Int J Digit Libr (2004) 4: 124–136 / Digital Object Identifier (DOI) 10.1007/s00799-003-0075-3

Commercial digital image libraries, digital images and digital discontent

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Received: December 2002/Revised: May 2003 / Published online: 23 July 2004 –

Abstract. Publications such as consumer magazines rely heavily on image libraries as sources for the images they use in their issues. Traditionally, magazine editorial staff have discussed their image requirements over the telephone with library staff and the library has conducted the search. Many libraries have now developed Web sites and their customers search them for images themselves. A minority have e-commerce capabilities, and enable customers to purchase and download digital images from their sites. This survey found that magazine staff do not often choose to search digital libraries, preferring instead to continue to contact the library by telephone. Most also choose not to buy the use of digital images, but prefer to continue to work with conventional transparencies and slides. The reasons for these preferences, and the reasons they are unlikely to change in the short term, are explored.

Keywords: Web – Digital image library – Image search – Keyword search – Human interaction

1 Introduction

This report results from a survey of commercial users of digital and conventional image libraries. The study was carried out to investigate whether Web-based digital image libraries are changing the ways in which commercial image purchasers search for and buy the images they use [16]. The users studied were the editorial staff of consumer magazines, chosen because they are heavy image library users. According to BAPLA, the British Association of Picture Libraries and Agencies, magazines represent the second largest buyers of images, purchasing the use of almost a quarter of all library images sold [3].

The sale of images (primarily photography but also art work) is a large and growing industry. BAPLA's most recent statistics gave estimates of more than 350 million images held in over 600 image libraries in Britain [3]. Libraries range from the small and specialist to the large, with collections covering many different domains. In 1999, libraries earned more than £110 million selling the use of their images. However, while most image libraries had either their own Web site, or access to one, it was also estimated that only 4% of the images libraries sold were through digital transactions. Most of the libraries' Web sites were not set up to support commercial transactions. CEPIC (the European Union's equivalent of BAPLA, whose membership includes British image libraries) also carried out a survey of its members in 2001 [4], based on the BAPLA survey. They too found that while a majority of image libraries have their own Web sites, only a minority use these for commercial transactions. Most images are still sold using the tools of the 'old economy' – telephone, fax and postal services. According to these surveys, though, many libraries intend to develop, or are in the process of developing, Web shop fronts to support the entire purchasing transaction.

Those who have installed the infrastructure for Web shop fronts for their collections aim them variously at the commercial and consumer sectors, and sometimes at both. However, certainly in the case of libraries' commercial customers, there is an absence of published research which could inform those creating these infrastructures about whether and how these customers might want to interact with digital libraries. The trend to developing Web-based business channels often seems to be underpinned by an assumption that the Web offers a way of conducting commercial transactions that can substitute for established practices [17]. The tacit assumption seems to be that transactions between businesses can entirely or in part be mediated by tailored Web applications, and can successfully replace business interactions done more traditionally between people communicating either di-

rectly (face-to-face) and/or mediated by older technologies such as the telephone. An accompanying assumption seems to be that the potential benefits of Web transactions, which include speed, reduced costs, efficiency and increased competitiveness and customer choice [2] are sufficiently compelling to make a change of practice desirable for buyer and seller alike.

However, when sellers create new business channels, they need to consider the business transaction from the perspectives of both seller and buyer. The ways in which business transactions are carried out are often not the results of chance evolutions of practice; they have generally evolved to support needs and requirements, some of which, although fundamental, may not be obvious. For example, in apparently routine commercial transactions, there may be unpredictable elements which require ad hoc person-to-person problem solving. However, a focus on the technical challenges of building interactive Web applications, with all their complexity, often seems to obfuscate awareness that they sometimes need to support more than the routine procedural aspects of a commercial transaction. If they are not capable of supporting non-routine elements, they may not thrive as new channels of business [17].

In theory, as a business channel of the 'new economy', digital image libraries could achieve all the benefits of it mentioned above. However, image libraries can only realise these benefits if their customers choose to interact with them through the agency of the Web, in preference to working as they have traditionally done, using old-economy tools. This means that the Web channel must support the needs of customers at least as well as, if not better than, the older tools.

To investigate whether the image library Web shop fronts serve the needs of commercial customers as well as of the image libraries themselves, we need to ask questions about the customers and their ways of working. These include: how do commercial users find and select images for purchase when the Web is not involved? What factors influence the ways they work? Does the process of finding and purchasing images from collections made available on the Web enhance the process of selection and purchase? If not, then why not? And what are the buyers' reactions to this new form of interaction?

This paper addresses these questions. Consumer magazines' requirements of images, and the significance of images to magazines, are explored. The importance and complexity of their requirements of pictures combine to make the process of locating appropriate pictures a time-consuming and challenging task for the specialist picture researchers whose job it is. How images are found through conventional and digital image libraries, and the advantages and problems of each, are described. This survey found that the current generation of digital image libraries has not generally made the work of finding images easier, nor have digital images eliminated the need to see the 'real' pictures. Digital image libraries have, rather, changed the problems picture researchers face; consequently, they have not supplanted traditional forms of contact with image libraries. The ways in which digital image libraries might need to develop in response are explored.

2 Method

Magazines were included in the study through the following two processes.

From commercial magazine stands, magazines which use many image library images (for the purposes of this study, defined as 10 or more) were identified and purchased. Image library images can be readily identified, as magazines are required by the libraries to publish the sources of their images.

Seventeen magazines were purchased. Most were specialist, and the sample covered a wide range of subjects: health and fitness, the home (decorating and furnishing), cookery and gardening, leisure interests and hobbies including country walking and classical, jazz and world music, science (aimed at the general public), current affairs, parenting and natural history. Some categories of magazine proved not to be eligible to take part (examples included magazines about cars and motorcycles, and the popular music industry) as their images are obtained mostly from industry sources, such as manufacturers, record labels and artists' agents.

In addition, two non-commercial magazines were included in the sample. These free magazines were available to the author as the result of personal or family organisational memberships. One magazine was produced for the alumni of a UK university; the other was published for family doctors.

