Finding Aids and Photographs: A Case Study in the Use of Analog Optical Disc Technology to Improve Access to Historical Images

by **MICHAEL B. MOIR***

Introduction

Keepers of cultural material constantly face the daunting challenge of providing access to ever-growing amounts of information. Many museum curators struggle with the knowledge that exhibit areas can accommodate only a small percentage of their collections, the veritable tip of an iceberg that lies in storage and is unavailable to all but the most specialized inquiries. The situation faced by archivists is equally vexatious. With the exception of a handful of records chosen for display, the treasures entrusted to their care are locked away in stack areas, securely stored in a formidable array of anonymous-looking boxes. Finding aids are developed to provide users with the keys to these fortresses of information, but efforts to establish intellectual control over graphic records often struggle to cope with the visual nature of these media, using approaches that are traditionally text-based. If a picture is worth a thousand words, how many words should be used to describe a picture?

Archivists have been eager to seize upon new technologies in the hopes of responding to this challenge. New gadgets, however, can do little to solve old problems when archivists are hesitant to proceed with the acquisition of systems that seem out of date with the arrival of next month's trade journals. The temptation to wait for the arrival of a newer, faster, cheaper, and more powerful system can be overwhelming, particularly when the selection of appropriate equipment is not always an obvious choice. This is often the case when archivists consider the use of optical disc technology for the management of cultural information. Within the past few years, advances in the storage of data in a digital format have apparently surpassed many of the limitations of analog systems. The success of the digital approach has given analog applications the reputation (in the minds of many curators and archivists) of a dinosaur, facing the threat of extinction that befalls obsolete systems.

Yet the situation is by no means so simple and straightforward. Both digital and analog approaches possess strengths and shortcomings that are unique to their format, and must be carefully weighed against the requirements of a specific application. The decision to adopt a particular format requires a consideration of organizational needs, available resources, and the potential of each approach to achieve the desired product. Such a study was undertaken by the Toronto Harbour Commission,[1] as it explored the use of optical disc technology to improve access to its holdings of historical photographs.

Finding Aids for Photographs

Access to information is one of the primary functions of any archival repository. It is the need to consult the historical record in a timely and efficient manner that provides the rationale for many programmes devoted to the management of information, particularly in a corporate setting. While physical access is important, the critical step in this process is the preparation of finding aids that allow users to identify appropriate material. Few would argue that the description of a record in a manner that best reflects its function and contents is perhaps the most persistent and demanding challenge confronting the keepers of information. Ranging from the clerks that laboured over their calendars to the "techies" who design databases, much time and effort has been invested in the preparation of finding aids that bring together researchers and those elusive gems of information lurking amidst the holdings.

Textual records have generally fared well as a result of this attention. Their original arrangement has often been the product of subject classification schemes or other systems that can facilitate the description of written material. A descriptive entry for a series or file might pull together hundreds or thousands of pieces of paper through their shared purpose and subject matter. Graphic records such as technical drawings, maps, and photographs tend to be more problematic. Originally arranged in a manner that is often based on their chronological sequence of creation or, at the very worst, the order in which they were stuffed into a drawer or box, these materials defy easy description and analysis at a collective level. In particular, the diverse array of information that can appear within a single photographic image suggests that the most effective access is provided through description at the item level, in spite of the overwhelming strain on financial and human resources that such an approach entails for archival repositories with substantial holdings of these graphic records.

Traditional methods employed by archival repositories to facilitate access to photographs have included the preparation of photocopies or modern prints stored in file folders arranged by subject; the reproduction of the entire fonds as photocopies, microform, or contact prints stored in binders that allow users to browse to their hearts' content; and the preparation of image-bearing catalogue cards arranged by subject.[2] All of these finding aids share an important concept: they provide users with a visual representation of an individual image, recognizing that photographs are most likely to find an appropriate audience when handled at the item level, and that at some point (sooner rather than later) researchers will need to view the image in order to determine its suitability not only in terms of content and date, but also in terms of mood, perspective, visual orientation (either horizontal or vertical), and ability to convey the editorial message that is often implicit in their use of the photograph.

Each type of finding aid will eventually satisfy these requirements, but their preparation is time-consuming, needs varying levels of mechanical assistance, and offers differing degrees of success in providing reference copies in response to user demand. The challenge is to combine a visual representation of the record with its textual description, and to have this finding aid available in a format that allows the timely identification of relevant information through access points that include photographer, date, format, place, and subject. This challenge has lain at the core of most programmes dedicated to the management of historical photographs, whether they be planned by large national cultural institutions, or by much smaller keepers of archives such as the Toronto Harbour Commission.

