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RETHINKING THE DESIGN OF PRESENTATION SLIDES: CREATING SLIDES THAT ARE READILY COMPREHENDED

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ABSTRACT

Presentation slides, when designed well, can significantly increase the amount of information that the audience comprehends. However, when the slide has type that can not be quickly read, the audience often gives up on the slide. Moreover, when the slide does not orient well, when the slide has too much information, or when the order of information on the slide is unclear, the audience can easily become confused. Given that these mistakes can prevent the audience from comprehending the presentation's content, presenters should strive to format slides that can be quickly read, that effectively orient, that have a reasonable amount of information, and that have a clear order of information. Unfortunately, the slide formats that many engineering presenters use do not meet these goals.

Presented in this paper are recommendations for the format of presentation slides—specifically, the typography, color, and layout of presentation slides (or overheads). An assumption for these recommendations is that the purpose of the presentation is to communicate technical information efficiently to the audience. Given that assumption, the goal of a slide's typography is to have type that can be read as quickly as possible. To obtain that goal, this paper recommends a bold sans serif typestyle such as **Arial** that is at least 18 points. In regard to color, the most important goal is to have colors that can be clearly distinguished from each other. To obtain that goal, this paper recommends either a dark color against a light background or a light color against a dark background.

In regard to layout, the goal is to have a slide design for which the audience can quickly discern the point of the slide and then can divide attention between the presenter and the slide as the presenter discusses the slide. To obtain that goal, this paper recommends the national laboratory design of a short sentence headline supported primarily by images. Other reasons exist for choosing this national lab design. Although this paper focuses on how readily that slides following this national lab design can be comprehended, the paper does direct the reader to references that discuss two other reasons for using this national laboratory design: (1) how well the slide design helps the audience remember details, and (2) how persuasive the slide design is.

INTRODUCTION

In the past decade, presentation slides have become a common addition to the teaching of engineering subjects, the presentation of engineering research, and the discussion of engineering designs. Ideally, presentation slides can emphasize key points, can show images too complex to explain in words, and can reveal the organization of the presentation. In addition, according to a study by Wharton Research Center [1], well designed slides can increase the retention of the audience from 10 percent, for just hearing, to 50 percent for both hearing and seeing the material.

In the past three years, harsh criticism of the traditional design of presentation slides has surfaced in several popular publications: *The New Yorker* [2], *The New York Times* [3], *The Wall Street Journal* [4], and *The Chicago Tribune* [5]. One common criticism in these articles is that presentation slides bury key information, sometimes with serious consequences. For instance, in the report about the Space Shuttle Columbia disaster, Edward Tufte [6] discusses in detail how one slide buried a key assumption in the analysis of risk that the ill-fated Columbia faced from its collision with debris at lift-off.

Typically, as soon as a slide is projected, the audience shifts attention to the screen. When the slide has type that is not readable, the audience is distracted with the question of what is written. Likewise, when the slide does not orient well, when the slide has too much information, or when the order that the information is to be read is not clear, the audience can easily become confused. Given that these mistakes can prevent the audience from comprehending the presentation's content, presenters should strive to format slides that can be quickly read, that effectively orient, that have a reasonable amount of information, and that have a clear order of information. Unfortunately, the slide formats that many engineering presenters use are not nearly as effective as they should be.

A slide's format consists of its typography, layout, and color. Given in this paper are recommendations for these three aspects. Affecting these recommendations are criteria other than how readily the information on the slide is comprehended. For instance, two other key issues are how much the audience remembers from the slide design [7, 8] and how persuasive the slide design is [7, 9].

Appearing in Table 1 is a summary of this paper's recommendations for designing slides that can be quickly read by the audience. Note that these recommendations are for presentations in which the speaker wants to communicate results efficiently to the audience. Some of these recommendations, such as using a sentence headline, might not apply to presentations in which the speaker desires to solicit opinions from the audience. Still, for engineering presentations that occur at professional conferences, in thesis defenses, or in classrooms we have found that these recommendations work well. Following these recommendations is a sample slide shown in Figure 1.

