Libraries and desktop storage options: results of a Web-based survey

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Keywords

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Abstract

The floppy disk drive is expected to become obsolete soon. However, this issue has been little addressed in library professional journals. This article reports the results of a Web-based survey that aimed at ascertaining what plans, if any, librarians have for dealing with this technological change to retain effective library services. Our survey found that librarians, especially academic, care about portable data storage for their patrons but do not have any clear plans.

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Introduction

The floppy disk, a thin slice of magnetic plastic that enables us to easily carry data from one machine to another, has existed in one form or another almost since the beginning of the PC. However, "the computer industry soon will be bidding *adieu* to the 3.5in. diskette drive" due to growing file sizes and the Internet (Waltner, 2000). The fact that this issue has been little addressed in library professional journals suggests that libraries may not be prepared for this impending technological change. This study investigates current as well as future desktop storage options; and it reports the results of a Web-based survey that aimed at finding out current and future storage options at all types of libraries (academic, public, corporate, school, government, law). Staff have increasing storage needs and, with the introduction of the digital library, so does the in-house library user. We hope that the findings will help librarians in deciding on the best solutions for their institution in light of these changes.

Literature review

While technology adds value to the services and products that libraries provide to patrons, it also strains those existing and traditional services. For libraries to continue to provide effective services, they must stay abreast of continuously changing technologies.

Data storage is a technology that is changing so fast that it transforms an industry or breaks a long-standing paradigm (Cary, 1999). This change is indisputably affecting library services. A review of the current literature on desktop storage shows that, although many options are available in addressing today's computing needs for data storage, back-up and portability, each option has its advantages and disadvantages.

Zip drives or disk-cartridge drives "are the leading candidate, because they have considerably more capacity than 3.5in. diskettes at modest cost. A 100Mb zip drive costs about $100 – with a capacity equal to 70 diskettes" (*Library Systems Newsletter*, 2000). However,

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Waltner has noted a significant drop in sales of disk-cartridges from Iomega Corp. in 2000 – 14.9 percent for external drives and 30.7 percent for internal drives. This is mainly due to the emergence of optical options such as CD-R/W (read/write) drives and DVD-R/W drives. On a positive note, Waltner reminds us that the Zip drive is a much more established technology than the optical read/write drives, is convenient to use, and has a very low failure rate, with full access to files via desktop PCs (Waltner, 2000).

Optical technology has emerged as an alternative removable storage option in recent years, though technical challenges are among several factors that have contributed to the delayed availability of portable CD-R/RW (Bennett, 1999). On the other hand, as Bennett has indicated, CD-R and CD-RW drives are particularly attractive to portable environments, because optical formats are not affected by magnetic fields and are extremely durable. Also CD-R has a huge edge in read compatibility, which is a powerful feature for desktops.

Herther (1998) echoes a similar sentiment about technical challenges, noting that current users choose more expensive non-optical systems – despite studies showing strong acceptance of and preference for optical storage – because CD-R remains a technology that is legendary for being difficult to set up, non-standard, and carrying a high cost of operation in both time and ongoing cost.

Waltner predicates that recordable DVDs are likely to be the successor to CDs because DVD-R/W drives promise all the advantages of CD-R/W devices, but with much more capacity (Waltner, 2000). Further, the recordable/rewritable DVD technology offers up to 5.2Gb on a two-sided DVD-RAM disc, while maintaining backward compatibility to read CD-R and CD-RW discs on the same DVD-RAM drives (Williams, 2001). In addition to being used as a removable storage medium, the major advantage of installing a DVD-R/W drive on a PC is that it can be used to play commercially produced DVD programs as well (*Library Systems Newsletter*, 2000).

A tape drive is a traditional and highly reliable medium for back-up storage, although it does not seem to be very popular today. "While the emergence of cost-effective writable optical media, such as CD-R and DVD-RAM offers the potential for higher-density and longer-life desktop storage options, the practical facts of corporate inertia mean that conventional tape back-up to magnetic media will continue to be around for the foreseeable future" (Hunt, 1999). Further, Waltner mentioned that tape drives continue to offer far more capacity than any of the other options. But the downside of this old technology is the inherent electro-mechanical nature of magnetic tapes. "Because of their close proximity to one another, the adjacent layers of tape on a reel can lead to magnetic 'print through' that blurs the integrity of the data over extended periods of time" (Hunt, 1999).

Removable hard drives are the fastest and most expensive storage option. They are made in either 3.5in. or 5.25in. sizes and from under 100Mb to over 3Gb of storage. The drawback is that information can be lost because of the nature of magnetic storage. However, these systems have proven to be very popular and resilient in many corporate applications, as they offer efficiency, speed, economy, security and convenience for multi-system users, telecommuters and mobile professionals (Herther, 1998; Kaczeus, 2000).

The latest desktop storage option is a removable tape drive from OnStream Inc. The product, Echo DI 30, is claimed to handle 30Gb of compressed data, far more than can be held by a Zip drive. The cost of the drive is less than $300 and the tape cartridges are priced at about $50 each. Although that is nearly 50 times the cost of a CD-RW disk, it offers up to 80 times the capacity (*Library Systems Newsletter*, 2000).

The Internet is emerging as a new storage option for many people. The use of e-mail attachments to back up data and share files is becoming common. Although e-mail is easier to use than floppies for portability, the transfer time may be more of a problem, particularly for those on dial-up connections, when files are very large. Web-based storage options are becoming more attractive, because they offer portability, back-up, disaster recovery, file

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sharing and photo shows. Many online storage services such as Tripod and GeoCities offer free home pages, functioning as storage space. NetDrive, IDrive and Xdrive are some general online storage options that accept almost any type of file, including images and MP3 files. The files can be shared with others or stored as private files (Notess, 2000). Another option is known as Web-enabled virtual storage (VS). VS lets customers lease storage from an off-site provider's data center via a broadband connection, so customers can manage, move, share,and protect their data as if they were on-site. Companies such as StorageNetworks provide this service and usually charge a flat monthly fee based on storage used per month plus fees for special services and personnel (Harney, 1999).