The Evolving Use of Historical Photographs

Throughout the last eighty years, the Commission has used photography to document its impact on Toronto's waterfront.[3] A succession of talented staff and freelance photographers created well in excess of 45,000 images in order to record the progress of public works and special events in the life of the port.[4] Through its use in annual reports and corporate publications,

photography helped to establish a sense of corporate identity, and to communicate the wide range of services provided by the Commission. These traditional functions expanded when the photographs were transferred from the originating departments to the care of the archivist. Many photographs attracted the attention of the growing number of individuals interested in ships and other means of transportation. During the past four years, however, the emergence of new and significant applications for these images had important ramifications for the Commission's approach to managing photographs.

In the first place, there has been an increasing emphasis on the preparation of exhibitions, as the Commission became more active in efforts to demonstrate its historical involvement with the development of Toronto. Graphic materials convey a sense of accomplishment by documenting the large-scale physical changes that have occurred on the waterfront, as well as a sense of precedent for the Commission's involvement in such unexpected activities as airport management. Secondly, photographs have played an important role in the preparation of site histories required for environmental assessments associated with decommissioning commercial and industrial properties prior to redevelopment. After geochemists and environmental engineers exhaust written records, they turn to graphic materials to fill the many gaps in their knowledge of what was where and how it affected the site. In the face of stringent regulations and growing uncertainty about the environmental legacy of industrial land use, these records can play a crucial role in influencing the scale and cost of remediation through careful research.

Finally, there has been a similar concern for the fate of the built environment as expressed through the preparation of heritage assessments.[5] The character of the city and its waterfront has changed dramatically over the last few decades, providing an opportunity for agencies and developers to create a clean slate for new projects by removing large blocks of Toronto's industrial landscape. It is often difficult to generate the support necessary to save vacant factories, warehouses, and storage elevators through the adaptive re-use of these structures. The ongoing process of redevelopment has demonstrated the fragility of industrial heritage, at a time when so much of it is disappearing from the evolving economic base of Toronto. Photographic evidence becomes a powerful tool in understanding this process of change, in documenting these developments, and in conveying to those people who visit the waterfront an interpretation of how industrial land use has affected the human condition.[6]

As a result of these relatively recent initiatives, photographs have become the most frequently used element of the Commission's archives. They were also the most difficult medium to use efficiently, for reasons that are probably representative of the situation confronting many archival repositories. The principal finding aids were the registers compiled by the photographers. Negatives were listed in chronological order, with a brief notation regarding their contents—providing some measure of access for users who had a specific date in mind, or were patient enough to wade through hundreds of pages for a caption that offered a glimmer of relevance. Subject access was provided by an even smaller number of handwritten indices, which dealt with no more than thirty-three per cent of the holdings and were by no means an exhaustive treatment of the indexed records. Most troubling of all, approximately thirty per cent of the holdings were not listed in any manner or form.

Should a user prevail against these rather daunting odds to compile a list of photographs that merited inspection, still more difficulties loomed on the horizon. A considerable amount of staff time was spent pulling original prints, photocopying items for reference purposes, and refiling the prints—with misfiles always lurking as a distinct possibility. This procedure also posed a threat to the preservation of the photographs, due to constant handling. These problems were at least manageable, because they involved photographs that survived as prints. On the other hand, thousands of images were available only as negatives or transparencies. They were difficult to inspect and impossible to photocopy—a predicament that restricted the range of materials available to the researcher.

In the face of user needs that were becoming increasingly demanding, the Commission began to explore several strategies to improve the management of its historical photographs. A system using photocopied images was tried, but this approach required the use of the original prints to produce reference copies in response to requests from researchers. Contact sheets were also prepared, but they were expensive and shared many of the limitations inherent in the use of photocopies.

Inspired by the use of micrographics at the City of Toronto Archives to make large collections of negatives available to the public, the Commission next examined this proven technology.[7] The medium is well-suited to browsing and a user can quickly cover a great deal of material, but it has definite drawbacks. Extended periods of time spent scanning fiche or roll film can be physically unpleasant,[8] while the cost of a computer-assisted retrieval system to locate individual images is roughly equivalent to that of an optical disc work-station. In addition, the quality of copies produced from microfilmed images of continuous-tone photographs left something to be desired. Micrographics offer a useful approach to the management of extensive photographic holdings (especially for those institutions equipped with in-house production facilities), but recent initiatives involving the use of optical disc systems gave pause to consider alternative technologies.

