ORIGINAL ARTICLE

Printed Book or E-book, Which is Better? An Investigation using Manga and Magazine

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Abstract: The market of e-book has been growing fast and showing a great potential recently. However, the traditional printed books are still predominating the major market. Most people still prefer printed book despite e-book's advantages. In this study, we conducted an experiment involving 34 participants to determine the difference between e-book and printed book in terms of user experience. We hypothesized that different contents would influence the result, therefore we chose two different genres of books: magazine and the Japanese comic book - manga. Participants were asked to read on E-Reader and printed book, then asked to evaluate their experience using questionnaire. ANOVA, Wilcoxon signed-rank test, multiple regression analysis and principal component analysis were conducted to analyze the difference between each group and correlative factors that affected overall evaluation. The result indicated that printed books were rated higher than e-books, and manga was more applicable to e-book than magazine.

Keywords: *E-book, Magazine, Manga*

1. INTRODUCTION

1.1 Definition of e-book

An electronic book (expressed as e-book, ebook, eBook, E-book or digital book. we use "e-book" hereafter) is a book-length publication in digital form, consisting of text, images, or both, readable on computers or other electronic devices [1]. Now the function of e-book is growing to cover various types of electronic materials such as movie, sound and 3D image, expanding the definition of e-book.

In earlier, e-book is simply considered as "an electronic version of a printed book available to view on a PC, Smartphone, E-Reader and other platforms" [2]. However, some publications are now offered as e-books in presale before they are printed (e.g. online blog and online novel) and some other e-books are exclusively sold in digital form without any printed equivalent.

1.2 Development of E-Reader

The resurgence of old publications has been increasingly prevalent in recent years in parallel with spread and development of e-book. E-Reader, also called as e-book reader or e-book device, is a portable electronic device that is designed primarily for reading digital e-books. The first sale of e-book readers, the Rocket e-book and the SoftBook Reader, was in 1998. The concept of them was a book-sized electronic device that could reposit many publications in digital form. Of them, the Rocket e-book

was the first dedicated e-book reader by NuvoMedia, a company founded in 1997 in Palo Alto, Silicon Valley. The Rocket e-book could connect to a computer (Windows PC or Macintosh) through the Rocket e-book Cradle, a device with two cables: a cable for power through a wall transformer and a serial cable for the computer [3]. Immediately after the launching of Rocket e-book, SoftBook Press released the SoftBook Reader, along with simultaneous releasing the SoftBook Network, that is a web-based content delivery service. The device was ergonomically designed for the reading of long documents and books could be downloaded from the Internet [3].

In 1999, succeeding e-book readers were launched (e.g. the Every-Book Reader & the Millennium e-book). The EveryBook Reader was "a living library in a single book", with a "hidden" modem to dial into the EveryBook Store, for the people "to browse, purchase, and receive full text books, magazines, and sheet music" [3]. The Millennium e-book was a small low-cost e-book reader launched by Librius, a "full service e-commerce company". On the website of the company, an advertising copy was "(a World Bookstore) delivers digital copies of thousands of books via the Internet" [3]. All these e-book readers didn't last long [3].

The Gemstar e-book was released in November 2000 after Gemstar carried out M&A through incorporating e-book pioneer companies NuvoMedia (the manufacturer of Rocket e-book) and SoftBook Press (the manufacturer of SoftBook Reader) [3]. However, the sales were far

below expectations. In 2003, the company discontinued e-book readers and e-books [3]. The sales of E-books were stumbled because the demand for e-book had remained as low. In contrast, the conventional printed books remained to be popular. The media criticized that the e-books trend would not continue so long [2].

In 2004, Sony released the Librie, known as the first e-book reader to adopt E Ink (electronic ink) technology. Words on the screen had almost the same clarity as printed on paper [2]. In 2007, the online book retailer Amazon released the Kindle that was sold out in five and a half hours [4]. In 2010, Apple iPad debuted. The associated iBookstore sold half a million e-books in less than a month. Recently many E-Readers were introduced at several electronic shows by Asus, Sony Plastic Logic Samsung and more companies [2].

