THE INFLUENCE OF FONT TYPE, FONT SIZE, LINE SPACING AND TEXT BACKGROUND COLOUR ON VISUAL SEARCH OF WEB PAGES

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ABSTRACT

This research investigated the influence of font type, font size, line spacing and text background colour on visual search of web pages in order to generate design suggestion for the production of web pages. The experiment used a multi factors factorial design with four factors: font type (A), font size (B), line spacing (C) and contrast colour between text and background (D). A number of 16 graduate students from CYCU were participated in this study. Result on anova test showed that there was significant interaction among factor A, factor B and factor C to the respond time of the subjects (p-value=0.031). Further analysis showed that for black text on white background (level D2) and font size 10 pt (B1), line spacing 1.0 ln has significant effect on time to respond of visual search. For black text on white background (level D2) and font size 12 pt (B2), font type verdana (A4) and line spacing 1.5(C2) has significant interaction effect on time to respond of visual search. Results of this study could be used by web designers for the production of web pages so that it will optimize interaction with the users.

Keywords: *font type, font size, line spacing, text background colour, visual search, web page.*

1. INTRODUCTION

In 1991, the creation of the *World Wide Web* (WWW) by Tim Berners-Lee and his team at the European Laboratory for Particle Physics (CERN) marked a monumental event in the history of communication. The development of hypertext markup language (HTML), the enabling code behind WWW pages, allowed users to see richly formatted documents with nicelooking fonts, emphasis and text alignment via the Internet on pages displayed on their computer screens (Pfaffenberger, 1996). This innovation both sustained and extended the boundaries of electronic publishing and became a trend during the mid-1990s. Suddenly, global publishing capabilities were in the hands of practically anyone who had access to a personal computer. From this time on, researchers began paying attention about how to present good and effective information to the users or also called "browsers". Readability of the web page became a practical of interest by the researchers.

The typographic design factors are associated with good and effective text readability. Among the most common typographic factors that are examined in an experimental research context include: typeface (e.g. serif versus sans serif typefaces), letterspacing, line spacing (or leading), justification contrast, resolution, inverted text, mechanically-tinted backgrounds, type size, type style, and letter spacing (Weisenmiller, 1999). Readability can vary in accordance with certain specific typographic variables. There are three basic elements that must be considered when developing a highly readable web page: typesize, spacing and colour (Ling and van Schaik, 2007). It is also well accepted that typeface affects text readability (Mackeben, 1999; Mansfield, et al., 1996).

This study investigated the influence of *four typographic factors* on visual search of web pages in order to generate design suggestion for the production of highly readable web pages for non-English native speaker participants. The typographic factors that are examined in this

experimental research include *font type, font size, line spacing* and *text background colour.* Those factors were taken from previous research about readability of the text (Ling and van Schaik, 2007; Mackeben, 1999; Mansfield, et al., 1996; Bernard et al., 2002).

2. METHODOLOGY

2.1 Experiment Design

The experiment used a multi factors factorial design. The four factors used in this experiment were font type (A), font size (B), line spacing (C) and contrast colour between text and background (D). Font type (A) has four levels: arial, verdana, tahoma and comic sans. These four types are classified as san serif fonts. These levels were taken from research conducted by Bernard et al. (2002). The most commonly used sans serif font is reported to be Arial (Bernard et al., 2002). However, Tahoma, comic sans and Verdana are also very popular. Arial has a rather large x-height and the letters are spaced so they do not touch (Bernard et al., 2002). Both Tahoma and Verdana were specifically intended for viewing on computer-screens by also having wider letter spacing and a large x-height (Bernard et al., 2002). Font size (B) has two levels: 10 pt and 12 pt. These two levels were taken from previous research conducted by Bernard et al. (2002). We took two out of three level as used by Bernard et al. (2002). Line spacing (C) has three levels: 1.0, 1.5, and 2.0. Contrast colour between text and background (D) has two levels: white text on black background and black text on the white background. We chose these two levels since we considered they represented the two most contrast colour between text and its background. The summary of factor, level factors and symbol used in the experiment are presented in Table 1. The dependent variable is time to visual search of text. Since there are four factors used in the experiments and each factor has four levels for A, two levels for B, three levels for C and two levels for D, we named this experiment as a *4x2x3x2 factorial experiment*. Thus, there were 48 treatment combinations in this experiment.

