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Final MA Portfolio

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FINAL MASTER'S PORTFOLIO

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A Final Portfolio

Submitted to the English Department of Bowling Green
State University in partial fulfillment of
the requirements for the degree of

Master of Arts in the field of English
with a specialization in
Professional Writing and Rhetoric

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Professor Gary Heba, First Reader
Professor Bill Albertini, Second Reader

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Analytical Narrative

Over the years, I have realized that effective technical communication is important across professions, and my experiences in the Master of English, Professional Writing and Rhetoric program only reinforces this observation. Although I initially knew very little about the scope of technical communication, I understood that it would be a valuable area of study.

I am naturally drawn to forms of visual communication, and my undergraduate education consisted primarily of coursework in the Visual Communication Technology and Art History programs at Bowling Green State University. Through these programs, I gained a solid foundation in photography and graphic design, and I learned valuable visual analysis skills. However, I made the mistake of neglecting my English education, opting to enroll only in a single, required introductory technical writing course. While I thoroughly enjoyed the course, I did not pursue any additional English courses, thinking that my writing skills were adequate for a career in marketing or communications.

After graduating with my B.S. in Visual Communication Technology and B.A. in Art History, I went on to study in the online Learning Design master's degree program at Bowling Green State University. In this program, I studied learning theories and instructional design, but again, I did not pursue any English education. Looking back, I realize that I once again missed out on an opportunity to develop writing skills that would be highly beneficial in any career path.

It was not until I had worked a year in collegiate recreational marketing that I realized how beneficial additional English education would be. Initially my tasks fell in the realm of visual communication; however, when I began to look past the visual aspects of my work, I noticed that much of the written content I worked with lacked clarity, was potentially confusing, and even contained grammatical errors. Before long, I was questioning the accuracy and

effectiveness of most of the documents I came across, and I started making basic revisions. The more I worked with written content, the more I enjoyed the process of both writing and editing, and I decided to enroll in the M.A. in English program with a specialization in Professional Writing and Rhetoric.

Prior to starting the coursework, I thought that technical communication and visual communication were two completely different subjects. However, as I progressed in the program, I quickly realized that the two fields have much in common. Although technical communication centers on written communication and visual communication encompasses various types of visual media, both disciplines share a common goal: communicating messages that inform, instruct, or persuade a targeted audience.

There is also content overlap between the two disciplines. While technical communicators may not be tasked with creating visuals, they should understand how to select effective visuals and compose multimodal documents that contain both textual and visual content. Likewise, visual communicators may not be responsible for writing or editing the textual content of a brochure or website, but they should be able to understand how to choose effective supporting visuals. They would also benefit from applying a critical eye toward text and recognizing the presence of grammatical, mechanical, or substantive errors.

Much of my research in this program, including the documents selected for this portfolio, reflects my interest in the overlapping area between technical communication and visual communication. Topics included in this portfolio range from the effective and ethical design of graphical representations, the role of semiotics and visual metaphor in the design of graphical symbols, and methods guiding the design of software video tutorials.

I also drew on my learning design background to write a resource guide for teaching a technical writing course, which includes a teaching philosophy, curricular objectives, a course syllabus, lesson plans, and assignments for an introductory technical communication course. While the topic for this teaching guide differs from the previous three topics in that it does not heavily focus on the intersection of visual and technical communication, it does demonstrate my ability to include visual communication considerations into course assignments.

In addition to demonstrating my interest in theories and methods that overlap technical and visual communication, the portfolio selections also demonstrate my growth as a writer and researcher as I progressed through the program. Each selection was written during a different semester, and a comparison between the original drafts demonstrate a positive shift in both research methods and writing style.

The first selection is a research paper titled, “Embellishments in Graphical Representations and Infographics: Effects and Ethics,” and it was the final course project for ENG 6410, Resources and Research in Professional/Technical Writing, which I completed during my second semester in the program. Since I had already completed a research methods course for the Learning Design master’s program, writing a research paper was a process I was already familiar with. However, selecting a suitable topic and type of study proved more difficult, as I was still relatively new to the program and unfamiliar with all potential topic areas. Therefore, I decided to review the effects of using visual embellishments in graphical representations (graphs and charts), a topic that overlapped with visual communication.

Due to my relative unfamiliarity with the topic, I felt that a literature review would be the most appropriate approach, and I followed the methods outlined in *A Research Primer for Technical Communication: Methods, Exemplars, and Analyses* by Michael A. Hughes and

George F. Hayhoe. The research process included locating and reviewing primary research, identifying gaps in research, writing to educate readers, and establishing credibility. During the semester, I read a variety of articles and prepared a reference list and annotated bibliography summarizing the sources and evaluating their credibility and effectiveness. This process, which was new to me, enabled me to get a good overview of the topic, and it also made the processes of writing an outline and composing the final paper much easier.

My primary focus in this research paper was to first distinguish the difference between graphical representations of quantitative data and infographics, which are multimodal displays of both visuals and text that often contain graphical representations. I then studied two contrasting approaches to designing graphical representations: minimalism, as is seen in traditional charts and graphs, and embellishing, which is a common practice when designing charts and graphs for infographics. When looking at the minimalist approach, I specifically studied Edward Tufte's principles of graphical excellence as defined in *The Visual Display of Quantitative Information*, including his ideas on data-ink ratio and "chart junk." I then looked at the use of embellishments in graphical representations, which includes decorations and visual backgrounds used within and around graphical representations, as in the case of many infographics. Based on existing research, I determined how these two approaches impact readability, communication accuracy, memorability, and viewers' aesthetic preferences. I also reviewed the ethical implications of using embellishments in graphical representations, looking at the opposing viewpoints of those who support minimalism, like Edward Tufte, and those who favor the inclusion of embellishments that incorporate humanistic elements.

The second selection, "The Use of Visual Metaphors in ISO Graphical Symbols," is the best representation of substantive research in this portfolio. I wrote this research paper to fulfill

the final course requirement for ENG 6050, Visual Rhetoric, which I enrolled in during my third semester in program. After completing my first research paper in the program the previous semester, I realized that I needed to narrow my focus, as my previous topic seemed too broad in retrospect. Therefore, I limited the scope of this topic to exploring the extent to which visual metaphors are used in ISO public information graphical symbols. This topic provided the opportunity to study how complex information is communicated in simple graphical symbols. It also allowed me to look at how meaning is communicated visually according to Charles Sanders Peirce's theory of semiotics. Even though I studied visual communication and art history as an undergraduate student, semiotics was a completely new area of study for me, and I valued the opportunity to learn more through this research.

To understand underlying trends in the design of ISO graphical symbols, I conducted a content analysis, which was a method that I was unfamiliar with prior to taking the Visual Rhetoric course. According to Gillian Rose in *Visual Methodologies: An Introduction to Researching with Visual Materials*, the content analysis was originally developed as a method to interpret spoken and written texts, but it can also be applied to visual images (2012). Furthermore, this method relies on strict rules and procedures for selecting, coding, and quantitatively analyzing large numbers of images.

The paper begins with an introduction that briefly outlines the problem, methods, and hypotheses. A literature review follows that establishes the long history of production of graphical symbols, reviews Peirce's semiotic model, clarifies overlapping terminology, provides a definition of ISO graphical symbols, reviews the various types of ISO graphical symbols, and provides an explanation of visual metaphors. Next, a methods section outlines the steps followed

in the content analysis, which include selecting symbols to analyze, creating coding categories, forming a hypothesis, coding the categories, analyzing the results, and summarizing the results.

Although the small sample size and participation of only one researcher presented some limitations, this study revealed that there are some significant trends in how ISO public information graphical symbols are designed. Understanding the design decisions behind ISO graphical symbols can aid technical communicators in both choosing and creating graphical symbols to incorporate into their projects.

The third selection, a seminar paper titled “Guidelines for Designing Effective Video Software Tutorials,” was completed most recently during my sixth semester in the program for ENG 6800, Multimodal Composition. In this class I felt like a fish out of water, as I was the only student who had never taught an English class. Therefore, I approached the course from the perspective of a visual communicator, and I viewed the class as an opportunity to learn how to better merge writing with my work with visuals.

When choosing a topic, I decided to draw on my learning design education by connecting multimodal theory and technical communication through an exploration of how to create effective video software tutorials. Creating instructions falls within the scope of technical communication, and is an important area of consideration as the popularity of video tutorials has increased since the establishment of video sharing sites like YouTube. Recognizing the possibility that technical communicators may be tasked with working on video tutorials, I decided to review existing literature to determine what the recommendations are for producing effective video software tutorials. While I did find several existing sets of guidelines informed by research, differences in content and organization were evident. Therefore, I combined all the content into eighteen distinct guidelines in three major categories: accessibility, cognitive design,

and affective design. In addition, I identified research and theories in education psychology, instructional design, and multimedia learning that support each guideline, drawing heavily on the theories presented by Richard E. Mayer and Roxana Moreno in multimedia learning.

The fourth and final selection is a teaching resource guide, which I completed during my fourth semester in the program for ENG 6470 Teaching Technical Writing. In this class, I studied current rhetorical theories and approaches to teaching technical writing, and I also looked at how technical writing differs from other forms of composition.

In one of the course texts, *Writing that Works: A Teacher's Guide to Technical Writing*, Dr. Steven M. Gerson discusses five components of technical writing: development, grammar, organization, style, and document design. Looking back at the introductory technical writing course I took as an undergraduate, I remembered that document design was given little consideration outside of following proper document formats, like the correct placement of information in a formal letter or resume or the use of numbered lists in instructions. Therefore, even though I focused on all five components in the teaching materials I created, I took the opportunity to especially highlight the document design component.

In a resume assignment I created, I included the application of the principles of graphic design in the document design as a learning outcome, and in a multicultural website comparison assignment, I asked that students compare two websites in the use of color, layout, white space, and images, as well as textual content and language availability. In the course schedule I created, I also allocated time to discuss the basics of how to communicate visually including the principles of graphic design, basic typography, and the use of tables, graphs, and charts in documents. By inserting basic visual communication education into an introductory technical

writing course curriculum, I hope that students would view document design as part of the overall writing process, rather than as an afterthought.

While the selections in this portfolio showcase only a fraction of what I learned in the Professional Writing and Rhetoric program, each of the ten courses I completed taught me important aspects of the field of technical communication. One course that I particularly value is ENG 6420, Professional/Technical Editing, which I completed during my final semester of coursework. After a decade-long hiatus from English language studies, this class was invaluable in helping me remember grammar and punctuation rules that I had forgotten as well as prompting me to learn new rules. I also became comfortable using *The Chicago Manual of Style*, 16th edition, a resource I had not used before and one that I now heavily rely on. In addition, I became familiar with Carolyn Rude and Angela Eaton's basic copyediting aims defined in *Technical Editing*, and now I always critically evaluate my writing and the documents I edit to ensure they are correct, consistent, accurate, and complete.

In the Professional/Technical Editing course, I also learned that there is a distinct difference between basic copyediting, which encompasses grammar, punctuation, and style conventions, and comprehensive editing, which also includes content and organization. As a result of this course, I discovered that I thoroughly enjoy comprehensively editing documents, and I heavily rely on the guidelines provided by Robert van Buren and Mary Fran Buehler's levels and types of edit as outlined in *The Levels of Edit*. While the levels of edit are not always applicable to my own editing tasks, I have made it a habit to always perform format, mechanical, language, and substantive edits when appropriate.

I also applied what I learned in the Professional/Technical Editing course to revise the works selected for this portfolio. For each document, I first performed a format edit, looking for

inconsistent uses of typefaces, leading, heading styles, and positioning of figures and tables. Next, I performed a mechanical style edit, reviewing the documents for issues that include improper capitalization, word compounding, form and construction, and bibliographic reference style. After looking at formatting and mechanics, I performed a language edit to review spelling, grammar and syntax, punctuation, language parallelism, and the use of smooth transitions. I also looked for ways to make the writing more concise or explanatory when necessary. Lastly, I performed a substantive edit, although this often took place simultaneously with the other edits. Substantive edits included the identification and inclusion of missing material, the elimination of repetition and redundancy when possible, and improvements in organization.

Through the revision process it became evident that my writing has improved over the two years I have been enrolled in the program. As “Embellishments in Graphical Representations and Infographics: Effects and Ethics” was written during my second semester, there was much to edit. In addition to improving grammar, I realized that I used multiple terms interchangeably, which made the writing confusing. I also identified a need to include smoother transitions between topics to more effectively guide the reader through the content.

I also noticed similar issues in my second selection, “The Use of Visual Metaphors in ISO Graphical Symbols.” Overall, this paper flowed better, but I did need to correct some grammar, inconsistencies in terminology, and figure labels and captions. I also improved the transition between the discussion of ISO graphical symbols and visual metaphors. One major issue in this selection was the incomplete development of the visual metaphor coding category, which required some additional writing.

My third selection, “Guidelines for Designing Effective Video Software Tutorials” was completed during my last semester of coursework while I was also enrolled in the

Professional/Technical Editing course. It is clear from re-reading this paper that the editing skills I learned in Professional/Technical Editing positively impacted my writing skills as this paper required much less revision.

My fourth selection, the teaching guide, also required some minor grammatical revisions. However, most revisions centered around formatting. I restructured the table format of the grading rubric to make it easier to read and added some bold and color typeface formatting to the course schedule to highlight important information. In addition, I divided the content in a lengthy assignment overview into a bulleted list so that the information would be easier to scan and remember.

Although I wasn't initially sure how I would apply the knowledge learned in this program in my current position or how my career path might change after completing this program, I was certain that my writing would improve with focused education and practice. What I did not anticipate was that this program would be complementary to my background in visual communication and learning design and improve my graphic design and instructional design work.

Overall, the range of course offerings has contributed in further diversifying my skillset by helping me develop valuable writing and editing skills and even allowing me the opportunity to build on my existing document design skills. Each semester, I have had the opportunity to apply new knowledge and methods I learned in the courses in my current position in collegiate recreational marketing by improving existing documents, writing new documents, and even establishing an editing workflow for staff to follow. As I contemplate my future, I am now confident that I have the writing and editing skills necessary for any career that requires technical writing and editing skills.

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Embellishments in Graphical Representations and Infographics: Effects and Ethics

Introduction

Visual thinking is important in the field of professional communication because technical communicators are increasingly responsible for design tasks. In addition, audiences now expect to view information in multiple forms and presented in different types of media (Brumberger, 2007, 377). Carliner (2001, 157) explains that advances in desktop publishing software as well as increased audience expectations have created a demand for graphics in communication products; for this reason, technical communicators need to be able to identify opportunities for the incorporation of visuals in communication products and also have the ability to communicate with graphic artists and production specialists.

According to Kienzler (1997, 171), visuals can have a greater impact than accompanying text for three major reasons: (1) readers perceive visuals as a gestalt, and, therefore, visuals have an emotional impact that words lack, (2) it is easier for viewers to see visuals when skimming, even if they do not read the text, and (3) readers tend to remember visuals longer. Doumont (2001, 220) discusses how people are able to grasp visual aids in a few seconds and often absorb them nonverbally.

Iliinsky and Steele (2011, Part 1) also identify many benefits of data visualizations (displays of quantitative data in charts and graphs) for the processes of examining, understanding, and transmitting information. They explain that data visualizations aid the brain in absorbing a large amount of information very quickly and help the brain identify patterns in order to understand relationships and meaning. In addition, data visualizations identify sub-problems and inspire new questions and further exploration. Iliinsky and Steele (2011, Part I)

also note that data visualizations help viewers identify trends and outliers and discover or search for specific data points in a larger field.

However, despite the known benefits of data visualizations, the actual effectiveness of data visualizations used throughout print and digital media varies depending on their design. Hegarty (2011, 447) explains that in the case of visual-spatial displays, task performance for different visual displays of the same information can be “dramatically different” depending on their design. As a result, researchers from many different disciplines (i.e. cartographers, statisticians, researchers in human factors and engineering psychology, educational researchers, and researchers of scientific visualization and geovisualization) are questioning the design and effectiveness of visual displays of information (Hegarty, 2011, 447).

While there are many different types of visuals used in technical communication, graphical representations (also known as data visualizations) are commonly used to visually display quantitative data. However, the design of effective graphical representations is one topic in which there continues to be much debate. This literature review examines the effectiveness of graphical representations that contain embellishments from two different angles: their effectiveness in communicating information and any ethical implications.

First, key terminology is defined to avoid any confusion in the meaning of various technical terms. Next, two different approaches to the creation of graphical representations—minimalism and embellishing—are reviewed. Following is a review of recent studies that demonstrate the effect of embellishments on graphical representations and demonstrate the impact of embellishments on readability, communication accuracy, memorability, and aesthetic preferences. Next is a discussion of the ethical implications of using embellishments in graphical representations. Finally, this literature review concludes with recommendations that include (1)

standardized names for various types of visualizations to prevent confusion, (2) additional research on the effects of embellishments, and (3) the need for professional communication instructors to be knowledgeable about graphical representations and infographics in order to teach future professional communicators how to judge the quality of existing infographics and create effective infographics.

Definitions of Key Terms: Graphical Representations and Infographics

Professional communicators should be concerned with two forms of visual communication: graphical representations (also referred to as data visualizations) and infographics. According to Iliinsky and Steele (2011, Part 1, Chapter 1), the vocabulary used to describe the art of representing statistical information visually is still evolving, and this creates some confusion on what the various terms relating to data visualizations actually mean. Wills (2012, 21) also discusses the lack of accepted standard names for various types of data visualizations. He explains that as data visualizations have become more complex, the problem becomes worse, and it is difficult for people unfamiliar with the field of data visualization to understand the differences and similarities between methods of displaying data. Nevertheless, according to Iliinsky and Steele (2011, Part 1, Chapter 1), the information design community does recognize solid definitions for these terms that make a distinction based on form and origin. However, this claim may be debated as the sources cited in this paper use a variety of different terms to discuss the same types of data visualizations.

Graphical Representations

The term graphical representation is often used interchangeably with a variety of other terms including data visualizations, data graphics, presentation graphics, and information graphics. According to “The Concise Encyclopedia of Statistics” published by Springer in 2008, graphical representations are a form of data representation that “encompass a wide variety of techniques that are used to clarify, interpret and analyze data by plotting points and drawing line segments, surfaces, and other geometric forms or symbols” (Dodge, 2008, 236-237). Figures 1 and 2 display two different examples of common graphical representations.

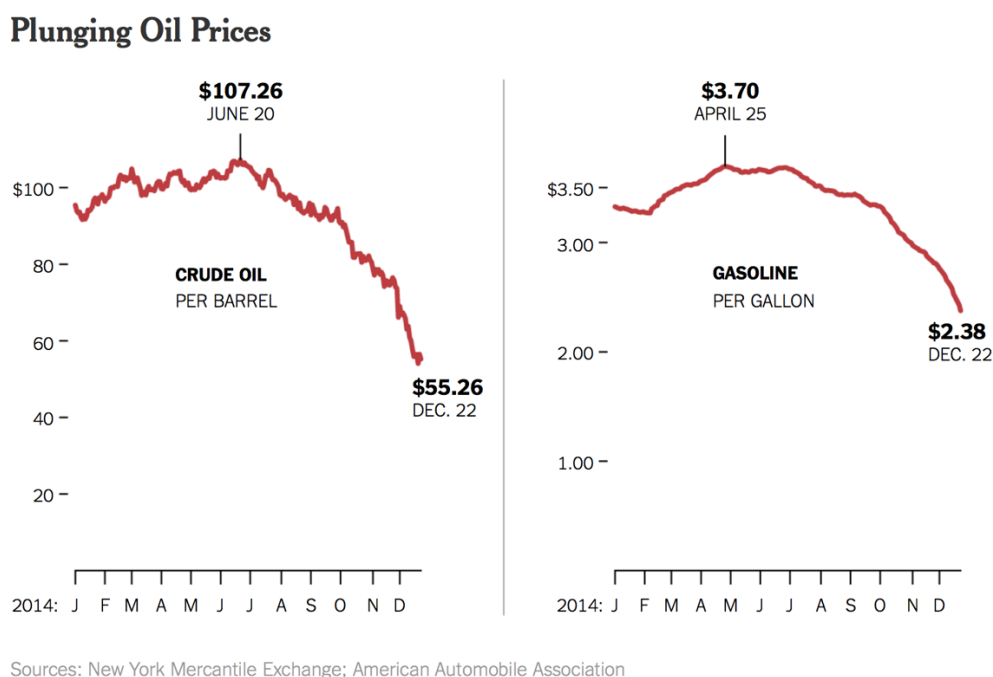


Figure 1. These line graphs, published by the New York Times in 2014, compare the change in oil prices over time by connecting points plotted on the x and y axes.

Source: The New York Times, 2014.

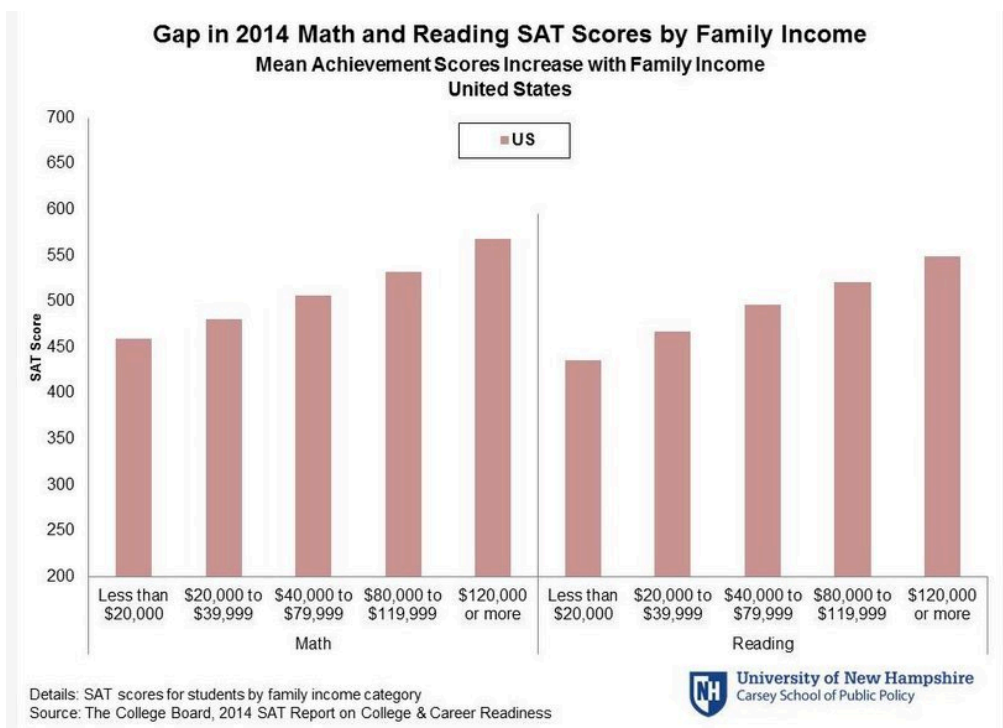


Figure 2. This bar graph, published by the Huffington Post in 2015, compares mean math and reading SAT scores for students based on family income.

Source: The New York Times, 2014.

Edward Tufte (2001), a renowned American statistician, uses the term “data graphics” to describe visual displays of quantitative data that make use of points, lines, a coordinate system, numbers, symbols, words, shading, and color. In contrast, Wills (2012) refers to visual displays of quantitative data as presentation graphics, Demir et. al. (2012) refers to them as information graphics, and Iliinsky and Steele (2011) as well as Skau et. al. (2015) refer to them as data visualizations.

According to Iliinsky and Steele (2011, Part 1, Chapter 1), data visualizations are visual representations of data that are algorithmically drawn using computer software. Furthermore, data visualizations are easy to regenerate with different data, often undecorated or “aesthetically barren,” and data-rich. While they are initially designed by humans, computer software is

ultimately used to render data visualizations. Notice that in both figures 1 and 2, the graphical representations are computer generated, data-rich, and include only the elements needed to accurately convey the information (i.e. words, numbers, and graphic elements).

Due to the potentially confusing range of terms used to describe the display of quantitative data in graphs and charts, only the term “graphical representation” is used from this point forward to refer to visual displays of quantitative data.

