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An Experimental study of differences in reading photo books by presentation media: print vs. screen

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An Experimental Study of Differences in Reading Photo Books by Presentation Media: Print vs. Screen

by Ya-Fang Tsai

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Certificate of Approval

An Experimental Study of Differences in Reading Photo Books by Presentation Media: Print vs. Screen

This is to certify that the Master's Thesis of

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has been approved by the Thesis Committee as satisfactory
for the thesis requirement for the Master of Science degree
at the convocation of

November 2009

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Abstract

As photography technology changes, the penetration of digital cameras is increasing, especially among young users. Compared to conventional camera users who print most of their images, digital camera users print about one-third of their digital images (PMA, 2009b, p. 10). Moreover, only 5 percent of camera phone users make photo prints (Henning, 2008, p. 4). One popular photo-finishing product is the photo book. The objective of this research was to determine whether people interacted differently with photographic content presented in print versus on screen. This research was focused on: 1. Time spent interacting with photo books. 2. Differences of recall and recognition by presentation modality. 3. Choices of medium preference.

An experimental study was administered at RIT with 64 participants. Half were shown the printed book, and half were shown the PDF displayed on a computer monitor.

The results showed that: 1. The average time spent interacting with the book was approximately 5 minutes for both printed book and screen views. There were no differences in the amount of time spent interacting with photographic content presented in print versus on screen. 2. There were no differences in how much participants remembered with photographic content presented in print versus on screen. 3. Overall, 74 percent of participants preferred to keep the printed book. However, relatively more participants selected the PDF when shown a PDF, even though the majority of participants overall selected the book.

Chapter 1

Introduction

The beginning of the film age of consumer photography began when Brownie No. 2 was introduced to the mass-market in 1901 by George Eastman (ICON Group International, Inc, 2008, p. 229). In the early days of the medium, it was necessary to develop photos using chemistry and paper if people wanted to see and share what they photographed. Film developing and photo developing were the basics of image display and reproduction. The digital age of consumer photography began at 1994 when Apple QuickTake100 was introduced to the mass-market (Cohen & Sadun, 2003). The technology has been rapidly adopted. The adoption of digital cameras by U.S. customers continued to grow in 2008, reaching 74 percent of U.S. household population, and is expected to grow to 78 percent in 2009 (Photo Marketing Association International [PMA], 2009b). In the digital age, making photo prints is no more a necessary method to view photos.

Statement of the Problem and Its Significance

According to Grevas (2008), about 90 percent of all images were printed in the film age. Compared to conventional camera users who print most images, digital camera

users print about one-third of their digital images (PMA, 2009b, p. 10). In 2008, 61 percent of digital camera *users* made photo prints (PMA, 2009b), while only 5 percent of camera phone users made photo prints (Henning, 2008, p. 4).

Since digital images can be shared at little cost on the Internet, it is easy for digital camera users to upload photos to web-based albums instead of printing them. Will people print photographs in the future? Viewing photos on computers is easier and cheaper than making photo prints. However, products personalized with photos are a growing market. In 2008, 57 percent of U.S. households made photo-finishing products, while 16 percent made photo books (PMA, 2009c, p. 2-3). For printed photo books to grow, people must value printed photos more so than pictures on the screen. The questions of this research are: 1. Do people interact with pictures in photo books differently from those on the screen? 2. When given a choice, will people select printed images or electronic images?

Reasons for Interest

With a background of photography, making photo prints is important to the author. Also, reading from paper is easier than from a computer for the author. This research may help the industry attract customers to print photographs through the use of photo books, postcards, calendars, and other tangible forms of the image.

Chapter 2

A Review of Literature in the Field

Introduction

With traditional photography, developing photographs was the only way to share images. Now, with computers and digital cameras integrated into people's daily lives, viewing images on a monitor is a common and effortless way to share images with others. The benefits of digital photography are its immediacy and versatility. "The very media of digital photography opens new opportunities for communication. Once digitalized, a photograph is almost infinitely malleable, much like a clay sculpture in process" (Johnson, 2006).

Is there a sustained value in printed pictures today? Do people treat pictures on the screen differently than they treat printed photos?