2.2 Participants

There were 16 male participants who participated in this experiment. All participants are graduate students from Industrial and Systems Engineering Department, Chung Yuan Christian University, Taiwan ROC. Their ages vary between 21 to 46 years old. They are *non-English native speaker (Taiwanese)* to ensure subject's homogenity. Participants were be given a series of task combination on the computer screen while seated comfortably in a chair.

2.3 Instrument

A simple software was used to generate 48 task combination of factor and level factor (as created by Dessy, 2010). For each accomplished task, the time of visual search is automatically saved on the software. Figure 1 illustrates one out of 48 task combination of factor and level factor generated by software.

2.4 Procedures

The experiments were carried out for 16 participants taking part concurrently. Prior to experiment, participants were provided with instruction and guideline. Participants were first presented with a set of on-screen instructions. They were told that they were going to perform in a visual search task and that they had to try to find out a word out of 25 in a screen of text. Participants should complete a series of 48 experimental task presented in random order by software. If the "word " is present on the page, they have to click it and the next task will be shown until they complete 48 task. The time to find out the "word" for each of the 48 combination tasks were automatically counted and saved by the software. Then the time for each of the 48 combination tasks were analyzed.

2.5 Statistical Analysis

There are 48 combination treatment of factors dan level factors. For each combination, 16 replications were conducted (regarding number of participants). Observed data (time to respond for each task) in the experiment were recorded in one table and organized for statistical analysis. The anova tables were calculated to help in

making conclusion which factor has significant effect on time respond. Then, further anova analysis using ANOM charts were used to determine the best candidate for each level factor. For all statistical test, Minitab 17 statistical package was used.

3. RESULTS AND ANALYSIS

Based on experiment, we have the results of time to visual search of the text for each 48 treatment combination and for each 16 participant (in second). Using these data, an anova test was conducted using Minitab 17 (using α=0.05). The anova test was conducted to get conclusion which factor has significant effect on time respond. The result of anova test using Minitab 17 was presented in Figure 2.

Figure 1. Interface one out of 48 task combination of factor and level factor generated by software

ANOVA: Time versus Factor A, Factor B, Factor C, Factor D

Factor	Type	Levels	Values
Factor A	fixed	4	Arial, Comic Sans, Tahoma, Verdana
Factor B	fixed	2	10 pt, 12 pt
Factor C	fixed	3	1.0 ln, 1.5 ln, 2.0 ln
Factor D	fixed	2	B on W, W on B

Analysis of Variance for Time

Source	DF	SS	MS	F	P
Factor A	3	26.598	8.866	1.49	0.215
Factor B	1	7.138	7.138	1.20	0.273
Factor C	2	2.939	1.470	0.25	0.781
Factor D	1	3.139	3.139	0.53	0.467
Factor A*Factor B	3	4.263	1.421	0.24	0.869
Factor A*Factor C	6	33.444	5.574	0.94	0.466
Factor A*Factor D	3	29.572	9.857	1.66	0.174
Factor B*Factor C	2	31.616	15.808	2.66	0.070
Factor B*Factor D	1	3.551	3.551	0.60	0.439
Factor C*Factor D	2	35.384	17.692	2.98	0.051
Factor A*Factor B*Factor C	**6**	**83.099**	**13.850**	**2.33**	**0.031**
Factor A*Factor B*Factor D	3	25.215	8.405	1.42	0.237
Factor B*Factor C*Factor D	2	7.136	3.568	0.60	0.548
Error	732	4342.854	5.933		
Total	767	4635.948			

Figure 2. Results of anova test for data results in Table 3 using Minitab 17

Regarding anova test result presented in Figure 3 for the data in Table 3, we conclude that there is significant interaction among *factor A, factor B and factor C* to the respond time of the participants at α=0.05 (with *p-value*=0.031). In addition, there is no significant interaction between *factor C and factor D* at α=0.05 (*p-value*=0.051), but significant interaction exist at α=0.1. Since there is interaction among factors (*factor A, factor B and factor C)*, then the result of changing one factor depends on the value of the other factors. Further analysis is required to determine which factors and level factors provide the best respond time. In case when interaction exist, it does not make sense to talk about "the main effect" of a factor (Copeland et al., 2003). Further analysis requires splitting the data into subsets where there are no interactions (Copeland et al., 2003) or interaction only exists between two factors.