Infographics

Unlike graphical representations, which visually display quantitative data, infographics are visual displays that convey both textual information and eye-catching design elements in addition to or in place of graphical representations (see figs. 3 and 4). Infographics are designed for both digital or print publications to communicate information to audiences (Skau et. al., 2015, 221). In addition to containing graphical representations, Toth (2013, 448) explains that infographics also may contain lists, graphics, and other visual elements to inform or persuade audiences. In addition, infographics are visual representations of data that are manually drawn, specific to the data at hand, aesthetically rich, and relatively data-poor or limited in the amount of data conveyed due to the fact that they are created manually (Iliinsky and Steele, 2011, Part 1, Chapter 1). Polman and Gebre (2015, 868) define infographics as “visual representations of complex data and ways of communicating insights in visual form.” They explain that infographics go beyond displaying quantitative data in the form of charts and graphs because infographics use both graphical and textual conventions to embed representations of the creator’s understanding of a topic and present an argument. Ashman and Patterson define infographics as “visual portrayals of research findings” and argue that infographics enable the transfer of

knowledge between academia and a wider audience (Ashman and Patterson, 2015, 613). According to Kostelnick (1998, 477), infographics fall into the category of aesthetic data displays. The aesthetic standard includes expressive approaches “which aim to capture the readers’ attention, motivating them to examine the data.”

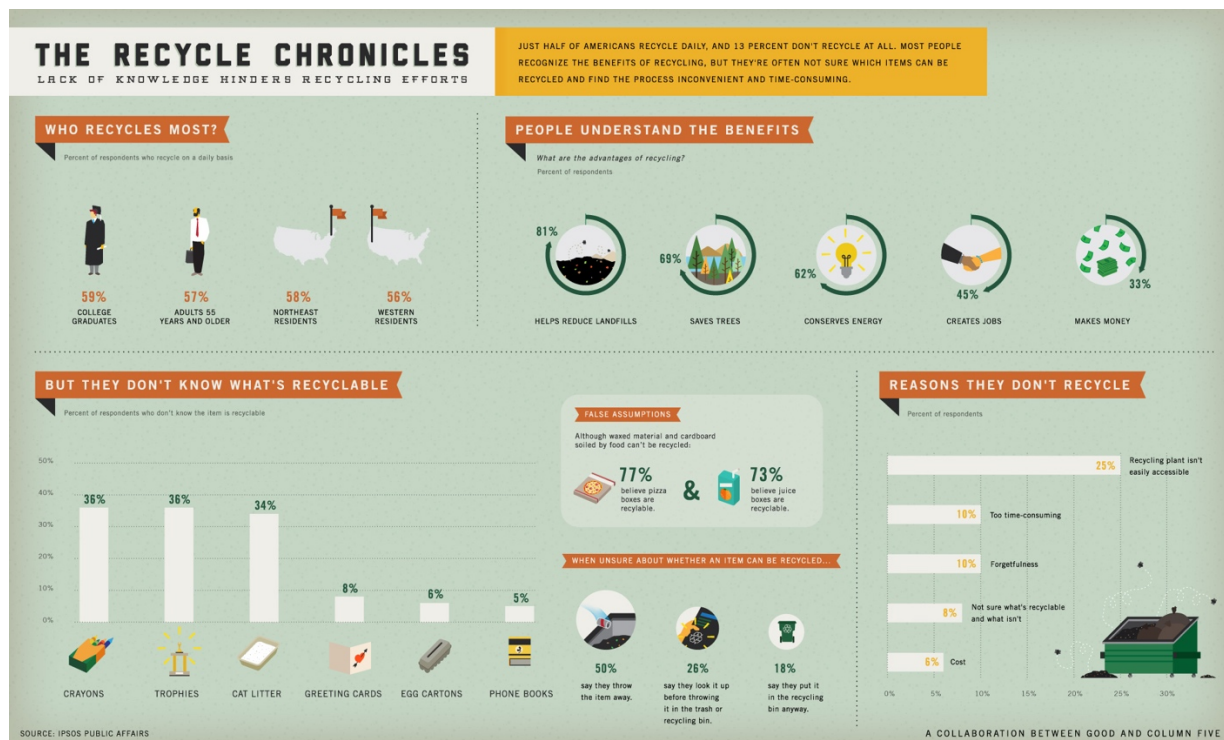


Figure 3. This infographic, published online on *The Daily Good* website in 2012, uses a combination of text, graphical representations, and graphic elements to describe how recycling efforts are hindered by a lack of knowledge.

Source: The Daily Good, 2012.

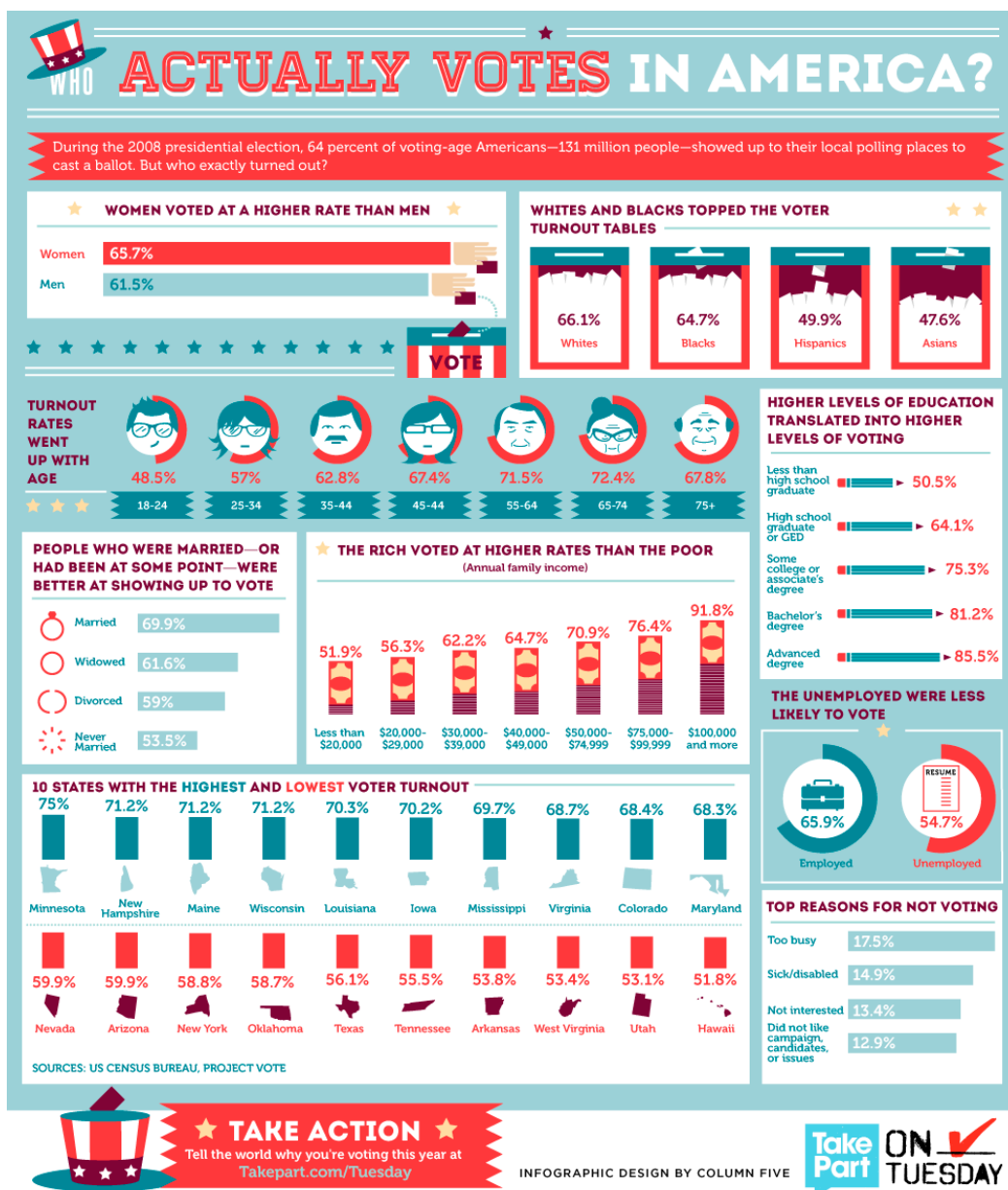


Figure 4. This infographic, published by the Independent Voter Project (IVN) in 2012, contains a combination of text and graphical representations packaged in an eye-catching design to describe voter turnout in the 2008 U.S. presidential election.

Source: IVN, 2012.

Because infographics incorporate a combination of text and visuals to communicate complex quantitative and qualitative information, they are considered multimodal forms of visual communication (Toth, 2013, 448). Holsanova et. al. (2009, 1216) explain that information

graphics usually consist of three components: text of varying complexity such as key words, phrases, sentences, and paragraphs; pictures with various levels of detail such as abstract images and naturalistic images; and graphic components such as arrows, lines, zoom boxes, and highlighting devices. (see fig. 5). Along with text and other graphic elements, graphical representations are often heavily used in infographics to display quantitative data (Skau, et. al., 2015, 221) (see figs. 3 and 4). However, it is important to note that even though graphical representations are often included within infographics, infographics, by their very nature, cannot be included in graphical representations.

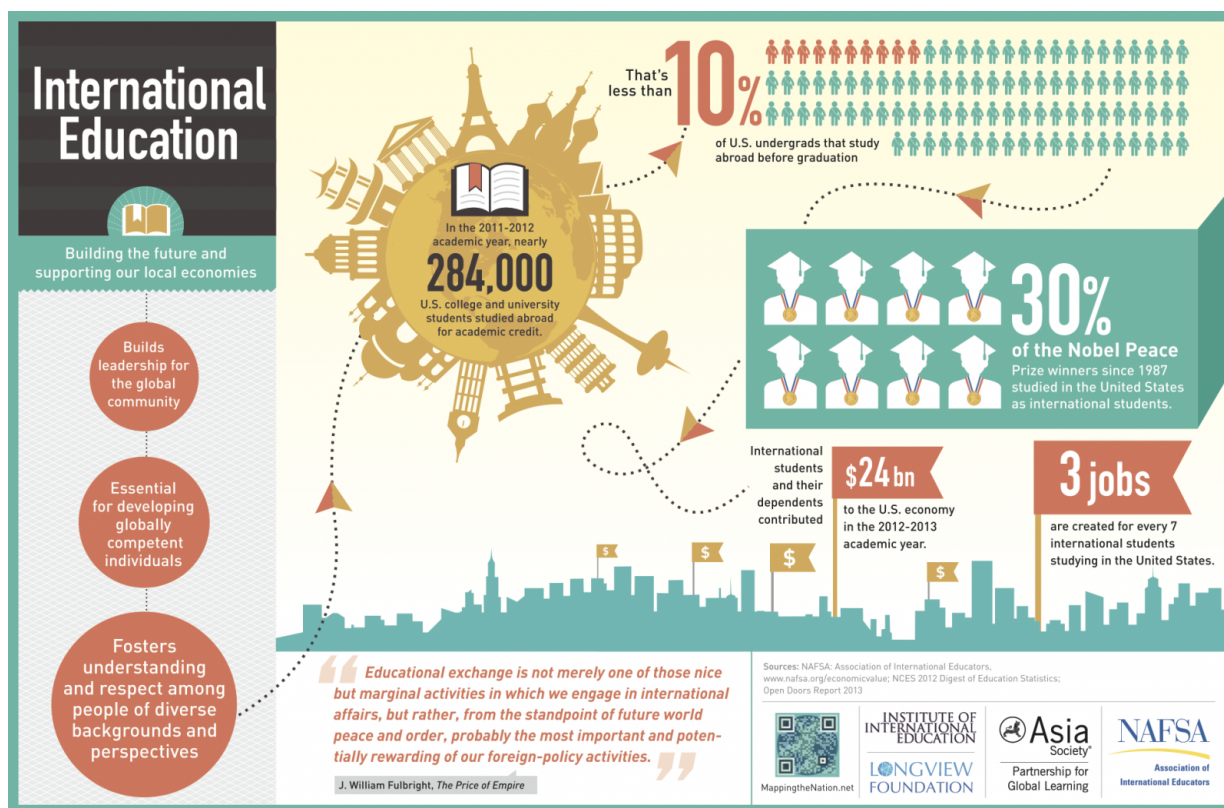


Figure 5. This infographic about the benefits of international education, is published online on *Mapping the Nation*, a site managed by *asiasociety.org*. This infographic uses arrows to guide the viewer through the data. Source: Mapping the Nation, 2015.

Another important aspect of infographics is their ability to use combinations of visuals and text to reveal relationships and tell stories about quantitative data and information to viewers. Lamb et. al. (2014, 27) explain that strong infographics depict multiple layers of related information and quantitative data to reveal relationships between variables and ideas. According to Kosara and Mackinlay (2013, 44), infographics define a story as “an ordered sequence of steps, each of which can contain words, images, visualizations, video, or any combination thereof,” and they argue that storytelling is an effective way of presenting information because stories are able to connect facts (usually chronologically) and make information more memorable.

Charles Joseph Minard’s 1869 map of Napoleon’s march on Moscow (see fig. 6) is an early example of graphic storytelling (Kosara and Mackinlay, 2013, 48). Minard’s graphic provides both temporal and spatial information as it depicts the size of Napoleon’s army throughout the historic march on Moscow in Napoleon’s Russian campaign of 1812. The information is plotted on a minimally styled map that accurately represents the geographical area traversed by the army. The names of key locations are included throughout the graph to reinforce the viewer’s sense of location. The size of the army is represented by the width of the tan line representing the march to Moscow and the black line representing the march out of Moscow, and it is numerically labeled at various increments. Minard also incorporated a temperature chart at the bottom of the graphic that adds an additional layer of information that is important to understanding the story being told. By viewing temperature information in relation to the number of soldiers represented by the black line, the viewer is able to see the relationship between the decreasing temperatures and deaths of soldiers during the march out of Russia. According to

Tufte (2001, 40), Minard's graphic, which contains multivariate data, is much more informative than if the data was displayed as a simple line graph.

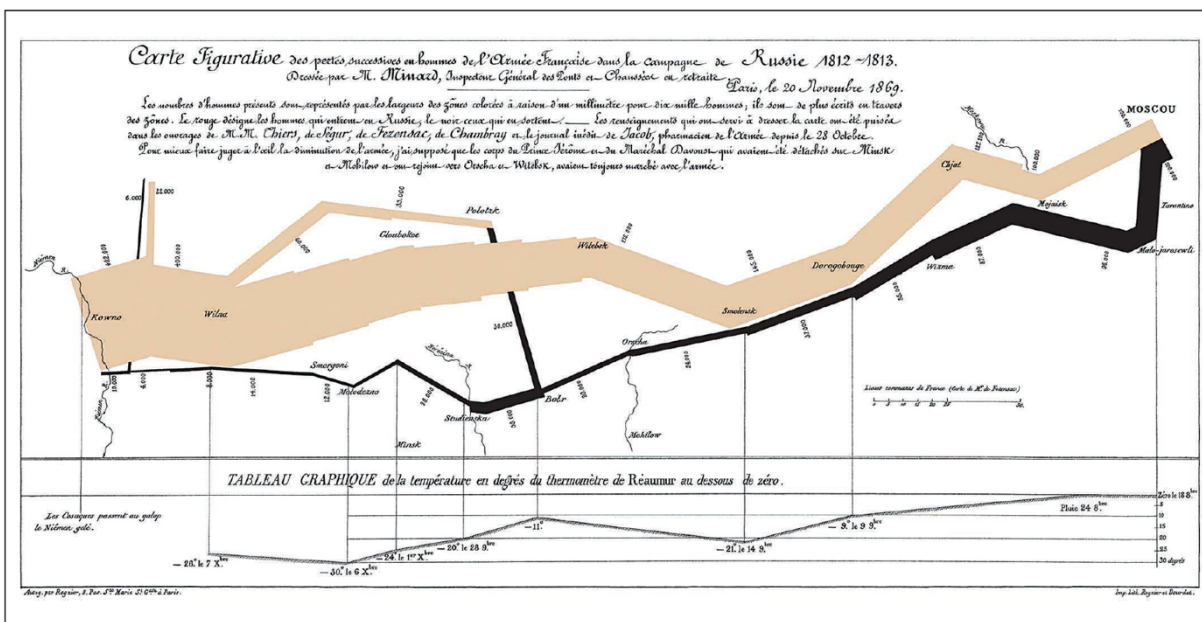


Figure 6. Charles Joseph Minard's 1869 map of Napoleon's Russian campaign of 1812.

Source: Map adapted from Kosara and Mackinlay, 2013, 48.

The use of infographics to communicate information has proliferated in the digital age (Toth, 2013, 446), and a Google search for the term "Infographic" resulted in approximately 85,500,000 results at the time this paper was written. Infographics have also become easier to create with the use of both free and subscription-based infographic generators available online at sites such as www.visual.ly, www.piktochart.com and www.canva.com. Infographics are now commonly used by businesses, non-profit organizations, and government agencies to present information to the public (Skau et. al., 2015, 221; Toth, 2013, 448). Although infographics are primarily distributed online on blogs, social media, and websites, they are also printed in newspapers, magazines, and brochures (Skau et. al., 2015, 221). There is also a growing trend in

incorporating infographics in science education. Polman and Gebre (2015, 869), and Lamb et. al. (2014, 25) explain that infographics are widely used to communicate complex scientific information and its importance to the public (Lamb et. al., 2014, 25).

Due to the increased prevalence and popularity of visually displaying information, it is highly likely that technical communicators will likely be asked to create graphical representations to represent quantitative data. Technical communicators may also be asked to create infographics that incorporate graphical representations or collaborate with graphic designers at some point in their career. Therefore, it is important that technical communicators understand how to design both effective and ethical graphical representations that may stand alone or be incorporated within infographics. This requires an understanding of the minimalistic approach to creating graphical representations as well as the effects of incorporating embellishments on readability, communication accuracy, memorability, and aesthetic preferences.

Minimalist vs. Embellishment Approaches to Graphical Representations

One ongoing debate surrounding the creation of both standalone graphical representations and graphical representations incorporated into infographics is between the minimalist approach and the inclusion of excessive chart annotation and decoration (Borkin et. al., 2013, 2306). Another term used to describe additions to or modifications of raw charts is visual embellishment, which Borkin et. al. (2012, 2579) define as a non-linguistic rhetorical figure that facilitates the transfer of human experience from well-known to less-known contexts.

Embellishments range from small decorations to large images and visual backgrounds incorporated both around and within charts (Bateman et. al., 2010, 2573). Skau et. al. (2015,

221) note that graphical representations within infographics are often embellished even though it is commonly thought that this practice interferes with the effective communication of data. Skau et. al. (2015, 223) also note a divide between theory and practice in the case of chart decoration.

Figure 7 shows an example of a highly embellished graphical representation designed by Nigel Holmes compared to a minimalistic version displaying the same data. In this case, the illustration by Holmes encases the data in embellishments that take the form of a creature; he also included embellishments within the graph in the form of gridlines and triangular bars that represent the teeth of the creature. In addition, the perspective of the embellished graph is skewed to better fit within the illustration, which also affects the viewer's perception of the data.

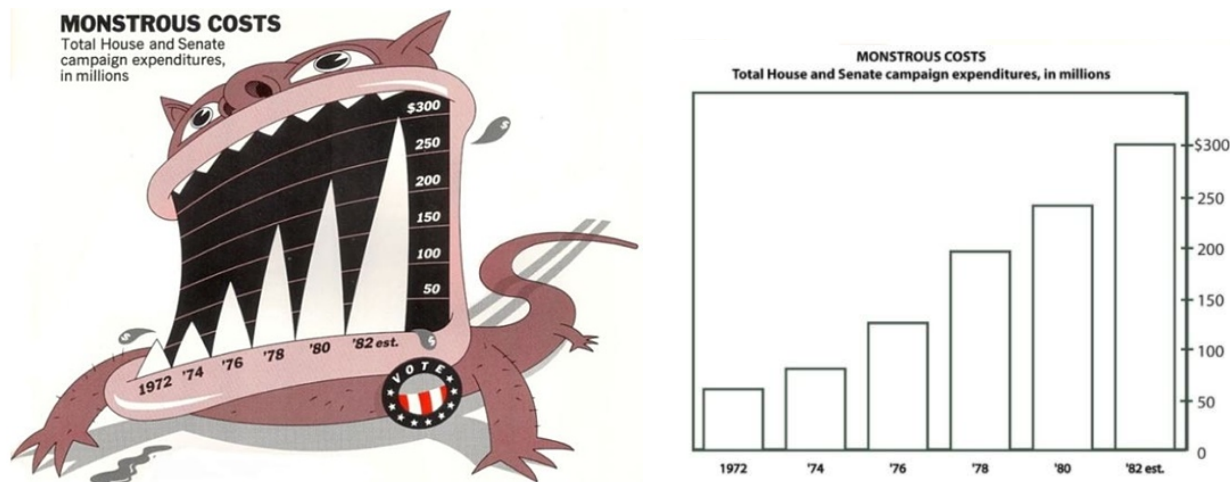


Figure 7. The graphical representation created by Nigel Holmes on the left is highly embellished. The same data is displayed on the right without embellishments.

Source: Bateman et. al., 2010, 2573.

Figure 8 also shows a comparison of an embellished chart and an unembellished chart displaying the same data. In this case, the columns in the embellished version are represented by pencils to emphasize that the data relates to school-age children.

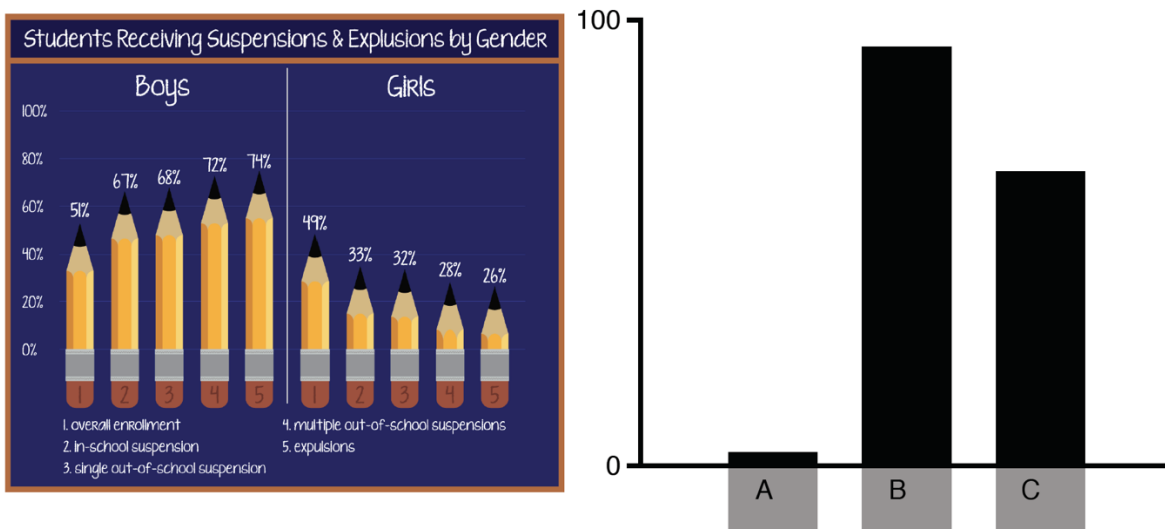


Figure 8. The graph on the left displays the same data as the graph on the right, but also includes embellishments.

Source: Skau et. al., 2015, 221.

The types of embellishments used within a graphical representation may affect how a viewer perceives data. Figure 9 shows two graphical representations depicting the same data, the number of alcoholic beverages consumed by type, but with different embellishments applied. The graph on the left is a typical column chart, but the columns contain illustrations that correspond to the labels. While the additional graphics may be distracting, and viewers may be tempted to attribute meaning to the number of beverages in each column, the columns are still clearly defined. The graph on the right is an atypical column chart in that silhouettes of people holding beverages are used in place of rectangular columns. By rendering the columns as figures with irregular shapes, it may be more difficult for viewers to distinguish minimum and maximum values. There is also some overlap between the figures, which may cause additional confusion.

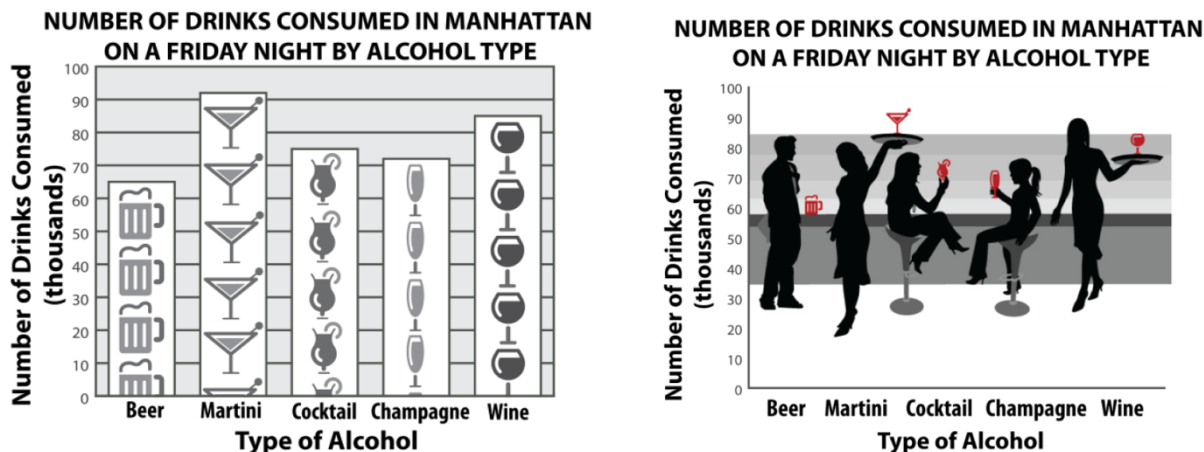


Figure 9. These graphs display the same data, but each are uniquely embellished.