Optical Disc Technology

Canadian archivists were alerted to the potential of optical disc systems for the storage of large amounts of information as early as 1977.[9] Few apparently heeded the call to become involved in the development of this medium, however, as the technology struggled rather unsuccessfully to cope with the expectations of information managers. Progress in this area was much more rapid during the late 1980s. Registrants to the International Congress of Archives' symposium on current records, held in Ottawa in May 1989, heard the results of a project that explored the use of optical discs and associated text-management software to store and retrieve large volumes of images held by the National Geographic Society's Illustration Library.[10] Visitors were also invited to attend demonstrations of the National Archives of Canada's optical disc systems, particularly its application in the Canadian Centre for Caricature (now known as the Canadian Museum of Caricature) that led to the digital recording of some 20,000 political cartoons to be used in place of the originals when needed for research or copying.[11]

Matters gradually evolved at the Commission on two separate but converging fronts. In the first place, the Commission settled upon a database management software, Inmagic, to handle its description of archival holdings.[12] Several factors figured prominently in the Commission's choice of this product: its relative ease in creating data structures and report formats; its use of variable-length, repeatable fields; the simplicity of its command language when creating and searching databases; and, most of all, its flexibility in terms of making changes to the structure and contents of databases, and adapting the software to new applications. This last feature would play an important role in the ensuing project.

As this decision was being made, involvement with optical media was being driven primarily by vendor persistence. A number of commercially available turn-key optical disc systems were being marketed in southern Ontario, including one that received lengthy scrutiny by the Commission. Images were digitized using a flat-bed scanner, described and indexed using a resident text-based retrieval software, and stored on optical disc. The record could be retrieved at the computer monitor or printed using a standard laser printer to produce a hard-copy output suitable for reference purposes. The scanner, however, presented a serious limitation: it could be used only when the image was available as a print. Close to fifty per cent of the Commission's photographs took the form of negatives and transparencies, and the scanner could not accommodate these non-print media. It became obvious that the Commission required a system that could address the wide variety of photographic media represented in its holdings.

At some point in the project's development, a decision had to be made regarding the use of either a digital or an analog system. Information recorded in a digital format is considered the more long-lasting of the two, although neither approach has advanced to the point where it can be considered as a permanent replacement for the original image.[13] The digital format is made up of a series of distinct elements, each representing either an "on" or "off" state, that are recorded onto an optical disc. This format draws upon error-correction methods to identify and remedy errors in the data that occur as the physical properties of the disc's plastics and glues deteriorate over time. Data can be transferred from disc to disc with practically no loss of information, and it can be manipulated to remove unwanted text or details, to correct exposure, or to introduce other editorial decisions that fundamentally alter the character of the information. If done with sufficient resolution, this type of recording can also be used to produce copy art that virtually eliminates the need to use the original photograph for the purposes of research and publication. Exhibitions, on the other hand, still require access to the archival record for the display of historical prints or the generation of high-quality modern reproductions.

These benefits do not come without some important concessions in terms of time and space, due to the nature of the media being recorded. Unlike textual records and technical drawings, which usually present information as a basic contrast between dark and light, black-and-white continuous-tone photographs contain a tremendous variety of grey tones, which must be registered by the scanner and transferred to the storage device. Attempts to capture this range of grey with a resolution sufficient to produce copy work suitable for publication can consume large amounts of space on the disc. The hardware and software required to create such an application are expensive, and can result in a system that will take between ten and fifteen seconds to paint an image on a monitor once the appropriate data has been retrieved and decompressed from its storage device.[14]

The analog format, on the other hand, is composed of a laser-inscribed signal made up of pits, bumps, or other types of markings that vary in length according to their frequency. The information can be captured by a video camera and placed directly onto disc using an optical memory device recorder, or it can be transferred from another medium, such as videotape, in a factory setting in order to create a videodisc. The hardware and image-management software required to drive these storage devices are much cheaper than their digital counterparts. Analog technology does not involve the compression of large amounts of numeric characters depicting the range of shades within the photograph, and the result is a substantial decrease in the time required to scan an image for storage in an analog system. Retrieval time is also substantially lower than in digital systems, as analog signals can usually be retrieved in less than one second.

The fact that analog does not use digital encoding to store information, however, is one of its major shortcomings. As deteriorating discs cannot be treated using error-correction software, the recorded information is inherently unstable. Copies can be taken from a master recording throughout its career, but subsequent generations will reflect any loss of detail that has occurred during deterioration of the master, as well as an additional loss of resolution that varies according to a variety of factors involving the processing circuitry, such as the age and condition of the heads on the recording equipment. This secondary loss represents a very small percentage of the recorded information, however, and it can range from being essentially undetectable to the introduction of a slight blurring of hard edges. Resolution is also affected by the limitations placed by video technology upon the number of lines per screen that can be used for the transmission of information, as well as by the difficulties encountered when the analog signal attempts to depict the progression of information from sharply focused areas of the image to portions that were outside the focal range of the camera.[15]

Project Development

The Commission's decision to select either an analog or a digital system was based on a consideration of how the system would be used by staff and the general public, and on concerns about cost. Some applications in the corporate sector have looked to optical disc technology to take the place of paper-based records, in an attempt to deal with the growing burden of information.[16] The use of optical discs in an archival setting, on the other hand, must respect the fact that the storage medium has not yet achieved a level of permanence where it can be considered a replacement for information in its original format. Instead, the emphasis should be placed on the ability of the technology to improve access to archival holdings. This was the primary purpose of the National Archives' work with ArchiVISTA, which also promoted the preservation of original material by providing an electronic facsimile that could be viewed by the researcher and used to produce reference copies.[17] The Commission sought a similar product: an electronic finding aid that would significantly reduce the handling of original photographs. The ability to manipulate and edit images was not a requirement. The Commission also had little need for a system that could generate hard-copy output for use as copy art, for negatives were readily available to respond to the infrequent requests for photographic prints.