There are several possible ways to split the data into subsets and we can split the data into some parts using each level of particular factor (either factor A, factor B, factor C or factor D). After trying few possibilities, the least amount of splitting occurred after we split the data by using two levels of factor D (*white on black and black on white background*) as illustrated in Figure 3. Table 1 presents *data subset 1* after splitting the data using level 1 factor D. Table 2 presents data *subset 2* after splitting the data using level 2 factor D. Thus, two anova test were conducted using Minitab 17 to get conclusion which factor has significant effect on time respond for *data subset 1* and *data subset 2.* For *data subset 1* (presented in Table 1), the anova test was conducted to investigate the effect of factor A, factor B and factor C at level 1 factor D (*white on black background).* For *data subset 2* (presented in Table 2), the anova test was conducted to investigate the effect of factor A, factor B and factor C at level 2 factor D (*black on white background).*

The result of anova test for *data subset 1* was presented in Figure 4. Regarding anova test result on data subset 1 in Figure 4, we can conclude that there is no significant interaction among *factor A, factor B and factor C* to the respond time of the subjects at α=0.05 since all *p-values* are greater than 0.05. The anova result also showed no significant effects for all main factors at α=0.05 (all *p-values* are greater than 0.05).

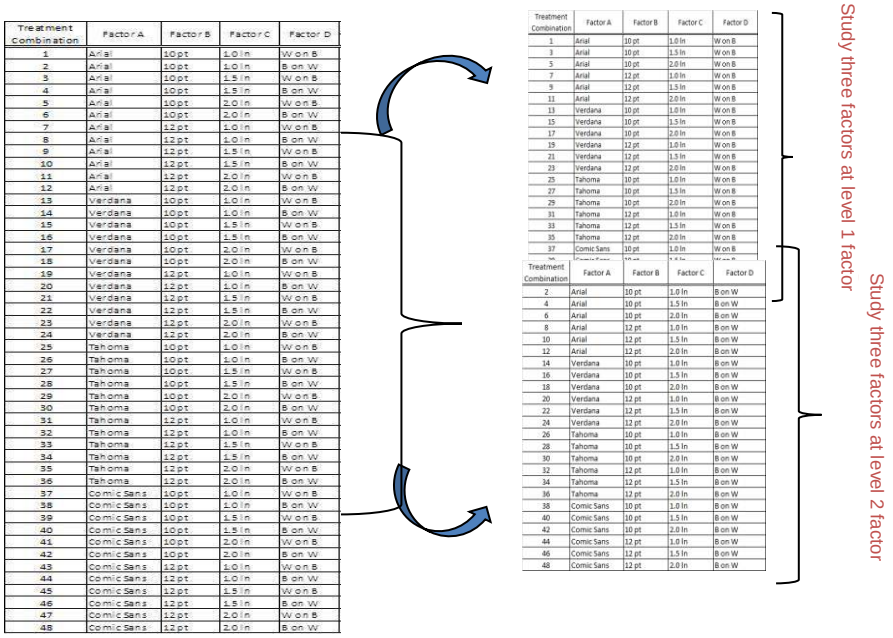

Figure 3. Splitting out the data using two level of Factor D

Table 1. Data subset 1 after splitting the data using level 1 factor D

Treatment Combination	Factor A	Factor B	Factor C	Factor D	Participant															
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Arial	10 pt	1.0 In	W on B	1.61	1.85	2.70	2.92	2.30	1.24	3.40	2.48	3.69	9.90	1.75	4.77	3.80	3.29	2.20	6.58
3	Arial	10 pt	1.5 In	W on B	1.31	1.79	5.19	2.60	4.70	1.27	2.10	2.66	9.11	3.38	3.17	3.35	3.31	3.40	1.89	10.42
5	Arial	10 pt	2.0 In	W on B	2.64	3.28	2.69	4.73	4.75	2.95	7.41	4.13	1.50	5.55	2.89	13.74	2.32	3.45	6.63	2.38
7	Arial	12 pt	1.0 In	W on B	4.69	2.50	2.67	5.13	3.50	1.83	2.00	3.96	12.11	4.50	2.83	2.34	5.91	2.46	1.56	3.89