Reading Online vs. on Paper

Previous research indicates that people read faster on paper than from a screen. In Kuruniawan and Zaphiris's (2001) study, they showed that reading text from a monitor was 10 to 30 percent slower than reading from paper. In a study by Spencer (2006),

students preferred print copies of textbooks because of portability, dependability, flexibility, and ergonomics. In addition, he found that reading on paper was more convenient than from a screen because paper was faster to access. Paper was also easier to highlight and annotate.

In a study of e-book use (Gregory, 2008), students liked e-books for their convenience, cost, and ability to print particular pages. Students could print only the pages they needed from e-books, which saved paper and cost less than a traditional textbook. However, students disliked e-books because of navigation (confusing menus), eyestrain, and the preference of having a book on hand. Portability is also a concern - people can bring books anywhere, even without electricity or an Internet connection, while these might be needed to use an e-book reader. The study also showed that people have better concentration when reading printed books.

In summary, the research discussed above found that reading from a book was superior to reading from a screen.

Viewing Photos on Monitors

Little research has been conducted on viewing photos on paper versus on a screen. However, market trends show that people like the technology options available to them. With digital images, sharing photos electronically is done through web-based albums or emails (Edward & Millers, 2007). “Compared to the cost and effort of print duplication, it is very easy to email others photos and links to online albums” (Greenberg, Neustaedter,

& Nunes, 2008). According to the *2009 PMA U.S. Consumer Photo Buying Report*, 99 percent of U.S. households stored digital images, 11 percent shared photos online, and 19 percent emailed digital images saved on their computer (PMA, 2009a). Furthermore, with 74 percent of U.S. households owning digital cameras, there are 7 percent who have digital picture frames (Gretzner, 2008). Digital picture frames are expected to grow in the future, as consumer preferences change with technology (Gretzner, 2008).

Printing Photographs

According to the *U.S. Photo Industry 2009: Review and Forecast*, 35 percent of saved digital photos were printed in 2008, and this number is expected to decline to 32 percent in 2009. However, the absolute amount of printed digital images is expected to grow from 8.6 billion images in 2008 to 8.7 billion images in 2009 (PMA, 2009b, p.10). The absolute number is rising as more consumers become digital camera users.

Nevertheless, digital photography has not entirely replaced physical photos, because people still make photo prints for family and friends as gifts or souvenirs (Boll & Henze, 2008). One popular photo-finishing product is the photo book. The main reasons for producing photo books are given below, according to the *2009 PMA Photo Book Report*: "… The majority of households (69%) make photo books as family keepsakes, followed by 37 percent who make them for the purpose of showing pictures to others and 32 percent who give them as gifts to family and friends" (PMA, 2009c, p.1).

Current Issue: Photo Books

The photo book market grew by 22 percent in 2008, and it is expected to grow to 26 percent in 2009 (PMA, 2009c). More than half of photo books produced were in 4-by-6-inch or 5-by-7-inch sizes, either as paperback or hardcover books. However, many photo book customers did not finish editing their photo books. The reasons ranged from "It takes a long time", "It is difficult to process", and "They don't have enough pictures", to "They intended to finish it later" (PMA, 2009c). As Frey says, "… A successful strategy to create products from digital images must combine the consumers' desire to keep their memories with new and easy workflow solutions to create these products" (Thall, 2009).

Summary

The benefits of printed photos are that they are tangible and long lasting, while the benefits of digital pictures are they are fast to create and easy to search (Martinez, 2008). A question remains as to whether the benefits of printed photo are valued over the benefits of electronic images? Therefore, this research examined how people interact with photos in print versus on screen and when given a choice, which modality they preferred.

Chapter 3

Research Question

The primary question that this research paper sought to answer was: Are there any differences in the way people interact with photographic content presented on print vs. screen?

The ways that this interaction was measured were:

- Behavioral – Will people choose one medium over the other?
- Cognition – How much time will they spend with the content? How much of it will they remember?

Chapter 4

Methodology

Sampled Population

The study was conducted during the spring quarter, 2009 in the College of Imaging Arts & Sciences (CIAS) at Rochester Institute of Technology (RIT). As a class activity, sixty-four subjects volunteered to participate in the study from two classes: Digital Asset Management and Typography & Page Design.

