E-mail's Contribution to Total Paper Consumption on the U.C. Berkeley Campus: An Investigation of the Printing Behavior of both Students and Staff

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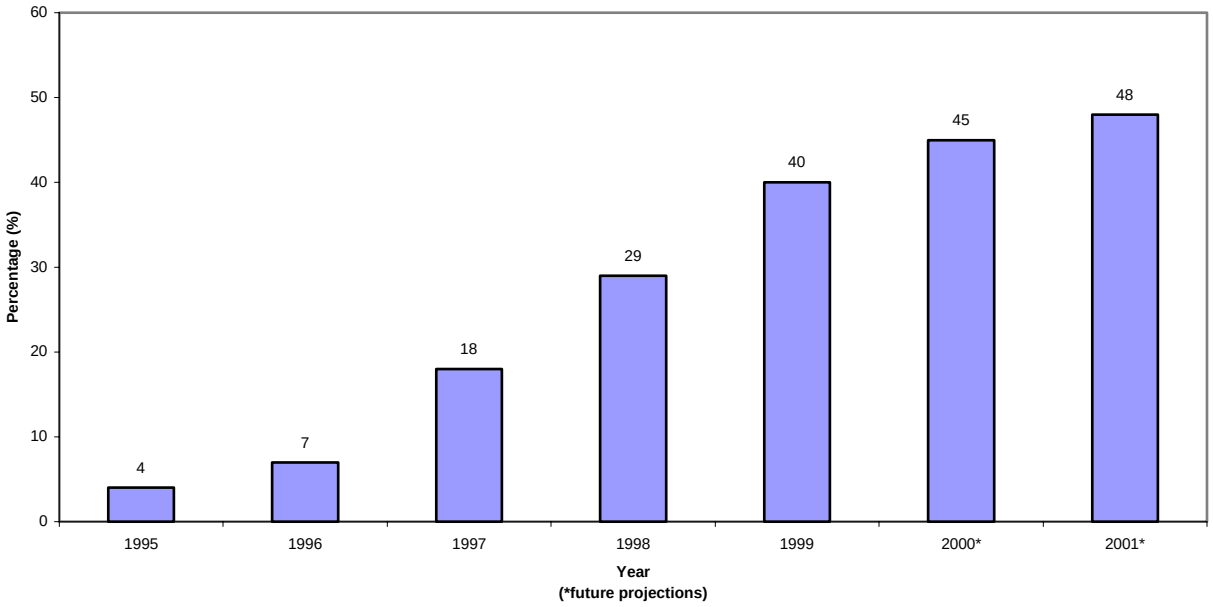
Abstract Digital technologies, such as the Internet, electronic libraries, and electronic mail (commonly called 'e-mail') have fundamental opportunities to reduce paper use. However, digital technologies also provide ample opportunities for vast waste of resources, such as paper. Despite the believable promises of a "paperless, digital future", paper consumption trends have indicated exponentially increases in the United States (Abramovitz *et al.*). The fact that modern technologies have greatly increased the amount of paper output suggests a tendency toward maintaining both digital and paper copies of documents and communications. The consequences of this behavior could exacerbate our already heavy reliance on national resources, namely forests, and possibly be solely responsible for the devastation of natural environments worldwide. By random social surveys, this study provides an examination of printing output dedicated to digital technology (specifically electronic mail) on the University of California, Berkeley campus. An interpretation of this study follows, outlining environmental and social implications, suggestions for future legislative policy, and recommendations for future investigations of printing behavior. Survey results suggest that printed electronic mail is responsible for 10% of the total paper used by U.C. Berkeley students, and 14% of the total paper used by U.C. Berkeley campus employees.