Although the increasing in the number of E-Reader users (e.g. Kindle & iPad) and the success of e-book store system (e.g. Amazon & iBookstore) had greatly promoted the growth of the e-book market, it seems that the conventional printed books are still the first choice for many people. In 2010, according to the Association of American Publishers, e-books made up 9.03% of total consumer book sales - compared to 3.31% at the close of 2009 [5]. It was a great leap in the development of e-books but the market was still much smaller than the conventional printed books. In the same year, the e-books boom broke out in Japan. Though the year 2010 was called "The first year of e-book" in Japan, the conventional printed books still dominated the market in Japan in 2011, showing 27 times larger in market scale than that of e-books [6].

Nevertheless, we can say that the success of Kindle implies the great potential of e-book market.

It seems that e-books could help people read and buy more books, and the market is growing fast. In the year 2014, online spending on books had overtaken in-store spending for the first time in the UK, and the sales of print and e-books together stood at £2.2billion, up from 4% the previous year [7].

In the year 2014, an investigation on the market share of e-books in the US showed that printed book is still the major of the market (65%) compared to e-books (35%) [8]. It was estimated that the market share for e-books in Spain in 2015 would be around 21% [9].

Why do most people still prefer the traditional printed books? What makes the difference between printed books and e-books? There is more than one answer. In this study, we focused on the difference in user experience between printed books and e-books when reading same contents.

1.3 Associated research

There are many reports that focused on the differences between e-books and printed books. According to a study that explored 36 subjects, reading on paper was more comfortable and relaxing than reading on E-Reader in subjects who preferred the printed books. On the other hand, the subjects who preferred e-books listed the legibility and ease of use as the advantage of e-books. Taking no account of those individuals' preferences, reading speed and the comprehension test score on E-Reader were significantly higher than those on paper while reading descriptive text. The authors suggested that the one of the most important reason why the paper is still a prevailing media with higher usability is merely the familiarity [10].

In another study focusing on the usability of e-book in educational situation, the reading time and the degree of text comprehension were compared between the readers using the Kindle 3 e-book and those using Apple's iPad tablet computer. to a printed document to determine if text presentation format had a significant effect on [11]. Results indicated that the reading time by printed materials showed faster than those reading from e-book readers and tablets. Participants found the tablet the most usable, followed by the e-book reader, and the printed material was considered the least usable. There was no effect of text presentation format on reading comprehension, supporting the use of e-book readers and tablet computers in academic environments [11].

2. METHODS

It remains still difficult to determine better media from e-book and printed book. Each of them has different advantages, and the reading content used in past experiments might have unexpected influences on subject's rating in satisfaction when using the reading media. In this study, we therefore aimed to determine better combination of media type and contents, not to focus on identifying definite best media.

Experience of reading images is also important. As manga (i.e. Japanese comics) is popular among Japanese and the e-books for manga are always listed in the Amazon best sellers rank, we chose manga as one of the contents for experiment. Again, we chose magazine as the other type of contents to compare with manga, considering that it also contains both words and images.

2.1 Participants

The participants were 34 Japanese graduate school students (17 males and 17 females) who were using Japanese as their first language. We checked and made

sure that all participants were able to see the information shown in E-book and printed in paper book clearly.

2.2 Materials

We chose the manga and magazine stimuli which are emotionally neutral. We checked that the stories in manga and the articles in magazine presented in this experiment were novel for the participants. The manga and magazine were all written in Japanese, and had been published in both e-book and printed versions.

Manga: Terrarium in Drawer (Hikidashi ni Terrarium), written and illustrated by Ryoko Kui, was chosen as the stimuli. It is a collection of short, odd and humorous stories on a wide variety of theme. The official printed version of the book was used as the manga printed book stimuli. Its e-book version in Kindle Store was used as the manga e-book stimuli.

Magazine: Pen with New Attitude (No.352, 2014), a Japanese lifestyle magazine, was chosen as the magazine printed book stimuli. It also has a wide range of topics, including food, travel, fashion, music, etc. The e-book version in Kindle Store was used as the magazine e-book stimuli.

E-Reader: Amazon Kindle Fire HD (5.0*7.5 inch) was used as E-Reader. The manga stories and magazine articles were purchased and downloaded into the device beforehand.

