, including image use, is now firmly entwined in every

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aspect of our personal lives.

For some time now, researchers in Information Retrieval (IR) have argued that we need to look beyond simple models of search to support what people really do on the Web. They have argued that a model which assumes that users formulate goals, specify queries, and then look for results to satisfy those goals oversimplifies what people do with the Web [9, 15]. This is sometimes called "directed search" or "look-up". A more recent emphasis on "exploratory search" stresses the ways in which users are often opportunistic when they use the Web, and that their strategies can be heavily reliant on browsing and serendipity [9, 15]. Others have gone one step further pointing out that "searching" or even the broader term "information seeking" assumes that Web use is purposeful, even though research shows that Web users may sometimes have no explicit goals at all [23].

Despite this, the simple look-up model continues to dominate in terms of driving the underlying design not only in text search, but also in specialized image search tools: users enter a set of keywords, and a rank ordered array of images is returned. Of course there are many specialized sites which focus on images (such as Flickr and Facebook) and also innovations in the way images are searched for (including searching by color [26, 10], or other visual features [10, 19]), but the fact remains that mainstream image search, at least in terms of the user experience, is not significantly different from any other kind of keyword search on the Web.

This study asks whether, like general Web search, this view of what users do with images on the Web is, in fact, too narrow, and thus whether we are missing opportunities to deliver more compelling kinds of Web-based tools. It does this by looking at the range of behaviors and motivations for engaging with images online from a user's perspective.

We limit the scope of this study in the following ways: First, we focus on the everyday ways in which people search for images on the Web from home, as opposed to purely professional use. We also constrain our enquiry to images which are not within people's own personal collections, such as home photo and video collections. Largely this is because this topic has been covered extensively elsewhere [e.g. 12, 22] and the issues raised are likely to be quite different from searching for images for which one has little familiarity. Finally, there is no doubt that one of the main uses of images in the domestic sphere

is pornographic [3, 24]. Because of the highly personal and sensitive nature of this aspect of image use, we chose not to include this in our work.

Our contribution is to provide deeper insight into the ways in which people engage with images on-line. We will refer to this behavior as image “access” or “use”, to reflect the fact that, as we will show, these behaviors go beyond searching and browsing. In addition to providing this deeper understanding through contextual examples, a second contribution is to use this to show how the design of Web-based tools might better support the ways in which people want to use images from the Web. Accordingly, we develop a framework for classifying the various motivations for image use, and reflect on the implications of the range and diversity of these activities.

#### RELATED WORK

Much of the literature on image search is technical in nature, focusing on new ways in which to increase the relevance of retrieved images through, for example, better matching of queries to images [5], better tagging of images with meta-data [27], or ways to do content-based image retrieval [13, 29]. New features and interfaces too, form a considerable body of work, exploring concepts such as new ways to cluster and present results, [see 1 for a review]. New and specialized image search tools are also appearing [19] but most are specialized to particular communities.

In terms of understanding users’ intentions or behaviors when using images on the Web, there is much less pertinent research, and most of this concerns image search behavior in organizations and professional contexts [1, 2, 6, 16, 30]. Here, though, there are some interesting findings, pointing to the fact that, in contrast to general Web use, image professionals [16, 30] are more heavily reliant on browsing. More general analyses of image search logs [1, 10] also reveal that, in comparison to general Web search, image search relies on rapid browsing of many more pages of search results per query, involves the exploration of many more paths per query, and much more iterative modification of queries per session. One might reasonably conclude from this that image search is either more reliant on flexible navigation and exploration than mainstream Web searching, or that the tools are less successful for helping users find what they need.

In terms of more in-depth studies of users’ behaviors and intentions, most studies of the everyday use of images outside the workplace focus on people’s use of their own personal photo collections. For example, Kirk et al. [12] provided an overview of “photowork”, or activities people perform with their digital photos after capture but prior to end use such as sharing, focusing on practices in the home. Other studies have addressed other aspects of personal photo use in the home, such as browsing [11], archiving [22] and sharing [17], particularly in the use of photo sharing Websites such as Flickr [14, 18].

Taken together, whether in professional contexts or otherwise, there are very few studies which have conducted

in-depth interviews with users to delve into the strategies, motivations, and contexts where individuals engage with images on the Web. Our approach was to conduct in-depth interviews, but also to ground these using a careful record of participants’ activities over an extended period of time—a method used previously to investigate more general Web use behavior [23]. This way, one can capture a realistic “slice” of image search activities in the context of everyday life, along with the rich descriptions and stories that accompany them. This approach generally means using a relatively small sample of participants, but gathering a detailed set of data about each person in question.

