A TAXONOMY OF VISUALS IN SCIENCE COMMUNICATION

1990
1995
2000
2005
2010
2015

- **VISUAL ARGUMENTS IN TECHNICAL HANDOUTS**

- **COLOR AS TRUSTWORTHINESS CUE IN WEB SITES**

Simplify the Way You Create, Collaborate, & Publish

Doc·To·Help®

Download Free Trial at:
www.doctohelp.com/simplify

Society for Technical Communication

What is a technical communicator? Technical communicators develop and design instructional and informational tools needed to ensure safe, appropriate, and effective use of science and technology, intellectual property, and manufactured products and services. Technical communicators combine multimedia knowledge and strong communication skills with technical expertise to provide education across the entire spectrum of users' abilities, technical experience, and visual and auditory capabilities. For more information visit www.stc.org/story/tc_tw.asp.

The Society for Technical Communication is the largest association of technical communicators in the world. STC is currently classifying the Body of Knowledge for the field and communicating the value of technical communication. Its volunteer leadership continues to work with government bodies and standards organizations to increase awareness and accurate perception of technical communication. Membership is open to all with an interest in technical communication. Visit the STC Web site (www.stc.org) for details on membership categories, fees, and benefits.

INDEX TO ADVERTISERS

Technical
COMMUNICATION

Journal of the Society for Technical Communication

MAY 2011

DEPARTMENTS

INSTRUCTIONS FOR AUTHORS

About the Journal

Technical Communication is a peer-reviewed, quarterly journal published by the Society for Technical Communication (STC). It is aimed at an audience of technical communication practitioners and academics. The journal's goal is to contribute to the body of knowledge of the field of technical communication from a multidisciplinary perspective, with special emphasis on the combination of academic rigor and practical relevance.

Technical Communication publishes articles in five categories:

- **Applied research** – reports of practically relevant (empirical or analytical) research
- **Applied theory** – original contributions to technical communication theory
- **Case history** – reports on solutions to technical communication problems
- **Tutorial** – instructions on processes or procedures that respond to new developments, insights, laws, standards, requirements, or technologies
- **Bibliography** – reviews of relevant research or bibliographic essays

The purpose of *Technical Communication* is to inform, not impress. Write in a clear, informal style, avoiding jargon and acronyms. Use the first person and active voice. Avoid language that might be considered sexist, and write with the journal's international audience in mind.

Our authority on spelling and usage is *The American Heritage Dictionary,* 4th edition; on punctuation, format, and citation style, the *Publication Manual of the American Psychological Association*, 6th edition.

Manuscript Preparation and Submission

Submitting a manuscript to *Technical Communication* for review and possible publication implies that its submission has been approved by all authors, researchers, and/or organizations involved, that the manuscript (or a substantial portion) has not been published before, and that the manuscript is not under review elsewhere.

When using previously published materials (for example, images or text excerpts), authors are responsible for obtaining the permissions needed to reprint copyrighted materials.

The typical article length is between 5,000 and 8,000 words. Exceptions are possible.

Use up to three levels of headings, and indicate them clearly. Do not number headings of sections and subsections.

FIRST-LEVEL HEADING

(all caps, on a line by itself)

Second-level heading

(first word only capitalized, bold, on a line by itself)

Third-level heading (first word only capitalized, bold, followed by two spaces, as part of the first line of the paragraph)

Except for the cover page, remove all identifying information from the manuscript. This includes author names, author affiliations, acknowledgments, and references to work in progress or unpublished manuscripts.

Do not use footnotes. Instead, use author-date citations within the text, and provide a complete list of works cited (labeled "References"). Avoid multiple citations for ideas or approaches unless they demonstrate an evolution in thought or practice.

Check all author-date citations within the text and all entries in the reference list for both accuracy and conformance to the *Publication Manual of the American Psychological Association* (APA), pp. 169–224.

Submit your manuscript as a double-spaced electronic file with one-inch margins. Do not attempt to mimic the format or layout of a published article. Keep the layout as clean and simple as possible.

Microsoft Word files are preferred. If you use another word processor, a Rich Text Format (RTF) file is also acceptable. Organize your manuscript as follows:

- Page 1: Cover page – Title of the manuscript, a running head, and the names, affiliations, and contact info of all authors
- Page 2: Structured abstract – A summary of the article (maximum 250 words), using the headings "Purpose," "Method," "Results," and "Conclusion"
- Page 3: Up to five keywords and a practitioner's take-away (maximum 100 words) – A bulleted list summarizing the practical implications of the article
- Page 4: Start of the manuscript
- References
- Tables and figures – Start each table or figure on a new page.

Send the manuscript as an attachment to an e-mail message to the editor-in-chief, Menno de Jong (e-mail: TCEditor@gw.utwente.nl).

Review Process

The editor-in-chief will read your manuscript and check its potential suitability for the journal. In the case of a positive outcome, the manuscript will be sent to three independent referees for a double-masked review. On the basis of the referees' recommendations, the editor will send you a decision about the manuscript. There are five possibilities: (1) reject, (2) revise and resubmit, (3) accept with major revisions, (4) accept with minor revisions, and (5) accept as is.

Copyrights

The Society for Technical Communication requires that authors transfer copyrights to STC for articles appearing in *Technical Communication* and grant STC permission to post the articles on *Technical Communication Online* for an indefinite period. STC will grant colleges, universities, and libraries the right to use the articles free of charge for educational purposes.

Menno D.T. de Jong, Editor

Exploring the Borders of Technical Communication: Human-Computer Interaction

In my editorial of this year's February issue, I discussed the relationship between technical communication and corporate and organizational communication. It is not hard to distinguish the two disciplines from each other, but I hope to have demonstrated that they may fruitfully complement each other. In this editorial, I would like to explore the borders with a field much closer to home: human-computer interaction.

This is the perfect time for me to make this comparison, as I am just back home from attending two conferences: the ACM CHI Conference on Human Factors in Computing Systems in Vancouver, and STC's Technical Communication Summit in Sacramento. Both conferences were very informative and stimulating, and can be expected to more or less reflect the way the respective fields are developing.

Usability

An obvious area of overlap between the two disciplines is usability. Usability seems to have developed into a separate discipline, with its own association (Usability Professionals' Association) and its own journal (Journal of Usability Studies), but it has also remained one of the key concepts both in technical communication and in human-computer interaction.

I have noticed, however, that the link between technical communication and usability may not be clear to everyone. In the past half year I received questions from potential authors and reviewers about the suitability of manuscripts about usability for the journal. Apparently some academics and practitioners do not see usability as one of the central concepts of technical communication, or do not see technical communication as one of the leading disciplines when it comes to usability. They are wrong. In the interface between technology and people usability is by definition an essential concept, and many fruitful contributions to the discussion of usability and usability evaluation methods originate from the technical communication literature.

Essentially, the same developments in usability and usability evaluation methodology can be seen in technical communication and human-computer interaction. Think-aloud usability testing and heuristics are prominent evaluation approaches, although there is a growing interest in methodological research putting the current methods to the test. Scenario approaches and personas are increasingly used to optimize the usability of documents and interfaces. The benefits of

eye-tracking are explored in various directions.

A possible difference in approach involves the evaluation object. Compared to human-computer interaction, technical communication researchers pay more attention to the textual and visual content of applications. And of course, the evaluation of paper documents is also relevant within technical communication research. As such it also builds on the insights and methodology developed in the field of document design.

Technological Developments vs. Effective Use of Technology

A difference of emphasis can be found in the way technological developments are approached. In human-computer interaction, there is relatively much attention for the many different ways in which information and communication technologies can be used in human life. I was impressed by the variety of topics that are addressed nowadays by human-computer interaction researchers. Almost every aspect of human life (and death) can be linked to the present or future use of computers. Technical communication seems to focus less strongly on the frontiers of technological developments, and

more on the effective use of technology.

In addition, the attention for writing and editing and the professional orientation, which I also mentioned in my editorial about corporate and organizational communication, appear to be distinctive features of technical communication compared to human-computer interaction.

In this Issue

All three articles in this issue focus on issues of visual design. In the first article, Luc Desnoyers proposes a taxonomy of visuals in science communication. He argues that the terminology used for the various options to visualize information is ambiguous and therefore develops a more univocal system of possible visuals. In the second article, Chien-Ching Lee analyzes students' PowerPoint handouts, focusing on the quality of the visual information as such and in relation to the textual information. In the third article, Wouter Alberts and Thea van der Geest present the results of an empirical study into the effects of color on the perceived trustworthiness of corporate Web sites in three different sectors.

Frank R. Smith Outstanding Article Award 2010

Each year, an independent jury of three researchers and practitioners selects one outstanding article and up to three distinguished articles that appeared in *Technical Communication* during the previous calendar year. This year's jury members were Tom Warren (chair), Jeff Hibbard, and last year's winner, Han Yu.

The award honors the memory of Frank R. Smith, during whose 18 years as editor this journal became established as the flagship publication of STC and of the profession.

This year, the jury selected one outstanding article and two distinguished articles.

2010 Outstanding Article in *Technical Communication*

Tatiana Batova. Writing for the participants of international clinical trials: Law, ethics, and culture. (August 2010)

"For offering insightful discussion and lessons-learned regarding clinical trials across cultures; covering a region (Russia) and area (clinical trials) not much examined in current intercultural technical communication studies; and for raising serious issues that extend to all cross-cultural communication. Inclusion of future research needs is a positive, not only for academics but also for technical communication professionals. Very informative on a topic that is important both professionally and socially. Well written for the total STC audience with obvious and thorough scholarship and research."

2010 Distinguished Articles in *Technical Communication*

Nicole St. Germaine-McDamiel. Technical Communication in the health fields: Executive Order 13166 and its impact on translation and localization. (August 2010)

"For offering findings in intercultural health communication, an important area in intercultural technical communication, and for offering practitioners some best practices. An especially good model for those wanting to understand how government regulations influence technical communication."

Lisa Meloncon, Erin Haynes, Megan Varelmann, and Lisa Groh. Building a playground: General guidelines for creating educational Web sites for children. (November 2010)

"For offering useful and practical guidelines for developing web sites for children that fill a current gap in web site usability studies. The article shows rigorous and well distilled research with relevant examples and case reviews."

Toward a Taxonomy of Visuals in Science Communication

Luc Desnoyers

Abstract

Purpose: To develop and present a systematic, hierarchical taxonomy of visuals used in science communication, in order to facilitate analysis as well as selection and design of visuals.

Methods: Iterative analysis of commonly used visuals and existing typologies and selection of a classification system.

Results: A taxonomy is proposed based on Linnean principles, which distinguishes three classes of visuals based on their information and sign content; these are subdivided in orders and families. A systematic nomenclature is described.

Conclusions: Used successfully in training sessions and research, the taxonomy offers the basis for the development of comprehensive guidelines and improvements in the design and usage of visuals.

Keywords: visuals, taxonomy, denominations, science communication

Practitioner's takeaway

- Denominations of visuals used in science communication differ considerably among authors, resulting in confusion.
- The article presents a hierarchical classification and denominations based on the principles of a taxonomy developed in the natural sciences.
- Research conducted with this taxonomy shows how writers use specific types of visuals in different article genres.

- The taxonomy is currently used in training science graduates in communication.
- The taxonomy should help writers choose efficient visuals, analyze and criticize the actual use of visuals, compare results between researchers, and develop more comprehensive guidelines for the design of visuals.

The Problems with Visuals

As part of their research activity, scientists have to report on their findings and do so using mainly two different genres of communication media: papers published in periodicals and oral presentations given at conferences. For both media, scientists systematically rely on visuals to better convey part of the information they wish to transmit. Gross, Harmon, and Reidy (2002) have shown how much the use of visuals has increased in periodicals during the 20th century: they were present in 33% of papers in a sample dating from the first quarter of the century, and in 100% in the last quarter of century. Science writers in magazines and the press are also important producers and users of visuals, and although they use a different set of visuals (Jacobi, 1985; Miller, 1998) their use of visuals has also been growing. We have no data on the evolution of the use of visuals in conference presentations, but the successive development of slide and overhead projectors and the generalization

A Taxonomy of Visuals in Science Communication

in the use of electronic projectors has no doubt led to a tremendous increase in the use of visuals for "paper" presentations.

Visuals play a slightly different role in articles and conferences. Printed visuals usually include more information and tend to be more complex than projected visuals. This is in agreement with a simple fact: Printed visuals are autonomous entities that the readers can refer to and analyze separately from the text, at their own convenience, whereas projected visuals tend to be (or should be) less dense as they have to be looked at for a restricted time while the audio-spectators are simultaneously listening to the oral presentation. Yet in both instances, as Lemke (1998) pointed out, the visuals are attempts at using spatial, topological representations to convey information hardly deliverable with the linear affordances of written or oral speech, due to their complexity. Printed and projected visuals therefore have much in common.

Attempts have been made at studying the use of specific visuals in communication activities. The pioneering work in this area is probably that of Cleveland (1984), who was actually interested in detecting common errors and poor design in graphs. But Cleveland's work was also noticed because of his quantitative study on the use of different types of graphs in different disciplinary periodicals. Studies of this type have been infrequent. Also, a major obstacle encountered in analyzing and comparing the results of different authors is in the denominations used to distinguish types of visuals. All scientists and science communicators, for example, use the term "graph" and are probably confident they share a common definition of the term. Unfortunately, such is not the case. Cleveland (1984) defined graphs as figures that have scales and convey quantitative information, which included statistical maps. In his remarkable encyclopedic work, Harris (1999) defined graphs (or plots, which he considers a synonym) as one category of charts, as opposed to maps, diagrams, tables and "others" (proportional charts like pie charts, Venn diagrams, etc.); a graph is then "a chart that graphically displays quantitative relationships between two or more groups of information" (p. 164). Some authors preferred avoiding the general term "graph" and used specific denominations: the use of "bar charts" and "line charts" is reported by Busch-Lauer (1998), that of "bar graphs,"

"point graphs," "scatter plots," and "survival curves" by Cooper, Schrieger, and Close (2002). It may be a paradox that no author has included the graphs defined in the mathematical graph theory as a type of graph; these figures represent the links between entities and are used in the representation of all kinds of networks. Finally, it should be added that dictionaries are useless in this area, offering contradictory definitions of what is a graph, a chart, a plot, a diagram, and so on. Common denominations at times refer to more than one kind of visual, and a single type of visual frequently bears many different names, a situation defined as polysemic, and a source of confusion.

The most striking case of polysemy is probably that of the term "diagrams." For botanists, diagrams may be the schematic representations of plants; for the statistician, they may be the distribution of dots showing data in Cartesian space; for an engineer, they may be representations of the flow of matter in processes. Funkhouser (1937) defined as diagrams "all the various kinds of graphs, charts, lines and pictorial illustrations for the display and comparison of numerical data," (p. 365) which seems to exclude only maps and organigrams. In many fields, diagrams bear the name of their inventors, whatever their content: Venn's, Euler's, or Johnson's diagrams in logics, Watt's in thermodynamics, Feynman's in quantum physics, Gantt's in management, Hertzprung-Russel's in astrophysics, and the like. The denomination has also received consideration by semioticians analyzing the structure and contents of images. For example, Peirce (1978) defined as diagrams a category of icons expressing relations: he considers an algebraic formula a good example. Bertin (1973) used the term diagram to designate all types of representations, tables, or graphs that show relations between two sets of data, excluding maps, and he defined Peirce's diagrams as networks.

Denominations fare no better when considering representations of material entities: they are at times quite vague (picture, illustration), at times they refer to media (photograph, painting, line-art, etc.), or suggest the precision level of the image (sketch). Tables and bullet lists refer to specific alphanumeric visuals but the available terminology here again does not cover all types. Organigrams are either charts (e.g., flow charts) or diagrams (organizational diagrams), or trees.

Luc Desnoyers

This general lack of precision in the current denominations has deleterious consequences in many areas. The situation is similar in other languages and trying to translate these terms from English to French, for example, is a nightmare. Scientists and science writers looking for the right graph to produce can rely on different textbooks, but again, however excellent some may be, the terminology used by different authors varies, and the same is true for many of their recommendations. Speakers and authors are usually given guidelines for the design of visuals. Some periodicals have their own guidelines, but in most instances these are remarkably laconic as to visuals, even offering contradictory advice, as Schrieger, Arora, and Altman (2006) have shown for medical journals. Style manuals of professional groups like the often-referred-to American Psychological Association manual (2010) also present very limited guidance in graph design. Studies on the use of visuals, as discussed above, are extremely difficult to compare because authors refer to different and barely compatible classifications of visuals. A consensual glossary of visuals would facilitate the development of harmonized guidelines and therefore help students, scientists, and writers in the selection of appropriate graphs. It would be an efficient tool in the critical analysis of the actual use of visuals in publications and conferences.

A special consideration should be brought to the question of training future scientists and writers in communication, which does not attract much attention (Trumbo, 1999). Most scientists were scarcely exposed to formal training in the use of visuals and it is our experience that students resort to learning by doing and imitating what they read and see, for better or for worse. Students frequently rely on their self-acquired mastery of software like Microsoft Excel, which offers indiscriminate use of different types of awkwardly named visuals for any type of data. Studies conducted on visuals published in periodicals show a possible consequence of this: According to Cleveland (1984), 30% of visuals printed in *Science* had at least one error. The situation was described as "worse" in subsequent studies (e.g., Cooper, et al., 2002; Hartley, 1991; Krebs et al., 2001). There seems to be a definite need for more extensive and systematic training in this area.

Historical Perspective

Despite these ambiguities and the rampant polysemy of denominations, it seems few efforts have resulted in establishing order in this chaos. In his study on the history of science graphs, Funkhouser (1937) reported that one of the first attempts in the field was produced during the 1857 International Statistical Congress in Vienna. The proposed classification was then founded on the nature of data to be presented and not on the graphical form used. Funkhouser further mentioned that in 1877, G. von Mayr presented a report proposing to separate graphical formats under two classes; diagrams and maps, where data was represented by dots, lines, areas, and three-dimensional volumes. After lengthy discussions, it was discovered that the large variety of graphical formats made it impossible to agree on a universal classification. During the final part of the 19th century, as Costigan-Eades (1984) reported, some attempts at classifications were made using descriptive approaches, and others proposed a functional basis, but no significant progress was made. And the first half of the 20th century was marked by the development of new quantitative statistical tools, which was accompanied by a decreased interest in the graphical expression of data.

In 1937, Funkhouser defined only a dozen different graphical forms. Forty years later, Macdonald-Ross (1977) was following the same path, defining around 15 formats without attempting any classification, but presenting a critical synthesis of studies on their relative efficiency. In 1981, Levin published an often-referred-to study in which he proposed a general classification of images, with eight functional groups: images were used for "decoration, remuneration, motivation, reiteration, representation, organization, interpretation or transformation" (p. 212). Five categories of this classification (decorative, representational, organizational, interpretative and transformational) (p. 759) will be the basis for a study on the nature of images used in scientific textbooks (Codone, 2005).

Bélisle & Jouannade (1988) published a book on visual communication in which they distinguished seven types of visuals: photographs, drawings (including exploded views and maps), graphs ("graphical presentations of statistical results"), organigrams, sketches, tables, and texts (p. 41). This is a more

A Taxonomy of Visuals in Science Communication

complete list of visuals used in conferences, but the classification may be unsound since it is based here on technique (photograph, drawing) and there on content (maps, organigrams), while opposing drawing and sketch. Meanwhile, Cleveland (1984) had published a first systematic analysis of visuals used in periodicals. He used a simple typology, defining entities such as bar charts, histograms, point graphs, statistical maps, and miscellaneous. One might note that the author separated bar charts from histograms, which is not a universal distinction. In a statistical perspective, Cleveland also classified graphs according to the number of variables they supported, distinguishing between controlled and uncontrolled variables; a perspective rarely taken into account by others.

Kosslyn (1989) published an important paper on the design of charts and graphs. He then offered a simple classification of the visual presentation of data: graphs are images where data are represented through a scale; charts are figures where relations between entities are presented with lines; maps are a category of their own; and finally diagrams are schematic representations of objects or entities. The paper presented an analysis of certain theoretical aspects of graphic representation and a number of recommendations that will eventually be the basis for a remarkable textbook (Kosslyn, 1994; Kosslyn, 2006).

In 1990, Rankin published a detailed repertoire of "graphs," which in fact only dealt with curves and histograms and considered primarily the number of variables to be shown and the eventual periodicity of data. The result was a low efficiency classification and at times awkward denominations, such as a "Linear array of 4-D cylinder-like trend surfaces," (p.152) which has rarely been referred to in the literature. Shortly thereafter, Wileman (1993) published a much broader study. He defined three manners in which to represent objects: by pictorial symbols giving realistic representations, by graphic symbols that are more abstract, and finally with verbal symbols. This led him to put forward five categories of figures for the representation of numerical data: circle graphs, line graphs, bar graphs, pictorial graphs, maps and area graphs. Lohse, Biolsi, Walker, and Rueter (1994) used an empirical approach based on the results of attempts at classification by subjects in an experimental setup. Lohse et al. proposed a nonsystematized list of 11

categories: graphs, graphic tables, tables, network charts, structure diagrams, process diagrams, maps, cartograms, icons, time charts, and pictures. One may conclude that ambiguousness persists in denominations.

Some attempts at classification will be made for more limited fields. For example, Clément (1996) put forward a taxonomy of medical images. He first defined three categories of *graphical* images: those that are based on tables of numerical data, those representing mathematical expressions, and those that are designed to visualize scientific concepts (diagrams and schemas). A second set of images are *figurative* and result either from the iconic coding of visual signals (photographs, drawings) or from what he calls the iconic transcoding, which transforms other physical signals into visual signals.

Rowley-Jolivet (2002) published a systematic study of projections presented in scientific congresses. She defined four classes of images: scriptural, presenting textual information (titles, conclusions, etc.); numerical, showing quantitative information such as tables and equations; figurative, showing representations of material objects; and graphical, which included maps as well as graphs, sketches, and abstract diagrams. This attempt is more global than preceding efforts, but it does group together visuals that are semiotically distinct, and offers no classification of the different scientific "graphs."

The same year, Doumont (2002) proposed a pragmatic method to "choose the right graph." His list of categories is short (bar charts, dot charts, histograms, box plots, scatter plots, line plots), but he insists that the choice must be made on the basis of the database structure, of the intended use (analysis or communication), and of the operation performed with the data (comparison, distribution, correlation, temporal evolution). Here, a link is established between structure and function, but it is limited to the presentation of quantitative data.

Arsenault, Smith, and Beauchamp (2006) completed a series of studies, mostly in psychology, on graphs and tables (Smith, Best, Stubbs, Johnnston, & Archibald, 2000; Smith, Best, Stubbs, Archibald, & Roberson-Ray, 2002). They added to these two categories what they call nongraph illustrations, which include diagrams, pictures and maps as well as montages, and so-called nonvisual inscriptions, which comprise numerical tables and equations.

Luc Desnoyers

This short historical review demonstrates that we are confronted with a complex problem. We are faced with the existence of a huge number of different visuals, of which no complete list is available or even feasible, since any author can create new types to better illustrate certain phenomena. This diversity is probably exacerbated by the development of computer visualization techniques that offer new types of often complex visuals calling for interactive processes. We then have an abundance of denominations, a number of them being so general that they are polysemic and ambiguous. Different authors have tried, in different contexts, to produce lists or typologies of visuals used in different areas of science or of communication: none is general enough to include most types of visuals, and many are too field-specific to allow generalization. No systematic attempt has yet yielded a true taxonomy of science visuals, which could offer a comprehensive, rational classification of visuals according to generic types, and the development of a consistent nomenclature.

Method: Developing a Taxonomy

The development of a taxonomy follows a process more akin to design than to scientific research. It is an iterative process in which trial and error contribute to the elaboration of a system that should eventually be as logical and comprehensive as possible.

The first step in the process is the assembly of an extensive catalog of current scientific visuals that should be representative of major scientific disciplines as well as communicational genres. This is a lengthy and ever unfinished process that goes on through critical attendance at conferences, consultation of periodicals of all kinds, of monographs in data analysis as well as in graphic design. There are now excellent anthologies in this field, and the work of Harris (1999), for example, is a wealth of information on science visuals.

The second step is the selection of a classification system. A *typology* of visuals would try to define and name the different types of images used in communication. A *taxonomy*, however, would go one step further in offering a logical, systematic and hierarchical classification, distinguishing related groups and subgroups.

The basis for modern taxonomy is found in the works of Carl von Linne (or Carolus Linnaeus). Throughout the 17th century, this Swedish scientist studied the diversity of living organisms to classify them in a systematic way, based on their natural characteristics. Taxonomy allows one to create categories (taxa, sing.: taxon) going from the more general to the more specific level, according to precise rules. Biological taxonomy distinguishes between phyla, which are subdivided into classes and then orders, families, genera, and species. At each level, one expects that the set of categories or taxa be collectively exhaustive and mutually exclusive. The distinction between taxa on a given level (e.g., classes) is based on a single criterion, a character that has a distinctive expression in each. Different characters will be used at different levels, and these characters may be structural or functional. One can therefore create on this basis a hierarchical classification defining groups in reference to their actual similarities and differences.

Such a taxonomy would be useless if it did not come with the attribution of a distinctive denomination for every single taxon described; this is done through nomenclature. In Von Linne's work, each phylum, class, order, family, and genus therefore received a distinctive and exclusive name. It was impossible to do the same for species because of their numbers, and Von Linne developed a binomial system to bypass the problem: species would be designated by the name of their genus plus another qualifier. Here, Von Linne systematically made up names based on Latin and Greek vocabulary, therefore creating an international system readily usable in many languages, which virtually eliminated problems in translation.One can use the same principles of taxonomy and nomenclature and apply them to any set of entities, and this is what we have tried to do for visuals used in science communication. This implies a lengthy analytical process for the selection of efficient discriminating criteria, and the actual definition of taxa at different levels. On this basis, we then had to find distinctive designations in order to avoid the confusion generated by the actual polysemic denominations. It would prove unavoidable to create neologisms, hoping not to walk straight into abstruseness. The goal pursued would be more modest than that of biological taxonomists: it would prove impossible to try and name every visual, but a general and systematic frame of

A Taxonomy of Visuals in Science Communication

reference would allow one to deal with the most widely used visuals in a coherent and methodical manner.

A certain number of considerations must be mentioned before going into the details of the taxonomy. First, the "phylum" we will be considering is mainly that of communication visuals: Images developed in the field of data exploration will not be addressed specifically. In this we would follow the path offered by Bertin (1973) as well as MacEachren (2004) considering these images as analytical tools that can be quite complex, frequently interactive, and in most cases not fit for communication purposes. Second, we will be unable to tackle the domain of complex visuals or montages; taxonomies can only consider singular cases, and Von Linne himself no doubt never considered classifying floral arrangements. Third, this will also lead us to consider only static images, and not moving ones. Fourth, we cannot pretend to cover all types of visuals used in communication; as mentioned above, some types exist that are rarely used, and new ones can be developed that will have to be taken into account in due time, but this is the case with any taxonomy. Fifth, we will not attempt to name every existing visual to the species level, being satisfied with precise enough categories, denominations, and lists of qualifiers that cover most types of current visuals. Sixth, taxonomy rests on the selection of relevant criteria that must be chosen with care; in the case of visuals, it is difficult at times to choose between descriptive and functional criteria and therefore alternative criteria frequently exist, some of which will be underlined. Finally, we will renounce using general and polysemic terms such as "graph," "diagram," "chart," or "plot," to which one could not give a new definition without adding to the actual confusion; however, we will keep terms like "organigram" or "histogram," which seem unequivocal, and use the suffix "gram" to name most taxa. Following Von Linne's example, we will propose a nomenclature based on Greek and Latin terms, again to avoid confusion and facilitate communication and translation in different languages.

