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**Bridging the digital divide:
libraries providing access for all?**

"Reading by the Year 2110"

Reading Behavior and Mobile Reading Devices. A Case Study.

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Abstract

The purpose of the paper is to present results of experiments conducted in a project course held at the Berlin School of Library and Information Science. The aim of the experiments was to find out if and how human reading behavior is influenced by electronic reading devices. The students conducted three experiments. The first gave an overview on how people react to new reading technology/devices. The second and third were exploring implications such as reading rate, concentration and symptoms of fatigue.

Test objects were the Sony Reader PRS-505, iRex iLiad, Laptops and the Smartphone HTC Touch HD in comparison to printouts (DIN A4: 210 by 297mm) and books.

Contrary to common opinions the results show that concentration when reading does neither depend on reading media nor on reading rates. Furthermore, rather the nature of a text (scholarly or novelistic) and the person's personal preferences and habits influence reading rates and concentration.

Future research on this topic should include experiments with more participants and a wider selection of different reading devices.

Keywords

Reading behavior, eBook Reader, Electronic reading devices

Introduction

During the summer term 2009 the Berlin School of Library and Information Science offered the project "Benutzungsstudie Lesen" under the direction of Dr. Michael Seadle Ph.D. and Elke Greifeneder MA.

Nine students participated in the course - playing the role of test persons and persons conducting experiments at the same time. Each of the three experiments was conducted by three students.

Before the course started every participant had to take a population test, which included questions regarding ones own reading behavior, and two German reading behavior tests that are available on the Internet.

Methodology

The first experiment was conducted to find out attitudes of participants towards electronic reading devices. Qualitative interviews were taken with each of the six test persons. The interviews were recorded either on video or audio. Furthermore, notes were taken on answers and gestures of the participants.

The aim of the second experiment was to collect information on reading rates for different test persons reading on numerous devices for a certain time span.

The third experiment tried to expand the results of the second experiment. Each test person read on one reading device only as well for a certain time span. This was done in order to find out how reading for a long time affects concentration or exhaustion.

First Experiment

In the first experiment each participant read one page of a dissertation (available on the edoc-server of the Humboldt University, Berlin) as a paper printout. Afterwards the test persons were asked to continue reading on either a smartphone, an eBook Reader or a LCD screen. After reading on both devices each test person was asked the same questions concerning their personal opinions on handling the electronic device as well as their personal preferences.

The first experiment tried to answer the following questions:

1. How did the test persons experience the difference between reading a paper printout and reading on an electronic device?
2. Was there a difference between using the two devices?
3. How did the test persons manage the electronic device?

Most test persons claimed that there was no difference between reading with the electronic device and reading the printout. Nevertheless the printout was preferred because of reading habits the participants have accomplished. The observations were contradictory. For example, the eBook Reader was taken into the test persons hands like a book but the printed text stayed on top of the table throughout the experiment. The resentments toward the electronic devices, especially the Smart Phone and the eBook Reader are most likely caused by the very short time each test person had to get used to the device. The LCD Screen was rated negatively because of the exhaustion of the eyes. For all electronic devised scrolling and the missing ability to jump to footnotes was felt to be tiresome.

Second Experiment

The question the second experiment tried to answer was:

1. Does a reading device constitute a significant influence factor on reading rates?

To answer that question five test persons were asked to read a German novelistic text for eight minutes on one reading device. After the eight minutes the sentence where the participants had to stop reading was recorded and then they had to switch devices and start reading from the same point they left at the other device for another eight minutes. That was conducted five times, so each participant used five different devices. The total reading time was forty minutes. The devices used were a printout, a book, a LCD Screen, a Sony eBook Reader and an iRex eBook Reader. The sixth test person read on a printout for comparative reasons, throughout the experiment.

To avoid skim-reading the text and to keep the motivation up the participants were told that their reading comprehension will be tested after the experiment.

Before and after the experiment the participants were asked on which reading device they thought they would read fastest. Before the experiment four out of five participants assumed that they read fastest on the printout. The fifth person stated that there will be no difference in reading rates. After the experiments every test person was asked the same question again and surprisingly answered differently to before. Three participants claimed they read fastest on the Sony eBook Reader, one test person assumed that there was no difference and one test person could not decide on the fastest device but said that the slowest reading rate was recorded when reading on the LCD Screen.

Unlike their self evaluation two of the test persons were fastest when reading on the Sony eBook Reader, two on the paper printout and one on the iRex eBook Reader.

Table 1: Reading Rates by participants and reading devices in words per minutes (wpm).

	Test Person No. 1	Test Person No. 3	Test Person No. 7	Test Person No. 8	Test Person No. 9
Book	212.38	74.88	408.63	251.75	202.63
Printed Document	219.13	101.38	487.88	237.75	253.5
iRex Reader	274.25	85.13	381	227	252.75
Sony Reader	190.88	81.38	435	257.13	304.5
LCD Screen	234	95.6	425.88	222.88	209.13
Population Test	211	66	445	225	215

The figures in rows 2 - 6 are the data gained in the experiment. The bottom row show the data gained in the population test.