Although it is predicted that the days of the legacy floppy disk drive are numbered, there is still no single clear leader in the removable storage media market. Computing companies are offering many choices to their end-users. Compaq has been offering SuperDisk as an option on its desktop computers as well as Zip drives as an option for certain notebooks.

MicroSolutions Inc.'s Backpack CD-rewriter 2X has offered a flexible, multimedia storage solution that uses a variety of low-cost, removable media – CD-RW, CDR, CD-ROM and audio CDs (Bisby, 1998). Hewlett Packard released two desktop systems (NetStorage 6000 and AutoBackup) that could be easily attached to the network and automatically back up changes made on systems connected to the network (Brownstein, 2000).

Networked storage products, such as Enterprise Storage Networking, are gaining popularity. It combines two storage architectures, storage area networks (SAN) and network-attached storage (NAS), into one storage networking subsystem. This combination of NAS/SAN technology allows for the easy, reliable sharing and scaling of storage over standard networks and the speed and availability of multiple storage devices over a fast and fault-resilient dedicated fibre channel. NAS/SAN creates a multifaceted data access point that can meet the most demanding storage application requirements (Grulke, 2000).

Could the floppy disk make a come-back? A recent article published in the February 2001 issue of *PC World* reports that a new disk drive, just released to the market and priced at less than $87, can store 32Mb of data on a standard 2HD (double-sided, high density) floppy disk, meaning that the same 1.44Mb floppy disk can hold 20 times the information (Williams, 2001).

It can be seen that there are potentially many options available for desktop storage, should the familiar floppy disk drive be discontinued by computer manufacturers. In order to assess how aware librarians are of the impending technological change and to determine what their storage plans are, we undertook a Web-based survey.

Methodology

A single html page was created with a total of 15 questions (plus a place for additional comments). A common gateway interface (CGI) script written in Perl 5 parsed the form data. The script sent a response in plain English to the authors via e-mail as well as appended a file that was machine-readable. The resulting file saved the responses in a flat ASCII file that was imported into Excel 2000. Once the bugs were worked out of the script, several test subjects were given the survey. These people took the survey and then proffered feedback to the authors, who in turn made changes to the survey and the CGI script (see the Appendix for the original survey).

Once the final version of the survey was complete, the authors sent an e-mail message to various electronic discussion lists, soliciting responses to the survey. Nine lists were addressed, which were WEB4LIB (for library-based World Wide Web managers), Oregon libraries (libs-or), American Society for Information Science and Technology (ASIS&T), the Chinese-American Librarians Association (CALA), INNOPAC users (INNOPAC list), Linux in Libraries (LIL) special interest group, local area networks,

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ASIS&T (siglan), and the Information Technology Division of the Special Libraries Association (SLA-DITE).

A total of 248 responses were recorded. The script did not perform any error checking, so it was possible for someone to submit a blank response; but only three blank responses were received. The results were imported into Excel, which was then imported into SPSS version 10.

Results

The majority of the respondents were from academic institutions, with other types of libraries less well represented:

- academic libraries – 50.2 percent;
- public libraries – 18.78 percent;
- corporate libraries – 13.47 percent;
- medical (hospital, health, etc.) libraries – 4.49 percent;
- other – 4.49 percent;
- school libraries – 3.27 percent;
- government libraries – 3.27 percent;
- law libraries – 1.22 percent;
- non-profit libraries – 0.82 percent.

The survey results indicate that respondents represent various job categories:

- technical services – 16.46 percent;
- administration – 14.81 percent;
- systems librarians – 14.40 percent;
- reference librarians – 13.99 percent;
- database librarians – 7.82 percent;
- Web resource librarians – 7.41 percent;
- library systems support – 6.58 percent;
- solo librarians – 4.12 percent;
- Webmasters – 3.29 percent;
- information librarians – 2.06 percent;
- research librarians – 2.06 percent;
- other – 7 percent.

After establishing where respondents worked and what they did, the first question asked was what the library currently uses for desktop storage. The respondents were given the opportunity to select as many options as they desired. See the results below:

- Hard drive – 83.9 percent;
- floppy disk – 79 percent;
- network (LAN) – 77.8 percent;
- Zip disk – 39.5 percent;
- CD-RW – 19.4 percent;
- tape drive – 13.3 percent;
- Internet drive (e.g. X-drive) – 7.7 percent;
- RAID – 4.8 percent;
- Other – 3.6 percent;
- Superdisk (LS-120) – 2.8 percent;
- DVD-RW – 0.4 percent.

As the results demonstrate, hard drives are predominantly favored, and floppy disks and LANs are also widely used. Among the newer technologies, only the Zip drive and CD-RW had more than limited usage. Among the options classified under "other" were Iomega's Jaz 1Gb and 2Gb disks (cited by just one respondent) and use of a remote server for data storage.

Also we were interested in finding out what other storage options were available in libraries for patrons and staff. Not surprisingly, the results are similar to those of the first survey question, although the percentages are somewhat different. Again, multiple selections could be made:

- floppy disk – 46.4 percent;
- network (LAN) – 36.3 percent;
- hard drive – 34.7 percent;
- Zip disk – 33.9 percent;
- CD-RW – 25.4 percent;
- tape drive – 21.8 percent;
- Internet drive (e.g. X-drive) – 9.3 percent;
- Superdisk (LS-120) – 6.5 percent;
- RAID – 6.0 percent;
- Other – 5.2 percent;
- DVD-RW – 2.0 percent.

Again, a majority selected floppy disks and hard drives. A network connection (LAN) was another popular option.