A Taxonomy of Communication Visuals in Science

Over the years, the repeated observation and analysis of visuals used in conferences and periodicals has led to the conviction that Wileman's (1993) approach gave us the most efficient global categorization of science visuals in three classes. Images being defined by semioticians as assemblages of signs, it seems logical to define these classes on the basis of their information and sign content, as Wileman suggested.

A first class is composed of diverse figurations of material entities, representing for example objects under study, subjects, equipment, environments, and places. Semiotically, these visuals are essentially made of iconic signs. Since they represent entities from the infinitely small to the infinitely large, we will call them "cosmograms."

A second class, used more broadly in oral than printed communication, defines visuals that are composed of text and numbers: these visuals are essentially made up of the symbolic signs belonging to language, whether verbal or numerical. As this class is relying on the art and signs of typography, we choose to call these visuals "typograms."

A third class offers inscriptions of data that are presented through graphic symbols or signs arranged in a calibrated area, for example (but not exclusively) in Cartesian space. In this class the representation of data is always based on an analogy between a quantitative value (resulting from a counting operation, a calculation or a measure), and a dimension of space (length, angle, etc.). This has led authors to speak of an "analog scale" and this is the reason why we will call them "analograms."

Each one of these three classes is a collection of taxa that differ in their graphical design, their affordances, and the practical use we make of them. We will consider each one separately.

Cosmograms

Scientists use various visuals to show material entities, but these all share a common feature: they are calibrated and usually show a quantitative scale, which is not the case in nonscientific contexts. Cosmograms could then be divided in two categories: photographic (analog or digital), and pictographic (drawing with different

manual tools, computer assisted drawing). In the first case, we get a realistic representation of a specimen; in the second, we choose to illustrate the generic type, following iconicity levels as described by Moles (1981). A technical criterion could therefore be used to distinguish between two orders of cosmograms. However, it is generally better to refer to image content for taxonomy, as techniques can be efficient qualifiers shared by otherwise different visuals. We will therefore distinguish two orders of cosmograms: topograms and reigrams, as detailed in Table 1.

Topograms (from the Greek topos, place) are figurations of places and environments; in other words, a portion of space occupied by a set of objects. They can be complex visuals possibly representing a large number of entities. It is practical to subdivide topograms in two families. First come figurations of natural environments; therefore, called *ecograms (*from the Greek oikos: natural habitat). These can be aerial or satellite photographs,

but more frequently they will be pictographic maps. Particularly in the case of maps, the design of ecograms is governed by rules (e.g., defining types of projections in geographical maps) that have been described by numerous authors (Bertin, 1977; MacEachren, 2004). Maps can be "silent" representations, but they can be further divided in *descriptive* maps when their purpose is to illustrate features of the environment with textual or iconic legends, or *statistical* maps when the map becomes the support of statistical information on, for example, populations or economic data. In this last case, depending on the nature of the data (nominal, ordinal, or quantitative), different graphical elements such as area coloring or hatching, vectors, or isocontour lines can be added to the map to present the data.

The second family of topograms calls for the representation of artificial constructions. These we will call *domograms* (from the Greek domos: construction). The distinction is important because, while purely

Table 1. Cosmograms

Orders	Families	Qualifiers	Descriptions / examples
Topograms (environments)	Ecograms (natural environments)	Descriptive	• Topographic maps • Aerial/satellite photos
		Statistical	• Nominal data: zones identified by texture or color, symbols or icons • Ordinal data: zones identified by gradation of tint or scale of greys • Quantitative data: numbers, vectors, contour lines, histograms on specific zones
	Domograms (built environment)		Photography of man-made constructions Drawing in plan, elevation and profile
Reigrams (objects)		Descriptive	Photography of isolated specimens Pictography (anatomical, technical drawings)
		Functional • Cinematic • Transformational	Chronophotography of movement (multiple exposures) Life cycles, infectious processes
Both orders		Photographic Pictographic	

A Taxonomy of Visuals in Science Communication

descriptive domograms can be obtained by the same photographic techniques, pictographic figurations are quite different and frequently much more abstract. These are no longer maps but plans and, in the universe of architects, engineers and draftsmen, the design of such figurations obeys strict rules that differ from those governing the production of maps, implying for example the necessary representation in plan, elevation and profile. And if, as their name implies, plans are first of all tools for planning the construction of nonexistent entities, they are also used to portray existing industrial setups. The amount of information they carry can be important but, contrary to maps, plans are seldom the support of statistical information.

Reigrams are the second order of cosmograms (from the Latin res, rei: thing, object). All cosmograms do not represent complex environments. Reigrams are figurations of material objects, either natural or artificial. They frequently represent objects isolated from their environment or background in order to bring out specific properties. These again can use photographic or pictographic techniques, according to the objectives of the author. *Descriptive reigrams* can show the external morphology of objects, using perspective drawing or top, frontal, and side views. They can show the internal configuration of objects with a variety of techniques (see-through views, cut-outs, exploded views, etc.). *Functional reigrams* allow one to show the spatiotemporal changes of entities using, for example, composite views. In a first case, cinematic reigrams show the different phases of a movement or displacement; this was mostly developed by Marey (1894) as chronophotography, through multiple exposures and superimposed drawings. The second case is that of transformational reigrams dealing with morphological changes; this would be the case, for example, in representing the life cycle of a parasite.

As a class, cosmograms are therefore an efficient tool in the description of the aspect and properties of the very different types of material entities considered in science communication. They are a topological, scaled transcription of entities or of their properties and that is why they include images of traces and indexes, footprints as well as traces in bubble chambers. Cosmograms play an essential role in the descriptive stages of all disciplines, yielding progressively to analograms when scientists concentrate on more

analytical stages of research. The taxonomy we have put forward only defines large groups, as it can be seen that specific types of cosmograms can be well described by adding to their names one or two qualifiers specifying some properties or the function (e.g., descriptive, statistical, functional) supported by the visuals.

Typograms

Language-based visuals are topological representations of specific aspects of discourse (Lemke, 1998). They are not the mere visual transcriptions of parts of the discourse (in which case they would not be considered as visuals), but inscriptions set in such a spatial arrangement as to complement the oral or printed presentation. Typograms can be divided into three orders, according to both their content and function, as shown in Table 2.

Scriptograms are the first order of typograms, and they are the closest to simple print. Scriptograms are more widely used in oral communication, where they compensate for one of the disadvantages of oral delivery, that is the disappearance of structural information about the discourse offered in printed information by layout, such as paragraphs, numbering, font choice and size, and bold characters, that have no real equivalent in oral presentation. In this context, specific screen-pages offer titles and author identification, short phrases (usually not sentences) reinforcing a statement, equations, but most of all visuals that have almost become the trademark of projections, bullet lists. These are frequently used to merely present series of items, but they seem particularly efficient when they list markers of the sequential structure of the oral text.

Cellulograms are the second order of typograms. They offer the possibility of presenting alphanumeric data by category, each data being filed in a cell within a metaphoric filing cabinet or pigeonhole. The archetype of this order is the numerical rectangular table, but the existence of other forms (e.g., "stem and leaf" displays, triangular tables), as well as a necessary coherence in nomenclature make us call this order cellulograms. These can be qualified according to the nature of their content, which bear either nominal, ordinal, quantitative or symbolic/iconic signs. It is worthy to note that large cellulograms are usually avoided in oral presentations: they are analytical rather than communicational tools, images that have to be "read" at length rather than "looked at" (Bertin, 1973).

Organigrams are the third order of typograms. Contrary to cellulograms, which simply divide entities into cells, organigrams are designed to display components of a system and their relations. Organigrams were probably first developed using the metaphor of a tree. In these *arborescent* organigrams, the components are identified by their name, each one usually enclosed in a box, and relations are indicated by lines or arrows. In many fields of science, implicit rules govern the design of these organigrams. Visuals describing processes are usually read from left to right. Hierarchical organizations are traced from top to bottom, as well as genetic transmission of characters, while evolutional anthropology will show the "ascent of man" using a bottom-up approach. Closed-loop systems or those implying feedback call for circular organigrams, while centralized organizations can be described in a radiant fashion, each subentity boxed in on a different radius. Arborescent organigrams are therefore usually easy to qualify by their graphical design as well as their content (structural, functional, conceptual). A second subgroup of *intersecting* organigrams is devoted to the illustration of logical relations between sets, as first described in the mathematical set theory; they are frequently designated as Venn or Euler "diagrams." In this case, sets are represented as circles and relations of exclusion or inclusion are illustrated by separation or overlap of circles, without resorting to lines or arrows.

Again, typograms are efficient forms of topological translation of nominal and numerical information. They rely on some of the basic rules governing printing, with a preference for left to right and top to bottom layout, but also resorting to other layout metaphors; they afford a truly visual description of otherwise discursive information.

Analograms

The third and final class of visuals is the most characteristic of scientific "inscriptions," as indicated by Latour (1987) and Latour and Woolgar (1988). Visuals like cellulograms or cosmograms present data mostly in their primitive form, as the result of direct observation or measure. Scientific investigation of course goes further, and for example through computational processes that yield results in forms too complex to be expressed efficiently by language, or to be shown with the visuals mentioned above. This is what led Playfair (1786) to develop new types of visuals, like histograms, and to borrow from Descartes' analytical geometry to plot mathematical relations in Cartesian space. Again, the same objective, topological transduction of information, is targeted, so that we can visualize information that would otherwise only be expressed and deciphered with difficulty. And, as we have mentioned, this transduction relies in all cases on the same analogical process, transforming numbers in a dimension of space.

Analograms use different graphical signs to represent data. These signs are those Leonardo da Vinci (Da Vinci, Kemp, & Walker, 1989) or more recently Kandinsky (1991) described as the basis of all pictorial representations, and the same that G. von Mayr recognized as the basis of graphical presentations (Funkhouser, 1937). Data can be shown by dots, by lines, by areas, by forms. And this will be the basis of the

Table 2. Typograms

Orders	Qualifiers	Descriptions / examples / synonyms
Scriptograms	Phrases Equations Lists	Title page, statement Bullet list, word chart, text chart
Cellulograms	Content (nominal, ordinal, quantitative, symbolic, iconic) Format • Quadrangular • Triangular • Linear	 • Tables in columns and rows • Mileage table/chart • Stem and leaf display/chart
Organigrams	Arborescent (content, structure) Intersecting	Network diagram, organizational chart, block diagram, flow chart/diagram, trees Venn, Euler diagram

A Taxonomy of Visuals in Science Communication

present nomenclature, distinguishing between five orders to be named punctigrams (dots), curvigrams (lines), puncti-curvigrams (both dots and lines), histograms (areas), and morphograms (shapes). Table 3 describes these orders.

Punctigrams afford to represent individual data using dots, which will be aligned along an axis calibrating a variable. Punctigrams can be subdivided according to the number of variables they show and their configuration. In the case of a single variable, univariate distributions are shown by placing dots along

a single axis, giving rise to linear punctigrams. Much more frequently, the individual dots refer to the relation between two variables, each one attributed to one axis (abscissa or ordinate) in a Cartesian space: the result is a planar punctigram. At times, data refer to three variables, and dots are arranged in a three-dimensional Cartesian space, creating a sterical punctigram. The specific affordance of all punctigrams is the descriptive presentation of all individual values without implications as to the nature or form of the relation between them, but with the intent to display the variability in data.

Table 3. Analograms

Orders	Families	Qualifiers	Descriptions / examples / synonyms
Punctigrams		Linear/ univariate Planar/bivariate Sterical/trivariate	One axis point graph Scattergraph, scatterplot, scattergram 3D point graph
Curvigrams		Axis system (cartesian, polar, floating…) Line configuration (straight, segmented, curved, stepped…)	Globally: line graph, curve graph, line plot, line chart. Polar graph: clock, circular graph or chart. Floating: instrument graph, name derived from technical process (chromatogram, etc.)
Puncti-curvigrams			Hybrid figure with both data points and curve
Histograms	Absolute • Descriptive • Comparative Proportional	Band orientation (horizontal, vertical) Band arrangement (paired, opposed, stacked…) Figure used (subdivided circle or band)	Globally: bar/column chart or graph, vertical/horizontal bar chart or graph, frequency distribution chart. Circular: pie chart, cake chart, divided circle graph, sector chart, circle diagram, sectogram, etc. Band: divided, subdivided, stacked, extended, composite bar/column chart/graph
Morphograms	Radial Polygonal Chernoff faces		Star, radar, spider or radial column graph, glyph Cartoon faces

Luc Desnoyers

Curvigrams, by contrast, afford the description of the more abstract form of the quantitative relation between two variables. They are bivariate by nature, and the curve that traces the shape of the relation is either constructed mathematically based on the principles of analytical geometry, or approximated with different techniques; it is traced in a Cartesian space. One of the graphic rules of curvigrams is that the variable whose fluctuation is studied (the dependent variable) is assigned to the ordinate or vertical axis, while the acting (independent) variable is assigned to the abscissa or horizontal axis. Rarely, attempts are made to show the relative variations of three variables; the result is then the drawing of a curved surface within an x-y-z space.

Curvigrams have been adapted to very different uses. The basic Cartesian design calls for calibrated perpendicular axes with a value of zero at the origin and a continuous progression of values along the axes. In some instances, the independent variable is treated in a different manner: values are grouped in quantitative intervals (e.g., age groups) and the resulting interval curvigram is a series of steps at times separated by vertical lines. But there are many forms of what can be called quasi-Cartesian designs, using a different axis system. The most frequent is probably the polar curvigram, whose name evokes maps viewed from the poles; here the curve is drawn within a circle whose center is the origin, with the x-axis on parallels and the y-axis on meridians. Instruments recording cyclical events frequently produce this type of recording then known as a clock chart. The floating axis is also frequent, and is used for example to represent instrument recordings such as electrocardiograms or chromatograms in which there is no real origin, and where calibrations are indicated by lines of a given length and value.

Curvigrams can also be qualified according to the type of line drawn: straight lines, broken or segmented lines, true curves, stepped lines corresponding to the nature of the data (continuous or interval) or to the type of relation depicted (linear for simple correlations, curved for higher order relations). In all these curvigrams, the distinguishing feature is the possibility to move at least one step away from the crude results and to topologically model the relation between variables.

Puncti-curvigrams are in a way a hybrid form between the two preceding orders. Here both the individual dots and a curve of the relation are graphed in order to show both the variability in the data and the ideal relation between them. This dual affordance makes puncti-curvigrams one of the most frequently used analograms.

Histograms are the fourth order of analograms. Here quantitative data belong to or describe distinct groups within a population. This is an important property of histograms: they do not represent sets of quantitative data, but quantities assigned to nonquantitative entities; therefore, they cannot be designed in a truly cartesian space, which calls for two calibrated axes. The categories used can be nominal or ordinal. They are represented by the graphical sign of a surface, or area, either rectangular or wedge shaped, with this peculiar feature that only one dimension of the figure (either length of a rectangle or angular opening of a wedge) is modulated by the value in the data.

We can distinguish two families of histograms based on the type of data they represent. The first is that of *absolute histograms*, which show data expressed as numbers resulting from counting or measuring. These are shown using series of horizontal or vertical bands or rectangles, one per category, with their length related to the appropriate value; in his first description of histograms, Playfair (1786) insisted on the metaphorical origin of the columns he used, financial data being depicted by idealized piles of coins. The rectangles in histograms are not drawn on an axis, but on an uncalibrated baseline, which is more of a plastic sign, a metaphorical representation of a post or a ground line supporting the rectangles. Printed absolute histograms are usually vertical, using "columns," while projected visuals can more frequently call upon horizontal bars, due to the greater width of screen images.

The second family of histograms, *proportional histograms*, is characterized again by the nature of the information they present. Here we deal with proportions showing the distribution of values within a given population; the values are therefore expressed in percentages. Graphically, two distinct figures can be used to represent a population and its subdivisions. In one case, a circle is used, giving birth to a visual better known as a pie chart. As is well known, the circle is the metaphor of a whole entity, 100%, which is then

A Taxonomy of Visuals in Science Communication

divided in wedges the angular openings of which are proportional to the percentage value attributed to the category they represent. The inefficiency of this graphical representation has been frequently and soundly demonstrated (Cleveland & McGill, 1985; Bertin, 1977; Tufte, 1983) and a different figure, the proportional band or rectangle, is available. In this case, the length of each rectangle is defined as 100%, and each subdivision is of a length proportional to the percentage it represents.

On a functional basis, all families of histograms can be used to simply show the distribution of a property in a population, in which case they can be qualified as descriptive histograms. But they are also used widely to establish comparisons between populations, and a certain number of graphical variants can be used to draw comparative histograms (Desnoyers, 2005). A single histogram can be drawn with multiple sets of bands that can be arranged in different fashions (e.g., paired, opposed, stacked); the texture or color of each set specifies the group it represents. Or montages can be used, juxtaposing different histograms for each set; this is the only way to show comparisons between proportional histograms.

We have kept the name histogram for this class since its etymology seems appropriate: histo referring in ancient Greek to mast as well as tissue, which is compatible with rectangular or wedge-shaped areas. Some authors distinguish histograms from bar graphs or pie charts, reserving the first denomination only for sets of adjacent rectangles presenting classes based on quantitative intervals; there is no sound reason to use full rectangles in this case, and it is our opinion that such figures are better described and represented as interval and stepped curvigrams. We have not considered here the case of iconic histograms, which are a tool of science popularization rather than of communication among scientists. Neurath (1980) one of the most important protagonists of their use, has well demonstrated the usefulness but also the limits in the efficiency of these figures (i.e., Tufte, 1983).

Morphograms are the fifth and final order of analograms. This order specifically affords the comparison of statistical populations described with multivariate data. Each population is represented by a figure of the same type, and each variable is attributed to one calibrated graphical element of this figure. The

result is, for each population, a particular shape of this figure, and the visual comparison of shapes allows one to detect global similarities and differences between populations. The figures used here are best described as "object-oriented figures" and have received considerable attention in fields concerned with display design (Carswell & Wickens, 1987). Morphograms are not frequently used by scientists, despite their efficiency (Desnoyers, 2011).

A first family of morphograms is often referred to as "star," "radar," or "spider" graphs but is better described as *radial morphograms*. In this case, the figure is made by drawing from a central point equidistant and calibrated virtual spokes, each one assigned to a specific variable. A line of appropriate length is then drawn on each spoke, giving rise to a starlike figure of a distinct shape. *Polygon morphograms* use the same principle, but in this case the ends of all radiuses are joined by a line, giving rise to a solid figure. The third case is that of *Chernoff's faces* (Chernoff, 1973) where the figure is a stylized human face with each variable assigned to a given trait, the size or shape of which varies with the value of the variable. The human brain being quite efficient in recognizing shapes in general and particularly faces, morphograms can be an efficient tool for global multivariate comparisons.

Globally, analograms are the class of visuals that call for the more radical form of topologization. The transfer of nonspatial, quantitative data to spatial representation is done according to a set of rules rarely defined in explicit terms. Basically, these rely on the concept of calibrated Cartesian space, while frequently referring to metaphors or object-oriented images for graphic expression. They are the visuals that are the most characteristic of scientific discourse, up to the point where they are often used in nonscientific contexts to offer a veneer of science and credibility.

Comments

We briefly mentioned the study by Cleveland (1984) and others on errors made in visuals accompanying papers in periodicals. It seems paradoxical that, despite the professionalism of authors as well as editors and referees, so many faulty visuals would be printed. The causes of such a failure could be manifold, from a lack

of consideration for graphical expression to inadequate visual literacy (Felten, 2008). In all areas of knowledge, literacy implies the mastery of both a lexicon and the rules or the grammar that govern its use in expression. It is certainly difficult to master a language when the basic vocabulary is loaded with ambiguity and clouded by polysemy, as it is impossible to learn playing chess without knowing the names of the pieces. Training students, helping professionals, and conducting research on the use of visuals are problematic in the absence of a consensual lexicon of visuals.

It is these reasons that led us to develop the taxonomy summarized in Figure 1. We have followed the rules developed by von Linne to organize taxa and to develop a systematic nomenclature. This ensures a certain coherence in the proposed taxonomy but certainly offers no warranty as to its adequacy, its usefulness, or its acceptance. We know the proposed taxonomy is incomplete, considering the remarkable number and diversity of existing visuals, as well as the creativity of scientists and authors in graphic design. It

will have to be added to, analyzed, discussed, and put to the test in order to verify its relevance.

Implications: Guidelines Development

As mentioned above, the development of a consensual taxonomy would provide a harmonized lexicon, but visual literacy also implies a grammar whose rules would be the basis of guidelines in the choice as well as design of efficient visuals. Some of the existing texts on guidelines are productive tools, but many are incomplete since they either cover only part of the visuals used in science or overlook some of the guiding principles in the design of efficient visuals, not to mention their differences in denominations. There is need for a thorough integration of theoretical and empirical knowledge from areas as diverse as perception psychology, science methodology, and particularly statistics, graphic arts, communication sciences, etc. A systematic taxonomy is but a first step in this direction.
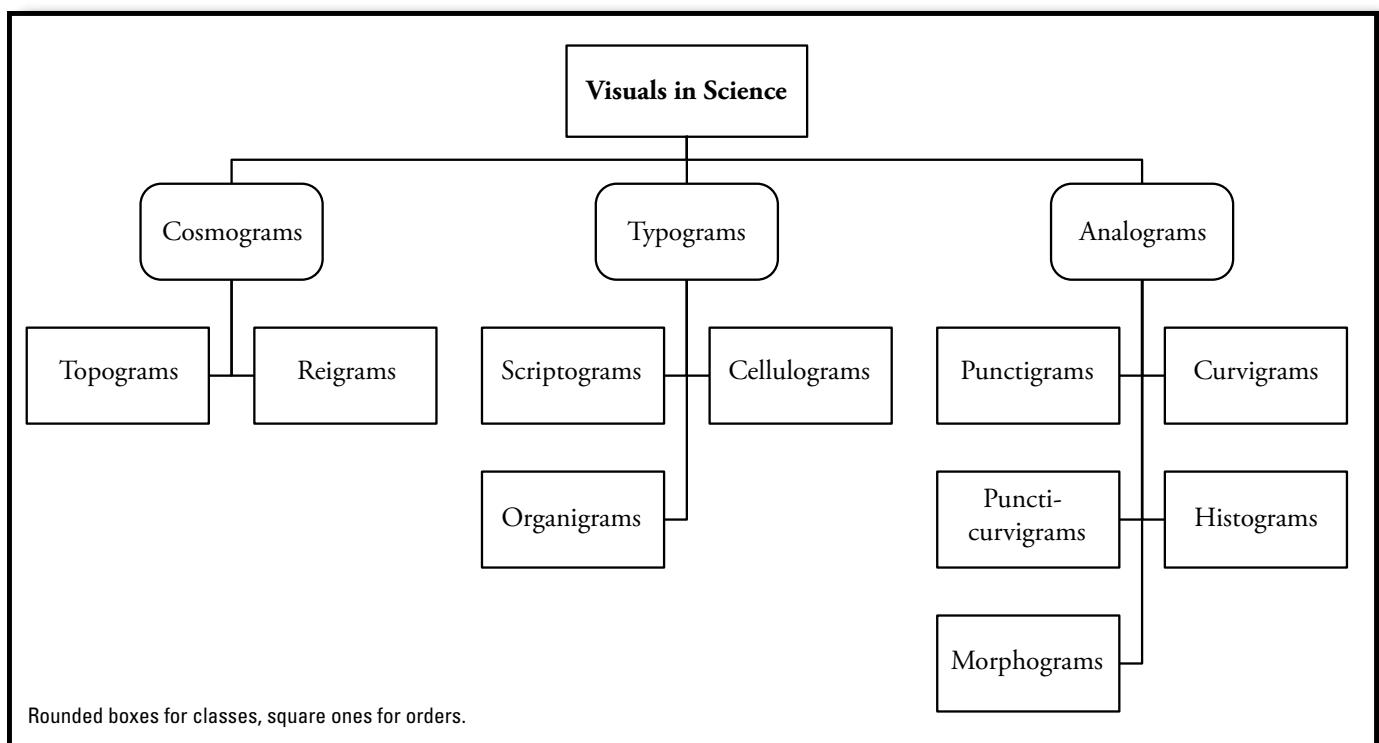

Figure 1. Organigram of the taxonomy and nomenclature of the main taxa of scientific visuals

A Taxonomy of Visuals in Science Communication

Implications: Student Training

In the long term, an improvement in the use and design of visuals in science implies a major move in training, particularly with graduate students in science. The generalized use of presentation software like PowerPoint has wrongly convinced students that paper presentation is impossible without projections and that almost anything is better than a blank screen. There is a need for coordinated efforts in training, while little information is available on isolated attempts throughout the world. In our continued practice, mostly at Université du Québec à Montréal, the proposed taxonomy is systematically used as a basis to expose the specific affordances of currently used visuals (Desnoyers, 2007). The guidance provided is put to the test when students are invited to evaluate visuals presented to them as well as react to the presentations by colleagues during rehearsals within the class group. Although this type of course has not been submitted to scientific evaluation, the simple fact that it is still offered after 30 years indicates a certain efficiency. It is our opinion that this area deserves more attention than what it gets, and that the extension of such training to groups like science communication classes should be considered.

Implications: Professional Practice

Science communicators and scientists are avid readers of papers and monographs in their field of interest and have been trained or have developed abilities in the critical reading of scientific prose. Visuals are some of the most important arguments in these writings (Latour & Woolgar, 1988). But the fact that so many still contain mistakes after a strict reviewing process is a challenge for readers, who in our opinion could be better trained in error detection (Bryan, 1995). A harmonized taxonomy and more stringent guidelines would alleviate our task in appraising scientific visuals as well as other forms of presentation. We could likewise all become more rigorous in our own production of visuals.

Implications: Research

As noted above, little research has been produced on the actual use of visuals in science communication. Again, the lack of a harmonized classification and lexicon is an impediment in such activity and in the comparison of published results. Using the proposed taxonomy, we have been able to analyze the use of different categories of visuals in different scientific paper genres published in ergonomics periodicals (Desnoyers, 2009; forthcoming). The preliminary results show that review papers make a very limited use of visuals, except for organigrams, while papers dealing with theorization and modeling used the largest number, particularly equations, organigrams, and pictographic cosmograms. Experimentations make a massive use of analograms, mostly histograms, and photographic cosmograms. Reports of inquiries use a maximum number of quantitative cellulograms. Such findings call for in-depth analysis and comparisons with different disciplines and communicational genres, and they should be useful in training.

Conclusion

Communication in science and technology relies heavily on visuals of an extraordinary diversity, developed and still developing in separate and even isolated fields of science as well as in different contexts. That this diversity has led to such variety in the denominations of visuals and to the prevailing polysemy is probably not surprising, but surprising is the fact that not much has been done to bring some order in this chaos.

From the author's ergonomics perspective, taxonomy can be considered as a tool. There is no such thing as a universal and definitive tool, and for example the simple hammer has been adapted in shape, mass, and material to the specific needs of mechanics as well as sculptors, carpenters, and the like, and no doubt more adaptations will follow. Frequent adjustments or additions have been made to this taxonomy since it was first considered in the 1980s. It is expected that adaptation would go on to make room for new entities, and to consider additional criteria for classification.

References

American Psychological Association (2010). *Publication manual of the American Psychological Association*. Washington, DC: American Psychological Association.

