

maybe Ref.  
Tech comm  
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critique

they do need are some tools to recognize and examine the passives they already use, though understand only partially (if at all).  
I have strong reservations about the scheme Ferguson and Parker offer—in particular, that it is only a set of statements to be memorized, not a set of principles to be learned; in short, that it is not linguistics. But I will leave it to readers of both articles to decide what might be useful to them in each, and leave the mean-  
ingful, school-yardish, my-approach-can-beat-up-your-approach argumentation to Ferguson and Parker.

REFERENCES

K. S. Ferguson and F. Parker, Grammar and Technical Writing, *Journal of Technical Writing and Communication*, 20, pp. 357-368, 1990.  
R. A. Harris, Linguistics, Technical Writing, and Generalized Phrase Structure Grammar, *Journal of Technical Writing and Communication*, 18, pp. 227-240, 1988.  
J. W. Williams, *Style* (2nd Edition), Scott, Foresman, and Company, Glenview, Illinois, 1985.  
P. Rosenbaum, *The Grammar of English Predicate Complement Constructions*, MIT Press, Cambridge, Massachusetts, 1967.  
R. Jacobs and P. Rosenbaum, *English Transformational Grammar*, Waltham, Massachusetts, 1968.  
J. Gruber, *Studies in Lexical Relations*, doctoral dissertation for MIT, Cambridge, 1965.  
R. S. Jackendoff, *Some Rules of Semantic Interpretation for English*, doctoral dissertation for MIT, Cambridge, Massachusetts, 1969.  
R. S. Jackendoff, *Semantic Interpretation in a Generative Grammar*, MIT Press, Cambridge, Massachusetts, 1972.  
C. Fillmore, The Case for Case, in *Universals in Linguistic Theory*, E. Bach and R. Harms (eds.), Holt, Rinehart and Winston, New York, pp. 1-90, 1968.

Direct reprint requests to:

Dr. R. A. Harris  
Department of Linguistics  
University of Alberta  
Edmonton, Canada  
T6G 2E7

General set of guidelines,  
mostly recommendations but  
working to really compare to  
NOT research based.  
NOT addressed as specific  
ppr texts

ORGANIZATION BY DESIGN:  
SOME IMPLICATIONS FOR  
STRUCTURING INFORMATION

WILLIAM M. GRIBBONS  
Bentley College  
Waltham, Massachusetts

ABSTRACT  
This article proposes a system for document organization based on cueing and page formatting techniques. The logical and systematic use of cueing and formatting creates a visual hierarchy organizing and signalling information for the reader. When the proposed system is properly applied, the result is increased reading speeds, increased ease of access and increased comprehension.

Design, as used in the present study, is employed as a systematic approach to document organization. A well organized document, in turn, facilitates the reader's processing, comprehension and storage of information. Specifically, this article analyzes visual cueing and page formatting techniques. Visual cueing structures and signals information through the use of typography and color, while page formatting organizes information through the systematic allocation of vertical and horizontal white space and the pre-determined placement of information within this space. Together, these techniques create a visual system that increases reading speed as well as readers' access to and comprehension of the printed information. Ultimately, cueing and formatting create a visual system whereby page design becomes an organizational device—in other words, organization by design.  
The employment of traditional design techniques to achieve document organization is by no means a new idea. Koler indicated that as early as the late 19th century designers and psychologists were interested in the effects of page organization on the dissemination of information [1]. Despite an apparent lull during the

st half of this century, the organization of information on the printed page has maintained a focus of intense interest for researchers from many and varied disciplines. Most recently, there has been a flurry of activity during the past two decades coinciding with the tremendous advances made in the cognitive sciences. Researchers from the cognitive sciences have provided valuable insight into the reader's selection, processing, encoding and storage of information. Subsequently, this research has had profound effects on the visual display of information and has encouraged countless research efforts in the disciplines of visual communication and instructional design. North and Jenkins [2], Klare et al. [1], Crouse and Idstein [4], Fowler and Barker [5], Coles and Foster [6], Foster and Coles [7], Glynn [8], Foster [9], Frase and Schwartz [10], Crowell [11], Hartley et al. [12], Waller [13], Waller [14], and Hartley [15], Waller [16], Hartley et al. [17], Hawk et al. [18] have each examined isolated visual elements and their ability to facilitate the processing and storage of information. Unfortunately, these studies alone only provide a partial solution. Because of the tight laboratory controls exercised in these studies, the ability to generalize from their findings is severely restricted [19-21]. However, when these findings are combined in a complementary fashion with the pure research of the cognitive sciences and the practical intuition of the text designer, valuable insight is provided into readers' use of information products and the design of formats maximally compatible with this use. Controlled laboratory studies suggest probable links between the pure research of the cognitive sciences and the intuition of the practitioner.