These two magazines were included after an exploratory telephone discussion with a third magazine. In this discussion it became clear that images are as critical to these 'subscription magazines' as they are to commercial magazines, albeit for a slightly different set of reasons (see Sect. 3.1).

In all, 19 magazines were identified. The name of the magazine's picture researcher, picture editor or art editor was obtained from the editorial pages. Roles vary from magazine to magazine, but the picture editor is generally responsible for the final choice of images, subject to the magazine editor's approval, and the art editor for the layout and arrangement of images on the page. The picture researcher locates candidate images, and carries out the administration associated with handling the pictures received and paying for those used. Some magazines do not have all three roles, and so where there was no picture researcher, the letter was addressed to the picture editor if there was one, or the art editor if there was not.

A letter explaining the purpose and scope of the research project was sent by post to the editorial staff member. As many people outside the computing industry have

not heard of HP, they were also sent two leaflets which introduced HP and described the purpose of the Bristol research laboratories. The letter also stated that the author would follow up the letter by a telephone call to discuss with the staff member his or her potential participation in the study, unless the staff member had already declined to participate.

The first three persons from commercial magazines with whom telephone contact was made and who agreed to take part served as pilot interviewees.

The sample size of the final study was 14 participants, representing the same number of magazines (12 commercial and two subscription). One person declined to take part when telephoned (the cookery magazine); and one person (a magazine on home interior decoration) had later to drop out through ill health. All participants received a copy of the final report to thank them for their participation.

Interviews were conducted face-to-face in the participants' offices, except in two cases, where it proved impossible to schedule mutually convenient times. These two interviews were conducted over the telephone. Interviews, lasting between one and two hours, were semi-structured. All were audio-taped, with the consent of the participant. Using the purchased issue of their magazine as an anchor in all interviews, participants were questioned upon their requirements of images, how these influence the places and the ways in which they search, where they search, the ways in which they procure images not sourced from libraries and the problems and benefits associated with all methods of sourcing. They were also asked about their use of Web-based digital image libraries, how these compare with the traditional ways in which they deal with image libraries, their uses of digital and conventional images and the problems and benefits of both digital and analogue images, including the means by which the images are sent to them.

To understand something of the perspective of the image libraries themselves, one face-to-face exploratory interview was also conducted with the head librarian of an image library, prior to any of the interviews with magazines. This library was in the process of developing its own digital image library, and HP Laboratories was providing technical consultancy.

3 Results

Literature searches did not reveal any similar published research, and this study therefore appears to be unique. As a result, a 'loose and inductive' analysis of the data collected [10] is more appropriate than the 'tight and deductive' analysis suitable for domains which are more studied and so better delineated. The goal of such analysis is to explore and describe, rather than to explain or confirm. Techniques used to analyse the data included noting patterns and themes, seeing plausibility, clustering, counting and making contrasts and comparisons [10].

For ease of reference, both the commercial and the subscription magazines are referred to as 'consumer magazines' in the following discussion. They are only referred to separately when they differ.

Analysis of the 14 interviews found a high degree of consensus among magazine researchers in the perceived benefits and problems of working with both traditional and digital image libraries. In the following sections, these benefits and problems are explored. Although the way of working with traditional image libraries has disadvantages, working with digital image libraries creates a new and different set of problems for magazine researchers and other members of the editorial team.

The interview analyses revealed three main obstacles to widespread acceptance of digital libraries.

The first obstacle is that digital libraries require magazine researchers to work in ways that are different and unsympathetic to their needs and the constraints upon them. This largely revolves around a set of difficulties associated with using keyword searches to find appropriate images. More fundamentally however, digital image libraries require magazine researchers to do their own searching, a time-intensive task they have not previously had to do. Digital libraries have not saved most researchers time in other ways, and so rather than increasing the efficiency with which they work, they in fact reduce it.

The second is that there are, from the magazines' perspectives, many significant problems associated with working with digital images. This tends to perpetuate the preference for the traditional sorts of interaction. In particular, viewing digital images on screens is an unreliable guide to their final printed appearance, and this causes problems late in the editorial process, and significant expense, in altering and improving them.

The third is that some requirements of the commercial Web-based transaction are fundamentally incompatible with the ways in which editorial staff work to produce magazines. In particular, many of them require that customers pay for images whose use they purchase at the time of downloading them. This contrasts with magazines' traditional method of payment in retrospect. Since the fee depends on the specific use to which many images are put, and since issues can undergo significant layout changes at the very last moment before printing, it is not feasible to specify in advance the way in which a picture will definitely be used.

In the sections which follow, these problems are explored in detail. When magazine staff discussed circumstances in which digital libraries do provide a valued alternative to conventional libraries, these alternative experiences are also discussed.

Understanding the number and complexity of requirements that magazines have of the images they use is key to understanding why digital image libraries do not cur-

rently serve editorial magazine staff well. The discussion opens in Sects. 3.1 and 3.2 with these requirements. Sections 3.3 and 3.4 explore the benefits and problems of working with traditional image libraries; Sects. 3.5 to 3.7 explore those of digital image libraries. Sections 3.8 to 3.10 focus on the use of digital images and Sect. 3.11 looks at new and traditional methods of payment.

3.1 The use of images in magazines

Images are used intensively in consumer magazines. A single issue of an average-size monthly magazine may contain several hundred images ranging from the full-colour 'double-page spread' for a feature article to small 'filler' pictures for news items. The anchor magazine used in the interview with one of the gardening magazines had used 300 images altogether, 167 of which came from image libraries. Numbers of this size are not unusual for consumer magazines. The anchor magazines in this study each used between about 200 and 400 images.

The requirement for an image generally starts with a 'brief' from a magazine's editor to the picture research team or staff member. The brief is a verbal description of an image or set of images required to illustrate an article. The brief may be very precise ('pictures of a specific village square on a misty day at dawn in the winter') or very general, such as 'pictures of whales'. One picture researcher said of very general briefs, "these briefs horrify me: 2000 images come in!".