Experiment Limitation

These subjects, who were imaging major students, were separated into two groups by using a quota sampling plan. Because of this sampling, it was not possible to generalize the results to a broader population.

Stimulus Design

The photo book used in the experiment was designed with 21 photographs and captions in landscape format. The amount of content in the book was adjusted (by pre-

experiment testing) to be readable in less than ten minutes. The photographs were all of Rochester, NY landmarks and subjects familiar to anyone living in the area. The printed publication was a 7-by-9-inch landscape-format saddle-stitched paperback book, which was printed using Lulu.com (see Appendix D). A 12-inch computer screen was used to display the photo book in PDF format. The size of pages displayed on the monitor was the same as in the printed book. Participants were able to view the electronic version of the book page-by-page by using the "Page Up" and "Page Down" keys on the computer keyboard.

Procedures

Half of the subjects participating in the experiment read the printed book only. The other half read the electronic book only. Each of the two formats was read by 32 subjects.

The experiment was conducted over a period of three weeks, from April 22, 2009 to May 5, 2009. Subjects were distributed between the two presentation media so that both groups had approximately equal distributions of gender, auditory capability, and English as a first-language by using a quota sampling plan. Participants signed up for a specific hour during the three-week period to participate in the experiment. Participants were advised not to talk about the experiment with their colleagues after taking the survey. It is important that participants were unaware of the content in the test until it was their turn to participate in the experiment.

When the participants arrived for their session, reading instructions were provided. Participants were instructed to look through the content carefully in preparation to take a test regarding the content of the book. Participants were instructed to take as much time as they needed to review the contents. A timer was started when the participant began, and the participant was asked to press the stop button on the timer when he or she had finished. At that point, the book or computer display was removed from sight and the test was administered.

The test included 22 questions (see Appendix A). Twelve questions were used to test the amount of recall. These questions were about the content and format of the book. The other ten questions were used to test the amount of recognition. These questions were about the test images used in the book. The subjects had to determine whether those were the exact images in the book. Four of the images were exact matches. Three were similar photographs of the same content from slightly different viewpoints. The other three were completely different photographs, but with possible logical associations to the ones in the book. The interviewer recorded the answers provided by the participants verbally (see Appendix B).

When participants concluded the experiment, they were offered either a copy of the printed book or a PDF sent via email to keep for their participation in the study. Participants were also asked why they selected the particular medium to keep. The choice each participant made and the reasons for their preference were recorded. Three weeks later, participants received their choice of either the printed book or PDF once the experiment was concluded. This prevented other participants from seeing the content

before taking part in the experiment.

The data gathered were then added to a spreadsheet that contained one row of data for each coded participant. The columns of the spreadsheet included the type of media presented (print or electronic), elapsed time for reading, responses to each question in the test, choice of medium (print or PDF) and the reasons for the choice.

The data were then analyzed using a chi-square test and a t-test. For the choice of medium preference, a chi-square test was used to compare the frequencies of choices. For time spent interacting with the book and the cognition test results, a t-test was used to test the means of both samples.

Chapter 5

The Results

Behavioral Result - Choice of Medium Preference

Of the 62 subjects who made a choice as to what version of the book they wanted to keep, 74 percent selected the printed book and 26 percent selected the PDF. Table 1 shows that there was a difference in preference. Of the 32 subjects who were shown the book, 29 selected the book and the other three selected the PDF. Of the 30 subjects who were shown the PDF, 17 selected the book, and 13 selected the PDF (see Figure 1).

Table 1: Choice of medium preference

	Shown Book	**Shown PDF**	**Overall Preference**
Selected Book	29	17	46
Selected PDF	3	13	16
Total	32	30	62

To test whether there was a difference in choice by presentation modality, a chi-square test was used (for calculation details, please see Appendix C). The result was statistically significant ($X^2 = 9.33 > X^2_{.05} = 3.841$). Thus, the presentation medium shown and the

subjects' choices are related. Relatively more students selected the PDF when shown a PDF, even though the majority of students overall selected the book.