Introduction

Digital technology, such as the Internet, electronic libraries, and electronic mail (commonly referred to as 'e-mail') have fundamental opportunities to increase global efficiency in everything from communication, education and commerce exchange. However, digital technologies also provide ample opportunities for worldwide inefficiencies, such as dramatically increased paper use. Digital technology allows computer users to copy, store, transfer, organize and analyze an enormous amount of information in a fraction of the time that these same processes were performed prior to digital technology, increasing efficiency dramatically. E-mail can support e-mail address lists, so that an individual or organization can send e-mail to a list of individual addresses, other organizations or even other list groups. A digital computer user (sender) can e-mail a message or even send a copy of an entire digital book to over thousands of other computer users (recipients) in seconds, whereas, given the same amount the time, the sender could make very few copies of the same document using non-digital technologies, such as a photocopy machine. Yet, with this increased time-efficiency for information utilization by digital technology, increased inefficiency or deadweight loss is equally possible. Using the same example, the thousands of recipients could all individually print out the sender's document on paper seconds after they have received it, greatly increasing the amount of paper consumed. It should also be noted that with e-mail, one could potentially correspond with any one of the expanding hundreds of millions of other e-mail users worldwide. Another variation of e-mail lists are e-mail-based discussion groups or list servers. Participants can send e-mail to a central mailing list server, and the messages are broadcasted to the other participants. With the hundreds of thousands of discussion groups and list servers used by schools, many fields of specialized industry, administration, and the general internet population, it is not uncommon for a single e-mail message to have thousands of recipients. Also, messages can be easily forwarded. A great example of this is an e-mail that an M.I.T. graduate student sent to three friends regarding his personal correspondences with the Nike Corporation. These friends forwarded the message, and eventually, the same e-mail was sent to 86 million users all across the world (Peretti 2001). The consequences of this, even if just a small percentage of the recipients print their e-mail, could greatly increase paper consumption. According to a 1999 study of numerous business offices, the introduction of e-mail has coincided with an increase in paper consumption by 40% on average in less than five years (Greengard 1999).

Figure 1: Business Increase in Paper Output Due to Email (Workforce 1999)



History shows that corporate business printing of e-mail has been steadily increasing over the last few years, and indicates the possibility that it will continue to increase (Figure 1). The increasing amounts of paper use require additional sources of paper-producing materials, inevitably placing more pressure on the use of natural resources. Previous examinations, like the 1999 study noted, have found that e-mail in particular has been responsible for a sharp rise in paper consumption, but only business offices have been examined. However, attention should also be given to other paper-intensive environments, such as college campuses. Considering the University of California, Berkeley contributed 10 million pounds of office paper to landfills in 1998, it is clear that the campus consumes an enormous amount of paper (Cockrell, 1998). How much of this paper is printed e-mail on the U.C. Berkeley campus? By random social surveys of both students and campus administrative personal, this study will bring to light that printed e-mail presently contributes a notable amount (5-10%) of the Berkeley campus paper use.

Methods

In an effort to more effectively design the social survey to fulfill the specific research objectives, several pilot studies were performed, and modifications were made to the survey

methods and questions. This was necessary to further test the precision, expressions, objectivity, relevance and communication of the survey. Some questions from the initial pilot surveys were eliminated, revised, simplified, or concentrated. A preliminary survey was then conducted and suggested the potential of e-mail greatly contributing to the total paper consumption for U.C. Berkeley students. The pilot survey questions were tested on ten students in Sproul Hall, during the evening (5 to 6 P.M.) of randomly selected weekdays.

A definition of electronic mail (e-mail) was refined, tested and produced. The following definition was given to every participant of the survey:

"Any or several electronic messages created, sent, forwarded, replied to, transmitted, stored, held, copied, downloaded, displayed, viewed, read or printed by one of several e-mail systems or services. This definition of e-mail included pictures and other forms of multimedia sent in the body of the e-mail, but excludes all attached documents."

The final survey study was conducted from January to April, 2001, at three different times of the day, (9 A.M., 2 P.M. and 6:30 P.M.), on consecutive Tuesdays, Wednesdays, Thursdays and Fridays in an effort to make the survey results more representative of the entire student body. This is necessary because similar departments on the Berkeley campus generally have all their classes at one particular time of the day, and in some departments, only on particular days. For example, a science major may only be on campus in the morning, on Monday, Wednesday and Friday, whereas an english major may only be on campus in the afternoon and on Tuesdays and Thursdays. In order to have representatives from every major study field, surveys need to be taken at different times of the day and different days of the week. 200 participants were surveyed from *each of the four survey locations*: (1) Sproul Plaza, Northgate, the West Gate, and the East Gate of Campus. This is particularly important due to the socio-geographic trends that are unique to the Berkeley campus, (for example, more freshman undergraduates live in the resident dormitories and therefore enter campus through Sproul Plaza, whereas many graduate students reside on the North area of Berkeley, and enter the campus through North Gate). Therefore, the surveyed population is more diverse than the population of the preliminary results. Another modification made for the final survey study was that it was not required that the participant have an e-mail account, (in order to get representation for those without e-mail accounts). Photocopy results were recorded in exact numbers (not using a range as was previously done) unless the participant would not remember. In the case where a participant