#### METHOD

##### Participants

With this aim we undertook a study of nine individuals’ domestic image use practices, who were recruited through snowball sampling. Our participants included five men and four women ranging in age from 24 to 59: one participant was under 25, four were aged between 26-35, three between 36 and 45, and one over 46. With the exception of one person (a graphic designer), we recruited participants with professions that were not image-intensive. This included: a bookshop assistant, an accountant, a civil servant, an eco-blogger, a recruitment agent, a student, a homemaker, and a retiree who actively volunteered for charities. Our main criterion for selection was also that they reported using images from the Web at least 5 times a week. All participants used the internet for at least 30 minutes a day and were familiar with general Internet activities such as searching for content on the Web, browsing image galleries, and manipulating images on the Web (e.g. downloading, enlarging, and viewing).

##### Procedure

The study employed a diary study method [21] similar to the one used previously in Sellen et al. [23]. A diary study was chosen over an ethnographic approach given the likelihood of the experimenter’s presence influencing the environmental validity of findings combined with the impracticality gaining access for 24/7 ethnography. On a simple diary form, participants were asked to log a short description of each Internet activity involving images. Participants were told to log all Web-based activities in which images (such as illustrations, photos, and graphics) were deemed to be important in the accomplishment of their tasks. This could include using images in order to accomplish a goal, finding an image as an end goal in itself, or engaging with images in other ways that might not involve explicit goals. When in doubt, participants were encouraged to include rather than exclude an activity. They were also asked to exclude activities which involved images from their own personal photo collections. In addition to a short description of each activity, they were also asked to log the activity start time. They were told that these entries only needed to be sufficient to trigger a longer discussion of each activity in the ensuing interview. When necessary, participants’ browser histories were used to fill in gaps in the data and to validate the diary entries.

Participants recorded an average of approximately 3 activities per day (see Table 1).

Initial interviews introduced participants to the purpose of the study and the diary study method, and were used to gather demographic information about the participants and their households. After initial interviews, participants were contacted via phone or in-person for follow-up interviews approximately twice a week, each interview lasting between 30 to 60 minutes. The frequency of interviews depended on how many activities had been logged in a day. If fewer than 4, then the interview would be delayed until more activities were recorded. However, the interval between interviews was never less than 3 days, or more than 9 days.

During these interviews, participants were asked questions to explore both the “why” and the “how” of each activity logged, including why they were looking for specific images, how often the activities occurred, the process of the activity, internal or external influences on that activity (e.g. an email reminder or a high-level goal), and other contextual aspects (e.g. the environment or situation as the activity was taking place). Interviews were audio-recorded. All participants were given a shopping voucher for their participation on completion of the study.

## FINDINGS

We begin by providing an overview of the activities we examined, including the operational definition of image use we adopted for the purpose of the analysis. Next we look at the “how” of the activities we explored, highlighting the technologies and strategies used by participants in accessing images, and summarizing key observations regarding commonly used Internet sites. Third, and most importantly, we examine the “why” of these image use activities, and present an analytical framework (a taxonomy) for understanding users’ motivations for domestic image use.

### Overview of Image Use Activities

In our instructions to the participants, and in our analysis, we sought to gather information on any activities in which the Web was used to obtain image-based content of significant importance or value to the participants during the activity. For example, if an image was present on a Website but was ignored, we did not count this as an activity of interest. Obviously, these judgments are subjective. However, we relied on participants to make those judgments, taking at face value the explanations for each activity that they offered up.

This means that the analysis that follows includes activities where finding an image may not necessarily be the end goal. It also means that many of the activities considered here may not necessarily be “searching” or “browsing” tasks—images may be accessed for other purposes. This broader definition of *image use* rather than search, per se, aims to embrace a larger spectrum of image-related activities in order to get a more grounded and realistic

understanding of the value of images and the activities surrounding it.

Participant Pseudonym	Overall Total	No. of days per person	Average No. of Image-based Activities per day
Elle	18	3	6
Sue	17	9	2
Florence	18	12	1.5
Gracia	22	8	3
Colin	20	10	2
Elizabeth	21	8	2.5
Andy	17	9	2
Tom	16	9	2
William	30	8	4

**Table 1. Overview of number of image-based activities logged per participant. (Participants’ names have been changed to protect their identities.)**

Table 1 provides a summary of the number of activities collected for each participant over the course of the study. The total number of image use activities in our corpus was 179, ranging from 16 to 30 activities per person over the course of the study. The average number of image use activities across different participants ranged from 1.5 to 6 per day.