Arsenault, D. J., Smith, L. D., & Beauchamp, E. A. (2006). Visual inscriptions in scientific hierarchy.

Mapping the "treasures" of science. *Science Communication*, *27*, 376–428.

Bélisle, C., & Jouennade, G. (1988). *La communication visuelle. Rétroprojecteur, microordinateur*. Paris, France: Les Éditions d'organisation.

Bertin, J. (1973). *Sémiologie graphique* (2nd ed.), Paris, France: Gauthier-Villars.

Bertin, J. (1977). *La graphique et le traitement graphique de l'information*. Paris, France: Flammarion.

Bryan, J. (1995). Seven types of distortion: A taxonomy of manipulative techniques used in charts and graphs. *Journal of Technical Writing and Communication*, *25*(2), 127–179.

Busch-Lauer, I. A. (1998). Non verbal elements and data commentary in english medical texts. In I. Fortanet, S. Posteguilo, J. C. Palmer, & J. F. Coll (Eds.), *Genre studies in English for academic purposes* (pp. 109–132). Castello de la Plana, Spain: Universitat Jaume I.

Carswell, C. M., & Wickens, C. D. (1987). Information integration and the object display. An interaction of task demands and display superiority. *Ergonomics*, *30*, 511–527.

Chernoff, H. (1973). Using faces to represent points in K-dimensional space graphically. *Journal of the American Statistical Association*, *68*, 361–368.

Clément, P. (1996). L'imagerie médicale: Définition d'une typologie et proposition d'activités pédagogiques. *Aster*, *22*, 87–126.

Cleveland, W. S. (1984). Graphs in scientific publications. *The American Statistician*, *38*, 261–269.

Cleveland, W. S., & McGill, R. (1985). Graphical perception and graphical methods for analysing scientific data. *Science*, *229*, 828–833.

Codone, S. (2005). A study of visual literacy in technical communication textbooks: A work in progress. *Proceedings of the IEEE Professional Communication Conference* (pp. 795–763). Piscataway, NJ: IEEE.

Cooper, R. J., Schrieger, D. L., & Close, R. J. H. (2002). Graphical literacy: The quality of graphs in a large-circulation journal. *Annals of Emergency Medicine*, *40*, 317–322.

Costigan-Eades, P. (1984). *Data graphics in the 20th century: A comparative and analytical survey* (Unpublished doctoral dissertation, Rutgers University, New Brunswick, NJ).

Da Vinci, L., Kemp, M., & Walker, M. (1989). *Leonardo on painting. An anthology of writings*. New Haven, CT: Yale University Press.

Desnoyers, L. (2005). *La communication en congrès-repères ergonomiques*. Québec, Canada: Presses de l'Université du Québec.

Desnoyers, L. (2007). Training future scientists for conference presentations. Paper presented at the Public Communication of Science and Technology Conference, PCST 10, Malmö, Sweden.

Desnoyers, L. (2009). L'image comme outil de la communication scientfique: diversité et spécificités. *Protée*, *37*(3), 81–92.

Desnoyers, L. (forthcoming). Visuals and text in scientific articles. Manuscript submitted for publication.

Doumont, J.-L. (2002). Choosing the right graph. *IEEE Transactions on Professional Communication*, *45*, 1–6.

Felten, P. (2008). Visual literacy. *Change, The Magazine of Higher Education*, *40*(6), 60–63.

Funkhouser, H. G. (1937). Historical development of the graphical representation of statistical data. *Osiris*, *3*, 269–404.

Gross, A. G., Harmon, J. E., & Reidy, M. (2002). *Communicating science. The scientific article from the 17th century to the present*. New York, NY: Oxford University Press.

Harris, R. L. (1999). *Information graphics. A comprehensive illustrated reference*. New York, NY: Oxford University Press.

Hartley, J. (1991). Tabling information. *American Psychologist*, *46*, 655–656.

Jacobi, D. (1985). La visualisation des concepts dans la vulgarisation scientifique. *Culture Technique*, *14*, 153–163.

Kandinsky, V. (1991). *Point et ligne sur plan*. Paris, France: Gallimard.

Kosslyn, S. M. (1989). Understanding charts and graphs. *Applied Cognitive Psychology*, *3*, 185–226.

Kosslyn, S. M. (1994). *Elements of graph design*. New York, NY: W.H. Freeman & Co.

Kosslyn, S. M. (2006). *Graph design for the eye and mind*. New York, NY: Oxford University Press.

Krebs, C. J., Bredesen, E., Coombs, A., Daniel, R., deGraf, R., Elz, A., … Welstead, K., (2001). Graphical presentation of data in the journal

A Taxonomy of Visuals in Science Communication

Ecology. *Bulletin of the Ecological Society of America*, *82*, 247–248.

Latour, B. (1987). *Science in action*. Cambridge, MA: Cambridge University Press.

Latour, B., & Woolgar, S. (1988). *La vie de laboratoire*. Paris, France: La Découverte.

Lemke, J. (1998). Multiplying meaning. Visual and verbal semiotics in scientific text. In J. R. Martin & R. Veel (Eds.) *Reading science. Critical and functional perspectives on discourses of science* (pp. 87–113). London, U.K.: Routledge.

Levin, J. R. (1981). On functions of pictures in prose. In F. J. Pirozzolo & M. C. Wittrock (Eds.), *Neuropsychological and cognitive processes in reading* (pp. 203-228). New York, NY: Academic Press.

Lohse, G. L., Biolsi, K., Walker, N., & Rueter, H. H. (1994). A classification of visual representations. *Communications of the ACM*, *37*(12), 36–49.

Macdonald-Ross, M. (1977). How numbers are shown. A review on the presentation of quantitative data in texts. *AVCR*, *25*, 359–409.

MacEachran, A. M. (2004). *How maps work*. New York, NY: Guilford Press.

Marey, É.-J. (1894). *Le mouvement* (reprinted 1994, Nîmes, Éditions Jacqueline Chambon). Paris, France: Masson.

Miller, T. (1998). Visual persuasion: A comparison of visuals in academic texts and the popular press. *English for Specific Purposes*, *17*, 29–46.

Moles, A. (1981). *L'image, communication fonctionnelle*. Tournai, Belgium: Casterman.

Neurath, O. (1980). *International picture language* (reprint of the original 1936 edition). Reading, United Kingdom, U.K.: University of Reading.

Peirce, C. S. (1978). *Écrits sur le signe*. Paris: Éditions du Seuil.

Playfair, W. (1786). *Commercial and political atlas*. London: Corry.

Rankin, R. (1990). A taxonomy of graph types. *Information Design Journal, 6*, 147–159.

Rowley-Jolivet, E. (2002). Visual discourse in scientific conference papers. A genre-based study. *English for Special Purposes*, *21*, 19–40.

Schrieger, D. L., Arora, S., & Altman, D. G. (2006). The content of medical journal instructions for authors. *Annals of Emergency Medicine*, *48*, 743–749.

Smith, L. D., Best, L. A., Stubbs, D. A., Johnnston, J., & Archibald, A. B. (2000). Scientific graphs and the hierarchy of sciences: A Latourian survey of inscriptions practices. *Social Studies of Science*, *30*, 73–94.

Smith, L. D., Best, L. A., Stubbs, D. A., Archibald, A. B., & Roberson-Ray, R. (2002). Constructing knowledge. The role of graphs and tables in hard and soft psychology. *American Psychologist*, *57*, 749–761.

Trumbo, J. (1999). Visual literacy and science communication. *Science Communication*, *20*, 409–425.

Tufte, E. R. (1983). *The visual display of quantitative information*. Cheshire, CT: Graphics Press.

Wileman, R. E. (1993). *Visual communicating*. Englewood Cliffs, NJ: Educational Technology Publications.

About the Author

Luc Desnoyers is an Associate (retired) Professor in the Biological Sciences Department at the Université du Québec à Montréal. After earning a PhD in visual system neurophysiology (1969), he turned to ergonomics and made a specialty of visual ergonomics. He has been involved in the training of graduate students from different fields in science communication for more than 30 years and has conducted research in this area. He is an Honorary Fellow of the Société d'Ergonomie de Langue Française and the Canadian Association of Ergonomists, having served as president of both Societies. Correspondence concerning this article should be addressed to Luc Desnoyers, Département des Sciences biologiques, Université du Québec à Montréal, CP 8888 Succ Centre-ville, Montréal QC, Canada H3C 3P8. E-mail: desnoyers.luc@uqam.ca

Specific Guidelines for Creating Effective Visual Arguments in Technical Handouts

Chien-Ching Lee

Abstract

Purpose: This paper analyzes the PowerPoint handouts of 22 engineering undergraduate students to establish criteria for judging the persuasive capabilities of the students' visual argument in handouts that are expanded versions of PowerPoint slides used for presentations. Specific guidelines on how to create effective visual arguments that are useful as slides meant for presentations cannot be used as handouts.

Method: The criteria were derived primarily from Doumont's (2002) three laws of professional communication that suggest how to combine rhetorical and visual elements to form coherent arguments.

Results: The results show that Doumont's laws are helpful in judging the persuasiveness of the students' visual arguments. In addition, the weaknesses in the students' visual arguments applied to all three laws, which is in line with Doumont's view that the laws have an order of precedence.

Conclusion: The guidelines in this paper can help practitioners convert their slides into handouts more effectively and encourage teachers to spend more time teaching visual argument in the classroom.

Keywords: visual communication, technical communication handouts, visual arguments, Doumont's three laws of professional communication, arguments

Practitioner's Takeaway

- PowerPoint handouts may be able to replace lengthy documents following presentations.
- Presented were specific tested guidelines used to create effective visual arguments in technical communication handouts converted from PowerPoint slides from a rhetorical perspective.

- With these guidelines available, more time should be allocated to the teaching of visual argument in order to bridge the gap between practice and pedagogy.

Guidelines for Visual Arguments in Technical Handouts

Introduction

The potential for using PowerPoint handouts instead of lengthy follow-up documents after a presentation is quite promising. Even though there are currently reservations concerning this idea, PowerPoint handouts can be a viable solution to many needs in the academic and corporate world if specific guidelines on how to create effective PowerPoint handouts from a rhetorical perspective are made available. In the academic world, PowerPoint handouts can be used to replace progress reports for research projects or postgraduate students' confirmation. The handouts may help create a win-win situation in which the process of preparing the handouts helps presenters crystallize the significance of the information they are presenting so listeners can understand the argument in less time. Similarly, many multinational companies see the need to leverage knowledge sharing in their companies and among their various worldwide branches because knowledge sharing is the prime driver for innovation (Lin, 2007; Trussler, 1998) and the value of knowledge grows when it is shared (Garvin, 2003). However, employees often do not have the luxury of time to write and revise lengthy documents. Godin(2008) added that "no one reads memos anymore." (p. 20). PowerPoint handouts can highlight the important points to be made more easily, thus enhancing readability and reducing the need for presenters to edit volumes of text.

Currently, it is difficult to find guidelines on how to construct effective visual arguments in technical handouts. Visual argument in this paper refers to the persuasive rhetorical strategy where text and visual elements are used to present an argument that meets the presenter's purpose and audience's needs. The term "visual" in visual argument refers to the use of text and visual elements together rather than just visuals alone. As technical communication uses the informative and persuasive mode, it is not practical "to imagine diagrams working without textual explanation, or textual explanation working without diagrams, or graphs, or tables of some kind" (Amare & Manning, 2007, p. 69). Furthermore, the word "argument" is used in this paper rather than "rhetoric" to refer to technical communicators having to explain or provide reasons for the conclusion made in line with their rhetorical goal.

In many instances, technical communicators use the slides meant to supplement their presentation as handouts because they are not aware that presentation slides and handouts serve two different purposes (Atkinson, 2005; Doumont, 2005; Godin, 2008). In addition, many textbooks have sections on document design and informative graphics. However, guidelines on how to combine these elements to form arguments both rhetorically and visually are lacking (Amare & Manning, 2007). Furthermore, many technical communication instructors do not teach visual argument or do not spend enough time teaching visual argument even though their students are assessed on it. Brumberger's (2005) survey for example, found that a significant number of her respondents who were business communication educators reported that more than 50% of student assignments required visual communication, but more than two-thirds of her respondents dedicated 20% or less of teaching time in undergraduate courses to visual communication. The reason for this neglect might be because they assume students will be able to automatically transfer their knowledge of verbal argument to visual argument. Another possible reason could be that many teachers do not know what to teach in visual argument. Without adequate understanding about visual argument, it is therefore difficult to justify the amount of time in the curriculum spent teaching it in an already packed course.

This paper analyzes the PowerPoint handouts of 22 undergraduate students to establish criteria for judging the persuasive capabilities of the students' visual argument in handouts that are expanded versions of PowerPoint slides used for presentations. The handouts were analyzed using Doumont's (2002) three laws of professional communication because these laws can be applied widely in communication as they are general laws of communication and, more important, suggest how to combine rhetorical and visual elements to form coherent arguments. In addition, the application of these laws has been tested on individual slides but not in visual arguments (Gross & Harmon, 2009) and specifically, not in technical communication handouts.

I hope to explore in this paper what information elements are needed in handouts to enhance the reader's understanding of the holistic argument with the least constraints. Many technical communicators create handouts to accompany presentations, but little has

been written about how to create those handouts or what makes for a good handout. This paper focuses on the rhetorical perspective of visual arguments rather than the document design and informative graphics perspective. In addition, I hope the specific guidelines will help deepen technical communication teachers' understanding about the teaching of visual argumentation and promote further experimental studies on visual argument at the level of whole presentations in handouts.

I will first present the case for the use of visual arguments in technical communication followed by the different purposes served by PowerPoint slides and handouts. I will then present a checklist for creating effective visual arguments based primarily on Doumont's (2002) three laws of professional communication and other related literature, which I used to analyze the students' handouts. Finally, I will conclude by highlighting some guidelines in creating effective visual arguments gleaned from the results of the study.

Literature Review

The Viability of Using Visual Arguments in Technical Communication

Robinson (1998) mentioned that engineering thinking is very much argumentative in nature. He explained that engineering thinking involves solving problems based on deduction and analogy and engineers need to use rhetoric effectively to explain the choice of the solution using propositions similar to that in an argument. Arguments are traditionally written in the textual form since they require the statement of propositions in sentences. Therefore, I would like to first address two objections made regarding the viability of visual arguments before going on to discuss the use of visual arguments in technical communication.

One objection toward the use of visual arguments is that they are too ambiguous and vague (Fleming, 1996). A defense to this statement is that verbal arguments could sometimes be ambiguous too (Blair, 2004) due to inappropriate word choice, incorrect sentence structure, or grammar issues. In addition, there are many strategies that can be used to reduce ambiguity in visual arguments. Birdsell and Groarke (1996) felt

that presenters could reduce misinterpretation by making the context of the communication clear to the audience. Besides that, presenters could also use textual content to clarify the intended message for the audience. Amare and Manning (2007) further suggested that technical communicators could reduce ambiguities by using diagrams rather than images as diagrams are able to provide clear contrasts (highlight the important points), could be edited to show only the relevant details and enhance the audience's ability to understand the main message of the diagrams more easily. They also classified Peirce's (1935) 10 classes of sign into three rhetorical purposes and mentioned that informative diagrams (diagrams that promote the audience's understanding of some idea) serve the purposes of technical communication better than decorative diagrams (diagrams that evoke the audience's feeling), or indicative diagrams (diagrams that provoke the audience to action for example, to locate some information). When everyone in the audience draws the same interpretation about the visual argument made, then the argument is no longer ambiguous or vague.

The other objection to the use of visual arguments is that arguments must have propositional content and visual communications are not able to convey propositions (Fleming, 1996). It is important to acknowledge that meanings are derived differently from the visual and verbal forms. In verbal arguments, presenters need to have a strong mastery of the language in order to convince their audience logically and emotionally. In visual arguments, we need to consider not only the words, but also the immediate visual context, immediate verbal context, and the visual culture (Birdsell & Groarke, 1996). For example, a presenter might want to argue for the use of light-emitting diodes instead of incandescent light bulbs in car lamps because they promote better road visibility. If we use Alley's (2009) assertion-evidence structure for PowerPoint slides, the assertion (point to be proven), could be stated in the heading of the slide. The evidence for the assertion (propositions) could be provided by a sequence of diagrams that provides the immediate visual context for the argument and is in line with the visual culture in engineering. The sequence of diagrams could include diagrams that contrast the difference in the degree of luminance offered by the two types of light bulbs on a dark road and during rainy days. The clarity of the

Guidelines for Visual Arguments in Technical Handouts

propositions in the sequence of diagrams could be enhanced when the presenter includes text that clarifies the point being made for each diagram (immediate verbal context).

Having established the viability of using visual arguments for technical communication, I would like to present the different purposes served by PowerPoint slides and PowerPoint handouts in technical communication.

The Different Purposes Served by Powerpoint Slides and Powerpoint Handouts

PowerPoint slides and PowerPoint handouts serve two different purposes (Atkinson, 2005; Doumont, 2005; Godin, 2008). PowerPoint slides for presentations are meant to supplement the presenter's talk by highlighting important points using visuals. In addition, the slides should use as little text as possible so as not to distract the audience from listening to the presenter's explanations. PowerPoint handouts, on the other hand, are more detailed because they are meant to be read after the presentation and readers do not have the opportunity to seek immediate clarification from presenters regarding any ambiguities they have in the handouts. Doumont (2005) felt that since PowerPoint slides and PowerPoint handouts serve two different purposes, there is no point in comparing the two. I would like to however, extend results from research conducted regarding PowerPoint slides to PowerPoint handouts. Just as researchers (practitioners) revise their presentation papers for potential publication in journals (company documents) after conferences (presentations), presenters could convert their PowerPoint slides into PowerPoint handouts effectively if they have clear guidelines to follow. To build on research regarding PowerPoint slides for PowerPoint handouts, let us look at the criticisms made regarding the default PowerPoint structure.

Criticisms Regarding the Default PowerPoint Structure

The first criticism is that the default PowerPoint structure of topic-subtopic with bullet points imposes a linear order to the slides where hierarchies are deeply nested in lists. Doumont (2005) felt that lists are ineffective since they make it difficult to highlight the relationship between ideas. Godin (2008) and Tufte (2003) also agreed that lists fragment the subject matter

so much that they obscure the logical connections among ideas in an argument. Garner, Alley, Gaudelli, and Zappe (2009) added that lists violate the principle of signaling because the reader is not given clear cues with regard to the relationship between the bulleted items.

Another criticism regarding the default structure is that it provides presenters with the opportunity to fill up the large text box in the body of the slides with as many details as they want (Garner et al., 2009). The use of too much text in slides violates the redundancy principle (Kalyuga, Chandler, & Sweller, 1999) because the audience is more likely to read off the slides than listen to the presenter if both the information in the slides and the presenter are saying the same thing. Hence, redundancy in this case is detrimental and it reduces the coherence of the argument (Lee & Tan, 2010; Mayer, 2001).

The large text box also provides more space for presenters to include visuals. However, presenters tend to misuse visuals or use inappropriate visuals, which mislead the audience. Doumont (2005) and Alley and Neely (2005) felt that presenters tend to focus more on using flashy animations and over-decorated visuals rather than presenting content in the slides. Goldstein (2003) agreed that presenters seem to have delegated the task of presenting the talk to the special effects in their slides rather than owning their presentation and making a connection with their audience as human beings. Furthermore, Garner et al. (2009) found that some images do not explain the point being made but instead repeat verbal information that is already in the slides. The inappropriate choice of visuals also misleads the audience (Markel, 2009). For example, Venn diagrams are used to compare two things in terms of similarities and differences. If a presenter uses Venn diagrams to present information about processes instead, the audience would be very confused about the message presented.

The criticisms above regarding the PowerPoint default slide structure seem to show that presenters do try to present the message in an impactful manner but often fail because they do not understand what effective communication involves. Let us now look at Doumont's (2002) three laws of professional communication, which can address these lapses and help us create effective PowerPoint handouts.

Doumont's Three Laws

Doumont's (2002) three laws focus on getting the message across to the reader in the most impactful manner given constraints. In order to do so, presenters must first have a clearly defined purpose or message. In addition, Doumont (2002) mentioned that presenters must be aware that the three laws have an order or precedence. For example, the second law cannot supersede the first law.

The first law is to adapt the content to the readers' needs. Duarte (2008) and Reynolds (2008) agreed that the most important process in preparing for presentations is the brainstorming process where presenters analyze their readers' needs and then define a clear purpose in their message to meet those needs. Doumont (2002) added that to fulfill the first law, presenters must focus on catching the readers' attention and getting them to act upon the message.

The second law is to maximize the signal-to-noise ratio in order to enhance the clarity of the message (signal) and minimize anything that would distort the message (noise). To maximize the ratio, presenters must increase the strength of the signal or filter out the noise. The strength of the signal is increased when presenters are clear about the readers' needs and the purpose of their presentation. In addition, noise is reduced if the handouts convey the message clearly and accurately without any irrelevant information or misleading graphics. Furthermore, presenters could improve on the clarity of their organization if they use an organization suitable for their audience. Gross and Harmon (2009) found that presentations made to general audiences are best organized as narratives while presentations made to professional audiences are best organized as arguments.

The third law is to utilize effective redundancy. In terms of organization, effective redundancy refers to handouts having an overview that outlines the content to be presented and a review to recapitulate main points before the conclusion.

Guidelines on document design and information graphics look at the visual and text elements at the individual slide level but not at the whole presentation level (Gross & Harmon, 2009). It is important to investigate to what extent individual slides are integrated into the presentation as a whole rhetorically because presenters need to present coherent arguments in handouts.

Methods And Procedures

Participants

One class of 22 students participated in this study. There were 15 Singaporeans, 4 Malaysians, 2 Burmese, and 1 Chinese national in this class. The students were polytechnic graduates who gained direct entry to the second year of their undergraduate studies. These students have written technical reports for their final year polytechnic project; however, they do not have experience in writing PowerPoint handouts.

Context

I teach Technical Communication to second-year engineering undergraduates in a university in Singapore. The course consists of 2-hour tutorials per week and lasts for 13 weeks. The course schedule and teaching materials are prepared by the module team in order to standardize teaching across the more than 50 classes taking this course each semester.

A key feature of last semester's course was the use of a project-based learning approach. The students wrote a report, developed an oral presentation based on the report with the aid of PowerPoint slides, and prepared a visual argument using PowerPoint handouts. As the assignments were related, it is necessary to explain what input was given prior to the students' submission of their visual argumentation assignment.

The first assignment was a group assignment in which the students had to write a recommendation report for a professional audience. The main information elements in the report follow Finkelstein (2005) and are listed below (Figure 1).

The introduction (background, objective, scope)

- The results (definition of the point of comparison, explanation of the relationship between the point of comparison and the conclusion needed, the results, and the explanation regarding the significance of the results)
- The conclusion and recommendations

Figure 1: The outline of the report following Finkelstein (2005)

Guidelines for Visual Arguments in Technical Handouts

For the second assignment, the students presented the part they wrote in the group report. Each student's presentation lasted 5 minutes and included the use of PowerPoint slides.

For the third assignment, the students had to prepare a visual argument using PowerPoint handouts for their part of the presentation. The rationale was that as this was a separate assignment it should cater to another audience need (other than oral presentation) as its primary focus (Doumont, 2002). Each student was limited to six PowerPoint slides. The handouts needed to have Introduction, Body, and Conclusion sections. As they were writing for a professional audience, I told them to use an argumentative organization (Gross & Harmon, 2009). In addition, I provided input mainly on document design and informative graphics following Bovee and Thill (2008). I also used the report outline to include a few more guidelines derived from Doumont's (2002) three laws in order to highlight to the students what they needed to focus on in the handout (Figure 2).

- The introduction (background, objective, scope)

  Focus on orientating your reader by having an overview, catch the reader's attention by acknowledging the reader's needs explicitly, and state a clear action that you hope the reader will take after reading your handout.

- The results (definition of the point of comparison, explanation of the relationship between the point of comparison and the conclusion needed, the results, and the explanation regarding the significance of the results)

  Focus on explaining the significance of the results in meeting your reader's needs, always consider the relevance of the content in your text or visual to your reader, go straight to the point in your text and visual (be concise), make sure you have a consistent layout, few changes in typeface and color.

- The conclusion and recommendations

  Focus on getting the reader to take a decisive action with regard to what you have presented; a review of the important results helps the reader.

Figure 2: Additional guidelines from Doumont's (2002) three laws that highlight to students the focus necessary in each section of the handout

In addition, I reminded the students that they needed to put in more effort to make the handouts clear because the readers would not have avenues for immediate clarification if they did not understand the content in the PowerPoint handouts. The breakdown of marks for this assignment was 20% for content and organization, 50% for design, and 30% for language. The students submitted the assignment 1 week after their oral presentations. After grading the assignments based on the given breakdown, I was very curious to find out the level of effectiveness of these handouts from a rhetorical perspective, specifically with reference to visual arguments, and thus I re-analyzed the handouts based on the checklist on the next page.

Analysis

The students' handouts were analyzed using a checklist derived from Doumont's (2002) three laws of professional communication and the above mentioned literature review to find out the level of effectiveness of the handouts in forming unified arguments.

The first information element in the checklist is the overview, which is important because it outlines the content of the whole presentation to readers at one glance. A clear context also helps readers better understand the argument. Thus, presenters should elaborate on the problem(s) faced in the company (background), propose a solution for the problem(s) faced (objective), and state the qualifications for their recommendation based on specific measurements (scope).

In addition, the clarity of the message could be enhanced if presenters follow a consistent argumentative organization. This consistent organization helps readers to understand the immediate visual and verbal context for the argument because readers can see how the ideas in each handout are linked to the whole argument. Presenters can reduce noise by using appropriate informative diagrams that contain only relevant results followed by verbal content that clarifies the significance of the results in the diagrams. Presenters can also review the main results at the end of the argument. Readers might miss important information in the argument and a review helps to re-establish common ground with the readers. A clear and explicit conclusion that answers the objective set out in the beginning of the argument also reinforces the strength of the argument.

Items in the checklist were not weighted because an argument should be viewed and assessed holistically rather than based on individual items. This is in line with Doumont's (2002) view that if law 1 is not fulfilled, law 2 and law 3 are unlikely to be fulfilled.

Results

Table 1 shows that Doumont's laws are helpful in judging the persuasiveness of the students' visual arguments. In addition, the weaknesses in the students' visual arguments show that the weaknesses applied to all three laws, which is in line with Doumont's (2002) view that the laws have an order of precedence.

Generally, the argument in the more persuasive handouts showed that the students were able to

establish a clear context for the reader. There was also a consistent argumentative organization that helped to provide a clear immediate visual and verbal context to the argument. The text and visuals also formed unified arguments. The students used tables that included only relevant results, and text to explain the significance of the results to the reader. However, many of these handouts lacked an overview, suggesting that the students seemed to view the overview as less important than the review.

