

Comparison of Self-Reported Attitudes toward the use of Recycled Paper and Actual Paper Consumption Behavior at the University of California, Berkeley

Kankun (Nancy) Yo
Department of Environmental Sciences, U.C. Berkeley

Abstract

This paper sought to determine the possible differences in the self-reported attitudes and the actual paper consumption behavior exhibited by the photocopier users at three selected libraries on the U.C. Berkeley campus, namely the Moffitt Undergraduate Library, the Bioscience Library, and the Engineering Library. A survey was carried out to determine the attitudes toward and willingness of recycled paper use, and results suggested that the copier users were willing to use recycled paper. Following the survey, a six-week pilot study involving a total of 22 copiers was conducted in the three libraries. Half of the copiers were loaded with 30% post-consumer content recycled paper and the other half with virgin paper. Over this time period, recycled paper consumption was higher than virgin paper consumption although there was no statistically significant difference in the average weekly consumption between the two paper types. Unobtrusive observations were also made during the pilot study to gain qualitative insight into the behavior of people when they were given the two paper selections. The comparison of the survey results and the actual paper consumption of copiers led to the conclusion that there was a consistency between self-reported attitudes toward using recycled paper and actual paper consumption.

Introduction

Attitudes have been studied extensively as one of several primary influences on behavior. Since the late 1970s, social scientists have conducted substantial research on attitudes toward and/or behaviors concerning recycling using interview and survey techniques. Several studies indicated an inconsistency between environmental attitudes actual and behavior (Bratt 1999i).

Manfredo and Shelby (1987) stated that self-reports were reasonably accurate, but they produce results different from actual behavior in attitude-behavioral tests. Barker *et al.* (1994) compared the individual attitudes and behavior toward self-reported paper recycling with actual individual behavior at Bard College, New York. They predicted that the majority of college students would report a positive attitude toward recycling, and this was confirmed by their survey results. However, they could not provide strong evidence that self-reported measures regarding positive recycling attitudes and behavior predicted actual paper recycling behavior. On the other hand, they found that the minority who expressed negative attitudes toward recycling was consistent in their actual behavior.

Recycling has been viewed as an appropriate and positive behavior in the USA (Barker 1994 and De Young 1990). To promote pro-environmental attitudes and recycling behaviors among the public, it is necessary to examine the social context within which people participate in ecologically responsible activities (Derksen and Gartrell 1993). Convenient and well-organized programs are also crucial in maintaining pro-environmental attitudes and behaviors (Simmons and Widmar 1990). There was a variety of reasons that motivated people to recycle. First, people recycled because they thought it was morally right to do so (Derksen and Gartrell 1993). Second, some people participated in recycling activities because they perceived those as social norms. Third, they gained intrinsic satisfactions from conserving resources and being frugal, and also wanted to do what was right for the environment (De Young 1986 and Oskamp *et al.* 1991).

Recycling is one key component in the resource conservation effort. Various recycling programs have been adopted on the U.C. Berkeley campus to collect and divert paper wastes. Two paper-recycling programs have been administered on the campus. The Mixed Paper Recycling run by Campus Recycling Services collected mixed paper from academic departments, administrative offices and residence halls, and the ASUC/ File 13 Recycling

Groupⁱ collected white paper from high volume areasⁱⁱ (Bauer 1999, pers. comm.). In the recent past, Bucknell (1998) conducted a study at the university residence halls that led to more efficient residence hall recycling programs. Cornish (1999) measured post-consumer food and paper wastes at the University dining commons, and provided valuable information for improving composting programs on campus. However, studies focusing on reducing virgin paper consumption were lacking. Since an enormous amount of virgin paper was used on campus, studies ought to be made to seek out possible solutions that would not only reduce its paper consumption, but also dampen environmental impacts in general.

In recent years, recycled paper was proven to be a good substitute for virgin paper. Improvements in technology allowed production of high quality post-consumer content recycled paper that was often superior in quality to its counterpart (California Environmental Protection Agency 1997). Despite the rising awareness for ecologically responsible consuming, virgin paper was used in the majority of copying and printing purposes on campus because it was lower in price than recycled paper. A cartonⁱⁱⁱ of 30% post-consumer recycled paper was priced approximately \$2.00 more than virgin paper. Each department purchased its paper independently through the Campus Supply Services or from an off-campus vendor such as Office Depot (Balsley 1999, pers. comm.).

The general library system^{iv} had two entities that were responsible for maintaining the copiers. The University Copy Services was in charge of maintaining the copiers that were used in the library offices, and Xerox Business Services (XBS), which was not a part of the University, was in charge of “public access machines”^v (Jackson 1999, pers. comm.). A crew of technicians from Xerox Business Services checked to ensure that the library copiers had enough paper several times a day (Campos 1999, pers. comm.). The Main Library Office purchased the paper directly through XBS in bulk, which was then distributed among the general library system. The University Library contracted Xerox Corporation to supply paper and maintain the copiers (Llosa 1999, pers. comm.).

This study addressed the possible differences in stated intention or preference (to use recycled paper) and actual behavior (reflected by the paper consumption in copiers). To explore the question of whether recycled paper would be a feasible alternative to virgin paper, the project approached this issue from the perspectives of library copier users^{vi}. The

potential for reducing virgin paper consumption at the University of California Berkeley will also be discussed later in the paper.

I selected three libraries namely the Bioscience, the Moffitt Undergraduate and the Engineering Libraries^{vii} as the study sites. I carried out a survey to investigate the attitudes of copier users toward using recycled paper before collecting the data to determine their willingness to use recycled paper. Next, I made recycled paper available at the copy areas along with virgin paper, and recorded the weekly paper consumption in each copier. This allowed a comparison of the self-reported results of the survey to the actual consumption behavior. I predicted that if the copier users were willing to use recycled paper, the average virgin paper consumption would decrease and vice versa.