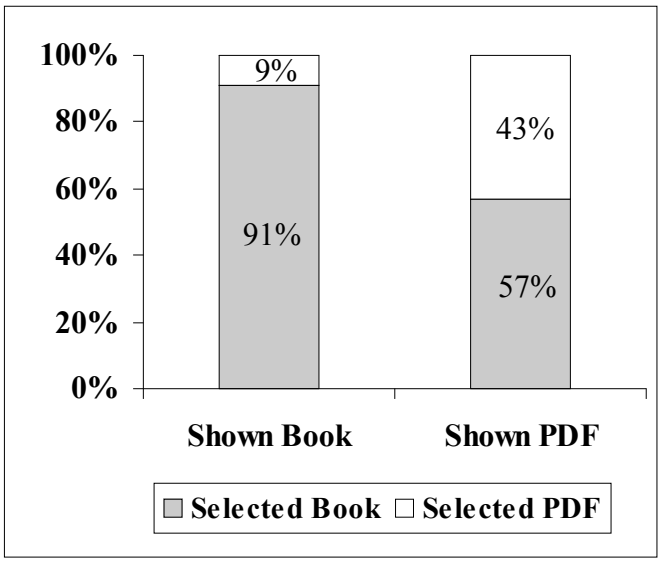

Figure 1: Percentage of book vs. PDF chosen

The reasons for selecting each medium are presented in Table 2. Results show that "tangible", "prefer hard copies", and "easier to look/flip/show" were the top three rated reasons for choosing the book to keep, regardless of whether participants read the book or the PDF. For those who were presented the book, "tangible", "prefer hard copies", and "easier to look/flip/show" were the top three reasons for choosing the book to keep. For those who were presented the PDF, "tangible", "prefer hard copies", and "easier to keep book" were the top three reasons for choosing the book to keep. "Easier to keep PDF" and "easy to access/carry PDF" were the top two reasons for choosing the PDF, regardless of whether participants read the book or the PDF.

Table 2: Reason for choice of medium selected

	Shown Book		**Shown PDF**		**Total**
Reason for Choice	***Selected Book***	***Selected PDF***	***Selected Book***	***Selected PDF***	
Tangible	9		10		19
Prefer hard copies	6		3		9
Easier to keep PDF		2		5	7
Easier to look/flip/show	6		1		7
Easy to access/carry PDF				6	6
Easier to keep book	1		3		4
Free	2		1		3
Print Quality	2				2
More Valuable	2				2
PDF=Homework Book=leisure	2				2
Don’t like to look at content on screen			2		2
Easier to show PDF		1			1
I don’t like print photos				1	1

Cognition Results

Time Spent Interacting with Images

Table 3 shows that the average time spent interacting with the book was 5 minutes and the average time spent interacting with the PDF was 4 minutes and 45 seconds. The time spent was almost equal. To test for significance by presentation modality, a t-test was used. The results were not significant ($t = 0.4012 < t_{.05} = 1.67$). Thus, the time spent interacting with the images was not related to presentation modality.

Table 3: Time spent interacting with images

	Book	**Screen**
Mean Value	5’	4’45’’
Standard Deviation	2’58’	2’20’’

The Recall Test

For the recall results in the first part of the test, subjects were asked to agree with statements that described the photos presented. As shown in Table 4, an average of 67 percent of participants who were shown the book answered the 10 questions correctly, while 66 percent of those shown the PDF answered them correctly. To test for statistical significance, a t-test was used. The result was not significant ($t = 0.1317 < t_{.05} = 5.991$). Therefore, recall was not related to presentation modality.