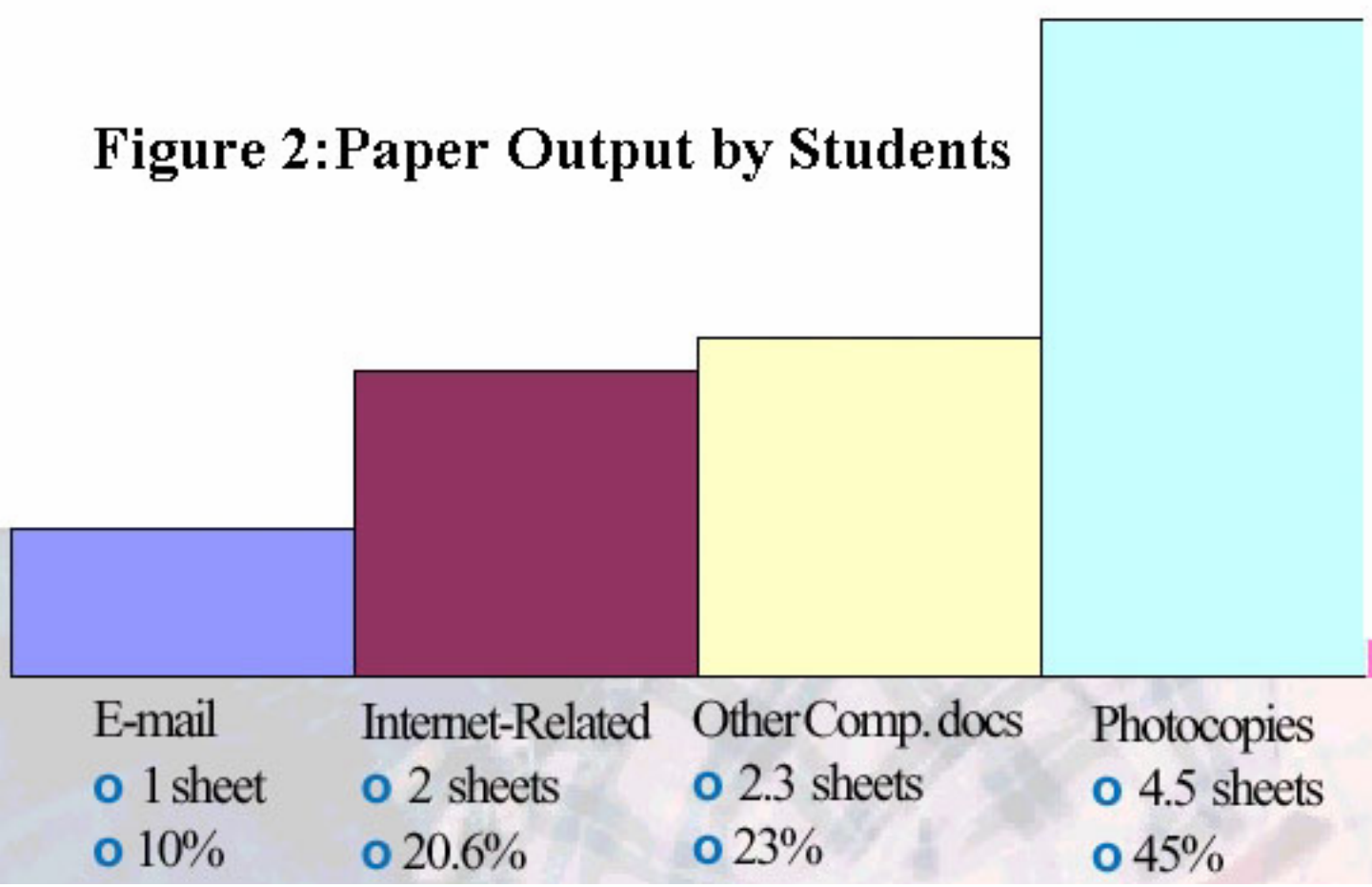
could not remember the exact count of sheets of paper printed or copied in any of the categories, a range was offered. In the case where a participant could not remember what range of sheets of paper printed or copies in any of the categories, the survey was aborted and the rest of the results for that participant were not used for the final study. The survey has been revised to ask for "sheets of paper used for e-mail" instead of "how many e-mails did you print", to make the question more precise. Lastly, the most important revision that was done for the final study was that instead of inquiring about printing output of that current day, (as was done in the preliminary study) participants were asked for their printing output of the previous day.