Switching from using virgin paper to recycled paper could be one of the simplest acts that would greatly reduce virgin paper consumption without any extra effort on the part of the paper users. Collectively, such action would definitely reduce the University's environmental impact due to paper consumption. Furthermore, not only would the results from this study highlight the relationship between environmental attitudes and behavior in a university setting, it would also provide useful information for environmental groups on campus who would be seeking and promoting ecologically responsible consumption by the University.

Hypotheses In this project, the following hypotheses were tested.

Overall hypothesis: Copier users' self-reported willingness to use recycled paper would be consistent with their actual consumption behavior.

Sub-hypothesis 1: Copier users would be willing to use recycled paper in the library copy room if given the option.

Sub-hypothesis 2: There would be an equal consumption of both virgin and recycled paper when both paper type options were offered in the library copy areas.

The two sub-hypotheses were tested based on the survey results and the paper consumption measurements respectively. The willingness to use recycled paper was determined based on six specific questions asked in the survey questionnaire (Appendix A: Questions 1, 3, 4, 5, 12 and 13).

Finally, the overall hypothesis was answered using the two sub-hypotheses, keeping in mind that no significant causal link between these two results could legitimately be determined. It was simply because those people who participated in the survey may not necessarily have contributed to the consumption data. In other words, the population of survey participants did not necessarily overlap perfectly with those copier users in the library during the consumption measurement period. However, it was reasonable to draw separate conclusions about copier users' willingness to use recycled paper, and how their consumption behavior was changed as the result of having two paper types. Using these separate conclusions, I attempted to draw a final conclusion about the consistency in environmental attitudes and behaviors.

Methods

Part One: Surveying Attitudes and Willingness to use Recycled Paper To find out the attitudes and willingness of library copier users to use recycled paper, I conducted a survey (see Appendix A for survey questionnaire). The survey included questions on aspects of paper quality that copier users might be concerned about, whether the type of paper used in the copiers mattered to them, and also if the survey participants were willing to pay extra to use recycled paper. One of the questions asked whether the survey participants consider both virgin and recycled paper equally good for their copy jobs in the libraries. In addition, the survey questionnaire consisted of two pages. The first page was printed on 30% post-consumer paper while the second page was printed on virgin paper^{viii}. The survey participants were not informed which paper was recycled and which was virgin. One question in the survey asked them to distinguish between the two paper types on the spot (see Survey Questions 6 and 11).

Survey samples were collected in November 1999 and from late-January to mid-February of 2000. The survey was only given to people who entered the copy areas, most of whom also used the copiers. The survey samples collected in November 1999 (approximately a fifth of total) followed a routine of handing out surveys to every third person that walked into the copy areas. Each session took place for one hour in the morning, afternoon or in the evening per day in the order of Bioscience, Engineering and Moffitt libraries.

As for the samples collected from late-January to mid-February, changes were made to the sampling method. This was done to accommodate changes to my class schedule as well as to broaden the sample size as much as possible within a shorter time frame. Instead of collecting the survey alone for one hour each day, I sought the help of Xerox Business Services (XBS) representatives who worked inside the copy room of Bioscience Library and my Environmental Sciences (ES) seminar classmates to hand out the surveys. Since the XBS representatives spend about eight hours daily in the copy room on rotation, they were able to get more survey questionnaires completed. I requested my ES classmates to go to the copy areas especially at Engineering and the Moffitt Libraries at their convenience to hand out surveys to as many people at the copy areas as possible.

As described earlier, there was a series of hypotheses to be tested before the overall hypothesis was tested. In this project, the willingness of copier users was determined in terms of the following points:

1. Whether the type of paper used in the copiers mattered to the survey participants (Survey Question 3)
2. The issues that influenced their concern for the type of paper that was used for the copier (Survey Question 4)
3. The maximum price increase per page that the survey participants were willing to pay to put their copy jobs on recycled paper (Survey Question 5)
4. Whether the survey participants thought that the libraries should have some of the copiers loaded with recycled paper so that they could choose to use recycled paper as needed (Survey Question 12)
5. Whether they would like to see more recycled paper used on campus (Survey Question 13)

For the purpose of analysis, if the results for each of these questions were positive (in this case >50% of survey participants), Sub-hypotheses 1 would be accepted. There might be a slight discrepancy on the conclusion if the results to each question were analyzed individually instead of looking at whether each individual participant had positive response for all the questions listed above. The survey was structured in such a way that allowed some questions to be skipped depending on the answers provided for previous questions. Therefore, each question was examined separately for the purpose of this study.

Part Two: Pilot study for Determining Recycled and Virgin Paper Consumption

There was a total of 22 public access copiers in the three libraries. Half of the copiers were loaded with recycled paper^{ix} on February 27, 2000. They were selected based on their location within the copy area, copier model, wheelchair accessibility, and whether they were full- vending (accepted a combination of card, change and bill) or card only. There were three models available: BookMark 21, BookMark 35, and EnergyStar 5855C models. The first two models copied 21 and 35 sheets per minute respectively, and the last model copied even faster. It also had a duplexing function that allowed users to copy double-sided without having to feed the paper through a bypass tray. The copiers were labeled with the type of paper they contained. I posted signs on the door of the copy room in the case of Bioscience Library, and at the entrance of the copy areas in the Moffitt and Engineering Libraries. This was done to inform the copier users about the paper options that they had so that they could make selection about which paper type to use before approaching a copier.