### Strategies and Tools for Image Access

The data show that participants used one of four main ways to access and engage with images on the Web: they either used image-specific search tools, used social networking sites, visited domain-focused Websites, used Websites featuring maps, or used some combination of the four. The most frequent method was the use of domain-specific Websites that contained images (e.g. news, blogs, e-commerce Websites). Image-specific search tools (in this case exclusively Google Image Search) were used less than 10% of the time, despite its straightforward interface and relative popularity.

#### Image-Specific Search Tools

Google Images is a general image search tool that retrieves images based on keyword queries, and the only such tool we saw used in the course of the study. Only five participants reported use of Google Images. They used it infrequently (less than 10% of the time) and mostly to support quick searches for specific images that were easily identifiable via a keyword (e.g. “fitflops”, “Van Gogh”). One participant, Gracia, used Google Images more frequently compared to other participants. She spoke English as her second language, and sometimes used Google Images to learn new English words. In one example, she used several keyword combinations to physically describe an outdoor cooking stove in order to find recognizable images and subsequently “guess” the correct term. Another participant, William, attempted several keyword combinations on Google Images to discover humorous pig photos. While this is a small sample, this suggests that tools such as Google Images are appropriate for goal-directed searches where users have ideas for a specific keyword and expected search result, occasionally supporting exploratory searching involving

keyword variations. However, the fact that this is done infrequently either means that there are other effective ways of answering such queries, or that the need to do keyword search on images happens relatively infrequently.

#### *Social Networking Sites*

Facebook, while primarily designed for social networking, provides a comprehensive photo gallery feature that members can use to upload images. Some participants made use of Facebook photo galleries to see what their friends were up to and posted comments on certain photos as a means of informing them that they had seen the photos or to amuse them. There were elements of serendipitous discovery as participants often visited photo galleries by clicking on a thumbnail of that gallery located on their Facebook home page. The activities involving Facebook showed how behavior is motivated by participants' goals to connect with friends [28], and how the thumbnails and photo galleries catered to this need.

Only two participants used Flickr during their image related activities. One participant visited Flickr to view photos from her friends and sister about once a week to find out news about them, while another participant browsed Flickr mainly for amusement or inspiration.

#### *Domain-specific Websites Containing Images*

The majority of image use activities involved domain-specific Websites such as news sites, company Websites and e-commerce sites (on average 42% of the time). Most of these were routine activities, such as reading the news or checking the weather, sometimes leading to other activities through serendipitous discovery of images. Some activities were occasional, but focused around a topic of interest such as property hunting, whereby participants were searching for specific types of images such as property floor plans. In all cases, images were important or even critical parts of the activities in question.

It became clear that one reason that many of the image use examples were linked to domain-specific Websites was that they were interwoven into participants' normal routines when using the Web. For instance one participant routinely visited the BBC Website for news and the weather. Another looked at Glastonbury event photos which led to deeper exploration of articles and more images relating to artists and bands.

Other times, participants were observed making routine visits to certain Websites in the course of more directed search. Elizabeth's use of a property agent's Website to examine properties for purchase, which was characterized by her search for floorplans and photos of the property, is an example of this. In this case, she commented on the importance of images: "The photos I usually look for are to get a better feel for the house, and the floor plans are very important as well—especially for knowing how to decorate the place".

Some participants also performed routine tasks involving e-commerce sites (e.g. Amazon, eBay) and, once there,

engaged in more focused search. For example, William routinely used eBay's advanced search feature to routinely locate new listings of items to bid on, followed by scanning thumbnails that matched his specific requirements.

The examples above show how domain-specific Websites can be more effective than general image search tools (e.g. Google Images) due to features that are designed to support search strategies that are relevant to users of that site and the tasks that they engage in (e.g. searching for new items to bid on eBay).

#### *Maps*

Maps are a unique type of image use, as they are visual in nature and afford various visual tasks such as exploration and recognition. The study observed the use of interactive maps (e.g. Google Maps) as well as illustrated (static) maps. They are distinguished from domain-specific Websites because they were used to provide confirmation and assistance for geographical and spatial navigation. For example, maps were used to confirm the location of a particular landmark (e.g. the location of a real estate property) or to obtaining the general direction to walk from a specific venue.

#### *Summary*

In summary, we can see that there were many different ways in which the participants in the study obtained images they were interested in, or otherwise used them in the context of larger activities. More than half of these were interwoven with routine Web use, often leading to serendipitous browsing and exploration. Others involved specific kinds of search strategies tailored to particular tasks, and thus making use of specific Websites designed for those tasks. Interestingly, fewer than 10% of the activities we examined actually involved the use of specially designed tools for image search. In order to understand this more deeply, we turn now to examining users' motivations behind these activities.