The most basic requirements of images are to meet the brief and to be of outstanding or very high technical quality. However, images must meet other criteria as well, and serve several functions. The most basic is to provide structure and interest to a page. Images help to break up a page, and attract the viewer's attention to the article. Images also inform and 'bring to life', supporting and enriching the textual content of an article. In that respect they are more useful than other devices which can break up the space, such as boxes, inserts and blank space.

Images also promote emotional responses to the content such as excitement, aesthetic appreciation or shock. Considerable time and care are spent in editorial sessions upon the selection of images that will help to elicit the type and degree of emotional response sought. Images also have aesthetic and motivating functions. The beauty of an image may inspire the reader: beyond attracting her to look at the pictures and read the article, the editors may hope to encourage a particular behaviour, whether that be to help young parents adopt safer techniques when bathing their newborn baby, or to inspire people to take up cycle touring.

Commercial magazines must survive in a very competitive marketplace. They have to achieve differentiation from their competitors. To do this, they develop an approach to their subject, or ethos, which guides the types of article their issues contain. Along with their ethos, they have a house style or 'look' and, of course, images are fundamental to the look, and a vital part of a magazine's communication with its readers. The look reinforces the ethos and says to potential and existing readers: 'this is our style and these are our values: we are aimed at people like you'. The need to compete with others in grabbing a purchaser's attention contributes to front covers that are as eye-catching as possible; the criteria for magazines' covers are therefore even more exacting.

Subscription magazines do not have to compete on the newsstands, but they cannot assume that the magazines will be read, as their readers have not actively purchased them. Images, on the front cover and inside, play a vital role in stimulating the browser's attention to read them.

"If there are a number which are equally relevant, I'd choose the most striking [image]. We have to consider that sadly, many of our readers will just flick through this, and ideally we want to break up the text. This is reducing the pictures to their most basic function really. All other factors being equal, you have to make sure that there are 'hooks' throughout the article to hook the reader."

3.2 Constraints upon image selection

If images had only to satisfy these requirements, the editorial team's job would be relatively easy. However, there are many factors which constrain their choices and make selection more complex.

Pictures must be consistent with the magazine's ethos. The magazine aiming to teach young parents the correct way of bathing a baby would only consider pictures where the child was being correctly held and supported. It would not print pictures of a pregnant woman drinking alcohol. A picture must be what it claims to be. A natural history magazine would not use a picture of an extremely rare animal taken in a zoo, if the article was about the animal in the wild, even if the picture was aesthetically pleasing and alternatives were hard to find. Sometimes it can be excessively time consuming to locate a picture. For example, the researcher of a music magazine doing an article on Javanese gamelan players was not able to find an illustration of a Javanese gamelan, although pictures of the gamelan and its players from other south-east Asian countries were relatively easily available. Although the effort required to find this single picture created many difficulties for the picture researcher, the search continued until a Javanese gamelan player was finally located.

The need for scrupulous honesty is not just a matter of principle; it is also determined by the magazine's readers and contributors.

"We were criticised recently by an author whose article on contraception we were illustrating. I asked [the library] for something to illustrate a woman being injected with a contraceptive. The author criticised that and said the picture was completely inappropriate. That is what

the picture shows, but who am I to know that that's not the right way to do it? It's very difficult."

"You need to have something that doesn't, crudely, insult your readers' intelligence. There have been problems in the past. You have to be careful when you're ordering things. Someone will be sure to let you know! So you have to communicate that precisely, and also be alert when the images come back in case something is incorrect. It can be quite difficult."

Anticipated reader reaction is also a strong force in constraining the possibilities the magazine may consider. For example, prior experience of reader aversion to graphic images of war will limit subsequent choices of photographs illustrating conflicts, as will the expectation that parents will react badly to particularly distressing illustrations of childhood diseases.

"There are pictures we won't publish – for example, gory or disturbing pictures. People do complain. There's a debate on how far you can go. Is it titillation or is it information?"

"We also don't like to scare people too much either. There's a medical page, a doctor's page, but it doesn't show really horrible pictures. The pictures we use are quite mild. We did a feature on skin recently, and we used small pictures of all the different skin conditions. It might be too distressing to show eczema."

On a practical level, an image also has to fit well in the article as a whole. It has to balance in colour and style with other images on the page and to contain material which complements them. For example, a music magazine doing an article about a particular composition will try 'to balance the page so that it contains a portrait and a picture which says something about the music.' A gardening magazine doing an article about a particular plant will strive for a set of images which show the plant at different ages and in different seasons, but will need to obtain pictures whose colours and lighting conditions complement each other.

The same requirement of good fit is true if the article spans several pages. A beautiful and appropriate image may be rejected if it does not look good with a group of others.

The process of determining which pictures will be used in an issue is, therefore, highly complex. The criteria are many and varied, and both subjective and objective. There are also additional constraints which result from experience in the field, such as: "this is poorer quality than we'd normally use, but it's the only available picture of this endangered animal", or "our main competitor used this picture last year."

3.3 The traditional image library

Magazines locate images from a number of sources. The libraries are a main source because of the vast repository of images available through them. While images used from libraries may also be published anywhere else (from books to advertising brochures), although with some constraints if they are royalty-controlled, they are an economic way of meeting the need. Commissioned photography guarantees unique pictures but is too costly to be used other than for cover pages and feature articles. In some of the smaller magazines, for example, the expenses associated with a single shoot can consume a quarter of that issue's budget for illustrations.

When the magazine picture researcher has been given a set of briefs, he will contact the library picture researcher. The magazine researcher will usually discuss multiple briefs with the library researcher in one call. The same searches are usually requested at several libraries to maximise the chance of finding the right images. The following quote describes the process well:

" . . . so when I call [library], I ask not only for the fine art image which I'm pretty sure they'll have, I'll ask for lots of different things which will all come under the same search fee. When I call the next library, I don't have the time to wait and see if the first library has got the pictures I want. So I know they'll have a particular image I definitely want, but since I'm on the phone to them I'll also ask them if they've got the images I've asked the first image library for: they're going to charge me £25 anyway, so I may as well. If [the first library] don't have something, I'd only find it out in two days' time when the images arrive by post. Then I'd have to call up another image library again – and generate another search fee – to ask for the images it didn't have."