We asked what storage media libraries would choose, if floppy disks were discontinued. Choices were to be ranked. Interestingly, the most popular first choice (66.9 percent of respondents) was network storage. The other choices selected by a majority of respondents were: a hard drive (52 percent) and a Zip drive (52.4 percent). Somewhat less popular was CD-RW (48.4 percent), while 19 percent chose DVD-RW. Of those, it would be their second choice and third choice. Least popular, in descending order of preference, were: tape drive

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and the Internet drive (15.3 percent each) a Superdisk (12.5 percent), RAID (5.6 percent); and only 3.2 percent chose something as Other, such as a network-attached storage device (Dell Power Vault 705N).

We used a *t*-test and found a statistically significant relationship ($p = 0.05$) between academic institutions and their choices. The *t*-test determines whether the differences between group averages could have occurred by chance. Lower case *p*s are the *p*-value, which represent a decreasing index of the reliability of a result, e.g. the probability of error in accepting an observed result as valid. The higher the *p*-value, the less believable the relationship is between variables. A 0.05 level of significance means that there are five chances in 100 trials that a difference would occur by chance.

Almost all academic libraries use hard drives (89.43 percent said yes) for their primary storage. While a majority of academic libraries use Zip disks (52.03 percent) for primary storage, almost the same percentage (58.54 percent) would not use Zip drives as replacements for the floppy disk. Also most academic libraries would not use Internet storage services (86.99 percent said no).

We also found a statistically significant relationship between the type of job and the current use of CD-RW, tape drives and Zip drives for storage. CD-RW is not widely used among systems librarians (82.9 percent said that they do not use it versus 17.1 percent ($n = 6$; lower case *n*s represent the sample size) who do, technical services librarians (72.5 percent no, versus 27.5 percent who do ($n = 11$)), Web resource librarians (72.2 percent do not versus 27.8 percent ($n = 5$) who do). Webmasters were split evenly between those who do and do not use CD-RW ($n = 4$). Use of CD-RW has a little more support among other types of librarians: 40.0 percent ($n = 10$) of solo librarians, 31.6 percent of database librarians ($n = 6$), 37.5 percent ($n = 6$) of library systems support respondents, 8.3 percent ($n = 36$) of administrators or those in library administration, and 5.9 percent ($n = 34$) of reference librarians (see Tables I to III).

Not surprisingly, use of tape drives for current desktop storage is not a popular choice. Webmasters are an exception; 87.5 percent ($n = 7$) indicated that they use tape. Other respondents who reported use of tape were: 22.9 percent ($n = 8$) of systems librarians, 30 percent ($n = 12$) of technical service librarians, 25.0 percent of library systems support and administrative ($n = 4$) and ($n = 9$), respectively, and 27.8 percent ($n = 5$) of Web resources librarians.

Use of Zip disks is greatest among these categories of librarian: webmasters, 62.5 percent ($n = 5$); database librarians, 52.6 percent ($n = 10$); library systems support, 50 percent ($n = 8$); technical services, 47.5 percent ($n = 19$); information librarians, 40.0 percent ($n = 2$); system librarians, 37.1 percent ($n = 13$).

We asked respondents why their library would choose a particular solution to floppy obsolescence. The choices included: economic reasons, ease of use, technological advantage and in-house expertise. They could make multiple choices. Ease of use (69.0 percent) and economics (49.6 percent) were the primary reasons, followed by in-house expertise (36.7 percent). Only 26.6 percent chose technological advantage, and 7.3 percent said that they did not know why. A small number of respondents (10.9 percent) chose to write their own comments. One wrote:"All these would be considerations, though the answer is not obvious at this time." A technology manager at a public library wrote: "We are looking for the storage media that has the best market penetration. We want to serve as many customers as possible with maybe one or two storage solutions". Several people cited security as a reason. One person stated "in-house inexpertise".

We used a *t*-test to determine whether there were any statistically significant differences in the averages between academic and non-academic libraries. We found that CD-RW, Network and Internet drives were picked most by academic libraries versus all others as potential replacements for the floppy disk. Since a value of one, the lowest number, indicates the most preferred choice, lower

Table I Job type and CD-RW use

		Systems librarian	Technical services librarian	Web resources librarian	Webmaster	Database librarian	Library systems support	Administrative	Solo librarian	Reference	Information
CD-RW											
No	Count	29	29	13	4	13	10	33	6	32	5
	Percentage	82.9	72.5	72.2	50.0	68.4	62.5	91.7	60.0	94.1	100.0
Yes	Count	6	11	5	4	6	6	3	4	2	
	Percentage	17.1	27.5	27.8	50.0	31.6	37.5	8.3	40.0	5.9	
Total	Count	35	40	18	8	19	16	36	10	34	5
	Percentage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: Pearson chi-square = 26.069; significance = 0.01

Table II Job type and tape use

		Systems librarian	Technical services librarian	Web resources librarian	Webmaster	Database librarian	Library systems support	Administrative	Solo librarian	Reference	Information
Tape											
No	Count	27	28	13	1	15	12	27	9	32	5
	Percentage	77.1	70.0	72.2	12.5	78.9	75.0	75.0	90.0	94.1	100.0
Yes	Count	8	12	5	7	4	4	9	1	2	
	Percentage	22.9	30.0	27.8	87.5	21.1	25.0	25.0	10.0	5.9	
Total	Count	35	40	18	8	19	16	36	10	34	5
	Percentage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: Pearson chi-square = 31.749; significance = 0.00

Table III Job type and Zip use

		Systems librarian	Technical services librarian	Web resources librarian	Webmaster	Database librarian	Library systems support	Administrative	Solo librarian	Reference	Information
Zip											
No	Count	22	21	13	3	9	8	28	9	26	3
	Percentage	62.9	52.5	72.2	37.5	47.4	50.0	77.8	90.0	76.5	60.0
Yes	Count	13	19	5	5	10	8	8	1	8	2
	Percentage	37.1	47.5	27.8	62.5	52.6	50.0	22.2	10.0	23.5	40.0
Total	Count	35	40	18	8	19	16	36	10	34	5
	Percentage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: Pearson chi-square = 20.322; significance = 0.04

averages indicate preferred choices. Non-academic libraries (M = 2.41; capital Ms are the mean) rated CD-RW lower than academic libraries (M = 3.11). Academic libraries (M = 2.56) rated network storage more than all other libraries (M = 2.03). However, academic libraries rated Internet drives (M = 3.14) less than everyone else (M = 4.71). These differences are all statistically significant ($p < 0.05$).