Table 4: Percent of correct replies by presentation modality for recall test (n=64)

Questions	Book	Screen
A1: Which of the fonts below is used in the photo book?	37.50%	28.13%
A2: What are the weather conditions in the photo of the Highland Park Diner?	87.50%	81.25%
A3: What are the people doing in the photo taken in Highland Park?	78.13%	71.88%
A4: In the aerial view of RIT's campus are the parking lots full or empty?	65.63%	56.25%
A5: At what time of day was the picture of Cobbs Hill Reservoir taken?	59.38%	62.50%
A6: How many people are in the picture of the Little Theatre Café?	34.38%	53.13%
A8: What is the color of the car in the Henrietta Wal-Mart parking lot?	96.88%	93.75%
A9: How many bridges are visible in the picture of the Dinosaur Barbeque?	46.88%	46.88%
A10 What color are the shirts people are wearing in the photo of the concert at the Hochstein School of Music and Dance?	81.25%	75.00%
A11: The High Falls at Dawn, Noon, Dusk, and Night: which two pictures are not in the photo book?	81.25%	87.50%
Mean Value	67%	66%
Standard Deviation	22%	20%

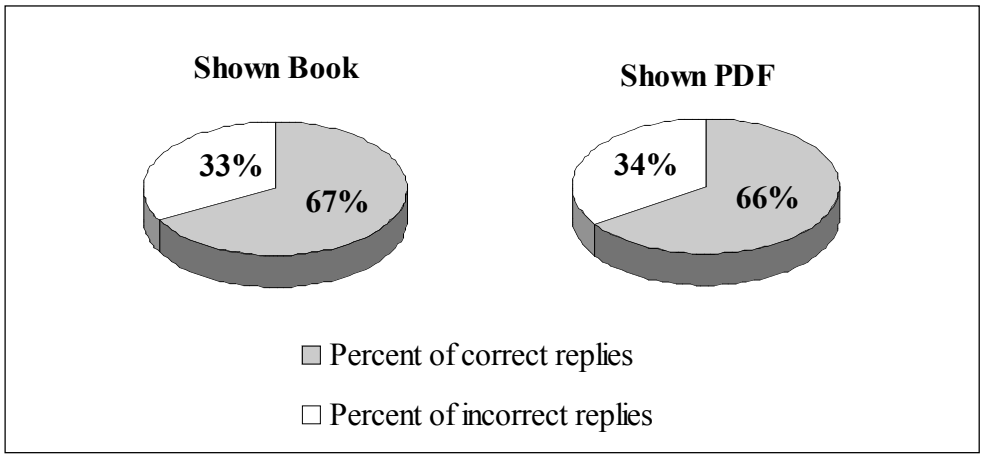

Figure 2: Average percent correct by presentation modality for recall test

The Recognition Test

For the recognition results in the second part of the test, subjects were shown ten images and asked if they were exactly the same as they were in the photo book (see Appendix A for the test images). Table 5 shows that an average of 78 percent correct for those shown the book and 77 percent correct for those shown the PDF. To test for statistical significance, a t-test was used. The results were not significant ($t = 0.0703 < t_{.05} = 5.991$). Therefore, recognition was not related to presentation modality.

Subjects got high error rate on image number C1, C5, and C8, which were similar photographs of the same content from slightly different viewpoints. Image number C3, C6, C7, and C9 were exact matches. Image number C2, C4, and C10 were completely different photographs, but with possible logical associations to the ones in the book.

Table 5: Percent of correct replies by presentation modality for recognition test (n=64)

Image No.	Book	Screen
C1	62.50%	37.50%
C2	100.00%	96.88%
C3	87.50%	100.00%
C4	90.63%	87.50%
C5	53.13%	53.13%
C6	96.88%	96.88%
C7	78.13%	90.63%
C8	12.50%	9.38%
C9	93.75%	96.88%
C10	100.00%	96.88%
Mean Value	78%	77%
Standard Deviation	28%	32%