The telephone is the preferred mode of contact, because a discussion about the requirements is immediately possible. Some briefs are straightforward but, more usually, for the reasons given in the previous section, qualification and clarification of the brief is needed.

When requirements are not straightforward (e.g. a picture which 'conveys some of the legal complexities surrounding divorce'), a discussion of the possibilities will occur. The observations below encapsulate the views of the majority and illustrate the benefits of working with a library researcher:

"Phoning them is quicker and you can make yourself understood. You can have a continuing conversation. They will add suggestions too which could help: 'We've got a photographer who's done this.' You give them the bones of the story and they'll make suggestions."

"The human contact is incredibly important, because they're going to know their collection."

The discussion draws on the expertise of both participants. The library researcher knows the library's collection of pictures; the magazine researcher understands the magazine's look, ethos and the various constraints. The magazine researcher describes the brief and talks around it, while the library researcher explores her possible solutions. "Have you thought about this type of picture?" or "We have pictures on X – would they be any good?" In other words, they work together in a collaborative problem-solving exercise, pooling their different know-

ledge and experience. As the quotes above show, magazine researchers emphasised the high value they place upon this team work. They particularly appreciate it when they start off without any well-formed ideas for suitable images for a given brief. It was also clear that magazine researchers like working with libraries where they can develop long-term relationships with their researchers. Not only is there pleasure in working socially; relationships assist the process of finding good images.

"You build a relationship with a picture library over the years. Some only employ one or two people. They are nice and easy to talk with and they'll help me, even if I call and say "I don't know exactly what I need – can you help me?"."

It was clear from the observations made by magazine picture researchers that the ease of finding images from libraries that match the brief is not necessarily related to or predictable from the specificity of the brief:

"You never know: the easiest picture you think you could get could take me two or three days, and there's something you think might be quite hard, but I could ring up one library and yes they've got it, and I could have it in the office the next day."

3.4 Problems with the traditional process

One of the most frequently mentioned problems with the traditional process described above is that the researchers have to suffice with verbal descriptions of the ideas and images they are discussing. Given the high degree of subjectivity in the process, not only is this inefficient, but often yields results that are disappointing to the magazine team. A picture may fit the objective aspects of a brief but may fall short in other ways. There may be subsidiary aspects of the picture that do not fit the requirements of the magazine's look or ethos.

Image libraries send magazines selections of images for each brief, as negatives, via the mail or courier. They often prefer to err on the side of caution, and so also send images which may only be of marginal relevance to the brief. The magazine researcher is responsible for the physical processing of images: receiving them from the libraries, storing and tracking them to make sure none get lost and sending them back. Since each issue might involve searches at up to 20 libraries and receiving thousands of images, the administration is not a trivial task and can occupy several days of the researcher's time. Then there are the costs involved: the library's search fees and the transport costs. Disappointing selections are not just a setback in locating an appropriate image; they are also costly in time, money and effort.

The quotes below illustrate this range of problems.

"Many times we have to get back to them because none of the photos are what we're looking for. They're not to our standard or not quite what we're looking for. We always ask if they've got any more. Mostly it's that they're not up to our standard. We get such a selection anyway. We don't just go to one [library], we go to the lot."

"A lot of the pictures we get are just not right. Even when I say 'I want movement and I want it to be modern.' the image libraries will still send pictures that don't meet those criteria. I find it really irritating when I have to trawl through pictures that are wrong. That happens quite a lot really."

Many libraries produce large glossy catalogues as guides to the sorts of pictures contained in their collections. These are not very popular with magazine researchers for two reasons. First, they contain only subsets of the library's pictures and, second, it is often difficult to find in which section pictures of interest have been 'filed'.

"A lot of them have irrelevant stuff and they aren't always catalogued well – the things we want cross over with lifestyle things. Sometimes you find something you like but it isn't where you expect it to be. It's quite difficult."

"They don't put all their things in the catalogues so we ring them and ask them to do a search and they send a batch."

It is clear that the traditional process of locating images through the libraries has benefits, but also that there are clear difficulties, inefficiencies and disadvantages associated with it. Do digital image libraries overcome these problems?

3.5 Digital image libraries

Most image libraries have developed their own Web-based image libraries in the last few years. These consist of digitised copies of some of the prints or slides in their collection. Search is usually by keyword. Keywords are intended to capture the objective and subjective aspects of each picture, and there are an arbitrary number of them associated with each. Viewers can browse images and sometimes can download digital copies from the site, though most sites are not yet equipped for e-commerce [3, 4]. If the magazine researcher wants to order conventional copies, this has to be done another way, such as by telephone, fax or email.

The key feature of digital image libraries is that collaborative problem solving between the picture researchers is no longer possible, as the library researcher has been removed from the process. This is a benefit from the library's perspective, as in theory it frees the researcher for other work, such as cataloguing the ever-increasing collection. However, the magazine researcher is now expected to do the search on the Web site for herself.

3.6 Problems with digital image libraries

The magazine researchers showed antipathy towards searching in digital libraries. Their principal reasons included the considerable time pressures under which editorial staff already work.

Table 1. Number of hours that could be spent searching for 167 images as a function of the number of libraries searched and the amount of time taken to complete each search

Number of libraries searched per image	Amount of time taken to conduct 167 searches (hours)		
	5	10	15
One library	13.91	27.83	41.75
Two libraries	27.83	55.66	83.50
Three libraries	41.75	83.50	125.25

"They [libraries] don't understand about the economy of time. We work under enormous time pressures."

"Beautiful Web sites, but you just don't have the luxury of time to look at them. You want a picture and you want it *now*. Speed is of the essence."

While magazine researchers enjoyed problem solving with library researchers, reporting it to be one of the most enjoyable and creative parts of their work, search on Web sites is largely stressful and unfulfilling. They are so for several reasons. First, doing the searching themselves requires that magazine researchers find new time in which to do a job formerly done by the library researchers.