2.3 Task sessions

The participants were asked to be seated themselves and were instructed the procedure of the experiment. Then the participants touched the E-Reader Kindle Fire. They were requested to get familiar with the basic functions and operations of it. We asked the participants to report their general reading experience, not focus on specific phrases, images or other details of contents when they were exposed to stimuli.

The experiment was divided into 4 sessions: e-book manga, printed book manga, e-book magazine and printed book magazine (Figure 1). The participants underwent all the sessions. In each session, participants read specified

Figure 1: Examples of used stimuli

From left to right: e-book manga, printed book manga, e-book magazine and printed book magazine (the images are blurred to protect their copyright).

pages from e-book or printed book, then answered the questionnaire sheet. The sequence of the sessions was counterbalanced across participants. We selected 4 different pages for 4 sessions: Story A (manga), Story B (manga), Article C (magazine) and Article D (magazine). Story A and Story B were chosen from the manga Terrarium in Drawer and both have 8 pages. Article C and Article D were chosen from the magazine Pen with New Attitude and both have 4 pages. The reading time in each session was limited to 10 minutes.

2.4 Questionnaires

We considered the satisfaction score after reading was representative index to evaluate the overall reading experience. On the first page of the questionnaire, participants were asked to rate the score of satisfaction in the range 0 to 100. Afterwards, 25 adjective word pairs based on Semantic Differential Method (SD method) were presented to participants and requested them to score each item by -3 to 3 which seemed to best quantify reading experience.

2.5 Analyses

A 2-way 2-level ANOVA (Analysis of Variance) with repeated measure and post hoc analysis using Bonferroni adjustment were conducted to analyze the differences between group means of the satisfaction score. A multiple regression analysis was also conducted to estimate the relationship between the dependent variable (satisfaction score) and the independent variables (adjective word pairs in SD method). Finally, using all the scores for adjective word pairs, principal component analysis was conducted to examine whether the responses could be explained less components that loaded the scores. We considered the principal components with absolute value more than 0.500 as strong.

3. RESULTS

3.1 Overall satisfaction score

The averaged satisfaction score of each session is shown in Figure 2 (e-book/magazine: mean=61.44, sd=18.38, printed book/magazine: mean=73.74, sd=16.86, e-book/manga: mean=74.44, sd=15.68, printed book/manga: mean=78.18, sd=16.74). A 2-way ANOVA with repeated measures yielded significant main effect both for the reading medium (e-book vs printed book: $F_{1,33}=22.58$, $p<0.01$) and for the reading contents (manga vs magazine: $F_{1,33}=18.14$, $p<0.01$). The interaction between medium and contents was also significant ($F_{1,33}=5.34$, $p=0.027$). This implies that a combination of specific medium and

Figure 2: The satisfaction rating score of each group

specific genre of contents might improve the legibility of that content.

Thus, we carried out post-hoc analysis using Wilcoxon signed-rank test with Bonferroni correction. The satisfaction score when reading e-book were rated lower than that when reading printed book (the differences in averaged score: $\Delta=8.02$, $p<0.01$), nevertheless the satisfaction score when reading manga was significantly higher than that when reading magazine ($\Delta=8.72$, $p<0.01$). This analysis also showed that the satisfaction score when reading manga was significantly higher than that when reading e-book.

3.2 Contribution of adjective word pairs on satisfaction score

Then we conducted linear multiple regression analysis to investigate whether the satisfaction score could be estimated from weighted mixture value of the scores rated in adjective word pairs by SD method.

In the session of e-book magazine, the adjective word pair “understandable - incomprehensible” made the largest contribution ($\beta=-0.517$, $p<0.01$) and “no fatigue - fatigue” made second largest contribution ($\beta=-0.395$, $p<0.01$) to the satisfaction score ($R_2=0.457$).

In the session of e-book manga, there were 4 adjective word pairs showed significant correlation with satisfaction score: “light - heavy” ($\beta=-0.331$, $p<0.05$), “concentrated - distracted” ($\beta=-0.315$, $p<0.05$), “understandable - incomprehensible” ($\beta=-0.314$, $p<0.05$), and “deep - shallow” ($\beta=-0.282$, $p<0.05$) ($R_2=0.522$).