When we asked respondents whether they had plans for desktop storage, 16.1 percent said yes, 58.3 percent said no and 25.6 percent indicated that they did not know. We left a space for respondents to write their plans, if they had them, and 11.30 percent did so. One

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wrote, "To complete saturation of Zip drives, and begin acquisition and move toward CD-RW drives." Another stated: "Currently, we plan to use floppy drives for public, but will be getting new machines with zip drives. Staff machines are not as big a concern at present, but we encourage and train staff to use the network drives." Another replied: "It is preferred that all library staff have and use CD-RW drives for periodic personal back-up. The reasoning, I believe, is that once the drives are installed, CDs are relatively economical to use and discard." Yet another wrote: "We have not discussed the issues of storage without 3.5in. floppy disks. A lot of students email themselves information, papers, etc. as it is now because we charge 10¢ a page to print. I guess that that kind of storage would be considered LAN or server storage on the university e-mail server." Another good example: "We are re-examining what types of files we need to keep and in what format we will need to store them." Finally, "Resources and partnerships are developing so it is hard to predict why in a given instance."

We inquired next whether the library would install floppy drives in new PCs, and, if so, what was planned. Only 22.0 percent of respondents said no and 32.0 percent said they did not know. Of the 46.1 percent who said yes, only 18.10 percent wrote down what their plans are. One respondent wrote: "Most likely, as we have items that would not make sense to convert to CD-ROM." Another wrote: "Until the students get the message and arrive zip-ready, we will. The truth is floppies that are cheap, easy to get and in an emergency we can afford to give them out. The same cannot be said of any other storage medium." Another: "Currently, CD writing is cumbersome and requires specialized software. It takes little knowledge to write to a floppy. Until the technology is improved, we would most likely continue to use floppy drives. Presently, we encourage our users to save their files to the network, where they can be backed up easily."

Matsushita, AKA Panasonic, is supposedly releasing a new floppy disk drive that stores 20 times the data of a conventional floppy disk (Williams, 2001). We asked whether libraries would install this new drive; 41.3 percent said yes, 9.1 percent said no, and 49.6 percent did not know. If the drive were to be installed, we asked whether it would be for patrons, staff or both. We also gave them the option of saying that it was not applicable. The majority (64.9 percent) chose "not applicable"; 22.9 percent would install it for both patrons and staff, 11.8 percent would install the drive for staff, and only 0.4 percent would install it only for patrons.

We concluded the survey by asking six Likert scale questions to gauge our respondents' attitudes toward portable data storage. (A Likert scale is used to represent people's attitudes to a topic.) It provides a way for respondents to quantify varying degrees of agreement or disagreement with a given statement. First, we asked respondents, "On a scale of 1-5, 1 being not important, please rank the importance of data storage for your library staff." The majority (55.2 percent) said very important, 18.3 percent said important, 6.6 percent said somewhat important, 17.8 percent said neither, and only 2.1 percent said not important.

We next asked them to rank the importance of data storage for library patrons. Here only 21.8 percent said very important, 13 percent said important, 15.5 percent said somewhat important, 20.9 percent said not important, and 28.9 percent were neutral.

Third, we asked respondents to rank the importance of portable data storage for library staff, with these results: 8 percent said not important, 21 percent said somewhat important, 29 percent said neither, 19.3 percent said important, and 22.7 percent said very important.

Fourth, we asked respondents to rank the importance of portable data storage for their library patrons; 16.4 percent said not important, 14.7 percent said somewhat important, 21.4 percent said neither, 17.6 percent said important, and 29.8 percent said very important.

Fifth, we asked respondents to rank the impact of the forecast obsolescence of the floppy disk; 10 percent said not important, 19.6 percent said somewhat important,

25.4 percent said neither, 19.2 percent said important, and 25.8 percent said very important.

Finally, we asked them to rank the importance of cost as a factor in choosing a desktop storage option. Cost proved to be an important consideration to over half the respondents (37.7 percent said very important and 36.4 percent said important). Only 3.3 percent said not important, 6.3 percent said somewhat important, 16.3 percent said neither (see Tables IV-IX).

Interestingly, we found a significant relationship between academic libraries and their responses to three questions: question 11 (regarding the importance of data storage for library patrons), to question 12 (regarding the importance of portable data storage for staff), and to question 13 (the importance of portable data storage for patrons). These differences are all statistically significant ($p < 0.05$) according to the t-test. Since 1 indicated not important at one end of the scale and 5 indicated very important, higher averages indicate a preferred choice. Academic libraries ($M = 3.19$) voted more significance to patron storage than all others ($M = 2.80$). As for the importance of portable storage for staff, academic libraries

Table IV Importance of data storage for staff

	Frequency	Percentage	Valid percentage	Cumulative percentage
Not important	5	2.0	2.1	2.1
Somewhat important	16	6.5	6.6	8.7
Neither	43	17.3	17.8	26.6
Important	44	17.7	18.3	44.8
Very important	133	53.6	55.2	100.0
Total	241	97.2	100.0	
Missing	7	2.8		
Total	248	100.0		