Using the example cited earlier of the gardening magazine that had used 167 image library images in the anchor issue, a few quick calculations, shown in Table 1 above, demonstrate why it is unrealistic for magazine researchers to conduct all their own searches when they need significant numbers of images. If, optimistically, we assume that it takes five minutes per image to find a set of candidate images searching at only one library per image, searching for these 167 images would take nearly 14 h. However, magazine researchers said that to be sure of finding the best pictures, they usually needed to contact several libraries for each image. In this example, more than 41 h could be consumed if each search was twice repeated and took five minutes.

Of course, this is a simplification, but it does illustrate why doing their own searches might present magazine researchers with problems. Even in an optimistic scenario, repeating each search twice would leave the picture researcher no time in a week for other work.

The inefficiency and frequent lack of results from the process of searching are the other main reasons Web searches are disliked. Image libraries have independent schemes of classification, which are sometimes domain dependent, and each of which has to be learned. Keyword searches are too hit and miss:

" . . . if I ask to see Series 3 it will show me 180 000 images and it's too much to scroll through. If I make it more specific then I get nothing at all. It's a difficult balance – you can get too many or miss the one you want by missing out one piece of information."

"Sometimes you come across a picture and you think "why haven't I seen that before? It should have been available under different keywords too." ."

On top of this, there are the 'dead times' picture researchers must spend as a result of system and network delays:

"Occasionally I use the Web, but I don't have the time to search – loading up, trawling through and searching takes too much time. It's easier for me to ring up and get someone else to do it for me."

There is also no way of knowing, without calling the library, whether search failures result from true negatives (no available picture), or false ones (the right keywords have not been used).

The researcher needs to contact the library anyway, for a different reason. As few libraries can afford to digitise their entire collection, they must make judgments about which images are most likely to yield a return on their investment. So those they deem most likely to sell are those they digitise. From the library's point of view, the more times they sell a picture, the more profitable it is for them. The requirements of magazines, by contrast, are more likely to be for the unusual or highly specific, and the less a picture is published by others, the more it will seem like 'their' picture. Libraries also do not digitise all the newly acquired photos they add to their collections. Since the digital image library does not contain all the library's pictures, the magazine researcher still has to telephone the library to check whether it has other pictures on the same subject. Why then bother with an unnecessary intermediate and time-costly step if the 'phone call has to be made anyway?

"I looked for this picture on their site and it's not there. You can't really rely on it. You have to be sure that everything they've got is there because you're missing out otherwise."

"You phone up and you say "this is the story on the Three Gorges Dam – what do you have?" This is one of those rolling construction projects and you think you've seen all the pictures and then suddenly three or four photographers from really good documentary agencies will have covered it in the last three to four months, and finally their work is in the collection, and suddenly you see a whole load of new stuff. You wouldn't have got that from the paper catalogue and you wouldn't have got that online."

Interestingly, the reasons given for disliking Web and catalogue searches were similar. Both are subsets of collections and are therefore not reliable guides to the collection as a whole. In Web searches, the problem of finding images changes from 'where in the catalogue?' to 'what keywords?' but evokes similar problems.

For all these reasons, magazine researchers generally prefer to have traditional searches conducted for them. At the moment, they seem to have inherited the worst of both worlds. Overall, the Web consumes extra time in the searching process rather than saves it. Additionally, time savings have not been made on administration, as a result of magazines' preferences to work with transparencies and slides (as discussed in the sections below) rather than digitised images.

3.7 Positive experience with digital image libraries

Of the 14 magazine staff interviewed, there were two who regularly used both digital and traditional processes to advantage. One conducts an online search and downloads images; the other conducts an initial search at a given digital library to identify a subset of candidate pictures, and then 'phones the library researcher to discuss it and order a small number of transparencies.

The first researcher works in a magazine which uses many fewer pictures per issue than most: typically, just one or two per article. It is thus easier for her to put together a set of pictures of good fit. Unusually, her magazine used many photos that were digital in origin, to illustrate the current affairs section, which also saved her considerable administration. She made the following two observations about how well the services of a specific agency worked for her:

"To this day there's not an agency which matches the quality of delivery [library] provide. They are the best. You choose the picture on the screen and they guarantee every single picture in their archives is on-line."

"[Searching on the Web] is a bit slow. But I prefer it because I can identify exactly what I want, and I don't have to get all the transparencies in. It's so easy that way really. I download a low-resolution copy to our server and then the designers can design the pages, and tell me which they want."

It is also worth mentioning here an additional significant factor that allowed this method to be so successful. The photos the magazine researcher purchased were royalty-free pictures: that is, they are purchased for a set fee for use without constraint, and for an unlimited number of uses. Royalty-controlled pictures, by contrast, are purchased per use, and there are complex fee structures based upon the size and location of the reproduction. Images are often royalty-controlled when they are of outstanding photographic merit or are exceptional pictures for other reasons; perhaps because they have captured an extremely rare moment or subject. This distinction will be returned to later, as it is adds practical reasons to the aesthetic ones that many magazines have for not purchasing digital images even when it is possible to do so.

The second, a picture editor, conducts initial Website searches, identifies a selection of promising pictures for each brief and then telephones the library researcher. They then pursue the search together over the phone, so that both could view and discuss search results on their Web browsers. This approach – overcoming the main disadvantages of search in both traditional and digital libraries – yielded the highest degree of reported satisfaction with the use of digital libraries.

Why did the other researchers not also adopt a technique like this? The answer would appear to be due largely to the pressure of time. For many reasons, not least of all a budget and a picture research team both larger than average, work in this particular magazine was felt to be busy rather than constantly pressured.

While, therefore, a small number of magazines in this survey felt digital libraries are an asset to the way they worked, the majority found that the current generation of digital libraries add to their burden of work. Thus they still prefer to use their traditional means of contact with the libraries.

The next three sections explore the magazines' experiences with using digital images.

3.8 Experience with digital images

Although all of the magazines in this study had the capability of receiving images digitally, most of the magazine staff in this study did not use digital technologies (from CDs through to online purchases) in the procurement of images as a matter of course. The majority in this sample had not completed entire transactions from digital image libraries – that is, they had not searched, selected, ordered, received and paid via Web-based image libraries.