During the first week of recording the consumption measurement, some changes were made to the experimental design. Signs that distinguished one copier from another were not approved to be put on the walls of the copy room in Bioscience library. Thus, similar signs in the other two copy areas were taken down during the first week of the pilot study. Furthermore, five days into the experiment, an email was sent by a staff from the Document Delivery Services (DDS) requesting a change in the paper type for one of the EnergyStar 5855C models. There were three of those copiers available in the Bioscience Library but none had contained recycled paper. The staff stated that “We [the campus DDS staff] all (or nearly all) prefer the 5855C copiers. Your tally for virgin/recycled paper is therefore going to be very skewed, because the majority of the DDS staff will be making copiers on virgin paper” (Reeder 2000, electronic comm.). I decided to switch the paper type in one EnergyStar 5855C copier from virgin to recycled. To keep the number of copiers with recycled paper the same as those with virgin paper, I also switched the paper type in the BookMark 21 copier beside the EnergyStar 5855C copier from recycled to virgin.

Data from vend units installed in each copier was used to determine the paper consumption in the copiers. Vend units were paper counters that automatically recorded the number of copy jobs done. Weekly vend unit readings of the 22 copiers were recorded on Sunday by a Xerox technician from February 27, 2000 to April 9, 2000 for a total of six

weeks. Vend unit readings were also taken when the switch was made between the BookMark21 model and the EnergyStar 5855C model so that the total paper consumption for each paper type could be accurately^x accounted.

After having finished collecting the paper consumption data, more rigorous data analysis was done rather than simply looking at the percentage distribution of paper consumption. A nonparametric statistical method was employed because there was a great variability in the paper consumption across the copiers. I could not conduct a meaningful statistical analysis that could have revealed the significant difference in the recycled and virgin paper consumption because of the experimental set up (as explained later in the paper). Therefore, I decided to determine if there was a significant difference in the average weekly paper consumption in copiers with recycled paper versus copiers with virgin paper by employing the Mann-Whitney Test.

Part Three: Qualitative Assessment of Copier Users' Behavior To gain qualitative insight into how copier users chose their copiers, I conducted unobtrusive observations of copier users (approximately 45 minutes during each session) at the study sites in the third week of the pilot study. Four different types of behavior were noted as discussed later in the paper.

Throughout the entire course of the project, I communicated with the staff from Xerox Business Services and University Copy Services as well as with individuals interested in this study. Their comments and feedback were included in the result as well. Finally, survey results were compared to the paper consumption data. The observation results were then integrated to supplement the explanation of the outcome.

Results

Part One There was a total of 225 survey responses obtained. One hundred and forty-nine samples were collected from the Bioscience Library, 48 from the Engineering Library and 28 from Moffitt Library. The results suggested that 19% of the survey participants were concerned about the paper quality of the copiers (Fig. 1) and 49% of the entire group responded that the type of paper loaded in the copiers did not matter to them (Fig. 2). These people were directed to skip Question 4 and 5. Of those who answered these two questions, 89% of people responded that using recycled paper was one way that they could help

conserve resources, and 60% responded that they felt obliged to make environmentally sound choices. Moreover, 80% indicated that they would pay extra to have their copy jobs printed on recycled paper (Fig. 3). An individual also commented on the survey questionnaire that he was willing to pay more with the increasing amount of post-consumer content in the recycled paper. For Questions 12 and 13, which everyone was expected to answer, 70% thought that

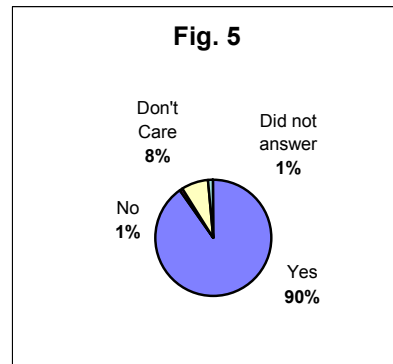
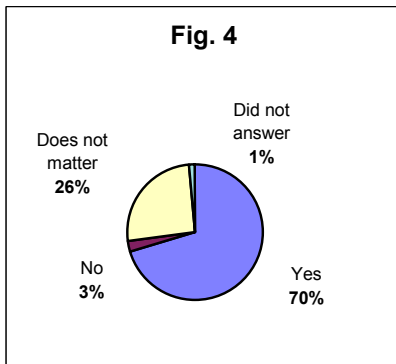
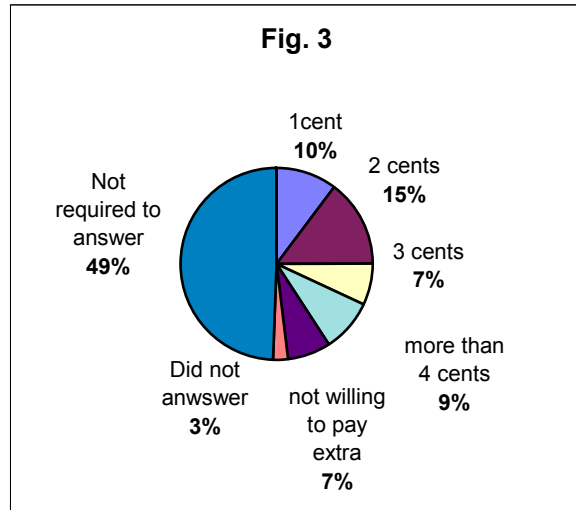
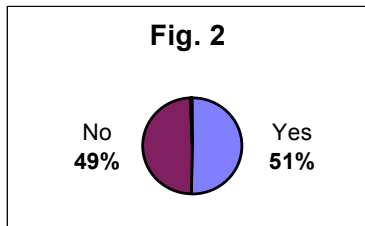
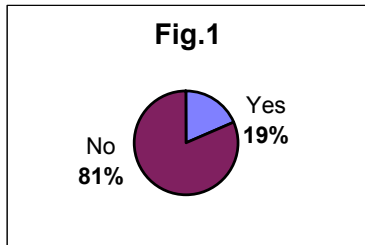


Fig. 1: Concern for Copier Paper Quality (Survey Question 1). Copier paper quality at the library was not a concern to the majority of copier users.