#### **Motivations behind Image use**

The primary focus of this research was to understand the underlying motivations when people engage with images on the Internet. An analytical framework consisting of thirteen search motivation themes subsumed under four higher-level categories was constructed using grounded theory. These themes are concepts that were based on codes we assigned to each activity based on the various motivations behind how images were used. Some activities fall under multiple themes, and thus are not mutually exclusive. Table 2 summarises these categories and shows the overall number of examples in the corpus falling into each high level category. We now describe each of these categories, along with their sub-categories, in more detail.

#### **Learning and Research**

The most frequent motivation for image use can be summarized as for the purpose of "learning and research". Here we found a whole range of activities involving images that were undertaken in order to gain new insight and ideas on particular themes, topics or concepts. However, within

High-level Categories	Frequency of Corpus Overall	Subcategories
Learning and Research	123	Images to support ongoing interests or research
		Images to satisfy curiosity
		Images for visual discovery
		Images as ideas
Image Access as Secondary goals	52	Images as alternative answers
		Images as aids for geographical orientation
		Images as indexes
Recreating or Connecting to Remote Experiences	77	Images for connecting to remote places
		Images for re-living past experiences
		Images for connecting to people and their lives
		Images to connect to personalities
Images as the Objects of Communication	20	Images to do the work of communication
		Images for social interaction

Table 2. Framework for motivation for image use including the total number of instances of the corpus falling into each high level category. (Note that any one activity can fall into more than one category).

this larger category, we found four main reasons why this occurred, as we shall describe.

#### *Images to Support Ongoing Interests or Research*

Similar to Marchionini's concept of "searching to learn" [15] or Sellen et al's "information gathering" [23], many image-based activities were in support of deepening or updating one's knowledge with respect to existing interests, hobbies or research topics. These activities were characterized by regular, repeated activity around specific topics or domains which represented a significant part of the overall corpus (40% overall). Whether it be about parenting, modeling, sports, family history or politics, the use of images to support ongoing interests formed anywhere from half to three quarters of the examples of image use for learning and research.

For example, some participants who were looking to purchase property consistently examined thumbnails for details such as the condition of an apartment and the external area of the location from apartment specialty sites. Elle, who was a part-time model, regularly followed the work of models and designers, and Gracia often searched illustrators' portfolio Websites.

**Fieldnotes for Elle:** Elle received an email from [model A], so she went to modelmayhem.com to see [model A's] photos - she wanted to see the new work she had been doing since the last time she chatted with her. Later, on Facebook, she viewed photos of another model, [model B], after posting a comment on her wall. She looked at her photos because "she's gorgeous and a very nice person" and that she looked like a celebrity.

**Fieldnotes for Gracia:** Gracia explained how she was looking for new work from [photographer A] on his Website. She found some new art there, then started searching for more of his work on Google Images, which she said was easier as it catches her attention.

The key to these activities was that they were specific and specialized to the participants' particular interests, and could be gleaned from sites which provided additional contextual details along with the images. This tended to happen as a matter of routine, where sites that were considered both trusted and familiar were visited regularly to check for new content.

#### *Images to Satisfy Curiosity*

Participants occasionally engaged in more focused and directed search for images to satisfy their curiosity about a particular issue or question, which can be considered another way in which images were part of learning.

**Fieldnotes for Tom:** Tom was reading that people were claiming that TV presenter Christine Bleakley was older than her reported age. He did a search for her photos out of curiosity on various Websites through Google text search, but he couldn't find anything conclusive. He said in response that he often engages in random browsing on a daily basis—"it's quite a nice thing to do before you go to sleep".

**Fieldnotes for Andy:** There was a picture of Nick Grinhorpe on the rotating banner at the top of the BBC Website, and Victoria Hesketh was next to him (of whom he was a fan). He clicked on the image which led to an article, and there were about 7 to 8 photos of her playing for a show, and he looked at them all.

Both Andy and Tom explained that their curiosity led them to look for images, confirming previous work which found that image search queries were often motivated by "curiosity or pursuit of entertainment" [7].

Unlike the previous category, where images were entwined with regular visits to familiar sites, this kind of image use tended to be more focused around particular queries. This was reflected in the way this was accomplished, namely, mostly through visiting various Websites found through regular text search, or by exploring further on the site where the object of curiosity was found.

#### *Images for Visual Discovery*

Moving on from supporting particular themes or topics, sometimes learning derived from the viewing of large collections of images where similarities and differences in visual features played an important role. This kind of learning was characterized by novelty for participants, where they specifically commented that they learned something new.

**Fieldnotes for Sue:** Sue was searching on Amazon for "meat mincers" but was unsure of what meat mincer she needed to get. As she was browsing the search results, she realised that there were two types of meat mincing devices – a clamp-type and a table-top type. In the scenario above, it was obvious from the images that there were two types of meat mincers from the product photos returned, as they were visually distinguishable.