9	Arial	12 pt	1.5 In	W on B	1.63	1.25	1.67	5.85	4.90	1.20	2.86	5.60	1.86	2.65	2.13	0.96	2.38	0.95	1.71	2.38
11	Arial	12 pt	2.0 In	W on B	3.36	2.20	1.68	3.45	1.96	2.68	3.15	2.58	2.46	3.81	3.20	5.57	1.57	3.15	2.49	2.14
13	Verdana	10 pt	1.0 In	W on B	9.71	1.25	3.68	5.14	2.19	1.23	2.15	3.60	1.59	3.94	1.90	4.12	2.48	1.32	3.85	3.18
15	Verdana	10 pt	1.5 In	W on B	4.79	1.66	3.70	3.40	1.77	2.12	2.96	3.40	2.60	2.24	1.20	2.91	3.82	1.59	2.85	2.29
17	Verdana	10 pt	2.0 In	W on B	1.83	0.96	2.67	2.23	1.30	2.93	2.77	1.94	6.80	2.78	2.32	1.20	2.30	1.31	1.32	5.61
19	Verdana	12 pt	1.0 In	W on B	2.71	4.77	3.76	2.31	1.48	3.00	7.21	2.31	4.42	1.59	1.50	2.43	2.65	2.20	2.16	2.89
21	Verdana	12 pt	1.5 In	W on B	3.12	1.22	2.70	1.27	3.62	1.80	1.34	1.77	3.89	3.67	1.20	13.49	4.00	2.60	1.47	2.86
23	Verdana	12 pt	2.0 In	W on B	2.36	5.39	2.72	3.17	1.84	2.10	4.93	6.41	7.79	1.69	0.89	2.11	1.40	4.10	1.65	8.77
25	Tahoma	10 pt	1.0 In	W on B	1.95	2.22	1.53	5.15	2.50	2.76	6.78	1.25	4.61	7.41	1.00	1.43	3.80	2.50	2.30	9.94
27	Tahoma	10 pt	1.5 In	W on B	5.75	1.38	2.72	9.47	2.78	4.81	5.91	2.85	4.39	8.72	6.97	2.22	2.93	2.79	1.60	7.98
29	Tahoma	10 pt	2.0 In	W on B	1.30	2.40	3.70	3.36	4.70	4.10	2.32	1.83	2.56	2.79	2.22	8.84	3.46	2.20	1.10	13.65
31	Tahoma	12 pt	1.0 In	W on B	2.20	2.28	7.19	3.70	2.50	3.46	5.20	2.95	7.18	5.42	2.93	1.93	1.76	1.67	2.50	14.50
33	Tahoma	12 pt	1.5 In	W on B	1.71	4.73	1.85	3.29	1.67	1.49	3.52	7.39	3.62	1.19	3.97	4.45	2.28	6.78	2.61	1.43
35	Tahoma	12 pt	2.0 In	W on B	0.96	1.30	1.35	2.90	1.91	2.41	2.00	2.40	1.99	7.46	3.25	3.99	3.67	2.10	1.88	1.88
37	Comic Sans	10 pt	1.0 In	W on B	2.10	1.69	3.61	18.18	3.21	1.98	4.22	4.47	1.38	9.29	2.47	5.89	9.93	3.71	2.70	6.78
39	Comic Sans	10 pt	1.5 In	W on B	2.53	1.98	6.76	5.19	2.80	1.33	2.20	2.00	1.40	6.86	3.30	1.66	2.95	1.52	6.34	3.45
41	Comic Sans	10 pt	2.0 In	W on B	1.63	1.82	1.84	1.84	4.37	1.65	6.81	4.97	3.75	0.86	6.89	2.32	2.67	2.17	12.77	6.40
43	Comic Sans	12 pt	1.0 In	W on B	1.41	2.58	7.76	4.15	1.66	2.50	4.82	1.47	11.41	1.57	2.19	3.48	4.26	3.24	5.46	4.80
45	Comic Sans	12 pt	1.5 In	W on B	2.80	2.68	1.82	1.88	3.22	2.10	5.40	2.10	6.32	7.51	3.12	5.64	1.79	1.90	4.67	23.83
47	Comic Sans	12 pt	2.0 In	W on B	1.78	1.10	2.28	6.80	2.23	1.24	1.98	1.44	5.75	1.50	4.58	1.91	1.75	1.55	3.10	3.14