In addition to the student survey, a survey of U.C. Berkeley administration and other employees was conducted (faculty members, office administrators, janitorial personnel, food service employees, librarians, and lecturers. The same survey used for the student survey was used for the U.C. Berkeley staff, except for the first question, for obvious reasons (see Survey). 100 participants were interviewed in total, most via face-to-face interviews but some by telephone interviews. The results of the student and campus staff social surveys were kept separate, and will be presented separately for analysis in this study. Times and the day of the interviews varied greatly, as it was apparently more difficult for campus staff to find time to be interviewed.

Results

After surveying 800 U.C. Berkeley undergraduate and graduate students, it was found that 94% of those owned computers. Most importantly, the sample population used 7,986 sheets of paper per day, nearly 10 pieces of paper per student, per day. Of this total, 9.97% of the total paper was used to print e-mail, nearly 1 sheet per student (see Figure 2). For comparison, 44.5% of the total paper consumed was used to make photocopies or microfiche copies, 20.6% for printing other Internet documents (2 sheets on average per student per day), 22.9% was used to print non-Internet related computer documents (2.3 sheets average), and a small percentage, 1.81% for other documents, (such as facsimiles) or .17 of a sheet on average. If this sampled population is an accurate example of the U.C. Berkeley student body and represents normal paper usage, then the total amount of paper used by the students every day is over 600 reams, or 300,000 sheets of paper per day, (considering the Fall 2000 enrollment figure of 31,277

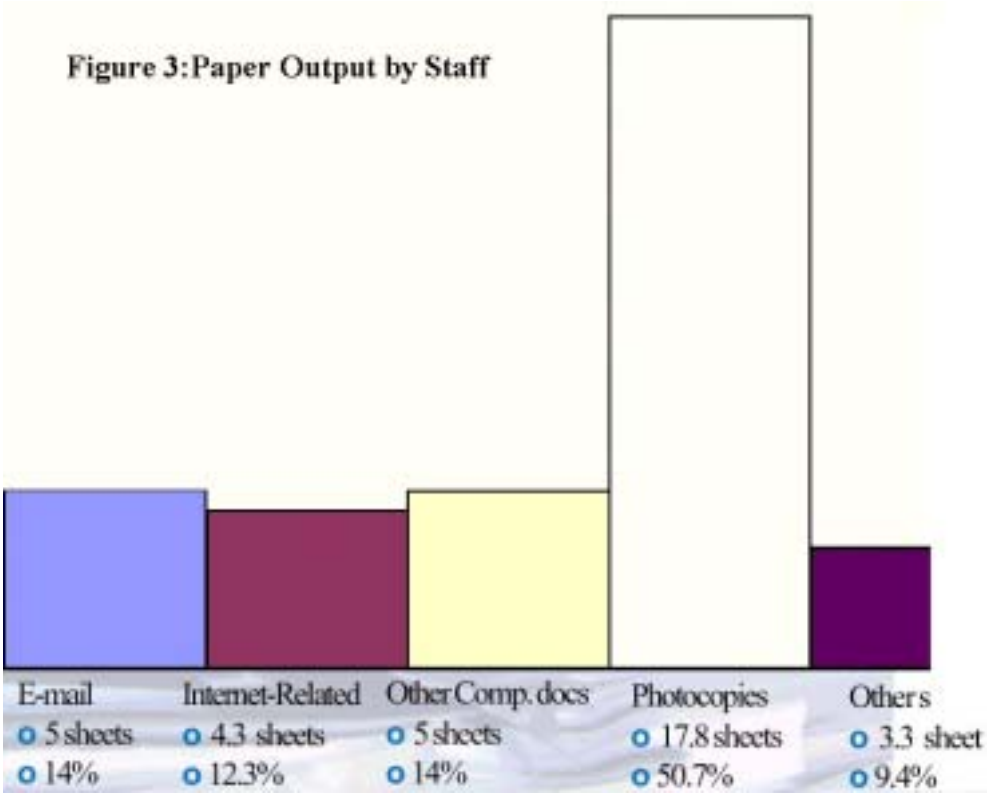
students). This also suggests that over 60 reams, or 30,000 sheets of paper per day are used to print e-mail.