Fig. 2: Does Paper Type Matter? (Survey Question 3). There was nearly an equal split between those who answered that the type of copier paper mattered to them and those who did not.

Fig. 3: Willing to Pay Extra for Recycled Paper? (Survey Question 5). Those people who answered 'No' to Question 3 were directed to skip this question. Of those who answered this question, about 80% were willing to pay some amount for recycled paper.

Fig. 4: Should Some Copiers be loaded with Recycled Paper? (Survey Question 12). A majority of people thought that the libraries should have some copiers loaded with recycled paper.

Fig. 5: Want to see more Recycled Paper used on Campus? (Survey Question 13). A convincing majority of survey participants was in favor of having more recycled paper used on campus.

the libraries should have some copiers loaded with recycled paper (Fig. 4), and 90% wanted to see more recycled paper used on campus (Fig. 5).

Finally, 91% of the total participants considered both the virgin and 30% post-consumer paper satisfactory for their copy jobs, and 51% of them could accurately distinguish between recycled and virgin when they took the survey. In addition, 91% of the total wanted to have their copy jobs printed on both sides of the paper if such an option was conveniently and reliably available at the library copy areas.

Part Two The result showed that copier users consume more recycled paper than virgin paper (see Summary section of Appendix B). In the Moffitt Library, there was 19.6% more recycled paper consumption, 23.0% in the Engineering Library, and 6.0% in the Bioscience Library. On the whole, there was 11.1% more consumption of recycled paper than virgin paper. The statistical analysis of the paper consumption indicated that there was no statistically significant difference between the average weekly paper consumption of copiers containing recycled paper and those with virgin paper as result of making recycled paper available at the copy areas (see Appendix C).

One individual commented that she was very much in support of the pilot study, and hoped that the necessary authorities would be convinced to make the switch from virgin paper to recycled paper in the library. She also pointed out that she would prefer to use recycled paper. However, all three of the EnergyStar 5855C model in the Bioscience Library contained virgin paper, and that had “put her in the annoying moral dilemma of having to choose between duplexing and casting [her] consumer vote for recycled” (Thomsen, electronic comm. 2000).

Two individuals that worked for the campus DDS informed me that they had some problems with the pilot study. The following was the excerpt from the email correspondence:

1. Not all the machines are the same. There are three machines of a particular model that I prefer to use. I am not sure which model but they are [of] the smallest models. All three machines have ‘virgin’ paper only, yet I prefer recycled paper. But since I make hundreds of copies, I won’t go to one of the other machines because of the way they function... I know that other people like myself who have such photocopying jobs prefer recycled paper. Thus, your study is being skewed by thousands of copies each week, implying that we prefer virgin paper when in fact we prefer recycled.
2. What happens when all the machines are occupied but one? And what if the available machine has virgin paper, yet the person who enters the room next prefers recycled paper? Will he/she wait until one of the ‘recycled’ machines is free? Of course not!

We've all got busy lives, and we've got other stuff to do!! Basically...people will take whatever machine [that] is available, regardless of what kind of paper is inside the machine.

3. Have you considered the ideas that these machines break down/jam quite often? If a machine becomes unavailable for use, then that is one less machine being used in your study. Presumably, you have an equal number of machines with recycled & virgin paper. So when one of the machines breaks down, it favors the other type of paper that is not in that machine, because now there are more of the other machine available.” (Rees 2000, electronic comm.)

Part Three Four typical behaviors of copier users were noted based on the unobtrusive observations in the libraries. Most of the copier users observed had less than three journals or only a few sheets of paper to copy. The copy area was relatively less busy, and most of the time, there were at least one ‘recycled’ and one ‘virgin’ copier available.

Type I: Headed directly to the nearest available copier; paid a lot of attention to the material that s/he was going to copy; did see the label on the copier lid; but stayed to use the copier

Type II: Came into the copy area; looked around; found one available copier; approached it; saw the label, decided to stay with the copier whether or not the copiers contained recycled or virgin paper

Type III: Came into the copy area; looked around; found one available copier; approached it; saw the label; realized that the machine contained virgin paper; decided to switch; looked around paying particular attention to the copier lids for labels; found one ‘recycled’ copier available nearby; moved to the copier.

Type IV: Came into the copy area; realized that most of the ‘recycled’ copiers near to the door were unavailable; paused for a moment; walked around the room in search for one ‘recycled’ copier; found one; stopped and used it

I did not observe how people would react when all recycled paper machines were occupied, and whether or not they would wait for one of them to become available and how long they would wait during my observation sessions. This could be an interesting follow up on the study.

Discussion

Part One With reference to the five points presented earlier in the Methods section, the survey results reflected that copier users were willing to use recycled paper. First, not many people had even thought about the quality of paper in the library copiers, and it also did not matter to them what type of paper was used in the copiers (Fig. 1 and 2). Second, people thought about conserving resources by using recycled paper and felt the obligation to make environmentally sound choices. Third, people were willing to pay extra for recycled paper

(Fig. 3). Fourth, a large percent of people wanted the option of having recycled paper copiers, and lastly, they wanted to see more recycled paper used on campus (Fig 4 and 5).

The survey results also reflected the pro-environmental attitudes among the survey participants through their thoughts on resource conservation by consuming recycled paper rather than virgin paper, and the obligations that they felt to make environmentally sound choices. Moreover, the survey participants were willing to pay extra money for consuming recycled paper as well. This meant that the library might be able to recover part of the additional cost if the cost of recycled paper remained higher than virgin paper when they were ready to switch to recycled paper^{xi}. This finding was consistent with public opinion polls which found a willingness of people to purchase higher priced products that were perceived to be environmentally friendly (Linn *et al.* 1994). Survey Question #5 was only answered by about half (114) of the survey participants. Since about 80% of those indicated that they would pay an extra amount for recycled paper, I found it reasonable to think that more than 50% of the entire survey participant would have responded the same if all had answered the question.