The argument in the less persuasive handouts showed that these students underestimated the importance of setting a context for the reader because the overview, background, objective, or scope information elements were missing. In addition, there seemed to be a lack of a consistent organization in the

Table 1: Results showing the number of students who have the respective information elements in their handouts

Information elements / Number of students (N=22)	No. of students whose handouts have the information elements	No. of students whose handouts do not have the information elements
Effective redundancy		
Overview provided outline for the entire presentation	6	16
Adapting to the audience		
Background – Acknowledged the reader's needs	15	7
Objective – Stated what are being compared and for what purpose	17	9
Scope – Stated the terms in which they were compared	14	8
Maximizing signal-to-noise ratio		
Consistent organization – Definition, explanation of the definition, results, explanation of the significance of the results	15	7
Visuals in the Results section contained important results only	17	5
Text explained the significance of the results to the reader	16	6
Presenter used appropriate visuals to convey the message intended throughout the handout	14	8
Effective redundancy		
Review summarized main results	18	4
Clear conclusion stated	16	6

Guidelines for Visual Arguments in Technical Handouts

handouts and this inconsistency resulted in the reader not being able to link the ideas in each slide, and from each slide to the whole argument. Furthermore, the students sometimes used indicative diagrams, which confused the reader. For example, one student had two arrows pointing toward each other from opposite directions in one slide to signify that the top speed of a car is 160 km/h whereas the top speed limit on expressways is 90 km/h. Although in engineering it is common to use these two arrows to indicate opposing forces, a table would have been a more appropriate diagram to present the intended message. Furthermore, the text in the handout repeated the results presented in the diagram, rather than explaining the significance of the results to the reader. In addition, many students did not have a clear review or conclusion for the reader.

Examples of persuasive and nonperuasive handouts are given below. These two examples were taken from two students in the same group.

Student 1

Student 1 was proficient in forming a unified visual argument in the handout (Figures 3a–3f). In the first slide (Figure 3a), Student 1 provided a clear context for the problem affecting the reader (the university's Planning and Estate Office) by stating that there was a need to reduce the electrical consumption of the air-conditioning system because it accounts for 60% of the electricity bill. Student 1 then stated that the objective of the argument was to convince the reader that the thermal energy storage (TES) system was better than

Figure 3a: Student 1 provided a clear context for the problem affecting the reader

the heating, ventilation and cooling (HVAC) system in terms of energy usage and operating cost.

Furthermore, Student 1 presented the content accurately and clearly with few irrelevant or misleading visuals (Figures 3b–3e). In addition, Student 1 provided an "overview" in the second slide (Figure 3b) that included a definition of the two points of comparison (energy usage and operating cost) and explained the relationship between the points of comparison and the expected outcome in the results (if the energy usage and tariff or electricity cost goes up, the operating cost would increase). Student 1 might have presented the definitions (which were supposed to be in the results section) in the overview slide because the two terms were the two main ideas that Student 1 was going to present for the argument.

Figure 3b: Student 1's overview slide provided the definition and explanation of the definition for operating cost and energy usage

Student 1 tried to highlight the significance of the results to the reader by establishing the difference in operating cost during peak and off-peak hours in Figure 3c. Student 1 stressed that there was a need to capitalize on the 7-cent difference for better cost savings.

Figure 3c: Student 1 highlighted the 7-cent difference in electricity cost during peak and off-peak hours

In the fourth slide (Figure 3d), Student 1 reinforced the argument that better cost savings could be achieved with the use of the TES system because it could shift its energy usage to the off-peak period. Student 1 highlighted in the table that although there was only a slight difference in terms of total energy usage in 24 hours, the difference in energy usage for the TES and HVAC systems during peak and off-peak hours was quite substantial, with the TES system using more energy during the off-peak hours while the HVAC system used energy only during the peak hours. Student 1 further explained that the TES system was able to shift its energy usage to off-peak hours because it freezes and

Figure 3d: Student 1 highlighted that there was a substantial difference in energy usage during off-peak hours between the two systems

Figure 3e: Student 1 showed how the difference in energy usage translated into substantial cost savings per day for the TES system

stores ice at night and uses the energy stored in the ice to cool the facilities.

Student 1 further highlighted the significance of the results in terms of cost savings to in the fifth slide (Figure 3e). The slide showed that using the TES system resulted in a savings of $583.19 per day, the equivalent of a 40% reduction in operating cost per day.

Student 1 concluded the argument by providing a review in the sixth slide (Figure 3f) showing that the TES system is better than the HVAC system because it uses less energy and reduces the operating cost by 40%. Student 1 could have added that based on the results, the TES system is recommended as the better air-conditioning system to make the conclusion of the presentation more explicit to the reader.

Figure 3f: Student 1's conclusion slide where the main results were reviewed

Guidelines for Visual Arguments in Technical Handouts

Student 2

Student 2's visual argument in the handout was ineffective. Student 2 did not provide a context for the argument as the overview, background, objective, and scope information elements were missing. Thus, the reader was not aware until the last slide that the student's aim was to convince them that the TES system was better than the HVAC system in terms of reliability, storage space, and reduced fire risk.

In addition, Student 2 tried to maintain the "definition, explanation of definition, results, explanation of the significance of the results" organization in the Results section but Student 2's argument was clouded by the presence of many irrelevant and misleading visuals (Figures 4a–4e). Student 2's first slide (Figure 4a) did not define "reliability" or establish the outcome in the data the reader should be looking for. Instead, Student 2 presented the results on reliability in the first sentence by mentioning that the TES system had a backup standby cooling system while the HVAC system did not. Student 2 repeated this idea again in the second sentence and then used a table to highlight that the maximum cooling capacity of TES during the peak period was more than 70% while that of HVAC was less than 50%. The information in the table was confusing because the reader could not establish a clear link between the standby cooling system and the cooling capacity during the peak period. In addition, the text that followed the table did not explain the significance of the finding but instead repeated the same information seen in the table.

Figure 4a: Student 2's unclear argument about standby cooling capacity and maximum cooling capacity

Student 2's explanation of the significance of the finding in the first slide was found in slide 2 (Figure 4b). The explanation was confusing because it was difficult to see the links in the argument. Student 2 mentioned that high reliability led to low maintenance (which is logical) but then went on to attribute it to the smaller size of the TES components. Student 2 further wrote that as the components were smaller, it would be easier for the technicians to repair the system. This statement confuses the reader because smaller components are not necessarily easier to repair.

Figure 4b: Student 2's explanation on why the TES system was more reliable

Student 2's third slide (Figure 4c) presented the second point of comparison, which was storage space. Student 2 seemed to have phrased the cause-and-effect relationship incorrectly because Student 2 mentioned that "storage space determines how large the storage tank will be." Logically, the size of the storage tank would determine the storage space needed and not vice versa. As the heading of the slide was storage space, the reader would expect information about the size of the storage space needed. Instead, in the sentence preceding the table Student 2 talked about the amount of chilled water needed and also highlighted in the table the amount of chilled water needed.

In slide four (Figure 4d), Student 2 provided information on the space required for the TES system and explained why it had to be placed underground. The two statements here disrupt the flow of the argument further as they would be more appropriate for slide 3. Furthermore, Student 2 used two unlabelled images, which seemed to serve a decorative function to fill up empty space in the slide.

Figure 4d: Student 2's suggestion on where to store the TES system

Student 2's argument regarding the third point of comparison (reduced fire risk) was also confusing (Figure 4e). Student 2 mentioned that the chilled water in the TES system could be used to extinguish fires but failed to establish why this led to a reduction in the facility and insurance premium costs. In addition, Student 2 did not have a Conclusion slide even though Student 2 had not used up the maximum number of allowed PowerPoint slides.

Figure 4c: Student 2's unclear argument about storage space and the amount of chilled water needed to operate the system

Figure 4e: Student 2's explanation about how the TES system reduced facility and insurance premium costs.

Discussion

The objective of this paper was to establish criteria for judging the persuasive capabilities of students' visual arguments in handouts converted from slides. The students' handouts were analyzed based on a checklist derived primarily from Doumont's (2002) three laws of professional communication. These laws have been tested on individual slides but there are no specific guidelines to date on the use of these laws to create effective visual arguments in technical communication handouts.

The results show that there was no automatic transfer of the students' knowledge from their verbal argumentation to their visual argumentation assignment. Although the students had already written their section of the report and presented their section orally, some of the students could not coherently structure the visual argument in their handout. The results from this study also seem to suggest that the weaknesses in the students' arguments are not just confined to one law but apply to all three of Doumont's laws. This is in line with Doumont (2002) who mentioned that the laws have an order of precedence. The two student examples above also highlighted that there can be distinct differences in the quality of the visual argument presented even between students in the same group. Thus, more specific

Guidelines for Visual Arguments in Technical Handouts

guidelines would help students analyze for themselves the effectiveness of the visual argument in their handouts.

In summary, I would like to share a few specific guidelines gleaned from this study on how to structure effective visual arguments in handouts:

1. Each document (report, slides or handout) should be a stand-alone document. Even if there are presentations (report or speech) before the handouts are distributed, presenters need to prepare the handouts with the assumption that readers will not re-read the report. Hence, information needs to be presented as clearly in the handout as in the report, and with more effort owing space constraints of PowerPoint slides.

2. Each document (report, slides, or handout) serves different purposes. Reports present detailed and lengthy arguments, slides are meant to supplement presentations, and handouts are meant to present detailed but concise information. Information presented in one document cannot be re-used without adaptation in another document.

3. Information elements like the overview, background, objective, and scope are very important in establishing a clear orientation and context for the reader. These elements cannot be omitted due to space constraints.

4. The flow of argument in the handouts could be enhanced if presenters follow a consistent structure. In this study, the Results section had a consistent "definition, explanation of definition, results, explanation of significance of the results" flow. A consistent structure helps presenters go straight to the point and be mindful about the message that has to be conveyed.

5. Information in the text and visuals should form a unified argument where the text explains rather than repeats the significance of the results in the visuals to the readers' needs. Presenters should not introduce too many new variables in an argument since it confuses the reader.

6. Informative diagrams are more appropriate for visual arguments in technical communication than indicative or decorative diagrams because they promote understanding of the argument. In addition, where visual illustrations or data graphics

are used, communicators must label them to convey their relevance. Furthermore, the visual information must be carefully chosen so that it directly supports the author's argument.

7. It is important to review the results and also state an explicit conclusion after the review in order to leave readers with no doubt as to how the objective of the argument has been answered.

Conclusion

Technical communication practitioners often create handouts that are converted from slides meant for presentations. I have emphasized that handouts and slides serve different purposes and I have proposed specific guidelines on how to create effective visual arguments in handouts. In the classroom, visual argumentation is seldom taught explicitly beyond the document design and informative graphic aspects. Two possible reasons for this might be that many teachers assume their students will be able to automatically transfer their knowledge about verbal argumentation to visual argumentation, and teachers may be unsure about what to teach their students about visual argumentation. I hope that the guidelines above are useful in encouraging teachers of technical communication to allocate more time in the curriculum to teaching visual argumentation and to promote more discussion within the academic community and among practitioners about the use of visual arguments in real-world contexts. Although the context for this study makes reference only to the recommendation report and the argumentative rhetorical strategy, I hope that the guidelines will be useful for other contexts of technical communication because the theoretical framework for the guidelines is based on Doumont's (2002) three laws of professional communication, which are general laws of communication. In addition, the sample in this study is small (one class only). I hope that more experimental research will be carried out to improve on the guidelines provided.

References

Alley, M. (2009). *Rethinking the design of PowerPoint slides: The assertion-evidence structure*. Retrieved March 29, 2010, from http://writing.engr.psu.edu/slides_body.html.

Alley, M., & Neely, K. A. (2005). Rethinking the design of presentation slides: A case for sentence headline and visual evidence. *Technical Communication*, *52*, 417–426.

Amare, N., & Manning, A. (2007). The language of visuals: Text + graphics = visual rhetoric. *IEEE Transactions on Professional Communication*, *50*, 57–70.

Atkinson, C. (2005). *Beyond bullet points: Using Microsoft® PowerPoint® to create presentations that inform, motivate and inspire* . Redmond, CA: Microsoft Press.
Birdsell, D. S., & Groarke, L. (1996). Toward a theory of visual argument. *Argumentation & Advocacy*, *33*, 1–10.

Blair, J. A. (2004). The rhetoric of visual arguments. In C. A. Hill & M. Helmers (Eds.), *Defining visual rhetorics* (pp. 41–61). Mahwah, NJ: Lawrence Erlbaum.

Bovee, C. L., & Thill, J. V. (2008). *Business communication today* (9th ed). Upper Saddle River, NJ: Pearson Prentice Hall.

Brumberger, E. (2005). Visual rhetoric in the curriculum: Pedagogy for a multimodal workplace. *Business Communication Quarterly*, *68*, 318–333.

Doumont, J.-L. (2002). The three laws of professional communication. *IEEE Transactions on Professional Communication*, *45*, 291–296.

Doumont, J.-L. (2005). The cognitive style of PowerPoint: Slides are not all evil. *Technical Communication*, *52*, 64–70.

Duarte, N. (2008). *slide:ology: The art and science of creating great presentations*. Sebastopol, CA: O'Reilly Media.

Finkelstein, L. (2005). *Pocket book of technical writing for engineers and scientists.* New York, NY: McGraw-Hill.

Fleming, D. (1996). Can there be visual arguments? *Argumentation & Advocacy*, *33*, 1–20.

Garner, J. K., Alley, M., Gaudelli, A. F., & Zappe, S. E. (2009). Common use of PowerPoint versus the assertion-evidence structure: A cognitive psychology perspective. *Technical Communication*, *56*, 331–345.

Garvin, D. A. (2003). Building a learning organization. *Harvard Business Review on Knowledge Management*. Cambridge, MA: Harvard Business School Press.

Godin, S. (2008). *Presentation Zen: Simple ideas on presentation design and delivery*. Berkeley, CA: New Riders.

Goldstein, M. (2003). It's alive! The audience, that is, but some presenters don't seem to know it. *Successful Meetings*, *53*, 20.

Gross, A. G., & Harmon, J. E. (2009). The structure of PowerPoint presentations: The art of grasping things whole, *IEEE Transactions on Professional Communication*, *52*, 121–137.

Kalyuga, S., Chandler, P., & Sweller, J. (1999). Managing split-attention and redundancy in multi-media instruction. *Applied Cognitive Psychology*, *13*, 351–371.

Lee, C. C., & Tan, S. C. (2010, December 7). Graphic representations and transfer of ideas between multi-draft pre-writing stages. Paper presented at the Ascilite Conference, Sydney, Australia.

Lin, H. F. (2007). Knowledge sharing and firm innovation capability: An empirical study. *International Journal of Manpower, 28*, 315–332.

Markel, M. (2009). Exploiting verbal-visual synergy in presentation slides. *Technical Communication*, *56*, 122–131.

Mayer, R. (2001). *Multimedia learning*. Cambridge, UK: Cambridge University Press.

Peirce, C. S. (1935). Collected papers of Charles Saunders Peirce, In C. Hartshorne & P. Weiss (Eds.), *Pragmatics and pragmatism* (vol. 2). Cambridge, MA: Harvard University Press.

Reynolds, G. (2008). *Presentation zen: Simple ideas on presentation design and delivery.* Berkeley, CA: New Riders.

Robinson, J. (1998). Engineering thinking and rhetoric. *Journal of Engineering Education*, *87*, 227–229.

Tufte, E. (2003). *The cognitive style of PowerPoint*. Cheshire, CT: Graphics Press.

Trussler, S. (1998). The rules of the game. *The Journal of Business Strategy*, *19*, 16–19.

Guidelines for Visual Arguments in Technical Handouts

About the Author

Chien-Ching Lee teaches technical and professional communication in Nanyang Technological University. Her research interests are in visual communication and interactivity issues in social media. Contact: leecc@ntu.edu.sg

Color Matters: Color as Trustworthiness Cue in Web sites

Wouter A. Alberts and Thea M. van der Geest

Abstract

Purpose: In today's increasingly technological world, the first impression of an orgnization is often based on a user's judgment of the corporate Web site's trustworthiness. This study investigates whether color as a Web site element can serve as a trustworthiness cue. In addition, the context of these Web sites was taken into account as research indicates that emotions associated with colors might differ between contexts.

Method: An experimental study was conducted in which first impressions of trustworthiness of Web sites were measured in relation with the chosen color scheme. More than 200 participants evaluated eight finance, eight legal, and eight medical Web sites on perceived trustworthiness. Each respondent was presented with an identical Web site that only differed on the used color scheme. Four different color schemes (red, blue, green, and black) were put to the test.

Result: The findings indicate that when the same Web site is presented using different color schemes, the Web sites are considered to have different levels of trustworthiness. Color has a statistically significant but limited effect, compared with all other reasons people can have to trust a Web site. Overall, the blue color scheme was perceived as most trustworthy and black as least trustworthy. The effect of the context is statistically significant, but very small.

Conclusion: The color-trustworthiness relationship has never been demonstrated in the context of Web sites. This study supports the common sense idea with scientific evidence by showing that color matters in a user's judgment of a Web site's trustworthiness. Web site designers can increase the trustworthiness of a Web site by using an appropriate color scheme.

Keywords: color, trustworthiness, Web site, credibility, trust.

Practitioner's Takeaway

- The users' view on the trustworthiness of a Web site is influenced by the color scheme of that Web site.
- The influence of color scheme on the trustworthiness of a Web site differs between contexts.

- Blue and green color schemes are a safe choice for different contexts.

Color as Trustworthiness Cue in Web sites

Introduction

One of the many design decisions that Web site designers have to consider is the basic color scheme for a Web site under construction. For existing brands it is often easy: The choice of color scheme is determined by the existing corporate color scheme. Some sites have a strong thematic association, like green and blue for nature and environment conservancy organizations; other sites are directed by a dominant corporate brand color, like blue for "Big Blue" IBM and red for the Coca-Cola Company. But what do you do when the brand doesn't exist yet, or when organizations merge and in the process are changing names and corporate styles? Common sense tells us that color matters: we don't expect a law firm or a hospital to present itself in purple, or a toy store in black and white. The chosen color scheme is particularly essential for e-commerce and e-service organizations that must make the right impression just through their Web site, because they are not supported by the physical qualities of the products offered the cues in the physical and spatial environment of the store, or the likeability of the sales person. The Web site must not only make the service or product offer very clear, but also create the users' perception that the organization can be trusted to deliver the purchased service or product as expected. Mackiewicz (2009) supposes that technical communicators might lack confidence in their color choices. They might wonder whether it matters which color is selected for the site, and if so, which color would work best if they intend to create a trustworthy impression for an organization. In this article, we report on an experimental study in which first impressions of trustworthiness of Web sites are studied in relation to the chosen color scheme. We focus on color because it is one of the easiest Web site characteristics that designers can manipulate.

Trustworthiness, Credibility, and Trust

Trustworthiness and credibility of Web sites, and the resulting trust that users have in Web sites and in the organizations behind the Web sites, have become a topic of engaged scientific debate among e-commerce researchers in the past ten years. Building trust is assumed to be imperative for success in the e-commerce environment (Corritore, Kracher, & Weidenbeck, 2003; Jarvenpaa & Tractinsky, 1999). Lack of trust is often mentioned as one of the main reasons for non-adoption of e-commerce and online purchases (e.g., Jarvenpaa & Tractinsky, 1999; McKnight, Choudhury, & Kacmar, 2002; Reichheld & Schefter, 2000). Trust in general is an important factor in contexts of risk and uncertainty, when one party (the trustor) has to rely on the behavior, the integrity, and the expertise of the other party (the trustee or the object of trust). In the business context, it determines the nature of people's interactions and their expectations for the relationship with a vendor. Gefen (2002) defines trust as a concept with several layers of meaning. It refers both to a general belief that the other party can be trusted, and to specific beliefs that a trustor holds about the integrity, benevolence, ability, and predictability of the party to be trusted. Those specific beliefs compose trustworthiness. In the context of the Internet, initial trust is assumed to be very important (McKnight et al., 2002). Initial trust is the kind of trust that trustors must invest when they do not have meaningful information or a positive or negative bond with the trustee. As McKnight et al. state: "The period during which a consumer visits and explores a vendor's Web site for the first time [...] is clearly within the domain of initial trust" (p. 336). In this study we have focused on initial trust, evoked by Web sites that are viewed for the first time. For an overview of other factors related to trust, see McKnight et al. (2002), Gefen (2002), Gefen and Straub (2000), and Grabner-Krauter and Kalusha (2003).

Trustworthiness is often confounded with credibility. In a narrow sense, credibility is the trustor's belief that information is accurate and reliable, for example because the source (the person or object who delivers the information) has a reputation of giving accurate information, or because the information is supported with ample and convincing evidence. McKnight et al. (2002) assume that credibility is built up when parties have interacted for some time, and hence is different from initial trust. Trustworthiness is a broader concept than credibility, because it is not restricted to the perceived quality of information. It covers every aspect of the Web site and its content that can contribute to beliefs that the other party can be trusted. However, the two concepts are used as equivalents in many studies of online trust and trustworthiness.

In our study, the trustworthiness of Web sites was measured. On the Internet, the Web sites rather than the organizations themselves or their representatives, become the object of trust and must evoke or create the specific beliefs that compose trustworthiness. For designers of Web sites it is essential to know which design elements, features, or characteristics of the Web site are signaling trustworthiness and can serve as cues for the creation or maintenance of trust.

Trust Cues in Web sites

Trust results from a mix of beliefs and convictions. For a legal Web site, a visitor can hold the beliefs that a particular legal firm is very trustworthy, that many lawyers are crooks, and that the legal system in general is in our common interest. These convictions play an important role when someone judges the trustworthiness of a legal Web site, and Web site designers cannot easily change or influence these beliefs. However, it is worthwhile to consider what a Web site designer can include in the design that can serve as trust cues and add a belief to the ones already established. Hence our focus on Web site design elements as trust cues, and on color in particular.

Several previous studies have focused on trust cues in Web sites. We are currently reporting studies that focus on visual elements, in particular color, as trust cues. Fogg (2003) developed a theory of credibility, which he defines in a way that matches our definition of trustworthiness. The prominence-interpretation theory explains how people assess the credibility of Web sites. It posits two aspects of a credibility (or trustworthiness) assessment: the likelihood that an element related to the Web site will be noticed or perceived (prominence) and the value or meaning assigned to the element based on the user's judgment, good or bad (interpretation). Fogg (2003) identified five factors affecting prominence: user involvement, information topic, task, experience level, and other individual differences. Three factors affect interpretation: user assumptions, user skill and knowledge, and contextual factors such as the environment in which the assessment is made. The study presented here can be placed in the framework of the prominence-interpretation theory. It investigates whether color as a conspicuous Web site element

(prominence) can serve as a trustworthiness cue (interpretation).

In an exploratory investigation of trust cues, Fogg, Soohoo, and Danielson (2002) asked more than 2,600 users to evaluate sets of paired live Web sites that were selected from 10 different contexts (for example news sites, travel sites, financial sites). Each pair of Web sites presented side by side belonged to the same category. The participants were asked to rate which of the two presented sites they found more credible. After having rated the pairs, they explained their criteria for credibility in open questions. The aim of this study was to obtain insight into the factors which, in the view of the respondents, determined the credibility of Web site. Fogg et al. found that users rarely used rigorous criteria when evaluating Web sites: "the average consumer paid far more attention to the superficial aspects of a site, such as visual cues, than to its content" (p. 6). For example, nearly half of the participants evaluated the credibility with a reference to the appeal of the overall visual design of a Web site, such as the color scheme. Fogg and his co-authors emphasized the speed with which users generally make judgments, and stated that visual design is important because, "The visual design may be the first test of a site's credibility. If it fails on this criterion, Web users are likely to abandon the site and seek other sources of information and services" (p. 26). They also stressed that the impact of overall visual design varied between site categories. Visual design criteria were mentioned more frequently for assessing finance, search engine, travel, and e-commerce sites, and less frequently for health, news, and nonprofit sites. This suggests that visual design as a trustworthiness cue within Web sites might be context-sensitive; a relation that we further explored in our study.

Robins and Holmes (2008) explored in their study the possible link between page aesthetics and a user's judgment of the site's credibility. They selected 21 Web sites and made them all available in two versions: a high aesthetic version (screen dump of the original) and a low aesthetic version (copy of original stripped of its visual elements). Twenty participants judged the 42 Web sites on their first impressions. Robins and Holmes conclude that when the same content is presented using different levels of aesthetics, the more aesthetic Web site was judged as having higher credibility. Van der Geest and Van Dongelen (2009) manipulated visual appeal of 12

Color as Trustworthiness Cue in Web sites

Web sites (screen dumps of home pages) and presented Web sites with high and low visual appeal during 750 milliseconds to prompt their 588 participants to report on first impressions of expected information quality (credibility in the narrow sense). A week later, 355 of the original participants were exposed again to the sites but now for a longer time (5 seconds) and again assessed the expected information quality. Their findings supported Robins and Holmes' (2008) conclusion that Web sites with a high visual appeal were rated higher on expected information quality than comparable Web sites with a low visual appeal. The longer exposure in the follow-up study reduced the effect of visual appeal somewhat, but the difference between more and less appealing Web sites remained. On the basis of these studies we conclude that visual design elements do act as trust cues in Web sites. One of the most prominent visual cues is color.

Perception of Color in Web sites

Perception of Aesthetics

Tractinsky and Lowengart (2007) examined the role of beauty (indicated with the term aesthetic design) in Web stores. In their study, they state that beauty is a subjective perception, based on a viewer's evaluation of visual design properties: Beauty is in the eye of the beholder. According to Tractinsky and Lowengart (2007), aesthetic evaluations of an artifact are made on the basis of both what the object looks like according to the viewer (perceptual evaluation) and what it means for the viewer (cognitive evaluation). The perceptual evaluation is based on the design properties that create appearance, such as color, shape, and size. The cognitive evaluation relates, in their opinion, more to the artifact's meaning or to the elicited associations and hence is influenced by concepts such as symbolism, identity, or image.

Tractinsky and Lowengart (2007) say that prior research suggests that there are two basic mechanisms by which aesthetics can affect decision making, such as the decision to make a purchase in a non-rational way. They base the two mechanisms on the Elaboration Likelihood Model of Petty and Cacioppo (1986). The first mechanism they suggest is the halo effect, which carries over first impressions of a Web site to user evaluations of other attributes of that Web site. For example, a

beautifully designed Web site of a clothing store might lead users to believe that the garments on offer are also very beautiful. The aesthetic design is seen as a sign of professionalism and therefore a good indication of the organization's quality and ability to serve its users. The second mechanism suggested by Tractinsky and Lowengart (2007) is that aesthetics may influence the users' evaluation by inducing an affective, non-rational response. When viewers are not motivated or do not have the capacity to process the information, they tend to use such non-rational "mental shortcuts," indicated with the term "heuristics," to come to a decision. One of the heuristics that is known from other fields of research is: What is beautiful is good. Applied to our case, it means that people may base their trustworthiness judgment on first impressions of Web site attractiveness or on a very shallow analysis of the site, rather than on a careful evaluation of the attributes and content of the site. They jump to conclusions based on the Web site's attractiveness. Because the Web site is visually appealing at first sight, they assume it is trustworthy. In our study we have assumed that color is an important and prominent element of the first visual impression of a site.

Perception and Appreciation of Color

Several studies have focused on the role of color in the perception and appreciation of Web sites. Gorn, Chattopadhyay, Sengupta, and Tripathi (2004) investigated the link between the color of a Web page's background while the page was downloading and the perceived quickness of the download. Their study indicates that the background screen color influences how quickly the user thinks a page is downloaded, even when in reality the download time was exactly the same for each tested background color.

In an experimental study, Schenkman and Jönsson (2000) studied the first impressions of 13 different web pages presented to 18 participants. They distinguished the following four primary dimensions as influencing preferences for particular designs:

- Beauty
- Mostly illustrations versus mostly text
- Overview
- Structure

Participants were proven to base their preferences primarily on the beauty dimension, how beautiful and appealing the person thought the page was. Schenkman and Jönsson did not specifically study the color aspect of Web sites, but point out that "[...] color would be expected to be one of the important factors for the preferences and the beauty ratings" (p. 376). The study reported here further investigates the role of color in creating trustworthiness.