Table V Importance of data storage for patrons

	Frequency	Percentage	Valid percentage	Cumulative percentage
Not important	50	20.2	20.9	20.9
Somewhat important	37	14.9	15.5	36.4
Neither	69	27.8	28.9	65.3
Important	31	12.5	13.0	78.2
Very important	52	21.0	21.8	100.0
Total	239	96.4	100.0	
Missing	9	3.6		
Total	248	100.0		

Table VI Importance of portable data storage for staff

	Frequency	Percentage	Valid percentage	Cumulative percentage
Not important	19	7.7	8	8
Somewhat important	50	20.2	21	29
Neither	69	27.8	29	58
Important	46	18.5	19.3	77.3
Very important	54	21.8	22.7	100.0
Total	238	96	100.0	
Missing	10	4		
Total	248	100.0		

Table VII Importance of portable data storage for patrons

	Frequency	Percentage	Valid percentage	Cumulative percentage
Not important	39	15.7	16.4	16.4
Somewhat important	35	14.1	14.7	31.1
Neither	51	20.6	21.4	52.5
Important	42	16.9	17.6	74.2
Very important	71	28.6	29.8	100.0
Total	238	96	100.0	
Missing	10	4		
Total	248	100.0		

Table VIII Impact of obsolescent forecast of floppy disk

	Frequency	Percentage	Valid percentage	Cumulative percentage
Not important	24	9.7	10.0	10.0
Somewhat important	47	19.0	19.6	29.6
Neither	61	24.6	25.4	55.0
Important	46	18.5	19.2	74.2
Very important	62	25.0	25.8	100.0
Total	240	96.8	100.0	
Missing	8	3.2		
Total	248	100.0		

Table IX Cost as a factor in choosing desktop storage

	Frequency	Percentage	Valid percentage	Cumulative percentage
Not important	8	3.2	3.3	3.3
Somewhat important	15	6.0	6.3	9.6
Neither	39	15.7	16.3	25.9
Important	87	35.1	36.4	62.3
Very important	90	36.3	37.7	100.0
Total	239	96.4	100.0	
Missing	9	3.6		
Total	248	100.0		

(M = 3.52) found more importance than other libraries (M = 3.04). Academic libraries (M = 3.54) also put more importance on portable storage for patrons than did other libraries (M = 3.05). One academic librarian wrote: "I felt weird answering 4 to the question above about the importance of data storage for our patrons. I think that access to information is very important to our library . . . but I cannot see my library worrying about providing storage space for our patrons – actually we do not provide it now. The university offers storage space but only for e-mail and Web pages to students. Staff, on the other hand have storage space on the library server provided for our use."

We concluded the survey by providing a space for additional comments. A total of 18.5 percent chose to leave a response. The comments ranged from hostile one-liners ("Kind of a non-issue subject ") to further thoughts ("I'm happy to complete this survey, but the concern that is not addressed exactly is that it is unlikely that a library would first and foremost consider the mix of options available. Of greater

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concern than simply the demise of the floppy would be transferring any data currently stored in that medium only.") A few respondents were confused by the survey. They were not clear whether we were talking about the importance of floppy disks to staff or patrons.

Web methodology

If we conducted another survey, we definitely would use the Web again and script it. It might be better, if error checking were performed, so that the respondents were forced to answer questions. In some instances, respondents were given a chance to fill in blanks, if they made a particular choice that needs explanation. Some would indicate a special circumstance, but fail to express what that was. Error checking would prevent non-responses and is easily accomplished in PERL. PHP is another scripting language that could be used to automate this process. PHP can be faster to produce than PERL.

Web-based surveys have no costs, as in mailing questionnaires, and there is no chance of entering data incorrectly. It is very easy to import plain text into Microsoft Excel and import the resulting spreadsheet into SPSS. On the other hand, unlike mailed surveys, there is no way of knowing the return rate. One could make an educated guess as to how many people are subscribed to a particular discussion list, and assume that their e-mail addresses are valid and that they see the message advertising the survey.

Conclusion

From our survey, it appears that libraries (especially academic) do not have a plan to cope with the forecast obsolescence of the 3.5in floppy disk. However, most libraries are willing to install floppy disks, if PC manufacturers stop installing them. Also, academic libraries by their nature are as concerned with supplying storage space to patrons as to staff. We also found that if the floppy disk is discontinued, the top choices for replacements, in order of preference, are the LAN, Zip disks, CD-RW, and hard drives. Tape drives and Internet drives are the least likely to be picked. The discussion lists to which we posted are primarily aimed at academic libraries, which may have caused the results to be skewed.

Finally, it should be noted that our survey addressed only one aspect of a much greater problem associated with advances in computer technology. Traditionally, librarians have been more concerned with providing information and not providing storage space. With the digitization of libraries, however, we need to begin thinking of storage space for both staff and patrons. The National Library of Australia conducted a trial to migrate data from floppy disk to recordable compact disc (CD-R) in order to investigate the usefulness of this information preservation method. The results of their trial indicated that "this was more an exercise in copying data from one medium to another, which is only a part of the process of migration, than complete migration across technologies . . . it does not adequately address the problems of changing operating systems or associated software dependencies" (Webb and Woodyard, 1998). It would be interesting to investigate whether libraries have begun to plan for this.

References

Bennett, H. (1999), "CD-R/RW on the go", *E-Media Professional*, April.

Bisby, A. (1998), "Storage junkies will like this CD-rewritable drive", *Computing Canada*, November 16.

Brownstein, M. (2000), "Hewlett Packard clarifies storage plans", *Computer Technology Review*, 1st quarter.

Cary, C. (1999), "Where will you put it?", *Inform*, January.

Grulke, T. (2000), "SANs vs NAS: what you should know and why you should care", *Computer Technology Review*, December.

