Summary of the DP3 Project Survey of Digital Print Experience within Libraries, Archives, and Museums

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Abstract

In order to quantify the experience cultural heritage institutions have had or are having with digitally printed materials in or entering their collections, the Image Permanence Institute (IPI) conducted an online survey. The survey gathered data relevant to the collecting of digitally printed materials, deterioration of those materials, preservation policies regarding the care of those materials, and the use of digital printers in-house. The results indicate that most institutions are receiving digitally printed materials but that their staffs do not possess the necessary information and skills to identify or develop policies for the care and handling of these materials in their institutions. Unfortunately, the data also indicates that digitally printed materials in many institutions are already decaying and doing so by a variety of mechanisms. In addition to collecting digitally printed materials from outside sources, institutions are relying on digital printers to produce their own institutional publications, work copies, exhibition signage, etc. While some of this material is intended for short-term use, others, such as conservation documentation, may be needed for extended periods of time.

Introduction

The variety of materials and technologies used in the creation of digitally printed materials is large and has been expanding rapidly. Preservation and conservation of digitally printed materials is becoming a concern within cultural heritage institutions. The DP3 (Digital Print Preservation Portal) Project at the Image Permanence Institute (IPI), funded by The Andrew W. Mellon Foundation and the Institute for Museum and Library Services, is intended to help professionals understand and identify the processes, spot deterioration, and provide storage and handling guidelines.

The purpose of this current project was to quantify the experiences that cultural heritage institutions have already had with modern, digitally printed materials. This includes both materials that have entered an institution's collections from outside sources and those that have been made by the institution for internal use. These experiences include the ability to identify prints made by the various digital printing technologies, evidence of print deterioration, and institutional usage policies (storage, handling, display, etc.). The institutions included in the survey were libraries, archives, and museums. The types of professionals within these institutions included (but was not limited to) conservators, curators, librarians, archivists, and exhibition specialists.

There is currently no data to express the level of institutional experience with modern digitally printed objects. The *Heritage Health Index Report* did not address digitally printed materials as a separate class [1]. It marginally addressed digital printed pictorial images when respondents were asked to include "digital and inkjet prints" in the category of "other photographs." Digitally produced documents, periodicals, books, and ephemera from non-pictorial holdings were also not differentiated from those traditionally printed. As a result, there is still no sense of what sorts of digitally printed materials are truly being held in cultural heritage collections or how they are being used and cared for.

This survey was intended only to pull together information regarding the experiences institutions are having with these modern materials. It was not intended to provide commentary on those experiences or provide suggestions for using and caring for these objects. Nor was it intended to offer suggestions for purchasing specific printers, papers, and inks. The value of the survey lies mainly in its providing direction for researchers to attend to the unaddressed needs of institutions charged with the care of these objects. Thus, the intended audience for this project is composed primarily of those engaged in studying the preservation/conservation of digitally printed materials. The data derived will help these researchers to prioritize their efforts. Additionally, the data may help agencies that fund preservation projects or research to apply their resources to needed areas.

For the purposes of this project, the questions focused on prints created using the most common modern, non-impact printing technologies: inkjet, dye diffusion thermal transfer ("dye sub"), and electrophotography. The following are brief descriptions of the processes:

Inkjet. This is the technology used by most consumer desktop computer printers, some retail photo kiosks, and wide-format printers. Small droplets of ink are rapidly jetted onto the printing paper. Inkjet can be used for both documents and images. Several variations of the technology exist, and each produces prints with unique properties. The colorants in inkjet prints may be dyes or pigments. Generally the pigment inks are more stable because of their large particle size, but this advantage is countered by the greater range of colors possible with the dye inks.

Electrophotography. This process (also referred to as xerography) is used in photocopiers and laser printers. In these systems color toners are transferred to the printing paper by an electrical charge (modulated by a laser, LED array, or by light reflected from the original) and "fixed" by heat or pressure. The toners are usually pigments, with the black toner being very stable carbon black. While black-and-white electrophotographic prints on stable paper have been shown to be long-lasting, this has not yet been proven true for color systems [2]. Electrophotography is used mainly for printing documents; however, it is also commonly used to print images for modern photobooks.

Dye Diffusion Thermal Transfer (D2T2). It is also called dye sublimation or dye-sub for short. In these systems, the printer modulates heat energy to colored donor ribbons to control the amounts of yellow, magenta, and cyan dye that is transferred to the

print paper. This technology is often used in snapshot-size home photo printers and in many instant-print photo kiosks.

Silver-halide. This is the technology used to make traditional photographic prints from negatives. In this case, metallic silver or color dyes are formed during processing in areas that have been exposed to light. What many people do not know is that a large majority of the prints made from digital images at photo labs or through online services are created using this same time-tested process. The main difference is that instead of using light through a negative to expose the photographic paper, a laser or light-emitting diodes, controlled by the data in the image file, are used to expose the paper.