In another example, as mentioned earlier, William used Google Images to search for humorous images of pigs by attempting different keyword combinations. Here, he used the phrase "weird pig", and discovered an image of a pig with tusks:

**Fieldnotes for William:** He went to Google image search, tried to think of a variation of pigs that he hadn't used before, and entered "weird pig" and got a lot of results... He selected these photos because he'd never seen anything like them before - one was of a pig with tusks – a very striking image, "a very exciting pig".

The element of discovery in both scenarios depended on the visual similarity or dissimilarity of the images (meat mincers and pigs) within the search results. Keyword queries also allowed participants to experiment with different search outcomes in order to explore these features along various dimensions such as shape, type, size, and so on.

#### *Images as Ideas*

A final way in which images were used for learning and research was in a more inspirational capacity. Rather than looking for information updates, or accruing additional knowledge about familiar topics, on the contrary, a few participants browsed images to be inspired and get new ideas for creative projects:

**Fieldnotes for Gracia:** Gracia likes to look at other illustrators' work to learn from them or to see how far she's grown as a graphic designer. She called this constant ogling at other people's work a "fixation".

**Fieldnotes for Sue:** There were a lot of beautiful images on this blog — she would look at the images before reading the content, as the images were very important to her. She visits the blog regularly because she wants to update herself about DIY, recycling and design.

Here, the important aspect of these activities was finding large collections of images which would surprise and be stimulating. Key here was the ability to browse quickly through many different high quality images around very high level topics, rather than particular kinds of objects.

#### **Image Access as Secondary Goals**

Images are sometimes used to facilitate other activities. This is characterized by an activity where a participant has a primary goal, but performs sub-tasks where images are used. There were three distinct types of scenarios where this pattern was observed, as we shall describe.

#### *Images as Alternative Answers*

In some activities, images were used as alternative ways of quickly finding an answer to a query. For example, Gracia's recipe search for an authentic Mexican dish returned American versions of the recipe, which she didn't want:

**Fieldnotes for Gracia:** Gracia first looked for recipes for "arroz a la mexicana" via the main Google search but the results returned inauthentic versions of the dish. She then used Google Images and looked for images of the dish that looked authentic, and clicked on the image that led to the correct recipe.

Another example was William's search for a specific book for a customer waiting directly in front of him:

**Fieldnotes for William:** He was searching for a specific bible for a customer, and the book supplier had a catalog online. He went to the Website and searched for "pocket bible". He clicked on a few options, and the picture was there, so he showed it to

the customer, who was in front of him. The whole process took about 5 minutes.

These activities show how images can sometimes be more efficient than text in delivering answers or offering up information. Having the choice of text or image in both of the cases described allowed for greater flexibility and efficiency.

#### *Images as Aids for Geographical Orientation*

Images can act as navigational aids, especially in combination with maps, to confirm the location of a particular landmark or for orientating oneself within a map. Although participants were already familiar with the location, they used images to obtain visual cues (e.g. landmarks, directions) to aid the physical navigation of a place.

**Fieldnotes for Florence:** Florence thought she would drop by the Japan Centre to buy things on the way home. On her Web browser, she searched for "google maps japan centre london", which led her to the Japan Centre Website. On the "location" page of the Japan Centre site, there was an embedded Google Maps widget, which she used to find out where the Piccadilly Tube station was to get her bearings right. She also checked the address of Japan Centre, and noted the photo of the front entrance of Japan Centre at the top of the page because "it [was] easier to recognize the place". As she closed the browser window, she made a mental note of the address, the photo of the entrance, and that it was on Piccadilly Street.

The above illustrates Florence's use of the shop's entrance as a way to identify the correct place. She also visually used the map to identify direction, match the address with the geographical space, and presumably the distance of travel as well. It is also interesting to note despite amount of information, she felt confident not to write it all down for future reference, as though she was depending solely on her mental model of the journey, made up of visual parts such as the shop's entrance and pre-existing knowledge of the area. This shows how images can be useful placeholders for things that are useful for judging geographical placement, orientation, distance and meaning.

#### *Images as Indexes*

Because images are often easier to visually scan, participants made use of images as indexes to locate an item on lists or grids, such as in search results, product listings and catalogues. For example, Elizabeth's search for a radio program on the BBC iPlayer Website returned search results with illustrations or artwork representing each program. Because she recognized the artwork belonging to the radio program she wanted, it was relatively easy for her to locate that program.