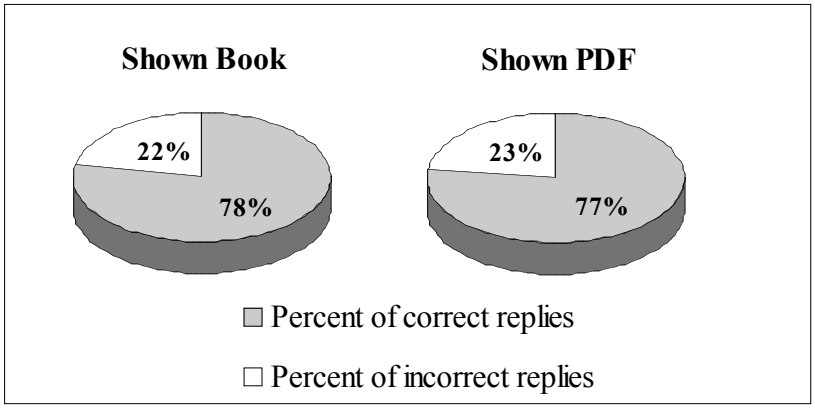

Figure 3: Average percent correct by presentation modality for recognition test

Chapter 6

Conclusions

Summary

The goal of this research was to investigate the differences in interacting with photo books by presentation modality. In previous research, reading text online was 10 to 30 percent slower than on paper (Kuruniawan & Zaphiris, 2001). There was little research about how people interact with photos, but market trends show that people are using electronic images more.

In this study, people were shown photos in a book or on a screen. The level of interaction was measured in two ways: 1. Behavioral: Will people choose one medium over the other? 2. Cognition: How much time will they spend with the content? How much will they remember?

A test to determine recall and recognition was administered after the participant read the photo book. The results were as follows: 1. There were no differences in the way people interact with photographic content presented in print versus on screen. 2. Cognition: The amount of time spent reading the content and how much people remembered were not related to the medium modality. 3. Behavioral: Overall, the majority of participants in both groups preferred the printed book to the PDF. However,

of those shown the PDF, a greater proportion selected it.

Implication for Photo Finishing Industry

This experiment shows that the physical touch of printed photos is still valued. Photo-finishers can demonstrate samples of printed photo books and other personalized products, which would attract people to make photo prints and/or products.

However, relatively more participants shown the electronic version were more likely to select the PDF. This may indicate that, as people get used to viewing photos on screen, they may adapt to the new technology at the expense of the old. Photofinishing may see a downward trend as a result.

Areas for Further Study

In this experimental study, subjects were offered the medium of preference for free. An area for further research would be to ask if subjects have to pay for the photo book in print or CD, would they prefer to pay to get either medium, and how much would they pay for the medium of preference?

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Appendices

Appendix A

Appendix A

Test Questions

Part A

A1. Which of the fonts below is used in the photo book?

- ☐ Rochester Landmarks (Courier)
- ☐ Rochester Landmarks (Times New Roman)
- ☐ Rochester Landmarks (Papyrus)
- ☐ Rochester Landmarks (Garamond)
- ☐ Rochester Landmarks (Arial)

A2. What are the weather conditions in the photo of the Highland Park Diner?

A3. What are the people doing in the photo taken in Highland Park?

A4. In the aerial view of RIT campus are the parking lots full or empty?

A5. At what time of day was the picture of Cobbs Hill Reservoir taken?

A6. How many people are in the picture of the Little Theatre Café?

A7. Describe the hairstyle of the man pictured in the Henrietta Town Recreation Center?

A8. What is the color of the car in the Henrietta Wal-Mart Parking lot?

A9. How many bridges are visible in the picture of the Dinosaur Barbeque?

A10. What color are the shirts people are wearing in the photo of the concert at the Hochstein School of Music and Dance?

A11. The High Falls at Dawn, Noon, Dusk, and Night, which two pictures are not in the photo book?

Part B

Describe in detail the image in the photo book you remember the best.

Part C

You will now be shown ten images. Your task is to decide whether or not each appeared in the photo book. Please answer "Yes" it did appear or "No" it did not appear for each image.

C1

Aerial View of the RIT Campus

C2

Wegmans Parking Lot

C3

The Corner of East Avenue and Main Street

C4

Group in Little Theatre Café

C5

Charlotte Pier

C6

The High Falls at Noon

C7

Concert at the Artisan Works

C8

The Highland Diner

C9

Show World, Monroe Avenue

C10

Lilac Festival Evening

Appendix B

Appendix B

Recording Sheets for Recall and Recognition Test

For Recall Test

Participant No.	Reading Time	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	
												Dawn	Noon
												Dusk	Night
												Dawn	Noon
												Dusk	Night
												Dawn	Noon
												Dusk	Night
												Dawn	Noon
												Dusk	Night