It was found that 10.1% of the student participants used Internet-based e-mail accounts exclusively, 20.5% used either a private Internet Service Provider or a campus account from home or an office connection exclusively, 69.3% of the students had both kinds of accounts, and less than 1% did not have an e-mail account.

After surveying 100 U.C. Berkeley Staff members, it was found the staff sample population used 3,516 sheets of paper per day, or about 35 sheets of paper per staff member, per day. Categorizing this total, 14% of total paper consumed was used to print e-mail, on average 5 sheets per staff member per day (Figure 3). Juxtaposing this to other uses, 50.7% was used for making photocopies or microfiche prints (17.8 sheets on average), 12.3% for Internet-related documents (4.3 sheets average), 13.8% for non-Internet-related documents (5 sheets average), and 9.4% for others (3.3 sheets on average, the majority of this used for facsimile use). If this

sample is indicative of the rest of the U.C. Berkeley staff and represents normal paper usage, then the total amount of paper used by the staff members is almost 400,000 sheets of paper per day (according to Sproul Hall unofficial employment counts of all campus employees, about 11,000) (LaPorte 2001, per. comm.). Most important to this study, this also suggests that over 55,000 sheets of paper are used for printing e-mail.



It was found that 7% of the staff participants used Internet-based e-mail accounts exclusively, 68% used either a private Internet Service Provider or a campus account from home or an office connection exclusively, 10% of the staff members had both kinds of accounts, and 15% did not have an e-mail account.

Discussion

After averaging both population estimates, an average of 17 sheets of paper are used by each person per day. After excluding weekdays, and taking into account that about 10% of most office paper is post-recycled material, it was calculated that 42 trees per day or 3,780 trees per semester are used to provide the U.C. Berkeley campus's paper demands (Wilderness Society 2001). It was also calculated that 4 trees per day or 360 trees per semester are needed to provide

the campus with the paper needed for printed e-mail. Weekends were excluded because this study examined weekdays only, but it has been suggested by interviewed campus staff members that the total paper demand would be even higher if one were to account for paper used during the weekends. (It was found through the surveys that the majority of the campus staff work over the weekends, and if was found through observation that students also work and use great amounts of paper over the weekend.) This is also only considering the ecological consequences of tree and pulp requirements. It should be noted that much energy, fresh water, and hundreds of gallons of calcium bisulfite, sulfurous acid, chlorine, hydrated aluminum sulfate and rosin are used to produce this paper (particular figures are difficult to estimate due to the inconsistency throughout the paper-producing industry.) Many studies have shown how pernicious these chemicals have been to the surrounding environments (Crosby, D.G. *et al.*1971, and Dulin, D., H. *et al.* 1986).

Recent studies have shown that the general outlook for the paper industry is extremely healthy and prosperous, increasing approximately 2.1% each year over the last 10 years, despite the popularity and promises of digital technologies (Ducey and Paper and Pulp Statistics, 2001). One does not even need to thoroughly research market trends to find that our society is increasingly reliant on paper. However, this study has gone beyond that conclusion to show that a substantial percentage (on average, 12%) of paper use on the U.C. Berkeley campus is dedicated to printing e-mail. There are a number of reasons why students and staff members print digital information.

Preservation: There may be a relationship between students who used Internet-based e-mail accounts and e-mail printing. After further research, as of April 3, 2001, it was found that Microsoft's Hotmail, with 50 million users worldwide, has a cap of 2 Megabytes (MB) of e-mail storage, or about 100 e-mails (Yahoo Magazine 2001). A Hotmail user who exceeds this size of e-mail storage will have e-mails automatically thrown away. Yahoo Mail, with 120 million users, has an e-mail storage of 6 MB's, or about 300 e-mails (also uses automated system which purges e-mails after a user exceeds 6 MB) (Yahoo Magazine 2001). Influenced by the fear of having their e-mail thrown away, an Internet-based e-mail user may rely on paper to save e-mails. Private Internet Service Providers (ISP) or other non-Internet-based e-mail users do not have such storage caps, or if they do, they are thousands of times larger than the two popular Internet-based accounts mentioned previously. However, many users find it difficult to backup