Table 1. Guidelines for the format of presentation slides [8].

Typography

Sans serif typeface such as **Arial** [10–11]

Boldface (**Arial**)

Type sizes at least 18 points (14 points okay for references)

Avoidance of presenting text in all capital letters [10–11]

Color

Either dark type against a light background or light type against a dark background

Avoidance of red–green combinations (many cannot distinguish) [12]

Layout

A sentence headline for every slide, but the title slide; left justification of the headline in the slide's upper left corner

Limiting of text blocks, such as headlines and listed items, to no more than two lines

Limiting of lists to two, three, or four items
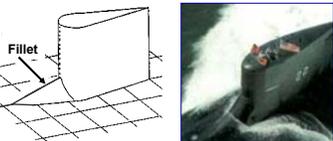
Generous use of white space

Figure 1. A slide that uses the recommended format design [13]. This slide comes from a research talk advocating the use of a fillet design on vanes in gas turbine engines.

TYPOGRAPHY OF PRESENTATION SLIDES

The typography of a document, be it a journal article or presentation slide, communicates much about the document. One important choice in typography is the selection of a typestyle, also called *font*. For instance, Garamond conveys a sense of tradition in documents, which is why Garamond is used in several journals. Garamond belongs to a class of typestyles known as serif fonts, which have projecting short strokes, such as the little feet on a serif "m." Another category of typestyles is sans serif. These fonts do not have the projecting strokes (consider a sans serif "m"). One of the most common sans serif fonts is Arial. Other important choices of typography include the type size, the choice of all capitals or lowercase, and the choice of bold, italic, or normal type.

1. Selection of a sans serif font rather than a serif font for presentation slides. Just because a typestyle such as Book Antiqua, Times New Roman, or Garamond is appropriate for reports and papers does not mean that it is appropriate for presentation slides. The most important consideration in choosing a typestyle for a presentation slide is not tradition, but reading speed. In a presentation, reading speed is important because the audience members, splitting their concentration between what the presenter shows and what the presenter says, allow themselves only a few seconds to read each projected slide. In general, when the amount of text is minimal such as on presentation slides, sans serif fonts are read more quickly—especially by those audience members looking at the screen from sharp angles on the far sides of the room. Within this category of sans serif typestyles, one might choose Arial for formal situations and Comic Sans MS for less formal situations.

Up until the release of its Windows XP version, the default typestyle of Microsoft PowerPoint was Times New Roman, a serif font that is not read as quickly as sans serif fonts are. That difference in reading speed is especially noticeable for an audience seated on the far left or far right sides of a room rather than in the room's middle. When viewed from a sharp angle, serif type is significantly more difficult to read than sans serif type. For an example, see the contrast of type in Figure 2.

2. Use of boldface. In addition to advocating a sans serif typestyle for presentation slides, many graphic designers also recommend using the bold version of that typestyle [14]. Boldfacing the type (**Arial**, for example) makes the letters more readable from a greater distance. Boldfacing the type also allows the lettering to reproduce better when placed onto an overhead transparency. Unfortunately, the default of Microsoft's PowerPoint does not call for boldface type.

While boldface is recommended for presentation slides, other options such as italic, underline, and outline are not [10]. Granted, in instructional documents, italic type in small blocks is useful for emphasis. However, on presentation slides, italic type is too slow to read—particularly when viewed from the far left or far right sides of the room.

3. Appropriate type sizes for the room. The size of the type is also a consideration. The size of type is measured in points (a point is about 1/72 of an inch). When a bold sans serif font is used, appropriate type sizes for a typical slide would be between 18 and 28 point*s* (for most rooms). In comparison, if an unbolded serif font is used, the presenter has to use a larger type size for legibility. The disadvantage of this design choice

is that less blank space exists, and blank space invites the audience to read the slide [11].