A similar pattern was observed with Tom and Colin who identified specific DVDs they wanted on sites like play.com and find-dvd.co.uk just by looking at the cover art. This activity of visual browsing was essential as each cover art is unique, and subtle differences in the cover art can make a difference in actual product features such as whether it is a special edition DVD or a boxed set. Again, this represents an economical alternative to scanning

headline and descriptive text for entries in a sequence, especially when it involves visually scanning for a known image or visual pattern.

### Recreating or Connecting to Remote Experiences

Participants also used images to understand, connect to or imagine experiences that were otherwise remote, either spatially or temporally. Here, the rich visual nature of images allowed participants to experience Web-based information in ways that text-based content could not. Here, quality and fidelity of the images was important as we will discuss.

#### *Images for Connecting to Remote Places*

Images were sometimes used by participants to “get a feel for a place”, referring to the sense of wanting to experience a specific physical location not previously visited. In one activity, a participant was looking at his friend’s photos of Wembley Stadium on Facebook:

**Fieldnotes for Colin:** Colin found it interesting how his friend managed to capture Michael Owen taking a goal at Wembley Stadium, as well as photos of players celebrating the goal. He had never been to the stadium before so it was nice to see inside. There were very close shots of the player and other players celebrating. He didn’t think you could get so close to the station. It made it feel very exciting.

This involved multiple photos of a given location showing various perspectives of the space, particularly from a perspective seen from someone else (his friend). Details like the seat numbers, close-up photos of the players, and scoreboard helped Colin to visualize the experience of being at the stadium.

#### *Images for Re-living Past Experiences*

We also found that images helped as a way of re-connecting people to a past experiences for familiar places from their past. This was the case even though they were not personal photos as most work on reminiscing assumes [25]. For example, Florence was informed of a snowstorm that hit the town of Dunedin, New Zealand, where she had previously lived:

**Fieldnotes for Florence:** Florence had heard from a friend that there was a snowstorm in Dunedin, New Zealand, where she used to live. She enlarged every thumbnail because it was a better experience, saying that it was more fun and satisfying and that she could see more details, such as bits of grass, and being able to identify which building that was. She missed Dunedin, and the photos helped her re-live the experience.

Another example showed how Elle was browsing through photos of a hotel she stayed in once:

**Fieldnotes for Elle:** Elle loved looking at the photos of the hotel she stayed at one time, saying how it was “such a beautiful place”. She says she keeps looking at photos like these to remind herself of her goals in life.

Colin browsed through his friend’s photos of a concert he also attended to connect with that experience again:

**Fieldnotes for Colin:** He was viewing other's people's Blur concert photos. He joyfully reminisced about being there as well, and the images helped him connect back with that experience.

These examples show how the images can provide a sense of nostalgia. It seemed that seeing details such as “bits of grass” were critical to the experience.

#### *Images for Connecting to People and their Lives*

Images also represented a way for participants to get to know their friends better, or keep abreast of their whereabouts and activities. These activities often occurred regularly, repeating on a daily to weekly basis. An example of this was Florence’s regular visits to her sister’s photos on Flickr.

**Fieldnotes for Florence:** Once a week, Florence checks her Flickr account to check on new photos from friends. She decided to visit Flickr because her sister was involved in a fashion show recently and so might have uploaded some photos... [However], she didn’t see anything new... and left. She uses Flickr as a way of checking up with her sister.

The scenario above illustrates the habitual process participants often went through to get news. In this case, the images represented events or activities pertaining to the participant’s friends or family members. This was a common observation with participants using Facebook as well, which was often accompanied by social interactions such as comments or tagging [4].

#### *Images for Connecting to Personalities*

Some participants used images in order to connect to people they didn’t know personally, such as celebrities—not as gossip, but to somehow feel closer to them, or understand them. For instance, during our study Michael Jackson passed away, and several participants used viewing photos as a way of understanding his personality and the stories or situations surrounding his life.

**Fieldnotes for Sue:** She found that Michael Jackson died when everyone was talking about the news on Facebook... While she read the news, she looked at the pictures that accompanied the photos, all the while asking – “Did he really die? How did he die?”, reflecting that she was learning about this personality through the photos as well... So the photos helped her see his condition just before his death... Finally, she said she was satisfied from piecing together a believable story after browsing through all those photos.

The above illustrates how some images have narrative qualities that are also valuable in helping users connect to the experiences of people. Here the participant was looking at the details of Jackson’s face to understand the discussions surrounding his plastic surgery and skin condition—fidelity was critical to the task at hand. As users sometimes hypothesize about personalities’ lives, these photos help users build believable stories surrounding these figures.

#### **Images as the Objects of Communication**

The final way in which images were used was to facilitate communication and social interaction. This occurred in two ways—one where images did the work of communication, and the other where images facilitated social interaction.

