The Effect of Text Spacing After the Period on Time for On-Screen Reading Tasks

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Abstract

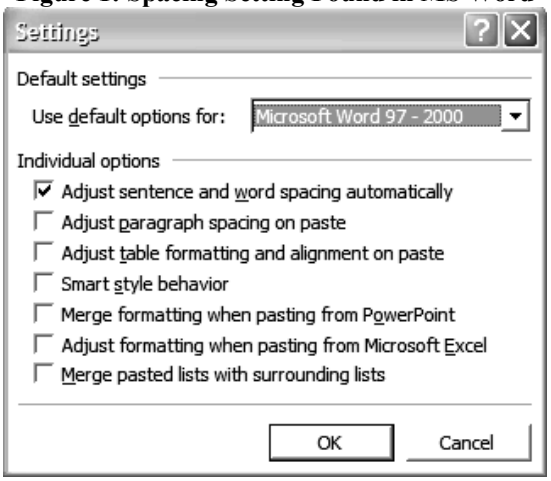
The conventional practice, prior to the advent of word processor, was to use double space after a period for sentence separation. However, today's leading word processors seem to contradict this position by having regulated the sentence separation to single space. The advent of proportionate type fonts, as compared to the mono-space typewriter characters, appeared to offer better readability. The use of proportionate type fonts has been carried over to all digital publishing such as Web pages, on-line documents and standardized tests, such as the Graduate Record Examination (GRE). Empirical studies are needed to determine the effect of the new text formatting, as compared with the conventional practice, on reading achievement. The purpose of this study is to measure the effect of sentence separation using single or double space on time in an on-screen reading task.

Introduction

Since the advent of Internet technology in the 1990s, Web designers and other digital authors had made use of the computer's capacity to structure and present information in the form of electronic texts and digital prints such as word processing, e-mail, Web pages, and e-books (Bolter, 2001). Even though the computer keyboard had inherited its interface and mechanism from that of the typewriter, many of the typewriting rules were modified for the computer keyboard.

Traditional wisdom in typing class (with typewriters) teaches double space after a period for sentence separation. However, today's leading word processing software seem to contradict this position by having regulated the sentence separation to single space (see Figure 1), as the proportionate type fonts appeared to offer better readability as compared to the mono-spaced typewriter characters.

Figure 1: Spacing Setting Found in MS Word



Word processing software seemed to have gained popularity and widespread use in today's offices and classrooms. Electronic word processing is no longer restricted to just print materials, but has been carried into other digital publishing such as Web pages, e-books, Acrobat's Portable Document Format (PDF) and other online materials commonly encountered through the Internet.

The popularity of the electronic word processing software can in parts be attributed to the numerous 'short-cuts' built into the program. Examples include the followings:

1. Ctrl- C, Ctrl-V, Ctrl-X, and Ctrl-Z for the copy, cut, paste and undo functionalities which made the correction of erroneous input a breeze on the computer,
2. Ctrl-1, Ctrl-2, and Ctrl-5 which allows users to reformat paragraphs at will into single, double, or one-half line-spacing, and
3. Ctrl-L, Ctrl-R and Ctrl-J, for left, right, full paragraph justification, respectively.

Other important enhancement in word processing software over the traditional typewriter also includes the "Tab" key which replaced the mandatory five-space indentation at the beginning of every new paragraph, the mail-merge function for printing mailing list, and the numerous aesthetically pleasing font types.

When writing a digital document, users have to contend with many decisions concerning font type, font size, spacing, leading, kerning, justification, and even the use and placement of art and graphic works. Today's word processors seemingly eased users into this complicated decision making process by presetting default values for these choices. For example, a new document created using Microsoft Word always defaulted to Times New Roman in 12 points, with single paragraph spacing and left justification. Although advance users could make changes in the "preference" setting and reformat the default document in anyway they want and in whatever way seem fit to them, novice users simply made use of the "default preferences" as provided by the word processing software.

It remained unclear on how software companies arrived at the designs for the above-said "templates;" for instance, was the initial decision on a prototypic "template" decided by engineers, magazine editors, copy editors, or visual literacy experts?

In an educational setting, the widespread use of word processors in preparing handouts, lecture notes, assignments, Web pages, online documents and other electronic texts called for a more systematic, if not better way of electronic text layout and formatting. It falls to the researchers, such as those who are proficient in visual literacy, to test, verify and even guide users in the best way to represent electronic text layout with the use of word processors, be it print, on-screen or otherwise.