Table 2. Data subset 2 after splitting the data using level 2 factor D

Treatment Combination	Factor A	Factor B	Factor C	Factor D	Participant														
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	Arial	10 pt	1.0 ln	B on W	2.97	1.19	1.83	2.79	2.30	2.66	3.46	2.50	7.80	1.71	2.86	3.10	1.90	1.12	2.16	2.74
4	Arial	10 pt	1.5 ln	B on W	3.20	2.64	2.10	1.15	2.25	0.96	2.91	2.89	2.77	4.13	3.26	2.72	1.95	1.59	3.36	2.74
6	Arial	10 pt	2.0 ln	B on W	1.30	2.45	2.64	2.90	2.98	3.27	4.36	1.58	4.24	2.40	1.32	8.77	9.97	2.22	5.50	1.78
8	Arial	12 pt	1.0 ln	B on W	2.79	2.87	1.48	2.20	1.66	1.65	2.13	3.97	2.53	2.31	8.50	5.70	3.82	2.18	2.70	1.50
10	Arial	12 pt	1.5 ln	B on W	8.15	2.34	1.15	2.60	3.56	2.69	8.35	1.21	13.35	1.50	3.15	1.46	2.38	1.68	3.93	6.90
12	Arial	12 pt	2.0 ln	B on W	2.91	2.83	4.14	2.20	1.30	2.46	4.89	3.46	2.19	1.81	5.16	1.93	3.25	2.67	1.32	4.97
14	Verdana	10 pt	1.0 ln	B on W	0.84	6.11	3.36	3.27	1.49	2.31	2.90	1.21	4.20	12.31	0.85	1.15	4.90	2.46	1.76	3.40
16	Verdana	10 pt	1.5 ln	B on W	3.50	4.24	2.80	7.40	1.18	2.15	10.81	1.86	1.85	3.39	6.58	6.70	4.86	5.41	1.93	3.30
18	Verdana	10 pt	2.0 ln	B on W	5.23	4.75	2.68	5.15	5.36	1.98	4.90	3.30	2.47	6.96	3.77	2.76	6.70	1.69	1.11	2.49
20	Verdana	12 pt	1.0 ln	B on W	6.73	1.80	1.24	1.10	4.30	3.50	7.53	4.80	4.52	2.50	1.41	2.71	2.70	1.90	2.12	1.92
22	Verdana	12 pt	1.5 ln	B on W	2.72	0.89	1.10	1.63	1.48	1.43	1.61	2.20	3.10	4.39	1.83	1.85	1.97	1.58	2.18	1.34
24	Verdana	12 pt	2.0 ln	B on W	7.95	2.16	6.84	5.11	4.30	3.81	3.70	1.26	1.76	8.35	6.68	3.92	6.80	3.83	7.90	4.30
26	Tahoma	10 pt	1.0 ln	B on W	4.38	3.91	1.78	6.21	2.46	2.00	3.37	2.36	1.28	2.60	4.75	1.31	1.74	1.90	1.42	1.64
28	Tahoma	10 pt	1.5 ln	B on W	2.56	1.86	1.92	3.61	2.26	1.97	3.84	3.70	1.85	1.99	4.75	4.11	4.57	2.31	3.13	4.14
30	Tahoma	10 pt	2.0 ln	B on W	1.33	2.79	3.60	7.27	10.51	1.79	8.33	2.35	2.35	2.84	10.22	1.20	4.52	2.47	4.75	5.93
32	Tahoma	12 pt	1.0 ln	B on W	2.70	3.82	3.70	3.66	2.12	2.00	8.22	2.59	1.65	2.89	4.20	1.90	2.37	4.85	1.98	3.61
34	Tahoma	12 pt	1.5 ln	B on W	3.27	2.35	3.38	6.88	7.86	1.95	2.24	2.97	7.88	1.17	4.38	6.58	1.52	1.70	2.35	2.29
36	Tahoma	12 pt	2.0 ln	B on W	3.92	1.55	2.15	1.31	3.20	1.86	1.62	2.67	3.80	2.83	2.70	3.40	3.61	3.11	1.33	3.40
38	Comic Sans	10 pt	1.0 ln	B on W	1.68	1.41	2.30	3.68	1.90	1.80	2.35	2.60	6.10	1.16	1.28	3.78	2.80	1.61	4.14	4.50
40	Comic Sans	10 pt	1.5 ln	B on W	3.16	1.94	2.57	3.11	1.46	4.75	10.54	2.63	4.80	3.82	3.15	3.90	3.30	1.82	4.57	4.18
42	Comic Sans	10 pt	2.0 ln	B on W	8.46	1.84	3.35	1.22	2.27	3.81	6.73	1.15	4.57	7.26	1.90	5.19	4.13	1.46	2.64	11.11
44	Comic Sans	12 pt	1.0 ln	B on W	7.15	1.81	3.62	1.60	7.13	2.27	12.59	5.21	1.72	16.49	6.52	1.11	1.36	2.79	2.46	2.51
46	Comic Sans	12 pt	1.5 ln	B on W	1.77	2.19	1.20	2.11	3.13	2.00	2.80	4.51	7.21	2.85	2.21	3.89	1.68	3.29	1.24	2.29
48	Comic Sans	12 pt	2.0 ln	B on W	5.60	1.91	2.71	1.89	1.88	1.49	4.30	1.96	3.48	3.46	1.15	4.97	1.62	1.87	8.26	4.69

