

An Executive Summary of

The impact of White Space on User Experience for Tablet Editions of Magazines

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As magazine publishing emerges into the digital world, it needs to achieve the degree of readers' desire that is comparable to or surpassing print publications. As a result, designers and publishers for digital magazines must create well-designed magazines that attract more readers.

We are moving into the digital arena, which is a new revolution for transferring the design from the printing platform to the digital platform. Essentially, the manifold technologies, operating systems, screen sizes, and resolutions impose the concern for publishers seeking a reference. Therefore, it is necessary to develop a compatible standard for digital magazine publishing to achieve scale and profitability. In this thesis, the researcher addressed one of the design elements: white space. Limited research has been done regarding white space in digital magazines. The aim is to investigate how user experience is affected by white space in the layout of digital editions of magazines designed for the

Apple iPad. The researcher chose food magazines for the present investigation, because the life style magazines, and specifically the food magazine category, is the fastest growing genre for digital magazine publishing (Bazilian, 2013).

Background

The magazine industry in the United States has experienced significant changes in recent years. With the proliferation of smartphones and the Internet, consumers make fewer trips to the newsstand (Sasseen, Matsa, & Mitchell, 2013). The *MPA FACTBOOK 2013-2014* (2014) investigated that digital magazine readers grew 84% from 9.2 million to 16.9 million from 2012 to 2013. In addition, the number of digital magazine downloads increased 39% from 2011 to 2013, and the prediction for further increases is favorable.

Therefore, more and more publications are meeting this challenge by distributing their content via up-to-the minute digital

platforms that include websites, smartphones, and tablets.

For helping designer to understand design patterns for digital magazines concretely and explicitly, the white space was chosen as only impact for present research.

The basic definition of white space chosen for this research is “The conspicuously open space found between other design elements or objects within the borders of an ad,” (Pracejus, Olsen & O’Guinn, 2006)

White space usually encompasses margins, gutters, leading, etc. It is named this because of the typical background material of its day, but the white space is not necessarily white.

The study adopted user experience to help researcher to understand the impact of white space on the digital magazines with readers.

The user experience is defined as “a person’s perceptions and responses resulting from the use and/ or anticipated use of a product, system or service” (ISO/FDIS 9241 -21). It quantified the readers’ response regarding digital magazine, help people to improve the design for digital editions.

With a shift to digital media, publishers need to provide a reading experience to their subscribers, that is on par or is better than with print editions, which will attract readers to subscribe to the tablet editions of digital magazines. As Johnson and Prijatel (2006) stated, “The challenge for magazines has been to discover their relevance across the different digital platforms.” The researcher has confidence that the findings of the present study will help designers in a concrete and explicit way to identify the best design patterns pertaining to white space for digital magazines.

Methodology

To assess the white space for the purpose of this research, the well-known “figure-ground” relationship is adopted. All the framed content represented by the blackened

rectangle figures is considered as the figure, and the space between the rectangle figures is the ground

In my research, the participants interacted with the digital magazine on the ipad, and gave their perception and responses regarding their interaction.

Present research follows the stable figure-ground relationship (White, 2011), where all the elements on the page are shaped into fixed frames (Figure 1).

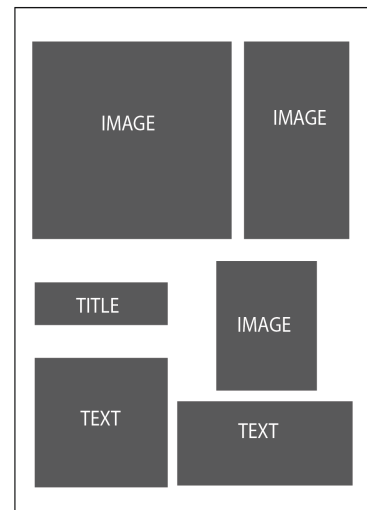


Figure 1. The example of “figure-ground” relationship. The blue boxes are figure and the white area surrounding is ground.