Source: Bateman et. al., 2010, 2581.

The minimalist approach to designing graphical representations is rooted in the “form follows function” architectural trend of the early 1900s, which argued that the most important feature of a design is practical utility, and both decoration and ornamentation should be secondary (Wills, 2012, 110). Wills (2012, 110) goes on to explain that later, architects and designers took the minimalist trend a step further by arguing that ornamentation should not exist at all in architecture.

In the case of graphical representations, the minimalist viewpoint is strongly associated with the theories of American statistician Edward E. Tufte (Inbar et. al., 2007, 186). Edward Tufte classifies graphical embellishments as “chart junk” and warned against decorating the interior of graphs because this practice generates a lot of ink without providing the viewer with any new information (Tufte, 2001, 107). According to Tufte (2001, 59), it is acceptable to decorate around a graph (see fig. 10), but it is not acceptable to decorate within a graph because such decorations unethically distort the data to fit within a decorative scheme or make an editorial comment.

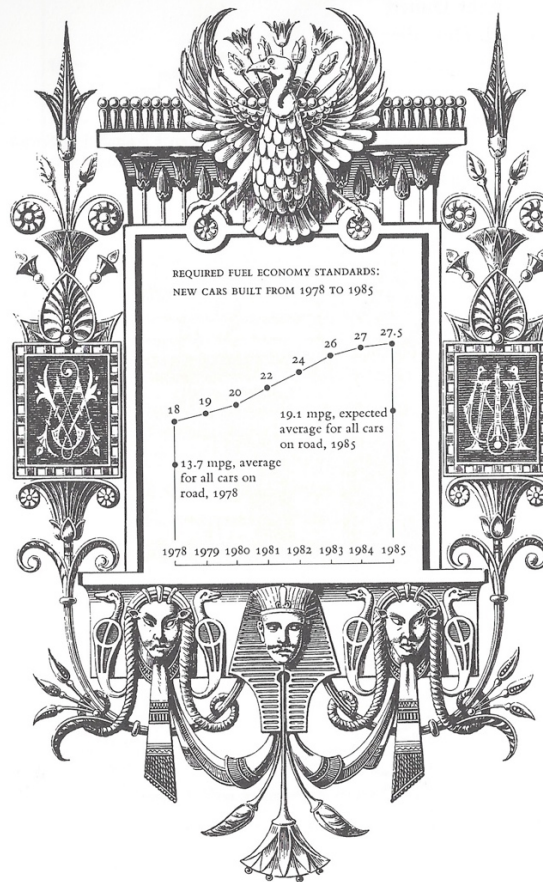


Figure 10. Although there are many embellishments surrounding this line graph, the graph itself is not embellished, and the data is not distorted.

Source: Tufte, 2010, 58-59.

One of Tufte's principles of graphical excellence is concerned with data-ink ratio. According to the data-ink ratio principle, only data-ink that presents new and relevant information should be included in a graphical representation. All redundant and non-statistical data-ink, including gridlines, should be excluded if it is unnecessary to properly deciphering the data. By removing all redundant and non-statistical data-ink, the designer ensures that the graphical representation remains uncluttered, making it easier for the viewer to read (Tufte, 2001, 96). Figures 11 and 12 show two examples of graphs in which all "chart junk" has been removed and the data-ink ratio is maximized. The data-ink ratio approach is a minimalist view

that intends to reduce the amount of effort it takes to interpret data within a visualization and to increase the accuracy of the interpretation (Bateman et. al., 2010, 2573). However, it is important to consider that reducing too much conventional data-ink may actually have the opposite effect because viewers may have to learn new ways to interpret the data.

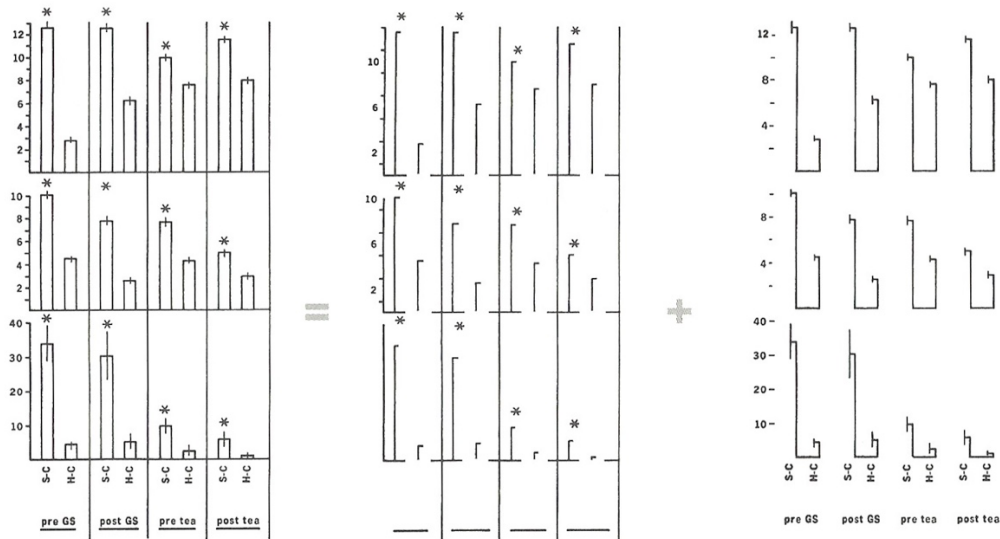


Figure 11. In this example, Tufte shows how the original graph (left) with unnecessary data-ink removed (center) results in a graph that maximizes the data-ink ratio (right).

Source: Tufte, 2001, 102.

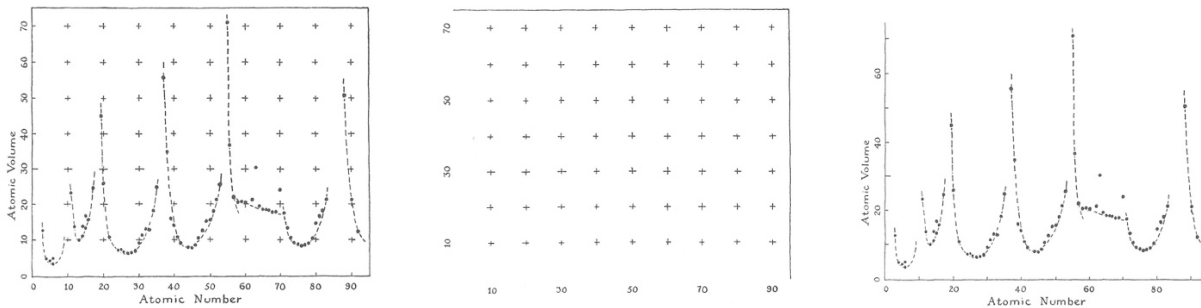


Figure 12. In this example, Tufte shows how the original graph (left) with unnecessary data-ink removed (center) results in a graph that maximizes the data-ink ratio (right).

Source: Tufte, 2001, 102-103.

Effects of Embellishments on Graphical Representations

Although Tufte argued that graphical representations are most effective when designers adhere to the minimalistic approach by reducing all unnecessary data-ink, Inbar et. al. (2007, 187) noted that Tufte did not actually empirically test his principles. Therefore, Inbar et. al. (2007) conducted an experiment to explore viewers' subjective preferences for standard bar graphs and minimalist designs using Tufte's examples. Their results revealed that participants preferred the standard bar graph designs over Tufte's minimalist design shown in figure 11. This may be because of participants' prior familiarity with standard bar graphs and unfamiliarity with the minimalist design, which required additional learning to properly decipher the data. Also, the results suggest that even though designers may favor a minimalistic approach to designing graphical representations, such simplicity may not be favored by the general public (Inbar et. al., 2007, 187).

While Inbar et. al. did reveal that study participants preferred standard bar graphs over Tufte's minimalist versions, they did not test the perception of embellished graphical representations that are commonly used in infographics. Some infographics contain graphical representations that are rendered in three dimensions rather than in two dimensions, which is also considered a form of embellishment. Three-dimensional graphs have become more prevalent due to technological advancements that make it easy for software programs to render graphs in three dimensions (Stewart et. al., 2015, 191). In some cases, a three-dimensional graph is necessary to convey meaning when information about three different variables is presented. However, in other situations, a three-dimensional graph may be chosen for purely aesthetic reasons (Stewart et. al., 2009, 193). In a 2009 study reviewed by Stewart et. al. (2015, 199), it was found that three-dimensional renderings that do not convey meaningful information negatively interfered with

participants' comprehension of the information, especially complex information. In a study conducted by Stewart et. al. (2015, 198), 95 percent of participants reported that two-dimensional graphs were easier to read, and 90 percent reported that two-dimensional pie charts were easier to read. However, it appeared that participants preferred to look at three-dimensional graphs, as 71 percent reported that the three-dimensional color graph was more aesthetically pleasing. These findings reveal that some individuals may value the aesthetic appearance of graphical representations more than their readability.

Another method of embellishing graphical representations reviewed by Skau et. al. (2015, 223) is to deviate from a baseline chart by changing the shape of bars, adding components, or designing bars with an altered set of data encodings (see fig. 13g). Skau et. al. (2015, 224) reviewed infographics found on Visual.ly and identified commonly used embellishments in graphical representations: rounded corners charts, triangle charts, capped bars, overlapping triangle charts, quadratically increasing charts, and bars that begin before the origin point (see fig. 13). They found that common embellishments (with the exception of the capped bar chart) reduce the communication accuracy of charts (Skau et. al., 2015, 229).

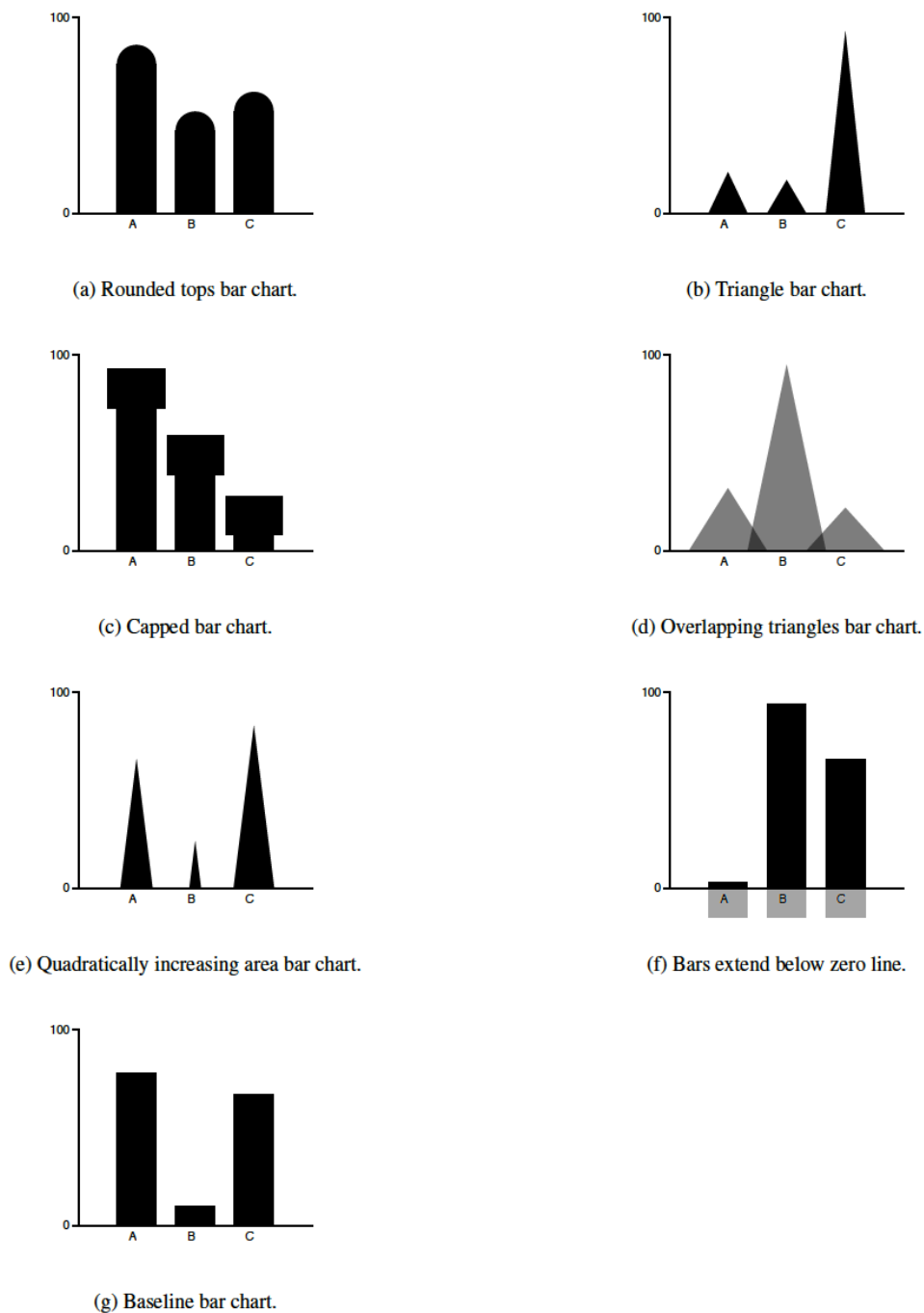


Figure 13. These bar chart variations were used in a study conducted by Skau et. al. to test communication accuracy of embellishment charts. Images a – f represent simplified embellishment charts commonly used. Image g represents a baseline bar chart without embellishments.

Source: Skau et. al., 2015, 225.

Some researchers believe that embellishments make graphical representations and infographics more memorable. According to Kosara and Mackinlay (2013, 45), the goal of a presentation is to communicate a point in a way that is memorable. Based on this viewpoint, the effect of graphical representations on memory is an important consideration. They argue that embellishments make graphical representations more memorable by adding context to information (Kosara and Mackinlay, 2013, 45). As previously noted, Kosara and Mackinlay (2013, 48) view infographics as storytelling mechanisms, and response accuracy and time to complete a task are not relevant metrics for understanding stories. This is because in the case of stories, engagement and interest, ability to remember key points, and information provided to make informed decisions are more important than response accuracy and task completion time (Kosara and Mackinlay, 2013, 48).

In a study of embellished graphical representations versus plain, minimalistic graphical representations, Borgo et. al. (2012, 2767) found that the use of visual embellishments improves information retention and has a significant, positive impact on the speed of memory recall. However, they also found that the inclusion of embellishments increases the amount of time needed to process information. They concluded that visual embellishments can be viewed as redundancy, and help with memorization and concept grasping. Bateman et. al. (2010, 2580), also found that while there was no significant difference in information recall accuracy after a five-minute gap, recall of chart topics and details were significantly better for embellished graphical representations after a long-term gap of 2-3 weeks. In this case, the researchers reason that the presence of embellishments may have aided viewers' ability to remember elements of the graphical representations because the images in the charts closely corresponded to the subject and details of the chart (Bateman et. al., 2010, 2581). Also, the embellished charts were all

visually different from one another, but the plain charts appeared visually similar, which could explain why it was easier for participants to remember the embellished charts. It is possible that the emotional response to imagery in embellished graphical representations may help anchor details in the viewers' memory (Bateman et. al., 2010, 2581).

Ethics of Graphical Representations and Infographics

Just as opinions are divided on the effectiveness of embellishments in graphical representations, opinions are also divided when it comes to the ethical implications of including embellishments. Manning and Amare (2006, 195) explain that ethical concerns arise when decorative elements distract viewers from the actual information. Although some embellishments may be more aesthetically pleasing to viewers and increase chart memorability, there must also be a balance with the accurate communication of information (Skau et. al., 2015, 229).

According to Kostelnick (1998, 477), "advocates of aesthetic standards implicitly argue that designers have an ethical responsibility to empower readers by making the data interesting, inviting, and accessible," whereas proponents of minimalistic approaches, such as Tufte, argue that graphical representations containing embellishments obscure the truth of the data.

Based on their visual nature and inclusion of statistical information, infographics containing graphical representations may create an illusion of trustworthiness even if the information provided is inaccurate. Also, because graphical representations have more emotional impact and are more memorable than text, viewers may be more likely to believe data presented in visual form in infographics even if the source material is questionable or nonexistent (Toth, 2013, 449). Therefore, it is the responsibility of the technical communicator and/or graphic

designer to communicate data in graphical representations in a way that is accurate, honest, and easy to understand.

In addition, Demir et. al. (2012, 528) explain that the majority of graphical representations published in popular media such as magazines and newspapers are constructed in order to convey a specific message, and graphic designers make deliberate choices on how they communicate these messages. Demir et. al. (2012, 528) argue that in order to exploit graphical representations, we must first understand their intention. One possible consequence of such deliberate communication choices is that designers may introduce bias in graphical representations that contain embellishments. However, Bateman et. al. (2010, 2582) point out that even a minimalist approach that removes embellishment and non-data ink can be biased. They explain that, in most cases, communication is persuasive and rarely purely objective. Various factors such as the type of chart, selection of data, ordering of bars (in a bar graph or column chart), scale of axes, and choice of titles and labels can all be used to draw attention to certain aspects of the data or hide other aspects of the data, even in minimalistic graphical representations (Bateman et. al., 2010, 2581). Therefore, embellished graphical representations should not be automatically assumed to be more biased than plain graphical representations.

On the other hand, Sam Dragga and Dan Voss hold the viewpoint that graphical representations are oftentimes too objective. Dragga and Voss (2003, 61) argue that the practice of communicating statistical information regarding human lives without incorporating a humanistic element is biased and unethical. They reject the minimalist approach to designing visual displays, claiming that it makes technical information appear ordinary and unavoidable, and it does not incorporate a humanistic element (Dragga and Voss, 2001, 269). Instead, Dragga and Voss (2001, 269) advocate the use of embellishments such as using appropriate pictographs

or superimposing bar graphs and line graphs on photographs or drawings of pertinent human subjects in order to humanize data displays. For example, in figure 14 Dragga and Voss (2001, 270) demonstrate how the inclusion pictographs could humanize Minard's 1869 map of Napoleon's Russian campaign of 1812 by reminding viewers that the numbers depicted represent human lives. Compare the "humanized" version of Minard's 1869 map (fig. 14) with a copy of the original version shown in figure 15.

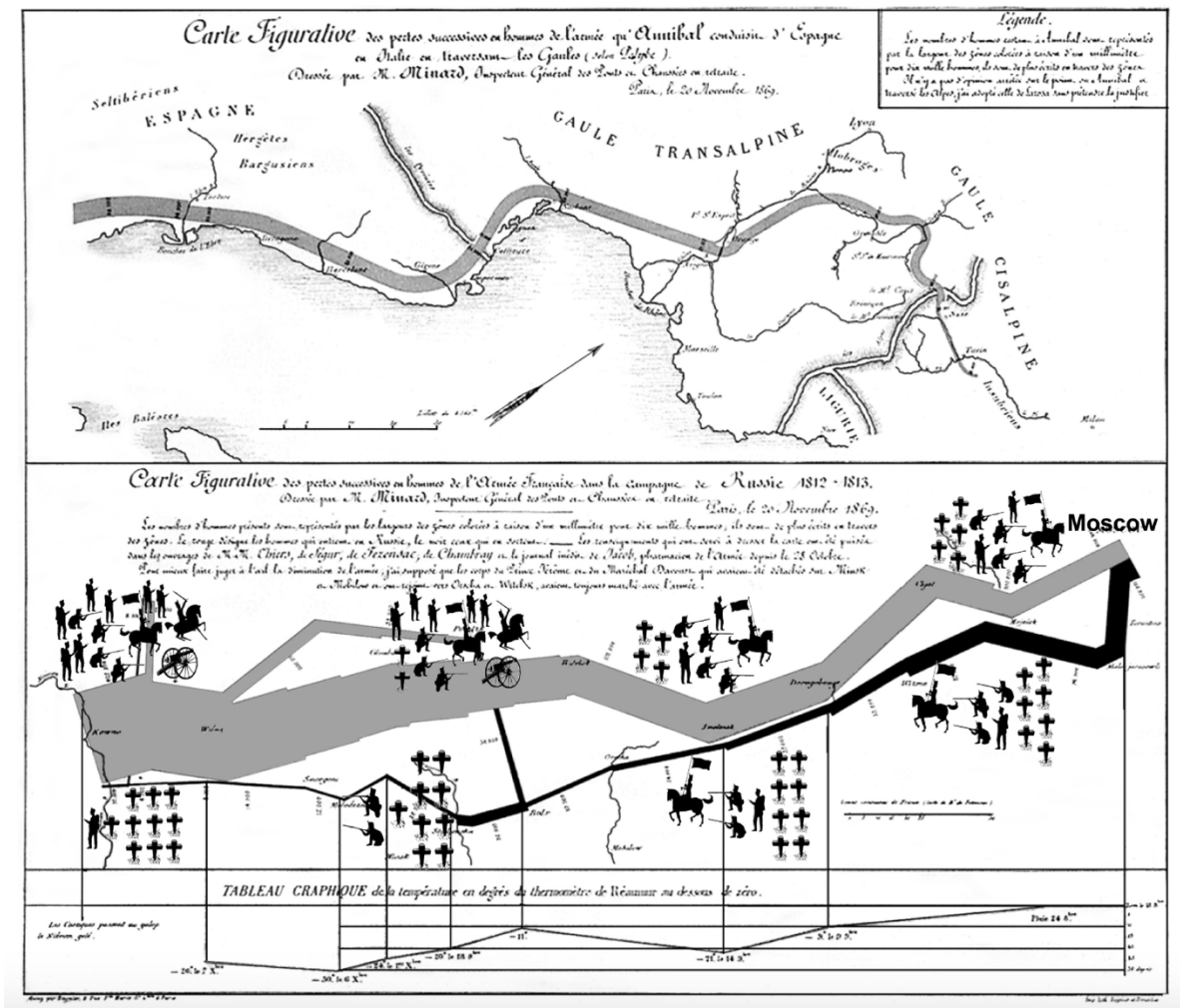


Figure 14. Dragga and Voss revised Minard's 1869 map of Napoleon's Russian campaign of 1812 by adding pictographs of soldiers and grave markers to remind viewers that the data reflects the loss of human lives. Source: Dragga and Voss, 2001, 270.

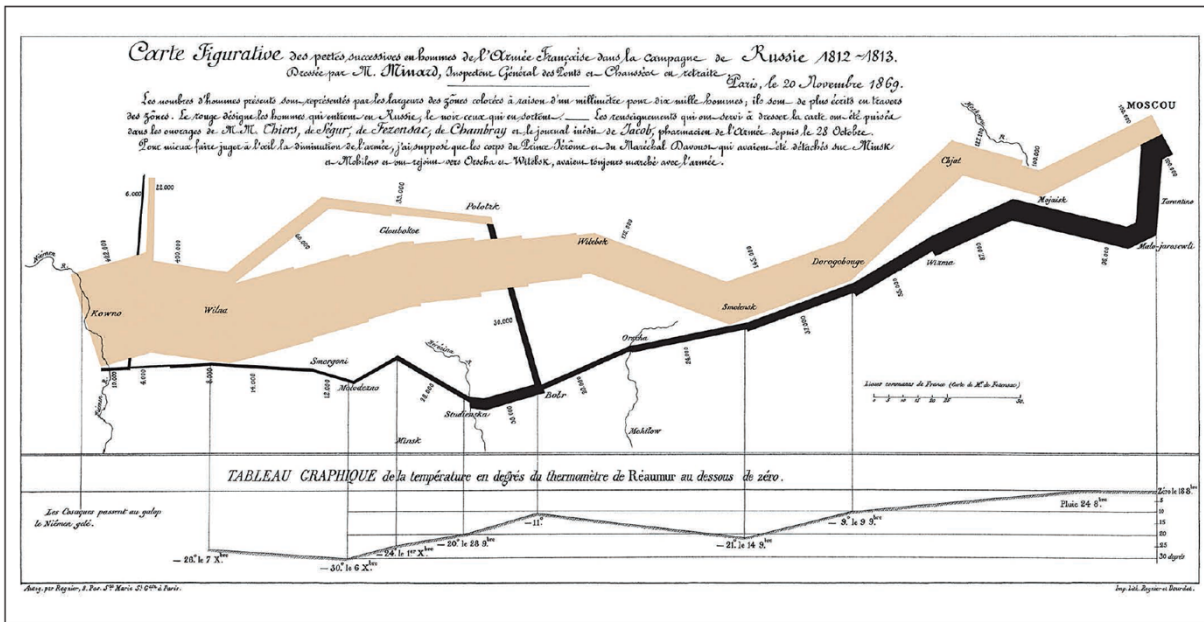


Figure 15. Charles Joseph Minard’s 1869 map of Napoleon’s Russian campaign of 1812.