The result of anova test for data subset 2 was presented in Figure 6. Regarding anova test result on Figure 5, there is significant interaction among *factor A, factor B and factor C* to the respond time of the subjects (at level 2 factor D) at α=0.05 (*p-values*=0.001). Again we need to split the data (Table 2) in subsets where there are no interactions. Here at level 2 factor D, we split the data by using two levels of factor B, *level 1 (10pt)* and *level 2 (12 pt)*. Again, the anova analysis were conducted for each subsets data (subset 2.1 and subset 2.2) to see the effect of factor A and factor C at level 1 factor B and at level 2 factor B (both at level 2 factor D).

ANOVA: Time (D1) versus Factor A (D1), Factor B(D1), Factor C(D1)

Factor	Type	Levels	Values
Factor A (D1)	fixed	4	Arial, Comic Sans, Tahoma, Verdana
Factor B(D1)	fixed	2	10 pt, 12 pt
Factor C(D1)	fixed	3	1.0 ln, 1.5 ln, 2.0 ln

Analysis of Variance for Time (D1)

Source	DF	SS	MS	F	P
Factor A (D1)	3	43.578	14.526	2.10	0.100
Factor B(D1)	1	10.379	10.379	1.50	0.221
Factor C(D1)	2	15.645	7.822	1.13	0.324
Factor A (D1)*Factor B(D1)	3	20.439	6.813	0.98	0.400
Factor A (D1)*Factor C(D1)	6	26.429	4.405	0.64	0.701
Factor B(D1)*Factor C(D1)	2	8.756	4.378	0.63	0.532
Factor A (D1)*Factor B(D1)* Factor C(D1)	6	77.667	12.945	1.87	0.085
Error	360	2490.167	6.917		
Total	383	2693.061			

Figure 4. Results of Anova Test for data subset 1 in Table 1 using Minitab 17

ANOVA: Time (D2) versus Factor A (D2), Factor B(D2), Factor C(D2)

Factor	Type	Levels	Values
Factor A (D2)	fixed	4	Arial, Comic Sans, Tahoma, Verdana
Factor B(D2)	fixed	2	10 pt, 12 pt
Factor C(D2)	fixed	3	1.0 ln, 1.5 ln, 2.0 ln