#### *Images to Do the Work of Communication*

Images can sometimes be more effective than words in communicating. This example of a conversation between

Florence and her flatmate involved learning that Van Gogh resembled someone they both knew:

**Fieldnotes for Florence:** Florence's flatmate found out that Florence didn't know who Van Gogh was, and said that Van Gogh bore a striking resemblance to someone they both knew and asked her to do a search for the artist. Florence did a quick scan at the Google Image search results and she pointed to a Van Gogh self-portrait and asked her flatmate, "is it that one?" and the flatmate said yes and they both laughed at it because it did remind her of someone that they both knew.

Here, the fact that no explanation was needed of who the image resembled points to the effectiveness of images for some kinds of communication. Of course, the goal was purely to amuse, but the example shows how images can sometimes speak differently than words.

The example of William's search for pigs (previously discussed) also illustrates this pattern, as his intent was to email the pig photos to his colleague to humor her.

**Fieldnotes for William:** He found two images which he planned to send over the next few days... Another picture [he found] was one of a pig bikini - he knew this would make his friend laugh. It was very amusing because it fit "her sense of humor".

In these last examples, the funny images sent were intended as messages in and of themselves, because of their shared meaning between two friends.

#### *Images for Social Interaction*

As a final sub-theme, images were seen to be used by participants in social games or social features online. Besides common examples like Facebook comments and wall posts, some scenarios showed social interactions taking place in online forums, such as this guessing game that involved locating interesting images of personalities and sharing them to encourage a response:

**Fieldnotes for Tom:** The object of the game, played twice weekly, is to identify an obscure person based only on a photo. The person with the correct guess then uploads the next picture. While Tom was on the site, he clicked on other thumbnails of obscure people that looked interesting. There was one of Mae Busch, which looked interesting because you could barely recognize the person. In fact, he enlarged the photo so he could identify the person better.

The social interaction here was indirect—the participant was entertained by other members' interactions around images, with no direct communication between them. This shows how images can spark interest in unique ways beyond starting points for conversation.

## DISCUSSION

This study has shown that the term "image search" may hide the rich and interesting complexity of reasons why users engage with images on the Web, and how they go about these activities. The results of this study derive a number of interesting findings. First amongst these was the fact that image-specific search tools (e.g. Google Images) were not the main way that images were accessed and used (less than 10% of the time). While it is difficult to make too much of this on the basis of a small sample, it is interesting

to speculate on why this might be. The fact that image search tools are designed to direct users to unfamiliar sites via keyword queries may go some way to explaining why they were used so infrequently during our study. Most of the image-based activities we logged tended to involve routine and familiar activities (61% overall). When seeking out particular images, users may be more adept at finding them quickly through familiar sites. In addition, given that images were often used in the course of other activities, rather than as end goals in themselves, suggests that a model of "search" is simply not a good fit in most cases where images are used on the Web. This leads on to a second main finding, which is that domain-specific Websites seemed to be the most important way that the images were engaged with (42% overall). Here it was clear that what was important was the whole array of features that these Websites deliver, often specialized for the kinds of activities users want to carry out where images happen to play a role. The use of retail sites, property sites, social networking and map sites are all examples of where images most effectively accessed in the context of other kinds of activities.

This, in turn, is why understanding specific needs, tasks, or motivations is so important if we want to understand image use, leading us to discover a whole diversity of reasons why people used Web-based images. Some of these did involve finding answers to specific questions via unfamiliar sites, but most did not. Rather than question-answering, we found it more useful to think about how images were used to build on ongoing learning or interests, how they could spark discovery or inspire, how they could connect people to remote experiences, or could be used for quick navigation or communication. While prior work has aimed to create better tools for searching [13] and browsing [5, 19, 29], these types of interactions reported in this study, we would argue, point to more diverse kinds of tools, and highlight other kinds of important criteria for assessing these tools beyond keyword relevance or ranking accuracy. We now briefly sketch out some other directions we might explore on the basis of our framework.

### Designing for Learning and Research

There were various ways in which we found that images were used to support learning and research. The main way was via familiar sites that were routinely visited, and often the goal was to see whether there was anything new to look at. Important here were not just new images, but the surrounding content, helping participants to keep abreast of any news, to be entertained, and to add to their already considerable knowledge around a topic. Such behavior suggests not necessarily the need for better keyword search, but the support of quick navigation to familiar sites, perhaps triggered by new content appearing on those sites. The analogy is almost like channel-surfing on TV, where interesting content can grab attention. It suggests that Web-based tools might be better at alerting users to changes in content (whether image-based or not) on sites that are frequently visited.