Harney, J. (1999), "Virtual storage: the new model for access to enterprise applications", *Inform*, September/October.

Herther, N.K. (1998), "Removable media for back-up and storage today", *Database*, April/May.

Hunt, J. (1999), "Will your back-ups still be there when you need them? Fend off data degradation", *Quality*, May.

Kaczeus, S.L. (2000), "The return of removable hard disk drive architecture", *Computer Technology Review*, July.

Library Systems Newsletter (2000), "A look at desktop storage options", *Library Systems Newsletter*, November, Vol. 20 No. 11, pp. 83-5.

Notess, G.R. (2000), "Online storage opportunities", *E-content*, December.

Waltner, C. (2000), "Desktop storage gets complicated", *InformationWeek*, October 2.

Webb, C. and Woodyard, D. (1998), "Migration trials: from floppy disk to recordable compact disc (CD-R)", *LASIE*, September.

Williams, M. (2001), "Will the floppy disk find new life?", available at: www.pcworld.com/news/article/o,aid,4050,oo.asp (accessed February 6).

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Appendix. Original Web survey

Figure A1

Library Survey of Desktop Storage Options
Technology is changing fast. It is predicted that the 3.5-inch diskette drive on PCs will soon be discontinued by the computer industry. PCs with CD/DVD drives are becoming standard. Libraries are challenged to rethink their desktop storage options in preparation for this change. The purpose of this survey is to gather information on the desktop storage options used or to be used in libraries. Responses to this survey will be summarized, and the results will be sent to those who participate in this survey if requested. All answers will be kept confidential. This survey should take only 5 minutes to complete.

1 What type of library do you work in?

- Academic
- Public
- Corporate
- School
- Other (please specify)

2 What is your position in the library?

- Systems Librarian
- Technology Manager
- Web Resources Librarian
- Webmaster
- Database Librarian/Manager
- Library Systems Support
- Other (please specify)

3 While at work, what do you currently use for desktop storage? (Check all that apply)

- Floppy disk
- Tape drive
- Hard drive
- Zip disk
- Superdisk (LS-120)
- CD-RW
- DVD-RW
- Network (Local Area Network)
- Internet drive (e.g. Xdrive)
- RAID
- Other (please specify)
- Don't know

4 What other options are available in your library? (Check all that apply)

- Floppy disk
- Tape drive
- Hard drive
- Zip disk
- Superdisk (LS-120)
- CD-RW

(*Continued*)

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Figure A1

- DVD-RW
- Network (Local Area Network)
- Internet drive (e.g. Xdrive)
- RAID
- Other (please specify)
- Don't know

5 If floppy disks are discontinued, what storage media would your library choose instead? (Indicate your preference with 1,2,3...)

- Tape drive not applicable
- Hard drive not applicable
- Zip disk not applicable
- Superdisk (LS-120) not applicable
- CD-RW not applicable
- DVD-RW not applicable
- Network (Local Area Network) not applicable
- Internet drive (e.g. Xdrive) not applicable
- RAID not applicable
- Other (please specify) not applicable
- Don't know

6 Why would your library choose this solution? (Check all that apply)

- Economic reasons
- Ease of use
- Technological advantage
- In-house expertise
- Other (please specify)
- Don't know

7 Does your library have current or future plans for desktop storage?

- Yes
- No
- Don't know

If yes, please describe your plans:

(*Continued*)

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Figure A1

8 Would your library install floppy drives in new PCs?

- Yes
- No
- Don't know

If yes, please describe your plans:

9 A new drive is about to be released ($87) that will use the same floppy, but will hold twenty times the data. Would your library use this new drive?

- Yes
- No
- Don't know

If yes, would you use it for library staff or patrons? not applicable

10 On a scale of 1-5, 1 being not important, please rank the importance of data storage for your library staff:

1 not important

2

3

4

5 very important

11 On a scale of 1-5, 1 being not important, please rank the importance of data storage for your library patrons:

1 not important

2

3

4

5 very important

12 On a scale of 1-5, 1 being not important, please rank the importance of portable data storage for your library staff:

1 not important

2

3

4

5 very important

(*Continued*)

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Figure A1

13 On a scale of 1-5, 1 being not important, please rank the importance of portable data storage for your library patrons:

- 1 not important
- 2
- 3
- 4
- 5 very important

14 On a scale of 1-5, 1 being not important, please rank the impact of the forecast obsolescence of the floppy disk:

- 1 not important
- 2
- 3
- 4
- 5 very important

15 On a scale of 1-5, 1 being not important, please rank the importance of cost as a factor in choosing a desktop storage option:

- 1 not important
- 2
- 3
- 4
- 5 very important

16 Any additional comments:

17 Thank you very much for your interest and time in completing the survey.

If you wish to have the results e-mailed to you, kindly include your name and e-mail address:

name:

e-mail:

RLG DigiNews
RLG's online newsletter for digital imaging and preservation

FAQ

One Last Spin: Floppy Disks Head Toward Retirement

Author: Richard Entlich - Cornell University (rge1@cornell.edu)

It appears the floppy disk is going the way of the long playing record and the rotary dial telephone. Is there any cause for concern?

Stories about the death of the floppy disk have been coming with increasing frequency in recent years and there are clear signs that the venerable floppy is on its way out. Apple introduced its first floppy-free design (the original iMac) in 1998 and not long afterward eliminated floppy drives from all its systems. Most laptop manufacturers removed floppy drives as standard equipment years ago. Dell announced in early 2003 that its high-end desktops would no longer include floppy drives and other manufacturers have made similar moves. Widespread availability of high-speed networks, CD writers, USB keys, and other data transfer and storage technologies — along with the floppy's paltry capacity in a world of huge multi-media files — have dramatically lessened dependence on this once essential technology.

