Ink, Paper, Scissors: Experiments in Cutting Campus Printing Costs

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ABSTRACT

Universities are always looking for ways to economize, both because of rising costs and because of growing awareness of ecological issues. Printing is a common target. Indiana University's Pervasive Technology Institute (PTI) compared several typefaces, looking at ink usage, paper usage, and readability. PTI chose to standardize on 11-point Times New Roman for printed documentation such as internal reports and white papers. PowerPoint presentations and other items with relatively small blocks of text are done in Century Gothic. Reports for external audiences will include a mix of fonts with deliberate mindfulness toward ink and paper usage. In short, if a message is rendered ineffective by its presentation, any ink or paper used can be considered wasted.

Categories and Subject Descriptors

I.7.0 [**Computing Methodologies**]: Document and Text Processing—*General*

General Terms

Documentation, Human Factors, Measurement

Keywords

Typography, readability, printing, on-demand publishing

1. INTRODUCTION

In 2010, one Midwestern university decided to cut costs by changing the default font of its e-mail system from Arial to Century Gothic and by encouraging everyone at the university to switch to Century Gothic for word processing documents and spreadsheets [15]. The rationale behind this decision is that Century Gothic uses approximately 30% less ink than Arial. University officials estimated that they spent $100,000 a year on toner [13].

In theory, a savings of $30,000 per year on toner sounds great. The reality, however, may look different on paper. On a typical college campus, the amount of e-mail printed by today's tech-savvy students is likely to be far surpassed by longer documents such as term papers, dissertations, and administrative reports. Does "going green" via typography really help the environment? This question led one Indiana University department to examine what it would take to produce all of its printed documentation in Century Gothic.

2. SAVE THE INK, SAVE THE WORLD?

The Indiana University Pervasive Technology Institute produces several lengthy reports and other electronic documents each year. Most are made widely available, and we have no way to know how many times each is printed on campus. Nevertheless, at first blush it is certainly reasonable to think that we could help reduce the university's printing costs by using a font that requires less ink.

To determine the validity of this idea, we created documents filled with the same amount of *lorem ipsum*, traditional incomprehensible Latin placeholder text [1], in a variety of fonts and sizes (one font at one size per document). We initially chose to compare two common serif fonts (Times New Roman and Garamond) and two sans-serif fonts (Century Gothic and Arial). Results are in Table 1.

In 2009, Printer.com tested several commonly used fonts to determine which used the least ink. They ranked 10-point Century Gothic, 10-point Ecofont, and 11-point Times New Roman highest, followed by 11-point Calibri, 10-point Verdana, 11-point Arial, and 11-point Sans Serif. Coming last on the list were 11-point Trebuchet, 11-point Tahoma, and 11-point Franklin Gothic Medium. Their findings show that the cost difference between 10-point Century Gothic and 11-point Times New Roman is negligible [2]. We thus chose to focus our comparison on these two typefaces. (While it is true that 11-point Garamond yields a slightly better result than 11-point Times New Roman, we decided to drop it in the comparison due to perceived readability issues.)

Our experiment clearly shows that while Century Gothic may use 30% less ink than Arial, at 10 points it uses approximately 10% more paper than 11-point Times New Roman. If a user is printing a one-page e-mail, this isn't an issue. However, if a user is printing a 100-page report, the tradeoff becomes clear. Fifty users printing a 100-page document in 10-point Century Gothic on a non-duplex printer will use an entire ream of paper more than the same users printing the same document in 11-point Times New Roman.

Table 1: Comparison of fonts and sizes using blocks of *lorem ipsum.*

Font	Size	Number of lines	Approx. number of pages	Approx. number of characters per full page
Century Gothic	12	275	6.5	3,110
Century Gothic	11	242	5.5	3,702
Times New Roman	12	242	5.5	3,702
Arial	12	242	5.5	3,702
Arial	11	242	5.25	4,086
Century Gothic	10	242	5	4,093
Garamond	12	209	5	4,197
Times New Roman	11	209	4.5	4,623
Garamond	11	198	4.25	4,886

This raises certain questions: At what point does the cost savings on toner balance the extra expenditure on paper? Will the additional wear on the printer cause it to require more maintenance or have a shorter life? At what point will the extra paper we use noticeably increase our negative impact on the environment? A preliminary study done by Indiana University in 2009 concluded that duplex printing on recycled paper certainly decreases environmental impact; however, the amount of carbon dioxide produced during the paper manufacturing process is significantly higher than the impact of printing itself [12].

Using our data from Table 1, we extrapolated to page counts of 100, 200, and 300 using 11-point Times New Roman as our baseline typeface. The results, shown graphically in Figure 1, indicate that 111 pages of 10-point Century Gothic roughly equals 100 pages of 11-point Times New Roman. This scales linearly as the number of pages in the document increases.

