AMERICAN JOURNAL OF PSYCHOLOGICAL RESEARCH

Email Format and Instructions: Influences on Reading Times, Retention, and Preferences

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ABSTRACT

This experiment explored how email text format and instructions affect reading times, content retention, and reader preference. Sixty participants viewed twenty emails, five each in four formats: normal mixed case, all capital letters, spacing emphasis, and capital letter emphasis. Half the participants were instructed they would answer email content questions following each email. We hypothesized text formatted in all capital letters would result in slower reading speeds, more incorrect answers, and be the least preferred. ANOVAs indicated neither format nor instructions significantly affected reading times or content retention. However, Chi Square analyses indicated readers liked exclusively capital letter text significantly less than other formats and believed it was harder to find important information when using all capital letters.

INTRODUCTION

Electronic messages, such as emails and cell phone text messages, are an increasingly important form of communication. One major benefit is the immediacy with which information is transmitted. Thus, as long as the messages are actually read when received, it is easy to understand why time-sensitive information, such as meeting times and locations or military orders, would be best disseminated via electronic messages. However, if the message text is not easily readable, and the reader must spend additional time deciphering the content, the time-saving aspect of electronically sent information may be reduced.

The current study stemmed from correspondence with a researcher employed by the U.S. Navy. All U.S. Navy message traffic emails (i.e. mass distributed messages from the

U.S. Navy administration, rather than personal messages sent between U.S. Navy personnel) are written in exclusively capital letters, and paragraph spacing is not always preserved upon receipt of a message. Several individuals in this researcher's lab found the capital letters format to be annoying and difficult to read, and they desired to know if such a format was measurably detrimental to reading (Jeffrey Dyche, personal communication, October 22, 2001). Thus, the primary purpose of the current research was to determine if the format adopted by the U.S. Navy affects the time a reader needs to finish reading an email as well as the ability to identify and remember important information presented in an email. Secondly, readers' preference of text style was determined, because these preferences can influence reading behavior. Understanding these factors is important, especially with respect to time-pressured cases when little time is available to decipher an email message, as might be the case for the U.S. Navy in hostile or unexpected military situations.

Readability is the ease with which a text may be comprehended (Samuels, 1983). Factors external to a reader, (e.g. text topic and structure, environmental characteristics, and the goal imposed on the reader by an external source), and factors internal to a reader, (e.g. visual system processes, background experiences, knowledge base, and awareness of text structure), dually affect the reading process (Samuels). Internal factors could be further categorized into physical and cognitive influences, both of which vary across individuals. For example, the functioning of the eye, visual cortex, and other cortical areas involved in reading are not equivalent across individuals , and further, reading ability will vary with the individual's learning style, word familiarity, and grammar usage to influence the reading process. The scope of the current research is limited to the effects of external factors, specifically letter case, text format, and "imposed goals", on reading times, information retention, and reader text preference; thus no physiological functions were measured.

According to many researchers (e.g. Hill & Scharff, 1997; Legge, Rubin, & Luebker, 1987; Samuels, 1983), there is an interaction among external factors to influence overall reading speed, comprehension, eye movements, and reading strategies (see also a review in Woods, Davis, & Scharff, 2005). These factors include: illumination and contrast, print size, font style and legibility (letter recognition), format design (page width, size, placement of text, etc.), the use of titles and headers, text style (word frequency, sentence construction, and text construction), and the goal or direction imposed on the reader. For example, a reader whose text has a less legible font style but important information separated spatially, may have an equivalent reading speed as another reader whose text has a more legible font but unorganized content. Because this interaction can occur, the factors influencing reading speed, retention, and reader text preference are not segregated for discussion. The following information refers to sighted readers with normal vision.

Historically, documents printed in English have been in mixed case (some upper and lower case letters), thus learning and continuing to read effectively requires some ability to recall differences between letters of different cases. Without good letter recognition, one's reading ability is severely impeded (MacKeben, 2000). With frequent exposure, the perceptual system becomes tuned to font regularities in order to effectively process visual information (Sanocki, 1987). These regularities act as cues in word recognition, and can include letter ascenders (vertical extensions above the letter body), descenders (vertical

extension below the letter body), curves, dots, and overall word shape. The shape of a lower case word provides a reader with significant clues about its identity, whereas a word in all capital letters has a destroyed shape (no ascenders or descenders), so the word appears to be rectangular (Williams, 2000). When unable to use previous experience and knowledge of word shapes, reading time slows as a result of slowed processing. Upper case type is read about 13 percent slower than lowercase type (Tinker, 1955).