their mailboxes (most e-mail software have “Inbox”, “Outbox”, “Sent Items”, and other mailboxes which may have been created by the user.) The average size of the “Inbox” of an e-mail user with popular e-mail software and not an HTML-based account was 23 MB, the “Outbox” average was 3.5 MB, and the average for the “Sent Items” was 10.6 MB (Riley and LaPorte 2001). Given a total average of 37.1 MB, a user would either have to use an “Internet Hard drive” in combination with an extremely fast connection to the internet (>1 KB per second) or a large capacity storage device, such as the use of a Compact Disc Writer or a Zip disk). A study on the U.C. Berkeley campus demonstrated that only about 25% of the student population had either of these backup abilities, and even fewer knew how to back up their e-mail files (Riley and LaPorte 2001). Many other reasons, such as compatibility, portability, low cost, paper familiarity, security, and presentability may also influence students’ and staff members’ decisions to print e-mail.

Trust: This idea slightly overlaps that of preservation, but has it’s own contributions as to why people print. Our culture is familiar with paper. History has taught us how to manage and preserve paper. But, American culture is not yet as comfortable and/or as familiar accessing electronic data. Americans are simply not as trustworthy of digital information as they are with paper. “Most of those surveyed feel as though they have little control over our digital data and e-mail,” (Yomens 2001, pers. comm.). Until people look at their hard drives with the same reverence as they do their metal file cabinets, some people will continue to print e-mail. By 2001, 10 billion e-mails are sent every day, and it is clear the amount of e-mail being sent is exponentially increasing every year (IDC Research 2001). The growth of this form of communication as a new way to share information is becoming staggeringly popular, but the results show that e-mail may still not be as trusted as a permanent, tangible sheet of paper.

Coercion: In 1997, Canada passed the Uniform Electronic Evidence Act, requiring all e-mail documents “sent between, from or to any government agency”, to be printed and filed, in an effort to provide a public record of government correspondences to anyone who can read a piece of paper. The United States followed this behavior, and the National Archives and Records Administration has issued standard guidelines to official records. “Agencies that maintain paper files as their record keeping systems [virtually all of them] shall print their electronic mail records and the related transmission and receipt data specified by the agency,” (Code of Federal Regulations (CFR), part 1228). Government bureaucracies are not the only ones with strict

record guidelines; Profit and Non-profit company official records communicated through e-mail must be both printed and saved electronically, and maintained in both forms as long as needed for ongoing operations, audits, legal actions, or other purposes (CFR 1222). This is consistent especially with the U.C. Berkeley staff, most of whom are required to print out e-mails for record keeping purposes, and easy document retrieval (state employees).

Computer Knowledge: A study by U.C.L.A. (2000) found that only 15% of e-mail users knew how to save copies of outgoing e-mails and how to keep copies of incoming e-mails on the server (Lebo, 2000). Some e-mail programs have an option to do these previously noted tasks. However, many do not, or require a manual operation for every sent e-mail or e-mail delivery, and generally these operations are multi-step tasks. Yet on nearly every e-mail program, it only takes one step to print an e-mail.

Presentability: With digital technologies, one can compile massive databases of information, assemble them into centralized storehouses, and make them easily accessible from virtually anywhere in the world. As is the case in e-mail, one can communicate large amounts of text information across the world in a matter of seconds, but when the time comes for delivering the retrieved information, we often resort to that age-old technology, paper. It is not likely that a U.C. Berkeley student turns in their final paper in digital form to professors.

Physical Strain: According to the latest Wired Magazine study, 83% people start to get headaches, eyestrain, and fatigue using a 15-inch typical SVGA monitor for more than 3 hours (O'Malley 1998). A U.C.L.A. study found that the average e-mail user spends about 1.2 hours per day using e-mail software, and the average computer owner uses the computer 4.6 hours a day (Lebo, 2000). Another important finding from the U.C.L.A. study was that most people complained about the shape of the monitor being inconsistent with e-mails, as monitors are generally in a 'Landscape' shape, and e-mail and actually all text is generally in 'Portrait' shape. Another popular complaint was that the inferior resolution of monitors to that of paper causes some people difficulty when reading without special "computer glasses". Other earlier studies are consistent with this finding: At MIT, a study found that reading comprehension and information retention was better with paper than on monitors for two main reasons: (1) resolution, (2) familiarity with paper (Bull *et al*. 1998). Considering this, there may be an advantage and natural desire to printing e-mail, in that it avoids additional time in front of the monitor.