As the BAPLA [3] and CEPIC [4] surveys found, only a minority of libraries have yet designed their Web libraries to support e-commerce: purchasing and downloading images direct from libraries' Web sites. The CEPIC survey found that most use their Web sites for the purpose of publicity, and they also reported that most pictures are still purchased using the tools of the 'old economy' – postal services and couriers – which take between one and three days to deliver the pictures.

One magazine picture researcher said "we've never received anything digitally: we've never been offered anything digitally." While the current lack of e-commerce capabilities on digital image libraries is doubtless a contributor to low adoption rates of 'new-economy' tools amongst this sector of image library customers, this study found that there are a number of independent factors which currently limit the acceptability of digitised images. These are explored in the next section.

3.9 The acceptability of digitised images

While most of the magazine researchers in this survey still prefer to involve library researchers in the search process, digital image library searches can perform a useful function in the early part of the search process and when the researcher is performing a search whose requirements are straightforward. An example was given by a researcher in a gardening magazine as a search for a specific species of plant in its flowering season. They do not, however, tend to complete the process by downloading and purchasing digitised images straight from the site.

"I would like to be able to do the initial selection digitally and perform an initial narrowing down and then make the final selection from a subset of transparencies sent from the library. A Web site could really help there.

It would be a lot more work initially but would cut down a lot of the administration."

"We've also used the internet but we've had quite a few problems with that ... the quality of the pictures on screen isn't great, so it's hard to see their quality and their colours. A lot of the pictures are low resolution and that doesn't help us. So we look on the Web, pick out a selection and get the image libraries to send the transparencies so we can get a good look at them. The Web's good for a quick search if you know exactly what you want. It'll come up with a selection and it saves you going through pages and pages in catalogues."

"I always go to [library] first if I need any natural history pictures because I know they're very good – they've got fantastic pictures – but somehow it doesn't come across on the screen. I still buy from them, but I wouldn't use their site."

These comments were typical of the magazine researchers interviewed. They gave their main reasons for wanting to see the original picture slides or transparencies rather than use digitised images as follows:

"What you see on the screen often is nothing like what it will look like when printed as far as colour is concerned. I would say that was one of our major concerns when choosing images over the Web – you can't see what you will get."

"Viewing the images on the screen, you can't always get an entirely reliable idea of what the final printed version is going to be like. Sometimes they look fine on the screen, but the quality isn't always there when you see the final printer version – they are fuzzier or the colours don't look as strong."

Thus, their current experience has shown them that what they see as a result of their Web searches is an unreliable guide to the qualities of the final printed image. Because colour-management technologies are not yet mature [8], the reproduction of colours can vary from device to device, between devices and paper and also between different sorts of paper. Printing the images in the magazine's office is no guide to their final colour or quality when published, and the quality and appearance of the printed image in the proofs that come back from the reproduction house are unpredictable. Inaccurate colour reproduction is a problem for magazines whose subjects require that picture colours need to be as true to life as possible (e.g. natural history or gardening). It can also mean that a set of images chosen for a double page, instead of complementing each other as expected, fail to work well together and need to be adjusted.

Accurate colour is not the only problem though. Most consumer magazines place great value on photographs of the highest technical quality, such as pin-sharp focus and excellent lighting conditions. Pictures that when printed appear dull, dark or lacking in sharpness will fail to meet their standards. As there is limited time remaining when the issue has reached the proofing stage, this adds to the 'general panic' of the immediate pre-publication period. As the reproduction house which prints the magazine's issues has no original to work to when printing digital images, it cannot improve the image before printing the proofs:

"Since the repro. house haven't had an original to proof by, they just print the image as it is. Then it tends to be different from the way it appeared on screen – generally images tend to be duller and darker than on screen – and the image requires correction."

The unsatisfactory reproduction of digital images creates extra work and extra cost. Some magazines adjust the images themselves, using image-manipulation software and losing some of the time they've gained in having the image sent digitally. Others send the images back to the repro. house and incur extra costs which eat into the budget they have available for purchasing images. The correction fees are very costly as the repro. houses also have to adjust images by hand.

"It's hurting a bit at the moment, because almost every single digital image we use generates a colour-correction fee of £40."

In addition, libraries often have their photographs scanned using a different colour system to the one used by magazines, and so the digital images received by magazines have to undergo additional conversions, which can result in further colour distortions.

"When a picture is sent I have to convert it to a CMYK image. ... Most of the digital images that come by email or off a Web site are in a different format to what's used in a magazine because it takes less memory. ... Most of them are in RGB which is a slightly less complex colour system than CMYK. Also they use different formats – jpeg. We use tiff."

Other magazine researchers complained that they are more limited in the uses to which they can put digital images compared to slides and transparencies.

"With analogue pictures it's up to me how big or small I want to use it. You're a bit restricted with digital pictures. When I get digital pictures, they always have to be converted from RGB to CMYK, but also to a resolution spec. of dpi to use in our magazine (250 in our case) and you're stuck when you convert it, with the size you've got. When it's been scanned and converted, you can only reduce or enlarge it by 25% when you're placing it on the page, otherwise the quality is awful. So digital pictures limit the way I can use them – for example, a double-page spread is right out. So it imposes limits on design."

In summary, then, the difference between the digitised image's appearance and quality and its actual qualities, the lack of colour fidelity and the costliness, in time and money, of having to adjust colours manually, the use of different colour systems and formats and the limited sizes at which digital images can be reproduced are all significant obstacles to wider acceptance of them by consumer magazines.

3.10 Positive experiences of digital images

By contrast, one of the researchers who regularly searches had described a positive experience of digital images, in a specific situation.

"Speed of delivery is the most important factor. ... You choose the picture on the screen. Once you've chosen the picture you just download it – you don't have to communicate with anyone or request anything. You just press a button and download it. They know that you did that. They charge you £15 for downloading whether or not you use it. This is the best service to this day."