Source: Map adapted from Kosara and Mackinlay, 2013, 48.

In figure 16, Dragga and Voss (2001, 272) take a similar approach to humanize data by incorporating humanistic illustrations of a baby and an ambulance. They argue that the data should not be viewed as objective statistics, and the additional illustrations emphasize that the data represents injuries to human life.

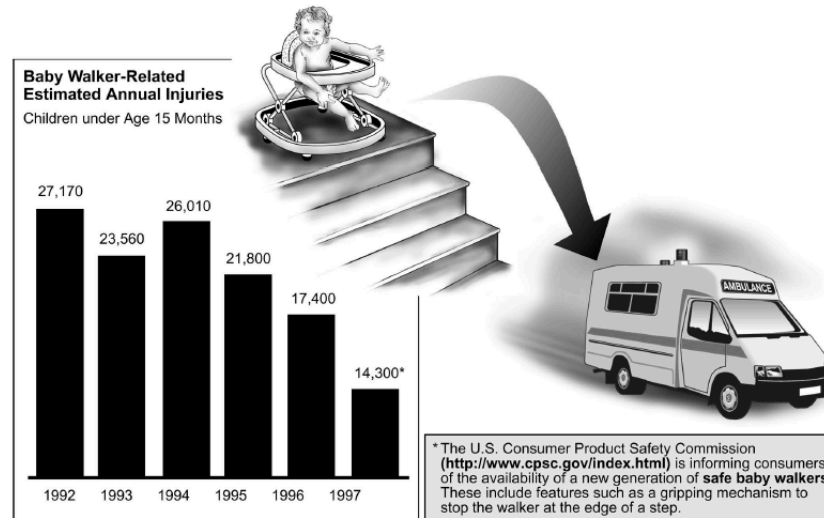






Figure 16. In this graphical representation, Dragga and Voss included an illustration of a baby at the edge of a flight of stairs and an arrow pointing to an ambulance to indicate a cause and effect relationship and to call attention to the fact that the data represents injuries to children.

Source: Dragga and Voss, 2001, 272.

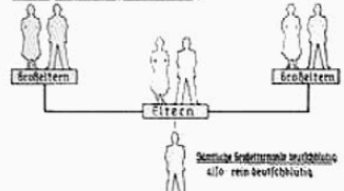
However, if the information to be displayed is unethical to begin with, even the use of humanizing imagery will not make the information more ethical. Ward (2010, 60-61) uses the example of the Official 1935 Nuremberg Laws poster used by the German government to illustrate racial categories to show how it is possible to represent unethical content in a way that is effective, efficient, and aesthetically pleasing (see fig. 16). However, despite the successful organization and presentation of information, as well as the inclusion of human figures, which, according to Dragga and Voss, should add a humanistic element, the message the poster communicates is still extremely unethical because it mandated who German citizens were and were not allowed to marry and procreate with based on race.

Das Gesetz unterscheidet :

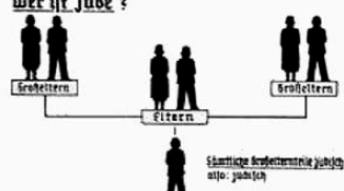
			
Deutschblütige Keinvermischung des jüdischen Blutes in das germanische Blut und keine Durchmischung der Rassen.	Juden Alle Angehörigen des jüdischen Volkes, die nach dem 1. September 1935 geboren sind.	Mischlinge 2. Grades Söhne und Töchter von Mischlingen 1. Grades und von Deutschen.	Mischlinge 1. Grades Söhne und Töchter von Mischlingen 1. Grades und von Juden.

Erkennungsmerkmal für die Zuordnung zu einer dieser Gruppen ist die rassistische Zugehörigkeit der Großeltern

Wer ist Deutschblütiger ?




Wer ist Jude ?



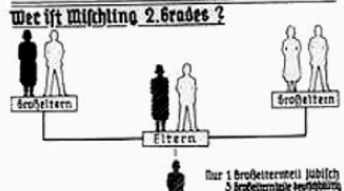
Als Jude gilt auch:

- ein Mischling, der der jüdischen Religionsgemeinschaft angehört.
- ein Mischling, der mit einem Juden verheiratet ist. Kinder werden Juden.
- ein Mischling, der aus einer Ehe mit einem Juden stammt, die nach dem 17.9.1935 geschlossen ist.
- ein Mischling, der aus verbotener außerehelicher Verkehr mit einem Juden stammt und der nach dem 31.7.1936 außerehelich geboren ist.


Ebenfalls zur jüdischen Rasse gehörig :



Wer ist Mischling 2. Grades ?



Wer ist Mischling 1. Grades ?



Welche Eheschließungen sind verboten ?

Es ist zu beachten, daß bereits bestehende Ehen unberührt bleiben. Als Rassen deren Blut dem deutschen Blut nicht ortverwandt ist, gelten j B auch tiefer (Teil 4) und Signatur.

- Verboten!** Zwischen Deutschblütigem und Juden
- Verboten!** Zwischen Juden und Mischling 2. Grades
- Verboten!** Zwischen Mischlingen 2. Grades
- Verboten!** Eine Ehe soll immer nicht geschlossen werden, wenn aus ihr eine die Rein-erhaltung des deutschen Blutes gefährdende Nachkommenschaft zu erwarten ist.

Figure 16. The Official 1935 Nuremberg Laws poster adapted by Ward from the United States Holocaust Memorial Museum shows how unethical content can be delivered in a way that is still effective, efficient, and aesthetically pleasing.

Source: Ward, 2010, 61.

One way to eliminate ethical conflicts in standalone graphical representations and those incorporated into infographics is to begin by defining the communication goals. Wills (2012, 105) explains that a common goal for presenting data visually is to present the important information, and the first step in the design process should be to define the goal of a graphical representation. Kostelnick (1998, 477) argues that visual communication is similar to writing, and a one-size-fits-all approach will not be effective in accommodating all audiences, purposes, and contexts. Therefore, it is important to begin a graphical representation by first defining the audience and their expectations, determining the desired results of the graphical representation, and identifying how the audience will view and use the final graphical representation. Similarly, Manning and Amare (2006, 200) assert that the mismatch of visual strategies and goals will cause a breakdown in communication, and this mismatch is unethical because the designer could have made a better choice but chose not to. Therefore, it is critical for designers to determine what the purpose of a graphical representation or infographic is prior to making the decision to add embellishments. If, as Manning and Amare (2006, 200-201) and Dragga and Voss (2001, 269) explain, the purpose of a graphical representation is to communicate a message that evokes emotions, then embellishments may be acceptable. If, however, the purpose of a graphical representation is to communicate information that should be judged true or false through logical reasoning, then embellishments may impede the viewers' ability to make logical conclusions and should be avoided or at least used with caution (Manning and Amare, 2006, 200-201).

Recommendations

Information presented in the form of graphical representations and infographics is becoming increasingly prevalent in today's print and digital media. In addition, audiences now expect to view quantitative data visually in both standalone graphical representations and infographics. As a result, it is likely that many technical communicators will at one time or another be tasked with the responsibility of communicating quantitative data visually in standalone graphical representations or in graphical representations contained within infographics. Many technical communicators will also likely be asked to work with graphic designers and illustrators to accurately display data in visual forms. In addition, technical communication instructors should be knowledgeable on the topic in order to help students learn how to judge the quality of existing graphical representations and infographics (Toth, 2013, 448-449).

In order to design effective graphical representations, technical communicators should first understand the differences between graphical representations and infographics. In addition, it is important to understand what embellishments are and how their inclusion may affect the readability, communication accuracy, memorability, and aesthetic preferences of graphical representations. As studies have indicated, embellishments within graphical representations may be more memorable and aesthetically pleasing to viewers, but may also run the risk of being more difficult to read and interpret accurately.

In addition, the use or exclusion of various types of embellishments may impact the ethicality of graphical representations and infographics. It is important that technical communicators always strive to communicate data visually in a way that is accurate, honest, easy for viewers to understand, and appropriate for the content. Analyzing audience needs and

expectations, as well as defining the communication goals of a graphical representation will aid technical communicators in selecting the most effective and ethical visual strategy.

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The Role of Semiotics and Visual Metaphor in the Design of ISO Graphical Symbols

Background and Statement of the Problem

As the world increases in complexity, communication is also becoming more complex (Westendorp & Waarde, 2007). This is especially true when communicating across diverse languages and cultures. To help adapt with the effects of internationalization, graphics are increasingly used in place of written language to communicate messages to culturally diverse audiences. In fact, in many cases, written language is either not applicable or not the most efficient method of communication when compared to various visual tools, including graphical symbols (Westendorp & Waarde, 2007).

Graphical symbols, also commonly referred to as icons, are especially useful because they facilitate succinct communication; as a result, graphical symbols have become both ubiquitous and utilitarian (Zender & Mejia, 2013). In addition to being used in signs, graphical symbols are also commonly used in instructions, product labeling, and technological device interfaces (Piamonte et. al., 2001).

On the surface, graphical symbols may be viewed as direct representations of reality. However, despite their realistic appearance, graphical symbols are instead interpretations of and abstractions from reality (Westendorp & Waarde, 2007). Through the processes of abstraction, designers convey complex ideas through simple visual forms (Wang & Hsu, 2007).

To aid in the process of communicating concepts visually, many designers use visual metaphors. Visual metaphors are potentially powerful tools that help viewers understand new concepts through familiar visualizations (Dent-Read, et. al., 1994). Although the role of visual metaphors in art, advertising, and marketing is well documented, their role in graphical symbols is less understood (Jeong, 2008).

To understand the extent in which visual metaphors are used in internationally accepted graphical symbols, a variety of International Organization for Standardization (ISO) approved graphical symbols were reviewed in a content analysis. Of the 137 public information symbols accessible online through the ISO Online Browsing Platform (OBP), smaller samples of the graphical symbols listed in each of the following subcategories were selected for analysis: public facilities; commercial facilities; tourism, culture, and heritage; transport facilities; behavior of the public; and sporting activities.

First, it was determined if each ISO graphical symbol consisted of a single symbol or multiple symbols. Then it was determined if each ISO graphical symbol was iconic, indexical, or symbolic in nature according to Charles Sanders Peirce's theory of semiotics, or a pictogram, which is a combination of icons and symbols. Finally, based on the definition of visual metaphors provided by Dent-Read et. al. (2004), it was determined if a visual metaphor was used in each of the ISO graphical symbols.

Prior to conducting the study, it was hypothesized that more than 50 percent of the ISO graphical symbols analyzed would contain multiple symbols. It was further hypothesized that the majority of ISO graphical symbols would be either symbolic in nature or a pictogram (combination of iconic and symbolic). Lastly, it was also hypothesized that the majority of ISO graphical symbols would contain visual metaphors.

Literature Review

Brief History of Visual Signs

People have ascribed meaning to visual signs for tens of thousands of years, and Daniel Chandler notes that, as a species, humans seem to be driven by a desire to make meaning through

the creation and interpretation of signs (Chandler, 2017). Currently, the oldest known visual sign constructed by humans is a cave painting that features a red disk. The painting is located in the El Castillo cave in Spain and is at least 40,800 years old. An ancient hand stencil that scientists have dated to 37,300 years ago is also located in the same cave (see Figure 1). These El Castillo cave paintings were created by blowing or spitting paint onto the cave walls (Vergano, 2014).



Figure 1. Photograph of “The Panel of Hands” located in El Castillo cave in northern Spain. The red disk (center) dates at more than 40,800 years old and is the oldest cave art in Europe. Copyright 2014 by National Geographic.

Over time, the visual signs produced by early humans became more sophisticated, as in the Lascaux cave paintings located in Lascaux, France. Estimated at up to 20,000 years old, these visual signs are nearly 2,000 in number and consist of animals, human figures, and abstract signs (see Figure 2) (The cave paintings of the Lascaux Cave, n.d.). Thousands of years later, the ancient Egyptians had started developing the earliest pictographic writing systems, and the use of simple visual signs has also been discovered in other early human settlements (Garrod et al., 2007).



Figure 2. Photograph of “Red Cow and First Chinese Horse” located in the Lascaux cave complex in southwestern France and dated at up 20,000 years old. Copyright by <http://www.bradshawfoundation.com/lascaux/>.

Semiotics

Even today, people rely on visual signs among others (i.e. words, images, sounds, odors, flavors, acts, and objects) to communicate meaning (Chandler, 2017). One way to make sense of how visual signs create meaning is through semiotics, which is the study of signs. Visual signs can be studied from a semiotic perspective to determine the role of signs in social life (Chandler, 2017).

Charles Sanders Peirce (1839-1914), an American philosopher, was a key figure in the development of semiotics. Peirce developed a triadic model to explain how signs communicate meaning. According to Peirce, a sign is a relation among three distinct elements: (1) a representamen, which is the form of a sign, (2) an interpretant, which is the sense made of a sign by an observer, and (3) the object, or idea, to which a sign actually refers (Chandler, 2017; Garrod et al., 2007).

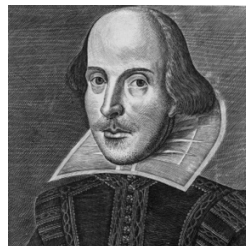
Chandler (2017) identifies a variation of Peirce’s triadic model in which the form of the sign is called the sign vehicle, the sense made of the sign is simply called the sense, and the

object or idea for which the sign stands for is called the referent. The representamen can also be referred to in Saussurean terms as the signifier, and the object as the signified, which are the terms that will be used throughout this paper. However, despite variations in terminology, the meaning of each component remains the same. The importance lies in considering how people are able to derive meaning from visual signs that corresponds to the object or idea that the designer is trying to communicate.

In addition to developing a triadic model to explain how signs are understood, Peirce also developed an extensive typology of signs, and he theorized that there could be a total of 59,049 different types of signs. However, only three sign forms are recognized today: the symbol, icon, and index (see Figure 3) (Chandler, 2017).



Symbol



Icon



Index

Figure 3. Examples of a symbol, icon, and index according to the definitions of Charles Sanders Peirce.

A symbol is a visual form/signifier that does not resemble the signified or object to which it refers. Instead, the form of the signifier is arbitrary, or based on a conventional social rule. As a result, the relationship between the form and the signified must be learned as is the case in the warning symbol depicted in Figure 4 (Chandler, 2017; Dent-Read et al., 1994). Additionally, Böcker (1996) describes a symbol as an abstract and often simplified pictorial representation that

may not be realistic and, in many cases, requires a learning process to be understood correctly. Some common examples of symbols include languages, numbers, Morse code, traffic lights, and national flags to name a few (Chandler, 2017). According to Garrod et al., (2007), viewers are able to interpret symbols based on their existing knowledge of previous use of the symbol; this allows symbols to be graphically simpler than icons. Piamonte et al., (2001) explain that a symbol has one of three main purposes: to stand for something else, to communicate a use for an object or structure, or to communicate what should or should not be done at a given time or location.



Figure 4. The visual printed on this warning sign is a symbol because it refers to a concept; the meaning of the form is only understood based on a conventional social rule. Copyright International Organization for Standardization.

An icon, on the other hand, is a signifier that visually resembles the signified or object to which it refers. For example, a portrait resembles an actual person and a scale-model resembles the physical object to which it refers (see Figure 5) (Chandler, 2017). Because the signifier visually resembles the signified, an icon does not require any special learning for a categorical referent as do symbols (Zender & Meija, 2013). Furthermore, an icon should be self-explanatory and consist of more or less concrete and realistic elements (Böcker, 1996). However, it is important not to confuse this meaning of the word icon with a religious icon, which is a two-

dimensional artwork that depicts a holy figure in the Byzantine style and is venerated in Orthodox churches.

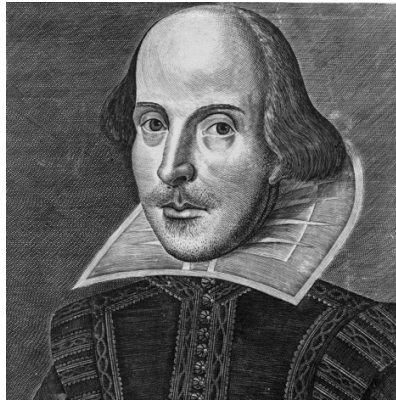


Figure 5. This portrait of William Shakespeare is an icon because it resembles the actual person (William Shakespeare) to whom it refers.

An index, unlike symbols and icons, is perhaps the most confusing of the three modes because the signifier is not arbitrary; rather, it is physically or causally connected to the signified in some way. Examples include natural signs such as smoke, which refers to fire, pointers such as directional signposts or a pointing index finger that indicate direction, and recordings such as photographs, video, or audio (see Figure 6) (Chandler, 2017).



Figure 6. The visual of footprints in the sand is an index because it refers to the people who had made the footprints.

Garrod et al. (2007) explain that symbols, icons, and indices fall on a continuum, and distinctions between iconic and symbolic signs as well as between iconic and indexical signs are more a matter of degree than a simple binary classification (Garrod et al., 2007).

Additional Terms: Pictures, Graphic Abstractions, and Pictograms

In addition to the terminology developed by Peirce, many other terms are used throughout the literature to describe signs, such as pictures, graphic abstractions, and pictograms. Many of the terms overlap in meaning, and in some cases, they may refer to different types of visuals depending on the author and context. Therefore, it is important to examine these additional visual terms, and to establish clear definitions for use in this study.

Similar to an icon, a picture is defined by Zender and Meija (2013) as a representational image that does not require any special learning for a particular referent. Dictionary.com (2015) defines a picture as a visual representation of a scene, object, or person, as in a painting or photograph.

Pictures may also be graphic abstractions. A graphic abstraction is defined by Wang and Hsu (2007) as a two-dimensional representation of a three-dimensional object, and they consider this to be one of the most important techniques in graphic design. The process of graphic abstraction uses a strategy of simplifying the detail of the original object to enhance the recognition of the object by observers. Through graphic abstraction, designers convey complex ideas in a simple visual form, which works well in the design of traffic signs, trademarks, and computer icons (Wang & Hsu, 2007). Based on this definition, all icons are essentially graphic abstractions of the physical objects to which they refer. Due to the similarity between icons and pictures, this study will refer to graphic abstractions as icons from this point forward.

It is also possible to combine symbols and icons into a single visual to create pictograms. Pictograms, also referred to as pictographs or pictorial displays, are combinations of symbols, icons, and/or glyphs that communicate a narrative, story, or data set (Zender & Mejia, 2013). Pictograms may not necessarily be a pure icon or a pure symbol, and may include a combination of both icons and symbols in a single sign (Böcker, 1996). In fact, it is common for a single sign to combine multiple symbols to construct meaning (Zender & Mejia, 2013). Piamonte et al. (2001) explain that pictograms are usually abstract and rely on analogy or symbolism to convey meaning. As a result, the creation of pictograms requires knowledge of certain learning processes.

For the purposes of this study, a visual will be considered a pictogram if it includes both a symbol and an icon as defined by Charles Peirce. This distinction is important because many ISO graphical symbols do consist of a combination of symbols and icons, thus requiring an additional classification category (see Figure 7).



Figure 7. This ISO Graphical Symbol contains a combination of icons (the two human figures and the shape representing an escalator) as well as a symbol (the arrow pointing to the left). Therefore, this symbol is classified as a pictogram. Copyright 2015 International Organization for Standardization.

According to Böcker (1996), pictograms are more beneficial in communicating meaning as compared to text because they are more visually distinctive and easier to recognize than

words. Pictograms also represent a lot of information in a smaller amount of space, and their syntax and semantics are simpler than text. Böcker also argues that pictograms require less learning time and effort than text-based alternatives, and evidence shows that there are fewer errors in interpretations of pictograms. Finally, pictograms are not bound to a particular language, and they can be understood across borders and by illiterate people as well.

However, Böcker (1996) also identified some negative aspects of pictograms. Pictograms are less efficient in conveying abstract and/or detailed information, and there is a risk of incorrect interpretation. Also, abstract pictograms may require prior learning for the observer to understand the intended message. In addition, there is a limit to the number of pictograms that can appear in a single context before a viewer may become confused.

In summary, symbols, icons, indexes, and pictograms (combinations of symbols and icons) are all signs that visually convey meaning to viewers and exist in a wide variety of settings worldwide.

Visual Metaphor

It is also important to consider how any underlying visual metaphors may influence how symbols, icons, indexes, and pictograms are interpreted. According to Lakoff and Johnson (2003), a metaphor is a device used to enable the “understanding and experiencing [of] one thing in terms of another,” and comprehension of metaphors is dependent on one’s experiential basis (pp. 5, 19). Although Lakoff and Johnson (2003) primarily focus on verbal metaphors, they also explain that metaphors are not limited to words, and they note that human thought processes are largely metaphorical.

In addition to verbal metaphors, visual metaphors are also used, especially in the design of signage. Dent-Read et. al. (1994) define a visual metaphor as “depicting an object in terms of a different kind of object to which it bears a resemblance,” and they provide the examples of mountains being depicted as rooftops and flight paths being depicted as highways as pictorial metaphors (p. 211-212).

As is the case with verbal metaphors, visual metaphors guide viewers’ attention “by referring to what is well known and familiar and by commenting on or depicting what is less well known” (Dent-Read et. al., 1994, p. 213). Dent-Read et. al. (1994) explain that visual metaphors guide viewers’ attention to specific information or resources, help viewers understand new tasks or information based on already well known activities or information, and aid in helping viewers interpret meaning (p. 212). Dent-Read et. al. (1994) also make the case that the basic structure of visual metaphors is the same as the structure for verbal metaphors, and the only difference is the use of images instead of words; as is the case for verbal metaphors, the resemblance of the visual to the object can be across different aspects of objects or events.

Dent-Read et. al. (1994), conclude that visual metaphors are powerful tools for organizing and providing structure for displays and the use of displays. However, they also discovered that mismatches or areas of dissimilarity will likely exist between visual metaphors and the objects they represent because each come from a different domain. Also, as is the case with verbal metaphors, visual metaphors have the potential to hide information; mismatches and hidden information may result in viewer confusion and deception (Dent-Read et. al., 1994). Therefore, it is important to understand how visual metaphors are used in the design process, what the reasoning is behind specific choices made in the use of visual metaphors, and how visual

metaphors are understood by viewers. By answering these questions, designers will be able to produce effective designs containing visual metaphors.

ISO Graphical Symbols

Various standardization organizations such as the International Standards Organization (ISO), Commission Electrotechnique Internationale (IEC), Comité Consultatif International de Telegraphique et Telephonique (CCITT), and the European Telecommunications Standards Institute (ETSI) recommend signs consisting of symbols, icons, indices, and pictograms that may or may not make use of visual metaphors. In addition, manufacturers and software developers also design their own signs for use of products (Böcker, 1996).

This study is concerned primarily with visual signs approved by the International Organization for Standardization (ISO), which is an independent, non-government international organization that has members in 162 nations (About ISO). The Organization for Standardization reviews and approves signs, referred to as graphical symbols, to provide people worldwide with “a coherent set of graphical symbols to help overcome language and other barriers” (The International Language of ISO Graphical Symbols, n.d.). In addition, to adhere to ISO standards, graphical symbols must meet specific requirements for designs, colors, content, and shapes (The International Language of ISO Graphical Symbols, n.d.).

ISO graphical symbols are divided into six different categories: warning signs, prohibition signs, mandatory action signs, safe condition signs, fire safety signs, and general information signs (see Figure 8) (The International Language of ISO Graphical Symbols, n.d.). Each category is visually distinctive, making it easy to quickly understand the type of content being communicated.

<p style="text-align: center;">Warning Sign</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Meaning: general warning</p>	<p style="text-align: center;">Prohibition Sign</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Meaning: no dogs allowed</p>	<p style="text-align: center;">Mandatory Action Sign</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Meaning: wash your hands</p>
<p style="text-align: center;">Safe Condition Sign</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Meaning: drinking water</p>	<p style="text-align: center;">Fire Safety Sign</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Meaning: fire extinguisher</p>	<p style="text-align: center;">General Information Sign</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Meaning: restaurant</p>

Figure 8. Categories of ISO graphical symbols approved by the International Organization for Standardization include warning signs, prohibition signs, mandatory action signs, safe condition signs, fire safety signs, and general information signs. The images above showcase an example of a sign from each category. Copyright International Organization for Standardization.