In the session of printed magazine, adjective word pairs “impressive - unimpressive” ($\beta=-0.490$, $p<0.01$) and “concentrated - distracted” ($\beta=-0.322$, $p<0.05$) were shown as the most correlative predictor variables ($R_2=0.373$).

Finally, in the session of printed manga, “impressive - unimpressive” ($\beta=-0.604$, $p<0.01$) and “friendly - unfriendly” ($\beta=-0.317$, $p<0.05$) showed largest contribution to the satisfaction score ($R_2=0.569$).

3.3 The components underlying the scores of adjective word pairs

In e-book manga group, we found 3 principal components with strong loadings (Table 1). Of them, the first principal component strongly loaded the scores for 5 adjective word pairs in reading contents category “vague - apparent” (-0.73) and in reading experience category “deep - shallow” (0.73), “impressive - unimpressive” (0.80), “interesting - boring” (0.70), and “attractive - unattractive” (0.87). All these word pairs seemed to be related with the feelings arises from reading content, manga. The second principal component loaded 7 variables (“uncomfortable - comfortable” (-0.52), “tension building - relaxed” (-0.75), “no fatigue - fatigue” (0.55), “easy - difficult” (0.53), “stressful - stress-less” (-0.81), “convenient - inconvenient” (0.66), and “cheap - pricy” (0.60), all these belong to using experience category) that seemed to be related with the usability of e-book. The third component loaded the scores of “rare - common” (0.63), and “heavy - light” (0.53) of the device and “no fatigue - fatigue” (-0.51) of the using experience. These scores seemed to be related with familiarity to E-reader.

Table 1: The component loadings of adjective word pairs in e-book manga group

Adjective word pairs	Component loadings		
	1	2	3
uncomfortable – comfortable	.112	-.516	-.320
real – unreal	.254	.044	.306
bright – dark	-.154	.357	.135
smooth – rough	.499	-.251	.382
rare – common	.070	-.374	.629
light – heavy	.192	.334	-.428
tension building – relaxed	-.247	-.754	.120
no fatigue – fatigue	.337	.551	-.511
Easy – difficult	.294	.534	.346
concentrated – distracted	.470	.441	.107
stressful – stress less	.086	-.807	-.131
convenient – inconvenient	.037	.657	.249
understandable – incomprehensible	.443	.216	.389
cheap – pricy	-.148	.597	.171
indecent – elegant	.032	.411	-.105
friendly – unfriendly	.484	.386	-.014
stimulating – calm	-.044	-.331	.415
vague – apparent	-.731	.126	.056
old – new	.116	.168	-.363
deep – shallow	.726	-.433	-.191
impressive – unimpressive	.800	-.330	.020
interesting – boring	.702	.098	.362
attractive – unattractive	.868	-.031	-.041
trustworthy – not trustworthy	.391	-.117	-.269
intent to buy – not intent to buy	.383	-.182	-.333

In e-book magazine group, we found 4 principal components with strong loadings (Table 2). The first principal component showed contribution on the score of 14 adjective word pairs, “tension building - relaxed” (0.57), “no fatigue - fatigue” (0.58), “stressful - stress-less” (0.75), “vague - apparent” (-0.66), “uncomfortable - comfortable” (-0.79), “rare - common” (-0.52), “concentrated - distracted” (0.59), “understandable - incomprehensible” (0.65), “friendly - unfriendly” (0.54), “deep - shallow” (0.69), “impressive - unimpressive” (0.55), “interesting - boring” (0.74), “attractive - unattractive” (0.74), “trustworthy - not trustworthy” (0.56). This component is mixed of factors related to reading content and reading experience (usability) of the medium. Among these variables, “uncomfortable - comfortable” (0.79) and “stressful - stress-less” (0.75) are the strongest correlated variables, related to the using experience of E-reader. The second component is strongly correlated with 4 variables, which are “rough - smooth” (-0.57), “easy - difficult (to understand how to use)” (-0.57), “convenient - inconvenient (to use)” (-0.79) and “friendly - unfriendly” (0.50). This component can be viewed as the difficulty of using E-reader. The third component is only positively corre-

lated with “cheap - pricy” (0.81) and “indecent - elegant” (0.66), which are all related to the impression of the contents. The forth component is negatively correlated with “bright - dark” (0.52), “concentrated - distracted” (0.53) and “intent to buy - not intent to buy” (0.53).