The picture researcher cited above, who used a specific digital library to illustrate her magazine's current affairs section, valued the ability of completely digital transactions to meet the need in minimum time. As the photos to which she referred were illustrating news articles decided upon at the last minute before going to press, speed of delivery was, as the researcher said, the decisive factor. The photos too were newly taken digital photos, added immediately to the Web library.

Some picture researchers also spoke of the value of being able to use digital images to solve last-minute problems, rather than meeting a regular and known last-minute need, as in the former case:

"Digital pictures come in very handy at the end of a schedule when we're running out of time. Even though it limits what you can do with the image, you make compromises at that point."

Digital image libraries are filling a gap, and that is that they do solve last-minute crises, and can fulfil last-minute requirements. As the researcher above indicated, sourcing a picture at the last moment before the magazine goes to press can override the criteria by which the magazine normally operates.

3.11 Incompatibility between magazine and library requirements

Finally, the magazine staff discussed another problem that they have with digital libraries. This problem does not affect their day-to-day work, but creates obstacles to use at a more general level. It results from a requirement adopted by digital libraries that is incompatible with the way in which magazines work.

In 2001, only a minority of digital image libraries had equipped their Web sites with e-commerce capabilities. Experience with transactions that were entirely Web-mediated from search all the way through to purchase and payment was therefore not common. Where it had been possible, most magazine staff had found that it had often been designed without appreciation of the way they need to work.

The researcher quoted earlier, who illustrated news articles with digital photos downloaded for £15, was referring to purchasing the use of royalty-free photographs. For these, it is possible to pay in advance, as the cost for using the picture is the same irrespective of how the picture is used. Many magazines, however, want to use royalty-controlled images to the extent that their budgets will permit it. Reasons for this include the rights the magazine is purchasing (the library will not sell the use of the same image to a competitor in the same sector within a specified time) and, with an eye to being as distinctive as possible, because of the higher quality or greater rarity of a royalty-controlled photograph.

The fee for a royalty-controlled photograph cannot be determined in advance, as it depends on the size of the picture's reproduction, and its location in the magazine. The exact use cannot be specified in advance, as the issue's content undergoes modifications right up to the last moment. So, while royalty-free images can be paid for in advance, royalty-controlled ones cannot. If payment before use for the latter were required, then payment corrections would have to be made after the final use had been determined. It therefore does not make sense to require credit-card payments at the time of downloading the image; yet this is what a number of magazine researchers had found was expected.

"We pay [the libraries] after publication because things change at the last moment, so there'd be a lot of corrections if we had to pay before. You'd have to get a credit note if you ended up not using a picture."

"The image libraries invoice us at the end of the month and we pay after it's gone to print. Magazines always change at the last moment – whole pages move, photos need replacing at last minute, and so on."

"One Web site wanted us to pay by credit card. No way. We went to another image library."

As these quotes show, magazines have evolved ways of working with libraries that accommodate the uncertainty of what, exactly, the issue will look like until it is published. As long as the fee structures for royalty-controlled images remain complex, then payment systems need to accommodate the magazines' needs for last-minute flexibility. Although royalty-free images are straightforward to cost, it also does not make sense for a magazine to be running two payment systems – credit card and account – and most are reluctant to do that. This would add to their costs, and to the time spent on administration. The libraries' payment processes therefore have to accommodate the realities of their customers' working patterns.

4 Discussion

Image libraries also sell the use of their images to book and newspaper publishers and, to a lesser extent, to commercial users [3]. However, as there are no comparable studies of these customer sectors available, it is not known whether or not the experiences and requirements of the magazine sector are shared with others, or distinctive from them.

The analysis above suggests that the current generation of digital image libraries is incompatible with the needs of magazine researchers for two non-mutually exclusive reasons. One is that some key technologies are not yet mature (such as search techniques and inter-device colour fidelity). Another is that the providers of digital image libraries have not understood and provided for the needs of this significant sector of their customer base.

4.1 Immature technology: image searches

The current generation of Web search technologies, based principally upon keyword searches, does not answer the needs of time-pressured magazine researchers for speedy and accurate retrieval. Keyword searches are a crude way of capturing the essence of a picture, when searches are open-ended and unconstrained. Compare for example, medical image retrieval. Medical image searches are generally specific, and their purposes well-defined. Successful retrieval systems are being developed [15]. The challenges of unconstrained searches, well understood by digital image retrieval researchers, e.g. [1], are apparent by looking at the criteria against which editorial staff assess candidate images. When the needs of magazine researchers to find pictures that reflect criteria such as the magazine's look or ethos are borne in mind, such as 'a contemporary feel' or 'appealing to a conservative readership', it becomes apparent that more sophisticated intelligence than a set of subjective and objective descriptors is needed. This is one of several reasons that magazine researchers continue to prefer creative problem-solving discussions with library researchers. Although the field of image-retrieval research is an active one, with research in techniques based upon colour [12, 14], shape [5], context [9], images' implicit meanings [7] and combinations of these [6], there are as yet no search techniques which singly or in combination approach the flexibility and subtlety of human creativity and problem solving.

However, as the magazine researchers in this study indicated, the principal problem they face is time pressure. Most simply do not have the time to do their own searching, and this obstacle is in conflict with the provisions that the libraries have made for magazine researchers to conduct their own searches. Magazine researchers need to request the same searches at multiple libraries: to do these searches on the Web themselves would consume more time than is available to them. Few digital image libraries belong to portal sites [4]. Portal sites could potentially permit a single search to span many libraries, assuming common classification schemes, but they do not overcome the 'false-negative' problem, when a library has a relevant picture but has not included it in its digital collection.

Given that picture researchers reported how highly they valued joint problem solving with the library researchers, it seems that enhancing their capability to do this might be one advance that could offer them more productivity gains. Web or IP (Internet protocol) telephony [13], that is, phone calls through the Internet between multimedia PCs and integrated with Web sites, may offer magazine researchers the best of both worlds when the technology reaches maturity [11], and is an enhancement that should be researched. It would give the magazine researcher the ability still to delegate the search to the library researcher, but to benefit from a subsequent interactive visual search refinement ('I'd like to see more pictures like that one') that the traditional process lacks. The more limited set of images that would result from shared searching would also save both library and magazine researchers much of the time that is currently spent in processing the movements of physical images.