The image retrieval time of each system was an important factor in the final decision, acknowledging a trend among users that could have important ramifications for archives. As researchers become increasingly conversant with the abilities of computers to store and process information, through exposure to these machines at home and at work, they will have steadily rising expectations of cultural institutions that bring computers into areas of public inquiry.[18] Users who once might have spent an afternoon happily searching through a bank of card catalogues now chafe at the passing seconds as they wait for a computer to spew out the results of its labours. A pause of up to fifteen seconds as the software paints an image on a monitor can become quite bothersome, particularly when many users can decide within a second or two whether a photograph is pertinent to their inquiries. The problem of improving the retrieval times of digital systems to meet such expectations can be addressed by converting the data to an analog format. At the Canadian Museum of Caricature, for example, visitors use a videodisc produced from the digital recording to achieve greater speed of retrieval.[19] This arrangement combines the best of both technologies, but it is questionable whether all institutions are in a position to pursue this two-pronged approach.

The Commission's deliberations were particularly influenced by some important comparisons developed by Multi Image Video Productions, an Ottawa-based service bureau that had carried out successful projects using both analog and digital optical disc technology for several departments of the Government of Canada. Based on the Commission's current holdings of some 37,500 photographs, image capture and data entry to develop an analog system would take approximately three months, as opposed to between nine and twelve months for a digital system. Storage requirements varied considerably—only one disc was required for the analog format, while a digital application would need approximately forty discs. The most significant difference, however, was cost. An analog system would cost less than $70,000—to procure a microcomputer, a laser printer to prepare reports from the database, optical disc hardware (player, disc, video monitor, and two types of printer), and conversion work by the service bureau at a rate of approximately one dollar per image (which varied according to the nature of the photographic media). A digital application would probably cost in excess of $200,000 for a workstation of similar proportions, and for conversion costs that were greater than those associated with the analog approach, due to the longer period of time required to scan individual images.

The recommendation to proceed with the project using an analog system was approved in August 1990 after relatively little debate. Recent exhibitions of photographs and assessments of industrial heritage had raised the profile of the Commission's archives, and had made management more familiar with the importance of the historical record than they had been in the

past. This was particularly true for photographs, the most appealing medium within the holdings due to its aesthetic qualities. The innovative nature of the project was perhaps another selling point; the image of any organization is enhanced by initiatives suggesting that it knows how to manage its important resources in an effective manner. On the other hand, the selection of analog technology for the project may have created an impression of moderate expectations and reasonable goals, particularly when the preservation of its archives cannot be portrayed as the primary operational responsibility of the Commission. While a large cultural institution such as the National Archives might have the resources and the mission to explore the potential of emerging technologies for improving the management of cultural resources, smaller repositories such as the Toronto Harbour Commission are perhaps better suited to the safe harbour of proven applications.

Project Implementation

After a month spent working out most of the details of the project, Multi Image Video Productions began transporting photographs to its Ottawa-based facilities in November 1990. Printed images were captured using a 750-line camera that sent the "S" video signal through a switcher, into the optical memory device recorder, and directly onto the disc. Photographic negatives and lantern slides were captured using a light table on a copy stand, while 35 mm slides were converted into an analog signal using a Tamron photo vix. The switcher allowed the service bureau to crop extraneous details, such as framing marks and the copy stand, from around the photograph, to ensure that only relevant information was stored on the optical disc. The switcher also inverted negative images to a positive format.

As the visual information of the photograph was being stored on the optical disc, the service bureau made an entry in the Inmagic database, indicating the item's citation number, and the side and frame number where the image was recorded on the disc. Inmagic's default settings for parity and data bits were changed to facilitate the movement of commands from the software to the optical disc player through the computer's serial communications port, and report formats were written by the service bureau to retrieve images from the optical disc. These two developments answered the customer's hopes that an off-the-shelf software could be used to manage a rather unconventional application.

The project incidentally resulted in observations concerning the characteristics of photographic storage materials. While polyethylene sleeves might be appropriate for the long-term storage of photographic prints, they were too opaque to permit image capture without removing the item from its enclosure. Polyester sleeves, on the other hand, caused no distortion in the recorded image once a polarizing filter had been attached to the video camera, and permitted a higher rate of turnover during the project. Prints placed in a polyester sleeve bearing the item's citation number, and stored in a box with no secondary enclosures, also tended to be processed much faster than those images that had been placed in folders to separate and protect each item. While these processing concerns had no impact on the cost of the project, they will be kept in mind as the Commission considers future additions to the optical disc in an attempt to keep unit costs of the conversion process to a minimum.