In the group of printed manga, we screened 4 components out of all extracted components (Table 3). The first component is correlated with “bright - dark” (0.59) of the E-reader, “indecent - elegant” (-0.66), and extremely correlated with “deep - shallow” (0.75), “impressive - unimpressive” (0.83), “interesting - boring” (0.85), “attractive - unattractive” (0.89), “trustworthy - not trustworthy” (0.74) and “intent to buy - not intent to buy” (0.82). This component can be viewed similarly to the first component in the group of e-book manga, which is mainly about the reading content of the book. The second component is correlated with “tension building - relaxed” (-0.62), “no fatigue - fatigue” (0.76), “easy - difficult (to understand how to use)” (0.65), “convenient - inconvenient (to use)” (0.58), “concentrated - distracted” (0.60) and “stimulating - calm” (-0.64). This component is also similar with the second component in the e-book manga group, which is viewed as the usability

Table 2: The component loadings of adjective word pairs in e-book magazine group

Adjective word pairs	Component loadings			
	1	2	3	4
uncomfortable–comfortable	-.786	.302	.258	.033
real–unreal	-.065	-.001	-.376	.491
bright–dark	-.084	.063	-.372	.520
smooth–rough	.061	-.571	.032	.339
rare–common	-.524	.126	-.293	.041
light–heavy	.107	-.042	.424	.152
tension building–relaxed	-.573	-.018	-.181	.060
no fatigue–fatigue	.579	-.439	-.031	-.016
Easy–difficult	.342	-.568	.188	.396
concentrated–distracted	.591	-.045	-.163	.532
stressful–stress less	-.745	.262	.339	.039
convenient–inconvenient	.413	-.789	-.024	.094
understandable–incomprehensible	.649	.409	-.085	.157
cheap–pricy	.181	-.233	.810	-.036
indecent–elegant	-.254	.137	.657	.299
friendly–unfriendly	.535	.501	.275	.249
stimulating–calm	-.202	.472	-.074	.243
vague–apparent	-.658	-.270	-.192	.240
old–new	.140	-.162	.413	-.329
deep–shallow	.694	.120	-.172	-.267
impressive–unimpressive	.545	.321	-.186	-.196
interesting–boring	.736	.207	.053	.012
attractive–unattractive	.736	.292	.072	.101
trustworthy–not trustworthy	.558	.053	-.167	-.437
intent to buy–not intent to buy	.424	.386	.251	.528

Table 3: The component loadings of adjective word pairs in printed manga group

Adjective word pairs	Component loadings			
	1	2	3	4
uncomfortable–comfortable	-.427	-.273	.102	-.176
real–unreal	-.117	.146	.474	.287
bright–dark	.587	.049	.016	-.474
smooth–rough	-.128	.165	.733	-.393
rare–common	.263	-.403	-.236	-.266
light–heavy	-.101	.481	.480	.134
tension building–relaxed	.313	-.615	.111	.205
no fatigue–fatigue	-.025	.760	.163	-.026
Easy–difficult	.074	.652	.290	-.059
concentrated–distracted	.397	.598	-.336	-.057
stressful–stress less	-.102	-.385	-.034	.370
convenient–inconvenient	.350	.577	-.231	-.238
understandable–incomprehensible	.440	.499	-.468	.109
cheap–pricy	-.404	.151	-.056	.683
indecent–elegant	-.661	.012	.283	.206
friendly–unfriendly	.25	.200	.330	.575
stimulating–calm	.096	-.643	.200	-.064
vague–apparent	-.243	-.030	-.588	-.176
old–new	.008	.087	-.484	.500
deep–shallow	.749	-.134	.292	.098
impressive–unimpressive	.825	-.120	-.013	.114
interesting–boring	.848	-.011	-.021	.244
attractive–unattractive	.892	-.022	-.068	.214
trustworthy–not trustworthy	.739	-.030	.395	-.090
intent to buy–not intent to buy	.822	-.201	.194	.042

and using experience. However, “calm - stimulating” is revealed as one of the important factors in this group. The third component is strongly correlated with “rough - smooth” (0.73) and “vague - apparent” (-0.59). The forth component is strongly correlated with “old - new” (0.50) and “friendly - unfriendly” (0.56), “cheap - pricy” (0.68).