Methods

The title of the survey was "Survey of Digitally Printed Materials in Cultural Heritage Institutions." It was designed to establish a baseline of current knowledge and practice through a set of multiple-choice and short, written-answer questions. Web-based survey software was used to collect the information required. The software *Clipboard*, developed by the Rochester Institute of Technology, was used to design, edit, and collect the data for the project. The estimated time to complete the survey was five to ten minutes. There were 16 questions in all, with additional responses for inclusion on an IPI email list, permission to be contacted for future surveys, and personal comments on the survey.

The types of questions fell into several categories:

- Basic information about the respondent and his or her institution
- Definition of the term "digital print"
- Skills for print identification
- Deterioration
- Institutional policy for the care of digitally printed materials
- Internal use of digital printing devices

Invitations to participate in the survey were submitted to the following professional organizations' online discussion groups:

- Conservation Dist List
- Archives and Archivists (SAA)
- Vismat -L – Visual Materials List (SAA)
- PADG – Preservation Administrators Discussion List (ALA)
- ACUMG – Association of College and University Museums and Galleries

In addition, 103 professionals in the field received direct invitations to participate; this was also to ensure their participation, as many may not have read the postings on the professional sites listed above.

Respondents were asked to answer as many questions as possible, to the best of their ability. All individual results are to be kept anonymous. No specific names or institutions will be reported. Respondents were given access to the survey from June 10, 2008 to June 30, 2008. Reminders were sent to all those on the personal invitation list on June 25, 2008.

Results

IPI received 182 responses before the survey close date. The majority of responses came from the US. Of the 182 responses, 134 resulted from the solicitations to the discussion lists. Of the 103 personal invitations, 48 responded, and 12 email addresses failed. This resulted in a 53% response rate for personal invitations. The response rate for the invitations posted to online discussion groups cannot be calculated. The data was then tabulated and is presented in the results below. All results are based on a single pool that includes the responses from both the professional groups and the personal invitations. To a 95% confidence level, that pool should not differ from the entire population of cultural heritage institutions worldwide by more than 7.3%.

Types of Institutions and Personnel

All types of institutions responded to the survey, primarily libraries (31%), archives (17%) and museums (25%). Additional responses were also provided by historical societies, conservation centers, and universities. Within these institutions, it was usually the conservator who responded (33%), with archivists and librarians following (24% and 11%, respectively). Additional responses were most often provided by curators, administration, digital imaging specialists, and registrars. Almost all institutions reported having digital prints within their collections (87%) though 5% were not sure.

Definition of Digital Print

The survey clearly showed that there is no commonly shared definition for the term "digital print" within the field. Some respondents felt that any object output by a digital printer, whether text or image, would be considered a digital print, and others felt that only pictorial images could be considered digital prints. Some felt that photographs printed on light-sensitive photo paper by a laser or LED digital printer could be considered a digital print, while others were strongly opposed to that idea. And some respondents felt that the term "digital print" can refer only to an object that was "born digital" regardless of how it was ultimately printed. It is clear that the field will struggle to communicate about the materials until some common terminology is developed. One respondent did suggest that instead of using the term "digital print" as a catch-all for the variety of printing processes, the specific process should be used to identify a particular print (e.g., inkjet, electrophotographic, D2T2, etc.). A more in-depth discussion of the definition results can be found in a separate article in the March/April issue of *Archival Outlook* published by the Society for American Archivists [3].

Digital Print Identification Skills

Only 24% of respondents said they could identify all three types of digital prints (inkjet, electrophotographic, and D2T2), though 64% stated they could identify an inkjet print. One-third of respondents said that they could not identify any type of digital print. Most respondents learned their identification skills from more than just one source – most commonly literature, websites, workshops, sample sets, and self-teaching.

Types of Digital Prints Found in Collections

Most institutions have inkjet prints in their collections (78%). Approximately half have electrophotographic prints, and one third have D2T2. In addition to those processes, respondents listed a variety of other digital print types in their collections. Dominant among these were color silver-halide prints created on digital printers such as the Lambda printer. Some other responses were synonymous for inkjet, electrophotographic, and, potentially,

D2T2. For example, brand names such as Iris (which is inkjet) or euphemisms such as giclée (which is also inkjet) were reported. This also applied to digitally exposed silver-halide which was additionally reported as Lambda and chromogenic.

Expectations Regarding Print Life of Digitally Printed Materials

Most respondents believed that digitally printed materials will not last as long as traditionally printed materials (62%). However, some respondents believed that while some prints won't last as long as traditional prints, others will last as long or longer. How respondents distinguished between these is not known. It is possible that they believed certain prints will be short-lived and others long-lived, for example those printed with dye inks versus those printed with pigments. It is also possible they believed that early digital prints were unstable but since technology has advanced the latest prints will be much more stable. Unfortunately, most institutions are concerned about a future influx of these digitally printed materials (77%), and only 17% feel well informed about how to care for these objects.

Experiences with Digital Print Deterioration

Most institutions have seen evidence of deterioration in at least some of their digital prints (71%). This seems a large percentage, given that digital printing is relatively recent technology. As such, prints have had little time to undergo dramatic changes. Respondents who have witnessed deterioration of their collection materials reported a variety of decay types. Abrasion was the most common form of decay reported, with fade a close second.