### BRIDGING THEORY AND PRACTICE

With decades of accumulated research, why produce yet another paper analyzing this topic? Quite simply, this article provides a unique approach to the topic by logically and systematically *bridging* the theoretical sciences and the day-to-day decisions of the text designer. Topics include the following:

- Analyzing the assumptions underlying visual systems of organization,
- Determining operating principles for effective organization,
- Employing visual cueing and page formatting techniques.

Rather than being confined to the paper-based medium, the proposed organizational system is applicable to all information products including online documentation, hypermedia and presentation media. In fact, the use of this organizational system is extremely effective in minimizing the severe ergonomic as well as technological restrictions inherent in these media.

### ASSUMPTIONS

Various assumptions guide the development and application of visual systems of organization. Among them are the assumption that

- The human-processing-system searches for organization in all sensory experiences
- Structure is quickly learned and used for future processing and storage of information
- Knowledge is maintained hierarchically in the cognitive structure
- Most information has inherent structure
- This structure can be signaled visually
- The reader processes most information products selectively
- The reader employs internalized priorities for visual processing
- The reader's perceptual and cognitive systems have limitations
- Structured information produces a positive aesthetic response

### Organization

Because we as humans live in an environment without order, most 20th century psychologists maintain that we appear to have an inborn tendency to impose our own sense of organization on sensory experiences. Much of this structure is derived from our sensitivity to reoccurring themes and repeated experiences in the environment. Sensitivity to and modification of these themes and experiences, in turn, serve as a foundation for processing and storing future stimuli. This process is as much a survival mechanism as it is a technique for managing the almost infinite number of sensory experiences received at any given moment.

It was this quest for organization that served as a foundation for the Gestalt psychologists of the 1930s. The Gestalt researchers formulated well over 120 separate laws that dictated how forms were organized. Of these many laws six appear to dominate: good continuity, proximity, similarity and good form. Good continuity dictates that marks suggesting a continuous line will tend to be grouped together. While the law of proximity suggests that marks positioned near each other will also be organized together. Next, the law of similarity states that marks possessing similar visual attributes will be grouped together. And finally, the law of good form suggests that enclosed shapes will be seen as single units. Of these six, similarity and proximity will have the greatest relevance for the visual structuring of information.

Over the past several decades, cognitive psychologists have continued to explore our innate tendency to seek organization. The vast majority of these efforts have focused on the structure of information, the transfer of this information into the mental structures of long-term memory and the individual cognitive styles used to process this information.

*Handwritten notes:*  
 Just a little  
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*Handwritten notes:*  
 Write  
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Recent research has demonstrated that individuals learn most efficiently when learning materials are compatible with their cognitive style. Ambaratar defined cognitive style as "a person's mode of processing information that includes perceiving, remembering, thinking and problem solving" [22, p. 23]. Perhaps the most pertinent styles are the field dependent and field independent. According to Ambaratar, a "field dependent person tends to perceive globally and is guided by the organization of a given field as a whole. . . . Field independent people are, by comparison, more analytical, tend to experience parts separated from the whole and possess their own structure of learning" [22, p. 24].

Of particular relevance to the present study, field dependents experience difficulty processing documents with insufficient structure as well as poorly structured documents. In contrast, the field independents overcome these shortcomings by imposing their own structure and sense of logic on the passage. Structure is typically derived from three sources: linguistic cues, typographic cues and spatial cues. While evaluating the complexity and appropriateness of an organizational system, the text designer must remain mindful that individuals, according to the cognitive style they adopt, vary in the benefit derived from structural aids.

### The Cognitive Structure

The cognitive structure is highly organized in order to manage the infinite quantities of information experienced in a lifetime. Psychologists use many terms to label this organization structure including schema, frame, prototype, grammar, network, hierarchy and matrix. Regardless of the label employed, the top levels of this structure contain knowledge of what is believed to be true of certain classes of objects, events, situations or concepts. Just and Carpenter maintain that the transfer of information into this structure is strongly affected by the appropriateness and cohesiveness of the information's organization [23]. According to Calfee, "long-term memory operates most efficiently when and if the arrangement of a body of knowledge matches some preexisting mental structure. Knowledge is parsimonious when properly organized; but the organization must highlight frequent events and respect the relatedness of events in time and space" [24, p. 20].