Analysis of Variance for Time (D2)

Source	DF	SS	MS	F	P
Factor A (D2)	3	12.592	4.197	0.88	0.454
Factor B(D2)	1	0.310	0.310	0.06	0.799
Factor C(D2)	2	22.678	11.339	2.37	0.095
Factor A (D2)*Factor B(D2)	3	9.038	3.013	0.63	0.597
Factor A (D2)*Factor C(D2)	6	23.398	3.900	0.81	0.560
Factor B(D2)*Factor C(D2)	2	29.997	14.998	3.13	0.045
Factor A (D2)*Factor B(D2)* Factor C(D2)	6	117.188	19.531	4.08	0.001
Error	360	1724.547	4.790		
Total	383	1939.747			

Figure 5. Results of Anova Test for data subset 2 in Table 2 using Minitab 17

The result of anova test for *Data subset 2.1* (at level 1 factor B and level 2 factor D) is presented in Figure 6. Based on anova result, we conclude that factor C has significant effect at level 1 factor B and level 2 factor D (*p-value*=0.008). To investigate which levels of factor C provide the fastest respond time, a further analysis using ANOM chart was conducted. ANOM chart for factor C (at level 1 factor B and level 2 factor D) is presented in Figure 7. Since the average time for level c_1 factor C (1.0 ln) falls below the lower decision line, factor C has significant effect at α=0.05. Since we concern with "the faster, the better" , **we choose level C_1 (1.0 ln)** as **the best recipe** for factor C (at level 1 factor B and level 2 factor D).

The result of anova test for *Data subset 2.2* (at level 2 factor B and level 2 factor D) is presented in Figure 8. We can conclude that there is interaction effect between factor A and factor C (at level 1 factor B and level 2 factor D) since p=0.001. ANOM chart for interaction between factor A and factor C (at level 2 factor B and level 2 factor D) is presented in Figure 9. W**e choose combination level A_4 factor A(Verdana) and level C_2 (1.5 ln)** as **the best recipe** (at level 2 factor B and level 2 factor D).

ANOVA: Time (D2B1) versus A (D2B1), C(D2B1)

Factor	Type	Levels	Values
A (D2B1)	fixed	4	Arial, Comic Sans, Tahoma, Verdana
C(D2B1)	fixed	3	1.0 ln, 1.5 ln, 2.0 ln

Analysis of Variance for Time (D2B1)

Source	DF	SS	MS	F	P
A (D2B1)	3	17.952	5.984	1.31	0.272
C(D2B1)	2	45.840	22.920	5.02	0.008
A (D2B1)*C(D2B1)	6	21.161	3.527	0.77	0.592
Error	180	821.202	4.562		
Total	191	906.155			

Figure 6. Results of anova test for data subset 1 in Table 6 using Minitab 17

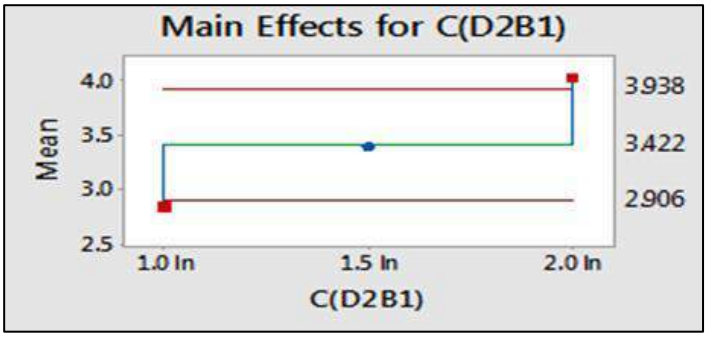

Figure 7. ANOM chart for factor C (at level 1 factor B and level 2 factor D)

ANOVA: Time (D2B2) versus A (D2B2), C(D2B2)

Factor	Type	Levels	Values
A (D2B2)	fixed	4	Arial, Comic Sans, Tahoma, Verdana
C(D2B2)	fixed	3	1.0 ln, 1.5 ln, 2.0 ln

Analysis of Variance for Time (D2B2)