Warning signs are printed on a yellow triangle with a black border and contain a black symbol. Warning signs warn of hazards that may result in injury or pose a health threat (see Figure 9) (The International Language of ISO Graphical Symbols, n.d.).



Figure 9. This image is an example of an ISO warning sign meaning “general warning.” Copyright International Organization for Standardization.

Prohibition signs are circular and consist of a red ring with a diagonal bar atop a black symbol on a white background. These signs specify behavior that is prohibited because it may result in immediate or potential risk of injury or health threat (see Figure 10) (The International Language of ISO Graphical Symbols, n.d.).



Figure 10. This image is an example of an ISO prohibition sign meaning “no dogs allowed.” Copyright International Organization for Standardization.

A mandatory action sign is printed on a blue circle and contains a white symbol. This type of sign specifies an action that is required to safeguard health and/or avoid the risk of injury (see Figure 11) (The International Language of ISO Graphical Symbols, n.d.).



Figure 11. This image is an example of an ISO mandatory action sign meaning “wash your hands.” Copyright International Organization for Standardization.

A safe condition sign is printed on a green square and features a white symbol that identifies evacuation routes, assembly points, the location of first aid and emergency equipment,

a safety facility, or a safety action (see Figure 12) (The International Language of ISO Graphical Symbols, n.d.).



Figure 12. This image is an example of an ISO safe condition sign meaning “drinking water.” Copyright International Organization for Standardization.

A fire safety sign features a white symbol on a red square and always includes a representation of flames. This type of sign indicates the location of fire equipment (see Figure 13) (The International Language of ISO Graphical Symbols, n.d.).



Figure 13. This image is an example of an ISO safety sign meaning “fire extinguisher.” Copyright International Organization for Standardization.

The final category, general information signs, feature a black symbol on a white background and communicate general information to the public (see Figure 14) (The International Language of ISO Graphical Symbols, n.d.).



Figure 14. This image is an example of an ISO general information sign meaning “restaurant.” Copyright International Organization for Standardization.

It is beneficial to use internationally accepted ISO graphical symbols because it reduces the use of different symbols with the same intended meaning and thereby reduces potential viewer confusion. Also, ISO graphical symbols communicate visually rather than verbally, as in the case of text, and are more likely to be understood by speakers of all languages as well as illiterate people. In addition, ISO graphical symbols express meaning in a compact form, may be more noticeable in busy environments than textual messages, may have more impact than written messages, and may be understood more quickly than written messages (Foster, 2001).

However, there are also potential issues with using ISO graphical symbols to communicate specific messages. To begin with, some viewers may not understand the intended message conveyed by the graphical symbol. This may be because a symbol may communicate a concept that the viewer is unaware of due to cultural differences (Chan et. al, 2009). This is more likely with ISO graphical symbols that are more symbolic in nature than those that are more iconic in nature. Another potential point of confusion is that ISO graphical symbols may be context-specific, and when viewed outside of their intended locations, ISO graphical symbols may be difficult to interpret. To account for the occurrence of misinterpretations, ISO (2007) and ANSI (2007) recommend 85 percent correct comprehension for all warning symbols (Zender & Meija, 2013).

Another potential obstacle to proper interpretation are the different types of context that may detract from accurate comprehension. Zender and Meija (2013) identify three different contexts that may impact viewer comprehension: (1) the immediate context, which is the way symbols interact within a single sign, (2) the environmental context, which is the way the images function in the environment, and (3) the proximate context, which is the field of interaction

where symbols in a system interact with other symbols in the same system (Zender & Mejia, 2013). In addition, Chan et al. (2009) identified the cultural context as a potential barrier to understanding. They found that the “cultural background of people should be regarded as an important determinant affecting the success of symbol communication,” and they determined that international comprehensibility of a graphical symbol can be increased if the design is culturally independent or of “high multi-cultural compatibility” (p. 849).

Hooker (2001) recommends registering graphical symbols with ISO to allow industries to be globally competitive. However, many graphical symbols are designed by individuals or groups working within an industry or firm, and such graphical symbols may not be registered with an organization such as ISO (Hooker, 2001).

In order for a graphical symbol to be registered with ISO, it must go through an extensive review and registration process. First, the proposed symbol must be submitted to the appropriate technical committee for review (Hooker, 2001). If the graphical symbol is approved at the national level, it is then submitted to the international technical committee for additional review and registration (Hooker, 2001). During the review process, a graphical symbol is judged on whether its design meets the ISO/IEC guidelines (Hooker, 2001). If the design is approved, then the graphical symbol is published in the ISO 7000 standard (Hooker, 2001). This rigorous review process ensures that only the most effective graphical symbols are approved for use.

Method

A content analysis (as described in Rose, 2012) was conducted to analyze a sample of ISO graphical symbols retrieved from the ISO Online Browsing Platform (OBP) (Online Browsing Platform (OBP), n.d.). Originally developed to interpret written and spoken texts, a

content analysis requires the counting and analyzing of the frequency of specific visual elements within a sample of images (Rose, 2012). In conducting the content analysis, the following six steps were completed:

1. Select the symbols to analyze.
2. Create the coding categories.
3. Form a hypothesis.
4. Code the categories.
5. Analyze the results.
6. Summarize the results.

Step 1: Select the symbols to analyze

Out of the 6,421 available ISO graphical symbols, a total of 51 graphical symbols were selected for analysis. Stratified sampling was used to limit the sample size to include only graphical symbols in the public information category.

The order in which the graphical symbols were listed in the ISO Online Browsing Platform database appeared to be random. The graphical symbols were not clustered by type, placed in order by registration date, or listed in alphabetical order by title. Also, graphical symbols that were similar in style and meaning and would logically be placed next to each other were spread apart at seemingly random intervals. Therefore, the following method was used to limit the sample size.

First, the graphical symbols were divided into six smaller groups based on subcategory. After dividing the graphical symbols into subcategories, only the first ten graphical symbols within each group were selected for analysis. A total of ten graphical symbols were analyzed in

the public facilities; commercial facilities; transport facilities; and tourism, culture, and heritage categories. Because ten graphical symbols were not available for analysis in the behavior of the public and sporting activities subcategories, all of the graphical symbols in these two categories were analyzed. A total of seven graphical symbols in the behavior of the public subcategory and four graphical symbols in the sporting activities subcategory were analyzed.

Step 2: Create the coding categories

After selecting the ISO graphical symbols to analyze, the following coding categories were created in a table within Microsoft Word:

- **Category** (as defined by the ISO Online Browsing Platform)
- **Title** (as defined by the ISO Online Browsing Platform)
- **Function/description** (as defined by the ISO Online Browsing Platform)
- **Image content** (as defined by the ISO Online Browsing Platform)
- **Registration date/status** (as defined by the ISO Online Browsing Platform)
- **Number of graphic elements**

Many of the ISO graphical symbols contained multiple graphic elements that each communicated specific information. For example, in the graphical symbol labeled “priority seats for injured people” there were a total of three distinct graphic elements: the human figure, the crutch to the right of the figure, and the seat, which is indicated by a solid, horizontal line beneath the figure (see Figure 15).

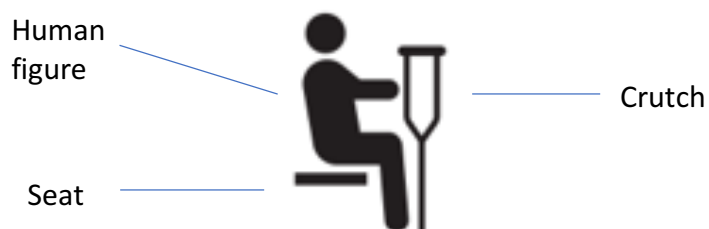


Figure 15. This ISO graphical symbol is labeled “priority seats for injured people” and contains three individual graphics: a human figure, seat, and crutch. Copyright International Organization for Standardization.

- **Type of sign:** symbol, icon, index, or pictogram

A graphical symbol was considered a symbol if the visual related to the object it represented purely on the basis of habit or convention. Symbolic graphical symbols represent an abstract concept that requires learning of social or cultural knowledge in order to understand the intended meaning. For example, the ISO graphical symbol titled “Way out or exit” is considered a symbol because it shows an arrow situated between two parallel lines (see Figure 16). An arrow does not represent a physical object and so the meaning must be learned.



Figure 16. This ISO graphical symbol is labeled “way out or exit” and shows a right-pointing arrow contained between two parallel lines. It is an example of a symbolic graphical symbol because an arrow is an abstract concept. Copyright International Organization for Standardization.

A graphical symbol was considered an icon if it was a direct visual abstraction of the object being referenced. For example, the ISO graphical symbol labeled “dogs should be carried”

is considered an icon because it shows a human form carrying a generic-looking dog form, and it is a two-dimensional abstraction of what a person carrying a dog would look like in reality. (see Figure 17).



Figure 17. This ISO graphical symbol labeled “dogs should be carried” is an example of an icon because the graphic is a two-dimensional abstraction of an actual scenario. Copyright International Organization for Standardization.

A graphical symbol was categorized as an index if the graphic referred to an object or concept that was causally related but not physically related in appearance. For example, the ISO graphical symbol labeled “money/currency exchange or bureau-de-change” graphical symbol is considered an index because the graphic, paper and coin money of different currencies, refers to a facility in which currencies may be exchanged (see Figure 18). In this case, the graphical symbol is not referring specifically to the physical objects being depicted in the image but rather to the facility where the objects may be obtained.



Figure 18. The ISO graphical symbol labeled “money/currency exchange or bureau-de-change” is an example of an index because the images of different types of money refers to a facility where currencies may be exchanged. Copyright International Organization for Standardization.

Finally, a graphical symbol was classified as a pictogram if it incorporated any combination of symbol, icon, or index through the use of multiple graphics. For example, the “Escalator down” graphical symbol was classified as a pictogram because it incorporated icons (human figures and escalator shape) and a symbol (arrow) in the same graphical symbol (see Figure 19).



Figure 19. This ISO graphical symbol labeled “escalator down” is an example of a pictogram because it combines icons (the two human figures and the shape depicting an escalator) and a symbol (the left-pointing) arrow. Copyright International Organization for Standardization.

- **Presence of Visual Metaphor** (answer yes or no)

An ISO graphical symbol contained a visual metaphor if one object or concept is communicated in terms of a different, yet related object or concept. For example, Figure 20 shows an ISO graphical symbol that resembles a shopping cart filled with products. However, the meaning of the graphical symbol is broader than the combination of graphic elements, and it refers to a facility where shopping may take place rather than to the shopping cart itself.



Figure 20. This ISO graphical symbol labeled “shops or shopping” is an example of a visual metaphor because a shopping cart containing products refers to the idea that there is a shopping facility nearby. Copyright International Organization for Standardization.

Step 3: Form a hypothesis

Next, the following three hypotheses were formed:

- **Hypothesis 1:** The majority (more than 50 percent) of the ISO graphical symbols analyzed will contain more than one graphic element, but few will contain more than 5 graphic elements.
- **Hypothesis 2:** The majority of ISO graphical symbols will be either symbolic in nature or a pictogram that includes a symbol.
- **Hypothesis 3:** The majority (more than 50 percent) of ISO graphical symbols will contain visual metaphors.

Step 4: Code the categories

All of the ISO graphical symbols in the sample were then coded based on the coding categories outlined above in step 2. The information was compiled into Tables 1–6, which are located in Appendix A.

Step 5: Analyze the results

After counting the number of individual graphic elements used in each graphical symbol, it was concluded that hypothesis 1, the majority of the ISO graphical symbols analyzed will contain more than one graphic element, but few will contain more than 5 graphic elements, was correct. There were a total of 11 graphical symbols containing 1 graphic element, 16 graphical symbols containing 2 graphic elements, 15 graphical symbols containing 3 graphic elements, 6 graphical symbols containing 4 graphic elements, 0 graphical symbols containing 5 graphic elements, and only 3 graphical symbols containing 6 or more graphic elements. Out of the 51

ISO graphical symbols analyzed, a total of 46 contained between 2 and 5 individual graphics. (see Table 1).

Number of ISO Graphical Symbols Containing 1, 2, 3, 4, 5, and 6+ Individual Graphic Elements						
	1	2	3	4	5	6+
Public Facilities (10)	3	1	4	1	0	1
Commercial Facilities (10)	2	5	1	2	0	0
Transport Facilities (10)	4	3	3	0	0	0
Tourism, Culture, and Heritage (10)	0	4	3	3	0	0
Behavior of the Public (7)	1	3	1	0	0	2
Sporting Activities (4)	1	0	3	0	0	0
Total	11	16	15	6	0	3

Table 1. This table displays the number of individual graphics present in the sample of ISO graphical symbols by subcategory.

When reviewing the number of ISO graphical symbols consisting of symbols, icons, indexes, or pictograms, it was concluded that hypothesis 2, the majority if ISO graphical symbols will be either symbolic in nature or a pictogram was incorrect. The majority of graphical symbols were icons (34), followed by indexes (9), and then pictograms (7). Only one of the graphical symbols in the sample was a symbol (see Table 2).

Number of ISO Graphical Symbols Consisting of a Symbol, Icon, Index, or Pictogram				
	Symbol	Icon	Index	Pictogram
Public Facilities (10)	1	5	2	2
Commercial Facilities (10)	0	1	6	3
Transport Facilities (10)	0	10	0	0
Tourism, Culture, and Heritage (10)	0	9	0	1
Behavior of the Public (7)	0	7	0	0
Sporting Activities (4)	0	2	1	1
Total	1	34	9	7

Table 2. This table displays the number of ISO graphical symbols in the sample that were symbols, icons, indexes, and pictograms.

When reviewing the composition of the pictograms, 1 of the graphical symbols was a combination of symbol and icon, 4 were a combination of symbol and index, and 2 were a combination of icon and index (see Table 3).

Type of Pictogram			
	Symbol/Icon	Symbol/Index	Icon/Index
Public Facilities (2)	1	1	0
Commercial Facilities (3)	0	3	0
Transport Facilities (0)	0	0	0
Tourism, Culture, and Heritage (1)	0	0	1
Behavior of the Public (0)	0	0	0
Sporting Activities (1)	0	0	1
Total	1	4	2

Table 3. This table displays the composition of pictograms in the ISO graphical symbols sampled.

Finally, when considering if visual metaphors were used in the designs of the ISO graphical symbols in the sample, it was revealed that hypothesis 3, the majority of graphical symbols would contain visual metaphors, was also incorrect. A total of 17 ISO graphical symbols in the sample used visual metaphors whereas 34 of the graphical symbols did not use visual metaphors (see Table 4).

Use of Visual Metaphor		
	Yes	No
Public Facilities (10)	5	5
Commercial Facilities (10)	9	1
Transport Facilities (10)	0	10
Tourism, Culture, and Heritage (10)	1	9
Behavior of the Public (7)	0	7
Sporting Activities (4)	2	2
Total	17	34

Table 4. This table displays the number of ISO graphical symbols in each category that used visual metaphors.

In addition, ISO graphical symbols that contained visual metaphors were either indices, symbols, or a pictogram containing an index or symbol. None of the icons in the sample used visual metaphors (see Table 5).

Type of Visual Metaphor Used				
	Symbol	Icon	Index	Pictogram
Public Facilities (10)	1	0	2	2
Commercial Facilities (10)	N/A	0	6	3
Transport Facilities (10)	N/A	0	N/A	N/A
Tourism, Culture, and Heritage (10)	N/A	0	N/A	1
Behavior of the Public (7)	N/A	0	N/A	N/A
Sporting Activities (4)	N/A	0	1	1
Total	1	0	9	7

Table 5. This table displays the use of visual metaphors in the ISO graphical symbols by sign type.

Step 6: Summarize the results

After coding the ISO graphical symbols in the sample and analyzing the results of the coding, a few key trends emerged. First, most of the ISO graphical symbols in the sample contained anywhere from 1 to 4 individual graphic elements, with the majority containing 2 or 3 individual graphic elements. This is probably because, in many cases, additional graphic elements may help clarify the meaning of the graphical symbols. However, as more graphic elements are included, the chances of viewers becoming confused or overwhelmed by additional and possibly unnecessary components may increase.

Second, it was hypothesized that the majority of ISO graphical symbols would contain symbols. However, this was not the case, and the majority of ISO graphical symbols actually contained icons. In fact, only one out of the 51 graphical symbols analyzed was a pure symbol and only 5 were pictograms containing symbols. The frequent use of icons may be because icons visually represent the objects to which they refer, whereas symbols require socially learned knowledge to understand meaning. By limiting the use of symbols or reinforcing the meaning of

symbols by adding icons and indexes to create pictograms, designers are increasing the chances that viewers will be able to correctly interpret the meaning of the graphical symbols because they can easily make the connection between the visual representation and physical object being represented. However, designers also must always be aware of cultural differences that may interfere with accurate interpretation, even when choosing to use icons.

Also, it was hypothesized that the majority of graphical symbols analyzed would contain visual metaphors, but actually there were only half as many graphical symbols containing visual metaphors than those not containing visual metaphors. Furthermore, none of the icons contained visual metaphors. This makes sense as icons represent physical objects and do not need an extra layer of meaning to create understanding. However, all of the indices and symbols sampled contained visual metaphors, indicating that designers tend to use familiar visuals to refer to lesser known concepts or objects.

Conclusion

Considering all of the trends revealed by this content analysis, it is evident that designers tend to use icons in ISO graphical symbols when possible to represent a physical object through graphic abstraction. Symbols and indices are only used when icons are not adequate, and symbols especially are used with caution to ensure that the maximum number of viewers will quickly and easily understand the meaning independent of their social and cultural backgrounds. In addition, symbols are often reinforced with additional meaning by also incorporating an icon or index to create a pictogram. Finally, these design practices are supported by the International Organization for Standardization (ISO) because this organization is responsible for reviewing and approving all ISO graphical symbols prior to their release to the public.

There are a couple limitations to this research. First, the sample size was small and only consisted of ISO graphical symbols in the public information category. Additional research is necessary to understand how graphical symbols in other categories are analyzed. Also, only one researcher conducted this study, and the accuracy of the results of the coding would have been strengthened if additional researchers had been involved in the coding process. It is recommended that this topic be explored further with multiple researchers and with a larger sample size in order to determine if these results are specific to public information ISO graphical symbols or if they also apply to other types of ISO graphical symbols.

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Appendix A

Table 1: Public Information Symbols: Public Facilities

Graphical Symbol	Category	Title	Function/Description	Image Content	Reg. Date/Status	# of Graphics	Type of Sign	Visual Metaphor
	Public facilities	Way out or exit	To indicate and identify the location of an exit or preferred way to go out	Two lines with direction arrow pointing out	2007-11-01/ Active	3	Symbol	yes
	Public facilities	Hospital	To indicate the location of a hospital	Human figure in bed with cross to indicate medical care	2007-11-01/ Active	3	Pictogram (symbol – cross; index – medical care location)	yes
	Public facilities	Toilets - female	To indicate the location of a public toilet for females	Frontal view of standing female human figure	2007-11-01/ Active	1	Index – female restroom	Yes
	Public facilities	Tickets or ticket sales	To indicate the location of a facility where tickets may be obtained	Hand holding two tickets	2007-11-01/ Active	3	Icon	no
	Public facilities	Check-in or reception	To indicate the location of check-in or reception facility	Human figure at representation of desk/counter greeting another human figure	2007-11-01/ Active	3	Icon	no
	Public facilities	Baggage storage or left baggage	To indicate the location of facility for the temporary storage of baggage	Four assorted pieces of baggage arranged on two shelves in an orderly fashion	2007-11-01/ Active	6	Icon	no
	Public facilities	Museum	To indicate the location of a museum.	*An antique building with columns viewed from the side. Base, four columns, triangular roof.	2013-05-31/ Active	1	Icon	no
	Public facilities	Priority access for people with small children	To indicate that people with small children are given priority access to facilities e.g. lifts.	*Frontal view of standing human figure holding a small child.	2013-05-31/ Active	2	Icon	no








	Public facilities	Post or Post office or mail box	To indicate the location of post or mail facilities	Outline of rear view of envelope	2007-11-01/ Active	1	Index – location of post office	yes
	Public facilities	Escalator, down	To indicate the location of a public escalator where the direction of travel is down	Side view of two human figures on an escalator with an arrow indicating downwards travel	2007-11-01/ Active	4	Pictogram (symbol – arrow; icon – escalator and people)	yes

Table 2: Public Information Symbols: Commercial Facilities

Graphical Symbol	Category	Title	Function/Description	Image Content	Reg. Date/Status	# of Graphics	Type of Sign	Visual Metaphor
	Commercial facilities	Money/currency exchange or bureau-de-change	To indicate the location of currency exchange facilities	Banknote with currency mark and three randomly arranged coins each with different currency mark	2007-11-01/ Active	4	Index – currency exchange facility	yes
	Commercial facilities	Filling station	To indicate the location of fuel for vehicles, boats, etc.	Fuel pump with hose	2007-11-01/ Active	1	Icon	no
	Commercial facilities	Shops or shopping	To indicate the location of shopping facilities	Side view of outline of shopping trolley or cart with items of shopping	2007-11-01/ Active	4	Index – shopping facility	yes
	Commercial facilities	Wireless LAN	To indicate the presence of a wireless network service through which you can be connected to the internet or go online.	*Outline rectangle above filled base with four curved lines.	2013-05-31/ Active	2	Pictogram (Symbol – WiFi connection; Index – location of WiFi)	yes
	Commercial facilities	Internet café	To indicate the location of a facility with access to computers with internet connection and where refreshments may be provided.	A coffee cup viewed from the side. The cup is branded with an “at” sign.	2013-05-31/ Active	2	Pictogram (Symbol – @; Index – café with Internet access)	yes










	Commercial facilities	Car repair workshop	To show the location of a car repair workshop.	*Front view of a car and a spanner, the spanner is above the car.	2013-05-31/ Active	2	Index – vehicle repair workshop location	yes
	Commercial facilities	Restaurant	To indicate the location of restaurant facilities	Plan view of knife and fork in line with each other	2007-11-01/ Active	2	Index – restaurant location	yes
	Commercial facilities	Foot care or podiatry	*Indicates the location of a facility where foot care or podiatry is offered.	A footprint and a cross in the upper right corner indicating a healthcare centre	2013-05-31/ Active	2	Pictogram (Symbol – cross sign; Index – refers to a healthcare center)	yes
	Commercial facilities	Hotel or accommodation	To indicate the location of accommodation facilities	Human figure in bed with lamp	2007-11-01/ Active	3	Index – hotel	yes
	Commercial facilities	Bar	To indicate the location of a licensed bar	Cocktail glass with stick	2007-11-01/ Active	1	Index – bar	yes

Table 3: Public Information Symbols: Transport Facilities

Graphical Symbol	Category	Title	Function/Description	Image Content	Reg. Date/Status	# of Graphics	Type of Sign	Visual Metaphor
	Transport facilities	Priority seats for injured people	To indicate priority seats for injured people.	*Side view of sitting human figure with crutch, horizontal line.	2013-05-31/ Active	3	Icon	no
	Transport facilities	Airport or aircraft	To indicate the location of an airport or aircraft	Aircraft in plan view	2007-11-01/ Active	1	Icon	no
	Transport facilities	Priority seats for people with small children	To indicate priority seats for people with small children.	*Side view of sitting human figure with a small child on the knee, horizontal line.	2013-05-31/ Active	3	Icon	no
	Transport facilities	Heliport or helicopters	To indicate the location of helicopters	Side view of helicopter	2007-11-01/ Active	1	Icon	no










	Transport facilities	Cable car	To indicate the location of cable cars	Side view of cable car suspended from inclined cables	2007-11-01/ Active	1	Icon	no
	Transport facilities	Airport bus	To show the location of an airport bus.	*Side view of bus with aircraft in upper right-hand corner.	2013-05-31/ Active	2	Icon	no
	Transport facilities	Tram or streetcar stop or trams or streetcars	To indicate the location of trams/streetcars	Side view of electric tram/streetcar	2007-11-01/ Active	1	Icon	no
	Transport facilities	Chair lift	To indicate the location of lifts	Side view of human figure seated on a chair suspended from an inclined cable	2007-11-01/ Active	2	Icon	no
	Transport facilities	Flight arrivals	To indicate the location of flight arrivals	Side view of aircraft landing on runway	2007-11-01/ Active	2	Icon	no
	Transport facilities	Baggage reclaim	To indicate the location of baggage reclaim point	Side view of human figure lifting bag from conveyor belt	2007-11-01/ Active	3	Icon	no