Rationale

The advent of word processors and Web page publication software had brought about the boom in Web pages and other online digital print materials. New and aesthetically pleasing type fonts were also being introduced to cater to the need in the advertising and publishing industries. Type fonts were ported over from the printing industry to the computer industry and were made available to those using the various publishing software. These modern type fonts were no longer of the mono-spaced varieties (such as `courier`) but were all proportionately spaced with individual kerning capability: a feat not possible at all, with the typewriter.

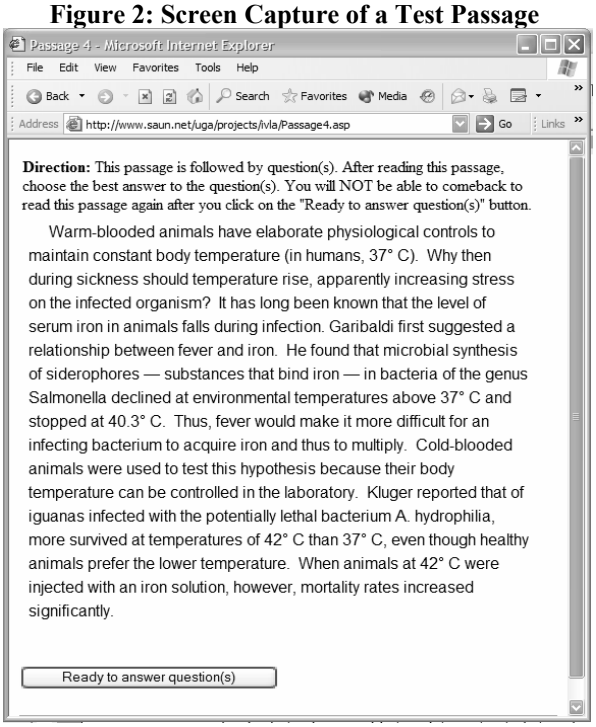
Although type fonts have departed from the typewriters, efficient input of "texts" into the computer would requires considerable typing skill; many took typing lessons to improve their keyboarding skills, while others resorted to "hunt-and-peck" with a couple of fingers. Interestingly, those who received formalized typing lessons continued to be taught to enter double space after punctuation much like in the days of the typewriter; while those who did not, tend to use only single space.

The lack of empirical research to support practice has resulted in two groups of users, namely those who preferred 'single space for sentence separation' and those who advocated for 'double space.' Despite no evidence to support or refute the use of single space or double space for sentence separation in digital prints or online reading, proponents from both groups continued to claim theirs as the better, more aesthetic approach that would provide easier reading.

To contribute to the literature regarding on-screen design and text format, the purpose of this study was to determine any performance differences during an on-screen reading task between sentences separated by single space and double space. The research question for the study was: "Does single space or double space after the period in sentence separation affect the reading time in on-screen reading task?"

This study measured the effect of sentence separation using single or double space on the amount of time spent by the students in an on-screen reading task, such as those commonly found in an online standardized testing (see Figure 2).

Figure 2: Screen Capture of a Test Passage



Importance

With the widespread use and availability of computing technology, resources were increasingly being made available to individuals in an online manner, through the Web pages, Compact Discs, and Digital Versatile Discs; the need for on-screen reading was quickly becoming the norm. However, despite the increasing popularity, research studies remained equivocal on the influence of the Internet and related media technologies (Warschauer, 1999). Kress (1998) noted that the new electronic medium was able to offer not only an alternate display of text, but also an overwhelming amount of information. In addition, software leaders such as Microsoft and Adobe, Inc. had also taken the step to move forward with e-book technology using electronic readers (i.e., Microsoft Reader and Acrobat e-Book Reader). In recent years, even standardized achievement tests, such as Graduate Record Examination (GRE), had likewise been offered exclusively in an online format.

The widespread Internet had not only affected the worldwide computerized communications, but also introduced an alternative lifestyle for many people. College students reportedly spent an average of 10 hours per week reading on the Web (Hucko & White, 2002). The advent of e-learning and mobile learning further escalated the issue. Online testing and assessment could become commonplace in the near future, as evidenced by the steps taken by Education Testing Services (ETS) to move standardized tests such as the Scholastic Aptitude Test (SAT) and Graduate Record Examination (GRE) into an online format. Not only do these standardized tests form part of the mandatory pre-selection requirements for entrance into colleges and graduate schools, it could further translate into tickets of entrance into prestigious colleges, as well as monetary aids in the form of college-wide scholarships. If the screen layout (e.g., text spacing used in sentence separation) was found to have an effect on the students' reading and comprehension performance, some recommendation ought to be made concerning the optimal layout of online reading and testing materials so as to ensure fair testing.