The turn-key system was installed by February 1991, with over 37,500 images stored on a single twelve-inch, two-sided Panasonic disc that contains room for an additional 16,500 photographs. The disc is played on a Panasonic TQ-3032F optical disc player, and images are viewed on an Electrohome ECM 1310U high resolution colour monitor. Photographs were originally retrieved using the database managed by Inmagic 7.2 in a DOS environment on a 386 microcomputer. The application is currently operated by the recently-released Inmagic Plus and can also be used with SearchMagic, a menu-driven, search-only version of the software that provides data security when the system is consulted by the general public. In terms of hardcopy output, reference prints can be made within nineteen seconds on thermal paper by

a Mitsubishi P71U video copy processor. Colour images on a more stable paper can be provided within ninety seconds by a Sony UP-5000 video printer. Users of the equipment have been impressed by the resolution and speed of the system, as well as by the quality, convenience, and affordability of the output.

The photographs were thus certainly more accessible, but their images did not always turn out as expected when examined on the video monitor. It has taken some adjustment on the part of users to become accustomed to the positive images of many photographic negatives, for the service bureau captured these items without the degree of intervention that might be expected during printing by a darkroom technician. Overexposed negatives appear overly bright on the monitor, and underexposed photographs have the opposite effect. Users might be frustrated by analog's inability to alter or enhance photographic images after they have been stored on the disc in order to correct exposure or to remove unwanted text or flaws, but this limitation has a useful role in this application. It results in a finding aid that provides a relatively faithful depiction of the original photographs. The project did not seek to interpret these records by putting forward a opinion concerning the appropriate appearance of these images, developed by individuals other than those responsible for their creation and use.[20]

Another characteristic of the image-capture process for photographic negatives was the distortion encountered when handling 35 mm film. The rectangular shape of these negatives became slightly rounded when displayed on the video monitor. The close proximity of the video camera to the negative during recording produced this effect, despite the macro setting of the lens. The final result is not displeasing, as it echoes the shape of the monitor's screen. The only holdings that did not copy well were colour negatives, which appear faint and are overpowered by the photographs' blue tones when viewed on the monitor. In general, the time-honoured maxim, "garbage in, garbage out," held true—the better the quality of the photograph used in the project, the better the quality of the recorded image.

The installation has met several important objectives of the project, and in particular it has broadened the range of information that can be consulted by both staff and the general public. Large numbers of photographs in the form of negative or transparent media, that were previously unavailable to researchers, are now readily viewed and copied. The beauty and information captured by fragile, hand-coloured lantern slides can be appreciated without handling the original items, and recent acquisitions of 35 mm negatives, unaccompanied by prints, are examined with ease and without requiring much interpretation on the part of the viewer.

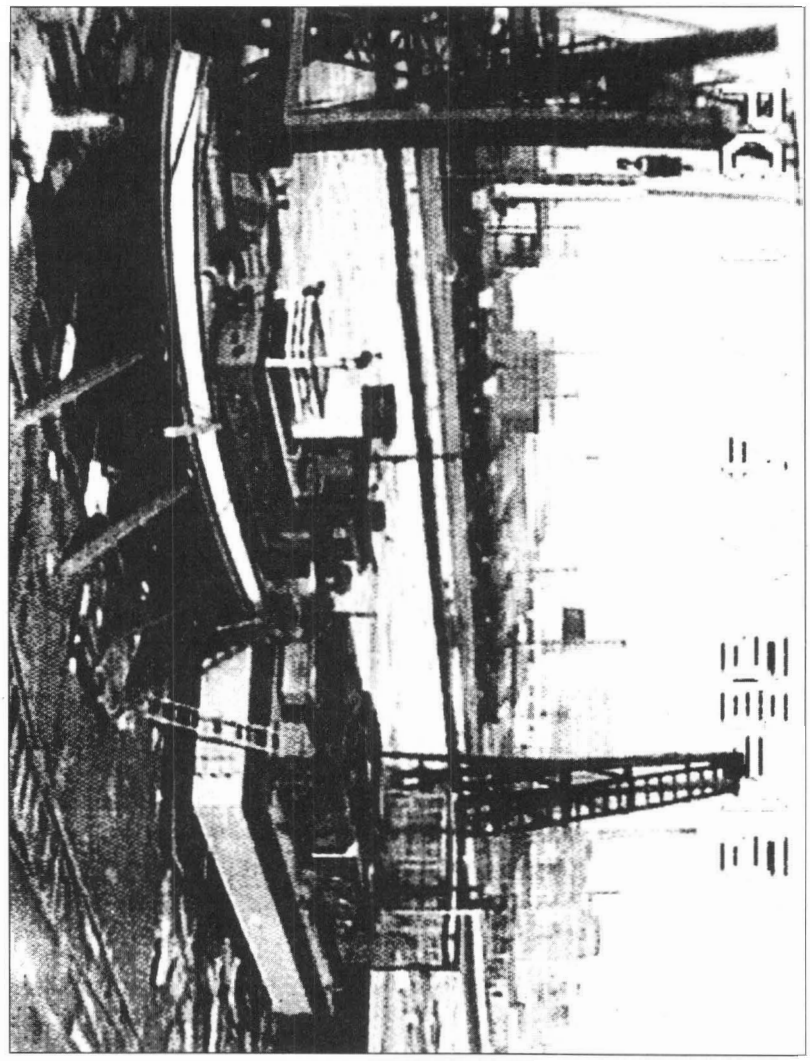
The system has also substantially reduced the strain placed on the archival holdings by becoming the principal method for retrieving and copying photographs in response to research inquiries. Instead of being handled several times a day, as was the norm before the installation of the system, original photographs are now examined only once or twice a month to verify specific details. Photocopying of original photographs has been virtually replaced by video printers that produce inexpensive output bearing the photograph's archival citation number. This procedure has also eliminated a great deal of uncertainty from subsequent references to these photographs, particularly when a researcher telephones at a later date to obtain additional information about the image or to order a photographic print. A second report format allows the production of video prints without the citation number, for use in unpublished papers and reports.