For reference listings that the speaker does not expect the audience to actually read during the presentation (but may want to read on a copy of the presentation slides afterwards), 14 points is appropriate as long as it is clear to the audience that the text block is a reference listing. An example of such a reference existed in the "Devenport et al." listing given back in Figure 1.
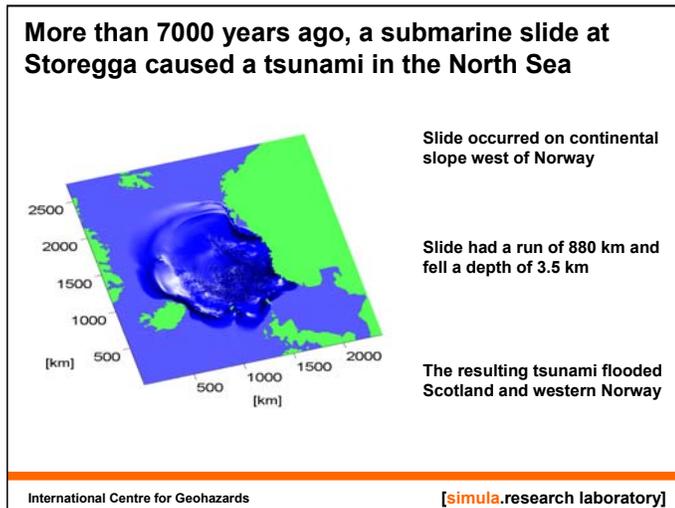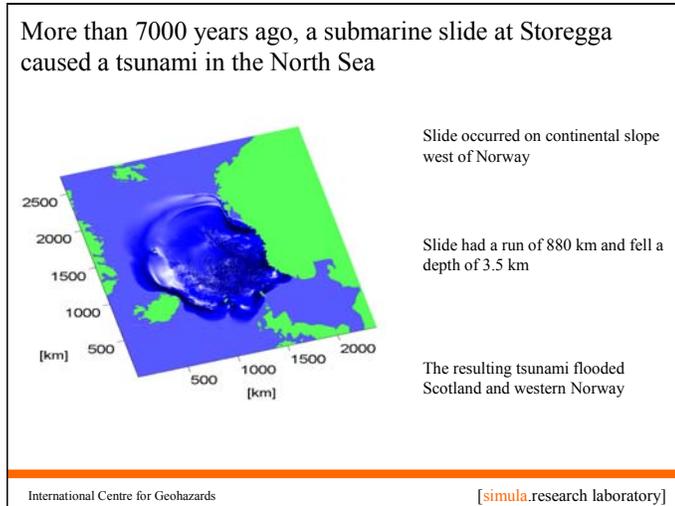

Figure 2. Contrast of slides that use different type faces [15]. The bottom slide, which uses the bold sans serif, can be read more readily at a farther distance and at a sharper angle than the top slide, which relies on unbolded serif type of the same size.

4. Avoidance of presenting text in all capital letters. Some presenters mistakenly use all capital letters on their slides. These presenters fail to recognize that readers recognize words not only by the letters in the word, but also by the shape of the letters: for instance, the shapes of ascenders such as *b, d,* and *f* and the shapes of descenders such as *g, j,* and *p*. Using all capital letters dramatically slows the reading because using all capitals prevents readers from recognizing the shapes of words.

Another problem with using all capitals is that type set in all capitals takes up significantly more space (about 35 percent more space) than type set in upper and lower case [10]. On a presentation slide, space is valuable, and what space one does not need for type and images should be blank, to make the slide more inviting to read [11].

COLOR OF PRESENTATION SLIDES

Color is an aspect that can distinguish the presentation and clarify differences among details. If chosen improperly, though, color can significantly reduce the reading speed of the presentation.

1. Consider the representative colors of the institution. For a company that has blue as its identifying color, incorporating blue into the color scheme of its presentation slides is natural. Sandia National Laboratories, for instance, uses blue as an identifying color. For that reason, many presentation slides representing Sandia use blue—either blue lettering on a white background or white lettering on a blue background. For slides that will be printed out as overhead transparencies or handout pages, dark lettering against a clear or light background is advantageous to save on toner.