Source	DF	SS	MS	F	P
A (D2B2)	3	3.678	1.226	0.24	0.865
C(D2B2)	2	6.834	3.417	0.68	0.507
A (D2B2)*C(D2B2)	6	119.425	19.904	3.97	0.001
Error	180	903.345	5.019		
Total	191	1033.282			

Figure 8. Results of Anova Test for data subset 2.2 using Minitab 17

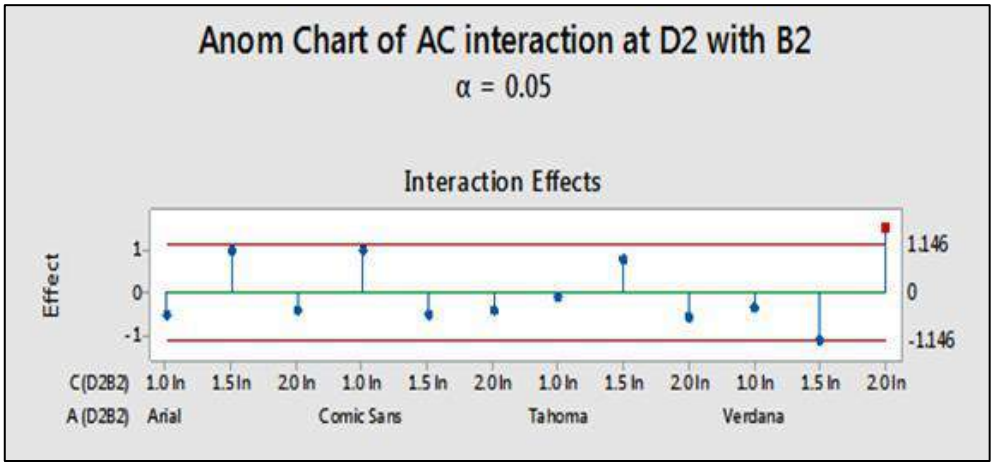

Figure 9. ANOM chart for factor A and factor C interaction (at level 2 factor B and level 2 factor D)

4. DISCUSSION AND CONCLUSION

Summary of conclusion is presented on the following Table 3. Regarding Table 3, we can see that using text with has *white text on black background* (level D1) resulted no significant effect on time to respond of visual search for all kind of font type, font size and line spacing. Regarding table we can see that for *black text on white background* (level D2) and font size 10 pt (B1), line spacing 1.0 ln has significant effect on time to respond of visual search. For *black text on white background* (level D2) and font size 12 pt (B2), font type verdana (A4) and line spacing 1.5(C2) has significant interaction effect on time to respond of visual search – hence we choose as the recipe for the experiment.

Findings in this study that Verdana (A4) and line spacing 1.5 (*black on white background* and 12 pt) was also relevant with result findings of Bernard et al. (2002). According to Bernard et al. (2002), in overall Verdana was the most preferred font web page use. Besides being the most preferred, verdana was read fairly quickly and was perceived as being legible (Bernard et al., 2002). Fonts at the 12-point size were read faster than fonts at the 10-point size (Bernard et al., 2002) and this findings were also relevant with findings in this study since verdana and line spacing 1.5 (at *black on white background* and 12 pt) gave the fastest respond time.

For future research, more samples could be taken in order the study to be more representative. Experiment for female participants could be conducted and we can find out the respond time difference between male and female. In addition, different factos and level factors could be considered to be used in the experiment.

Table 3. Summary conclusion for the best combination treatment for all level factors

Anova Results	Split Factor D	Results after split with D	Split Factor B (Font size)	Results after split with B for D2	Best combination results
There is interaction among factor A, factor B and factor C	White on Black (D1)	No significant main effect and interaction at α=0.05			No factors have significant effects – all level can be used
	Black on White (D2)	There is interaction among factor A, factor B and factor C at α=0.05	10 pt (B1)	Only factor C has significant effect. Factor A has no effect.	Line spacing 1.0 ln (C1) as the best recipe for factor C
			12 pt (B2)	There is significant interaction between factor A and factor C	Font type Verdana (A4) and line spacing 1.5 (C2) as the best recipe.

5. ACKNOWLEDGMENT

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