The copier users indicated that they wanted to use recycled paper for their copy jobs, and they would like to see more recycled paper used on campus. Using less paper by having double-sided copy option seemed to be a very popular attitude among those who participated in the survey. Perhaps, they wished to be involved in resource conservation efforts, or students might simply want to carry less paper. The weight (and therefore the convenience) from double-sided copies would obviously be lighter than single-sided copies especially if the students had plenty of copy jobs to do.

The survey results reflected pro-environmental attitudes among the survey participants and their willingness to use recycled paper if they were given such an option. Thus, Sub-hypothesis 1 was accepted. Additionally, 40% of survey participants reported that they could tell the difference between recycled and virgin paper and 70 % of whom were actually able to do so. This relationship between self-reported attitude and actually identifying a product would also be an interesting avenue for research.

Survey samples from the Bioscience library constituted the majority of the sample population. This might have biased the results toward having more survey participants from a presumably more environmentally conscious population. However, casual conversations with

survey participants and my observations at the three different libraries led me to other conclusions. It was because, even if the population around the Bioscience Library was more familiar with the ideals of resource conservation, it was only one of the numerous factors that affected their choice of paper for their copy jobs.

Part Two Percentage of recycled paper consumption was higher than its counterpart in all study sites. The difference was highest for Moffitt, then Engineering and then the Bioscience Library. Despite the higher recycled paper consumption, there was no statistical significance in the difference in the average weekly consumption between the two paper types.

Each campus DDS staff usually made about 300 copies per day mainly in the Bioscience Library (Thomsen 2000, pers. comm.) and each private DDS staff made about a thousand copies a day across the three libraries (Landolt 2000, pers. comm.). Unfortunately, I was not able to get further information on the number of either private or campus document delivery staff using the copiers in the library. According to Tony Landolt (2000, pers. comm.), a DDS staff from Infotrieve, the major private DDS using the campus libraries, there were at least two other staff members from other private DDS companies working everyday on campus. Based on email correspondences with the campus DDS staff and communication with Landolt, I estimated that there were *at least* two campus DDS staff and four private DDS staff using each of the three libraries everyday. As mentioned in the email correspondence, the EnergyStar 5855C model was the popular model among the DDS staff. The actual paper consumption also indicated that weekly paper consumption in copiers of this model was among the highest at all three study sites for both recycled and virgin paper (see Appendix C). Their collective effect could have skewed the consumption results toward higher virgin paper consumption since three out of five EnergyStar 5855C models, and three out of four BookMark 35 models were loaded with virgin paper. However, the result showed otherwise, which clearly pointed out the likelihood that usual copier users (i.e. students) were consuming more recycled paper. If the DDS staff had used recycled paper for all their copy jobs without having to decide based on copier functions and availability, the difference between recycled and virgin paper consumption could have been more apparent.

This study had also put some individuals into dilemmas as stated in the email correspondence (see Result section). As discussed in academic literature, consumers'

contributions to environmental protection were challenged by ‘social dilemmas’ i.e. because the individual understood that his or her individual pro-environmental behavior was not going to make a difference unless a majority of fellow individuals behaved similarly (Finger 1994). The individual who provided the feedback faced the dilemma of choosing virgin paper rather than recycled paper since it was more important for her to use the particular copier model that saved her more time and was able to provide the duplex function.

Several factors affected the outcome of the consumption data. The experimental set up was discovered to be less than ideal after the project was completed. I made a critical error in my experimental design that prevented me from obtaining data that would otherwise allow me to conduct a meaningful statistical analysis to determine if there was a significant difference between recycled and virgin paper consumption. In the early phase of my project, I considered factors that would have caused statistical variations in the consumption data such as copier model, copier location within the copy areas and other copier characteristics like full-vending units versus card only and wheelchair accessibility. However, I assigned a paper type to each copier instead of *changing the paper types systematically and periodically in each copier*. The latter experimental design could have accounted for those factors that I intended to account for more accurately than the experimental design that was actually employed.

Consequently, I could not determine any statistical difference in the recycled and virgin paper consumption, and there was also no significant difference in the average weekly paper consumption between copiers with recycled and virgin paper. However, the recycled paper consumption was higher than the virgin paper in all three libraries. Therefore, Sub-hypothesis 2 was accepted.

The effect of copier breakdown time (as pointed out by Rees; see Result section) might have affected the paper consumption, but probably not considerably. First, Xerox technicians were required to respond to a service call within one hour to put the copiers back into service (Gutierrez 2000, pers. comm.). Second, the copy areas, with the exception of one at the Bioscience Library, were not crowded most of the time. In the case of the Bioscience copy room, the Xerox Sales Representative often made quick repairs if there were minor problems. These minimized the impact of copier breakdown time on the paper consumption data.

Part Three Types I and II reflected that time and convenience seemed to be the main factors that affected users' choice of copiers. Bratt (1999ii) concluded that an individual's decision whether to buy environmentally friendly product did not have an observable effect on the environment. Consequently, as long as environmental friendly behavior implies costs (monetary or other social cost e.g. time, convenience) to the individual, it was rational for the individual not to contribute to environmental protection. . Thus, the unobtrusive observations made at the libraries dovetailed with the comments that Rees and Thomsen made about people being busy and not concerned about copier paper types (refer to Results section).

Type III showed that some people cared enough to move to the copier with recycled paper nearby, and the inclination to use recycled paper at the expense of time and convenience was demonstrated by those in Type IV. These individuals cared enough to use recycled paper and actually took the time to look for copiers with recycled paper The results from the observations could have been strengthened with quantitative results e.g. actual number of people whom I observed. Unfortunately it was done only in a qualitative manner.