### The Structure of Information

An underlying assumption of this study is that most bodies of knowledge have an inherent structure. It is also recognized that the complexity of this structure varies along a continuum from the simple to the complex. Consequently, the complexity of the visual structure must complement that of the body of knowledge being communicated. For example, the prose of the novel is an inappropriate application of a complex visual system of organization. Texts of this type are typically and more effectively structured linguistically or at the very most with simple typographic signaling of headlines and titles. In contrast, texts communicating sophisticated bodies of knowledge—e.g., instructional texts—benefit

from a more complex visual structuring of content. In these products, visual cues and the placement of information in designated areas of the page provide a visual road map organizing concepts and subconcepts, emphasizing important information, distinguishing between different types of information and allowing the reader to selectively access the information when necessary. Structure within these complex texts can typically be characterized as either a hierarchical structure, a list orientation or a unique hybrid of the two. Gagne claims that much information is organized hierarchically from highly inclusive concepts to narrow subconcepts. He further contended that the presentation of information must complement this hierarchy [25]. Lists, by comparison, are typically organized according to logical procedures or ordered according to alpha-numeric rules in the case of bibliographies or reference materials. Once the inherent structure of the information is determined, the visual display is designed to complement this structure in a redundant fashion.

### Selective Processing

In response to an almost constant barrage of information, readers process most texts selectively, reading and processing only that information deemed relevant to current and future information needs. Based on need, certain texts are more likely to be processed selectively while a limited number are more effectively processed in a more time-consuming and labor-intensive linear fashion. Continuous prose, similar to that found in a novel, benefits most from linear processing while the complex structure and multiple-purposes of instructional and reference texts are most effectively processed in a selective fashion. To facilitate selective processing, the reader employs a variety of reading strategies. Pugh identified five strategies employed by the selective reader [26]:

- Skimming—reading for the general drift of a package;
- Scanning—reading quickly to find specific information;
- Search reading—scanning with attention to the meaning of specific items;
- Receptive reading—reading for thorough comprehension;
- Critical reading—reading for evaluation.

The strategy selected is that deemed most economical while at the same time satisfying the reader's information needs. In turn, each strategy is facilitated by a different visual format. Diehl and Mikulecky [27], Huckin [28] and Samuels [29], advocate the use of appropriate linguistic, typographic and spatial cues to facilitate a particular reading style. For example, the use of visual cues focuses the reader's attention while employing the skimming, scanning or search reading techniques [30]. In contrast, the specialized search process used to locate an item in a reference text is best facilitated by the simple manipulation of white space [12, 31]. In the receptive reading of abstract or conceptual bodies of knowledge, on the

important

new word  
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to be read

critical

other hand, the reader benefits most fully from the simple employment of boldface for headlines. In contrast, Ausubel et al., suggests that a rather complex combination of formatting and typographic signalling is most effective in the learning of factual information [32].

While engaged in the selective processing of information, Huckin suggests readers pay greatest attention to information higher in the text hierarchy than low-level information; a process Huckin labels the levels effect. Huckin contends that the learning of high-level information is facilitated by the selective employment of visual cueing and formatting [28]. However, because the increased comprehension of the high-level, signalled information occurs at the expense of low-level information, caution must be exercised in the employment of signalling techniques [17, 33]. Consequently, the text designer must carefully critique both cued and uncued information to ensure the creation of an optimal format.

Parallel to the levels effect, the reader processes most visual cues according to an internalized hierarchy. The direct cause of this priority is unknown. More than likely it is a cumulative effect of the strength of the sensory experience and the effects of typographic tradition and culture. Regardless of the cause, Berlin in the *Semiology of Graphics* listed the visual characteristics of graphics in the following order of significance:

1. Size
2. Value
3. Pattern
4. Color
5. Orientation
6. Shape [34]

Quite simply, the reader perceives objects of a larger size as more significant than objects of a different value, color or shape. Furthermore, in addition to an assigned significance between characteristics, the reader detects and assigns meaning to variation within a characteristic. For example, objects of a larger size are typically perceived as more significant than smaller objects and objects of a darker value are viewed as more significant than lighter objects. The perceived significance is directly proportional to the degree of variation. Similarly, Kosslyn et al. describes the visual processing system as a "difference detector" [35]. Any sharp contrast will draw attention. The greater the contrast the more salient the effect.

The reader also attaches significance to the placement of information within a display. This significance is more than likely a product of the left-to-right reading pattern of western cultures. The learning of this pattern is so complete that it is quickly internalized within the first several years of reading. The effects of this pattern have many implications for the text designer. Dondis asserts that due to western print formation [rectilinear page format] and the way we learn to read left-to-right, the reader assigns the greatest importance to the left-hand portion of the page [36]. Aware of this reading pattern, graphic designers employ formats that utilize and facilitate this movement. The result is a self-perpetuating effect

with the reader expecting this format and the designer meeting and further reinforcing these expectations. Ultimately, the effects of our western reading pattern, the levels effect and the hierarchy of visual significance should each be exploited to more effectively communicate the structure and importance of information.