Additional problems arise when reading text presented in exclusively capital letters due to the amount of similarity between these letters. Briggs and Hocevar (1975) conducted a study in which the letters of the capital letter alphabet were defined based on common and distinctive features such as horizontal angularity (horizontal line at the top, middle, or bottom of letter) and curvature (small curve-convex right, closed curve, etc). Each letter was tested for confusability with all other letters. Their study showed more effort was required to decipher the differences between two capital letters, because they are more similar to each other (have fewer distinguishing features). Staats (1968) also suggests the reading process is affected by the difficulty in learning to distinguish between similar letters in the English alphabet.

Finally, upper case letters are simply larger than the corresponding lowercase letters, and may thus impact reading speed through the influence of size on eye movements when reading. With each eye fixation, a limited amount of material can be resolved, recognized, and used to guide the reading process (e.g. Legge, Mansfield, & Chung, 2001). Letter distinctions can be made only at a distance of three or four words from the fixation point; however, word-shape information in the periphery helps guide the eye during reading (McConkie & Rayner, 1975). Thus, the size of the text can influence the efficiency with which the visual system combines previous information with current information and plans to incorporate new information by controlling eye movements. Interruption of this process with the introduction of difficult-to-read text may influence the frequency of eye movements and could ultimately affect reading speed.

In addition to text case affecting reading speed, text organization can affect reading speed and content retention. Samuels (1983) suggests text construction/coherence is the most important aspect of readability. In describing information presentation on Web pages, Williams (2000, pp.384) stated "Good design reveals structure when it visually mimics the logical relationships that exist among elements…the human visual system attempts to find the structure of information… it does so by looking for visual patterns." According to Williams, logical relationships are assigned based on a text's visual characteristics, and readers assume placement of any element on a screen as intentional and as a result, try to assign meaning to it. Williams also identifies spacing as an important tool for organizing information, suggesting the visual system tries to group elements that are close together or separated by white space. This spacing simulates a "blocking" visual effect, helping the reader break down the information into smaller more manageable pieces of information, and in turn can facilitate better content comprehension. In addition to manipulating text case, the current study included conditions where some text was emphasized using either all capital letters or spacing. This manipulation allowed us to examine whether the use of selective text

emphasis would affect both reading speed and retention of emphasized and non-emphasized information.

As discussed above, text readability can be affected by an interaction of several format and organization factors. However, few studies have focused on how more subjective influences (i.e. reader preferences) impact text readability. Gump (2001) conducted a study in which participants rated various fonts as either easy or hard to read and indicated the "mood" created by each of the fonts. While ninety-eight percent of participants rated Arial as easy to read, approximately seventy percent of participants rated Arial as plain. The findings of this survey suggest differences in assessments of font readability and basic font aesthetics. Other researchers have also found poor relationships between participants' preference ratings and readability performance. For example, Hill and Scharff (1999) and Youngman and Scharff (1998) collected response time data and subjective preference ratings (based on aesthetic appeal), and both studies found very low (and sometimes negative) correlations between the two types of data. Thus, readers do not seem to accurately track their performance, or they simply do not use their performance when assessing their preferences. To determine if text format affects readers' subjective responses as well as objective performance (reading times and retention), subjective questions will also be asked of all participants.

Finally, reader motivation will be manipulated in order to determine its influence on reading times. Previous research on reading performance indicates the purpose of the reading task may dictate how quickly a participant reads text, thus affecting overall reading performance. Samuels and Dahl (1975) found that when participants were issued reading tests and asked to read for general as opposed to detailed information, large differences in reading speed were produced. Because participants knew beforehand how detailed the post-reading questions would be, they adjusted their reading according to the difficulty of the questions. Kaakinen, Hyönä, and Keenan (2002) also suggest readers looking for specific information in preparation of test questions spend more time gathering information for retention. Therefore, in the current study, one half of the participants answered retention questions following each email, while the remaining participants read the emails without answering any retention questions, and their reading times were compared.