However, a review of literature had shown that print-based research results might not be generalized to on-screen research (e.g., Dillon, 1992; Juola, 1988; Kingery & Furuta, 1997). In addition, the design guidelines for on-screen display were also found to be different from those for print and could further affect readability and legibility of an on-screen document (Geske, 1997). The attempt to apply print-based research guidelines to on-screen text designs might have significant consequences in terms of reading speed and comprehension, particularly where time limits were imposed, as in the case of online tests.

Furthermore, many attributes could directly or indirectly affect the readability and legibility of an on-screen document, such as font type, font size, spacing, leading, kerning, justification, line length, sentence length, etc. (see Kingery & Furuta, 1997; Zachrisson, 1965). The readability and legibility of the on-screen document could affect a reader's eye movements, time-on-task, understanding, rate of reading, time-to-fatigue, and even reading achievements. Thus, a person's performance may be affected as much by the format than his or her knowledge of the content.

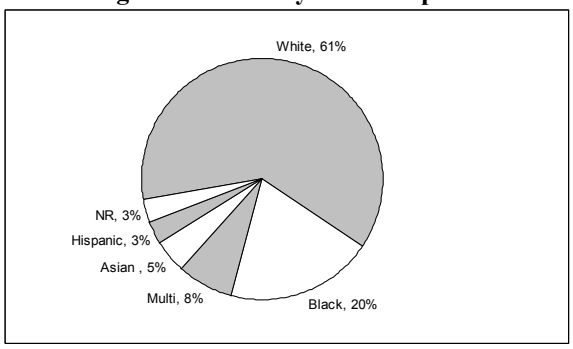
While several factors and variables affect an individual's performance on computer-based tests (Alderson, 2000), this study focused on after-punctuation spacing for sentence separation as test variable. Electronic texts taken from an online standardized test were formatted in two ways: one with single space after punctuation, and the other, double space in sentence separation.

Methodology

College students (n=66) from a variety of classes, namely Instructional Technology, Business Information Systems, and Technical Communication, from three large Southern universities in the US participated in the study. Permission was duly obtained from the Institutional Review Board for Human Subjects for all three universities.

The participants consisted of a total of 32 females and 34 males, age ranging from 21 to 51 (mean=26.4, mode=21). About 61% of the participants were white, 20% were black, and 19% were of other racial origin (see Figure 3).

Figure 3: Ethnicity of Participants



English was reported as the first language for 60 participants, and second language for 6 participants. One third of the participants reportedly spent more than 10 hours per week in reading both paper-based and online print materials.

The test passages and comprehension questions used in this study were obtained, with permission from ETS, from the 1997 GRE Practice General Test. Each passage contained an approximation of 164 words. They were first formatted using MS Word using single space and double space for sentence separation, and then a screen-capture of the passage was obtained to preserve cross-platform display consistency between Mac and PCs. A suitable graphic editor was used to convert the screen-captures into GIF images for embedding into the Web page used in this study. A Web Browser (in this case, Internet Explorer) was used to view the corresponding Web pages and to simulate the online test. Computer monitors used in the study were all set to 800x600 pixels for standardization and maximum contrast of on-screen display was achieved by using black texts over white background. Thus, it was deemed that the on-screen presentation of the reading tasks was commensurate with the online test.

Furthermore, the multiple-choice questions further simulated an authentic online testing environment.

Participants were randomly assigned to the 'single space' or 'double space' group through the use of scripting technology, according to the exact time they began the 'test.' Those who started the test on an 'odd' second (say, 09:45:3*5*) were assigned to the 'single space' group; and those who began on an 'even' second (say, 10:00:0*8*) were assigned to the 'double space' group. The participants also retained complete control through the use of a clickable 'button' located at the bottom of every Web page prepared for the study. Whenever they were ready, participants would click on the button to proceed to the next screen.

Procedure

The participants were directed to the Web site set up for the study. On the initial homepage, a consent form that explained the purpose of the study was presented to the participants. 'Clicking' on the button below the page would indicate that they had given their consents to participate in the study. Demographic information such as gender, age, ethnicity and the number of hours the individual spent reading text on-screen and in print each day were collected, in that order, on the following screen. The participants then clicked on another button to proceed to a 'practice' passage where they could then familiarize themselves with the screen layout of the actual study. The 'practice' page was a later addition, after a pilot study raised the concern about the familiarity of test-takers with the on-screen interface.