In order to manipulate white space easily, the white space is separated into macro and micro white space. The shadow area is the macro white space. Macro white space is the space between major elements in a composition. See Figure 2.

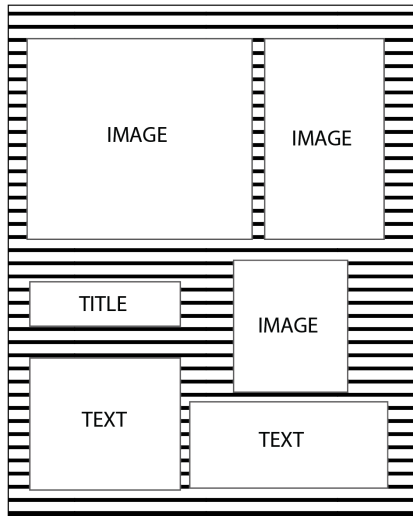


Figure 2. The shadow area is the macro white space

The micro white space is the interline space, which is the space from the baseline to the x-line of the line below. See figure 3.

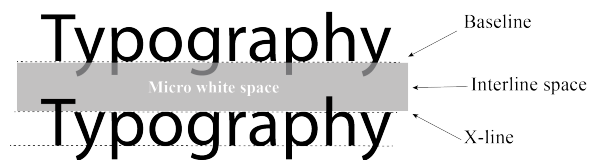


Figure 3. The micro white space is the shadow area which is interline space as well

The study adopted user experience (UX) to help researcher to understand the impact of white space on the digital magazines with readers. The objective of this research is to study user experience of participants interacting with the stimuli, which are digital magazines with quantified white-space elements. The study, therefore, focused on user’s reactions and responses while reading magazines with varying levels of white space. The researcher chose three perspectives of user experience; visual aesthetics (“satisfaction”), perceived readability (“usefulness”) and perceived legibility (“ease of use”) based on the characteristics of digital magazines. And

research questions of this research are followed:

1. For articles in the digital editions of food magazines on an iPad platform, does white space impact the UX (visual aesthetics, readability and legibility) for readers?
2. If so, which dimensions of UX have been affected acutely by white space?
3. Are there any exact quantitative features in terms of white space results that can help designers understand design patterns for digital magazines concretely and explicitly?

The experiment was generated into three steps: preliminary test, prepare stimuli and main experiment.

The preliminary test is to screen out the stimuli for selecting one reference page for the main experiment. The second aim of the preliminary study was to estimate the effect size which was used to understand how many participants are needed for the main experiment.

As a result of this experiment, one page with two-column structure was selected. The content was a recipe of savory food. Then the researcher calculated the white space of the reference page by using threshold and histogram options in Adobe Photoshop, the content area for the reference page is about 69%. The white space of the reference page is around 31%.

After choosing the best reference magazine page, the researcher varied the levels of macro and micro white. The researcher added 7% to each level from 31% macro white space. In total five levels of macro white space were created. They are: 31%, 38%, 45%, 52%, 59%. The manipulation of macro white space was done through calculations using Microsoft Excel. The researcher measured the width and height of all the blocks on the reference page. The height and width of each block were changed based on the selected levels for the independent variable of macro white space to produce different combinations for the 15

experimental stimuli. Specifically, the researcher reduced or increased the height and width of the blocks in proportion to the ratio between the target macro white space and the reference macro white space. The goal was to manipulate the white space evenly, not to affect the whole design of the page.

To manipulate the micro white space, I changed the “leading” in Adobe InDesign. The default auto-leading option is 120% of the type size because 120% is considered to be the optimal point. I added two additional levels of micro white that deviated from 120% by 15%. In total, I use three different levels of micro white space.

They are: 105%, 120% and 135%. The 105% of type size is the same as the line space setting in the reference magazine page.