2. Consider how readable the combination is. Choosing a color combination with a high contrast is important. Not all color combinations are read with equal speed. The color combination that is read most quickly is black lettering against a yellow background [10], which is one reason that caution signs use this combination. The next most quickly read combination is black lettering against a white background. One of the slowest-to-read combinations is black lettering against a red background, and even more slowly read is red lettering against a black background. Although dark blue or dark green lettering against a white background is not read as quickly as black against a white or yellow background, these combinations can be read quickly enough to serve an engineering presentation. In the end, what is important is that the contrast be high.

Another consideration is color blindness. About 8 percent of males and 0.5 percent of females have deficiencies in distinguishing certain color combinations [12]. The combinations that cause the most problems for these people involve red, green, and brown. For that reason, such combinations should be avoided.

3. Consider the effect of the background color upon the audience. Blue and green are soothing colors. For that reason, audiences feel comfortable with either of those colors used as the background of a slide. Orange and red, on the other hand, are hot colors and can unsettle an audience.

LAYOUT OF PRESENTATION SLIDES

On presentation slides, one of the main layout errors is having too many details. When a slide has too many details, the listeners are intimidated—they feel that they do not have time both to decipher the slide and to continue listening to the speaker. Specifically, what intimidates audiences are slides with large blocks of text (more than two lines per block), slides with long lists (more than four items per list), and slides that do not contain enough white space.

A second layout error that causes slides not to communicate effectively is an illogical arrangement of information. When a slide is projected, the audience turns from

the speaker and looks at the screen. At this point, the audience's attention is divided between the speaker and the slide. For this situation, it is important that the audience members quickly grasp the purpose of the slide and that they know how to read it: what to read first, what to read second, and so on. In poorly designed slides, the audience does not know on what to focus first.

Given in this section are guidelines for limiting the amount of information so that the audience is not overwhelmed. Also given here are guidelines for arranging the information so that the audience is quickly oriented.

1. For each slide except for the title slide, consider using a sentence headline to state the slide's purpose. When a presentation slide appears before the audience, the audience immediately turns to it and tries to decipher its purpose. A sentence headline, such as shown on the slide in Figure 3, serves this situation by orienting the audience quickly to the purpose of the slide so that the audience can turn its attention back to the presenter. Designing slides with short sentence headlines is not a new idea. For instance, in the 1960s, Robert Perry at Hughes Aircraft began advocating sentence headlines for slides, and since the 1970s, Larry Gottlieb of Lawrence Livermore National Laboratory has taught the design to hundreds of scientists and engineers [16].
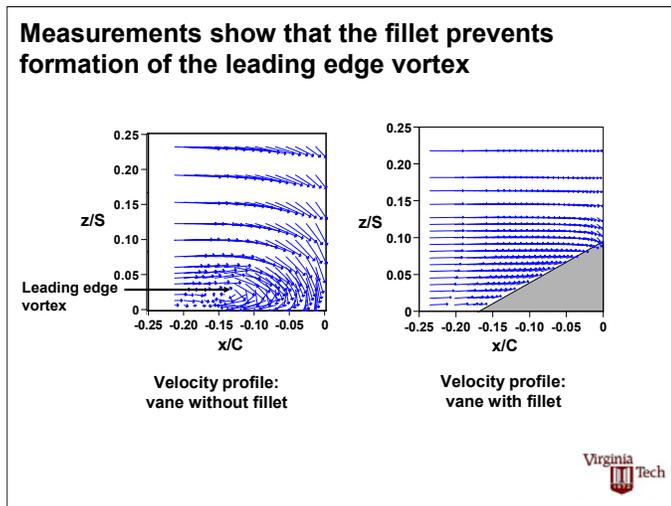

Figure 3. A slide that has an effective sentence headline to orient the audience [13]. This slide comes from a research talk advocating the use of a fillet design on vanes in gas turbine engines. Note that the headline "Results" would not have been nearly as effective.

Because a sentence headline is longer than a phrase headline, the presenter should try to make sure that the sentence headline can be read as quickly as possible. To this end, the national laboratories suggest three guidelines [16]. First, the sentence headline should begin in the upper-left corner of the slide. That way, the audience sees it first. Second, the sentence headline should be no more than two lines. Blocks of text longer than two lines on a slide are often not read. Third, to make it easier for the audience to read, the headline should be left justified, rather than centered, because a centered headline takes the audience longer to read, particularly if the headline goes to a second line.