Table 4: Public Information Symbols: Tourism, Culture, and Heritage

Graphical Symbol	Category	Title	Function/Description	Image Content	Reg. Date/Status	# of Graphics	Type of Sign	Visual Metaphor
	Tourism, culture and heritage	Audio tour	To indicate where audio tour equipment is available for the public.	*Headset, human figure.	2013-05-31/ Active	2	Pictogram (Icon – audio equipment Index – location to get audio equipment)	yes
	Tourism, culture and heritage	Packed lunch room	To indicate the location of an under-cover facility where people may consume their own food and drink.	*Apple, vacuum flask, mug, viewed from the side. Inverted "V" over.	2013-05-31/ Active	4	Icon	no
	Tourism, culture and heritage	Play area	To indicate the location of a public play area for children	Side view of children on seesaw	2007-11-01/ Active	3	Icon	no










	Tourism, culture and heritage	Viewpoint or panorama	To indicate the location of public viewing point	Side view of human figure looking through binoculars or telescope on stand	2007-11-01/ Active	2	Icon	no
	Tourism, culture and heritage	Campsite or camping	To indicate the location of public camping facilities	"Wigwam" style tent with tree	2007-11-01/ Active	2	Icon	no
	Tourism, culture and heritage	Beach	To indicate the location of beach.	Side view of human figure, parasol and water.	2013-05-31/ Active	3	Icon	no
	Tourism, culture and heritage	Hiking trail	*To indicate the location of a track suitable for hiking.	Human figure viewed from the side with a rucksack, walking with stick in hand. Tree in top right-hand corner.	2013-05-31/ Active	4	Icon	no
	Tourism, culture and heritage	Park - recreational	To indicate the location of a public park available for recreational purposes	Bench and tree	2007-11-01/ Active	2	Icon	no
	Tourism, culture and heritage	Hot spring or hot tub	*To show the location of a hot spring suitable for bathing or a hot tub.	Three s-shaped lines above three half human figures in a circle.	2013-05-31/ Active	3	Icon	no
	Tourism, culture and heritage	Indoor play area	*To indicate the location of a facility where children can play indoors.	Two children (one boy, one girl) viewed from the side, on their knees, toy truck, inverted "V" over.	2013-05-31/ Active	4	Icon	no

Table 5: Public Information Symbols: Behavior of the Public

Graphical Symbol	Category	Title	Function/ Description	Image Content	Reg. Date/ Status	# of Graphics	Type of Sign	Visual Metaphor
	Behaviour of the public	Quiet please or silence	To indicate areas where silence is required	Side view of head with hand in front and finger over mouth area	2007-11-01/ Active	2	Icon	no
	Behaviour of the public	Dogs should be carried	To indicate that dogs should be carried.	*Upper half of human figure holding a dog.	2013-05-31/ Active	2	Icon	no










	Behaviour of the public	Line up or queue in threes	To indicate the necessity to queue in lines of three for access to facilities	Front view of three lines of figures. Front ones solid, remainder in outline NOTE - Queuing in lines of four, etc. can be created by adding an appropriate number of lines of figures.	2007-11-01/ Active	9	Icon	no
	Behaviour of the public	Line up or queue in single file	To indicate the necessity to queue in single file for access to facility	Front view of line of figures, first one solid, other two in outline	2007-11-01/ Active	3	Icon	no
	Behaviour of the public	Surveillance camera	*To indicate the location of surveillance camera.	Side view of wall mounted surveillance camera.	2013-05-31/ Active	1	Icon	no
	Behaviour of the public	Line up or queue in twos	To indicate the necessity to queue in lines of two for access to facilities	Front view of two lines of figures, front ones solid, remainder in outline	2007-11-01/ Active	6	Icon	no
	Behaviour of the public	Stand on the left (or right)	To indicate the necessity to stand on the left (or right as required) to allow others to pass	Rear view of human figure standing to the left (or right) of moving walkway or escalator	2007-11-01/ Active	2	Icon	no

Table 6: Public Information Symbols: Sporting Activities

Graphical Symbol	Category	Title	Function/Description	Image Content	Reg. Date/Status	# of Graphics	Type of Sign	Visual Metaphor
	Sporting activities	Sports hall	*To indicate the location of a facility for indoor sports.	Racket, ball, hockey stick. Inverted "V" shape over.	2013-05-31/ Active	3	Pictogram (Icon – Roof: Index – Sports Equipment)	yes
	Sporting activities	Stadium	To indicate the location of a sports stadium	Aerial perspective of a stadium with stands and pitch	2007-11-01/ Active	1	Icon	No
	Sporting activities	Indoor swimming pool	*To indicate the location of a building for public swimming or bathing.	Human figure swimming. Two wavy lines. Inverted "V" shape over.	2013-05-31/ Active	3	Icon	No

	Sporting activities	Sporting activities or general sports	To indicate the location of an area or place set aside for a variety of sporting activities	Three items of sporting equipment: racket, ball and stick	2007-11-01/ Active	3	Index – sports activities location	yes
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Guidelines for Designing Effective Video Software Tutorials

Video tutorials have become an increasingly popular means of delivering “how to” information, and video software tutorials are especially popular in developing procedural knowledge by explaining how to complete software-related tasks (Giannakos, 2013; Van der Meij & Van der Meij, 2013; Van der Meij & Van der Meij, J., 2016). The majority of software tutorials are created using various screencasting software, which are programs that allow designers to record video of themselves interacting directly with the software interface while also narrating the procedures. Tutorials created using screencasting software are referred to interchangeably in the research as screencasts, recorded demonstrations, animations, and video. However, in this paper, screencasts are referred to as *videos*, and the term *software tutorial* is used to refer to video software tutorials created using screencasting technology.

Exponential growth in software development, along with a demand for user support, advances in affordable and user-friendly screencasting software, and the ability to easily publish videos online on sites like YouTube has contributed to the rapid proliferation in consumer-generated video software tutorials in addition to the professionally produced tutorials developed by software companies like Microsoft and Adobe and those found on sites like Lynda.com (Van der Meij & Van der Meij, 2013). In fact, a search on YouTube.com using the search term “software tutorial” returned approximately 30,600,000 results in April 2017, which emphasizes that there is a large supply of video software tutorials available to the public at no charge. However, ease of production and dissemination does not guarantee that all software tutorials are designed according to best practices that are informed by research, or that they are effective in creating meaningful learning experiences.

There are many technological, content, and design choices to consider when creating software tutorials, and learners evaluate the outcome of these decisions by determining if a tutorial is effective in helping them meet their learning goals. While learners may be able to instinctually understand if a tutorial is effective or not, it is important for designers to draw from the research conducted in the fields of instructional design, technical communication, and education psychology to guide design and development choices.

Fortunately, there are several existing sets of guidelines to aid designers in producing effective software tutorials. For example, in 2005, Plaisant and Shneiderman (2005) published an article outlining ten guidelines for the design of recorded demonstrations, which they defined as screen capture animations with narrations. Their guidelines are informed by research on best practices as well as by their experiences developing video demonstrations professionally. Plaisant and Shneiderman (2005) also assessed current practices through a review of web-based recorded demonstrations. Their guidelines can be sorted into two major categories: technology and content. It is important to note that the authors emphasize that their list is not comprehensive, but rather a compilation of commonly used strategies (Plaisant & Shneiderman, 2005).

Approaching the subject from the perspective that user-generated video tutorials are a new form of technical communication, Morain and Swarts (2012) developed a framework for assessing the effectiveness of video tutorials. They conducted a comparative study of user-rated YouTube videos to develop a framework for assessing the effectiveness of online video tutorials that consisted of three major categories based on Saul Carliner's three-part framework for information design: physical design, cognitive (intellectual) design, and affective (emotional) design (Carliner, 2000). Physical design is concerned with the learner's ability to locate information, cognitive design is concerned with the learner's ability to understand information,

and affective design is concerned with the learner's comfort with how the information is presented (Carliner, 2000). Although Morain and Swarts's (2012) focus was on assessing existing video tutorials, the information provided within their framework can also be used to guide designers in the process of creating new tutorials.

Most recently, in response to the growing popularity of video tutorials for software training and a relative lack of research on software training instructional videos, Van der Meij and Van der Meij (2013) developed and tested a set of eight guidelines to guide designers in both the creation and selection of effective video software tutorials. Rather than advancing new theory, their guidelines are based on accepted research conducted in the areas of education psychology, instructional design, and multimedia learning. Sequenced in the order that they would be used during the design process, the guidelines support both learning and skills retention. Van der Meij and Van der Meij (2013) note that although the underlying cognitive processing is the same for tasks that aim to enhance learners' conceptual knowledge and tasks that aim to enhance a learners' procedural knowledge, it is important to have separate guidelines to inform the design process for instructional videos.

While on their own, each set of guidelines appears to be thorough, differences in content and organization become more apparent through a comparison. These differences may present some confusion to designers of video software tutorials, which may result in a lack of confidence in the comprehensiveness of each individual set of guidelines.

Furthermore, issues of accessibility for learners of all abilities are only partially addressed in Plaisant and Shneiderman's (2005) guidelines and are not explicitly addressed in Morain and Swarts's (2012) guidelines or Van der Meij and Van der Meij's (2013) guidelines.

Therefore, this paper attempts to reconcile the differences in the guidelines developed by Plaisant and Shneiderman (2005), Morain and Swarts (2012), and Van der Meij and Van der Meij (2013) by combining all of the content into eighteen distinct guidelines organized into three major categories: (1) accessibility, (2) cognitive design, and (3) affective design. The researcher also draws on the accessibility research of Oud (2016) and Clossen (2014) to incorporate a more robust guideline that outlines methods to make video tutorials more universally usable for learners of all abilities. However, it is important to first define key terms and concepts to provide a context for the research and organizational decisions.

Definitions of Key Terms and Concepts

The form that a tutorial takes depends on the media used. *Media* is defined as the “physical system or vehicle used to deliver instruction,” such as a textbook, verbal lecture, computer desktop, or video. Media may be static, as in the case of printed text and visuals, or dynamic, as in the case of video and animation (Moreno, 2006). It is important to note that while both video and animation are dynamic because they depict movement in time, they are two different types of dynamic media. The key difference is that an *animation* is a pictorial representation achieved through either drawing or some other simulation method, whereas a *video* is a motion picture that shows the movement of real objects (Mayer & Moreno, 2002).

In addition, most tutorial videos and animations are also forms of *multimedia* because they present information in two or more forms, usually through a combination of pictures (video, animation, photos, and/or illustration) and words (spoken and/or printed) (Mayer, 2005). *Multimedia instruction* is the presentation of two or more types of media (e.g., words and pictures) in a way that is intended to foster learning (Mayer, 2005). Due to the dynamic nature of

both types of media and the ability to include audio in addition to visuals, most recommendations for producing effective animated tutorials also apply to video tutorials and vice versa. Therefore, research that focuses on both video tutorials and animated tutorials was reviewed and considered (Mayer & Moreno, 2002; Van der Meij, 2014; Van der Meij & Van der Meij, 2013; Moran & Swarts, 2012; Alexander, 2013; Clossen, 2014; Giannakos, 2013; Mestre, 2012; Roshier, Foster, & Jones, 2011; Plaisant & Shneiderman, 2005).

Gunther Kress emphasizes that all meaning, and therefore all communication, is multimodal. He explains that different modes (e.g., visual, auditory, gestural, etc.) have different capacities and limitations for making meaning (Kress, 2009). However, it is important not to confuse *multimedia* with the concept of *modality*. While multimedia refers to the types of media used within a single presentation, modality refers to the sensory channel(s) initially used by learners to process the information (Moreno, 2006). According to research in cognitive science on theories of working memory, learners use independent sensory channels to process visual information (e.g., static and dynamic pictures and printed or on-screen text) and auditory information (e.g., spoken words, music, and background noise). This is known as the dual channel assumption, and for a presentation to be multimodal, information must be processed in both channels. (Moreno, 2006; Mayer & Moreno; 2003). In this paper, the channel used to process visual information is referred to as the *visual information channel*, and the channel used to process auditory information is referred to as the *auditory information channel* (Mayer & Moreno, 2003).

For communication of any kind to be successful, correct interpretation of the information presented needs to take place (Kress, 2009). According to the modality effect, information transfer is more effective if the information is presented via dual-modality presentation

techniques (e.g., combination of video and spoken narration) than in a single mode (e.g., video and on-screen text) (Low, Jin, & Sweller, 2009). The effectiveness of dual-modality presentation techniques is supported by research in cognitive science and the development of the cognitive load theory. Cognitive load theory states that the human working memory has limitations in the amount of cognitive processing that can take place in either sensory channel at any one time (Mayer & Moreno, 2003). Instructional materials are often ineffective because they impose extraneous cognitive load on the learner by requiring too much cognitive processing in one of the sensory channels, such as the simultaneous presentation of pictures and visual text; this limits the ability of working memory to process the information effectively (Low et. al., 2009; Mayer & Moreno, 2003). However, by presenting information in multiple modes, extraneous cognitive load is reduced and effective working memory is increased. If designed with the dual channel assumption and cognitive overload theory in mind, multimedia instructions such as video and animated tutorials are ideal for promoting learning because they allow designers to take advantage of dual-modality presentation techniques.

In addition to taking advantage of dual-modality and reducing cognitive load, video tutorials have other benefits. For example, videos allow for the visualization of complex processes, systems, and procedures (Spanjers, Van Gog, & Van Merriënboer, 2010). In contrast to static instructional media, like printed manuals and web pages, videos are ideal communication tools because they present information through time and appeal to visual learners (Mestre, 2006). Videos also provide more opportunity for personalization through tone of voice and facial expressions (Clossen, 2014). Furthermore, video tutorials have the potential to greatly enhance the accessibility of content presented (Clossen, 2014).

Reorganized Guidelines for Designing Effective Video Software Tutorials

As previously discussed, the differences in content and organization of the guidelines presented by Plaisant and Shneiderman (2005), Morain and Swarts (2012), and Van der Meij and Van der Meij (2013) may cause some confusion for designers of video software tutorials who are looking for a single set of comprehensive design guidelines. Therefore, the researcher has reviewed each set of guidelines, made note of similarities, differences, and organizational techniques, and used this information to inform the development of a comprehensive set of guidelines based on previous research and established theories.

The eighteen guidelines are organized into three major categories: (1) accessibility, (2) cognitive design, and (3) affective design. Each guideline is explained in detail and supported by accepted research. The only serious content modifications concern Plaisant and Shneiderman's (2005) tenth guideline, "Strive for universal usability," which focuses in part on technology requirements and recommendations. In the decade since the publication of Plaisant and Shneiderman's ten guidelines, technology accessibility has become less of a concern. For example, video database websites like YouTube already have file size requirements in place and provide viewers with a variety of compression options so that response time is less of an issue than it used to be. Therefore, the advice about maintaining small file sizes and carefully reviewing technology choices has been removed from the new guidelines.

Also, while Plaisant and Shneiderman (2005) can be credited with referencing the importance of addressing the needs of learners of all abilities in guideline ten "Strive for universal usability," the researcher saw an opportunity to provide additional recommendations based on the research of Oud (2016) and Clossen (2014). As a result, the new guidelines offer

additional recommendations for making video tutorials more inclusive and accessible to learners of all abilities.

Category 1: Accessibility

The first category contains guidelines associated with the accessibility of video software tutorials. There are three important aspects of accessibility that need to be considered when designing software tutorials. First, learners need to be able to locate the videos online. Second, learners of all abilities need to be able to access and navigate the videos. Third, learners should be given the ability to control how videos are played to ensure that they are able to process and understand the information presented.

Guideline 1.1: Make videos easy to locate. First and foremost, software tutorials should be easy to locate and access through online video databases (Van der Meij, 2014; Roshier et. al., 2011). While it is up to learners to navigate to a database, once there, they need to be able to locate the tutorial they need either through a table of contents or through a keyword search. If tutorials are organized via a table of contents, the tutorial titles must succinctly describe the purpose of the procedure in the tutorial. Titles also must be easily understood by the learner (Farkas, 1999; Van der Meij, 2014). Van der Meij & Van der Meij (2013) recommend avoiding the use of any jargon in titles and introductory text to ensure that learners are not confused about the contents.

Additionally, Novick and Ward (2006) identified ease of navigation to online documentation through keyword searches as important to learners. Not only did participants in Novick and Ward's (2006) study indicate that it was important to be able to find what they were

looking for by using keywords, learners also wanted to see results that related to their keyword searches even if the results didn't contain the actual keywords.

Using hashtags in video titles or descriptions is another way to ensure that videos are easy to locate (YouTube Help, 2017). Hashtags originated in social media as a method to turn keywords into searchable links to help people locate relevant content and track discussion topics. Hashtags are created by placing the pound sign in front of a word or phrase (Drell, 2014).

Guideline 1.2: Strive for universal usability for people of all abilities. Oftentimes website and online resources are not formatted with people with differing abilities in mind, and the inability of a segment of the population to access and use the same online resources as the rest of the population creates a digital divide (Oud, 2016).

While there is no universally accepted definition of the term disability, attempts are made annually to determine population percentages that identify as having one or more disabilities. According to data from the 2015 American Community Survey (ACS), in 2015, a total of 12.6 percent of the U.S. non-institutionalized population identified that they had a disability, and the number of people reporting disabilities increases with age. In addition, in 2015, 2.3 percent of the U.S. population reported a visual disability, 3.5 percent reported a hearing disability, and 5.1 percent reported a cognitive disability (Erickson, Lee, & Von Shrader, 2016). That represents approximately 10.9 percent of the U.S. population who may have difficulty accessing, viewing, and understanding online video tutorials, which emphasizes the importance of designing tutorials with these groups in mind. In addition, designing tutorials to benefit people with differing abilities will also benefit more "traditional" users because additional learning modalities are included (Clossen, 2014).

Many blind or low-vision users rely on assistive technologies like screen-reading software, which can't always locate video player controls (Oud, 2016). In a review of 460 tutorials, Oud (2016) found that tutorials housed on YouTube were relatively accessible compared to other sites. In fact, 50 percent of the reviewed vendors had published tutorials that were either not findable on the webpage or not playable using the keyboard or screen-reading software. Depending on the accessibility of the vendor's website, it may be necessary to post copies of tutorials on accessible sites like YouTube and provide links for easy navigation.

Providing the option to read captions and subtitles allows learners who have difficulty hearing to still participate in the synchronized experience of video tutorials (Clossen, 2014). Captions can also be a solution for learners whose primary language is different than the language of the video narration. Captions also benefit people who are watching the video without headphones in public locations (Oud, 2016). However, it is important to provide learners with the option of turning captions on and off as they choose (Clossen, 2014).

Finally, providing a transcript of the narration and alternate versions of the video benefits learners with vision and hearing impairments as well as any other learners who have difficulty with the video format (Ong, 2016; Plaisant & Shneiderman, 20015). However, alternate versions should be developed simultaneously with the original to ensure that both versions are structured similarly and use the same vocabulary (Plaisant & Shneiderman, 2005). In addition, transcripts and alternate versions should be easy to locate, which is not always the case, even on sites like YouTube (Oud, 2016).

Guideline 1.3: Enable functional interactivity. Since videos convey change over time, it may be more difficult for learners to process the changing visual situation and learn the

information being presented (Tversky & Morrison, 2002). In addition, it may be difficult for designers to determine the correct pace for all learners, a reality that is further complicated by the fact that learners access and understand the presentation of information at different rates. However, a combination of user control and system-based pacing makes it easier for learners to process information (Van der Meij & Van der Meij, 2013).

While all videos have controls for starting, pausing, stopping, and replaying, providing learners with the additional ability to decrease or increase the speed of play may also be helpful (Van der Meij & Van der Meij, 2013; Plaisant & Shneiderman, 2005). The ability to increase and decrease the speed of play is available when viewing videos in YouTube, however, it is important to note that this comes at the price of a loss of quality.

It is also important to give learners the controls needed to skip familiar sections and easily locate sections they want to replay. YouTube allows designers to add annotations that link to specific sections of the video; this allows learners to click on the annotation if they wish to skip ahead. YouTube also provides the ability to create chapter markers in the description that link to specified portions of the video.

Category 2: Design

The second, and largest, category contains guidelines on the design of video software tutorials. These guidelines are based on the physical design and cognitive design sections outlined by Morain and Swarts (2012), and the guidelines focus on making the content understandable without overwhelming learners. The number of guidelines has been expanded to include additional guidelines outlined by Van der Meij and Van der Meij (2013) and Plaisant and Shneiderman (2005).

Guideline 2.1: Combine visuals and verbal narration. Presenting information through synchronized visuals and verbal narration aligns with both the multimedia principle and the modality principle (Van der Meij & Van der Meij, 2013; Van der Meij, 2014).

The *multimedia principle* states that “people learn better from words and pictures than from words alone” (Mayer, 2009, p. 223). The theoretical rationale is that the combination of words and pictures allow learners to “construct verbal and visual mental models and to build connections between them” (Mayer, 2009, p. 223). It is more difficult to mentally create a visual modal if only words are presented (Mayer, 2009; Mayer & Moreno, 2002).

The *modality principle* states that “people learn more deeply from pictures and spoken words than from pictures and printed words” (Mayer, 2009, p. 200). The theoretical rationale behind the modality principle is that pictures (static or dynamic) and text both enter into the cognitive system through the eyes, and this results in an overload of the visual information channel, which has a limited capacity. However, a verbal narration is auditory and enters the cognitive system through the auditory information channel, which makes it easier to process pictures in the visual information channel and build connections between corresponding words and pictures (Mayer, 2009; Mayer & Moreno, 2002; Moreno, 2006).

Guideline 2.2: Eliminate redundancy. While it is beneficial to combine visuals and verbal narration, according to the redundancy principle, it is counterproductive to combine visuals, on-screen text, and verbal narration. The *redundancy principle* states that “people learn better from graphics and narration than from graphics, narration, and printed text” (Mayer, 2009, p. 118). The theoretical rationale behind the redundancy principle is that scanning between both pictures and on-screen text can overload the visual information channel. Furthermore, learners

are forced to expend extra mental effort to compare incoming streams of both printed and spoken text (Mayer, 2009).

Guideline 2.3: Synchronize visuals and audio. Plaisant and Shneiderman (2005) also recommend the use of verbal narration in videos; however, they emphasize that the narration and demonstration must be compatible and synchronized so as not to confuse learners. Similarly, Morain and Swarts (2012) found that audio and video tracks of good videos were synchronized, but specified that steps for each task were verbally announced right before being carried out on the screen.

These recommendations of synchronizing visual and verbal information align with the *temporal contiguity principle*, which states that “students learn better when corresponding words and pictures are presented simultaneously rather than successively” (Mayer, 2009, p. 153; Mayer & Moreno, 2002). The theoretical rationale behind the principle of temporal contiguity is that when corresponding narration and picture (static or dynamic) are synchronized, the learner is more likely to be able to hold both mental representations in the working memory simultaneously, which makes it easier to form mental connections between the verbal and visual representations (Mayer, 2009; Mayer & Moreno, 2003).

Guideline 2.4: Align text and pictures. If text is used to label visuals, and the words and pictures are misaligned (e.g., the picture is placed toward the top of the screen and the text is placed toward the bottom of the screen), then the user is forced to perform additional scanning to determine which part of the screen display corresponds with the text. This misalignment not only confuses learners but also increases cognitive load (Mayer & Moreno, 2003). Mayer and Moreno

(2003) recommend created an integrated presentation by placing pictures and accompanying text in close proximity. This aligns with the *spatial contiguity principle*, which states that “students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen” (Mayer, 2009, p. 135). The theoretical rationale behind the spatial contiguity principle is that when corresponding pictures and words are placed in close proximity, learners use less cognitive resources to visually search the screen. As a result, they are more likely to be able to hold both representations in working memory at the same time (Mayer, 2009).

Guideline 2.5: Be faithful to the actual user interface. Software tutorials should give the impression that the interface being displayed in the video is the actual interface that learners will encounter when using the software. This requires that the full interface should be shown without any cropping or zooming if possible. Showing the full interface ensures that task execution is in context, and it will also help learners develop insights about the structural layout of the interface, including the location of tools and widgets (Plaisant & Shneiderman, 2005; Van der Meij & Van der Meij, 2013). Zooming in is only recommended if readability becomes an issue, and it is only meant as a temporary solution (Plaisant & Shneiderman, 2005; Van der Meij & Van der Meij, 2013).

Guideline 2.6: Simplify content and relate it to the instructional goal. Morain and Swarts (2012) emphasize that all content should be purposeful and relate to the instructional goal. In addition, Van der Meij and Van der Meij (2013) and Plaisant and Shneiderman (2005) emphasize that all tasks should be clear and simple as well as meaningful and realistic.