The desire to amass new knowledge on particular topics (such as new artists, or new work by a particular model) also suggests that more flexible tools for clipping and saving the results of Web browsing would be valuable. Tools that act as digital scrapbooks or repositories for information around a theme or topic could be effective ways of not just visiting sites, but collecting information from multiple sites, an issue which has been commented on before when looking at the predominance of the use of the Web for ongoing research activities [23]. A good example here would be the use of such “scrapbook” tools for putting together sources of ideas and inspiration, much like designers do when they keep notebooks.

Finally, learning and research sometimes did involve keyword search and the emergence of discovery through scanning large collection of images. Here, playing with different keywords, and analyzing images visually supported learning. Even though not a frequent activity, this suggests that tools that flexibly sort along different visual and semantic dimensions might be both fun and valuable to inspire and create new insights.

#### **Designing for Image Access as Secondary Goals**

When designing to support image access as a secondary goal, efficiency, accuracy and consistency are critical dimensions to consider. For example, one interesting finding was the way in which images could serve as an additional way of finding answers during keyword search. This suggests that, rather than having to always choose between a text search (with a ranked lists of text) or an image search (with a matrix of images), a mix of text and images in the returns might offer even more efficient ways of finding information or navigating to certain sites.

Additionally, it is important to consider whether the image is part of the end goal. For instance, in the case of Gracia’s recipe search, the photo of the dish was a simply a step along the way to obtaining the real goal –the recipe. In other cases, images might be used more systematically as navigational indexes, such as the case of William locating a product by visually browsing thumbnails of DVD album covers on Play.com.

Both cases suggest that rather than treating images as end goals, such as is implied in search tools, they might also be treated as steps toward better, more flexible forms of navigation. Not only could images be more integrated with text in the presentation of search results, but clicking on images might offer up new navigational pathways that help users to explore sites or products that they are connected to

#### **Designing for Recreating or Connecting to Remote Experiences**

In this third category of image use, participants often remarked on how they valued the detail in photos they observed during tasks to recreate or connect to remote experiences. Thus, higher fidelity photos can be used to help users in the task of analyzing visual detail and contextual relevance; aiding recall, recognition and stimulating emotions.

Users also analyzed images in these scenarios from spatial and historical perspectives, thus we can speculate that the ability to position images in those dimensions can improve this experience. For example, geotagging images, allowing for panoramic views, rendering images in virtual 3D and being able to place images within a wider geographic context may be important. Likewise, re-connecting to the past might benefit from linking images to a timeline, for example, personal history. In both cases the ability to juxtapose multiple high fidelity views or perspectives is desirable, as participants often viewed all photos within a given set to get a better sense of the observed space.

Images as understanding people or personalities both require related contextual information, such as timelines or links to more information. Activities involving image access to re-live past experiences would benefit from a feature that allows users to keep track of meaningful images for future reference (e.g. in Elle’s hotel scenario). Unlike traditional bookmarks, which facilitate information retrieval, here bookmarks are more akin to a digital keepsake box that allows the images to be re-experienced.

#### **Designing for Communication**

Images used in social interaction often occur over social platforms such as blogs, online forums, instant messaging, and social networking Websites. While some features exist (e.g. commenting, tagging) these could be extended, such as allowing users to be more creative with images in the course of interaction. For example, editing tools to modify images, create cartoons and storyboards, or simply to personalize an image for someone else are suggested. Further, general image search tools might more seamlessly connect with communication tools and social networking sites, recognizing that these are common follow-on activities.

#### **CONCLUSION & FUTURE WORK**

Research going forward will include looking at the relative frequency of these new forms of image use, the context in which they are preformed, and the implications for search. However, this study has extended our understanding of the contextual and behavioral details of users’ interactions with Web-based images as they occur in the course of everyday life for a small but diverse sample of users. In doing so, we have shown how both the “how” and the “why” of these activities rarely conform to the model of user interaction which appears to inform most image search tools. Users do sometimes want to issue queries in terms of keywords and receive answers in terms of images, but of interest is both why this would be so, and the myriad of other ways in which images play into people’s experience of the Web. We have found that images are often intertwined with the ongoing process of learning about the world, that they provide a compelling source of entertainment and inspiration, that they help create connections to other people and remote places, that they help us reminisce about our personal past, and that they provide a way of navigating both the Web and the physical world.

Our hope is that a small but in-depth study of this sort can serve to complement and deepen our understanding of larger scale, quantitative clickstream and query data analyses in bringing to bear an alternative set of findings more firmly from the user's perspective. Integrating these approaches, we believe, would be a valuable next step. Meanwhile, by beginning to look at the rich array of human values expressed within these findings, we hope to have shown that we can open up new opportunities for design to encourage reflection, connection, socialization and play with images.

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