Color in Context

Information is always selected and processed within a particular context. People use the context to quickly decode which information is relevant to the situation. The context defines how the message gets interpreted, a process known as sense-making (Dervin, 1989). With regard to color, the meanings attributed to different colors are associated with the context in which the color is used. In fact, color meanings are learned (Grossman & Wisenblit, 1999). For example, the use of a red instead of a black pencil when commenting on text has become associated with marking errors, a color association that we have learned to interpret as meaningful in the context of text reviewing and grading (Rouland, 1993).

Valdez and Mehrabian (1994) studied the effect of color on users' emotions. They demonstrated that the context in which a color is used can have a substantial bearing on users' emotions evoked by the color, as illustrated with the following example: "although the present data indicated blue to be a pleasant color, blue hair or blue food, for instance, are not expected to elicit pleasant reactions" (p. 408). Bottomley and Doyle (2006) also explored the relation between context and color, focusing on the process of building brand meaning by using colors that are appropriate for particular contexts. Distinguishing functional brands (that fulfill practical needs of consumers) from sensory-social brands (that fulfill more symbolic needs such as self-identity), they showed that it is more appropriate for functional products to be presented in functional colors (gray, black, blue, and green), and sensory-social products in sensory-social colors (red, yellow, bright pink, and purple). Their explanation of why some colors are more appropriate in a category than others is interesting. They assume that appropriateness is influenced by the ease with which a stimulus is processed: A congruent combination of color and

product will be processed with less effort and hence be perceived as more appropriate than incongruent combinations.

These studies show that perception and evaluation of colors are linked to contexts and that judgment about the most appropriate or the most preferred color differs between contexts. People do not have just one favorite color, but a favorite color for each context (Grossman & Wisenbilt, 1999). We decided to study the effect of color use on trustworthiness judgments of a site, taking the influence of context into account.

Method

Our study addressed the following research question: What is the relationship between the color scheme used within Web sites and the perceived trustworthiness of those Web sites, and does the Web site context have an effect on this relationship? We set up an experiment to investigate those relationships.

Participants

A convenience sample of 220 students at the University of Twente, which is located near the German border, participated in the experiment and completed the questionnaire. Eight of them proved to be color blind; their results were removed from the data set. Thirty-three respondents were not Dutch nationals; 28 of them were German. We decided to treat the non-Dutch respondents as a separate group because visual design preference may be related to culture (Aslam, 2006; Madden, Hewett, & Roth, 2000). We removed their responses from the data set for the main analyses, but retained the considerable group of German respondents to explore any differences between two so closely located countries as the Netherlands and Germany. In this section, the results are reported on the remaining 179 Dutch participants. They are average Internet users (weekly 10 to 20 hours) and their mean age is 22 years (SD = 2.1).

To make sure that the respondents saw the online questionnaire in more or less identical conditions, we also gathered statistics about traffic to the online questionnaire (screen resolution, color depth, and time visit). The most important conclusion is that participants were able to view the Web sites accurately,

Color as Trustworthiness Cue in Web sites

with sufficient color depth (98%) and screen resolution (99%). The average visit time among participants was between 10 and 15 minutes, which was also announced as the time needed to complete the experiment. Participants received no money or course credit, but were told they could win a free lunch by completing the study.

Materials

Web sites. We aimed at measuring the perceived trustworthiness of Web sites in various contexts, using actual home pages of real Web sites. We used English language Web sites from non-Dutch and non-German organizations and removed the original organizations' logo and Internet address from the pages

to prevent possible recognition of the Web site by participants. In the questionnaire, we presented each Web site as an image of 408 × 318 pixels. In previous studies, images of the object of analysis have proved themselves as reliable and valid material (Brunel & Kumar, 2007). By showing the Web sites as an image that could not be manipulated, and that only differed from its counterparts in color scheme, differences in trustworthiness judgments could only be attributed to the different color schemes.

Context. In this study, we defined context as the commercial sector in which the organization behind the Web site was active. We decided to select three equally "risky" contexts in which initial trust is essential, so we chose Web sites of financial, legal and

Figure 1. Example of a financial website in four color schemes: (upper-left) blue, (upper-right) black, (bottom-left) red, and (bottom-right) green

medical organizations that our respondents were not familiar with. Risky contexts are those in which users have to rely on the expertise of the other party and must disclose personal, possibly sensitive information about themselves. In this kind of context, users must trust the Web sites and hence will be more sensitive to trustworthiness cues. By selecting three contexts with a similar degree of perceived risk, we controlled the factor of risk influencing trustworthiness. Finally, we presented eight unfamiliar Web sites from each of the three contexts to make sure that the expressed judgments were stable, and influenced by the Web sites, and not just a haphazard answer to a one-time question or influenced by prior experience with the company.

Color Scheme. Because Web sites rarely have just one color, we selected and redesigned existing Web sites using different hues and tints from one of four color schemes: red, blue, green, or black. Figure 1 shows the four color varieties of one of the eight financial Web sites.

Procedure

To answer the research questions, we conducted an online experiment. First, participants were presented with written instructions in Dutch and then were asked to complete a color blindness test according to the Ishihara method, in which participants have to distinguish a digit in a pattern of dots (Ishihara, 1969). Next, participants were asked to evaluate the trustworthiness of a series of screen images, which were presented two at a time, side by side, that were only different in the color scheme used in the Web site (see Figure 2). We did not reveal the purpose of the study to participants; they were only asked to judge trustworthiness of each Web site (screen image) on the basis of their first impressions. Each participant saw two of the possible four color schemes for each Web site, in a random, counterbalanced color combination, random presentation order, and random left-right position. In total, the respondents rated 48 screen images (24 pairs) for trustworthiness, expressing their judgment
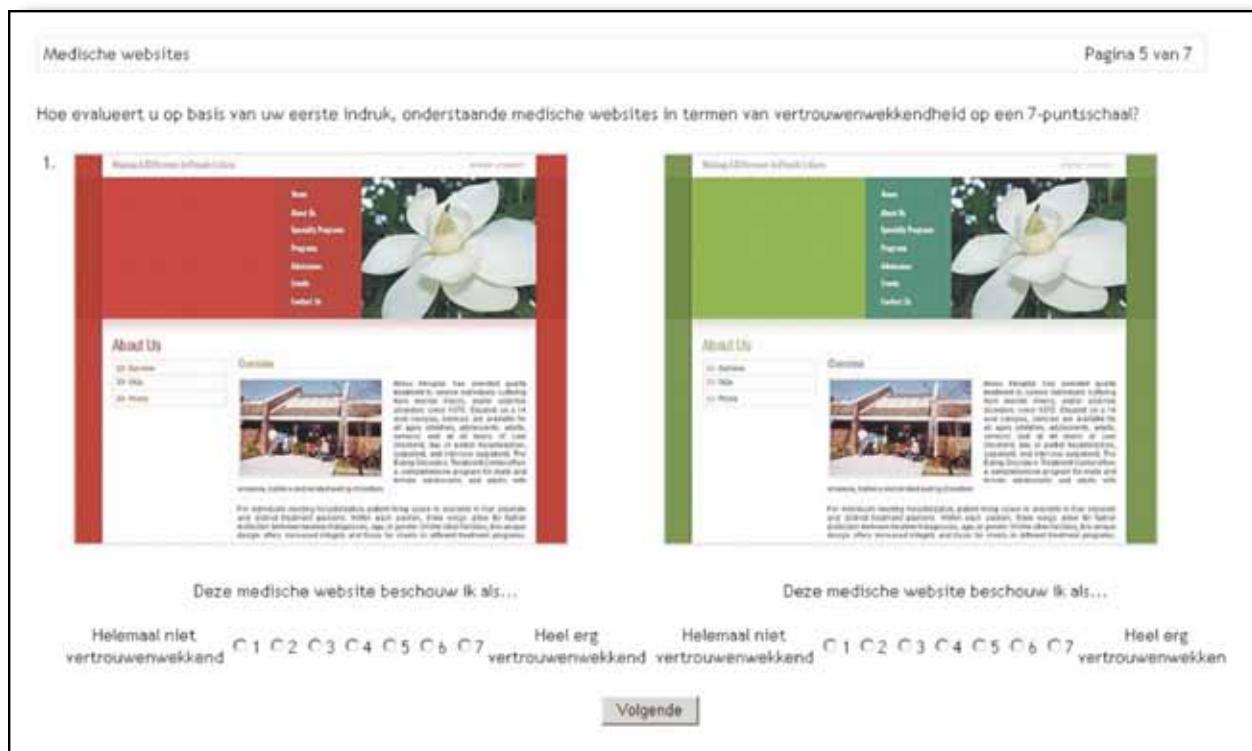

 Figure 2. Experimental presentation of two color versions of a medical website; (left) red color scheme and (right) green color scheme

Color as Trustworthiness Cue in Web sites

"I consider this Web site…" on a 7-point scale (not trustworthy at all to very trustworthy), a presentation format that was identical to the one used in the study of Fogg, Soohoo, & Danielson, 2001. Eight pairs of Web site screens were from the financial context (such as stock brokers and financial advisors), eight pairs from the legal context, and eight pairs from a medical context.

After every set of eight screen images from a particular context, we asked the participants with an open question to indicate which color they thought was the most trustworthy for that particular context: finance, legal, or medical. After completion, participants were debriefed and thanked for their participation.

Results

Color Scheme and Perceived Trustworthiness

Our main question was whether there is a relation between the color scheme used in the Web site design and the trust the site evokes in the viewers. Did our respondents judge the trustworthiness of Web sites differently on the basis of their color?

Figure 3 shows that the color scheme of the Web site did influence the trustworthiness judgment. Over all contexts and Web sites, the blue color scheme was perceived as most trustworthy and the black color scheme as least trustworthy. The differences in trustworthiness judgments were not caused by individual differences between respondents or by "chance", but were statistically significant (tested with ANOVA,
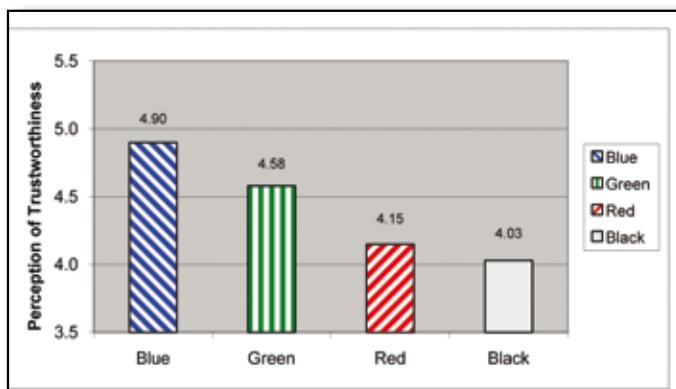

Figure 3. Perceived trustworthiness by color schemes, all contexts (scale 1 = not trustworthy at all, 7 = very trustworthy)

$(F(3, 8158) = 198.21, p \leq .001)$. Therefore, color matters within Web sites, and leads to different perceptions of trustworthiness.

Having assessed in general that color matters, we checked in more detail whether the four colors differed from each other in their effect on trustworthiness by analyzing the trustworthiness judgment for the two similar screens that were presented side by side (see Figure 2). In this way, we could see whether the difference between (for example) green and red or between red and black is statistically significant. This proved to be the case, as Table 1 shows. As one can see, the trustworthiness of (for example) the blue versions of the sites was rated 0.87 points higher on a 7-point scale than the trustworthiness of the black versions of the sites. The difference between the trustworthiness judgments of the red and black color scheme is statistically significant at $p = .018$, all other differences at $p < .001$.

Table 1. Mean differences of trustworthiness of color schemes

Color scheme	Black	Red	Green
Blue	.87	.75	.32
Green	.54	.43	
Red	.12		

Note. First column represents color schemes with highest perceived trustworthiness.

Our analysis of variance (ANOVA) analyses of the perceived trustworthiness judgments allow us to determine what the effect size is of color scheme; therefore, to what extent color contributes to the trustworthiness. The effect size of color is limited; it explains (over all contexts and Web sites) 6.8% of the variance in perceived trustworthiness. We will discuss the interpretation of that limited effect below.

We checked whether the women and men in our test judged the trustworthiness differently. The 73 female participants proved to rate the various color schemes significantly higher on trustworthiness than the 106 men. The mean value for women was 4.52 on a 7-point scale, against 4.27 for the men (analysis with T-test, $p \leq .001$). The effect on trustworthiness explained by the color scheme was also higher for women (7.4%) than for men (6.3%), suggesting that women, a bit more than

men, base their trustworthiness perception on the used color scheme.

Context and Perceived Trustworthiness

We also explored whether the relationship between trustworthiness and color scheme would hold in the three different, but equally risky contexts: financial, legal and medical. To do so, we analyzed the data set for each context separately (Figure 4).
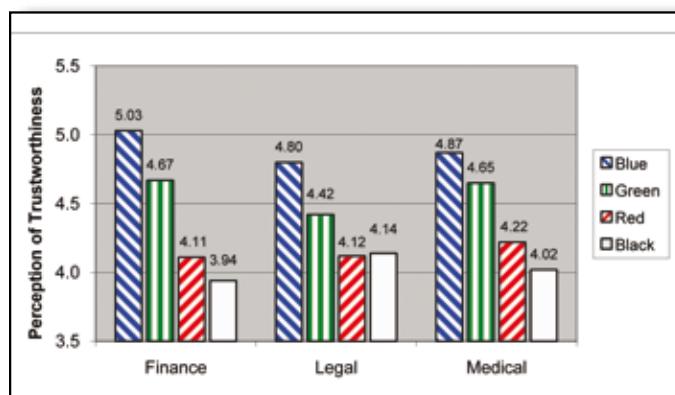

Figure 4. Perceived trustworthiness of color schemes, by context (scale 1 = not trustworthy at all, 7 = very trustworthy)

Our repeated measure ANOVA analyses showed that, for each of the three contexts, the color scheme used influenced the trustworthiness judgment, but this was not or only barely the case for context. The red and black Web sites from the finance and legal contexts did not lead to statistically significant differences in trustworthiness. The other combinations of color and context had a statistically significant effect on trustworthiness, but the effect size was very small, ranging from 0.1% to 0.4%. Context did not add much to the effect of color on trustworthiness. Yet the differences in trustworthiness scores in the various contexts are different. The ANOVA test showed that in the finance context, the color scheme of the Web site had a larger effect (11.2%) on the perceived trustworthiness, than in the legal (4.3%) and the medical context (5.8%). This finding suggests that color can have different effects in particular contexts, but to see this more clearly, the effect should be explored in contexts that are much more different from each other than the three equally risky contexts that we selected for

this study. We conclude that for some Web site contexts, the used color scheme appears to be more important than for other contexts.

Color Preferences for Trustworthiness

We asked participants to indicate the color they thought to be the most trustworthy for each context. As seen in Table 2, blue was perceived as most trustworthy across all contexts. Within the financial and medical contexts, the second most trustworthy color was green, and within the legal context it was the color black. The third most trustworthy color differed between contexts: for finance it was black, for legal it was green, and for medical it was white. The most preferred colors were also the colors used in the experiment—blue, green, red, black—which could be an effect of presenting Web sites in those colors. Interesting is the number of participants expressing a preference for black in legal sites, and an aversion against red for finance sites; color preferences that were not expressed in the trustworthiness ratings of the presented Web sites.

Table 2. Number of times a color is preferred as most trustworthy

Color	Finance	Legal	Medical	Total
Blue	74	57	57	188
Green	39	29	42	110
Red	9	19	25	53
Black	12	37	3	52
White	5	2	29	36
Brown	1	8	0	9
Purple	4	2	1	7
Orange	4	0	1	5
Turquoise	4	1	0	5
Yellow	1	1	1	3
Gray	0	0	2	2
No idea	12	9	4	25
Total	165	165	165	495

Color as Trustworthiness Cue in Web sites

Differences between Dutch and German participants

As we mentioned before, we explored the differences between the trustworthiness judgments of the 179 Dutch participants and the 28 German participants. Figure 5 compares the results.
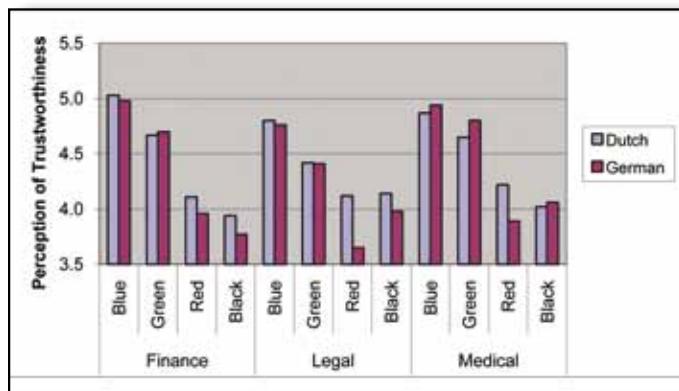

Figure 5. Comparison of trustworthiness scores between Dutch and German participants (scale 1 = not trustworthy at all, 7 = very trustworthy)

The group of German respondents found, as much as our Dutch respondents, the blue and green color schemes the most trustworthy. Yet there are some minor differences between the two groups. The Dutch were more positive about the trustworthiness of red sites than their German counterparts (tested with t-test, $p \leq .001$). Looking into specific contexts, it proves to be the medical and the legal context that makes a difference: The Dutch are more positive about the red medical sites, and that difference is statistically significant (T-test, $p = .044$). Over all Web sites and contexts, nationality proved to have some influence (tested with ANOVA, $p = .017$), in interaction with the main effect of color scheme ($p = .003$), but not with context ($p = .27$). The ANOVA tests show that combined, color and nationality account for an effect size of 7.5%, and again it is mostly color (7.1%) that influences the judgments about trustworthiness of a site.

Conclusions and Discussion

This study investigated whether perceptions of trustworthiness differ between Web sites with different color schemes and whether this relationship is affected by the context, demonstrating color-context associations.

The results showed that different color schemes resulted in different degrees of perceived trustworthiness, which led us to believe that color as Web site element can serve as a trustworthiness cue. Of the four tested colors, the blue color scheme was perceived as most trustworthy and black as least trustworthy. The results showed that the effects are strong in a statistical sense, but limited in effect size. They predict about 7% of the trustworthiness judgment. Trust is a consequence of various beliefs and convictions, which are established outside the realm of the Web site. Those beliefs and convictions determine to a large extent how much trust is invested in a Web site of a company in a particular business context. They cannot easily be influenced by the Web site design. As far as the design goes, color is one of the many design characteristics that determine the prominent visual appearance of a site, together with, for example, size and content of images, use of white space, and typography. Given all those factors that are likely to contribute to the judgment of trustworthiness in Web sites, we believe that the 7% effect size of color scheme still is a sizable contribution. In other words, color matters in the trustworthiness perception of Web sites, particularly as it is one of the easy ways to manipulate characteristics.

Further research could reveal which particular colors and hues would predict the highest or lowest perceived trustworthiness in Web sites. Although this study has provided some results, we are fully aware of the limitations in the number of color schemes used. We cannot formulate conclusions about specific hues (for example that light red is more trustworthy than dark blue) and about color schemes that were not used within this study.

We expected that the relationship between color scheme and perceived trustworthiness in Web sites would be affected by the context of the Web site because of different color-context associations. We selected three contexts for which Web sites assumedly need to be trustworthy: finance, legal, and medical. The results in a statistical sense supported the idea of color-context association, but the effect size of context was very small. Yet, we saw some differences between the three rather similar contexts we investigated, which is a good reason to explore this issue in a more varied set of contexts.

We explored differences among Web sites from three contexts that presented functional services: financial, legal, and medical services and products that help clients to prevent or solve a problem. Our respondents found blue and green color schemes, the colors marked by Bottomley and Doyle (2006) as appropriate for typical functional products, the most trustworthy for Web sites with these functional products. We hope that someone will pick up this lead and explore the effect of color scheme on the trustworthiness of very different types of sites and products, like entertainment versus functional service sites, low versus high involvement product sites, or low risk versus high risk sites. We have come to believe that for some Web site contexts the used color scheme is more important than for other contexts.

The color-trustworthiness relationship has never been demonstrated in the context of Web sites. This study has upgraded the common sense idea on the importance of color choices to scientific evidence, by showing that color matters in user's judgment about the Web site's trustworthiness. From a user interface perspective, color is an important design characteristic because it is in the control of the user interface designer. Using a trustworthy color might be especially important for start-ups and firms that have not yet established an offline presence or brand reputation. They have to build customer relations and credibility on the basis of their online presence: It takes users only one click to leave the Web site. Therefore, particularly these companies should take advantage of controllable factors such as the color scheme of their Web site. As an online communication design characteristic, color is simply too important to ignore.

Acknowledgments

References

Aslam, M. M. (2006). Are you selling the right color? A cross-cultural review of color as a marketing cue. *Journal of Marketing Communications*, *12*(1), 15–30.

Bottomley, P. A., & Doyle, J. R. (2006). The interactive effects of colors and products on perceptions of brand logo appropriateness. *Marketing Theory*, *6*(1), 63–83.

Brunel, F. F. & Kumar, R. (2007). Design and the big five: Linking visual product aesthetics to product personality. *Advances in Consumer Research*, *34*, 238–239.

Corritore, S., Kracher, B., & Weidenbeck, S. (2003). On-line trust: Concepts, evolving themes, a model. *International Journal of Human-Computer Interaction*, *58*, 737–758.

Dervin, B. (1989). Audience and listener and learner, teacher and confidante: The sense-making approach. In R. E., Rice & C. Atkin (Eds.), *Public communication campaigns* (2nd ed.) (pp. 67-86). Newbury Park, CA: Sage.

Fogg, B. J. (2003). Prominence-interpretation theory: Explaining how people assess credibility online. In *Proceedings of ACM CHI'03, Extended Abstracts on Human Factors in Computing Systems* (pp. 722–723). New York, NY: ACM.

Fogg, B. J., Marshall, J., Laraki, O., Osipovich, A., Varma, C., Fang, N., Paul, J., Rangnekar, A., Shon, J., Swani, P., & Treinen, M. (2001). What makes web sites credible? A report on a large quantitative study. In *Proceedings of CHI'01, Human Factors in Computing Systems* (pp. 61–68). New York, NY: ACM.

Fogg, B. J., Soohoo, C., & Danielson, D. (2002). How do users evaluate the credibility of Web sites? A study with over 2,500 participants. In *Proceedings of ACM DUX'03, Designing for User Experiences*. New York, NY: ACM.

Gefen, D. (2002). Reflections on the dimensions of trust and trustworthiness among online consumers. *Database for Advances in Information Systems*, *33*(3), 38–53.

Gefen, D., & Straub, D. W. (2000). The relative importance of perceived ease-of-use in IS adoption: A study of e-commerce adoption. *Journal of the Association for Information Systems*, *1*(8), 1–30.

Color as Trustworthiness Cue in Web sites

Gorn, G. J., Chattopadhyay, A., Sengupta, J., & Tripathi, S. (2004). Waiting for the web: How screen color affects time perception. *Journal of Marketing Research*, *41*, 215–225.

Grabner-Krauter, S., & Kalusha, E., (2003). Empirical research in on-line trust: A review and critical assessment. *International Journal of Human-Computer studies*, *58*, 783–812.

Grossman, R. P., & Wisenblit, J. Z. (1999). What we know about consumers' color choices. *Journal of Marketing Practice: Applied Marketing Science*, *5*(3), 78–88.

Ishihara, S. (1969). *Ishihara Tests for color blindness*. Tokyo, Japan: Kanchara Shuppan.

Jarvenpaa, S. L., & Tractinsky, N. (1999). Consumer trust in an internet store: A cross-cultural validation. *Journal of Computer-Mediated Communication*, *5*(2), 1–35.

Mackiewicz, J. (2009). Color: The newest tool for technical communicators—Redux. *Technical Communication*, *56*, 3–13.

Madden, T. J., Hewett, K., & Roth, M. S. (2000). Managing images in different cultures: A cross-national study of color meanings and preferences. *Journal of International Marketing*, *8*(2), 90–107.

McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research*, *13*, 334–359.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. New York, NY: Springer-Verlag.

Reichheld, F. F., & Schefter, P. (2000). E-loyalty: Your secret weapon on the web. *Harvard Business Review*, *78*(4), 105–113.

Robins, D., & Holmes, J. (2008). Aesthetics and credibility in web site design. *Information Processing & Management*, *44*, 386–399.

Rouland, R. C. (1993). What color are your school supplies? *Direct Marketing*, *33*(3), 60–63.

Schenkman, B. N., & Jönsson, F. U. (2000). Aesthetics and preferences of web pages. *Behaviour & Information Technology*, *19*, 367–377.

Tractinsky, N., & Lowengart, O. (2007). Web-store aesthetics in e-retailing: A conceptual framework and some theoretical implications. *Academy of Marketing Science Review*, *11*(1), 1–19.

Valdez, P., & Mehrabian, A. (1994). Effects of color on emotions. *Journal of Experimental Psychology: General*, *123*, 394–409.

Van der Geest, T. M., & Van Dongelen, R. (2009). What is beautiful is useful—visual appeal and expected information quality. In *Proceedings of the IEEE Professional Communication Conference*. Piscataway, NJ: IEEE.

About the Authors

Wouter Alberts has a passion for social science, strategy, and technology. He integrates these ingredients as researcher and business consultant within the areas of marketing and corporate communication. He obtained his Master's degree in Communication Studies (with honors) at the University of Twente, the Netherlands. Contact: w.a.alberts@alumnus.utwente.nl.

Thea van der Geest works with the Media, Communication and Organisations group of the University of Twente, the Netherlands. She has (co-) authored a wide range of articles and books on acceptance and trust of e-services, factors determining the user experience of Web sites, accessibility and usability, and evaluation methods of mediated communication.

Avon J. Murphy, Editor

Books Reviewed in This Issue

Marketing in the Age of Google: Your Online Strategy *IS* Your Business Strategy

Vanessa Fox. 2010. Hoboken, NJ: John Wiley & Sons, Inc. [ISBN 978-0-470-53719-0. 242 pages, including index. US$25.95.]
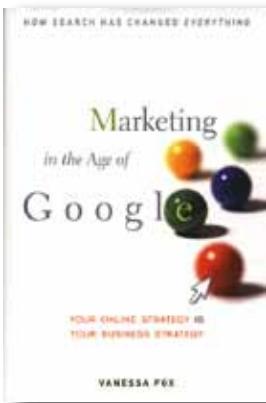
Marketing in the Age of Google, by former Googler Vanessa Fox, delves into an area of Internet search that some argue has been overlooked—organic search. Fox changes the conversation about search by taking the focus off ranking and moves it toward connecting with your best audience. Her goal is to help her readers "harness it [search] for better customer engagement, more informed business and product strategy—and introduce them to a whole new world of customers who they may have been missing" (p. xiv).

The book provides an eye-level look at why search is important to nonsearch people. You'll learn

- Why search is important
- How to integrate search into everyday business goals
- How to use search to drive business and product strategy

The introduction to the basics of search treats search in an essential, yet different, way than what you find in most books. It is an excellent read for anyone interested or involved in building a business case for search strategies. Fox includes nuggets of information about the evolution of search marketing. She encourages you to understand that developing a Web site for particular personas and building search engine optimization (SEO) are not two separate aspects of your Web presence: "Searchers aren't an isolated demographic from the rest of your target audience. They *are* your target audience" (p. 27). In effect, she redirects your focus to the bridge that connects a Web site, SEO activities, and business strategies with customers. (Experienced search marketers might need to be patient in the early chapters.)