In printed magazine group, we screened 4 principal components (Table 4). The first component is correlated with “rare - common” (-0.65), “tension building - relaxed” (-0.52), “no fatigue - fatigue” (0.52), “difficult - easy (to understand how to use)” (0.74), “concentrated - disturbed” (0.73), “stressful - stress-less” (-0.64), “understandable - incomprehensible” (0.69), “friendly - unfriendly” (0.72), “deep - shallow” (0.54), “impressive - unimpressive” (0.62), “interesting - boring” (0.73), “attractive - unattractive” (0.64), “intent to buy - not intent to buy” (0.51). This component is similar with the first component in e-book magazine group, which is mixed of factors related to both reading content and reading experience (usability). The second component is correlated with “stimulating - calm” (0.52), “vague - apparent” (-0.50) and “impressive - unimpressive” (0.56), “interesting - boring” (0.51), “attractive - unattractive” (0.53), “intent to buy -

not intent to buy” (0.61). The third component is strongly correlated with “cheap - pricy” (0.70) and “indecent - elegant” (0.75) of the impression of the contents. These variables are identical with those in the third component in e-book magazine group. The forth component is strongly correlated with “old - new” (0.75) and “trustworthy - not trustworthy” (0.65).

4. DISCUSSION

When reading printed manga, impression and approachability seemed to make larger contribution on the satisfaction. When reading e-book, on the other hand, the heaviness of the device and the subjects' concentration on the contents seemed to make great contribution on satisfaction. These results could be interpreted that the participants prefer printed manga to e-book manga, because the printed manga was more impressive and approachable, but the heaviness of e-book manga interfered with the concentration as printed manga. It was observed that most of the participants were holding the E-Reader in their hands while reading e-book manga, but most of them laid the E-Reader down on the table so that they could use their fingers to zoom in and out, or swipe on the screen when reading e-book magazine. It is considered as one reason why the weight of the device was not a correlative factor in the reading experience of e-book magazine. The e-book version of the magazine used the same layout design with the original printed version, which is much bigger than normal E-Reader's screen. Users had to swipe and zoom frequently to read the information of a big page on a small screen. This could also explain why participants rated e-book magazine with lowest score of satisfaction and “getting tired” was detected as a correlative factor according to the result of multiple regression analysis.

The result of the experiment indicated that in general, the traditional printed books provided better experience to users than e-books. Users felt more satisfied while reading printed books. While reading manga, because of the layout design was still applicable to E-Reader (the page sizes are similar), the difference between e-book and printed book is not obvious. However, while reading magazine, a marked deterioration was found in the e-book reading experience. The complicated operation made users tired and distracted.

It is suggested that the current layout design of the magazine page is not applicable to E-Reader. E-Readers are always designed with a limited size to improve the

Table 4: The component loadings of adjective word pairs in printed magazine group

Adjective word pairs	Component loadings			
	1	2	3	4
uncomfortable-comfortable	-.369	.290	-.495	.073
real-unreal	-.043	.007	-.407	.156
bright-dark	.292	.305	-.342	.498
smooth-rough	.263	.297	-.162	-.067
rare-common	-.653	.424	.105	.051
light-heavy	.232	.267	.376	.225
tension building-relaxed	-.521	.484	.267	.251
no fatigue-fatigue	.521	-.495	-.094	-.085
Easy-difficult	.742	-.394	-.117	-.104
concentrated-distracted	.733	-.457	.005	-.118
stressful-stress less	-.636	.475	.287	.099
convenient-inconvenient	.441	-.349	.298	.035
understandable-incomprehensible	.686	.301	.291	-.102
cheap-pricy	.064	-.272	.703	.356
indecent-elegant	.191	.147	.745	.186
friendly-unfriendly	.717	.020	.300	.086
stimulating-calm	.074	.524	-.399	-.172
vague-apparent	-.278	-.500	-.087	.331
old-new	-.059	-.265	.069	.747
deep-shallow	.541	-.045	-.444	.338
impressive-unimpressive	.619	.560	.101	.268
interesting-boring	.734	.508	.038	-.163
attractive-unattractive	.641	.533	-.010	-.175
trustworthy-not trustworthy	.223	-.102	-.383	.654
intent to buy-not intent to buy	.508	.609	-.100	.216

portability and reduce weight. Different from novels and comic books like manga, the layout of magazines should be redesigned for e-book version, concerning a proper font size, clear image quality, and readability. Scanning the page of printed version of the book and applying it to E-Reader might work for manga, but doing the same thing to magazine would only bring frustration and disappointment to readers.