Test person No. 3 has comparatively slow reading rates. The reason is that the participant is not a native German speaker and as mentioned above, the text was in German. The comparatively high reading rates from test person No. 7 can only be explained with the fact that the participant is a very fast reader as well.

Table 2: Average reading rates (wpm) by reading device.

Book	Printed Document	Sony Reader	iRex Reader	LCD Screen
230.05	259.9	253.78	244.03	237.5

The highest reading rate was achieved by test persons reading the printout, followed by the two eBook Readers. The LCD Screen and the traditional book were the reading devices with the slowest. As the difference between the fastest and the slowest device is 29.85 wpm (words per minute) and thereby very small, the students believe that it is not possible to determine clearly whether one device is superior to the other, but a small tendency is pointing at eBook Reader.

Table 3: Average reading rates (wpm) by test person.

Test Person No. 1	Test Person No. 3	Test Person No. 7	Test Person No. 8	Test Person No. 9
226.13	87.68	427.7	239.3	244.5
211	66	445	225	215

As in table 1 the figures in the second row are the data gained in the experiment and the bottom row shows the data gained in the population test.

The findings in this experiment show that differences in reading rates exist, but they are very small and rather continual across the five devices used. The reading behavior of test persons seems to be more significant than the reading devices they use. Certainly, the results have to be verified with a higher number of test persons, possibly with different backgrounds as only students from a certain age and social background were used in this experiment.

Third Experiment

The third experiment developed out of the results gained in the second experiment. The following questions were tried to be answered:

1. Have reading devices (electronic or not) any influence on test persons, as in do reading devices support exhaustion or alertness?
2. Are test persons influenced by the knowledge that a quiz testing reading comprehension will follow at the end of a defined reading session?
3. Does it make a difference if test persons read scholarly or novelistic texts?

To answer these questions three reading devices, a book, the Sony eBook Reader and a LCD Screen, were prepared with a scholarly text from the field of Library and Information Science. Each reading device was tested by two participants, one of the two was told to expect a reading comprehension test. That information was kept from the second test person reading on the same device.

Each of the test persons read on their assigned reading device for sixty minutes. After every ten minutes the participants were told to stop reading and the sentence up to which they read was recorded.

Table 4: Average reading rates (wpm) by test person.

Test Person No. 2 Sony Reader	Test Person No. 3 LCD Screen	Test Person No. 4 Sony Reader	Test Person No. 5 LCD Screen	Test Person No. 6 Book	Test Person No.10 Book
192	73	133	208.7	110.6	124.1
236	66	185	244	184	201

As in table 1 the figures in the second row are the data gained in the experiment and the bottom row shows the data gained in the population test.

One of the test persons was absent due to illness when the third experiment was conducted. Test person No. 10 filled the missing spot because otherwise the experiment could not have been completed. Unfortunately test person No. 10 did not come from the field of Library and Information Science. The students believe this to be the reason for the strong fluctuations of single data set.

Except for test person No. 3, the not native German speaker, every participant during the experiment was slower than in the population test. The students believe that this result shows a clear influence of the character of the text on reading rates. The reason that test person No. 3 reads scholarly texts faster than novelistic texts may be that as a foreign student one is used to reading scholarly texts in German but not fictional ones.

Table 5: Average reading rates (wpm) per time interval.

	Test Person No. 2 Sony Reader	Test Person No. 3 LCD Screen	Test Person No. 4 Sony Reader	Test Person No. 5 LCD Screen	Test Person No. 6 Book	Test Person No. 10 Book
1. Measurement	185.6	70.1	121.4	198.8	117.3	126.6
2. Measurement	188.6	77.9	137.4	191.3	118	84.2
3. Measurement	163.9	74.6	121	227.2	98.1	100.1
4. Measurement	195.2	66.8	132.8	190.8	102.6	163.2
5. Measurement	205.1	76.2	147.9	205.1	116	117.7
6. Measurement	215	72.4	143.2	237	111.5	152.7

The bold numbers in table No. 5 show the fastest periods for each test person. Except for test person No. 10 the data does not show significant variations in reading rates. Contrary to the received opinion that electronic reading devices cause exhaustion the fastest reading rates of test person No. 5, reading on a LCD Screen, and test person No 2, reading with the Sony eBook Reader, was during their last reading period.

The data also shows that the announcement of a reading comprehension test seems not to influence the reading rates. The test persons being told to prepare to answer a test were No. 4, 5 and 6. None of these participants showed slower reading rates than the test persons not expecting a test at the end of the experiment.

Table 6: Average reading rates (wpm) by reading device.

Book	Sony Reader	LCD Screen
117	162.5	140.5

Experiment 3 supports the result from experiment 2 concerning the average reading rates per device. The eBook Reader was the fastest device and the book the slowest.

Conclusion

Even though there were only a small number of test persons from a similar background the results are valuable and new. All participants had effectively a positive attitude towards new reading devices. Problems voiced in experiment 1 did not show when the electronic reading devices were actually put to test. Further they support mobility and experiments 2 and 3 show that there are no disadvantages compared to traditional devices, maybe even a small advantage may be seen

Test persons were not influenced by the reading devices, but by the character of the text. Further external influences or persona might affect their reading. Reading behavior is individually formed and may not change because of new technology.