She then catapults you into an overlooked approach to search. She walks you through building searcher personas to create an effective search acquisition strategy that includes

- Aligning business and product goals
- Identifying a target audience that will evolve into customers
- Determining queries that are used by your target audience
- Building content that resonates with both search queries and searchers
- Offering a compelling call to action
- Understanding metrics for determining the effectiveness of your strategy

Her discussion includes tactical uses of social media, which promote visibility in search results and serve as "a brand amplifier and customer support extension to deepen engagement with your customers" (p. 185).

Fox provides enough concrete information for you to act, effectively balancing the "why" of search with the "how" of using search to improve business. Checklists, complete with memory joggers for where to look or what to do, conclude her "how" chapters.

Marketing in the Age of Google is the beginning of the conversation about organic search rather than a detailed description of the tactics of SEO implementation. That being said, the strategies laid out in this book will give you an edge over the common practices of your competitors as you integrate search into your business and marketing activities.

Louellen S. Coker
Louellen S. Coker has more than 15 years of experience in public relations, instructional design, Web design, technical writing, and editing. With a technical communication MA, she is president of Content Solutions, an STC senior member, and a past Lone Star Community president. She has taught technical communication and presented workshops.

The Yahoo! Style Guide: The Ultimate Sourcebook for Writing, Editing, and Creating Content for the Digital World

Chris Barr and the Senior Editors of Yahoo! 2010. St. Martin's Griffin. [ISBN 978-0-312-56984-6. 512 pages, including index. US$21.99 (softcover).]

Yahoo! has been creating digital content for about as long as the Web has had a graphical user interface. And in that time it has learned a lot. Now it has released what it knows in the *Yahoo! Style Guide*.

The authors emphasize that the digital environment is different from the print environment in challenging ways. You have little control over how your audience views your content. Screens range from large to minuscule. Your pages may not be viewed sequentially and may be jumped to from outside your site. Your audience might include people who are not proficient in your language or familiar with your cultural references; it may also include people with special sight or hearing requirements that you must accommodate. These and other considerations make creating content for the digital world its own special craft—a craft well covered by *The Yahoo! Style Guide*.

At 512 pages, the guide is comprehensive. It thoroughly covers all the usual matters one would expect in a print style guide—grammar, punctuation, usage, difficult words, and so on—but with a special emphasis on the needs of digital content. Where warranted, the authors point out that what might be preferred in print might not work onscreen. Italics, for example, might not display correctly on some screen devices.

Although the guide may be used as a reference, it is sequentially organized, and the chapters make sense if read straight through. Often the point of view—define your voice, write for the world, make your site accessible for everyone—is as important to absorb as the detailed advice.

In general, the guide argues that short, strong, sentences are the essence of good digital content. It offers many suggestions for crafting good content and for cleaning out the deadwood. At the same time, it

stresses that you want to cut length, not clarity. Some "optional" function words (for example, "that" in "make sure *that* the wheels don't roll") might safely be cut for native readers but provide important clues to meaning for non-native readers and should be retained.

Where a style choice is subject to debate, the guide makes a recommendation but discusses the issue, so that you can know what the arguments are for doing it differently.

The guide stresses the importance of proofreading digital text and cites statistics that typographical errors can devastate a company's or a site's repute. To help, it provides many suggestions, time-savers, triage tips, lists of what to look for, and things likely to be missed, such as mathematics, link text, and image alt tags.

The discussion reaches well beyond Web page design to include advice on such matters as streamlining text for mobile devices, writing engaging e-mail and newsletters for online distribution, and producing alternative new media such as blogs.

Any editing and publishing endeavor should keep a word list of style choices. The guide contains an extensive Yahoo! word list to get you started.

The guide also includes many tips and sidebar articles, such as a quick reference list for common abbreviations, summaries of best practices, and so on. Where a subject is too broad to be adequately covered in a printed guide, this guide points you to online resources.

Each chapter concludes with a section called "Ideas in Practice," which takes various forms to reinforce the covered material. It might include an extensive before-and-after example, followed by solution notes explaining the reasoning behind the changes. Or it might include exercises or tests with answer keys at the back of the book.

A reference section includes a basic introduction to Web page coding, offers extensive suggestions for search engine optimization, and covers the basics of U.S. law for online content, including copyright.

If you are involved with creating digital or online content, *The Yahoo! Style Guide* belongs on your reference shelf.

Patrick Lufkin
Patrick Lufkin is an STC Associate Fellow and is currently chair of the Northern California STC Kenneth M. Gordon Memorial Scholarship and membership manager of the STC Management SIG.

Mobile Design and Development

Brian Fling. 2009. Sebastopol, CA: O'Reilly Media, Inc. [ISBN 978-0-596-15544-5. 336 pages, including index. US$34.99 (softcover).]
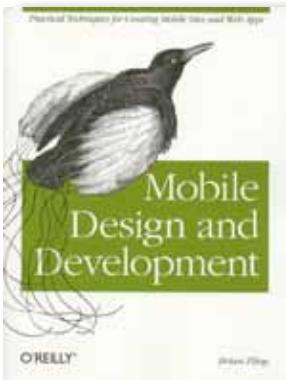
Mobile is the new buzzword. There are mobile devices (for example, the Apple iPhone and iPad and the Android smartphone), mobile applications, and mobile Web. Because of the rapid growth of mobile technology, you will likely be developing code or documentation for one or more mobile devices in the near future. Therefore, it is important to have a clear understanding of the technology.

In *Mobile Design and Development*, Brian Fling does an outstanding job of providing an overview of mobile technology and things to consider when developing mobile sites and Web applications. For example, he addresses

- Variables of the mobile medium, such as networks, devices, and operating systems
- How to understand the role of the mobile device in your user's life
- How to select the right mobile technology for your user's needs

Just days before reviewing his book, I purchased an iPad. Having little knowledge of mobile technology, I found Fling's introduction of the 1970s telephone to be the ideal starting point. He points out that the telephone, the most commonly used electronic device in the world today, has revolutionized communication. He goes on to describe how mobile can perform all the functions of the previous six media: printing press, recordings (vinyl to CDs), cinema (newsreels to movies), radio, television, and the Internet.

Fling reviews the types of mobile applications, the pros and cons of a mobile Web site, mobile Web applications, games, and informative applications. Although mobile brings applications into the user's hands, Fling points out the cost of these mobile applications can be two to three times more than creating one full-featured desktop application. So you'll want to spend time up front developing your mobile strategy.

After developing your strategy, you'll want to consider the design of your mobile application, for example, creating a site map and prototyping. You'll also need to consider color and typography. Because of the limited screen size of a mobile application, readability and screen layout are very important. Fling suggests using a high-contrast typeface, providing decent line spacing, not crowding the screen, and generously utilizing headings to break up the content in the screen.

Fling also addresses using markup and style sheets, making money in mobile, and selecting what devices to support.

This is a great resource for understanding mobile technology, a medium with which each of us in technical communication must become familiar. According to Fling, "People who think they can ignore the mobile web and succeed by launching new brands and services on the desktop alone need to wake up" (p. 43).

Rhonda Lunemann

Rhonda Lunemann is a senior technical writer with Siemens PLM Software, a senior member of STC's Twin Cities Chapter, and a member of the Hill Speakers Toastmasters Club (Club 4415).

Six Sigma for Technical Processes: An Overview for R&D Executives, Technical Leaders, and Engineering Managers

Clyde M. Creveling. 2010. Upper Saddle River, NJ: Prentice Hall. [ISBN 978-0-13-706985-9. 358 pages, including index. US$39.99 (softcover).]
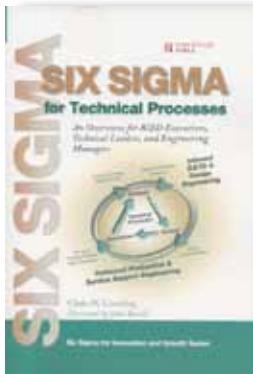
Six Sigma is *not* new; practitioners are well aware of most of the technical processes. To supplement the use of Six Sigma to achieve and sustain excellence in product development and commercialization, Prentice Hall has introduced a new series of books that seeks to communicate a newly emerging branch of Six Sigma that focuses on creativity and new business growth.

Six Sigma for Technical Processes is designed mainly to help business and technology leaders achieve excellence in new product development by adapting to newly defined Six Sigma processes. Clyde Creveling has done a marvelous job of providing a logical framework by proposing a lean Six Sigma to promote excellence in all facets of new product development, mainly market sensing, portfolio management, technology development, commercialization, and post-launch service and support. He presents tools, methods, and best practices for selecting the right projects, prioritizing them, and executing them rapidly, consistently, and successfully. Although the book offers no case studies or success stories, the author clearly explains his proposed strategy.

The simplified version to implement Six Sigma is popularly known as "lean" Six Sigma. The author innovatively proposes four lean Six Sigma processes: IDEA, I²DOV, CDOV, and LMAD.

The first process, IDEA (Identify, Define, Evaluate, and Activate), is well designed for strategic product and technology portfolio renewal. Creveling explains the role of I²DOV (Invent/Innovate, Develop, Optimize, Verify) in applying a very structured approach to be used in research and technology development environments. CDOV (Concept, Design, Optimize, Verify) helps organizations achieve tactical product

commercialization; in particular, it defines stripped-down, fast-track processes for commercializing high-risk and high-reward opportunities in businesses. The fourth process, LMAD (Launch, Manage, Adapt, and Discontinue), is better used for operational post-launch engineering activities.

Technical communicators will benefit from the book by coming to understand these four processes. They will be able to communicate more effectively with research and development executives, technical leaders, and engineering managers who are planning to implement Six Sigma processes. Overall, the book is an excellent reference on Six Sigma-enabled workflow for technical communicators.

Vivek Vaishampayan

Vivek Vaishampayan is an experienced information technology analyst who designs, develops, and tests computer systems. He has more than 15 years' experience in the information technology industry.

The Glamour of Grammar: A Guide to the Magic and Mystery of Practical English

Roy Peter Clark. 2010. New York, NY: Little, Brown and Company. [ISBN 978-0-316-02791-5. 294 pages, including index. $19.99 USD.]
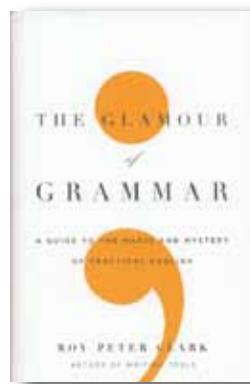
"Language is a gift, a treasure of evolution but also a spark of the divine" (p. 264). If you have lost your love of language, this book will help rekindle that love. It is reminiscent of Don Bush's columns in *Intercom*; indeed, Don once gave a presentation at an STC conference entitled "The Glamour of Grammar."

Peter Roy Clark is an interesting combination of journalist and academician. He teaches writing at the Poynter Institute, a prestigious school for journalists in Florida. He has a PhD in medieval literature and was elected a distinguished service member of the American Society of Newspaper Editors. So he has a foot in both the academic and

workplace worlds, but he is first and foremost a proponent of good writing.

This book is broken into "Words," "Points" (punctuation), "Standards," "Meaning," and "Purpose." Each section has something valuable to offer.

Like Ammon Shea, who spent a year reading the *Oxford English Dictionary*, Clark believes in reading dictionaries for fun and learning, and favors the *American Heritage Dictionary* because of its emphasis on usage. He also advocates using a thesaurus, not to look up fancy words, but to "remind yourself of words you already know" (p. 28). So don't be afraid to press the Thesaurus key combination in Word!

He notes that Shakespeare's vocabulary contained 25,000 words, which was double that of his closest rival. Clark is not surprised: "best writer, most words" (p. 57). He further demonstrates that Shakespeare either showed the meaning of new words in action or gave synonyms. So should we, translating new words or making sure the meaning is clear from context.

Clark compares editing to cropping photographs: "Like a photographer who crops a photo to omit extraneous images and improve composition, a writer has an ethical obligation to 'ellip'"—that is, omit words and sentences without destroying the original meaning (p. 99).

Clark sees writing as a mastery of tools over rules: "Whenever we concentrate on the *rules* of grammar... we run the risk of veiling...the flexibility to authors who think of them as *tools* of meaning and effect" (p. 108).

Controversially, Clark allows use of the singular *they* because "gender equality trumps the arithmetic logic of formal grammar" and because "that's the way we talk" (p. 124). I'm not sure I'm convinced of his argument; I still prefer rewriting or making the pronoun match the noun in number, usually by switching to plural.

It looks like the journalist in Clark trumped the academician, because he does not attribute the sources of quotes, nor does he provide a bibliography. Despite these omissions, *The Glamour of Grammar* is refreshing to read if you want to learn how to write better.

Charles R. Crawley

Charles R. Crawley is the lead technical writer for Rockwell Collins in Cedar Rapids, IA. He is the public relations chair of the Eastern Iowa Chapter of STC and a member of the Technical Editing Special Interest Group.

Talent Is Overrated: What *Really* Separates World-Class Performers from Everybody Else
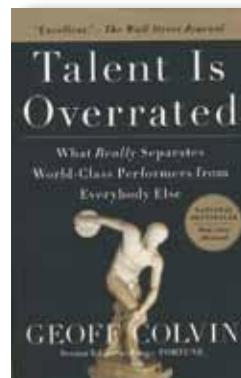
One of life's eternal questions is why some people perform so brilliantly. It's tempting to assume they were born with a divine gift, since that would explain why prodigies are so rare in any field and would help us feel better about not being prodigious ourselves. Unfortunately, scientific evidence for such "gifts" is lacking, and the few gifts that have been demonstrated rarely explain exceptional performance. There are obvious exceptions. For example, some of us are born with physical gifts (a seven-foot basketball player will surpass a five-foot player of comparable skill and dedication), some of us lose initial gifts over time (I'll never play in the National Hockey League because I lack a 20-year-old's endurance), and there are unquestionably savants who have a single supreme skill, such as the ability to perform complex mental calculations, yet do nothing else noteworthy. But there's a growing body of evidence that anyone can excel if they're willing to put in the necessary work—which means the right kind of work.

Superstars may have worked harder than everyone else, but the reason they stand above ordinary performers can't be explained by hard work alone. Until recently, it was unclear why there were so few superstars. But the research of K. Anders Ericsson and colleagues over the last several decades has shed intense light on why some people excel, recently summarized in their extensive review of the psychological literature (*The Cambridge Handbook of Expertise and Expert Performance*, Cambridge University Press, 2006). Since then, several books have attempted to popularize this thorny theoretical material, *Talent* being one of them. Does Colvin add anything to the familiar advice that "practice makes perfect"? Indeed he does, both skillfully and engagingly.

He presents overwhelming support for the claim that not all practice is created equal. *Deliberate* practice—intensely focused, often exhausting honing of one's weakest skills—is what creates prodigies, not mindless repetition. *Talent*'s inspirational message, illustrated by copious examples, is that you can improve *any* skill through focused practice guided by a mentor who understands your individual needs and can help you work on them. This rationale is why we send our children to school: We believe that thinking skills are learned, not innate, and that with the right teacher, the education process will help our children learn those skills. Colvin also notes that we should never assume that because we've reached a plateau, we can't progress further. By repeating the process of attaining mastery (identifying and honing key skills), we can continue improving throughout our careers.

Colvin provides many examples that illustrate how to use the book's principles, both personally and in an organization or team. Understanding how both we and our employers can encourage—or quash—excellence is knowledge each of us can use at work and in our daily lives, and that makes Colvin's book a must-read.

Geoff Hart
Geoff Hart plays an expert on the Internet (www.geoff-hart.com), but is living proof that practice doesn't make perfect. He has only reluctantly abandoned his dreams of hockey glory.

Sustainable Graphic Design: Tools, Systems, and Strategies for Innovative Print Design
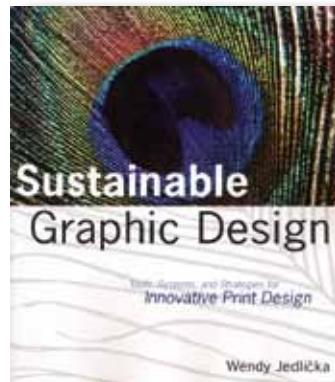
Wendy Jedlička, a faculty member at the Minneapolis College of Art and Design (MCAD), oversaw the development of *Sustainable Graphic Design*. She employed the tools, systems, and strategies necessary to influence the sustainability of natural resources management. With a team of 15 other highly qualified sustainable designers from diverse backgrounds, she put together this comprehensive, seven-chapter book while teaching in MCAD's groundbreaking Sustainable Design Certificate Program.

Unlike most books, this guidebook is an approved green, environment-friendly product, made possible by innovators who are responsible for and support sustainability outcomes. Sustainability gems include the following:

The book is printed on Cascade's Rolland Envir 100 paper, which was produced from 100 percent postconsumer, de-inked fiber, without chlorine. Cascade cites, for each ton of this paper, eye-opening savings of 17 mature trees; 6.9 pounds of waterborne waste; 10,196 gallons of water flow; 2,098 pounds of atmospheric emissions; 1,081 pounds of solid wastes; and 2,478 cubic feet of natural gas. The vegetable-based ink contains little or no toxicity. This overall printing process is a win-win strategy recommended by resourceful graphic designers.

Ideas in this book, especially those espoused by the Biomimicry Guild, fascinate me because they help graphic designers mimic nature. For example, observation of elk bulls shows that optimization is more important for reproduction and survival than maximization. If the bull's antlers are maximized, chasing and protecting cows and fighting predators

become more difficult. A reduced diet of nutrients helps optimize antlers and gives the bull the speed and agility to fight and avoid being eaten. This biological fact tells graphic designers that they can save resources by optimizing, for example, when they communicate more by placing elements appropriately on fewer pages.

Jedlička also points to a new typeface called Ecofont, designed by SPRANQ Creative Communications to reduce ink usage by up to 20 percent. Savings come from each letter having oblong holes that bypass the absorption of ink. He notes also that 90 percent of U.S. newspapers use vegetable-based (soybean) ink rather than petroleum-based ink; the vegetable-based type is safer for the environment and health.

Practicing sustainability is like emulating nature: We use its materials and then put back materials in a direct or indirect form that nature accepts. Otherwise, nature will become imbalanced and we will pay the consequences. Graphic designers who emulate nature cannot go wrong.

Is this a valuable book for STC members? I'd say definitely, because our concern for the environment is important. With awareness of sustainability efforts practiced by graphic designers, we can influence others to make wise choices in natural resources management.

William L. Kidd
The late William L. Kidd was a retired federal employee, having worked last with the Centers for Medicare and Medicaid Services. As a senior writer-editor, he developed publications that educated beneficiaries about health care benefits and related health issues. His experience included managing several newsletters, writing and editing technical documentation, and developing other informational materials.

The Craft of Scientific Communication

Joseph E. Harmon and Alan G. Gross. 2010. Chicago, IL: The University of Chicago Press. [ISBN 978-0-226-31662-8. 225 pages, including index. US$20.00 (softcover).]
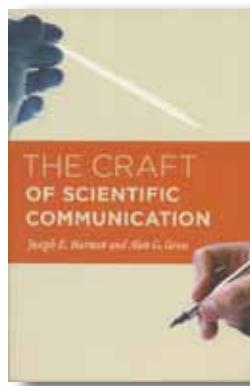
The Craft of Scientific Communication is not just another formulaic how-to book. Instead of providing a list of dos and don'ts, Harmon and Gross dissect excerpts of well-crafted scientific writing to show you why it works. They also present examples of ineffective writing, which they transform by applying a few basic principles. The writing samples encompass a wide range of scientific disciplines and come from scientists, both famous and not. The authors convey the basic principles of effective scientific communication in a manner that is relevant and easy to digest. What scientist wouldn't appreciate the opportunity to learn best practices in scientific writing from the likes of Albert Einstein, Charles Darwin, and Erwin Hubble?

The intended audience is scientists, both experienced and newly minted, all of whom must effectively communicate their work to other scientists, journal editors, and granting agencies. Although most scientists must "publish or perish," many do not invest much time or energy into honing their writing skills. *The Craft of Scientific Communication* is designed to help you, the scientist, "write prose that creates no serious barriers between your readers and the persuasive argument you have crafted" (p. vii). Put simply, your science will shine if its presentation both informs and engages your audience. Readers of all levels will find practical use for the authors' guidelines and checklist questions. The practice exercises would be well suited to a teaching environment and offer a wealth of opportunities for science students to discuss the many possible "right" answers. However, the exercises seem overly time-consuming and too abstract for the typical scientific practitioner.

Early chapters address how to prepare for, write, and revise a well-crafted scientific article. You learn how to write the different parts of a standard article, handle acknowledgments, and arrange the parts of an

article based on article type. Instead of being a tedious, pedantic presentation of "rules," this section is engaging and sometimes inspiring. For example, Watson and Crick engage readers by solving a problem when they introduce their 1953 paper, "'We wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.)'" (p. 10). Harmon and Gross conclude that after reading these chapters, you should appreciate that "good scientific articles combine rigorous argument and ritual observance [of routine principles of organization]" (p. 93).

Later chapters cover proposals, presentations, and writing style. The two chapters on style almost seem an afterthought, although they do nicely summarize tips for writing and editing scientific text. The authors' discussion of proposal writing and visual presentations emphasize that successful scientists will likely need to present their work in person. As in the rest of the book, the discussion of PowerPoint goes beyond rehashing others' comments to present examples of successful presentations and show why they work. The authors make an excellent point about a common flaw in PowerPoint presentations: "their creators fail to adjust the contents to take into account that their audience has only a minute or two to view each slide" (p. 153).

The Craft of Scientific Communication reads at times like historical fiction, which is a refreshing (and unexpected) approach for a writer's guide. The authors illustrate, in easily accessible excerpts from reputable scientists, the principles of well-crafted scientific communication. The checklist questions at the end of each chapter allow you to evaluate both published and in-process writing samples. This book deserves a prominent place on the bookshelf of every established and aspiring scientist, but only after it has been culled for helpful suggestions and interesting stories.

Patti Blair
Patti Blair is a freelance science writer who has spent nearly two decades in the scientific field, both at the bench and in various support functions. She specializes in writing grants and protocols/standard operating procedures. Patti is a member of STC.

Evaluating Research: Methodology for People Who Need to Read Research
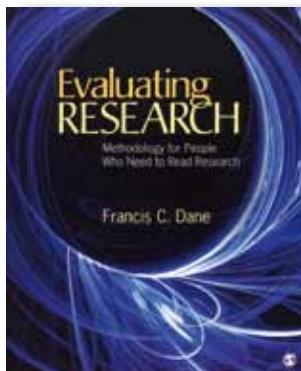
One important part of educating technical communicators is teaching them how to analyze research. Gone are the days when they relied on traditional grammar and instinct to provide effective communication through designing, editing, and presenting the product. Now, technical communicators have to provide research-based reasons for what they do. For example, when designing communications, they must understand how the receiver actually reads and processes the information. Justification for communication decisions comes from research in several different fields. The problem is how do technical communicators know that the research is accurate and well done?

Other academic disciplines also have this need. Each usually has a textbook to help students learn how to evaluate the research that underlies the assertions in publications and decisions. Such is the case with this book.

The book is designed for students of public policy. The examples and the evaluation techniques rely heavily on the author's experience as a researcher in public policy. However, even though the two disciplines are quite different, the research methodology used in both is essentially the same.

Dane's book consists of 12 chapters, beginning with a general introduction. Then he takes students through such topics as the scientific approach to research, how to read a research report, a conceptual overview of statistical analyses, and a variety of techniques that researchers use to develop experimental procedures that lead to the results and the conclusion. Chapters 7 through 12 describe various research approaches, such as experimental approaches, non-experimental approaches, and field and archival research. The last chapter brings

everything together in helping students to develop a method for evaluating research. In order to evaluate research, they need to know how research is conducted; and that is what Dane teaches.

Because technical communicators use research methodology for such things as usability research, focus groups, and product testing, Dane's book can provide helpful suggestions for designing the research that technical communicators do.

Chapter 4, on statistics, can be especially valuable. Dane's approach is to give enough information about various descriptive and inferential statistical measures to allow readers "to critically assess the 'researchers' interpretations of their results" (p. 80). Technical communicators can use this chapter and the next on sampling techniques to design their own research projects.

While the whole book may not be of use to technical communicators, the chapters on how research comes about can be very valuable not only when they actually do research, but when they have to evaluate research done by others. Dane's style is readable and does not get in the way of the information he presents. I would recommend that technical communicators who do the research themselves or use the research of others look into this book.

Tom Warren

Tom Warren is an STC Fellow, a winner of the Jay R. Gould Award for teaching excellence, and professor emeritus of English (technical writing) at Oklahoma State University, where he established the BA, MA, and PhD technical writing programs. Past president of INTECOM, he serves as guest professor at the University of Paderborn, Germany.

Surviving the Baby Boomer Exodus: Capturing Knowledge for Gen X and Y Employees
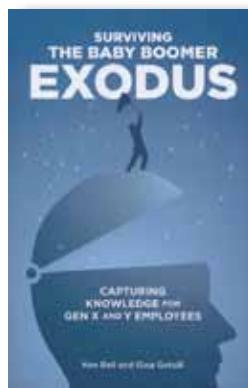
In *Surviving the Baby Boomer Exodus: Capturing Knowledge for Gen X and Y Employees*, the authors warn that many businesses are facing a tsunami for which they are ill prepared. In the next few years an entire generation of workers—many of them the most knowledgeable and experienced in their companies—will retire, taking with them undocumented knowledge and operational experience vital to the smooth running of their companies.

Although many companies are aware of the problem, its sheer magnitude—combined with the pressing demands of day-to-day operations—has kept many from confronting it. It would help to have a strategy for approaching the problem, and that is what the authors have produced.

Since the problem is essentially one of knowledge capture, retention, and transfer—a problem with which technical communicators have some expertise—savvy technical communicators who pick up the required management vocabulary may well be able to participate, while increasing their value to their employers.

Even though the book is primarily aimed at managers, technical communicators who want to contribute should find it valuable for several reasons:

- It describes the nature and size of the problem and provides a useful analysis of the relevant audiences. It discusses the types of knowledge—explicit, implicit, and tacit—that need to be captured and the challenges presented by the different preferred communication and learning styles of both the departing Boomers and the Gen X and Gen Y employees who will replace them.
- It discusses a wide range of knowledge capture and retention strategies, from warehousing written

knowledge, to mentoring, to using social media, to establishing communities of practice to share expertise.

- It provides a full road map to setting up a knowledge capture and retention initiative—researching and selling the need to management, researching the scope of the problem within a particular company, producing planning documents, designing and implementing the chosen strategies, and establishing metrics and analyzing results.

One needs to conduct in-depth interviews and produce written deliverables tailored to discrete audiences—activities at which technical communicators excel. Instead of documenting a product for an external audience, technical communicators would capture vital operational knowledge for an internal audience. The shift in focus might be just the move a technical communicator needs to get noticed and boost a career.

Patrick Lufkin

Legal Guide for the Visual Artist

Tad Crawford. 2010. 5th ed. New York, NY: Allworth Press. [ISBN 978-1-58115-742-0. 270 pages, including index. US$29.95 (softcover).]
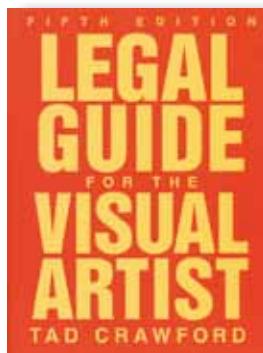
If you think that any book with a title that starts *Legal Guide for* is boring, forget that notion. Tad Crawford gives visual artists practical advice that is well written and thorough.