According to the *coherence principle*, “people learn better when extraneous material is excluded rather than included” (Mayer, 2009, p. 89; Mayer & Moreno, 2002; Clark & Mayer, 2008). The theoretical rationale behind the coherence principle is that “extraneous material competes for cognitive resources in working memory and can divert attention from the important material, disrupt the process of organizing the material, and prime the learner to integrate the material with an inappropriate theme” (Mayer, 2009, p. 89). Extraneous material is not limited to words and pictures and also includes sounds, music, and symbols (Mayer, 2009).

Mayer and Moreno (2003) suggest weeding as a method to prevent cognitive overload due to extraneous material. Weeding consists of eliminating any unnecessary material to make both the video and narration as concise and coherent as possible. While Van der Meij and Van der Meij (2013) focus on weeding out information, Morain and Swarts (2012) also recommend minimizing or eliminating any unnecessary actions, including extraneous mouse movements and audio such as sound effects, background noise, and music.

In addition, Plaisant and Shneiderman (2005) recommend using familiar terms, avoiding abbreviations, speaking directly to users using simple, active sentences, and making only positive assertions. They also recommend preparing a script in advance and editing out any unnecessary words and phrases that are recorded.

Guideline 2.7: Use signaling to guide attention. Sometimes it may not be feasible to remove all extraneous material through the process of weeding. However, cognitive load can still be reduced through signaling (also referred to as highlighting), which is the process of providing the user with cues as to how to select and organize the material. Signaling aligns with the *signaling principle*, which states that “people learn better when cues that highlight the

organization of the essential material are added” (Mayer, 2009, p. 108). Signaling guides the learner’s cognitive processes through a variety of means: stressing key words in speech, adding colored arrows to select images, adding circles around screen objects, spotlight features, adding an outline and headings to organize words, adding a map that displays which part of a lesson is being presented, and adding sound effects that represent mouse clicks or keyboard sounds (Mayer & Moreno, 2003; Plaisant & Shneiderman, 2005; Van der Meij & Van der Meij, 2013).

However, it is important that signals are not confused with the software interface (Van der Meij & Van der Meij, 2013). In addition, the cursor should only be moved to attract attention to a part of the screen if it is necessary to the task because too much cursor movement can be confusing to learners (Plaisant & Shneiderman, 2005).

Guideline 2.8: Provide procedural information. The purpose of any software tutorial is to learn how to complete a task, and the video should guide the learner through the necessary steps to complete the task by providing only procedural information (Van der Meij & Van der Meij, 2013; Plaisant & Shneiderman, 2005). Procedural information includes information about the goal, the conditions necessary for action, intermediate states, information to prevent and overcome problems, actions necessary to reach the goal, and likely system responses (Van der Meij & Gellevis, 2004). While conceptual information may provide interesting and important background information and theory, it should not be included if it is not needed to complete the task (Plaisant & Shneiderman, 2005).

Guideline 2.9: Present accurate information. Of the three sets of guidelines reviewed, the framework developed by Morain and Swarts (2012) was the only version that emphasized

that all information should be accurate. Errors of fact due to misspeaking or execution (e.g., mistyping or unexpected system feedback) should be immediately corrected or edited out if possible (Morain & Swarts, 2012). However, more severe errors such as failing to complete a task or only partially completing a task, reduce a video's ability to foster self-efficacy and may prevent learners from understanding or applying the information (Morain & Swarts, 2012).

Guideline 2.10: Keep videos short. Rather than presenting multiple tasks in longer videos and risk cognitive overload, it is recommended to present only single tasks in shorter segments, a process referred to as segmentation or “chunking” (Mayer & Moreno, 2003; Van der Meij & Van der Meij, 2013; Plaisant & Shneiderman, 2005; Mestre, 2012; Spanjers et. al., 2010). Segmentation or chunking aligns with the *segmenting principle*, which states that “people learn better when a multimedia message is presented in user-paced segments rather than as a continuous unit” (Mayer, 2009).

Plaisant and Shneiderman (2005) recommend limiting each segment to fifteen to sixty seconds to maintain learner engagement and minimize the amount of information learners need to remember at one time. Learners are more likely to view shorter videos in their entirety, which increases the likelihood that learners will understand the material (Mestre, 2012).

Plaisant and Shneiderman (2005) also recommend that only one task be shown per segment, and if tasks must be combined in a single segment, short titles should be used to separate sections of the recording. Furthermore, each task or sub-task should only consist of three to five actions (Spanjers et. al., 2010; Van der Meij & Gellevis, 2004). Mestre (2012) elaborates on this strategy by recommending the arrangement of segments in logical sequences.

Mestre (2012) also suggests providing summaries and reviews to help learners mentally organize the information.

According to Mayer and Moreno (2003), cognitive overload may still occur if the information content in each segment is rich and the presentation pace is too fast. This is because learners may not have enough time process all of the information in one segment of the presentation before the next segment begins. One solution is to allow additional time between successive segments to allow the learner to fully process the information before moving on to learn new information (Mayer and Moreno, 2003; Spanjers et. al., 2010). Allowing a deliberate pause of two to five seconds immediately after task completion will provide learners with an opportunity to reflect on the material and learning (Van der Meij, 2014).

Guideline 2.11: Choose an appropriate tempo. Video software tutorials should progress at a pace that allows learners to easily follow each of the steps (Morain & Swarts, 2012). Speeds that are too fast make it difficult for learners to interpret the information, and may require frequent pausing and rewinding. However, videos that are too slow tempt learners to skip ahead, which may result in missed content and failure to accomplish the task (Morain & Swarts, 2012). While there is no formula to determine the precise speed at which a video should progress, Morain and Swarts (2012) recommend choosing a speed that would be expected of a skilled learner who is teaching an inexperienced user. Designers should refer to guideline 1.3, “Enable Functional Interactivity,” to make accommodations for learners of all abilities who may process information at different speeds.

Guideline 2.12: Provide opportunities for practice. Learner's should be given an opportunity to strengthen the skills they learned from a video tutorial by completing a practice exercise. Not only does practice consolidate and enhance learning, it also allows users to see if they can apply what they just learned. All practice exercises should include a starting condition and an end goal (Van der Meij & Van der Meij, 2013). This guideline also aligns with the action-oriented approach of minimalist instruction, which states it is a priority to provide users with an immediate opportunity for meaningful action (Van der Meij, 1995).

Category 3: Affective Design

The final category of guidelines is affective design. According to Carliner (2000), affective design involves designing information for emotional impact. Whereas the previous two categories contained guidelines that focused on locating and understanding information, the affective design category contains guidelines that focus on designing tutorials in a way that engage learners and motivate them to view video tutorials and also apply what they learn (Morain & Swarts, 2012).

Guideline 3.1: Create confidence in the narrator. In order to create confidence, it is important to establish the credibility of the narrator as well as the credibility of the organization that is producing the tutorial (if applicable). According to Farkas (1999), the act of "selling" oneself is essential in convincing the learner that the procedures outlined in the tutorial come from a knowledgeable and trustworthy source; it is beneficial because it shows that the tutorial designer respects the learner's time and energy. Morain and Swarts (2012) echo this recommendation by stating that narrators in good video tutorials would reference prior videos or

explain their affiliation with the software company. They also specified the need for scripting lines and spending some time rehearsing prior to recording. In addition, Morain and Swarts (2012) explain that videos that appeared to be planned and edited were more effective than videos where narrators made off-the-cuff remarks, got lost in tangents, or did not perform tasks confidently, as evidenced by pauses, backtracking, and repeating actions.

Guideline 3.2: Preview the task. Previewing the task at the start of a tutorial is important to motivate learners and persuade learners that they will be able to successfully complete the task (Morain & Swarts, 2012; Van der Meij, 2014). Previewing the task may take the form of a tour of interface components and often includes an introduction to key vocabulary, concepts, and objects (Plaisant & Shneiderman, 2005; Van der Meij, 2014). The narrator should also clearly state the goal of the tutorial, explain what the learner can expect to achieve, and persuade learners that they will be successful in completing the task (Farkas, 1999, p. 47; Van der Meij, 2014; Morain & Swarts, 2012). This not only reassures learners, but also emphasizes that they are the focus of the instruction, which is a motivating factor as well (Morain & Swarts, 2012).

Guideline 3.3: Engage through personalization. According to the *personalization principle*, “people learn better from multimedia presentations when words are in conversational style rather than formal style” (Mayer, 2009, p. 242). The theoretical rationale behind the personalization principle is that learners are more likely to view the narrator as a conversational partner when they feel like the narrator is talking to them. As a result, learners will put more effort into trying to understand what the narrator is saying (Mayer, 2009).

Mayer (2009) also explains that according to the *voice principle*, “people learn more deeply when the words in a multimedia message are spoken by a friendly human voice rather than by a machine voice” (p. 255). In a review on video tutorials, Morain and Swarts (2012) also found that in effective videos, the narrators came across professionally and tended to speak clearly, conversationally, and enthusiastically without including too much humor. However, in average and poor videos, the narrators were disengaging by sounding monotonous, bored, sarcastic, or immature. Finally, Mayer and Moreno (2002) recommend creating a conversational style by adding first and second person pronouns (e.g., “I” and “you”) to the script.

Conclusion

By reviewing existing research, it is clear that video software tutorials are an increasingly popular form of multimedia for delivering online instructions (Giannakos, 2013; Van der Meij & Van der Meij, 2013; Van der Meij & Van der Meij, J., 2016). Screencasting technology is commonly used to record software demonstrations that explain a range of software-related tasks. Video software tutorials are both consumer generated and professionally produced by software companies and other professional organizations, and these tutorials are widely disseminated on a variety of websites, including popular video databases like YouTube that currently archive approximately 30,600,000 software tutorials (Van der Meij & Van der Meij, 2013).

However, despite their prevalence, there is no guarantee that all video software tutorials are designed according to best practices that are informed by research, or that they are effective in creating meaningful learning experiences. With all of the technology, content, and design choices to consider, it is important for designers to have access to guidelines that can guide them

through the conceptualization and production of effective video software tutorials; fortunately, during the last decade, several sets of guidelines have been published.

Individually, the sets of guidelines created by Plaisant and Shneiderman (2005), Morain and Swarts (2012), and Van der Meij and Van der Meij (2013) for designing effective video software tutorials appear to be thorough. However, when viewing each set of guidelines in relation to one another, there are several differences in content and organization that may cause confusion to designers of video software tutorials; this confusion may result in a lack of confidence in the comprehensiveness of any of the existing guidelines.

In addition, universal usability recommendations for designing video software tutorials that are accessible for learners of all abilities are not fully addressed in Plaisant and Shneiderman's (2005) guidelines, and neither Morain and Swarts (2012) nor Van der Meij and Van der Meij (2013) explicitly address universal usability. By neglecting to provide thorough recommendations for designing universally usable video software tutorials, authors of the existing sets of guidelines are ignoring an important segment of the population and potentially contributing to the existence of a digital divide (Oud, 2016).

This paper attempts to reconcile the differences in existing guidelines by combining and reorganizing all of the content into eighteen distinct guidelines that fall into three major categories: (1) accessibility, (2) cognitive design, and (3) affective design. Also included is a more robust guideline providing recommendations on how to make video tutorials universally usable for learners of all abilities.

While all of the reorganized guidelines described in this paper are based on existing guidelines that are a product of research in the fields of instructional design, technical communication, educational psychology, and cognitive science, it is recommended that the

effectiveness of the new organizational structure be tested in future research. Testing can take place in a couple different ways: (1) the guidelines can be used by video software tutorial designers as they work through the process of conceptualizing and producing video software tutorials, and (2) the guidelines can be used by researchers to analyze the effectiveness of existing video software tutorials. Future research and analyses of the reorganized guidelines will determine what, if any, changes need to be made to guarantee that designers have a reliable resource to consult.

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Resource Guide for Teaching Technical Writing

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Teaching Philosophy

Although my teaching experience is limited, I have taught some visual communication courses as a graduate teaching assistant and as an adjunct instructor. I also have several years of experience managing and training undergraduate students in a collegiate recreation and wellness marketing office. When teaching students, I focus on helping them develop subject-specific technical skills, but what I consider even more important is helping students develop problem solving skills and life-long learning skills that they can apply in the workplace.

At first glance, technical writing and visual communication seem like two completely different subjects, but I have learned during the course of my studies that they actually have quite a bit in common. Although the tools and techniques are different, both disciplines center on the production of media that communicate specific messages to targeted audiences. I have found through my academic studies and work experience that problem analysis is key to producing effective communication products in the most efficient way possible, and I share what I have learned with the students I teach. I emphasize that the first steps to any project are to analyze the problem or the goal of the project and to analyze the target audience. Without fully understanding what needs to be achieved, it is counterproductive to produce anything. However, by understanding exactly what needs to be communicated and to whom, the resulting products are much more effective.

I recently taught a visual communication technology course called Problem Solving for Visual Media, and although I was restricted on the types of projects I could assign students, I was not restricted in how the assignments were formatted. To prepare students for the type of work they would be creating in the workplace, I situated the assignments in realistic contexts. I addressed students as employees for various types of companies and presented them with specific projects to complete that each had different communication goals, audiences, and media considerations. I also added an extra layer of analysis to each assignment to encourage students to view problem solving as a process that should guide all production decisions. To help students think through each assignment, I required a written analysis of the project goal(s), intended audience(s), budget and media considerations, and initial design plans before allowing them to start any design work. I also required students to submit a brief reflection with their final submissions that explained the rationale behind any changes in their design plans and how effective they thought their projects were in fulfilling the project goal(s) and targeting the intended audience(s). These exercises helped students learn how to view problem solving as a process that can guide project decisions, making the actual production process more effective and efficient.

When evaluating assignments, I placed myself in the position of the employers and the audiences, and provided detailed feedback to help students understand how successful they were in fulfilling assignment requirements and producing work that met the needs of the employers and audiences. Class critiques and peer evaluations were also central in helping students gain additional feedback from other perspectives besides my own. By learning how to provide constructive criticism, students also learned how to critique their own work and accept criticism. In addition, they learned how to anticipate how others will understand and judge their work, and gained the ability to factor in these additional considerations in project planning stages.

Another method I used to help students learn problem solving skills was to guide them in learning how to find solutions without my help. While I always made myself available to answer questions and provide advice, I strongly believed that many questions could be answered by the students themselves

with help from each other and through research. Therefore, I encouraged students to communicate with their peers and to consult each other as well as the Internet for help and advice before asking me. If students did turn to me first, I oftentimes responded by asking them a series of questions until they arrived at a conclusion on their own. This helped students understand that a superior such as an instructor or supervisor will not always be able to answer all of their questions, and that it is important to be able to arrive at solutions independently. Oftentimes some students felt uncomfortable solving problems and making decisions independently. However, with some time and practice, I could see a transformation in both their attitude toward learning as well as their method of learning. Students became excited when they found answers and learned new techniques on their own. I believe that by asking students to think through their questions and find solutions on their own, they gained confidence, problem solving skills, and life-long learning skills that are critical to being successful in the workplace.

Curricular Objectives

The following curricular objectives are for an introductory technical writing course.

- Understand the elements and functions of the primary genres of technical communication.
- Produce professional caliber technical documents that are accessible and reader-centered.
- Learn to analyze specific audiences, purposes, and uses and adapt writing techniques.
- Learn problem-solving skills through research and analysis and how to communicate solutions through technical documents.
- Develop an awareness of the role of ethics in technical communication.
- Develop teamwork and collaborative skills.
- Understand and appreciate internationally and culturally diverse styles of written communication, and learn how to communicate effectively and ethically with diverse audiences.
- Develop an awareness of online sources of technical communication.
- Improve grammar, mechanics, and writing style.
- Learn elements of document design and how to design and integrate visuals in technical documents.

Course Syllabus

ENG 1010 – Introduction to Technical Communication

Course Meeting Times

Tuesdays and Thursdays from 1:00 PM – 2:30 PM

Course Overview

This course is an introduction to the principles and procedures of technical communication. It is designed to help students develop skills necessary to produce clear, concise, and effective workplace documents in a variety of real-world professional contexts. Students will learn how to analyze audience and purpose, organize information, and prepare such technical documents as letters and memos, job application materials, technical definitions, technical descriptions, instructions, proposals, reports, and oral presentations. Students will write both individually and collaboratively in teams throughout the semester.

Course Objectives

- Understand the elements and functions of the primary genres of technical communication.
- Produce professional caliber technical documents that are accessible and reader-centered.
- Learn to analyze specific audiences, purposes, and uses and adapt writing techniques.
- Learn problem-solving skills through research and analysis and how to communicate solutions through technical documents.
- Develop an awareness of the role of ethics in technical communication.
- Develop teamwork and collaborative skills.
- Understand and appreciate internationally and culturally diverse styles of written communication, and learn how to communicate effectively and ethically with diverse audiences.
- Develop an awareness of online sources of technical communication.
- Improve grammar, mechanics, and writing style.
- Learn elements of document design and how to design and integrate visuals in technical documents.

Required Texts and Technologies

- *Technical Communication*, 14th Edition by John M. Lannon and Laura J. Gurak, 2014
- Access to a computer outside of class meeting times
- Access to Microsoft Word, Excel, and PowerPoint outside of class meeting times

Grading

Students are required to complete a series of assignments and projects and publish them to the Canvas course shell. There will also be a midterm exam and final exam.

Course grades will be determined using the following criteria:

	A	B	C	D	F
Assignment Requirements	Fully understood and addressed all aspects of the assignment – went beyond the minimum assignment requirements	Understood the assignment and addressed all required aspects of the assignment	Reasonable understanding of the assignment – visible effort to fulfill all assignment requirements	Flawed understanding of the assignment – less than half of assignment requirements not fulfilled	Clear that the assignment was not understood – more than half of the assignment requirements not fulfilled
Mechanics, Grammar, and Spelling	Free of most mechanical, grammatical, and spelling errors	May have some mechanical, grammatical, and/or spelling errors	Adequate level of mechanical, grammatical, and/or spelling competence	High number of mechanical, grammatical, and/or spelling errors	Very high number of mechanical, grammatical, and/or spelling errors
Presentation and Style	Professional presentation and style	Semi-professional presentation and style	Adequate presentation and style	Some flaws in presentation and style	Inadequate presentation and style

Course Schedule (Fall 2016 T/R)

Class Week/Day	Topic	Class Activities	Homework
Week 1 Tuesday, August 23	Introductions	<ul style="list-style-type: none"> Course Intro & Syllabus Review Student Introduction Activity 	<ul style="list-style-type: none"> Read Chapter 1 “Introduction to Technical Communication” pp. 2-14 Review Part 5 “Resources for Technical Writers” pp. 629-687
Week 1 Thursday, August 25	Defining Technical Communication	<ul style="list-style-type: none"> Lecture: Introduction to Technical Communication 	<ul style="list-style-type: none"> Read Chapter 2 “Meeting the Needs of Specific

		<ul style="list-style-type: none"> • Discussion of the resources available in Part 5 of the textbook • In-class group activity 	Audiences” pp. 15-32
Week 2 Tuesday, August 30	Audience Analysis	<ul style="list-style-type: none"> • Lecture: Audience Analysis • Website audience analysis in-class activity on p. 32 	<ul style="list-style-type: none"> • Read Chapter 3 “Persuading Your Audience” pp. 33-58 for Sept. 1 • Complete in-class audience analysis activity – submit Sept. 1
Week 2 Thursday, September 1	Audience Persuasion	<ul style="list-style-type: none"> • Lecture: Audience Persuasion • Small group activity on p. 58 – due at the end of class 	<ul style="list-style-type: none"> • Read Chapter 15 “Workplace Memos and Letters” pp. 323-366 • Complete Global Project 1 on p. 58 – submit written summary Sept. 6
Week 3 Tuesday, September 6	Memos and Letters	<ul style="list-style-type: none"> • Lecture: How to Write Memos and Letters • Students complete question 5 a-h on p. 365 during class • In-class discussion of student answers 	<ul style="list-style-type: none"> • Read Chapter 4 “Weighing the Ethical Issues” pp. 59-79 • Complete question 1 on p. 366 individually – submit memo Sept. 8
Week 3 Thursday, September 8	Ethical Issues in Technical Communication	<ul style="list-style-type: none"> • Lecture: Ethics • Class discussion of case on p. 69 and case provided by instructor 	<ul style="list-style-type: none"> • Multiculturalism reading TBA • Complete Digital and Social Media Project on p. 79 – submit memo Sept. 13
Week 4 Tuesday, September 13			<ul style="list-style-type: none"> • Read Chapter 5 “Teamwork and

	Multiculturalism in Technical Communication	<ul style="list-style-type: none"> • Lecture: Multicultural and Transcultural (hybrid) Audiences • Introduce and provide class time to begin work on multiculturalism assignment 	<p>Global Considerations” pp. 80-100</p> <ul style="list-style-type: none"> • Work on multiculturalism assignment – submit Sept. 20
Week 4 Thursday, September 15	Teamwork and Global Considerations	<ul style="list-style-type: none"> • Lecture: Teamwork and Global Considerations • In-class teamwork activity 	<ul style="list-style-type: none"> • Read Chapter 6 “An Overview of the Technical Writing Process” pp. 101-118 • Complete multiculturalism assignment – submit Sept. 20
Week 5 Tuesday, September 20	Overview of Technical Writing Process	<ul style="list-style-type: none"> • Lecture: Technical Writing Process • In-class activity 	<ul style="list-style-type: none"> • Read Chapter 10 “Organizing for Readers” pp. 184-200 • Read Chapter 11 “Editing for a Professional Style and Tone” pp. 201-235
Week 5 Thursday, September 22	Organizing and Editing Information	<ul style="list-style-type: none"> • Lecture: Organizing and Editing Information • In-class activity 	<ul style="list-style-type: none"> • Read Chapter 16 “Assessing Your Skills and Aptitudes” and “Researching the Job Market pp. 367-371
Week 6 Tuesday, September 27	Skills Analysis and Job Searching	<ul style="list-style-type: none"> • Introduce unit on job application materials • Lecture: Skills Analysis • In-class time to work on skills analysis • Review job searching techniques 	<ul style="list-style-type: none"> • Read Chapter 16 “Resumes” pp. 371-377 • Complete skills analysis – submit Sept. 29 • Locate job posting – submit Sept. 29

		<ul style="list-style-type: none"> In-class time to work on job search 	
Week 6 Thursday, September 29	Online Resumes	<ul style="list-style-type: none"> Lecture: Online resumes and creating a LinkedIn profile In-class time to work on LinkedIn profile 	<ul style="list-style-type: none"> Review Chapter 16 "Resumes" pp. 371-377 Read Chapter 13 "Designing Pages and Documents" pp. 282-306 Complete LinkedIn profile – submit Oct. 4
Week 7 Tuesday, October 4	Document Design and Targeted Resumes	<ul style="list-style-type: none"> Lecture: Writing targeted resumes and tips for document design and typography Demo: Document formatting in Microsoft Word In-class time to work on resume 	<ul style="list-style-type: none"> Read "Application Letters" pp. 378-383 Complete Resume – submit Oct. 6
Week 7 Thursday, October 6	Application Letters	<ul style="list-style-type: none"> Lecture: Writing application letters In-class time to work on solicited application letter 	<ul style="list-style-type: none"> Read "Interviews and Follow-Up Letters" pp. 386-391 Complete Solicited Application Letter – submit Oct. 13
Week 8 Tuesday, October 11	NO CLASS – Fall Break		
Week 8 Thursday, October 13	Follow-Up Letters	<ul style="list-style-type: none"> Lecture: Writing follow-up letters In-class time to write follow-up letter – due at end of class 	<ul style="list-style-type: none"> Complete job application packet – submit Oct. 18

		<ul style="list-style-type: none"> Review requirements for job application packet 	
Week 9 Tuesday, October 18	Midterm Exam Review	<ul style="list-style-type: none"> Review for midterm exam 	<ul style="list-style-type: none"> Study for midterm exam
Week 9 Thursday, October 20	Midterm Exam	<ul style="list-style-type: none"> Take midterm exam 	<ul style="list-style-type: none"> Read Chapter 7 "Thinking Critically about the Research Process" pp. 120-146 Read Chapter 8 "Evaluating and Interpreting Information" pp. 147-167 Read Chapter 9 "Summarizing Research Findings and Other Information" pp. 168-181
Week 10 Tuesday, October 25	The Research Process	<ul style="list-style-type: none"> Lecture: The research process 	<ul style="list-style-type: none"> Read Chapter 12 "Designing Visual Information" pp. 236-281 Complete Digital and Social Media project research and memo on p. 167 – submit Oct. 27
Week 10 Thursday, October 27	Communicating Visually	<ul style="list-style-type: none"> Lecture: How to communicate visually Demo: Creating tables, graphs, and charts using Microsoft Word and Excel 	<ul style="list-style-type: none"> Read Chapter 17 "Technical Definitions" pp. 394-412 Complete questions 1-6 – submit Nov. 1