Using a sentence headline is not the norm in scientific presentations. In fact, given the thousands of presentations that use phrase headlines (or, worse yet, no headlines), this advice swims against the current of what is most often seen. However, many good reasons exist for using sentence headlines. One is that a sentence headline forces the presenter to come to grips with the assertions of the argument that he or she is making [8, 9, 16, 17]. Because the presenter has clearly established what the assertions of the presentation are, then the presenter is in a better position to select the best evidence to support those assertions. A second reason is that using sentence headlines makes the set of slides stand alone better as a set of notes. For instance, if the slide shown back in Figure 3 simply had the headline "Results," it would not be nearly as helpful to the audience two weeks later when viewed as part of a set of notes. Yet a third reason for the value of sentence headlines is that presentations using sentence headlines, as observed in thesis defenses [18], tend to have significantly fewer slides, thus reducing the frenetic pace that weakens so many engineering presentations. The reason for the reduction in the number of slides is that if the presenter cannot write a sentence for the slide that states its assertion, the design calls for the elimination of the slide [8, 16].

2. Try to rely on images in the slide's body to support the assertion of the headline. Once the presenter has established the assertion of the slide with the sentence headline, the presenter should support that assertion primarily with images and with words where needed. The reasoning for this guideline is that images, if well conceived, can communicate information much more quickly to the audience than blocks of text can. Figure 4 shows a slide with a reliance on supporting images and judicious use of supporting words.

How much wording should be placed onto slides? A good rule of thumb is to keep each block of text, including the headline, to no more than two lines. Audiences are much more likely to read blocks of text with one or two lines than blocks that are longer.
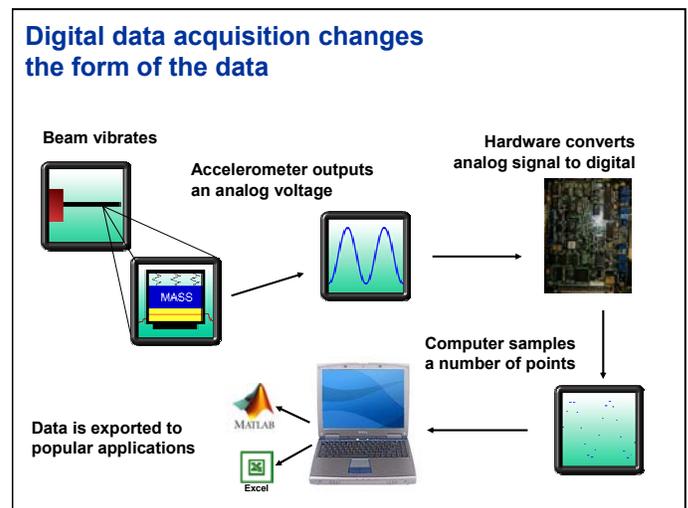

Figure 4. A slide that relies primarily on images to support the assertion of the sentence headline [19]. Supporting words are used only where needed. This slide comes from a junior-level course in measurement design.

3. Try to avoid lists with more than four items. Audiences are more likely to remember lists of twos, threes, and fours than

lists of fives, sixes, or sevens. Moreover, with a long list, the audience sees the length, perhaps reads the first couple of items, and then gives up on the remaining items. When the presentation's content contains a long list, presenters would do better to place only the four most important items from that list onto the slide and to reserve the less important items for the speech.