Comparing two groups both with e-book as reading medium, it is found that when reading manga, the reading contents is considered as the first component. However, in the case of reading magazine, reading experience of E-reader comes ahead of reading contents. "comfortableness" is the most correlated variable while reading magazine on E-reader, however, it is not revealed as an important factor while reading manga on E-reader. This indicates that participants did not feel comfortable to read magazine on E-reader.

The group of e-book manga and printed book manga did not show much difference both in the overall satisfaction score and the principal component analysis. However, traditional printed manga is still preferred despite very similar results in principal component analysis. We took a closer look at the difference between the extracted factors, and it is shown that calmness was one of the related variables in printed manga group. Printed manga group also showed a forth component (shows that printed book is cheap, old and friendly), which explains why participants intend to buy the book (as a factor only in printed manga group).

The group of e-book magazine and printed book magazine also showed many similarities. "calmness" also appeared only in the correlated factors of printed magazine group. This suggests that participants felt calmer while reading printed books than e-book, no matter what they read (manga or magazine). Printed magazine showed a different forth component with e-book magazine. The forth component of e-book magazine is related to brightness of the screen and concentration of the reading experience, however, the forth component of printed magazine is related to how new and how trustable of the book.

5. CONCLUSION

The purpose of this study was to compare the difference between e-book and printed book while reading different genres of book (manga and magazine), in terms of reading experience (reading quality). As the result showed, traditional printed books were rated higher than

e-books, and manga was more applicable to the form of e-book than magazine.

It was indicated that while reading e-book magazine on E-Reader, the readability and operation on the device affected the evaluation of the reading experience. The layout of magazines should be redesigned for e-book version and the operation should be reduced to improve the reading experience. A new interface for e-book magazine is needed.

The research only considered manga and magazine while comparing traditional printed books and e-books. While reading manga and magazine, the satisfaction of users might be influenced by either the reading contents or the reading experience of the medium, and their priority might change depending on what kind of contents. Experiments on other genres of books should also be conducted in the future research to understand and clarify what is important in designing the interface of an e-book.

In the contemporary information-oriented society, although the market of e-books has become another main stream success, there are still a lot of reasons why e-books cannot replace the traditional printed books. We believe that e-books and printed books will coexist in near future without replacing each other. E-book is another new form of reading which is completely different from the traditional way, and more research on the interface design of E-Reader is needed to improve the user experience.

6. LIMITATION AND FUTURE STUDY

While comparing e-book with printed book, this study only took E-Reader into consideration, as the representing media for e-book. However, the development of e-book apps on smartphone operation platforms is breaking the market of e-book in recent years. As the alternative media of E-Reader, smartphone is considered more portable, casual and convenient. The growth of free Manga smartphone application in Japanese market is enormous, with the market scale of 7.8 billion JPY in 2016, expanded to 10.1 billion JPY in 2017 [12]. In future study, smartphone is essential and necessary to be included as one of the reading media along with E-Reader and printed book, considering the huge market share and potential. Unlike E-Reader and printed book, smartphone is not an exclusive media for reading, but a constantly accompanied personal device that everybody cannot live without. Future studies on smartphone e-book should not only focus on the reading experience, but also explore the factors like motivation and convenience behind the behavior of reading smartphone e-books.

ACKNOWLEDGEMENTS

This work was conducted as an integrated practice for the Master's Program in Kansei, Behavioral and Brain Sciences, Graduate School of Comprehensive Human Sciences, University of Tsukuba, and was supported by an educational budget for that program.

Special thanks to Prof. Toshimasa Yamanaka in Kansei Information Science Laboratory, Kansei, Behavioral and Brain Sciences, University of Tsukuba for providing advice on statistical analysis.

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