Main experiment was consisted of two parts: The first is perceived self-report, the second is the objective observation. 62 was the sample size of the main experiment. For the first part of main experiment, or saying the perceived self-report, seven-point scale with anchored and points was employed in the questionnaire. It was a scale which was labeled by two ends. There were three questions for each page: How satisfied are you with the visual aesthetics of this page? How legibility does you find this page? How readable do you find this page? Participants were asked to rate each page on the scale from one to seven points, from “Not at all” to “extremely”

The questionnaires captured self-reported measure of perceived impressions. But for assessing legibility and readability, objective observation measures can be used and documented in the literature. Therefore, the researcher conducted the second part of the main experiment.

Legibility is the how easily people can read each character. In this research, letter counting was adopted to assess the

correlation between white space and legibility. Each participant was requested to read two paragraphs with different white space levels and count the total number of specific letters in the text. The performance time was recorded.

To analyze the legibility, two measures were used. The first one is the average time that participants spent on distinguishing each letter. The equation is followed:

The total time that participant used/ total number of all letters in the paragraph. The second measure is the percentage of correct responses. The equation is showed:

The number of letter participants counted / the actual number of selected letters in the paragraph.

Readability is how easily people can understand the content in the article. To assess the readability, the participants were told to recall the ingredients names after they read ingredients paragraph. The numbers of ingredients they recalled were recorded.

And the percentage of correct, which is the number of ingredients people can recall is divided by the total ingredients in the paragraph, was documented.

Results

The two-way repeated measures Analysis of Variance (ANOVA) was applied to test the significance of the independent white space variables, namely the main effects of macro and micro white space, and the interaction effect between macro and micro white space variables. F ratio is the statistical use to test null hypothesis. $p=0.05$ was used as a cutoff value to designate statistical significance. Least square means was employed to answer the third research question. Least square means are the estimated group means using the analysis procedure.

Using the repeated measures ANOVA the fixed main effects for macro and micro

white space and fixed interaction effect between macro and micro white space were evaluated for Visual Aesthetics. As seen from Table 1, all three fixed effects were statistically significant. All the P values were less than .05. This result demonstrated that the macro and micro white space had highly significant influence on participants' impressions of visual aesthetics. The interaction effect between Macro and Micro white space levels was also statistically significant.

Table 1.
Fixed effect table for visual aesthetics, the data of questionnaire

Source	F Ratio	Prob > F
Macro	3.14	0.0141
Micro	11.90	<.0001
Macro*Micro	3.13	0.0017

The least square mean estimates for this experiment shows that 38% macro white space with 135% micro white space has the highest estimate, which is 5.87.

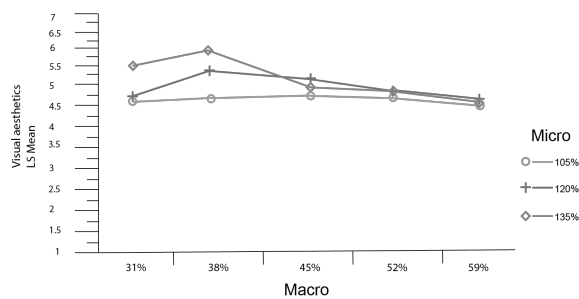


Figure 4. The Least square plot of visual aesthetics for interaction between macro white space and micro white space

As seen from the table 2 for the perceived legibility results, all three fixed

effects were statistically significant. All the P values were less than 0.05. This result demonstrated that both macro and micro white space had significant influence on participants' impressions of legibility, the same as visual aesthetics. Also, the interaction effect between Macro and Micro white space levels was also statistically significant.

Table 2.
Fixed effect table for legibility, the data of questionnaire

Source	F Ratio	Prob > F
Macro	4.76	0.0008
Micro	28.76	<.0001
Macro*Micro	3.08	0.0020

According to the least square mean estimate, the factor, 38% macro white space with 135% micro white space has highest estimate, which is 5.75. See figure 5. It also can be interpreted that majority people think this magazine page is more legible compared to the rest of 14 samples of white space combinations design. This result is identical with the result of visual aesthetics.