In retrospect, I would offer the following suggestions for those who might be interested in conducting similar projects in the future. First and foremost, decide on the type of data needed, and then design the experimental set up carefully and correctly. Second, for surveys, it would be best to have all questions answered, and finally, conduct observations and experiments for an extended period of time so that there would be enough time for trends to appear in the data.

Conclusion

This project sought to determine consistency in library copier users' attitudes and willingness toward having recycled paper in the copiers, and the actual paper consumption in the copiers. I determined the willingness to use recycled paper using a survey and the actual consumption behavior in terms of how much recycled or virgin paper was consumed in the copiers. The survey yielded positive results for the five points that were set up to test copier users' willingness to use recycled paper. The consumption results from Part Two also indicated higher consumption of recycled paper than virgin paper, despite the fact that no apparent statistical significance appeared to support this difference. Since the willingness to use recycled paper and the consumption behavior of copiers were consistent, the libraries

should consider using more recycled paper rather than virgin paper. Arguably, an individual's behavior normally would have no visible environmental effects, but collective behavior could certainly cause major impacts (Bratt, 1999ii). Not only would the simple act of switching paper type assist the University to be a better environmental steward, it would also definitely reduce the University's environmental impact of paper consumption since an enormous amount of paper was consumed on this campus.

Acknowledgments

I would like to thank Donna Green, Astrid Scholz, and Kevin Kennedy for giving me valuable advice throughout the year, also to the University of California Berkeley, and the staff from University Copy Services and Xerox Business Services, especially Charles Jackson, Celleste Chatman, Greg Webber, Arnetta Williams. I would also like to thank Lisa Bauer, James Kirchner, Lisa Kermish, Robert McCarthy, Takashi Orimoto, Ruth Gonzales, Rossze Lim and the ES 196 classmates, whose support made a great difference to this project.

References

- Bauer, Lisa. Recycling Coordinator, University of California, Berkeley. September 7, 1999, personal communication.
- Balsley, Rachel. Buy-Recycled Coordinator, University of California, Berkeley. September 7, 1999, personal communication.
- Barker, Kathleen *et al.* 1994. Comparison of self-reported recycling attitudes and behaviors with actual behavior. *Psychological Reports* 75: 571-577.
- Bratt, Christopher. 1999a. Consumers' environmental behavior: Generalized, sector-based or compensatory? *Environment and Behavior* 31(1): 28-44.
- _____. 1999b. The impact of norms and assumed consequences on recycling behavior. *Environment and Behavior* 31(5): 630-656.
- Bucknell, Tim. 1998. University of California Residence Hall Waste Composition Analysis Pp. 122-135. *In* Environmental Sciences, Tom Dudley, Kevin Kennedy and Instructors, ed. U.C. Berkeley Environmental Sciences Senior Seminar, Berkeley, CA.
- California Environmental Protection Agency. 1997. Integrated Waste Management Board. Recycled paper: The more I see you, the more I like you! Sacramento CA.

- Campos, Jose. Xerox Technician. Xerox Business Services, University of California Berkeley. November 3, 1999, personal communication.
- Cornish, Philip. 1999. Measuring Post-Consumer Food and Paper Waste in the University of California-Berkeley Dormitory Dining Commons *In Environmental Policies*, Tom Dudley, Kevin Kennedy and Instructors, ed. U.C. Berkeley Environmental Sciences Senior Seminar, Berkeley, CA.
- De Young, Raymond. 1986. Some psychological aspects of recycling: the structure of conservation satisfaction. *Environment and Behavior* 18(4): 435-449.
- _____. 1990. Recycling as appropriate behavior: a review of survey data from selected recycling education programs in Michigan. *Resources, Conservation and Recycling* 3: 253-266.
- Derksen, Linda, and John Gartrell. 1993. The social context of recycling. *American Sociological Review* 58: 434-442.
- Finger, Matthias. 1994. From knowledge to action? Exploring the relationship between experiences, learning, and behavior. (Green justice: conceptions of fairness and the natural world). *Journal of Social Issues* 50 (3) Fall: 141-161.
- Gutierrez, Chuck. Technician. Xerox Business Services. March 10, 2000, personal communication.
- Jackson, Charles. Manager, Library Copy Services, University of California, Berkeley. September 17, 1999, personal communication.
- Landolt, Tony. Staff, Infotrieve. April 17, 2000, personal communication.
- Llosa, Betsy, Administrative Assistant, Bioscience Library, University of California Berkeley. September 17, 1999, personal communication.
- Linn, Nancy *et al.* 1994 Toward a Sustainable Society: Waste minimization through environmentally conscious consuming. *Journal of Applied Social Psychology* 24(17): 1550-1572.
- Manfredo, Michael J. and Bo Shelby. 1987. The effect of using self-reported measures in tests of attitude-behavior relationships. *The Journal of Social Psychology* 128(6): 731-743.
- Oskamp, S. Harrington *et al.* 1991. Factors influencing household recycling behavior. *Environment and Behavior* 23: 494-519.

Reeder, Jessica, Document Delivery Services, Department of Public Health, University of California, Berkeley. March 7, 2000, electronic communication.

Rees, Denise. Document Delivery Services. University of California, Berkeley. March 8, 2000, electronic communication.

Simmons, Deborah and Ron Widmar. 1990. Motivations and barriers to recycling: toward a strategy for public education. *Journal of Environmental Education* 22:12-18.

Thomsen, Meredith. Department of Integrative Biology, University of California, Berkeley. March 2, 2000, electronic communication.