While current arrangements for the identification and retrieval of images within the system are satisfactory, this aspect of the project presents the greatest room for improvement. The optical disc can be browsed when the player is taken off-line, or the database can be used to locate certain fonds or individual items identified by means of the registers and indices that existed before the initiation of the project. These finding aids are gradually being replaced by descriptive entries in the database, prepared at the item level using a structure that has been expanded considerably beyond the three fields initially employed by the service bureau. When

compared with paper-based finding aids, this automated structure provides a much broader range of access points through which the archival descriptions can be searched and selected for viewing. In terms of retrieval, however, the interaction between users, the software, and the optical disc system requires simplification before this application can offer the ready availability of both textual and visual information (as in the case of image-bearing catalogue cards, for instance) that made earlier finding aids so useful for researchers.

Once a search has been successfully completed while in Inmagic Plus's "search" or "command" modes, a report format is used to instruct the optical disc player to retrieve a particular frame for display on the video monitor. The software's default setting has been reconfigured so that these commands are exported to the player through the computer's serial communications port (the auxiliary or "COM 1" setting), instead of the printer port ("LPT1"). The use of a print command instead of a display command—an arrangement necessary to send instructions to a device beyond the operating environment of the computer—results in a situation where the graphic image on the video monitor cannot be viewed simultaneously with the database's textual description; the computer monitor simply reads "Continue (Y/N)?" Researchers wishing to consult the description of an individual photograph must discontinue the print run, and return to the appropriate item in the search result's queue using a "display" command. Users who also require a printed report of their search results while in the "command" mode must enter the DOS environment, where Inmagic Plus can be reset to send the appropriate commands through the printer port.

These awkward procedures require dexterity and patience on the part of users, but there is hope for improvement. The release of a new version of Inmagic, equipped with image-management capabilities, has been announced for the near future.[21] It will enable users to select a key that will send the appropriate command to a third-party environment, such as an optical disc player, in order to display graphic information. This approach, however, is predicated on the assumption that users will work principally from the textual description of photographs, viewing only selected images as required. The Commission's experience with this project suggests that a more effective strategy would be to place the emphasis on the visual as opposed to the textual information. Users employ the database to prepare a list of images that are selected using rather broad search criteria. They drive the optical disc player through this list of photographs in quick succession as they watch the video monitor, requiring the textual description in the database only when a particular image has piqued their interest. This approach requires a default command incorporated into a suitable "display" format, so that, as the textual description appears on the computer monitor, images will be automatically retrieved and projected on the video monitor for those entries that contain information in the "frame" field. Given the pace of software development and the growing awareness of the need to incorporate image-management capabilities within the architecture of text-management software, this goal does not seem impractical or distant.



Conclusion

While the devices used in this project represent a considerable departure from binders of photocopies or rolls of microfilm, all of these finding aids share the goal of providing access to photographic records. Optical disc technology represents an improvement upon traditional approaches by combining speed of retrieval with the ability of a database to identify records through a wide variety of search criteria. In the case of this application, however, the image-management capabilities of the software require enhancement before users handle this technology with the same ease that is offered by photocopies, microfilm, and image-bearing catalogue cards. It will be some time before the system can be operated by the general public in a straightforward manner. In the meantime, users must rely upon staff to serve as intermediaries between themselves and the mysteries of the optical disc.