Types of Decay Found in Collections

Surface scratches or abrasions	42%
Image or text fading	41%
Paper yellowing	30%
Color bleed or transfer	23%
Adhesion between prints	21%
Binder cracking or delamination	12%
I have not seen any deterioration	29%

In addition to the types listed above, other forms of deterioration were also reported. Several respondents stated they had seen water damage, and others reported planar distortion or adhesion to glass.

Care Policies for Digitally Printed Materials

Most institutions do not have specific care policies for these materials (71%). Many treat their digitally printed materials the same as they treat their analog-printed materials. Those who did have specific approaches to caring for these materials expressed some contradictory ideas. Some use cold temperature storage for their digital prints or at least believe the materials *should* be kept in cold storage. Other respondents indicated that they keep their prints at room temperature; however, they did not state whether they actually believe this is the appropriate storage temperature or whether it simply is the condition they are using. Also some believed it is best to use plastic sleeves to house digital prints, while others believed it is inappropriate to use plastic sleeves. Most were concerned about the potential for abrasion when inserting or removing prints from enclosures. Some use interleaving tissue between prints to limit such abrasion. And finally, some were specifically concerned about potential damage caused during display and so use UV-blocking framing glass and/or limit time on exhibition. Some of the less common care policies reported were restricted handling and loaning, RH control to prevent bleed and sticking, making silver-halide or electrophotographic copies, and keeping electronic files in addition to the prints.

Digital Printing within Institutions

Almost all institutions own digital printing devices (98%). It is clearly important to institutions to have the capability of printing materials in-house. The vast majority of their printers are either inkjet or electrophotographic (80% each). Many institutions own both types. A small number use dye sublimation (10%). This may be largely due to the fact that dye sublimation printers are photo-specific and cannot be used to print documents as well. Approximately 10% of respondents have printers but don't know or are unsure of the type.

Institutions are utilizing their digital printing devices to create a variety of document and image types. The table below shows the variety of materials being printed.

Types of Materials Digitally Printed within Institutions

Work copies	80%
Exhibition signage	64%
Educational materials	61%
Display copies	59%
Institutional publications (posters, brochures, flyers, etc.)	59%
Conservation documentation	55%

Additional responses included hardcopies of born-digital objects, exhibition facsimiles, and prints for resale. Some of these materials may not be intended for long-term use, so there would be little concern about their long-term stability; other materials, such as conservation documentation or institutional records, would be expected to last for significant periods.

General Comments

The survey allowed respondents to add general comments regarding the survey or describe any other issue they have faced when dealing with these new materials. The most common comments were along the following lines:

- Institutions need help developing care guidelines and policies.
- Institutions need standards for creating "permanent" digital prints.
- The field needs workshops to train professionals on the care and identification of digital prints.

The most poignant comment, and certainly one not to be made light of, was simply, "Help us!!!" It is clear from this survey that institutions need information and tools to help them ensure the long-term accessibility of their digitally printed materials.

Conclusions

The results of the survey have provided a wealth of information and insight on how cultural heritage institutions are dealing with modern digitally printed materials entering or already in their collections. These results will provide a basis for future work to help institutions ensure the long-term preservation of and access to these objects. The highlights are listed below:

- Most institutions have digitally printed materials in their collections but do not feel fully informed about how to care for these materials.
- Currently the term "digital print" is defined in several, sometimes contradictory, ways. It may be better to identify these materials by their specific class (inkjet, D2T2, electrophotographic, etc.) rather than the generic category of *digital print.*
- Many institutional personnel struggle to identify some or all of the digital print types in their collections.
- Most respondents believe that digitally printed materials will not last as long as traditionally printed materials, and the majority of institutions have already seen a variety of deterioration manifestations with the most common being fade and surface abrasion.
- Most institutions do not have specific care policies for these materials, and those that do sometimes have contradictory ideas about appropriate care and use.
- Almost all institutions own inkjet printers and use them to create a variety of documents, graphics, copies, and signage, including some intended for long-term use.

Suggestions for Future Work

Given the above, it is clear that much will need to be done to aid institutions attempting to care for these objects. The following work is suggested:

- Develop multi-approach methods to teach print ID (e.g., websites, workshops, study sample sets, etc.) and make these accessible to the field.
- Develop a set of common terms regarding not only the print types but also their various individual characteristics.
- Develop a generic set of care and use guidelines that institutions can adapt for their own particular needs.
- Develop a set of standards for "permanent" digital prints so that institutions can have confidence that materials that meet those requirements will meet their goals of long-term use.
- Suggest to Heritage Preservation that the next *Heritage Health Index Report* include digitally printed objects as a unique category.

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References

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Author Biography

Daniel Burge, senior research scientist at IPI, received his B.S. in Imaging and Photographic Technology from the Rochester Institute of Technology in 1991. He has worked full time at IPI since 1990. The focus of his research there has been the chemical and physical interactions between imaging media and storage enclosures, including the development and improvement of testing methods. Currently he is leading IPI's investigations into digital hard copy stability and storage issues.