Due to the lack of word shape cues and a resulting difficulty reading all upper case text, we hypothesized participants would yield significantly slower reading times and more incorrect answers when reading all-upper-case text than when reading the emails presented in mixed case. We anticipated that participants who knew they would be questioned about the email content would have significantly slower reading times than participants who would not be questioned, because they would spend more time reading and trying to remember details about the text. Additionally, we hypothesized that participants would have faster reading speeds and better retention (more correct answers) when answering questions about emphasized text, than when answering questions about text with no distinguishing features. Finally, we hypothesized that text written in exclusively upper case letters would be the least preferred style as a result of this format being the most difficult to read.

METHOD

Participants

Sixty participants from a mid-sized, East Texas university were recruited from the Psychology department student subject pool. At this university the average verbal SAT score is 501, and most students in the student subject pool are between 18 and 20 years old. Participants were compensated with a one-hour experiment participation credit and were required to have 20/20 vision normally or corrected.

Design

The current research employed a 4 (text format) x 2 (instructions) mixed design. The independent variables were Text Format (all capitals (AC), mixed case (MC), capital letter emphasis (CE), and spacing emphasis (SE)), and Instructions (participants told they would be questioned about the material they read (Q), participants not told they would be questioned (NQ)).

The following describes each level of the Format variable: AC - email text written exclusively in upper case letters with single blank lines between paragraphs; MC -email text written in standard format (some lower and some upper case letters) with single blank lines between paragraphs; CE -email text written in standard format with four sentences or phrases in upper case letters and single blank lines between paragraphs; SE - email text written in standard format with an additional blank line separating the same information capitalized as in the CE conditions. See Table 1 for examples of each format. The three dependent variables were reading speed, content retention (for those receiving the questions), and the reader preference of text format.

Materials

Twenty U.S. Navy emails were each adapted to the four formats described above (AC, MC, CE, SE). Because the sample texts were adapted from U.S. Navy traffic message emails written in Arial 10 point type using black text on a white background, the current test conditions used the same font, size, and colors. The emails varied in their length, with a minimum of 84 words and a maximum of 844 words (median of 273). A laboratory with 20 single-user computer workstations (Dell Pentium 4 computers) was used to collect data. Each computer was equipped with Internet access to the Web-based program developed for this study. The program collected information about each participant's reading time, content retention, and format preference.

Each participant was presented with all twenty emails; five in each of the four formats. The specific emails that each participant received in each format were counterbalanced across participants to control for the varying email lengths and content. Thus, eight versions of the Internet program were created. Versions one through four were identical to versions five through eight, however they did not contain questions following each email message. To minimize order effects within the experimental versions, the experimental computer program randomized the order in which the emails were presented to each participant.

Table 1

Examples of each text format

_____

Format	Text Example (Excerpt from actual stimulus)

_____

AC
THE ROY WILKINS SERVICE AWARD WILL BE PRESENTED TO ONE MILITARY OR CIVILIAN MEMBER WHO HAS SIGNIFICANTLY ENHANCED OPPORTUNITIES FOR MINORITIES IN THE WORKPLACE. COMMANDS MAY NOMINATE ONE PERSON - OFFICER, ENLISTED OR CIVILIAN OF ANY RACE OR ETHNIC GROUP. NOMINATION PACKAGES MUST INCLUDE THE FOLLOWING:
A. COMMAND ENDORSEMENT
B. COMMAND POC NAME, RANK, PHONE, FAX AND E-MAIL ADDRESS
C. NOMINEE NAME, RANK OR POSITION TITLE, WORK MAILING ADDRESS AND PHONE NUMBER.

MC
The Roy Wilkins Service Award will be presented to one military or civilian member has significantly enhanced opportunities for minorities in the workplace. Commands may nominate one person - officer, enlisted or civilian of any race or ethnic group. Nomination packages must include the following:
A. Command endorsement
B. Command POC name, rank, phone, fax and e-mail address
C. Nominee name, rank or position title, work mailing address and phone number.