All technological change produces a certain amount of dislocation. Floppy disks have been around in one form or another for over 30 years and have already caused their share of heartache. The length, depth, and nature of one's relationship with this technology will determine whether its decline will be greeted with panic, concern, a shoulder shrug, or a cry of joy. Read on to see whether you're ready to say a painless goodbye to the floppy.

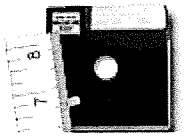
Background

Those who are familiar with the history of small computers since their advent in the 1970s know that floppy disk technology has come in three major waves. In 1971, IBM introduced an 8" variety, initially as a data loading peripheral for its System/370 mainframe computers. Five years later, in 1976, Shugart Associates brought out a 5.25" version, dubbed the minifloppy, that became the standard in IBM PCs and their many clones during the early to mid-1980s.

In 1981, Sony debuted the 3.5" floppy that was adopted by Apple for its Macintosh computer in 1984 and gradually became the predominant form of floppy, displacing all other designs. The 3.5" floppy [1] (also called a microfloppy) became ubiquitous not only on computers, but other electronic equipment as varied as music keyboards, laboratory instrumentation, and medical diagnostic devices.

Many other floppy designs were proposed, in a range of sizes from two to four inches. Few had any real market impact, but the 3" floppy designed by Hitachi was utilized in several mid-1980s computers, most notably some models by Amstrad. We can be thankful, however, that "only" three major size variants of floppies exist, for there is no shortage of technical usage issues among them.

Design and Usage Issues



Many people have never seen an 8" floppy disk, but if you've seen a 5.25" one, you can easily picture its larger forbearer. Besides size, the two were essentially identical in appearance. Both consisted of a round flexible plastic disk with a magnetic

also considerably more expensive. It should be noted that the data on even badly damaged floppies can often be fully recovered, though heroic rescue is quite expensive and should be reserved only for especially valuable data.

Due to the sheer number of compatible systems still around, data stored on PC microfloppies, if properly stored, is probably not immediately threatened with loss. However, even though there are plenty of older Macintosh systems with internal or external USB floppy drives still around, it is certainly time to start moving data on Mac floppies to other media. In fact, all 400KB and 800KB Macintosh microfloppies written using the MFS file system are already in greater danger, since support for that file system was last provided in MacOS v.7.5.5, which was superseded in 1997 and definitely qualifies as obsolete.

For data that must remain on a floppy in order to be usable, disk images will help extend the life of the data while allowing migration of the media. Windows, MacOS Classic, and Unix/Linux all have utilities available for creating and reading floppy disk images. See the resource listings for further information.

Conclusions

The history of the floppy disk provides an excellent object lesson in the management of content on digital media. All media is subject to obsolescence. Media types that are less mainstream, less standardized, and less widely adopted are hit harder and faster by obsolescence. If one is paying any attention, there is generally ample opportunity to recognize that a medium is headed for obsolescence at a time when migration can be accomplished relatively painlessly and inexpensively. Of course, it goes without saying that no data of value should be stored on only a single piece of media. Placing backup copies on different kinds of media diminishes the likelihood of loss.

Most physical media formats go through a period of evolution before reaching a dead end. Typically, the storage capacity is increased one or more times and it is often the case that later generation drives are backward compatible with one or even two generations of previous capacities. It's easy to be lulled into complacency by backwards compatibility, but once a media capacity is no longer the current specification, it is time to consider migrating data to newer formats.

A dead end occurs when backwards compatibility is no longer available. All three common sizes of floppy disks should now be considered to be at a dead end, including the still popular microfloppy. There is no forward migration path that allows data to remain safely on microfloppies. In the late 1990s, there were several efforts to develop high-capacity removable media drives that could also read standard 3.5" floppies. Notable among these were the Imation SuperDisk and the Sony HiFD. Neither survived in the marketplace.

What will replace the floppy? None of the dozens of proprietary, higher-capacity, removable, magnetic media devices that have emerged in the past ten years can lay claim to the crown. Some contenders, like those from SyQuest and Iomega's Jaz, were discontinued. Others, like the Castlewood ORB, have tiny installed bases. Even Iomega's successful Zip drive has nothing like the huge installed base of microfloppy drives, and Zip disks exist in three different capacities, meaning that owners of the older drives cannot read the newer disks. Finally, the media for all of these drives (and for USB key drives where the media and drive are one unit) is too expensive to be parted with casually.

Only CD drives and media, which like the microfloppy are based on international standards, come anywhere close to matching the floppy's universality and low-cost media. But CDs lack many of the microfloppy's most desirable characteristics. Thus, we can expect that users will gravitate to a variety of floppy replacements that best meet their specific needs. A survey of libraries conducted in 2001 by Hendricks and Wang [3] found no consensus on a target technology to replace floppies and concluded that " ... libraries, (especially academic) do not have a plan to cope with the forecast obsolescence of the 3.5in floppy disk."

A recent article [4] from *The New York Times* suggests that the problem of preserving data on obsolete storage media will be solved by for-profit computer museums. It posits the emergence of "a whole industry of people who will have shops of old machines, like the original Mac Plus." This seems unlikely, given the enormous technical obstacles to such an

Rather than relying on "Ye Olde Antique Computer Shoppe" to save the day, long-term digital stewardship requires vigilant

sectored disks had one hole for each sector.

3Hendricks, Arthur, and Jian Wang, "Libraries and desktop storage options: results of a Web-based survey," *Library Hi-Tech*, v.20, no.3, 2002, pp. 270-284.

4Hafner, Katie, "Digital Memories, Piling Up, May Prove Fleeting," *The New York Times,* Wednesday November 10, 2004, Late Edition - Final, Section A, Page 1, Column 3.