What about documents that *don't* comprise solid blocks of text with no headings or graphics? We next looked at three papers previously published by Indiana University. To compare them, we used Microsoft Word's Word Count feature to count pages and lines in the font in which each was originally published, and then chose one page of text from which to estimate a character count.[1] We then substituted our chosen fonts for the body text of each. For two of the three papers, 11-point Times New Roman still came out ahead of 10-point Century Gothic (Table 2). However, we noted that for documents with lists, headings, and other non-body text, the difference between the two fonts was much less striking. (Additionally, the fonts in which papers 1 and 2 were originally published yielded fewer pages than either of our chosen fonts.)

3. CAN YOU READ ME NOW?

We looked next at readability. Allan Haley, director of "words and letters" at the firm which developed Century Gothic, has stated that the font is suitable for small blocks of text such as headlines. He does not recommend its use for longer documents, instead promoting Times New Roman or Arial [3].

For presentations, Microsoft recommends avoiding serif fonts [11]. When it comes to the printed page, however,

according to Merriam-Webster's Manual for Writers & Editors, "...serif faces are somewhat easier to read in blocks or paragraphs of text than sans-serif..." [10].

Readability is, of course, subjective. It's based not only on personal preference, but also on the context in which a typeface is used; e.g., a tabloid-sized concert poster printed in a 10-point typeface isn't likely to get the point across. Not only is it important to choose a readable typeface, but it is also important to choose one that conveys the correct tone. Figure 2 is a reimagining of Arnold Skolnick's iconic 1969 Woodstock poster. It deliberately flaunts standard rules of design, using typefaces that are either unreadable, inappropriate, or both. This illustrative revision makes the dates of the concert indecipherable from the rest of the text – even at full size – and expresses the main message in a typeface more evocative of a horror movie than of the peace and love symbolized by the concert.

In a perhaps more relevant example, the National Science Foundation's (NSF) Grant Proposal Guide says: "The guidelines [for formatting grant proposals] ... establish the minimum type size requirements; however, ... readability is of paramount importance and should take precedence in selection of an appropriate font for use in the proposal. Small type size makes it difficult for reviewers to read the proposal; consequently, the use of small type not in compliance with the above guidelines may be grounds for NSF to return the proposal without review." [14] (It should be noted that 11-point Times New Roman is, as of this writing, one of the typefaces allowed by the NSF. Century Gothic, however, is not listed as an acceptable choice at any point size.)

4. THE DEPARTMENTAL MONEY SINK

The wide variety of print jobs on a typical college campus makes it difficult to control ink and paper usage in campus computer labs. Print quotas currently in place at Indiana University are an effective mechanism toward controlling overall student printing costs [6]. It would be difficult, if not impossible, to institute a mechanism that limits students' print jobs to certain fonts at certain sizes. Doing so would most certainly cause an uproar from the student body. It would be fairly simple, however, to educate those using shared printers about the effect font choice can have on their print quota. There is already information online about conserving paper in the Student Technology Centers (STCs) [7]. A bullet item on this page would reach hundreds of students. (Ironically, hanging eye-catching posters that graphically demonstrate how to manage conservation
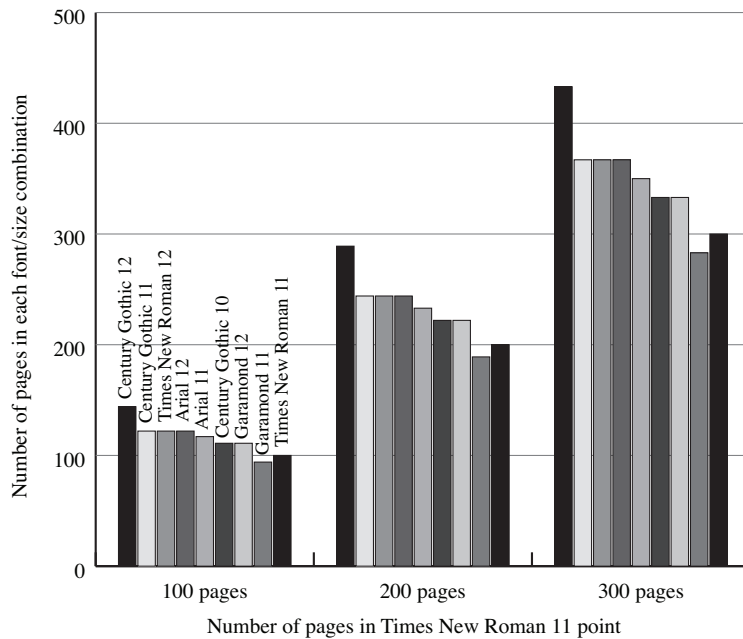
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[1]Paper 3 was converted from PDF. This caused breaks between paragraphs to be counted as very narrow lines, yielding an unusually large line count for the number of pages. This may also explain why the page and character counts were equal, while the line count differed.