Public programming will have to be developed as these limitations are overcome; long-term strategies for this access system have not been clearly developed, as staff continue to adjust to the implications of a new technology. A number of important issues remain to be addressed in the future. It is likely that the number of people wishing to use the system will increase steadily, resulting in the need for parallel access from more than one work-station, instead of the current arrangements for serial access to the disc. There will probably be a desire to exchange information with other systems and institutions—which raises the issue of standards and the current inability to share information among different proprietary systems. Situations may arise when the Commission will explore the integration of the analog system in other applications that use a digital format to store images of media that are not so memory-intensive as continuous-tone photographs—such as text and technical drawings. Such opportunities will likely occur during the coming years, but it is equally apparent that optical disc technology will evolve at an accelerating pace. The responses prepared in five years' time will be substantially different from those offered today.

The Toronto Harbour Commission's experience with optical disc technology has been a relatively qualified success. Staff and researchers make regular use of a system that can take them through several thousand images in less than an hour, and can generate reference copies within a few seconds. The system has improved the public's perception of the Commission's record-keeping practices, replacing preconceived notions of inaccessibility with a progressive approach to the management of visual information. The preservation of original photographs also benefits from the reduced handling that results from use of the optical disc system. While this project has stressed the need to tailor the selection of technology to the requirements of a specific application, many other cultural institutions are actively exploring the use of optical disc systems in similar situations.[22] This trend should accelerate as hardware becomes more affordable, and the image-management capabilities of software become more refined. In the meantime, the technology points the way towards a new generation of finding aids that can significantly improve access to graphic records while complementing other aspects of a repository's operations.

Notes

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1 Under the terms of the incorporating legislation dated 19 May 1911 (Canada, *Statutes*, 1-2 George V, chapter 26), the organization was given the name of The Toronto Harbour Commissioners. For purposes of convenience, this paper uses the less formal style that has been employed by newspapers and government agencies throughout the agency's history, and will usually refer to it as "the Commission."

2 Discussions of these processes can be found in Robert A. Weinstein and Larry Booth, *Collection, Use, and Care of Historical Photographs* (Nashville, 1977), pp. 56-58, 116-17; and Mary Lynn Ritzenthaler, Gerald J. Munoff, and Margery S. Long, *Archives & Manuscripts: Administration of Photographic Collections* (Chicago, 1984), pp. 91-93.

3 General descriptions of the historical records created and preserved by this organization can be found in the author's articles, "The Toronto Harbour Commission Archives," *Urban History Review/Revue d'histoire urbaine* 17, no. 2 (October 1988), pp. 112-15; and "Toronto's Waterfront at War, 1914-1918," *Archivaria* 28 (Summer 1989), pp. 126-40.

4 This number reflects the current extent of the holdings. At the time that new approaches to the management of photographs were being studied, approximately 37,500 items had been preserved by the Commission.

5 See, for example, Christopher Andreae, *Railway Lands Precinct A, Environmental Report: Heritage* (London, Ont., 1986); Jeffery Stinson, *The Heritage of the Port Industrial District* (Toronto, 1989); and Jeffery Stinson and Michael Moir, *Built Heritage of the East Bayfront*, Royal Commission on the Future of the Toronto Waterfront, Technical Paper No. 7 (October 1991).

6 This statement does not apply only to historical photographs. The recent decommissioning of an oil company's property in Toronto's Port Industrial District led to lengthy discussions between the owner and several agencies regarding preservation of the site's industrial heritage. A warehouse and office building constructed on the property in 1930 was decorated with a pattern of brickwork that was uncharacteristic of industrial structures. Unfortunately, tests indicated that the building was situated over the greatest concentration of pollutants on the site, and that it had to be demolished to make way for remediation of the contaminated soil. At the suggestion of the Toronto Historical Board, the company took several black-and-white photographs of the brickwork in the context of the building and its site. They were deposited with the Toronto Harbour Commission to ensure public access to this information. Faced with economic and environmental concerns, the process adopted by the company was a recognition of both its historic involvement in the development of the community and the role that archival repositories play in making this heritage available to interested individuals.

7 R. Scott James, "Microfilming Glass Negatives," *Archivaria* 5 (Winter 1977-78), pp. 148-50.

8 These remarks are based on the personal experiences of the author, and not upon any objective analysis of the reaction of the general public to the use of microfilmed records.

9 Sam Kula, "Optical Memories: Archival Storage System of the Future, or More Pie in the Sky?," *Archivaria* 4 (Summer 1977), pp. 43-48.

10 Maura A. Mulvihill, "Visual Data Bases: Photographs as Information Records," in Cynthia J. Durance, comp., *Management of Recorded Information: Converging Disciplines* (New York, 1990), pp. 69-75.