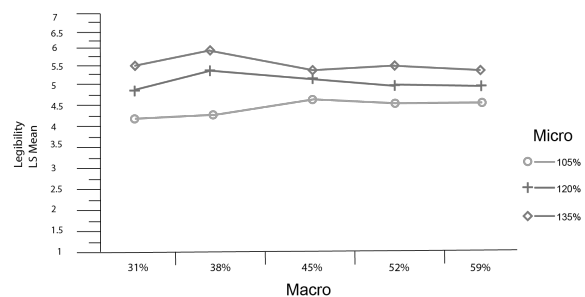


Figure 5. The Least square plot of legibility for interaction between macro white space and micro white space

As seen from table 3 for the data of questionnaire, all three fixed effects are

statistically significant. All the P value is less than .05.

Table 3.
Fixed effect table for readability, the data of questionnaire

Source	F Ratio	Prob > F
Macro	3.96	0.0008
Micro	8.57	<.0001
Macro*Micro	2.33	0.0020

According to the least square mean estimate, the factor, 38% macro white space with 135% micro white space has highest estimate, which is 5.68. See Figure 6. This demonstrated that this design was the most readable for majority of participants. This result was identical with the result of visual aesthetics and legibility.

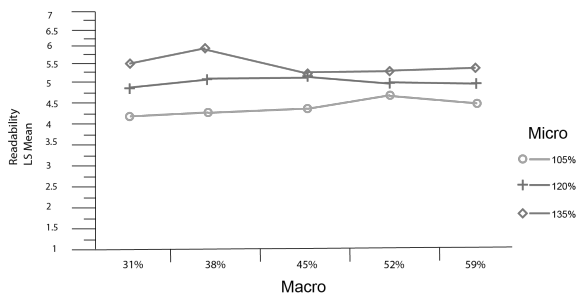


Figure 6. The Least square plot of readability for interaction between macro white space and micro white space

Second part of main experiment was conducted to observe the relationship between user experience: legibility and readability and the white space.

For the first measure of legibility, the results of showed that the macro and micro white space had significant influence on the time participants spent on distinguishing each letter. The interaction effect

between Macro and Micro white space levels was also statistically significant.

Table 4.
Fixed effect table for legibility, the time of distinguishing letter

Source	F Ratio	Prob > F
Macro	11.63	<.0001
Micro	33.72	<.0001
Macro*Micro	7.33	<.0001

Observing the plot of least square (Figure 7) mean results for macro white space, It demonstrated that participants took more time when the macro white space was less. The average time participants spent on distinguishing letters for 31% and 45% was the longest. Comparatively, the average time for distinguishing letters for the 59% macro white space was the least.

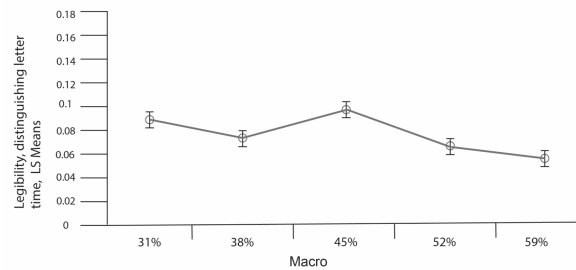


Figure 7. The Least square plot of time of distinguishing letter for macro white space

The plots of searching time regarding micro white space demonstrated that the higher the micro white space, the less time was spent on distinguishing letter. See figure 8.