CE
The Roy Wilkins Service Award will be presented to one military or civilian member has significantly enhanced opportunities for minorities in the workplace. Commands may nominate one person - officer, enlisted or civilian of any race or ethnic group. NOMINATION PACKAGES MUST INCLUDE THE FOLLOWING:
A. Command endorsement
B. Command POC name, rank, phone, fax and e-mail address
C. Nominee name, rank or position title, work mailing address and phone number.

SE
The Roy Wilkins Service Award will be presented to one military or civilian member who has significantly enhanced opportunities for minorities in the workplace. Commands may nominate one person - officer, enlisted or civilian of any race or ethnic group.

Nomination packages must include the following:

A. Command endorsement
B. Command POC name, rank, phone, fax and e-mail address
C. Nominee name, rank or position title, work mailing address and phone number.

Procedure

Before beginning each experimental session, the computers were turned on and one of eight versions of the data collection program was started on each machine so that the experiment instructions were displayed. After participants were seated, they completed consent forms and were provided with answers to any questions they had. Participants were then given instructions emphasizing the relationship between the experiment and the U.S. Navy (to encourage participants to take the task seriously), the importance of using three initials for data coding purposes, and that the on-screen instructions would indicate whether there would be questions after each email presentation. Participants then entered their initials and began the experiment.

All participants received all treatment combinations for the Format variable (within-participants manipulation) and only one level of the Instructions variable (between participants manipulation). A participant's reading speed was measured in milliseconds and calculated as the time between the complete loading of a Web page that displayed a single email and the participant's request to go to the next page. The timer began as soon as a page was completely loaded (based on the browser and not the server from which the page was hosted) and ended when the participant clicked a button at the end of the email. In the Q condition, each email was followed by four multiple-choice questions pertaining to the text content. These questions were presented on the computer screen and answered electronically. Content retention was measured by the number of correct answers to these questions. To better estimate the effects of text case and emphasis on comprehension in the CE and SE levels, two of the four answers came from capitalized/spatially separated information, while the remaining two came from information not emphasized by capitalization or spatial separation.

Following the twenty emails were four subjective, multiple-choice questions about the readers' preference of text format. Using the mouse to click an online response button, participants indicated which of the four formats they most preferred (was easiest to read), they least preferred (was hardest to read), and which they thought "seemed to make it *easiest (or hardest)* to find what you thought might be important information." The four format choices were worded as follows: a. test using all capital letters, b. test using normal case configurations, c. test using normal case configurations with some text capitalized, and d. test using normal case configurations with some text set apart using extra spacing.

At the end of all twenty trials and the subjective questions, participants were debriefed and provided with documentation of experiment completion. Participants took between 10 and 45 minutes to complete the experiment.

RESULTS

Three participants did not follow instructions; therefore, their scores were not included in the data analysis. Of those remaining, 28 participants received experiment versions including questions and the remaining 29 received versions without questions. One

ANOVA was performed for the dependent variable of reading speed and second was performed using question accuracy (content retention). For each participant, for each condition, the median reading speed was calculated. For those receiving retention questions, the total number of correct answers from emphasized text, and the total number of correct answers from non-emphasized text were calculated; these values were used in the ANOVAs. Chi-square analyses were used to analyze the subjective data.