Endnotes

- ⁱ This is a student-run recycling group that was formed by the Associated Students of University of California in the early 1980s.
- ⁱⁱ High volume areas include library copy areas, department offices, microcomputer facilities, and student study lounges.
- ⁱⁱⁱ There are 10 reams of paper, each with 500 sheets in a carton.
- ^{iv} Examples of general libraries included the Moffitt Library, the Main Library, the Bioscience and the Engineering Libraries. Departmental Libraries were not included.
- ^v “Public access machines” refer to those copiers located in the general libraries where the general library copier users like students and the general public can get access.
- ^{vi} There were various factors that affect the type of paper used. These factors included cost factors and other socioeconomic factors; for example, the store from which the paper was purchased might not have supplied recycled paper. These were interesting research topics but they were simply beyond the scope of this project.
- ^{vii} These three libraries were chosen as the experimental system because there was a wide range of people who used the services, and the libraries used an enormous amount of paper.
- ^{viii} In both cases, I printed both pages on the same copier in one of the libraries to keep the print quality consistent. Both virgin and 30% post-consumer paper were of the Xerox brand. This was to ensure that the survey participants were looking at the types of paper that they would see in Part Two of the project. Quality of recycled paper varies from company to company even if they had similar paper specifications on the label.
- ^{ix} For the purpose of this project, recycled paper meant 30% post-consumer paper. I decided to use 30% post-consumer paper because it was the most abundant and widely used type of recycled paper (Bauer 1999, pers. comm.).
- ^x The vend unit readings for FM#626 copier (EnergyStar 5855C model) and FM#625 (BookMark 21 model) were 71,970 and 69,260 when I switch the paper types on March 2, 2000. Since the paper type was changed in these copiers, the readings for the first week paper consumption was not included as part of the statistical analysis (See Appendix C).
- ^{xi} Assuming that paper cost consists only a third of total cost of making a copy, and recycled paper cost 10% more than virgin paper, the resulting cost change per copy would be 3% of the current copy charge. If it had cost 10cents per page to copy, the cost increase due to switch in paper type would be 0.3 cents. So, the price increase for copier users would probably be minimal.

Appendix A: Environmental Sciences 196: Post-Consumer Content Recycled Paper Survey

Please put an "X" in the boxes for your response.

Library Location: Moffitt Bioscience Engineering

Undergraduate student (Freshman Sophomore Junior Senior)

Graduate student

Faculty

Staff

General Public

Major:

Age: 16-20 21-25 26-30 31-40 40 or more

Please put an "X" in the boxes for your response.

1. Has the quality of copy paper at the library been of any concern to you?
 - Yes (Go to the next Question) No (Skip to Question 3)

2. Circle on the scale of 1-5, the aspects of copy paper that you have been concerned about (1=least concerned, 5=most concerned).

Characteristics	Not at all concerned	1	2	3	4	5	Very concerned
Brightness (Whiteness)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Performance quality (whether it gets jammed or not)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Print quality (whether the ink smears or not)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Cost		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Durability		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

3. Does it matter to you what type of paper (recycled paper or virgin paper) is used for the copiers?
 - Yes (Go to the next Question) No (Skip to Question 6)

4. What issues influence your concern for the type of paper that is used for the copy paper? Put an 'X' for all that apply.
 - I think using post consumer content recycled paper is one way that I can help conserve resources
 - I think using virgin paper is absolutely necessary for my copy jobs
 - I feel obliged to make environmentally sound choices
 - I feel that I have the right to use virgin paper at all times
 - Others (Please specify: _____)

5. What is the maximum price increase you would be willing to pay to put your copy jobs on recycled paper? Put an 'X' in one of the following options.
 - 1 cent
 - 2 cents
 - 3 cents
 - More than 4 cents
 - I will not use recycled paper if it costs more.

6. Can you tell the difference between recycled paper and virgin paper?

- Yes (Go to the next Question) No (Skip to Question 8)

7. How do you tell the difference between the recycled paper and virgin paper? Put an 'X' for all that apply.

- By brightness (for example white or off white)
 By specks of dirt on the surface
 By texture
 By weight
 By other methods (please specify: _____)

8. How often do you engage in the following kind of copy jobs in the library? Put an 'X' in each row.

Copy job	Never	Rarely	Sometimes	Often	Always
Journal articles					
Books					
Lecture notes					
Official letters					
Publicity flyers					
Others					

9. This questionnaire is printed on two different types of paper. One of the papers is recycled paper and the other is virgin paper. Do you think they are *both* equally satisfactory (quality-wise) for your copy job?

- Yes (Skip to Question 11) No (Go to the next Question)

10. Please indicate which paper, either Sheet 1 or Sheet 2, you would prefer for the specific copy jobs. Please put an 'X' in each row.

Copy job	I prefer Sheet 1	I prefer Sheet 2	Does not matter for this copy job
Journal articles			
Books			
Lecture notes			
Official letters			
Publicity flyers			
Others			

11. Which sheet do you think is recycled paper?

- Sheet 1 Sheet 2 I have no idea

12. Do you think the Library should have some of the copiers loaded with recycled paper so that you can choose to use recycled paper as needed?

- Yes No does not matter

13. Would you like to see more recycled paper used on campus (e.g. handouts, assignments, and letters to be printed on recycled paper)?

- Yes No I don't care

14. Would you be willing to copy double-sided for the majority (more than 50%) of your copy jobs if such option was reliably and conveniently available at the library?