This may conflict with the libraries' aims for returns on their investment in digital libraries, which include freeing their researchers from doing searches and administration in order to do more development work (personal communication by a library researcher). However, no advances will be made for the libraries on this front if magazine researchers continue to favour traditional searches. It is therefore in the interests of the libraries to better understand how search capabilities can be developed and designed to meet the needs of both their own staff and their customers.

4.2 Customer needs: what's in a search?

There is a second reason library researchers are not being released from conducting searches. There are many millions of conventional photographs in libraries: CEPIC found in their survey of 233 image libraries in the European Union that the average collection size was around 1.4 million [4]. Libraries cannot afford the costs of digitising them all. They aim to maximise their returns by digitising those of their legacy images that will sell best. By contrast, consumer magazines generally want unusual and distinctive pictures: those less likely to maximise the library's profits because they are unlikely to sell so often. This means that magazine researchers, having performed Web searches, still need to communicate with library researchers to find out whether other images are available. Slides and transparencies from the library have to be sent to magazines using the slower 'old-economy tools'. As professional photographers become more accepting of digital photography, and as the quality of images taken with professional digital cameras improves, this is likely to be less of a problem in time for new stock additions to collections, but the legacy problem is a considerable one.

Other things being equal, as far as magazine researchers are concerned, part of the answer could be for libraries to digitise more of their collections as low-resolution images. This would also increase the value of shared Web telephony searches. As several magazine researchers indicated, preliminary Web searches along with downloading candidate low-resolution images could potentially offer them considerable benefits. One of the

most valuable is that this would offer a way for picture researchers to make images available to other team members early in the editorial process. The images need to be low resolution so that transmission times are kept as low as possible. However, as magazines may use several hundred pictures in each issue, and review many more than that, there could easily be a thousand or more pictures downloaded over the pre-publication period. More research here is needed therefore to discover whether this would truly help researchers and their colleagues.

The Web shop front is also seen by some as an opportunity to showcase the pictures they contain. Libraries may be reluctant to show only lower-resolution pictures, as this does not help them 'show off' their collections.

4.3 Customer needs: harnessing the strengths of both digital and conventional images

When the inadequacy of current search technologies unites with the disappointing and costly experiences magazine staff have had with using digital images, it creates a considerable disincentive to use digital image libraries for the entire procurement process. The libraries have not recognised magazines' preferences and needs to work with 'real' images – by enabling them to view digital images on the Web site, but to order the original analogue slides and transparencies from it.

There is a lot of research in progress, and has been for some years, into technologies which will preserve colour consistency between conventional and digital image formats, and between digital devices, but reliable technologies are not yet available for commercial use [8, 18].

Until then, libraries need to meet their magazine customers' needs to work from traditional media, even if some of the selection process is carried out using the digital medium.

4.4 Customer needs: payment mechanisms

Libraries appear to have failed to understand the importance of accommodating magazines' needs to pay for the images they have used after publication. They need to cater for it.

4.5 In what other ways could image libraries be developed?

Ways of relieving the great pressure of time under which magazine researchers work should be explored. This does not seem to be an area that has been explored by the image libraries. If Web telephony does offer a way ahead, then researching and providing more useful search terms is another measure which could help. Even more important, though, would be to make more information available, thus reducing the amount of time researchers have to spend foraging for it. Currently, keeping on top of all that they need to remember is a rather haphazard affair. For example, if a researcher remembers vaguely that his magazine has used a particular picture before, he generally has to rely upon his own and his colleagues' memories, or leafing through back issues, to help him verify this. It would be very helpful if the library provided a use history of each image. This would also serve the very useful purpose of informing the researcher whether a competitor had used an image recently. Researchers would like to be able to access "all the pictures about x we have used in the last e.g. year" to help exclude some from current consideration. Even better, they'd like to be able to exclude from search results those pictures they're used within a given period, as they will not want to re-use them. Researchers also need to be able to find out easily when the digital collection is a subset of a library's collection on a subject.

Personalised Web pages would assist researchers, and perhaps be more time-efficient than downloading images. As a time-saving measure, researchers would like to be able to choose to save searches, so that their results could be retrieved readily by them and their colleagues. They often have to repeat searches, and cannot always remember the most successful combination of terms used.

Dates are very helpful search terms. One is the date pictures were taken. This is useful when searching for pictures of historical interest, but also helps exclude pictures from a search. For example, magazines with a fashionable accent do not wish to use pictures with last decade's hairstyles!

Another is the date when images are added to the digital collection. This could be added to an older search to check whether new pictures had been added since the last time the same search was conducted.

Magazine researchers would also like services that bring information to them, rather than having themselves to seek it. The best example of this would be the ability to request email notifications of new images in the collection on specified subjects.

5 Conclusions

Today's digital image libraries have not been designed to reflect the needs of and constraints upon magazine staff. They are not supported by sufficiently mature key technologies, and thus do not realise significant benefits to consumer magazines for the bulk of their work. On the evidence of this survey, it would seem that if they are to enhance the value they offer in the short term to this significant sector of their business, libraries need to re-examine the services available to their customers through their digital libraries. Research needs to be undertaken to learn how to tailor search mechanisms to better suit this sector of their customers. But even more productive would be a research investment which aimed to learn about the services digital libraries could develop that would result in efficiencies of time for magazine staff. This could focus particularly on activities that consume large

amounts of researchers' time, and which are currently not supported by technology, such as looking for and checking facts.

The libraries also need to re-examine a perhaps implicit assumption that the digital medium can entirely supplant the traditional one. For example, digital searches might be made more efficient using Web telephony and other enhancements, but magazines may continue to prefer to work with conventional images, and so their Web sites should support orders for both digital and conventional images.

In addition to developing the work on magazine researchers described here, studies of other sectors of commercial image library users, whose needs and experiences are as yet unknown, are also required.

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