A 4 (AC, MC, CE, SE) x 2 (Questions, No Questions) ANOVA revealed no significant effects of text format on reading times (all p values > 0.10). See Figure 1 for a graph of average median reading times (seconds) for all conditions. Although it was not significant, there was a tendency for participants who received questions to read emails using all capital letters or capital letter emphasis slower than those who did not receive questions. Emails using normal mixed case format were read most quickly. The average medians in seconds for each format are as follows, AC: 65.2, MC: 56.7, CE: 61.9, SE: 60.4.
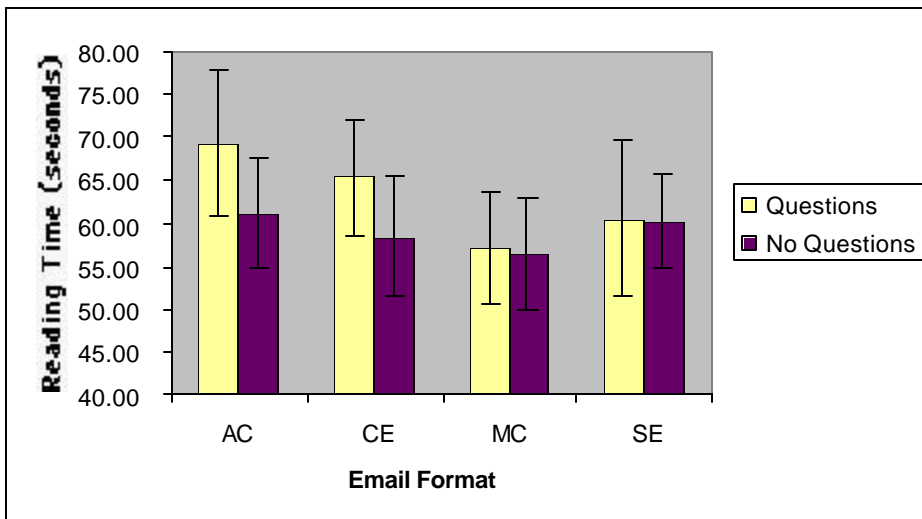

Figure 1: Average median reading times (seconds) for each condition as a function of text format and instructions.

A 4 (AC, MC, CE, SE) x 2 (Emphasis, No Emphasis) ANOVA also revealed no significant effects of text format on accuracy (all p values > 0.10). See Figure 2 for a graph of mean accuracy scores for all conditions. Although it was not significant, there was a tendency for the spacing emphasis to improve accuracy for the emphasized questions, but decrease accuracy for non-emphasized questions.
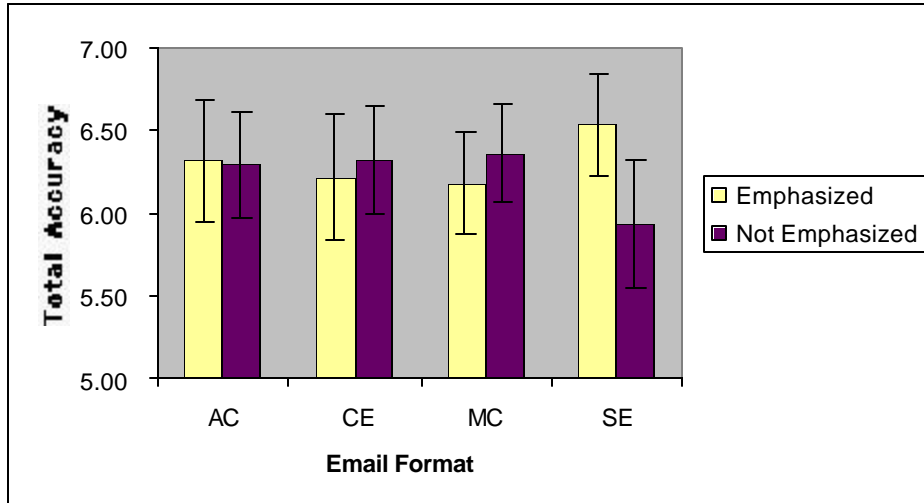
Figure 2: Mean accuracy for each condition as a function of text format and emphasis.

Before conducting Chi Square analyses on each of the four subjective questions, the answers were tallied for each question (see Table 2 for a summary).

Table 2

Tally of Answers to Subjective Questions

	AC	MC	CE	SE
Q1: Format Most Preferred (Easiest to read)	4	7	22	23
Q2: Format Least Preferred (Hardest to read)	46	6	2	2
Q3: Format Easiest to find Important Information	5	4	27	20
Q4: Format Hardest to find Important Information	46	5	1	4

Only 56 participants were included because one participant neglected to answer the fourth subjective question. Responses from all four questions showed significant effects of format. Participants preferred the two formats using emphasis; χ^2 (9, $N = 56$) = 33.96, p

<.001. The all-capital-letters format was the single least preferred format of the four format types; χ^2 (9, $N = 56$) = 34.98, $p < .001$. A similar pattern was found for the formats for which it was easiest to find important information (capitals emphasis and spacing emphasis; χ^2 (9, $N = 56$) = 36.63, $p < .001$), and for which it was the most difficult to find important information (all capital letters; χ^2 (9, $N = 56$) = 33.73, $p < .001$).