Number of pages in each font/size combination

500

400

300

200

100

0

Century Gothic 12
Century Gothic 11
Times New Roman 12
Arial 12
Arial 11
Century Gothic 10
Garamond 12
Garamond 11
Times New Roman 11

100 pages   200 pages   300 pages

Number of pages in Times New Roman 11 point

Figure 1: Pages used for the same amount of text in various typefaces.

Table 2: Comparison of fonts and sizes of actual documents.

		As published			Century Gothic 10 points			Times New Roman 11 points		
Paper	*Original font*	*Pages*	*Lines*	*Characters per page*	*Pages*	*Lines*	*Characters per page*	*Pages*	*Lines*	*Characters per page*
1	Calibri 12	106	5,883	2,899	108	6,415	3,370	107	6,165	3,491
2	Garamond 11	59	2,289	4,178	65	2,548	3,765	63	2,361	3,983
3	Times New Roman 12	104	13,302	2,719	103	12,488	2,719	103	12,577	2,719

Figure 2: Woodstock reimagined – poorly. (Figure based on original artwork ©1969, Arnold Skolnick.)

through font choice would probably be the most effective way to educate students.)

Departmental printing costs, however, may be somewhat easier to mitigate. Among the reports produced each year by the Indiana University Pervasive Technology Institute are several that must be high-quality, bound copies. In late 2009, printing costs for a perfect-bound, full-color, 152-page report were quoted at approximately $31 each for 160 copies, and approximately $21 each for 260 copies. We quickly determined that printing costs for this particular project would far outstrip the remaining budget. Not only that, but a quick tour of our document storage indicated that we sometimes overestimate our needs, producing more documents than we actually use. With shrinking storage space, a desire to be environmentally friendly, and continued higher education budget cuts, it was time to seek a new solution. We examined several print-on-demand options. Indiana University is a staunch supporter of open source systems, and so our first candidate was Rice University's Connexions [16]. Unfortunately, our ability to design the finished product was too limited by the system. We began to compare commercial options.

All commercial print-on-demand options have pros and cons that will vary depending on one's needs. We found CreateSpace [4] to be the best option for the report in question [8]. Using a print-on-demand service allows us to print only as many copies as needed, with the option to order more

at any time without additional setup costs. In this particular instance, we printed only two copies for our records. While our per-unit cost was slightly higher than the price quoted for 260 copies by our local printer, we are not required to purchase a minimum number of copies. What would have been a $5000 print job was instead just over $50.

With the print-on-demand model, the entire cost may be passed to the consumer. While this model saves the university money, the message will tend to reach a narrower audience – only those willing to pay for the printed document. We've alleviated this by offering the same document electronically for free [9]. We also have made every attempt to keep the cost to the consumer as low as possible by offering the report at "publish-at price" – i.e., the cost to CreateSpace for the actual printing and binding. Although self-publishing options are designed to allow the author to set a price in order to receive royalty payments, we did not take advantage of this. The legal, ethical, and public relations issues that would likely stem from a university profiting from a report such as this were easily avoidable. Finally, we are able to purchase copies of our own documents for a lower price than that offered to the general public, so we could certainly use departmental money to purchase copies for others if necessary.

5. CONCLUSIONS: A FONT OF WISDOM

Typography is a surprisingly popular subject (e.g., the documentary *Helvetica* [5]) and a sometimes controversial one (e.g., the online movement to ban Comic Sans [17]). Even mainstream comic strips such as Dilbert, FoxTrot, and Doonesbury have at one time or another poked fun at font choices. No longer solely a tool of printers and graphic designers, fonts can get our message across, save money, and help save the environment – all at the same time.

Following this study, the Indiana University Pervasive Technology Institute chose to standardize on 11-point Times New Roman for printed (or likely to be printed) documentation consisting mainly of blocks of text, such as internal reports and white papers. For items with a high design-to-text ratio, such as glossy brochures and posters, Century Gothic is certainly a feasible choice. Additionally, PowerPoint presentations and other items with relatively small blocks of text may be done in Century Gothic, although presentations are by nature less likely to be printed. Documents destined for professional design and printing, such as reports for external audiences, will continue to include a mix of fonts deemed appropriate by the designer with deliberate mindfulness toward ink and paper usage. And finally, employees are encouraged to avoid printing whenever possible. The bottom line is this: Choosing a font based solely on how much ink or paper it uses is dangerous. If your message is rendered ineffective by its presentation, any ink or paper used can be considered wasted.

6. ACKNOWLEDGMENTS

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