11 Gerald Stone and Philip Sylvain, "ArchiVISTA: A New Horizon in Providing Access to Visual Records of the National Archives of Canada," *Library Trends* 38 (1990), pp. 737-50, reprinted in *Archivaria* 33 (Winter 1991-92), pp. 253-66. Subsequent references to this work will be from *Archivaria*. The article provides an interesting overview of the programmes developed at the National Archives since 1964 to improve access to graphic materials, including early work with optical discs between 1978 and 1983 that produced rather discouraging results. The project is also discussed in Gerald Stone, "ArchiVISTA: New Technology for an Old Problem," in Susan Stone and Michael Buckland, eds., *Studies in Multimedia: State-of-the-Art Solutions in Multimedia and Hypertext* (Medford, N.J., 1992), pp. 153-59.

12 Case studies involving the use of this software in the development of records management and archival programmes can be found in Thomas F. Lee, "Records Control in Local Government Using INMAGIC and SearchMAGIC Software," *Records Management Quarterly* 26, no. 1 (January 1992), pp. 22-24, 57; and Elspeth Reid, "The Presbyterian Church in Canada Archives Recataloguing Project," *Archivaria* 34 (Summer 1992), pp. 91-108.

13 The technical details provided in this section are based on an unpublished paper by Philip Sylvain, "Preservation Copying using Optical Disc Technology," 2 June 1989; and on Stone and Sylvain, "ArchiVISTA: A New Horizon," pp. 255-56.

14 Compression techniques make digitized information much more manageable. A large engineering drawing requiring approximately 8,000,000 bytes of memory, if stored as scanned, can be reduced to some 300,000 bytes by using algorithms that extract unnecessary details and consolidate repetitious information, such as large areas of a constant shade or colour on the drawing: "The Power of Imaging," *Solutions: The Executive Magazine from Unisys* 11 (1990), p. 8. The experience of the National Archives of Canada, however, suggests that compression techniques available in 1988 were not suitable for the storage of digital images of graphic materials in an archival setting. Magnification of decompressed images revealed "checker-board type patterns" that were inconsistent with the goals of its project: Stone and Sylvain, "ArchiVISTA: A New Horizon," p. 260. It should be noted that compression technology has since advanced beyond this point.

15 The ability of video technology to project only a limited number of lines per screen has led to some contradictory and confusing statistics. For a detailed discussion of this question of resolution, as well as the issue of image definition, see Harry Mathias and Richard Patterson, *Electronic Cinematography: Achieving Photographic Control over the Video Image* (Belmont, 1985), pp. 54-57, 220-23.

16 "The Power of Imaging," p. 6; and Vicki Wood, "Is imaging in your future?" *Office Systems & Technology* 38 (November 1992), pp. 18-20.

17 Stone and Sylvain, "ArchiVISTA: A New Horizon" p. 253; Stone, "ArchiVISTA: New Technology for an Old Problem," p. 156.

18 This situation could reflect the experience of librarians, who have dealt with the provision of online access to automated catalogues for a longer period than their counterparts responsible for the management of historical records. As one consultant recently remarked, "Now that we have shown patrons a glimpse of what we can provide, there is a danger. We have gotten on the express track and can't possibly get off. We must keep running just to keep up": Susan Baerg Epstein, "Selling Automation to Your Patrons: It's Easier Than You Feared," *Library Journal* (15 October 1990), p. 63.

19 Stone and Sylvain, "ArchiVISTA: A New Horizon," pp. 261-62.

20 The ability of graphics technology to manipulate visual information should be a matter of concern for archivists. During the preparation of a history of the Queen City Yacht Club in Toronto, four separate photographs were selected to produce a panoramic view of Ward's Island in the 1940s. Modern prints were made from copy negatives of the original prints, each item bearing the stamp "Office Copy" prominently displayed across the image. These modern prints were scanned, the text and borders removed, and the images merged to form the final, expansive view: Wayne Lilley, *Queen City Yacht Club, 1889-1989* (Toronto, 1991), p. 49. This approach is not new; scanners and "mice" have replaced the traditional paint and pens of touch-up artists. The sophistication of current graphics technology, however, makes it difficult for archivists and the public alike to discern the impact of editorial decisions resulting in "historical" images that never really existed.

21 See *INMAGIC News* 7 (Winter 1990-91), p. 2 for additional information on this product.

22 The use of optical discs by the Cleveland Public Library to manage a collection of 55,000 motion-picture still photographs is discussed by Harry Stainer in "Research at [the] flip of a switch," *Cleveland Plain Dealer* (7 February 1990). This technology is also being implemented at the Avery Architectural and Fine Arts Library of Columbia University in order to improve access to 45,000 architectural drawings ranging in size from a business card to ten feet across: *Library Journal* (15 April 1990), p. 16. Overviews of the use of optical disc technology in the programming of museums and archival repositories can also be found in Roberta H. Binder, rev. ed., *Videodiscs in Museums: A Project and Resource Directory* (Falls Church, VA, 1992); and Martha Mills, "Use of Advanced Digital Technology in Public Places," *Archives & Museum Informatics* 6 (Fall 1992), pp. 2-8.