Compatibility: In 1998, 90% of business information was still on paper. Again, many problems arise with platform incompatibilities and attachment problems (Grenkie 1999). Certainly Americans without Internet access have compatibility problems when they are expected to receive an e-mail. Furthermore, e-mail is saved as a proprietary document format (that is to say the computer code for an e-mail saved with Eudora is completely different and unintelligible by Microsoft Outlook, another popular software e-mail program.) This creates both compatibility problems, and the chance that e-mail files will be difficult to retrieve if the software program that it was saved with becomes obsolete.

Practicality: E-mail may have altered the way in which people communicate, but it has not changed their reading behaviors. There are many places were e-mail users would like to read their e-mails, but the environment is not befitting of containing a computer (such as in the bathtub, on the bus, etc.). In response to computer consumers' opinions of the impracticality of e-mail in electronic form, both Brother and Hewlett-Packard, dominant companies in the computer printer industry, have produced software for their printers that allows every e-mail to be printed out automatically, as soon as a user receives it. In the year 2000, these companies report that 18 million computers have this software, a sharp increase from the 3 million reported for the fiscal year of 1999 (Brother Inc. 2001).

Legal Consequences: The nature of e-mail as a 'dimensionless' communication makes it very difficult for the American court system to apply the same legal regulations as with physical forms of communication, such as a letter. Recent cases are currently questioning the similarities between the privacy rights of a paper document and the privacy rights of an e-mail (Northwest Airlines Inc. v. Teamsters Local 2000, Konop v. Hawaiian Airlines, Inc. 2001, U.S. v. Martin 2000). Under the Fourth Amendment of the United States Constitution, investigative authorities have no legal right to search through a file cabinet of paper documents to find incriminating evidence of a subject, but in Northwest Airlines v. Teamsters Local, (2000), because of how e-mail travels between the sender, the routing servers, and the recipient, it is not awared the same protection a paper document will receive from the courts. This certainly encourages many companies or perhaps individuals to print their e-mails, and delete the electronic versions to avoid these legal consequences.

Additional Note: It should be noted that both the sender and the recipient may print their e-mail correspondences due to any of the factors just covered, producing two copies of the same correspondence.

In observation at the computer centers, I noticed that many people were targets of vast amounts of 'Spam' commercial e-mail. This makes it difficult for them to organize their e-mails in the digital form to separate desired e-mail and 'Spam' e-mail. Many solved this problem by simply printing out the desired ones, and leaving everything else on their e-mail account. Just as an example of what people will do to avoid 'Spam' e-mail, there is a successful for-profit company that charges $49 per month for filtering out e-mail users' junk mail (C.A.U.C.E. Organization 2000). Many e-mail account servers are providing filtering techniques for free, however, the technology is very new. The e-mail filter filters in either two ways (1) it only accepts e-mail from pre-designated senders, or (2) it refuses e-mail from pre-designated senders. 'Pre-designated' means that an e-mail user decides which e-mail domain addresses they wish to receive e-mail from, and the e-mail server automatically rejects any incoming e-mail not previously designated by this user. Because of the fact that this filtering may filter out desired e-mail, Hotmail reports that only about 10% of their e-mail account holders use either of these procedures (Microsoft 2001, elect. comm.). California has recently taken some tough stances against Spam e-mail. AB 1676 prohibits 'Spamers' (those sending Spam mail) from sending unsolicited offers unless a valid toll-free phone number, return postal address, or e-mail address is given with the e-mail. Requests by Spam recipients to be removed from the Spam e-mail list must be honored, according to AB 1676, but enforcement is almost non-existent. Furthermore, most Spam recipients are unwilling to take the time to send a letter or make a phone call to request their removal from the list. Revisions of AB 1676 need to be made to account for this if it is to be effective. AB 1629 outlines damages that a Spam recipient may collect from a Spammer violating these guidelines or the ISP's independent policies, yet, again enforcement is difficult and the civil suit recovery amount of $50, as noted in AB 1629 is unlikely to encourage an e-mail user to file suit. Considering this, it may be possible that people print their desired e-mail to paper, producing a group of desirable e-mail to read, separate from their complete (and possibly cluttered with Spam) e-mail Inbox.

There have been some comments about this study in regard to the rumored government tax of $.05 per e-mail, and how this tax will eventually alter the results. This e-mail tax has been

verified by numerous Internet watchdogs as a hoax, and will not affect the data or the future of this study. Computer experts and government officials find it highly unlikely that a government tax will ever be applied to individual e-mails, as it is far more expensive to track and bill for the amounts of e-mail sent than the amount generated by the tax.