For Recognition test

Participant No.	B	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Choice and Reason

Appendix C

Appendix C

Choice of Medium Preference

		Observed	Expected	Difference	Squared Difference	Squared Difference divided by expected Frequency
Shown Book	Selected Book	29	23.74	5.26	27.67	1.17
Shown Book	Selected PDF	17	22.26	-5.26	27.67	1.24
Shown Electronic	Selected Book	3	8.26	-5.26	27.67	3.35
Shown Electronic	Selected PDF	13	7.74	5.26	27.67	3.57
						9.33

Degrees of Freedom = (2-1)(2-1) = 1

$X^2 = 9.33 > X^2_{.05} = 3.841$

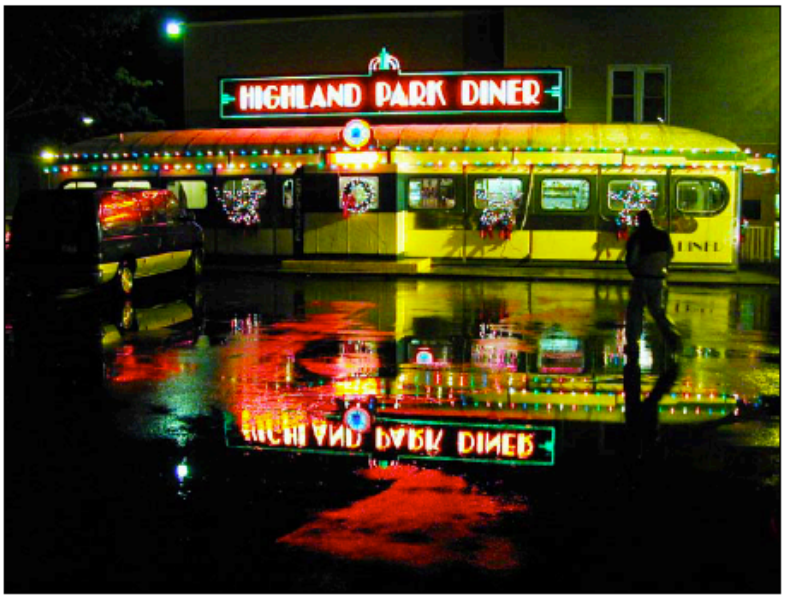
Appendix D

Appendix D

The Photo Book

Rochester Landmarks

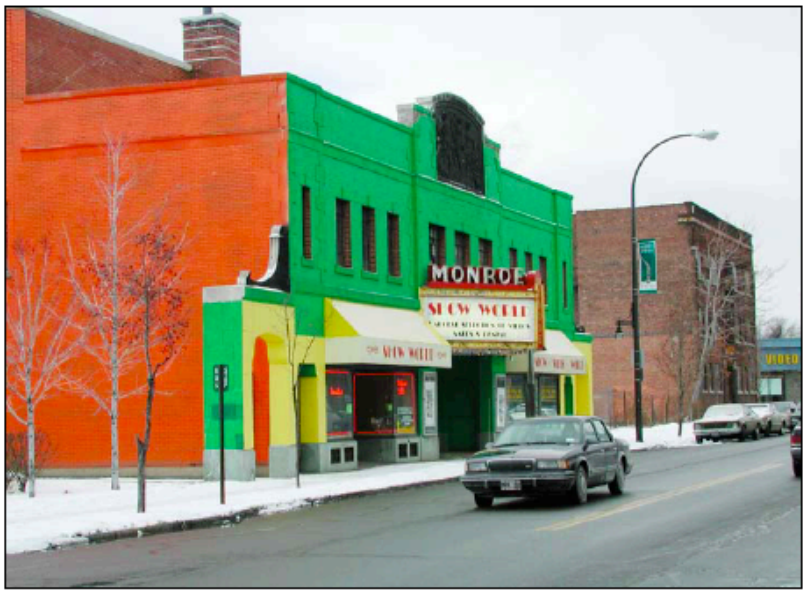
Aerial View of the RIT Campus