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Question format and response elicitation

Open ended questions
Closed questions
Alternatives

There are two main types of question format:

Open ended	in which the format of the response is free, with the user phrasing their own replies
Closed ended	in which the respondent selects one or more response from a set of possible answers

Closed ended questions are easier for the respondent to answer, and also to code and analyse, than **open ended** questions which require content as opposed to statistical analysis. They should therefore be used sparingly in questionnaires, if at all.

For a discussion of these issues, see 'Open versus closed questions - an open issue' by Gerald Vinten.

Open ended questions

According to Peterson (2000)[1] there are a number of instances when open ended questions may be appropriate:

- when it is not easy to foresee the answers
- when the responses may be influences by the choices
- when the variables measured dictate unaided recall
- where flexibility is called for by unanticipated events
- where initial responses necessitate more in-depth follow-up questions.

Open questions are often used when carrying out research on issues prior to developing a questionnaire, in order to find out more background information and develop hypotheses on which to base questions.

Closed questions

These questions require some skill in writing, but are easier to code and analyse. The main types are as follows:

Multiple choice

The most straightforward format, this involves selecting from a

range of options, as in the following example, taken from 'Libraries and desktop storage options: results of a Web-based survey':

1 What type of library do you work in?

- Academic
- Public
- Corporate
- School
- Other (please specify)

2 What is your position in the library?

- Systems Librarian
- Technology Manager
- Web Resources Librarian
- Webmaster
- Database Librarian/Manager
- Library Systems Support
- Other (please specify)

Note the way in which the author has in both instances included an 'Other (please specify)' field for options which are not in the categories provided.

Free choice

Here, the respondent can choose one or more option from a list, which should include all alternatives, and not be mutually exclusive.

Free choice and multiple choice collect *nominal data*, in other words, it is possible to assign a number to the respondent's choice.

Ranked

Here, the respondent is required to list alternatives according to an order, for example the desirable attributes of a holiday, ranked according to importance. The data collected are described as *ordinal*.

Rating

This type of answer rates items according to a scale, as in the following example ('Is your TQM Programme successful? A self-assessment tool for managers'):

Since our firm began implementing a total quality management programme:	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
1 Our TQM efforts have been beneficial in strengthening our competitive position in our industry.	1	2	3	4	5

It is one of the most commonly used methods in management research, and is particularly useful for measuring affective issues such as attitude.

Rating scales are particularly useful for dealing with affective measures - i.e. those that relate to a person's perceptions, beliefs, feelings, attitudes and values towards themselves, individuals or organizations. Their use in management research is common. Because they measure *interval data*, which is a higher order than *nominal* or *ordinal data*, it is possible to apply a wider range of statistical procedures.

There are a number of different ways of measuring affective issues, of which some of the most commonly used in questionnaires are:

Numerical rating scales	Respondent is asked to select a particular numbered response on a scale with either all points 'anchored' (i.e. strongly agree - strongly disagee) or just the beginning and end points
Likert rating scales	Use a numbered scale as above but provide respondent with statements with which to agree/disagree
Semantic differential	Use a numbered scale that is measured by bipolar adjectives
Thurstone scales	Assign ratings to a series of statements which respondents are asked to check those which apply to them
Guttman scales	A similar approach to Thurstone, but here the checking of statements can be cross-checked to see whether or not attitudes are uni-dimensional

An interesting example of the use of **rating scales** is the use of the Likert scale in research on library use and library anxiety as developed by Sharon L. Bostick and used in subsequent research by Qun G. Jiao, Anthony J. Onwuegbuzie in their research on the relationship between anxiety about library use and social interdependence, as published in a number of articles, for example 'Dimensions of library anxiety and social interdependence: implications for library services', in *Library Review*
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An interesting example of use of the Likert scale

You are being asked to respond to statements concerning your feelings about college and university libraries. Please mark the number which most closely matches your feelings about the statement. The number ranges from:

1 = Strongly Disagree 2 = Disagree 3 = Undecided 4 = Agree 5 = Strongly Agree

1. I'm embarrassed that I don't know how to use the library.	1 2 3 4 5
2. A lot of the university is confusing to me.	1 2 3 4 5
3. The librarians are unapproachable	1 2 3 4 5
4. The reference librarians are unhelpful	1 2 3 4 5

Numerical rating scales are used in 'Libraries and desktop storage options: results of a Web-based survey', as in the following example from their questionnaire:

10 On a scale of 1-5, 1 being not important, please rank the importance of data storage for your library staff:

- 1 not important
- 2
- 3
- 4
- 5 very important

The choice of question format will be determined by the type of data you seek to elicit, but also by the level of sophistication of the statistical analysis which you hope to perform - some formats elicit more exact data than others, as we shall explore in the next section.

Alternatives

Many of the points raised earlier about writing questions apply about writing answers:

- ensure that all items listed are strictly necessary to the question objectives
- ensure that all items are clearly worded, and mean the same thing to the respondent as they do to you
- avoid items which make use of jargon, technical terms or words which are outside the sample's knowledge range
- the respondent should not have to look outside the survey -

in other words, try and recall forgotten events

In addition:

- response items should be exhaustive and mutually exclusive
- do not provide too many alternatives - 15 is considered a maximum by some
- decide what order to present the alternatives - this could be random, alphabetical, or with an order dictated by the research objective
- if including very specific questions (e.g. How many cigarettes do you smoke a day? 1-5 etc.) preface it by a screening question (Do you smoke? Yes/no)
- it may be appropriate in some instances to give range variables (0-5, 6-10) etc. in stead of precise measures, for example if asking a question such as 'How many emails do you receive in a day' when precise recall may be a problem
- when using the same question type (for example, multiple choice, Likert scale etc.) use the same response format, as in the examples above.

[1]Peterson, R.A. (2000) Constructing Effective Questionnaires, Sage, Thousand Oaks, CA

The analysis and writing up of questionnaires