To illustrate this point, contrast the mapping slide of top part of Figure 5 with the mapping slide in the bottom part of the figure. The mapping slide in the top part has a long list that the audience probably will not remember. In the mapping slide of the bottom part, though, the presenter shows only those details that the audience needs to know *at that point* in the presentation. In doing so, the presenter keeps her list of items to three, rather than the soon-to-be-forgotten list of seven that was given in the top part.
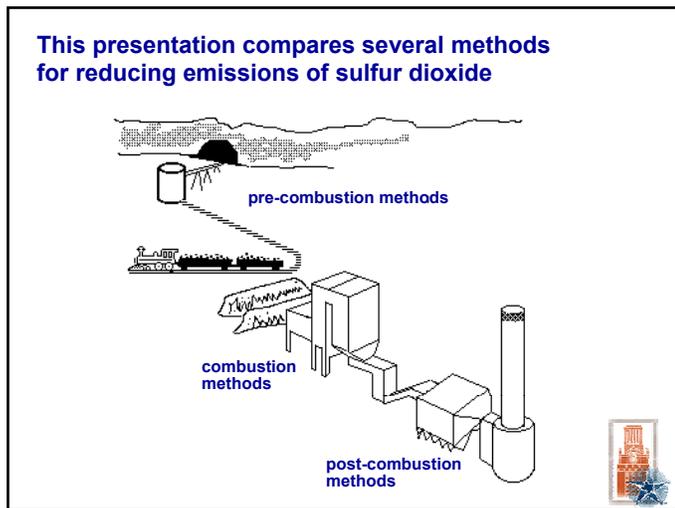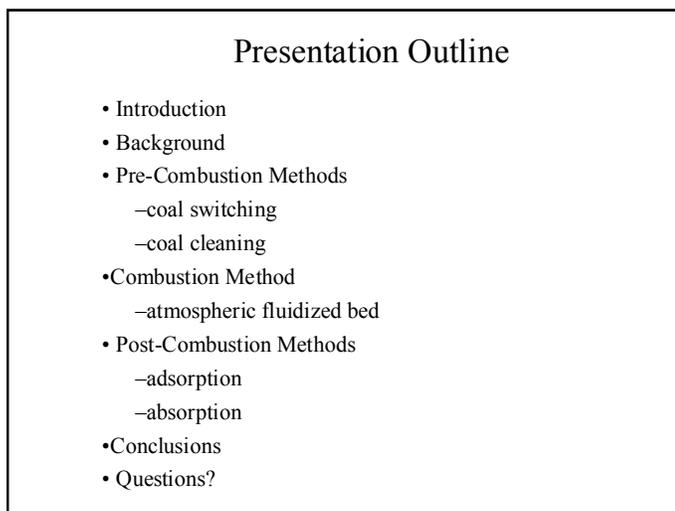

Figure 5. Contrast of mapping slides, for the same presentation, that have significantly different layout strategies. The bottom mapping slide [20] is much more memorable than the top mapping slide.

4. Be generous in the use of white space. One way to prevent a slide from seeming overcrowded is to be generous with white space [11]. For instance, Figure 4, which communicated much information, contained important white space. This white space not only allowed the audience to separate the items in the slide's body, but also allowed the audience to find a logical order in which to view those items.

CONCLUSIONS

This paper has presented recommendations for the typography, color, and layout of slides used to teach engineering principles, present engineering research, and defend engineering designs. Recommending an effective format for presentation slides is one thing, but persuading faculty and students to adopt that format is quite another.

One large hurdle is the difficulty that the presenter faces in overcoming the weak defaults of presentation slide programs such as PowerPoint. For the presenter, it takes much work to change the typography, color, and layout defaults of PowerPoint. To help presenters overcome this hurdle, we have found much success in the use of templates that simply remove the hurdle. These templates are designed such that headlines begin in the upper left corner, and have a size that can produce a two-line sentence. Such templates are available for downloading from the following web site [21]:

http://writing.eng.vt.edu/slides.html

Although this page was created just a few months ago, Google already lists this page as the number 3 most popular site (out of more than 2 million) for the topic of *presentation slides* [22]. This high ranking points to the attention that this recommended format is receiving. Not surprisingly, this web page is accessed often. For example, the page was visited more than 2000 times during August 2004 [23].

Given the criticism that PowerPoint presentations have received in the past few years [2–7], the time is appropriate for engineers and engineering educators to rethink the design of presentation slides. This paper has focused on one perspective: how readily the slides can be comprehended. Other perspectives, such as how much the slide design helps the audience remember details and how persuasive the slide design is, deserve deep consideration as well.

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