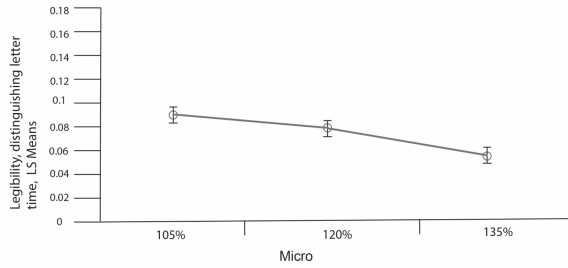


Figure 8. The Least square plot of time of distinguishing letter for micro white space

According to the least square plot of distinguishing time for interaction of micro and macro white space (Figure 9), it showed that 52% macro white space with 135% micro white space was the easiest design for participants to distinguish each letter in the paragraphs. On the other hand, participants spent longest average time on distinguishing letter in the paragraphs on the 31% macro white space and 105% micro white space.

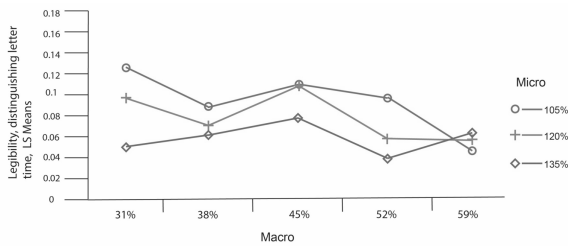


Figure 9. The Least square plot of time of distinguishing letter for the interaction of macro and micro white space

In order to get better understanding of the correlation between legibility and white space, the researcher calculated the percent of correct for letter counting. From the effect test table (Table 5), the macro white space had no significant effect on the percent of correct for letter counting. Micro white space and the interaction of micro and macro white space had highly significant influence on the percent of correct for letter counting

Table 5.

Fixed effect table for legibility, the percent of correct

Source	F Ratio	Prob > F
Macro	1.20	0.3153
Micro	3.16	0.0472
Macro*Micro	3.75	0.0008

The least square mean plot for this measure showed that with the increase of micro white space (figure 10), the correct percentage of letter counting increased. One hundred and thirty-five percent micro white space had the highest least square mean of percent of correct. Comparatively, the percent of correct was the lowest when the micro white space was 105%.

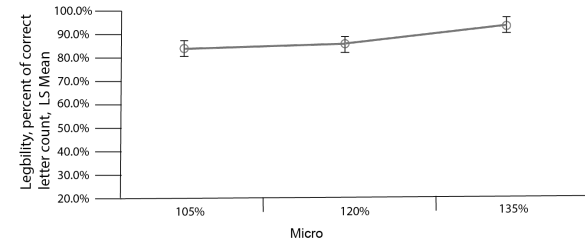


Figure 10. The Least square plot of percent of correct for micro white space

The least square plot of macro and micro white space combination (Figure 11), showed that the highest percent of correct responses happened when micro white space was 120%, and macro white space was 59%. The lowest least square mean of percent of correct occurred at the point of the 135% micro with 59% macro white space.

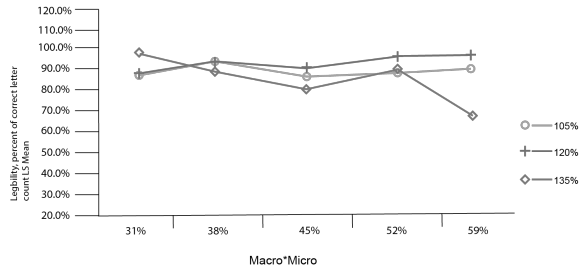


Figure 11. The Least square plot of percent of correct for the interaction of macro and micro white space

For the correlation between readability and white space, the researcher calculated the percent of correct, how much participants recalled. From the effect test table (table 6), according to the effect size table, all the main effects were significant for this readability measure.

Table 6. Fixed effect table for readability, the percent of correct

Source	F Ratio	Prob > F
Macro	3.65	0.0095
Micro	14.53	<0.0001
Macro*Micro	6.64	<0.0001

The least square plot of macro and micro white space combination, showed an irregular curve. So did the least square plot of macro white space.