- Yes No

Thank you very much for participating in the survey. Any questions regarding this survey can be e-mailed to kankun@uclink4.berkeley.edu

Appendix B: Paper Consumption Data (Vend Unit Readings)

Location	Paper Type	FM#	27-Feb	5-Mar	12-Mar	19-Mar	26-Mar	2-Apr	9-Apr	Copier Characteristics
Moffitt	Recycle	553	28,095	31,295	33,187	35,634	38,669	39,761	41,892	BK21, FV
		554	5,886	6,490	7,005	7,334	7,623	8,159	8,790	BK21, CO
		559	12,729	14,444	15,936	16,929	17,578	18,026	19,037	BK21, FV, WA
	Virgin	555	8,486	8,677	8,855	9,233	9,811	10,015	10,360	ES5855C, CO
		556	19,161	20,097	21,447	22,433	23,527	23,876	25,350	BK35, FV
		557	22,281	24,153	25,197	26,490	27,816	28,499	29,675	BK35, FV
Engineering	Recycle	401	113,658	116,495	118,766	121,140	124,387	125,765	128,397	BK35, FV
		604	56,588	59,985	63,834	66,802	69,509	72,079	76,541	ES5855C, CO
		606	30,587	32,101	34,063	35,646	37,469	38,358	39,962	BK21, FV
	Virgin	602	17,161	18,244	19,907	21,835	23,752	24,205	25,152	BK21, FV, WA
		603	26,679	28,785	30,577	32,651	34,140	34,686	36,247	BK21, FV
		605	27,571	30,041	31,724	32,860	34,902	35,772	37,557	BK21, CO
Bio-Science	Recycle	620	57,055	61,444	66,307	70,356	73,673	75,936	79,802	BK21, FV
		623	50,360	54,356	56,466	59,335	62,402	65,153	69,280	BK21, CO
		624	65,384	70,354	74,914	79,349	83,529	86,618	90,781	BK21, FV
		626	68,904	73,672	79,115	82,072	87,324	92,767	99,034	ES5855C, CO
		765	69,209	73,360	78,272	82,419	87,443	90,062	94,842	BK21, FV
	Virgin	400	213,225	217,697	221,579	225,007	228,874	231,195	235,317	BK35, FV
		621	25,854	27,566	29,806	31,610	33,641	34,801	37,033	BK21, FV, WA
		625	66,859	70,315	74,334	77,781	80,868	83,197	86,391	BK21, CO
		627	80,951	86,161	91,165	95,734	98,678	103,258	107,667	ES5855C, CO
		770	67,759	71,791	76,166	81,909	86,955	90,686	96,016	ES5855C, CO

Legend: FV—Full vending; CO—Card only; BK21—BookMark21; BK35—BookMark35; ES5855c—Energy Star; WA—Wheelchair accessible

Summary

Location	Total Recycled Paper Consumption	(in %)	Total Virgin Paper Consumption	(in %)	% Difference
Moffitt	23,009	59.8%	15,457	40.2%	19.6%
Engineering	44,067	61.5%	27,545	38.5%	23.1%
Bio-Science	122,162	53.0%	108,441	47.0%	6.0%
Overall	189,238	55.5%	151,443	44.5%	11.1%
Total Paper Consumption (6weeks) (at 3 libraries and for both Paper Types)		340,681			

Appendix C: Weekly Consumption Data

Location	Paper Type	FM#	Week1	Week2	Week3	Week4	Week5	Week6	Avg. Weekly Consumption
Moffitt	Recycle	FM#553	3,200	1,892	2,447	3,035	1,092	2,131	2,300
		FM#554	604	515	329	289	536	631	484
		FM#559	1,715	1,492	993	649	448	1,011	1,051
	Virgin	FM#555	191	178	378	578	204	345	312
		FM#556	936	1,350	986	1,094	349	1,474	1,032
		FM#557	1,872	1,044	1,293	1,326	683	1,176	1,232
Engineering	Recycle	FM#401	2,837	2,271	2,374	3,247	1,378	2,632	2,457
		FM#604	3,397	3,849	2,968	2,707	2,570	4,462	3,326
		FM#606	1,514	1,962	1,583	1,823	889	1,604	1,563
	Virgin	FM#602	1,083	1,663	1,928	1,917	453	947	1,332
		FM#603	2,106	1,792	2,074	1,489	546	1,561	1,595
		FM#605	2,470	1,683	1,136	2,042	870	1,785	1,664
Bio-Science	Recycle	FM#620	4,389	4,863	4,049	3,317	2,263	3,866	3,791
		FM#623	3,996	2,110	2,869	3,067	2,751	4,127	3,153
		FM#624	4,970	4,560	4,435	4,180	3,089	4,163	4,233
		FM#626	n.a.	5,443	2,957	5,252	5,443	6,267	5,072
		FM#765	4,151	4,912	4,147	5,024	2,619	4,780	3,580
	Virgin	FM#400	4,472	3,882	3,428	3,867	2,321	4,122	3,682
		FM#621	1,712	2,240	1,804	2,031	1,160	2,232	1,863
		FM#625	n.a.	4,019	3,447	3,087	2,329	3,194	3,215
		FM#627	5,210	5,004	4,569	2,944	4,580	4,409	4,453
		FM#770	4,032	4,375	5,743	5,046	3,731	5,330	4,710

Mann Whitney Statistic Calculation

Avg Weekly Consumption, Recycled	Rank	Avg Weekly Consumption, Virgin	Rank
2,149	11	2,192	1
464	2	456	3
941	4	849	5
333	12	358	6
1,047	15	997	8
1,126	7	1,139	9
2,393	18	2,413	17
3,314	13	3,224	10
1,571	19	1,505	14
1,373	22	1,325	20
1,509	16	1,462	21
n1=11	R1=138	n2=11	R2=114

Mann-Whitney statistic:

$$U = n_1 n_2 + [n_1(n_1 + n_2)/2] - R_1$$

$$= (11)(11) + [11(12)/2] - 139$$

$$= 48$$

$$U_{0.05(2), 11, 11} = 91$$

Therefore, $48 < 91$, there is no statistical difference between average weekly recycled and virgin paper consumption.

Legend: n1 & n2-- number of readings in both groups; R1 and R2--sum of ranks of readings in both groups