In today's Internet environment, with some people saying "it's on the Internet, so it's free," it is critical to spread far and wide knowledge of copyright and the legal and financial problems resulting from infringement. This book does exactly that.

The first half gives the background on copyright and general protections for artists. Crawford defines what is copyrightable and describes the history of copyright. Did you know that copyright issues go back to Roman times? Information on completing the correct paper or Internet form is straightforward and helpful.

What is copyrightable? Typefaces aren't, but the software programs to design them are. In the chapter "Moral Rights," Crawford describes the 1990 Visual Artists Rights Act, which defines protections for American artists. The principles apply to writing as well. The rights of attribution, integrity, and disclosure and the duration and enforcement of copyright are the key to the entire book. Crawford includes clear examples in which artist Jeff Koons wins one case and loses another based on subtlety of the law and differences in what he did. Crawford gives specific case numbers, should you want to research any case further.

Crawford describes other issues for artists: unfair competition, trademarks, protection for domain names, the right to privacy, and defamation in art. Particularly interesting is his analysis of New York state's Arrington Bill, which gives freelance photographers and agents the same protections that publishers and employee-photographers have.

The second half of the book explains contracts and other legal documents one should—and should not—sign. Crawford recommends negotiation, which can result in a win for both sides. Although most

chapters are specific to visual artists, there is a chapter on publishing contracts. Four chapters on taxes indicate the author's practicality. After reading the preceding chapters, you shouldn't need the final chapter, "How to Avoid or Resolve Disputes with Clients."

The book is comfortable to peruse, lying flat when opened. Margins are generous so you can easily take notes. The index is good but could use some expansion of terms for the novice.

Legal Guide for the Visual Artist is one of the most clearly written and organized nonfiction books I've read. The principles and examples are so illustrative of legal issues that anyone involved in writing for a living will benefit. I highly recommend the book especially for anyone who is self-employed and for technical communication teachers.

Beth Lisberg Najberg

Beth Lisberg Najberg is principal of Beginnings, an information design consulting firm. She has over 20 years of experience as a consultant to large corporations and public entities. Beth teaches people to communicate complex messages clearly and develops custom information graphics. She speaks frequently at national conferences and is an STC Associate Fellow.

Applying Communication Theory for Professional Life: A Practical Introduction

Marianne Dainton and Elaine D. Zelley. 2010. 2nd ed. Thousand Oaks, CA: Sage Publications, Inc. [ISBN 978-1-14129-7691-6. 246 pages, including index. US$61.95 (softcover).]
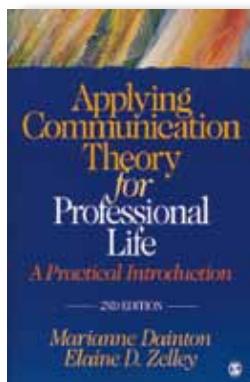
If you teach upper-level or graduate courses in communication theory or are a practitioner who is interested in learning more about communication theories, you will find *Applying Communication Theory for Professional Life* useful. The theories described can apply to technical communication as well as other communication fields.

The first two chapters include foundational information not included in the first edition. They introduce you to the nature of communication and theory and to theory development. The remaining chapters cover many of the major communication theories, including intrapersonal, interpersonal, group, organizational communication, persuasion, leadership, and mass communication theories. Each chapter details a particular theory and concludes with a concise summary and a real-life case study that illustrates a practical application of that theory in communication or business situations. The case studies are followed by open questions that can foster classroom discussion. Tables and visuals enable you to quickly review the central concepts of each theory.

In the discussion of interpersonal and intrapersonal communication theories, one of the more interesting theories is uncertainty reduction theory. There are two types of uncertainty. *Behavioral uncertainty* "takes into account your insecurity about which actions are appropriate in a given situation" (p. 44). For example, when starting a new job, you may be unsure about when you should arrive at the office and how long you are expected to stay. This is typical behavioral uncertainty for a new employee. *Cognitive uncertainty* "emphasizes the doubts in your ability to pinpoint the attitudes and beliefs of others" (p. 44). The authors provide the example of a colleague noting how "comfortable" you look on a casual

Friday. You are then unsure if he is complimenting you or hinting that you are too casually dressed.

One of the most interesting concepts in the chapter on group communication is that of fantasy themes, which help a group to develop a cohesive group identity. Fantasy themes start "with a *dramatizing message*—a joke, pun, figure of speech, anecdote, double entendre, or metaphor" (p. 88). The case study describes how a team's fantasy theme revolving around the Austin Powers movies helped them get through a challenging project.

Managers may find relevant the descriptions of theories of organizational communication, persuasion, and leadership. Dainton and Zelley describe four leadership theories and contrast management with leadership. One perspective on leadership is the theory of leader-member exchange (LMX), which "argues that leaders actually treat each of their subordinates differently" (p. 155). The authors debate whether "high employee performance lead[s] to an LMX relationship" or if "an LMX relationship lead[s] to high employee performance" (p. 156). They conclude that both situations work. An employee who is trusted by leaders will perform well, and leaders trust an employee who performs well.

User experience professionals may find relevant the discussion of mediated communication and cultural theories, because these theories stress the importance of knowing your audience and using the appropriate media for that audience.

Instructors should take advantage of the additional online resources provided by the publisher, including access to a password-protected site that includes such things as sample syllabi, a test bank, and PowerPoint slides.

Applying Communication Theory for Professional Life provides a comprehensive view of multiple communication theories that becomes more enjoyable as you start seeing applications of theories in real-life situations.

Mary C. Corder
Mary C. Corder is a senior technical writer with F5 Networks, where she writes hardware and command line interface documentation. She edits the Puget Sound STC chapter's newsletter and belongs to Sigma Tau Chi. She received a Professional and Technical Writing MA from the University of Arkansas at Little Rock.

HTML & CSS: The Good Parts

Ben Henick. 2010. Sebastopol, CA: O'Reilly Media, Inc. [978-0-596-15760-9. 318 pages, including index. US$34.99 (softcover).]

Ben Henick wrote his book to fast-forward to the "good parts," or best practices that Web developers need in order to create efficient sites, because wading through the specifications of Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS) is "*sleep-through-it* boring" (p. xvii). This is a much-welcomed book for developers, because reading the minutiae of markup can be impenetrably dry. Keeping lines of markup to a minimum, Henick deftly describes the structuring of elements in real-world examples.

After giving an overview of hypertext, HTML, and CSS, Henick dedicates the bulk of the book, 10 chapters, to exploring the good parts of HTML and CSS. These cover the gamut of the presentation layer of Web sites, including Web standards; color and backgrounds; tables and forms; and images and multimedia. He addresses both basic features, such as working with lists, and more advanced techniques, such as the use of Fahrner Image Replacement for backgrounds.

Henick painstakingly walks through the "notoriously hard to master" CSS layout techniques (p. 73), including multicolumn designs. Yet, after explaining technical markup, he also expounds on layout aesthetics, such as the importance of the rule of thirds.

Indeed, non-computer technology passages are interspersed throughout the book. For example, Henick provides background on image publishing etiquette, how letterforms led to computer typography, and color theory.

Henick provides even more help by identifying the worst of the Web, "the bad parts," and how to avoid detrimental or outdated practices. Even CSS is not spared his critiquing. For example, the z-index and clip properties are "great in theory, lousy in practice" (p. 284). Henick also explains the particular problems with Internet Explorer 6. Henick's humor comes

through: "Just *don't*—not today, not tomorrow, not ever," he pleads about the use of frames (p. 278).

The audience for this book is wide, from software engineers needing to learn presentation markup, to graphic designers delving deeper into Web design, and to other Web professionals who have not updated their HTML skills for a while. The book is definitely not for beginners. Henick writes on the companion Web site's home page that the "intended audience is professional developers with at least 3–5 years' experience." Because the target audience is varied, the book has an unbalanced feel. As Henick admits, "there may be times material meant for engineers is painfully obvious to designers, and vice versa" (p. xix).

Also, given the many aspects of Web page presentation that the author addresses, it is curious that he omits any discussion of the growing prevalence of content management systems. Perhaps this omission is his opinion; Henick has written a practical book that implicitly encourages readers to design sites from the ground up. But he also acknowledges that pre-written markup can be useful, such as when he lists third-party helps for multimedia insertions.

Henick has a passion for the fundamentals of Web site development. He does not speak as a theorist or as an educator but rather as a veteran practitioner sharing hard-won experience. His "good parts" are concise and interesting as well as effective, and he also previews several new markup elements being developed for HTML 5. Web professionals needing to brush up on their markup skills can use this book to add more elegance to their designs within the constant evolution of Web technologies.

James Morgan
James Morgan has been in nonprofit communications for sixteen years.

Corporate Creativity: Developing an Innovative Organization

Thomas Lockwood and Thomas Walton, eds. 2008. New York, NY: Allworth Press. [ISBN 978-1-58115-656-0. 239 pages, including index. US$24.95 (softcover).]
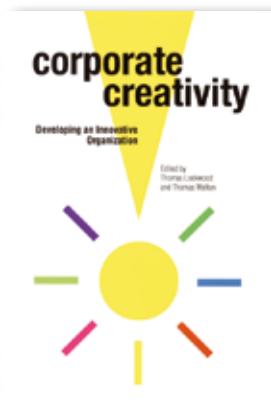
Building on the widely accepted maxim that "the successful organizations of the future will be those that make the most of the creativity of their employees and their partners" (p. xi), the 26 contributors to these chapters apply principles of design to the various facets of corporate creativity. In many of its operations, the corporate world includes both public and private organizations.

As the editors point out, creativity has traditionally been associated with the arts rather than business. But this is mythology: "Learning to think creatively in one discipline opens the door to understanding creativity in other disciplines" (p. xii).

The authors emphasize the integrative and multidisciplinary nature of the process, approaching it from the several points of view that comprise the book's major sections: "Create," "Collaborate," and "Innovate." The first section explores how personal and team creativity works, the second discusses building the best environment for creativity and innovation, and the third provides examples.

We're at the mercy of the jargon. The discourse examined in this book includes such words as *discovery*, *integrative*, *multidisciplinary*, *collaboration*, *innovation*, *team creativity*, and *creativity* itself. As buzzwords become overused, they lose their creative force. The best way to restore them is probably to accept a range of meanings rather than to establish a canonical form.

As technical communicators, we constantly face questions of meaning across various technical fields. Fittingly, the 26 authors provide stories illustrating how creativity helps bring new products to market and transform businesses into brands within a wide range of disciplines. They draw from several applications familiar

to us, including open source systems, prototyping, design management, and crisis communication.

The authors remind us to maintain our creative faculties in adulthood. One of the best ways of doing this is making connections between things and things, between things and people, and between people and people. And of course, between words and things; this is, in the end, a primary charge of our craft.

Steven Darian

Steven Darian retired from a career at Rutgers University, where he taught business communication, technical writing, and other language-related courses. His work in several countries includes managing a training school for Raytheon Corporation in Saudi Arabia and teaching in China. His most recent book is *The China Business Reader* (2006).

The Shallows: What the Internet Is Doing to Our Brains

Nicholas Carr. 2010. New York, NY: W. W. Norton. [ISBN 978-0-393-07222-8. 276 pages, including index. US$26.95.]
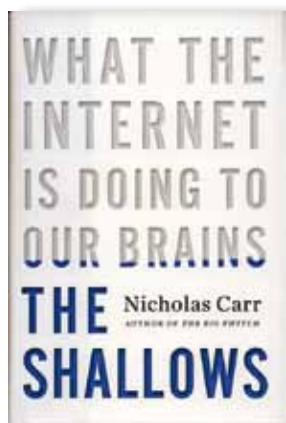
Readers of a book with a title like *The Shallows* will not be surprised to learn that its author thinks what the Internet is doing to our brains is not necessarily good. But Nicholas Carr is no Luddite writing in nervous reaction to technology he doesn't like or understand. He first encountered computers in the 1970s, bought an early Mac in 1986, and today spends as much time on the Net as any professional must. *The Shallows* began out of his personal experience after he noticed some changes in his thinking and began to suspect that, rather than being merely a passive tool, his computer was changing him and the way he worked. Exposure to the Internet caused more changes. "Sometime in 2007," he says, "a serpent of doubt slithered into my info-paradise. I began to notice that the Net was exerting a much stronger and broader influence over me than my old stand-alone PC ever had" (p. 16). This book is the story of those changes.

In the first half of *The Shallows,* Carr synthesizes material from many fields to provide background for his argument in the second half of the book that electronic media are affecting not only the metaphors people use to think about memory and intelligence but the human brain itself. He counters the claims of technophiles that the Internet will expand the human mind and make a utopian world. While some believe that hypertext and other electronic media promote deeper and more creative thought, Carr argues just the opposite: "The division of attention demanded by multimedia . . . strains our cognitive abilities, diminishing our learning and weakening our understanding" (p. 129).

A recurring theme is that the human brain is plastic and can be shaped by actions and environments. According to Carr, we are in danger of losing centuries of progress in building our skills of deep thought and sustained close attention. He cites research showing that brains function differently after extended use of digital media. Some of the results may be positive, such as the ability to judge the reliability of information found on the Web quickly and spot patterns in a mass of information, along with the oft-mentioned improvements in "hand-eye coordination, reflex response, and the processing of visual cues" (p. 139). Other results, however, are negative, including the loss of empathy and compassion and "the pastoral ideal of meditative thought" (p. 168).

Carr has written a comprehensive and accessible overview of his subject. He supports his views by referencing history, philosophy, and science, drawing on the work of Ong, McLuhan, Nietzsche, Nielsen, and many neuroscientists. Well researched and including a list of suggestions for further reading, *The Shallows* is a good place for readers with an interest in the relationship between technology and thought to wade in.

Marilyn R. P. Morgan

Marilyn R. P. Morgan has an MA in English from the University of Tennessee. After serving as a technical writer and editor in academic and government research organizations, she now works as a freelance writer and teaches English at the college level. She has been an STC member since 1993.

Content Preparation Guidelines for the Web and Information Appliances: Cross-Cultural Comparisons

Huafei Liao, Yinni Guo, April Savoy, and Gavriel Salvendy. 2010. Boca Raton, FL: CRC Press. [ISBN 978-1-4200-677-4. 176 pages, including index. US$82.95.]
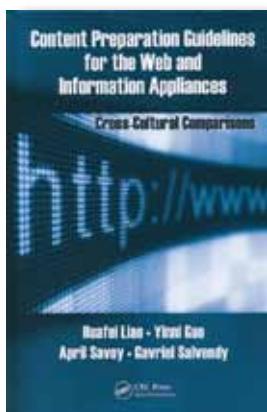
As an academic who researches content localization across various media, I know firsthand that all too often the furthest a localization effort goes on the Web is to change the surface variables, like the language or colors. This focus on content is why *Content Preparation Guidelines for the Web and Information Appliances* is important in today's localization research: Liao, Guo, Savoy, and Salvendy advocate that these content changes should not only be considered, but be the most important considerations in a localization effort, because "people in different countries will often approach similar tasks in different ways because of cultural differences" (p. 6). This is very practical advice that many in e-commerce dismiss as not necessary or too expensive, but Liao and colleagues make a very persuasive case that e-commerce sites should be built from the ground up with that culture's preferences in mind rather than merely translated later.

Content Preparation Guidelines for the Web and Information Appliances is, in essence, a large-scale usability study based on the work of Liao, Guo, and Savoy in their dissertations. That may be the text's only downfall: Although that the proposed audience is "usability professionals and Web and IT appliance designers" (p. xiii), the discourse is exceedingly academic, and the quantitative nature of the study may be more complicated than most practitioners would care to wade through.

Despite the complexity of the information, the authors' work really shines in its part-by-part breakdown of what U.S. versus Chinese users like to see when considering the purchase of an electronic product. Their discussion goes through each individual specification of the product and what the users would prefer to be highlighted on a Web page. Chinese users, for example, prefer information on the weight of the object to be put in a prominent place because they often hang cell phones and MP3 players around their necks.

I appreciate also the discussion of how the cultural dimensions of Geert Hofstede and Edward T. Hall influence the preferences for content on e-commerce Web sites. For instance, Chinese purchasers prefer to see the country of origin information on the product description because they are more accepting of authority, making them more likely to consider the known "expertise" of that country before they buy.

In summary, while academics and practitioners will likely appreciate different aspects of *Content Preparation Guidelines for the Web and Information Appliances*, it is a valuable work for each audience. Practitioners will enjoy the clear, practical advice on making product descriptions and e-commerce Web sites culturally appropriate, while academics will appreciate the solid methodology and use of theory to arrive at useful advice for constructing these sites.

Nicole St. Germaine-McDaniel

Nicole St. Germaine-McDaniel is a senior member of STC and head of the Technical and Business Writing Program at Angelo State University. Her research interests include technical communication for a Mexican-American audience and technical communication in the health fields.

Sherry Southard, Editor

The following articles on technical communication have appeared recently in other journals. The abstracts are prepared by volunteer journal monitors. If you would like to contribute, contact Sherry Southard at southards@ecu.edu.

"Recent and Relevant" does not supply copies of cited articles. However, most publishers supply reprints, tear sheets, or copies at nominal cost. Lists of publishers' addresses, covering nearly all the articles we have cited, appear in *Ulrich's International Periodicals Directory*.

Thanks to J. A. Dawson who helped me assemble the manuscript for "Recent & Relevant."

Collaboration

Assessing the value of corporate blogs: A social capital perspective

Baehr, C., & Alex-Brown, K. (2010). *IEEE Transactions on Professional Communication, 53,* 358–369.

"This three-phased study examines corporate blog use, specifically the impact and value of blogs on organizational social capital and knowledge sharing at Dell Inc., a global computer manufacturer. The impact of social-mediated Web 2.0 technologies on organizational social capital has received limited attention in scholarship, possibly because of the inevident connection to measurable economic value and newness of the technology. Our findings indicate the corporate blog can be used as a sustainable forum leading to a shared understanding of organizational roles, increased sense of group cohesiveness, improved work processes, and improved professional and personal ties among employees in the organization."

Jenny West

Information seeking in an information systems project team

Xu, Y., Zhang, C., & Zhang, C. (2010). *IEEE Transactions on Professional Communication,* 53, 370–381.

"Why does a team member prefer some colleagues to others in information seeking? Past literature suggests that the physical accessibility of a knowledge source, the information quality of the source, and relational concerns influence such a choice. This study extends past literature by suggesting that formal structural factors are also important. Particularly, job interdependence, competition, and supervisory relationships are hypothesized to affect information-sourcing frequency. Our social-network analysis of an information systems project team indicates that formal structural factors are important to the development of informal networks and the perception of the information quality of a source. They have direct and indirect impacts on sourcing behavior. Implications for information systems project management are discussed."

Jenny West

Learning localization through trans-Atlantic collaboration: Bridging the gap between professions tutorial

Mousten, B., Maylath, B., Vandepitte, S., & Humbley, J. (2010). *IEEE Transactions on Professional Communication, 53,* 401–411.

"In light of what has taken place since their presentation at the IEEE International Professional Communication Conference in 2005, the authors describe additional requirements and merits of matching technical writing students in the US with translation students in Europe in a collaborative assignment. Where the original article dealt with how to set up and organize the collaboration, this tutorial delves into the pedagogical challenges and the process dynamics involved in such an exchange, including mediation, power, and teamwork issues."

Jenny West

Miscommunication in international virtual workplaces: A report on a multicase study

Brewer, P. E. (2010). *IEEE Transactions on Professional Communication, 53,* 329–345.

"What factors seem to cause miscommunication in international virtual workplaces? The research reported here seeks to respond to this question with a multicase study of 22 employees from three different types of international organizations. Interview data indicate that participants in this study emphasized the practical, day-to-day challenges of virtual workplaces; few of them had given thought to broader theories that might account for challenges—theories that are often presented in the literature of computer-mediated communication (CMC). In addition, participants in this study emphasized different factors than did CMC literature as most significant to causing miscommunication in international virtual workplaces."

Jenny West

Team listening environment (TLE) scale: Development and validation

Johnson, M. K., Reed, K., & Lawrence, K. (2011). *Journal of Business Communication, 48,* 3–26.

"Although past research has focused on the individual's ability to listen and on the broader concept of communication satisfaction, limited attention has been devoted to the listening environment. This article develops the construct and measurement of a new scale, Team Listening Environment (TLE). Team listening environment is defined as the individual's perception of behaviors demonstrating genuine attention and understanding by team members. This article investigates the individual perception of the listening environment within a variety of academic and professional contexts. Three studies were conducted for rigorous analysis of this latent construct using confirmatory factor analysis in the structural equation modeling function of EQS 6.1. Results suggest that TLE is a valid construct and a contributor to workplace commitment."

J. A. Dawson

Technology alignment: A new area in virtual team research

Bjørn, P., & Ngwenyama, O. (2010). *IEEE Transactions on Professional Communication, 53,* 382–400.

"Technology use and adaptation are the center of attention in research on virtual teams. Through empirical observations from six interpretative cases of virtual teams, we suggest conceptualizing the relationship between technology-use practices and collaborative practices as a technology-alignment process. We define technology alignment based upon four key perspectives on technology-use practices: continuous iterative process, reflection-on-action activities, malleability and reconfigurability, and transformation. Moreover, we show how these four key perspectives influence the design, the outcome, the task processes, and the socioemotional processes of the particular virtual team."

Jenny West

Towards a pedagogy of relational space and trust: Analyzing distributed collaboration using discourse and speech act analysis

McMair, L. D., Paretti, M. C., & Davitt, M. (2010). *IEEE Transactions on Professional Communication, 53,* 233–248.

"Distributed work is an increasingly common phenomenon in a number of technical and professional settings, and the complexity of this work requires high degrees of knowledge sharing and integration that move beyond assembly-line approaches to collaboration. Since participants in distributed-work settings rely almost exclusively on written and spoken language to mediate their collaborative relationships, professional communication faculty need educational approaches that empower students with language practices designed specifically to support effective teaming in these complex environments. To address this need, we employ discourse analysis and Speech Act Theory to identify these language practices in a case study of two cohorts of distributed, interdisciplinary, and cross-cultural student teams. The findings show correlations between language practices and successful collaboration. These correlations have significant implications for teaching and practice."

Jenny West

Communication

Analyzing the genre structure of Chinese call-center communication

Xu, X., Wang, Y., Forey, G., & Li, L. (2010). *Journal of Business and Technical Communication, 24,* 445–475.

"This study investigates the genre structure of Chinese call-center discourse based on data collected from the call centers of a telecommunication company in China. Using an integrated theoretical framework informed by approaches to genre from English for specific purposes, systemic functional linguistics, and social perspectives, the study focuses on an analysis of the recurrent situation and social practices, the communicative purposes, the move structure, the exchange structure, and the generic-structure potential of call-center communication. A corpus-based quantitative analysis further reveals the dynamic complexity of interaction at call centers. The study compares Chinese and English call-center interactions in order to illustrate universal language functions as well as institutional and cultural differences in this professional discourse. The findings may have implications for both academics and practitioners in the call-center industry."

Lyn Gattis

The co-construction of credibility in online product reviews

Mackiewicz, J. (2010). *Technical Communication Quarterly, 19,* 403–426.

"Reviews of products on Web sites like Epinions.com make explicit the ways in which credible identities are co-constructed. Product reviews reveal not only how reviewers construct credibility for themselves but also how readers of reviews, through their comments about reviews, ratify and contribute to reviewer credibility. I present a framework and analyze examples of reviews of digital cameras to examine how reviewers of a technical product convey credibility and how review readers co-construct reviewers' credibility. The framework and analysis can help identify those reviewers who are likely to influence review Web site users."

Lyn Gattis

Explanations first: A case for presenting explanations before the decision in Dutch bad-news messages

Jansen, F., & Janssen, D. (2011). *Journal of Business and Technical Communication, 25,* 36–67.

"In argumentative texts, authors must choose between two presentation orders: providing the decision or claim first and then the explanation (direct order) or providing the explanation first and then the decision (indirect order). This study addresses which presentation order is most effective when the decision entails bad news by discussing two experiments that evaluate Dutch letters and e-mails. The first experiment evaluates denial letters from insurance companies and rejection letters to job applicants in which the presentation order is manipulated. The second experiment replicates the first, using a different medium (e-mail) and other instances of bad news. The results of both experiments indicate that readers perceive texts with the indirect order as more comprehensible and agreeable and its writer as more competent and empathic. Readers are also more inclined to comply with the decision in such texts when the explanation is presented first."

J. A. Dawson

Productive management communication: Online and face-to-face

Kupritz, V. W., & Cowell, E. (2011). *Journal of Business Communication, 48,* 54–82.

"This case study examined employees' perceptions about the types of information management could productively communicate through electronic communication to augment face-to-face contact with employees. The benefits of effective face-to-face communication between managers and staff are widely appreciated; however, the costs associated with this mode of communication require organizations to make decisions about when scarce resources should be allocated for face-to-face communication and when the alternative, less costly resource of electronic communication could be substituted. The study determined that employees perceived human resource information that is private (confidential), personal, or sensitive as critical to receive through face-to-face contact. Employees perceived that information not

deemed confidential—meeting times, training times, policy changes, system problems, and information with numerous details—[was] just as productive and some even critical to receive through e-mail."

J. A. Dawson

The readership of corporate websites

Pollach, I. (2011). *Journal of Business Communication, 48,* 27–53.

"This study investigates people's interest in the content of corporate websites based on a survey of 521 respondents from Asia and Europe. Four main findings emerge from this study: (a) People are primarily interested in recruitment information and product-related information on corporate websites but not in corporate social responsibility messages or financial information; (b) content features on corporate websites are retrieved more frequently out of work-related interest than out of private interest; (c) utilitarian motivations provide more compelling reasons for people to visit corporate websites than hedonic motivations do; and (d) Internet users from Asia visit corporate websites for hedonic purposes to a far greater extent than respondents from Europe do."

J. A. Dawson

The rhetoric of layoff memos: Beyond the craftsmanship tradition

DeKay, S. H. (Ed.). (2010). *Business Communication Quarterly, 73,* 318–342.

This "Focus on Business Practices Column" includes short articles about layoff memos. In his introduction, DeKay explains the craftsmanship tradition that "originated from several early-20th century textbooks that portrayed sales letters as the archetypal form of written business communication. Advocates of the Craftsmanship Tradition emphasize the use of standardized approaches to structuring letters, depending on their objectives …. The contributors ... embrace a broader vision of rhetoric than the ethos-dominated view espoused by the Craftsmanship Tradition." The column consists of "Introduction to the rhetoric of layoff memos" (C. King, 320–322), "A close textual analysis of corporate layoff memos" "Q. Warnick,

322–326), and "The rhetoric of Chinese layoff memos" (L. S. Sisco and N. Yu, 326–342), along with appendixes (330–342) containing the six layoff memos the authors analyzed. C. King details the names and titles of authors, dates, and companies.

Sherry Southard

Design

Designing from data: Rhetorical appeals in support of design decisions

Friess, E. (2010). *Journal of Business and Technical Communication, 24,* 403–444.

"This case study investigates how a group of novice technical communicators used appeals to support their design decisions during group meetings. The results of this ethnographic study suggest that although these technical communicators were well acquainted with user-centered design (UCD) concepts and claimed to actively practice UCD, their appeals often did not reference data collected within user-centered research and instead referenced designer-centric appeals to support their claims. This group's overall use of appeals to support their design decisions suggests that more empirical study into UCD theory and practice as well as students' argumentation skills is warranted."

Lyn Gattis

Evaluating applications for an informal approach to information design: Readers respond to three articles about nursing

Willerton, R., & Hereford, M. (2011). *Journal of Technical Writing and Communication, 41,* 59–82.