The recent energy crisis on the west coast of the United States is already greatly affecting paper costs, and is likely to reduce the amount of paper used. Eight large paper mills in Washington, Oregon, and California have shut down since January 2001, citing a response to skyrocketing energy costs (of nearly 50% in cost on average for both electric and natural gas) (Shaw 2001). The paper industry agrees that the cost of paper will rise substantially, assuming no government intervention and a continuing downward trend of paper producing capacity in the United States (Massey 2001). However, it should also be noted that the recent economic downfall has reduced the value of the U.S. dollar compared to other paper-producing countries, and economists and currency traders expect a large segment of Canadian paper producers to import additional paper amounts to the United States, which may actually equal or even reduce the current price of office paper, considering the trade forecasts (Kohler 2001).

A number of suggestions have been made regarding the possibility of investigating why people print e-mail. A survey of greater length would be required, and the results would more likely resemble that of a psychology paper, since it would be investigating human behavior and motivations to print. Also, the size of the e-mail may be an interesting question. It has been shown that over 82% of all e-mails are very brief messages, no longer than three sentences of original text and when printed, use only a quarter of a regular 8.5x11 inch sheet of paper (English 1999). It may also be interesting to follow the paper trail of printed e-mail. That is, to investigate what happens to paper e-mail after a student or campus staff member prints it. Is it quickly thrown away or recycled? Is the majority of printed e-mail filed and stored, and if so, for how long? It may also be interesting to use this study and apply it to the general public of the United States to find approximately how much paper is consumed to print e-mail nationwide. U.C.L.A. found that 67% of all Americans, and of all ages, use the Internet. Of those, 81.6% have e-mail accounts. Furthermore, 76% of all United States e-mail users check their e-mail accounts at least once a day, implying that 42% of all Americans use e-mail every day (Lebo, 2000). Also, considering Hotmail and Yahoo Mail's combined 170 million and growing e-mail

user accounts, it is clear that e-mail is having and will continue to have a great impact on total paper consumption on a national and most likely a worldwide level (Yahoo Magazine).

On a positive note, new technologies are providing opportunities for reduced paper use. Microsoft has developed the E-Book device, a portable, high-resolution LCD tablet that one can store and read many text documents with, although the problem of proprietary formats and file incompatibilities still exists. Many companies and groups are moving towards saving documents on CD-ROM's, however, the National Archives Agency reports that current CD-ROM technology has only six years of complete data retention per CD, requiring an ongoing cycle of copying CD's (for comparison, paper is reported to have a life of 35 years) (NARA 2001). Teams of researchers from M.I.T. and Xerox have produced an electronic paper (e-paper) which may provide for a simple, inexpensive and reusable form of a paper alternative (Gorman 2001). However, so far this technology is still being researched, and currently, e-paper requires the use of batteries, which may actually be more pernicious to the environment overall. The possibility of a non-proprietary e-mail format that allows all e-mail software to use the same files could also become available in the near future, such as seen in digital non-proprietary music (MP3) or picture (JPEG) formats, however the dominant companies in e-mail software such as Qualcomm (Eudora), Microsoft (Outlook), Netscape (Messenger), and AOL (AOL Mail) have not provided any indication that such a format is being developed. Education and making people aware of how much paper they use, and they may be encourage to print less, and may in fact be the most effective way to reduce much of the paper that is dedicated to e-mail hardcopies.

Conclusions E-mail is now widely recognized as a convenient and cost-effective means of communication. By 2005, it is predicted that 35 billion e-mail messages will be sent daily; what will happen to our world's forests if 10% of those are printed everyday? (IDC 2001). Just like many modern technologies, e-mail boasts intangible qualities that could either greatly reduce or increase paper output levels. Considering that 20% of the world's wood harvest is turned into paper products (Black 2000), e-mail technology has the ability to either greatly reduce, have no effect, or perhaps greatly increase this substantial percentage of wood harvests. In U.S. history, colleges and universities have been the parents of modern innovations, but more importantly, they establish a path that the rest of society often follows. Therefore, this unique leadership role makes this study an important investigation, and the results may make the students and staff of

U.C. Berkeley become aware of common printing habits and encourage change at both the university and eventually the national level.

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