All participants were required to complete four 'tests' in succession, each comprising of a passage that was followed by a multiple-choice question on the passage read. Once they had completed the reading of the passage they would click on the button to proceed to the question section. Another button would then allow them to proceed to the next passage and so on.

Thus, two sets of data-points were obtained, each representing the time taken to read a passage that was formatted either using single space or double space for sentence separation. The reading rate for the passages, measured as the number of seconds passed between the click of two buttons, was captured into the database, again with the use of scripting technology.

Because the multiple-choice questions were included only for the purpose of directing the reading task, the scores were neither captured nor used as part of the study. Similarly, the time taken by the participants in answering the question of a passage was also not measured.

The participants did receive feedback on the accuracy of their answers, and it was possible for them to attain a maximum possible score of 100%, if they answered the test questions correctly. At the end of the study, a 'Thank You' note was displayed along with the 'test score' of the participant. All the data-points were captured and stored using an Excel spreadsheet, and the data subsequently analyzed using a statistical package called SPSS.

Results

The Cronbach's reliability alpha (α) for the sample was found to be 0.6. Figure 4 presented the means of the reading speed for individual passages, as well as the grand means of the two groups. The grand means of double spaced passages was reported to be 65.61 seconds, whereas for the single spaced passages, it was 59.80 seconds.

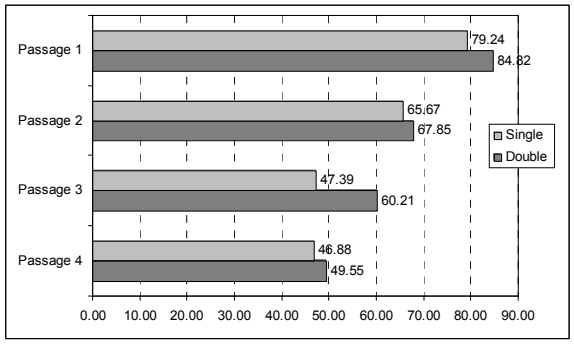
Figure 4: Means of Reading Speed (in seconds)

	Single *(sec)*	Double *(sec)*
Passage 1	μ_1= 79.24	μ_A= 84.82
Passage 2	μ_2= 65.67	μ_B= 67.85
Passage 3	μ_3= 47.39	μ_C= 60.21
Passage 4	μ_4= 46.88	μ_D= 49.55
Grand Means	μ = 59.80	μ = 65.61

Figure 5 presented a clear picture of the reading speed by the two groups, measured in seconds. It can be seen that the 'double space group' consistently took longer time to complete the on-screen reading task than the 'single space' group.

Paired sample *t*-test between the two groups (single space versus double space) was carried out using SPSS and the two-tailed significance level was found to be 0.226 (i.e., $p>0.05$ at the 95% confidence level). We have concluded that there was not enough evidence to suggest that a significance difference exists in an on-screen reading task, between text formatting using single space or double space in sentence separation.

Figure 5: Reading Speed (in sec) by Passages



Conclusion

This study measured how screen layout such as spacing in sentence separation could possibly affect the time taken to complete reading test passages. Although the mean of the reading time indicated that the 'double space' group took longer time to finish reading the passages as compared to the 'single space' group, the time difference were not statistically significant.

Because there was no added advantage in advocating sentence separation using single space over double space, our recommendation is to adhere to the long-standing practice of using double space for sentence separation, be it in print or for online documents. As this article was being prepared for print in accordance with the IVLA guideline for 'Selected Readings,' the authors noticed that the block justification stipulated would preclude the use of double spacing in text separation. Hence, different combination of text formatting would result in different effects.

Recommendation

The on-screen layout and text format of online document is not a trivial issue. Since the Hypertext Mark-up Language (HTML) used in creating Web pages ignores consecutive spacing in texts, the conversion of any written document into a Web page would removed the double space used in sentence separation. This study may have other implications on future screen design, Web-based testing, online publication, e-documents, and even the readability of documents found in portable computers with smaller screens, such as the like of personal digital assistants, (or PDAs).

More research studies in the area of on-screen text format and layout of electronic and online documents should be conducted, to obtain empirical evidence to support any 'standard practice.' Future research could also look into the combined effects of text spacing, font types, justification and paragraph spacing in on-screen reading task, and their effects on reading achievements.

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