"Although books in the For Dummies series and other similar series have found commercial success, the approach to information design they use has not received much attention in technical communication journals. This article reports on readers' responses to information presented in the magazine *Nursing Made Incredibly Easy!* and two other nursing journals. Three groups of readers (two groups of nursing students and

one group of nursing faculty members) responded to three articles they read by completing questionnaires and participating in focus groups. *Nursing Made Incredibly Easy!* was regarded as easy to read and as a good starting point for less-experienced readers, but its tone and style elicited some strong objections as well. The article provides observations and recommendations about using an informal approach to information design."

Daniel Drahnak

Relational genre knowledge and the online design critique: Relational authenticity in preprofessional genre learning

Dannels, D. P. (2011). J*ournal of Business and Technical Communication, 25,* 3–35.

"This study explores the types of feedback and implicated relational systems in an online design critique using an inductive analysis of an online critique about a project focused on designing a new food pyramid. The results reveal eight types of feedback and three implied relational systems, all of which suggest relational archetypes that are disconnected from typical preprofessional activity systems. These results illustrate the potential for the online medium to be a space in which participants pursue idealized relational identities and interactions that are not necessarily authentic approximations of actual relational systems. Using these results as a foundation, the author discusses the potential relevance of the online medium to this setting and the implications of relational authenticity and genre knowledge on oral genre teaching and learning."

J. A. Dawson

The ubiquity paradox: Further thinking on the concept of user centeredness

Johnson, R. R. (2010). *Technical Communication Quarterly, 19,* 335–351.

"This essay argues that user centeredness has become ubiquitous and is in danger of being rendered meaningless. To address this problem, a meditative essay theorizes user centeredness by examining a base term—*use*—as defined through the ancient concepts of *techne* and the four causes of making. It concludes that

user-centered design should employ the causes in order to avoid inversions during the development of all things technological."

Lyn Gattis

Education

Awareness versus production: Probing students' antecedent genre knowledge

Artemeva, N., & Fox, J. (2010). *Journal of Business and Technical Communication, 24,* 476–515.

"This article explores the role of students' prior, or antecedent, genre knowledge in relation to their developing disciplinary genre competence by drawing on an illustrative example of an engineering genre-competence assessment. The initial outcomes of this diagnostic assessment suggest that students' ability to successfully identify and characterize rhetorical and textual features of a genre does not guarantee their successful writing performance in the genre. Although previous active participation in genre production (writing) seems to have a defining influence on students' ability to write in the genre, such participation appears to be a necessary but insufficient precondition for genre-competence development. The authors discuss the usefulness of probing student antecedent genre knowledge early in communication courses as a potential source for macrolevel curriculum decisions and microlevel pedagogical adjustments in course design, and they propose directions for future research."

Lyn Gattis

British Indian grammar, writing pedagogies, and writing for the professions: Classical pedagogy in British India

Jeyaraj, J. (2010). *Technical Communication Quarterly, 19,* 379–402.

"Nineteenth-century freshman composition instruction at Madras University, based on a classical paradigm, prepared students for writing in professional discourses. Examining this pedagogy from today's perspective raises, for the field of postcolonial theory, questions of whether the British, who offered Indians a curriculum comparable to those at important British universities, viewed Indians as inferior beings or those needing help to become modern."

Lyn Gattis

Critiquing community engagement

Dempsey, S. E. (2010). *Management Communication Quarterly, 24,* 359–390.

"Universities increasingly cast themselves as engaged institutions committed to building collaborative relationships with community-based stakeholders. Although promoted in terms of empowerment, community engagement can reproduce or accentuate problematic social relations. This qualitative case study of a campus–community partnership provides a critical analysis of community engagement. The data reveal how the ambiguities of 'community,' including the politics associated with defining and representing local groups, complicate these initiatives. The analysis extends existing conceptualizations of community and community engagement by (a) illustrating how a campus/community divide serves as a rich source of critique and (b) demonstrating the need to reshape community engagement around a critical understanding of community and community representation. In addition to these contributions, this study provides a set of guidelines for future community engagement efforts."

Sherry Southard

Crossing global boundaries: Beyond intercultural communication

Herrington, T. K. (2010). *Journal of Business and Technical Communication, 24,* 516–539.

"This article analyzes the benefits of experiential learning in cross-disciplinary global learning environments by recounting work in the Global Classroom Project, which electronically links students and professors from Russia and America. The author asserts that students learn by experience what cannot be taught and claims that they benefit from synthesizing the viewpoints, ideologies, and frames of reference of diverse co-participants. In doing so, students prepare for a future in which synthetic thinking that leads to innovative, imaginative problem solving and invention will be desirable and necessary."

Lyn Gattis

Integrating an executive panel on communication into an engineering curriculum tutorial

Norback, J. S., Leeds, E. M., & Kulkarni, K. (2010). *IEEE Transactions on Professional Communication, 53,* 412–422.

"Communication skills are key to the workforce success of engineering graduates. The Stewart School of Industrial and Systems Engineering (ISyE) Workforce Communication Program at Georgia Tech has successfully incorporated executive panel interaction into its capstone design course to align student skills with executive expectations. The objectives of the panel are to raise student awareness about the importance of communication to workforce success and to gain knowledge about communication skills directly from executives. Executives interact directly with students about workforce communication, career advancement, and the communication skills they consider most critical. The process of assembling and holding a panel is described for potential implementation in other engineering programs."

Jenny West

Integrating technical communication into China's English major curriculum

Yu, H. (2011). *Journal of Business and Technical Communication, 25,* 68–94.

"Previous research has suggested the need for developing technical communication education in Chinese universities. Following this suggestion, this article examines the possibility of integrating technical communication into China's English major curriculum. Based on findings from two universities, the article discusses the design of China's English major curriculum and Chinese teacher and student perspectives on technical communication. The author suggests that China's English for Specific Purposes (ESP) education provides a promising home for integrating technical communication and that this integration can enhance China's current ESP education. The author presents three integration models and discusses questions for future research."

J. A. Dawson

Linking contextual factors with rhetorical pattern shift: Direct and indirect strategies recommended in English business communication textbooks in China

Wang, J., & Zhu, P. (2011). *Journal of Technical Writing and Communication, 41,* 83–107.

"Scholars have consistently claimed that rhetorical patterns are culturally bound, and indirectness is a defining characteristic of Chinese writing. Through examining how the rhetorical mechanism of directness and indirectness is presented in 29 English business communication textbooks published in China, we explore how English business communication textbook writers in China keep up with the contextual changes in the Chinese society and how the rhetorical mechanism of directness and indirectness is locally situated in the English business communication teaching practices in China. We conclude that the pedagogical strategy on directness and indirectness represented in Chinese English business communication textbooks echoes the same strategy favored by scholars in the United States."

Daniel Drahnak

Outsourced: Using a comedy film to teach intercultural communication

Briam, C. (2010). *Business Communication Quarterly, 73,* 383-398.

"Given that feature films can enhance the teaching of intercultural communication, this article describes in detail how the 2006 comedy film, *Outsourced,* can be integrated into a course. The article relates the film to four different functions of film and shows how *Outsourced* can help create an intercultural experience for students, serve as the basis for a case analysis of cross-cultural adjustment, give meaning to cultural concepts, and create powerful metaphorical images to expand classroom discussions to broader issues. Also explored are ways the film can be used in teaching advanced intercultural communication concepts."

J. A. Dawson

Students' perceived preference for visual and auditory assessment with e-handwritten feedback

Crews, T. B., & Wilkinson, K. (2010). *Business Communication Quarterly, 73,* 399–412

"Undergraduate business communication students were surveyed to determine their perceived most effective method of assessment on writing assignments. The results indicated students' preference for a process that incorporates visual, auditory, and e-handwritten presentation via a tablet PC. Students also identified this assessment process would improve their writing by helping them understand the types of errors they were making and why these errors were incorrect. Students also indicated this type of assessment would help build a relationship with the instructor and help them be successful in the class."

J. A. Dawson

Toward an accessible pedagogy: Dis/ability, multimodality, and universal design in the technical communication classroom

Walters, S. (2010). *Technical Communication Quarterly, 19,* 427–454.

"This article explores the challenges and opportunities that the rising numbers of students with disabilities and the changing definition of disability pose to technical communication teachers and researchers. Specifically, in a teacher-researcher study that combines methods from disability studies, I report on the effectiveness of multimodal and universal design approaches to more comprehensively address disability and accessibility in the classroom and to revise traditional impairment-specific approaches to disability in technical communication."

Lyn Gattis

Ethical Issues

Business ethics research: A global perspective

Chan, K. C., Fung, H-G., & Yau, J. (2010). *Journal of Business Ethics, 95,* 39–53.

"Using 10 years of publication data (1999–2008), from 10 leading business ethics journals, we examine global patterns of business ethics research and contributing institutions and scholars. Although U.S. academic institutions continue to lead in the contributions toward business ethics research, Asian and European institutions have made significant progress. Our study shows that business ethics research output is closely linked to the missions of the institutions driven by their values or religious belief. An additional analysis of the productivity of each highly ranked institution suggests that business ethics research is highly concentrated in a limited number of eminent scholars within each institution."

J. A. Dawson

Communication of corporate social responsibility: A study of the views of management teams in large companies

Arvidsson, S. (2010). *Journal of Business Ethics, 96,* 339–354.

"In light of the many corporate scandals, social and ethical commitment of society has increased considerably, which puts pressure on companies to communicate information related to corporate social responsibility (CSR). The reasons underlying the decision by management teams to engage in ethical communication are scarcely focused on. Thus, grounded on legitimacy and stakeholder theory, this study analyses the views management teams in large listed companies have on communication of CSR. The focus is on aspects on interest, motives/reasons, users and problems related to corporate communication of CSR information. A questionnaire survey and in-depth interviews confirm that there is a distinct trend shift towards more focus on CSR in corporate communication. Whilst this trend shift started as a reactive approach initiated by the many corporate scandals, the trend shift is now argued to be of a proactive nature focused at preventing legitimacy concerns to arise …. [W]e are witnessing a transit period between two legitimacy strategies. Furthermore, the findings suggest that the way respondents argue when it comes to CSR activities coincides with consequentialism or utilitarianism, i.e. companies engage in CSR activities to avoid negative impacts instead of being driven by a will to make a social betterment or acting in accordance with what is fundamentally believed to be right to do." The authors also discuss implications for policymakers and stakeholders.

J. A. Dawson

Constructing a code of ethics: An experiential case of a national professional organization

Messikomer, C. M., & Cirka C. C. (2010). *Journal of Business Ethics, 95,* 55–71.

Writers and editors who might be asked to prepare a code of ethics for their employers can benefit from "this paper [that] documents the development and implementation of an ethically valid code of ethics in a newly formed national professional organization …. It provides a model for code development that is

both practical and grounded in theory. Although the content of a code of ethics ('the product') provides guidance to organizational members in the conduct of everyday business, especially when they face ethically challenging situations, how the code is developed (the 'process') influences its ethical validity. Few published cases document an organization's experience developing a code, and this is the first case … that provides a first-hand longitudinal account of an effective code development process."

J. A. Dawson

Employer's use of social networking sites: A socially irresponsible practice

Clark, L. S., & Roberts, S. J. (2010). *Journal of Business Ethics, 95,* 507–525.

Although the article is directed to employers, both employers and employees in technical communication need to be aware of ways employers may be using social networking sites. "Millions of people are using social networking sites to connect with others, and employers are using these sites as a source of background information on job applicants. Employers report making decisions not to hire people based on the information posted on social networking sites. Few employers have policies in place to govern when and how these online character checks should be used and how to ensure that the information viewed is accurate. In this article, we explore how these inexpensive, informal online character checks are harmful to society. Guidance is provided to employers on when and how to use these sites in a socially responsible manner."

J. A. Dawson

Framing and counterframing the issue of corporate social responsibility: The communication strategies of Nikebiz.com

Waller, R. L., & Conaway, R. N. (2011). *Journal of Business Communication, 48,* 83–106.

"This article reports on the communication strategies that sports shoe giant Nike used to successfully protect its corporate social responsibility (CSR) reputation during the late 1990s. The article opens with a brief

discussion of CSR and its critical importance to transnationals such as Nike. The opening also includes four research questions guiding this study. The article then discusses why frame analysis offers such a potentially rich approach to analyzing public relations controversies like this one. The Analysis section of the article examines how an anti-Nike coalition initially succeeded in imposing negative frames on two CSR issues and how this framing generated highly negative media coverage. The remainder of this section provides a detailed commentary on eight Web texts from Nikebiz. com and how the framing strategy behind these texts enabled the company ultimately to defend, even to enhance its CSR reputation."

J. A. Dawson

Information Management

Delivering more than text

Berry, M. [with Atchison, D., & Ward, J.] (2010). *Best Practices, 12,* 141–144. [Center for Information Development Management]

The company where the authors work "has always produced context-sensitive help, stand alone HTML help and guides, and PDF help and other guides, along with the occasional workbook and quick reference card …. [They share their experiences with] new types of information: videos, guided tours, and even a comic book …. [They also share] why we turned to these output types, how it all worked, and what lessons we've learned in the process."

Sherry Southard

It all starts with standards

Stevens, D. (2010). *Best Practices, 12,* 145–152. [Center for Information Development Management]

"Although the best practices of highly efficient information development groups clearly indicate a need for standards, the trick is in knowing what to include and how to obtain buy-in. This article provides suggestions for how to get started defining your standards …. [by discussing] driving factors,

contents, product definitions, job responsibilities, tools, file management, work flow, project management, editorial, graphic design and photography, audio/video, formatting (style sheet) standards, instructional design, e-learning, interface design, testing, XML standards, implementation, buy-in, communication, training, accessibility, enforcement, change control … [and] return on investment."

Sherry Southard

Reducing context in modular documents

Self, T. (2010). *Best Practices, 12,* 133, 136–140. [Center for Information Development Management]

"This article argues that by adopting context-agnostic writing techniques for topic-based modular documentation, technical writers can improve content reuse and achieve greater efficiency through the technical documentation life cycle without significantly compromising quality. In some cases, context can simply be removed from topic modules, but when critical to meaning, it is possible to move context from the topic to a document specification or map. This separation of context from content mirrors the more common separation of content and form fundamental to many XML applications."

Sherry Southard

Supporting people where they need it, when they need it

Trotter, P. (2010). *Best Practices, 12,* 153–155. [Center for Information Development Management]

According to the author, with "customized user assistance and dynamic content, users experience a 30 percent increase in productivity …. Tools and technology … [exist that change] user support from content-generic to content-specific assistance …. Moment of Need content is content that finds the user, appearing in the workspace as the user navigates daily tasks …. [The author advises readers to] carefully evaluate any dynamic publishing tool to ensure that it fits your workflow and authoring tools to provide the best experience for your users."

Sherry Southard

Instructions

English agricultural and estate management instructions, 1200–1700: From orality to textuality to modern instructions

Tebeaux, E. (2010). *Technical Communication Quarterly, 19,* 352–378.

"This article discusses the history and development of English agriculture and estate management instructions, 1200–1700, as these shifted from oral to textual forms. Beginning with manuscript treatises that influenced important instruction books printed in the 16th century, the article shows how major agricultural writers developed instructions for a range of users. By the close of the 17th century, agricultural and estate management books exemplified increasingly modern presentation and style."

Lyn Gattis

Legal Issues

Beyond plain language: A learner-centered approach to pattern jury instructions

Miles, K. S., & Cottle, J. L. (2011). *Technical Communication Quarterly, 20,* 92–112.

"Before a jury begins deliberation, judges provide instructions to guide jury decision-making. Unfortunately, extant literature has demonstrated poor comprehension of these instructions. Although there have been attempts to simplify the language of these instructions, plain language may not be enough to ensure comprehension. Instead, the principles of technical communication advocate the adoption of a learner-centered perspective and suggest increased novice-expert interactions to assist jurors in comprehending the task assigned to them."

J. A. Dawson

Copyright, free speech, and democracy: Eldred v. Ashcroft *and its implications for technical communicators*

Herrington, T. (2011). *Technical Communication Quarterly, 20,* 47-72.

"This article explains the Constitution's intellectual property provision and its goals, then deconstructs the Supreme Court's decision in *Eldred v. Ashcroft* as a means to unravel the pieces in the complex relationship among the constitutional provision, the First Amendment, and copyright. The article then considers how an understanding of the relationship of these elements can be helpful for considering the positions of technical communicators as both users and producers of intellectual products."

J. A. Dawson

Guest editors' introduction: Technical communication and the law

Reyman, J., & Schuster, M. L. (2011). *Technical Communication Quarterly, 20,* 1–4.

"This special issue features articles that address legal issues as they relate to technical communication research, pedagogy, and practice. The articles will assist instructors who wish to engage classes in activities that allow students to understand, analyze, and respond to legal dilemmas related to workplace activities. The articles will also highlight contemporary subjects for research inquiry in technical communication, including the relationship between technical communication and civic engagement, which often depends on the study of legal processes. It is our hope that this special issue will generate interest in the intersection of technical communication and the law and that it will provide readers of *TCQ* with a valuable and unique foundation for teaching and research in this area."

J. A. Dawson

A legal discourse of transparency: Discursive agency and domestic violence in the technical discourse of the excited utterance exception to hearsay

Andrus, J. (2011). *Technical Communication Quarterly, 20,* 73–91.

"This article analyzes the effects of a transparency view of language that is implicit in some technical discourses. Using a legal concept, the excited utterance exception to hearsay, as an exemplary discourse, I show that this view of language is predicated on social norms rather than empirical standards. Indeed, I argue, the measurement of accuracy using an empirical standard creates a situation in which the speaker's rhetorical concerns and the context can be ignored."

J. A. Dawson

Legal literacy: Coproducing the law in technical communication

Hannah, M. A. (2011). *Technical Communication Quarterly, 20,* 5–24.

"This article discusses the need for technical communicators to develop a more sophisticated understanding of the relationship between law and their work. The author reviews the discipline's literature regarding the relationship between law and technical communication and argues that technical communicators must learn to see themselves as coproducers of the law. To that end, the author offers pedagogical strategies for helping technical communication students develop skills for recognizing the legal implications of their work."

J. A. Dawson

Monitoring changes to federal health IT privacy policy: A case study in punctuated equilibrium

Markel, M. (2011). *Technical Communication Quarterly, 20,* 25–46.

"Applying the communication theory called punctuated equilibrium to an activity system in the federal department that oversees health-information privacy reveals that the theory fails to align well with a government activity system rooted in a stable

democratic tradition. This activity system is structured to accommodate a wide variety of stakeholders and significant organizational change. This case study prompts a reexamination of punctuated equilibrium as an approach to understanding the role of documents in certain types of activity systems."

J. A. Dawson

A multi-perspective genre analysis of the barrister's opinion: Writing context, generic structure, and textualization

Hafner, C. A. (2010). *Written Communication, 27,* 410–441.

"In teaching and researching English for Law, considerable effort has been put into the fine-grained description of legal genres and accounts of associated legal literacy practices. Much of this work has been carried out in the academic context, focusing especially on genres encountered by undergraduate law students. The range of genres which must be taught in professional legal writing and drafting courses is comparatively underresearched in the applied linguistics literature. This article explores one such underresearched genre, the barrister's opinion. The article reports the findings of a genre analysis (Bhatia, 1993; Swales, 1990), drawing on the written opinions of five Hong Kong barristers, individual interviews with the barristers, and data from background information questionnaires. The study adopts a multi-perspective approach to genre analysis, drawing on the accounts of specialist informants to explain the genre as socially situated rhetorical action. Thus, the genre is analyzed in terms of its intertextual and interdiscursive writing context, generic move structure, and lexico-grammatical textualization. It is suggested that the findings may usefully be applied to the teaching of legal writing and drafting in a variety of contexts."

Sherry Southard

Research

Linguistics from the perspective of the theory of models in empirical sciences: From formal to corpus linguistics

Grabinska, T., & Zielinska, D. (2010). *Journal of Technical Writing & Communication, 40,* 379–402.

"The authors examine language from the perspective of models of empirical sciences, which discipline studies the relationship between reality, models, and formalisms. Such a perspective allows one to notice that linguistics approached within the classical framework share a number of problems with other experimental sciences studied initially exclusively within that framework because of making the same sort of assumptions. By examining solutions to some of these problems found in contemporary science, the authors point out alternative approaches, which could be relevant for linguistics research, and some of which have already been tested in language studies. In particular, Corpus Linguistics is presented as an especially promising approach, positioned to avoid many of the pitfalls of the classical framework. Consequently, it seems that the future of linguistics, from theoretical to applied, such as Technical Writing, must be embraced by Corpus Linguistics research."

Daniel Drahnak

Quantitative content analysis: Its use in technical communication

Boettger, R. K., & Palmer, L. A. (2010). *IEEE Transactions on Professional Communication, 53,* 346–357.

"Quantitative content analysis can enrich research in technical communication by identifying the frequency of thematic or rhetorical patterns and then exploring their relationship through inferential statistics. Over the last decade, the field has published few content analyses, and several of these applications have been qualitative, diluting the method's inherent rigor. This paper describes the versatility of quantitative content analysis and offers a broader application for its use in the field. This discussion frames two original case studies that illustrate the design variability that content analysis offers researchers."

Jenny West

Seeking a direct pipeline to practice: Four guidelines for researchers and practitioners

Cotugno, M., & Hoffman, M. (2011). *Journal of Business and Technical Communication, 25,* 95–105.

"The authors of this article, a researcher and a practitioner, revisit the collaborative process by which a training program addressing report writing for police officers was developed and implemented as a means of understanding why and how this collaboration was successful. From this reflection, the authors offer four guidelines for others involved in similar efforts to help them obtain a direct pipeline to practice."

J. A. Dawson

Scientific Writing

Writing material in chemical physics research: The laboratory notebook as locus of technical and textual integration

Wickman, C. (2010). *Written Communication, 27,* 259–292.

"This article, drawing on ethnographic study in a chemical physics research facility, explores how notebooks are used and produced in the conduct of laboratory science. Data include written field notes of laboratory activity; visual documentation of *in situ* writing processes; analysis of inscriptions, texts, and material artifacts produced in the laboratory and assembled in notebooks; and an in-depth interview with an expert chemist whose research and writing formed the basis of this investigation. Findings from this study suggest that the notebook occupies a negotiated space between the scientist's contingent response to exigency in the laboratory and the genre-specific strategies that he or she deploys to communicate his or her work outside the laboratory. …. This article ultimately offers a methodical approach for investigating how the material, technical, and symbolic dimensions of writing and text converge in a modern scientific workplace."

Sherry Southard

Technology

Long live the Web

Berners-Lee, T. (Dec. 2010). *Scientific American, 303* (6), 80–85

"On the 20th anniversary of the World Wide Web (www), the man widely acknowledged as its creator, Tim Berners-Lee, writes that the World Wide Web Consortium (W3C) has developed the Web into a powerful tool deeply embedded in our human experience because the Web was built by a great number of people working individually and as part of universities, companies, and government entities. He asserts that from the first, the Web was based on egalitarian principles. However, he discusses ways that the Web is currently being threatened and suggests ways to increase the value of the Web."

Gary Hart

Writing

The communication habits of engineers: A study of how compositional style and time affect the production of oral and written communication of engineers

Steiner, D. (2011). *Journal of Technical Writing and Communication, 41,* 33–58.

"Writing is common skill for many whose job requires them to communicate through business documents. But there are many professionals who seemingly have difficulty with writing. Many engineers are required to write proposals and reports yet have received little formal writing instruction. The purpose of this study was to determine if writing apprehension, their composition process, or the presence of deadlines affects the production of documents. The hypothesis was that engineers have high writing apprehension, generally use a product-based approach, and tight deadlines negatively affect the end quality. The researcher conducted in-depth interviews with civil engineers to gauge their level of apprehension, learn their personal composition process and determine how deadlines affect their

writing. While the hypothesis was not conclusively supported, the study revealed six key themes into how engineers structure their writing tasks and found that the writing environment of engineers significantly impacts the composition process."

Daniel Drahnak

I, pronoun: A study of formality in online content

Thayer, A., Evans, M., McBride, A., Queen, M., & Spyridakis, J. (2010). *Journal of Technical Writing & Communication, 40,* 447–458.

"This article presents the results of a study that investigated readers' perceptions of tone formality in online text passages. The study found that readers perceived text passages to be less formal when they contained personal pronouns, active voice verbs, informal punctuation, or verb contractions. The study reveals that professional communicators can impact their readers' perceptions of tone in online passages. This study provides useful guidance for writers who wish to understand the impact of their stylistic decisions on audience perceptions of passage formality."

Daniel Drahnak

Secret sauce and snake oil: Writing monthly reports in a highly contingent environment

Spinuzzi, C. (2010). *Written Communication, 27,* 363–409.

"At a search marketing company, each search engine optimization (SEO) specialist writes up to 10 to 12 complex 20-page monthly reports in the first ten business days of each month. These SEO specialists do not consider themselves to be writers, yet they generate these structurally and rhetorically complex reports as a matter of course, while negotiating a constantly changing landscape of a contingent, rapidly changing business sector. Under these conditions, how did the SEO specialists manage to write these reports so quickly and so well? What is the standing set of transformations that they enact in order to develop and produce these reports? And given the multiple contingencies, rapid changes, and high individual discretion at this organization—seemingly a recipe for discohesive

practices—how did they maintain and develop this standing set of transformations in order to turn out consistent reports? In this article, I draw on writing, activity, and genre research (WAGR) to examine how Semoptco's SEO specialists produced monthly reports, specifically in terms of their constant networking, audience analysis, and ethos building. Finally, I draw implications for applying WAGR to knowledge work organizations."

Sherry Southard

Did You Miss the Summit?

SUMMIT@aClick is a second chance at attending the Summit—from the privacy of your home or office!

You can "attend" all the 2011 sessions that interest you at a time and place of your choosing and without having to travel.

SUMMIT@aClick lets you attend the conference you missed! Content of almost every session was captured (audio and visuals) and will be available at the STC Live Learning Center. Members who did not attend the Summit will be able to purchase SUMMIT@aClick when the sessions are archived—check the STC website for updates! **STC is the only meeting in the technical communication field that offers recorded conference sessions.**

Note: SUMMIT@aClick was included in the full registration fee. Attendees will receive a password to access the content at no additional charge.

SUMMIT@aClick

ADOBE® TECHNICAL COMMUNICATION SUITE 3

Efficiently author and publish documentation to multiple channels and devices

Adobe

50% less than buying individual products

3 ways to work smarter

Stretch your limits. Shrink your hours. Save your money.

Adobe® Technical Communication Suite 3 is a complete authoring toolkit with multichannel, multidevice publishing capabilities. Develop standards-compliant content, publish in a variety of formats, collaborate with reviewable PDF files, incorporate images, and add demos and simulations.

Try the full functionality of Adobe Technical Communication Suite 3, plus tutorials, in minutes without downloading the software.

Visit: http://bit.ly/gsj7WV

View Technical Communication channel on Adobe TV

Visit: http://adobe.ly/gdfYUJ

View On-demand eSeminars

Visit: http://adobe.ly/hAz0he

Included

FM RH Ps Cp

Learn more about Adobe Technical Communication Suite 3,

Visit: http://adobe.ly/guEXDb

Coming Attractions ...

STC Proudly Presents

The 2012 Summit
20-23 May 2012
Chicago-Rosemont, IL, USA

Attend the excellent education sessions!
Network with top technical communicators!
Visit the exciting Expo!
And learn more than you ever thought possible!

Visit http://summit.stc.org *for more
information as it becomes available.*
See you in 2012!