The Highland Diner

Sledding at Highland Park

The Lilac Festival



Show World, Monroe Avenue

The Corner of East Avenue and Main Street

Cobbs Hill Reservoir

Henrietta Town Recreation Center

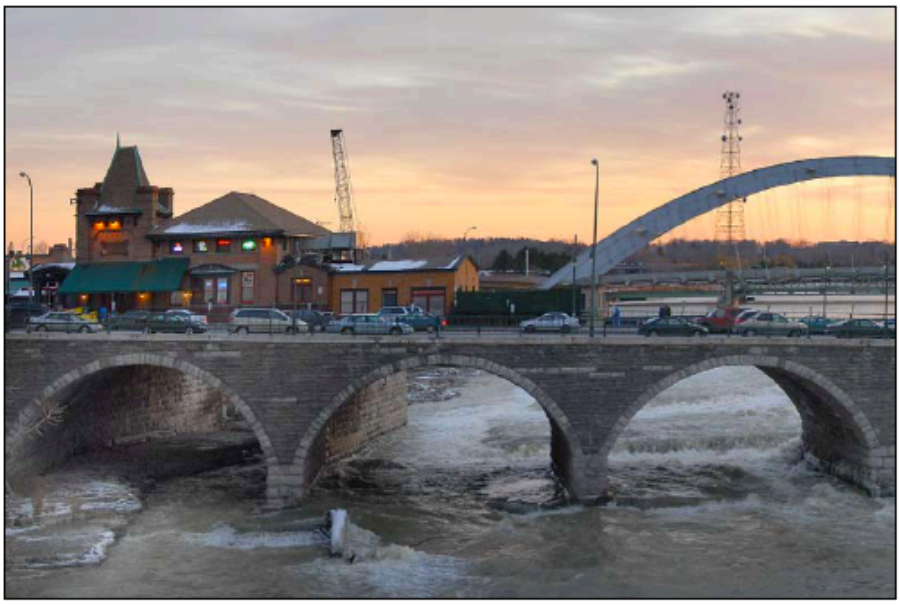
The Little Theatre Cafe

The High Falls at Noon

The High Falls at Dusk

Cellino and Barnes, Your Injury Attorneys, Call 454-2020

Future Cellino and Barnes Rochester advertising plans



The Dinosaur Barbeque

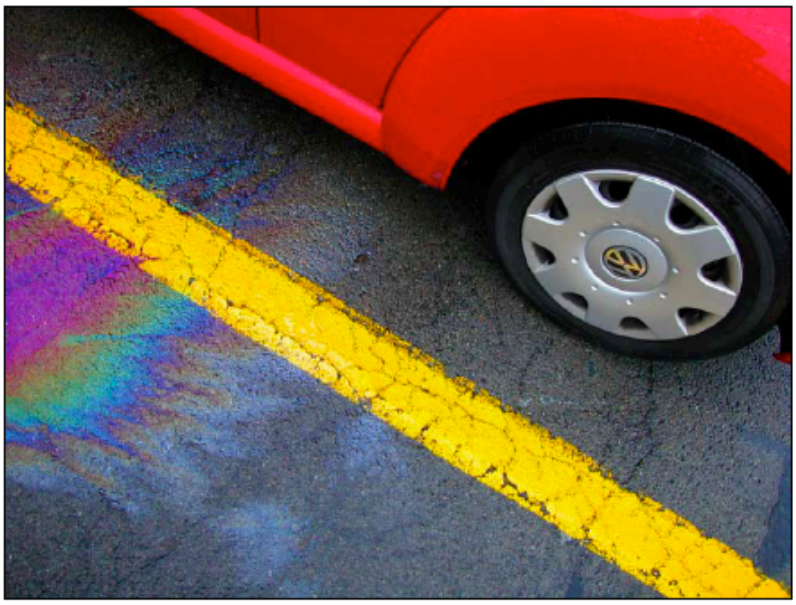
Cinema Theatre Benefit Concert

Concert at the Artisan Works

Charlotte Pier

Lipstick Aisle in Pittsford Wegmans

Concert at the Hochstein School of Music and Dance



Henrietta Wal-Mart parking lot

House of Questionable Repute, Brighton