From the least square mean plot for macro white space, an irregular curve can be observed. See Figure 12. The highest percent of correct recall was found for the 31% macro white space and the lowest – for the 59% macro white space. Some discrepancies existed when comparing the results from the questionnaire and the recall data. The researcher believed that it related

to people’s reading habits and capability of memorizing. Besides, the value of 120% of type size is a widely used space as a default value in page layout in leading settings.

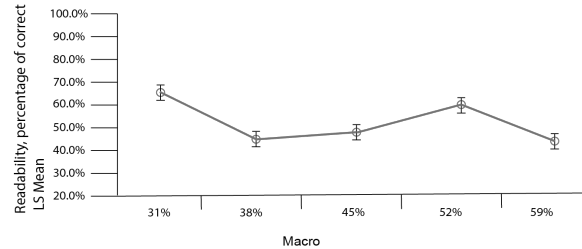


Figure 12. The Least square plot of percent of correct for the interaction of micro white space, Readability

For the primary micro white space, the plots showed that the highest percent of correct of people memorize when they read the text with 120% micro white space. It demonstrated that the least square mean of percent dropped quickly when the micro white space increased to 135%.

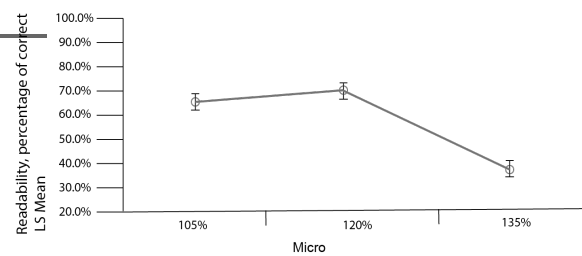


Figure 13. The Least square plot of percent of correct for the interaction of micro white space, Readability

Summary and Conclusion

Upon the results of self-perceived report, as known as questionnaire, three fixed effects: macro, micro and interaction of macro and micro white space had significant impact on all three attributes of UX. Based on the questionnaire results, the perceived data demonstrated that the majority of 62 participants chose the 38% macro white space, and 135% micro white space was the

best combination regarding all three aspects of UX. Also, from the results of second part of main experiment, for the legibility, only the macro white space didn't have significant effect on the percent of correct for letter counting. For the readability, all three effects were significant.

The purpose of this study is to develop a compatible solution to help designer to manipulate white space. The above findings concluded three main results that designer might refer for different concerns. First, the 38% macro white space with 135% leading setting option is the best choice regarding perceived visual aesthetics, perceived legibility and perceived readability. What's more, the results from the second part of the experiment showed that people spent the least time on searching letters when the primary macro white space was 59%. For the percent of correct regarding the legibility, the design with 59% macro white space with 135% micro white space had the

most positive effect. As a result, if designers want to achieve high legibility of a magazine page, they should consider leaving high macro white space, which is more than 50% space of the magazine page on the iPad and high micro white space that is higher than the default line space in the Adobe InDesign software. For the perspective of readability, the results were similar to the legibility. It was concluded that for the combination of macro white and micro white space, the readability increased when the macro white space was bigger than 38% and 52%; the micro white space was 120% or 135%.

There were some discrepancies between the results of questionnaire and the objective observation. The researcher assumed that it related to participant's different reading habits and capability of memorizing. But the researcher believed that no matter which results, designers could refer them for different purposes.

Fanyi Cheng earned her Master of Science in Print Media at Rochester Institute of Technology. Born in Shanghai, China on May 13, 1992, she has a Bachelor of Print Art in University of Shanghai for Science and Technology. Her personal interests are in pre-press and color management. She chose RIT to avail the opportunity of learning the fundamentals of the graphic communications industry and understanding the printing technologies.

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The School of Media Sciences at RIT has a long tradition in the print industry. While technology is constantly changing, the School of Media Sciences is continually quantifying important trends that will shape the future of the graphic arts.

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