### Limitations of Perceptual and Cognitive Processing

It is generally acknowledged that both the perceptual and cognitive processing systems have limitations. When these limitations are exceeded, the reader's ability to process, comprehend and store information is severely compromised. The previously discussed levels effect and hierarchy of visual significance are more than likely mechanisms employed to compensate for these limitations.

Perceptual limitations might include the inability to detect minor differences in size, values and colors as used in the layout of information products. Additionally, color anomalies such as color blindness or spectrum sensitivity create significant constraints. Constraints which pose important challenges for the text designer who employs these visual elements to emphasize and structure the information product. Kosslyn [35], Berlin [34] and Marcus [37] provide a comprehensive overview of these limitations.

Perhaps the most significant of the cognitive limitations are those imposed by short-term memory. Kosslyn et al. defined short-term memory as "the locus where conscious reorganization and reinterpretation of the information takes place" [35, p. 17]. Short-term memory is typically of limited duration, with unrehearsed information typically decaying within twenty seconds. In addition, short-term memory has a finite capacity, typically somewhere between five to nine categories of information at one time. Miller theorized that our short-term memory has a limited channel capacity. "A limitation imposed either by conditioning or the design of our nervous system" [38, p. 86]. Although the number of units in short-term memory is limited, Miller indicated channel capacity could be extended by organizing or "chunking" information within these limited number of units. Visual displays that exceed the maximum channel capacity or displays that force readers to retain information for longer than twenty seconds are far less effective. The findings of Miller have significant implications for text design in terms of the complexity of the organizational structure as well as the chunking of information within this structure.

### Compatibility of Organization and Aesthetic Appeal

Visual systems of organization are often rejected by professional designers on the grounds of being "dull, cold or mechanical." These are indeed valid concerns since the readers' affective response to a design strongly influences their expectations for the information product and often their decision not to read a product. Although valid, this concern is not warranted when an organizational system is

applied properly. When executed properly, visual systems of organization serve the dual function of visually structuring the content while providing desirable novelty and complexity in the layout. Gibson and Levin indicate that readers prefer to view displays that break with similarity and offer a certain degree of complexity or novelty [39]. This complexity, however, must complement and signal the linguistic and rhetorical cues residing within the text. Burt provided the most useful principle on this matter, stating that "beauty depends on variety organized into unity" [40, p. 15] a principle, according to Burt, that dates to the followers of Pythagoras. Similarly, Tinker reported a high correlation between the legible document and readers' perception of aesthetic appeal [41]. Apparently, legibility and aesthetic appeal can be mutually compatible.

## OPERATING PRINCIPLES

Based on the above assumptions, four operating principles guide the design of visual systems of organization:

1. The organizational structure must be employed selectively.
2. The visual cues and formats employed must complement the inherent structure of the information.
3. The visual cues and formats must be employed consistently.
4. The complexity of the visual system of organization must be minimized systematically.

### Selective Employment

*The Organizational Structure Must Be Employed Selectively.*  
*The First Principle States:*

As indicated in the section on the structure of information, some information products are more appropriate cases for visual structuring than others. Texts with a clearly defined hierarchical structure or texts containing a variety of information components such as conceptual information, factual information, procedures, lists, and notations benefit most from visual systems of organization. Furthermore, the sophistication of the visual structure must complement the sophistication of the information being communicated.

In addition to complementing the structure of the body of knowledge, the visual structure must also be appropriate for the intended audience. The most significant determinants of appropriateness are compatibility with readers' cognitive style and their familiarity with the body of knowledge. While there is surely some overlap with cognitive style, individuals can be viewed as standing along a continuum from novice to expert in a given content area. The novice, on one hand, tends to benefit from structural devices while the expert might view this very same structure as a hindrance. In situations where both novices and experts exist within

a readership, Foster suggests that the text designer might appropriately favor the novice in the design of the information product. According to Foster "the cueing system which helps the novice will not necessarily obstruct the expert; it could still help him locate sections of the content and portray its structure" [9, p. 194]. One may certainly doubt whether the converse would be equally true. While it is not always possible to determine cognitive styles and knowledge level of a particular readership, most information products are designed for a given use and at a level of sophistication appropriate for a select audience. At the very least, sensitivity to the above factors increases the likelihood of designing a format maximally compatible with the greatest percentage of the readership or what many instructional designers term "averaging the strengths of the layout."