DISCUSSION

Even though group means were consistent with our predictions, there were no significant effects of text format or instructions on either response times or content retention. Thus, the hypotheses regarding these variables were not supported. In contrast to the objective measures, participants showed strongly significant preferences for the different formats. Participants liked and found it easiest to locate important information using mixed case with capitals emphasis and mixed case with spacing emphasis. Further, as hypothesized, they specifically disliked and found it difficult to locate important information using the all-capital-letters format. While they did not strongly like the normal mixed case, they also did not strongly dislike it. It is possible that participants least preferred the all-capital-letters because this is the most unfamiliar way to read text, and reading this format was more frustrating due to the lack of word shape cues.

Although readers did not perform differently on retention tasks as a result of emphasized text, they still believed it was easiest to find important information in a paragraph that contained emphasized sections. Such a result supports Williams' (2000) assertion that spacing can be a powerful tool for the organization of visual material. However, the accuracy means regarding the use of spacing emphasis highlight a less positive point of practical significance. It seems that while spacing emphasis somewhat helped readers accurately recall information of the emphasized material, it seemed to hinder their recall of non-emphasized material. Thus, emphasized material may cause readers to pay close attention to that information and, in the process of doing so, may cause readers to inadvertently disregard information that was not emphasized. This conclusion is supported by research on inattentional blindness, where fully visible stimuli are not perceived because the viewer is not attending to them (for a summary see Simons & Rensink, 2003). Therefore, students (when using highlighting in texts), educators, marketers, and others who disseminate information, need to be aware of the potential drawbacks of emphasizing some material relative to other material, because non-emphasized material may not be processed.

A similar pattern did not exist for the emphasis conditions using all capital letters. This lack of effect for the all-capital-letter emphasis may have occurred because these particular emails often contained U.S. Navy acronyms in all capital letters. Thus, readers may not have been able to efficiently scan for and use the all-capital-letters emphasis and, in turn, they effectively ignored it. In the future, experimenters should test emails without acronyms. Experimenters may also want to require participants to read material with more difficult content. Emphasis may have more of an impact on the reading comprehension of more complex messages.

The current participant sample consisted of college students at a state university; thus, all were fairly accustomed to the use of computers, and had at least average reading ability at the college level. U.S. Navy personnel are not given any specific training on reading the all-capital-letter email format, and the U.S. Navy sends the same mass message traffic emails to civilian, active duty, and reserve personnel. Thus, the use of college students (civilians) as participants should generalize to many of the U.S. Navy's email recipients. However, over time, some U.S. Navy personnel may become more accustomed to the all-capital-letter format and find it less annoying. Future researchers could compare long-term recipients of such emails and civilians with respect to both the empirical and subjective measures.

Given that at least this current civilian group had such strongly negative subjective responses to the all-capital-letter format, and that the study was initiated by some U.S. Navy personnel that found the format frustrating to read and scan to find information, the use of the all-capital-letter format might warrant attention from the U.S. Navy administration. Further, the condition means for format as a function of instructions highlight an additional point for future consideration. Participants only took extra time to process the all-capital-letters format when they knew they would be questioned over the content. Without questions, they spent the least amount of time reading emails in the all-capital-letter format, most likely because they did not like reading that format. Because readers generally are not quizzed over e-mail content, the U.S. Navy might inadvertently be encouraging its personnel to superficially skim any traffic message emails not prejudged to be important to the reader. This response tendency is also supported through personal communication with U.S. Navy employees (Jeffrey Dyche, Personal Communication, November 21, 2002).

Because emails are so widely used, the results of this experiment also extend beyond the realm of the U.S. Navy. General users sometimes write emails in all capital letters, either to suggest emphasis (such emails are often interpreted as "shouting"), or because it is easier to type without using the shift key as often. Cell phone text messages are also often written using all capital letters. Such messages may not be read as efficiently, or readers may choose not to read them at all. In general, it is important to know how to best present electronic text messages to optimize the transfer of intended information.

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