<p>Week 11 Tuesday, November 1</p>	<p>Technical Definitions</p>	<ul style="list-style-type: none"> • Lecture: Technical definitions • Introduce product development documentation assignment (technical definition, technical description, instructions, and memo) • In-class time to choose topics and work on technical definition 	<ul style="list-style-type: none"> • Read Chapter 18 “Technical Descriptions, Specifications, and Marketing Materials” pp. 413-438 • Complete technical definition – submit Nov. 3
<p>Week 11 Thursday, November 3</p>	<p>Technical Descriptions and Specifications</p>	<ul style="list-style-type: none"> • Lecture: Technical descriptions and specifications • In-class time to work on technical description 	<ul style="list-style-type: none"> • Read Chapter 19 “Instructions and Procedures” pp. 439-470 • Complete technical description – submit Nov. 8
<p>Week 12 Tuesday, November 8</p>	<p>Instructions and Procedures</p>	<ul style="list-style-type: none"> • Lecture: Instructions and procedures • In-class time to work on instructions 	<ul style="list-style-type: none"> • Read Chapter 20 “Informal Reports” pp. 471- • Complete instructions – submit Nov. 10
<p>Week 12 Thursday, November 10</p>	<p>Informal Reports</p>	<ul style="list-style-type: none"> • Lecture: Informal reports • Introduce major group project – writing a formal analytical report • Introduce extra credit assignment – writing meeting minutes (due by Dec. 8) 	<ul style="list-style-type: none"> • Read Chapter 21 “Formal Analytical Reports” pp. 492-535 • Complete product development documentation memo; revise product development documents; compile all 4 pieces

			into single document – submit Nov. 15
Week 13 Tuesday, November 15	Formal Analytical Reports	<ul style="list-style-type: none"> Lecture: Formal analytical reports” Introduce major group project – students form small groups in class and begin discussing topic 	<ul style="list-style-type: none"> Read Chapter 22 “Proposals” pp. 536-570
Week 13 Thursday, November 17	Proposals	<ul style="list-style-type: none"> Lecture: Proposals In-class group work on project topic proposal 	<ul style="list-style-type: none"> Complete proposals – submit Nov. 22
Week 14 Tuesday, November 22	Work on Group Projects	<ul style="list-style-type: none"> In-class time to work on group project 	<ul style="list-style-type: none"> Work on group project
Week 14 Thursday, November 24	Work on Group Projects	<ul style="list-style-type: none"> In-class time to work on group project 	<ul style="list-style-type: none"> Read Chapter 23 “Oral Presentations and Video Conferencing” pp. 572-601 Complete group project rough draft – Submit Nov. 29
Week 15 Tuesday, November 29	Creating Oral Presentations	<ul style="list-style-type: none"> Lecture: Oral presentations Demo: Microsoft PowerPoint In-class time to work on group project and presentation 	<ul style="list-style-type: none"> Work on group project and presentation
Week 15 Thursday, December 1	Work on Group Projects	<ul style="list-style-type: none"> In-class time to work on group project 	<ul style="list-style-type: none"> Complete group project, presentation, and member

			evaluations – submit Dec. 6
Week 16 Tuesday, December 6	Project Presentations	<ul style="list-style-type: none"> • Project presentations 	<ul style="list-style-type: none"> • No Homework
Week 16 Thursday, December 8	Project Presentations and Final Exam Review	<ul style="list-style-type: none"> • Project presentations • Review for final exam 	<ul style="list-style-type: none"> • Study for final exam • Last day to submit extra credit assignment
Week 17 Exam Week	Final Exam		

5-Day Lesson Plan

Course: Introduction to Technical Communication (undergraduate level)
2 classes/3 hours per week

Unit: Job Application Materials

Lesson Plan 1: Creating a Skills Analysis and Performing a Job Search	
Objectives	<ul style="list-style-type: none"> • Learn how to complete a skills analysis • Learn how to perform a job search
Time	<ul style="list-style-type: none"> • 1.5 hours (1 class period)
Materials	<ul style="list-style-type: none"> • Computer lab • Students should have read pp. 367-371 (“Assessing Your Skills and Aptitudes” and “Researching the Job Market”) in <i>Technical Communication</i> by Lannon and Gurak for homework • Skills analysis handout and provided by instructor
Announcements	<ul style="list-style-type: none"> • Ask students to submit any homework that is due from the previous class
Connection to Course Goals	<ul style="list-style-type: none"> • Teaches students how to create a skills analysis and perform online job searches
Introduction	<ul style="list-style-type: none"> • Introduce the unit on job application materials • Provide an overview of the items students will be including in their job application packets during the next 5 classes <ul style="list-style-type: none"> ○ Skills Analysis ○ Job Posting ○ LinkedIn Profile ○ Resume (Chronological or Functional) ○ Solicited Application Letter ○ Thank You Follow-Up Letter
Procedures	<ol style="list-style-type: none"> 1. Lecture on skills analysis – provide students with a skills analysis handout (15 min) <ul style="list-style-type: none"> • Explain how the skills analysis will help students search for job postings and write their job application materials • Emphasize honesty when listing skills 2. Provide students with time to work on their skills analysis (20 min) <ul style="list-style-type: none"> • Encourage students to brainstorm with each other • Circulate the room answering questions and offering advice

	<ol style="list-style-type: none"> 3. Ask volunteers to share some of their items with the class (10 min) 4. Review job searching techniques (15 min) <ul style="list-style-type: none"> • Research industries of interest • Explore online resources (job portals, LinkedIn, etc.) • Networking 5. Have students perform a job search during the remaining class time (20 min) <ul style="list-style-type: none"> • Circulate the room answering questions and offering advice • Encourage students to communicate and share ideas
Conclusion	<ul style="list-style-type: none"> • Briefly summarize content covered • Review skills analysis and job posting homework assignments and assigned reading; answer questions
Homework	<ul style="list-style-type: none"> • Submit completed skills analysis at the start of next class (bring extra copy for in-class use) • Submit job posting at the start of next class (bring extra copy for in-class use) • Read pp. 371-377 (“Resumes”) in <i>Technical Communication</i> by Lannon and Gurak

Lesson Plan 2: Composing a LinkedIn Profile	
Objectives	<ul style="list-style-type: none"> • Learn the benefits of having an online resume • Learn how to write a professional LinkedIn profile
Time	<ul style="list-style-type: none"> • 1.5 hours (1 class period)
Materials	<ul style="list-style-type: none"> • Computer lab • Students should have read pp. 371-377 (“Resumes”) in <i>Technical Communication</i> by Lannon and Gurak for homework • LinkedIn profile handout and checklist provided by instructor
Announcements	<ul style="list-style-type: none"> • Ask students to submit their skills analysis and job posting and to retain a second copy of each item for themselves
Connection to Course Goals	<ul style="list-style-type: none"> • Teaches students how to choose, write, and format information for a digital resume
Introduction	<ul style="list-style-type: none"> • Explain how a LinkedIn profile is a digital resume that can showcase all of a students’ skills and achievements and help students network with other professionals in their field

Procedures	<ol style="list-style-type: none"> 1. Lecture on LinkedIn – distribute LinkedIn profile handout and checklist (40 min) <ul style="list-style-type: none"> • Explain benefits and limitations of LinkedIn • Review and provide advice on completing each of the following categories: <ul style="list-style-type: none"> • Basic Info – Name, Title, URL, Contact Info • Photograph • Summary • Experience • Education • Skills and Endorsements • Courses • Honors and Awards • Organizations • Volunteer • Additional Info • Visuals • Emphasize the importance of including items that match criteria listed on job postings located during the previous class • Provide advice on how to add connections and what type of connections to seek/accept • Review privacy settings • Emphasize importance of correct spelling, grammar, and punctuation and consistent style • Emphasize importance of honesty 2. Provide the remaining class time for students to create a LinkedIn account (if necessary) and add information to their profiles (40 min) <ul style="list-style-type: none"> • Circulate the room answering questions and offering advice • Encourage students to communicate and share ideas • Encourage students to add each other as connections after completing their profile
Conclusion	<ul style="list-style-type: none"> • Briefly summarize content covered • Review LinkedIn profile homework assignment and assigned reading; answer questions
Homework	<ul style="list-style-type: none"> • Submit printed copy of completed LinkedIn profile at the start of next class (bring extra copy for in-class use) • Review pp. 371-377 (“Resumes”) in <i>Technical Communication</i> by Lannon and Gurak

Lesson Plan 3: Writing a Resume	
Objectives	<ul style="list-style-type: none"> • Learn how to target information from a skills analysis and LinkedIn profile in a resume that is tailored to a specific job posting • Learn how to apply principles of design in a resume format to create a layout that is visually pleasing, accessible, and professional
Time	<ul style="list-style-type: none"> • 1.5 hours (1 class period)
Materials	<ul style="list-style-type: none"> • Computer lab • Students should have reviewed pp. 371-377 (“Resumes”) in <i>Technical Communication</i> by Lannon and Gurak for homework • Resumes Checklist p. 391 in <i>Technical Communication</i> by Lannon and Gurak • Functional resumes handout and checklist provided by instructor
Announcements	<ul style="list-style-type: none"> • Ask students to submit their printed LinkedIn profile and to retain a second copy for themselves
Connection to Course Goals	<ul style="list-style-type: none"> • Teaches students how to write and format chronological and functional resumes and target information to a specific audience and job posting
Introduction	<ul style="list-style-type: none"> • Explain how a resume submitted to an employer is more targeted to a specific job than a LinkedIn profile; students should be selective about what content to include on a resume and base their decisions on specific job postings
Procedures	<ol style="list-style-type: none"> 1. Lecture on resumes – distribute resume handout and checklist (40 min) <ul style="list-style-type: none"> • Discuss the differences between chronological resumes and functional resumes • Define the following categories included in a chronological resume: <ul style="list-style-type: none"> • Heading – name and contact information • Career objectives • Education • Employment • Personal information • References • Define the following categories included in a functional resume <ul style="list-style-type: none"> • Heading – name and contact information • Career objectives • Skills • Education • Employment • Interests • References

	<ul style="list-style-type: none"> • Discuss importance of audience and job postings in selecting information to include • Review formatting and demonstrate various functions in Microsoft Word <ul style="list-style-type: none"> • Review principles of design from previous unit (alignment, proximity, contrast, repetition, balance, white space) • Name and contact information • Section headings and body font types, styles, and sizes • Use of bullets where appropriate • Consistency in design • Overall design appropriateness • Emphasize the importance of including items that match criteria listed on job postings • Emphasize importance of correct spelling, grammar, and punctuation and consistent style • Emphasize importance of honesty • Explain how to create PDF files and why a PDF file is better to submit online unless otherwise stated • Remind students to refer to the resume samples on pp. 374-375, resume guidelines on p. 376, and the resume checklist on p. 391 <p>2. Provide the remaining class time for students to work on their resume (40 min)</p> <ul style="list-style-type: none"> • Circulate the room answering questions and offering advice • Encourage students to communicate and share ideas
Conclusion	<ul style="list-style-type: none"> • Briefly summarize content covered • Review resume homework assignment and assigned reading; answer questions
Homework	<ul style="list-style-type: none"> • Submit printed copy of completed resume at the start of next class (bring extra copy for in-class use) • Read pp. 378-383 (“Application Letters”) in <i>Technical Communication</i> by Lannon and Gurak

Lesson Plan 4: Writing an Application Letter	
Objectives	<ul style="list-style-type: none"> • Learn how to write a solicited application letter that is tailored to a specific job posting and resume
Time	<ul style="list-style-type: none"> • 1.5 hours (1 class period)

Materials	<ul style="list-style-type: none"> • Computer lab • Students should have reviewed pp. 378-383 (“Application Letters”) in <i>Technical Communication</i> by Lannon and Gurak for homework • Application Letters Checklist p. 392 in <i>Technical Communication</i> by Lannon and Gurak • Application letters handout and checklist provided by instructor
Announcements	<ul style="list-style-type: none"> • Ask students to submit their resume and to retain a second copy for themselves
Connection to Course Goals	<ul style="list-style-type: none"> • Teaches students how to write and format an application letter in the style of a business letter and target information to a specific audience
Introduction	<ul style="list-style-type: none"> • Explain how an application letter’s main purpose is to describe how an applicant’s credentials and skills fit a particular job; application letters complement and explain the information in a resume
Procedures	<ol style="list-style-type: none"> 1. Lecture on application letters – distribute application letters handout and checklist (40 min) <ul style="list-style-type: none"> • Explain the difference between solicited and unsolicited application letters • Discuss importance of audience in writing an application letter • Discuss how to format a solicited application letter in a business letter style; refer to samples on pp. 379-380 as well as samples in the handout <ul style="list-style-type: none"> • Applicant’s contact information • Date • Employer’s contact information • Subject line • Salutation/greeting • Introduction <ul style="list-style-type: none"> • Identify yourself • Identify the desired position • Body <ul style="list-style-type: none"> • Provide rationale for hiring you • Outline qualifications and match them to specific criteria in the job posting <ul style="list-style-type: none"> • Expand on relevant information in the resume • Closing <ul style="list-style-type: none"> • Provide a call to action and include contact information • Signature • Enclosure <ul style="list-style-type: none"> • Indicate that the resume is included with the application letter • Emphasize the importance of discussing items that match criteria listed on job postings

	<ul style="list-style-type: none"> • Emphasize importance of correct spelling, grammar, and punctuation and consistent style • Emphasize importance of honesty • Explain how to create PDF files and why a PDF file is better to submit online unless otherwise stated • Remind students to refer to the application letters guidelines on pp. 381-382, and the application letters checklist on p. 392 <p>2. Provide the remaining class time for students to work on their solicited application letter (40 min)</p> <ul style="list-style-type: none"> • Circulate the room answering questions and offering advice • Encourage students to communicate and share ideas
Conclusion	<ul style="list-style-type: none"> • Briefly summarize content covered • Review application letter homework assignment and assigned reading; answer questions
Homework	<ul style="list-style-type: none"> • Submit printed copy of completed solicited application letter at the start of next class (bring extra copy for in-class use) • Read pp. 386-391 (“Interviews and Follow-Up Letters”) in <i>Technical Communication</i> by Lannon and Gurak • Bring an unused 2 pocket folder to the next class

Lesson Plan 5: Writing a Follow-Up Letter	
Objectives	<ul style="list-style-type: none"> • Learn how to write a follow-up letter
Time	<ul style="list-style-type: none"> • 1.5 hours (1 class period)
Materials	<ul style="list-style-type: none"> • Computer lab • Students should have reviewed pp. 386-391 (“Interviews and Follow-Up Letters”) in <i>Technical Communication</i> by Lannon and Gurak for homework • Follow-up letter examples on p. 389 in <i>Technical Communication</i> by Lannon and Gurak • Follow-up letters handout and checklist provided by instructor • Unused 2 pocket folder supplied by students
Announcements	<ul style="list-style-type: none"> • Ask students to submit their application letter and to retain a second copy for themselves
Connection to Course Goals	<ul style="list-style-type: none"> • Teaches students how to write and format handwritten and email follow-up letters

Introduction	<ul style="list-style-type: none"> • Explain how follow-up letters are often overlooked but important in making candidates look professional
Procedures	<ol style="list-style-type: none"> 1. Lecture on follow-up letters – distribute follow-up letters handout and checklist (25 min) <ul style="list-style-type: none"> • Explain the difference in purpose and content for thank you letters, acceptance letters, and refusal letters • Discuss importance of audience in writing a follow-up letter • Discuss how to format follow-up letters that are handwritten and emailed; review email etiquette • Emphasize importance of correct spelling, grammar, and punctuation and consistent style • Emphasize importance of honesty 2. Provide time for students to write a follow-up thank you letter – due at the end of class (30 min) <ul style="list-style-type: none"> • Circulate the room answering questions and offering advice • Encourage students to communicate and share ideas 3. Review the items required for the completed job application packet – hard copy due at the beginning of next class (10 min) <ul style="list-style-type: none"> • The following revised items are due in the 2 pocket folder in order: <ul style="list-style-type: none"> ○ Skills analysis ○ Job posting ○ LinkedIn Profile ○ Functional Resume ○ Solicited Application Letter ○ Thank You Follow-Up Letter 4. Any additional class time should be used to complete the follow-up letter and make revisions to previously submitted items based on instructor feedback and to print copies for the job application packet <ul style="list-style-type: none"> • Circulate the room answering questions and offering advice
Conclusion	<ul style="list-style-type: none"> • Briefly summarize content covered and state that this concludes the unit on job application materials • Review job application packet homework assignment and answer questions
Homework	<ul style="list-style-type: none"> • Submit completed job application packet in 2 pocket folder at beginning of next class

Resume Assignment and Rubric

Due: _____

Overview

Prospective employers want to know who you are and what you can do for them. Your resume is your first opportunity to quickly show that you have the skills and experience that employers are seeking to fill a specific position in their company. However, employers will likely spend less than a minute when initially viewing your resume, so it is critical that your resume makes the maximum impact by adhering to the following guidelines:

- **Target the content:** Include only information that is relevant to the position you are applying for. If employers are interested in knowing more about you, they will contact you for an interview.
- **Demonstrate professional writing skills:** Create a professional-looking resume by eliminating any mechanical, grammatical, and spelling errors. You need to show that you are a qualified candidate, and a resume that contains poorly formed sentences and any errors will not be taken seriously.
- **Create an effective layout:** Design your resume in a way that is visually pleasing and easy to read; follow the principles of design (alignment, proximity, contrast, repetition, balance, and white space) in your layout.
- **Represent yourself accurately:** It is critical that you are honest and only include information in your resume that is accurate so that employers are not misled.

By targeting your content, writing in a professional style that is free of errors, designing a visually pleasing layout, and accurately representing yourself, you will increase your chances of being selected for an interview.

Learning Outcomes

- Learn how to target information from your skills analysis and LinkedIn profile in a resume that is tailored to a specific job posting.
- Learn how to apply the principles of design in a resume format to create a layout that is visually pleasing, accessible, and professional.

Methods

To complete this assignment, you will write a single-page chronological or functional resume tailored to the specific job posting you have already located.

1. Determine if you will write a chronological or functional resume.
2. Organize your resume sections based on the type of resume you choose, and format your headings.

A chronological resume should include the following information (in order):

- a. **Heading** – prominently display your name and contact information at the top of the page (portfolio link optional)
- b. **Objective(s)** – write a career objective(s) that is specific and tailored to the job posting
- c. **Education** – include your school, location, degree, and expected date of graduation
- d. **Employment** – list most recent jobs first; include skills applied on the job that match skills listed on the job posting
- e. ***Personal Information (or other relevant title)** – include awards, skills, and activities that may be relevant to the job and show that you are a well-rounded candidate
- f. ***References** – either list the names and contact information of references or write “Available on request”

* optional category

A functional resume should include the following information (in order):

- a. **Heading** – prominently display your name and contact information at the top of the page (portfolio link optional)
- b. **Objective(s)** – write a career objective(s) that is specific and tailored to the job posting
- c. **Skills** – Emphasize 3 skill areas that are appropriate to the job and include specific headings for each area; include specific accomplishments in a bullet list format
- d. **Education** – include your school, location, degree, and expected date of graduation
- e. **Employment** – list most recent jobs first
- f. ***Personal Information (or other relevant title)** – include awards, skills, and activities that may be relevant to the job and show that you are a well-rounded candidate
- g. ***References** – either list the names and contact information of references or write “Available on request”

* optional category

3. Choose information from your skills analysis and LinkedIn profile to include in each section and format the text. Incorporate key words from the job posting into the language of your resume.
4. Review your resume and ensure that it meets all of the requirements outlined in the grading rubric (see below)
5. Present your resume and job posting to at least two other people for review to ensure that your resume is completely error-free.

6. Print two copies of your resume. Submit one copy at the beginning of class and retain the other copy for use in the application letter assignment.

Resume Assignment Grading Rubric	
<p>Content</p> <ul style="list-style-type: none"> • All required categories/content included • Content is suitable to the purpose and audience • Content is accurate, complete, and clear • Content is targeted to the job posting and includes key words used in the job posting 	____ / 10
<p>Organization</p> <ul style="list-style-type: none"> • Sections are organized in the correct order (according to the type of resume chosen – chronological or functional) • Organization is suitable to the purpose and audience • Correct headings used for each section • Content is appropriately grouped under the correct headings 	____ / 10
<p>Layout Design</p> <ul style="list-style-type: none"> • Layout makes content easy to access and read • Layout is suitable to the purpose and audience • Layout incorporates the principles of design (alignment, proximity, contrast, repetition, balance, and white space) • Font types, styles, sizes, and colors are consistent throughout all headings and body text • Bulleted lists used where appropriate 	____ / 10
<p>Style, Spelling, Punctuation, Grammar</p> <ul style="list-style-type: none"> • Style is appropriate to the purpose and audience and consistent throughout • Correct use of verb tenses • Strong action verbs used • Free of spelling, punctuation and grammatical errors 	____ / 10
<p>Total</p>	____ / 40

Multicultural Website Comparison Assignment and Rubric

Due: _____

Overview

Due to the effects of globalization, people from different cultures are coming into contact with each other physically and digitally on an unprecedented scale. You will undoubtedly encounter multicultural situations in the workplace whether you are working with coworkers or clients from a different culture or developing documentation for audiences from different cultures.

In order to communicate effectively across cultures, it is critical to develop an awareness of multicultural issues that relate to technical communication. This assignment requires you to review several different websites to gain insight as to how content is presented differently depending on the target culture.

Learning Outcomes

- Develop a sensitivity to the cultural influences that affect how information is communicated
- Develop an awareness of transcultural communication practices that result in hybrid document and website design elements

Methods

To complete this assignment, you will be comparing and contrasting three different websites to determine the cultural influences on the content and design choices. You will write your findings and analysis in a memo.

1. Select a company that operates or sells products/services in the United States and at least one other country located on a different continent.
2. Locate the website of a company that markets products or services to the US (Website A).
3. Locate the website of a foreign branch of the same company that markets the same products or services to a country or region on a different continent (Website B).
4. Compare and contrast the homepages and at least one other page of two websites for the following:
 - Use of color: How are colors used in the two websites? What meaning can you infer from the colors used?
 - Layout: Are there differences in layout? What are those differences?
 - White Space: Do either of the websites include white space? If so, how much?
 - Navigation: How does the navigation compare between the two websites?
 - Textual Content: How much text is shown? What type of font is used? Describe the different hierarchies of text (headings, subheadings, body text, call out text, etc.)
 - Language: What languages are available on the websites? Does changing the language also change other elements of the pages?

- Images: How many images are shown? How are the images similar/different? How are people portrayed in images? What nationalities do people appear to be? Do the images represent specific locations and cultural elements or are they more global in nature?
 - Any other aspects you might think of
5. Locate the website of a completely different company that *only* operates in the foreign country or region of the world that developed Website B in the first part of this assignment (Website C). It is preferable that the company operates in the same industry or a similar industry.
 6. Compare Website C to the other two websites, paying close attention to the same criteria as before (use of color, layout, white space, navigation, textual content, language, images, etc.).
 7. In a memo describe the audience profiles for each website and the major similarities and differences between the three websites. Be sure to address all of the items outlined below. Use the same order in your memo.
 - a. Include the following information in a description of each website:
 - Website addresses
 - Company names
 - Geographic locations
 - Products manufactured/sold or services provided as well as the industry
 - Describe the intended audience of each of the websites
 - Screenshots of all pages reviewed with titles and captions containing brief descriptions of the pages' contents and purposes
 - b. Compare and contrast at least 3 of the following aspects of each website and explain how they appeal to the culture of the target audience:
 - Use of color
 - Layout
 - White space
 - Navigation
 - Textual content
 - Language
 - Images
 - Anything else you analyzed
 8. Discuss what might explain the similarities/differences you found between the 3 websites.
 9. Explain any evidence of a blurring of cultures or if all the websites display only culturally distinct characteristics.
 10. How do your findings impact the decisions technical communicators and web designers make when choosing content and designing websites for companies that operate on a global or regional scale?
 11. Cite any references used to support your analysis in a "References" section on your memo.

Multicultural Website Comparison Assignment Grading Rubric	
<p>Content</p> <ul style="list-style-type: none"> • All required content and analyses included • Content is suitable to the purpose and audience • Content is organized in the correct order according to the assignment requirements • Content and analyses are accurate, complete, clear, and concise 	____ / 10
<p>Layout</p> <ul style="list-style-type: none"> • Document is written in a memo format • Content is organized in the correct order according to the assignment requirements • Layout makes content easy to access and read • Font types, styles, and sizes are consistent throughout all headings and body text • All images contain titles and captions 	____ / 10
<p>Style, Spelling, Punctuation, Grammar</p> <ul style="list-style-type: none"> • Style is appropriate to the purpose and audience and consistent throughout • Free of spelling, punctuation and grammatical errors 	____ / 10
Total	____ / 30