### Logical Ordering

*The Visual Cues and Formats Must Complement the Inherent Structure of the Information. The Second Principle States:*

The text designer must thoroughly understand the structure of the communicated information in order to designate a logical and objective assignment of cues and formats. The primary objective of the text designer is to create a visual hierarchy which distinguishes major concepts from subconcepts and one category of information from another. The structure of this hierarchy is portrayed by visually signaling important information while positioning this same information in prominent areas of the page. The assignment of cues and formats communicates the structure of information by exploiting the readers' hierarchy of visual significance and the significance attached to certain areas of the display. For example, high-level information should be cued with the largest type size and the darkest color. Furthermore, this same information should be positioned at the left-most margin and at the top-most area of the page. Remaining information should be assigned cues and positioned in accordance with its relative position in the information hierarchy.

Critical to the success of this system are the text designers. Their role, as members of an encoding team, is to structure, emphasize, and organize—not to impede the passage of information through carelessly applied design techniques and graphic embellishments. Working against the designer is the customary mode of text design. Because the orthographic code is essentially non-visual, visual systems of organizations are typically added after the composition process. Although the written code is the dominant feature in the text, I would suggest that composition and layout can and should be performed simultaneously. Moreover, the two functions can be mutually compatible and supportive of one another. Or as Hartley and Burnhill so aptly put it "clarity in layout leads to clarity in content because it requires clarity of thought" [42, pp. 237-238].

## Consistency

*Visual Cues and Formats Must Be Employed Consistently Throughout the Information Product. The Third Principle States:*

Once the visual cues and formats are established, the reader quickly becomes accustomed to and anticipates the visual hierarchy. According to Anderson and Ambruster, consistent presentation is critical to communicating structure to readers [43]. As previously stated, readers are sensitive to reoccurring themes and structural redundancy in sensory experiences. This sensitivity, in turn, serves as a foundation for processing and storing future information. Consistency also allows the reader to move more confidently through the text and to selectively access information when necessary. Furthermore, consistency forms the cornerstone for the Gestalt principles of similarity and proximity. Given the importance of consistency, style guides must be established before undertaking a design and text designers must painstakingly adhere to these guides throughout the design process.

## Complexity

*The Fourth Principle States: The Complexity of the Visual System Must Be Minimized Systematically.*

Visual systems of organization can be "over done" by creating hierarchies so complex that the reader directs greater attention to the system than to the information. Gibson and Levin warned that overly complex graphic systems interfere with the reader's goal of obtaining information [39]. According to Calfee any system that draws attention to itself "shunts" the automatic routine of reading [24]. The result, according to Calfee, is reduced reading speed, lower comprehension and a considerable increase in frustration.

Complexity, as discussed here, applies to the amount of visual redundancy in the system, the number of levels in the hierarchy and the amount of information cued. For example, the designer might cue a major headline by setting it in a different type style, weight, size, color, and spatial arrangement. Although the designer employs these strategies in an effort to communicate the information more effectively, the excessive redundancy imposed by these cues might actually reduce the effectiveness of the display. While determining the optimum level of redundancy, the text designer should accommodate the limitations imposed by the reader's short-term memory or what Kosslyn et al. terms the reader's "psychological maximum" [35]. Similarly, Hershberger et al. reported that when too many cues were combined, the reader is "befuddled sufficiently to offset any advantage derived from the cueing" [44, p. 59]. When the psychological maximum is reached, improvement in comprehension levels off briefly. Beyond the maximum, any additional increase in redundancy sharply reduces comprehension. In other words, there is a point of diminishing returns. The number of levels in the visual

hierarchy is first determined by the complexity of the communicated information. Next, the complexity of the structure is systematically minimized so not to tax the capacity of short-term memory. Consistent with Miller's concept of chunking, a limited number of levels are established, each with a more complex internal structure. The text designer must also limit the quantity of cued information. It is not necessary nor even desirable for all important information to be cued. Cues are most effective when used sparingly. In fact, excessive cueing produces a figure-ground reversal in which the uncued information becomes more apparent or at the very least the effectiveness of the cue is severely diminished.

Unfortunately, no one measure of complexity applies to all information products. Ultimately, the designer determines appropriate complexity based on the inherent structure of the information, the intended audience and the use of the information product.

## CUEING AND PAGE FORMATTING

To facilitate the user's search for structure and organization, visual cueing and formatting reinforces the linguistic and rhetorical cues residing in the orthographic code. Once established, the visual hierarchy facilitates both *local and global* communication of the information. Globally, the visual structure provides an overview of the content area and suggests and perhaps even encourages the most effective reading strategy. On a global level this structure continues and complements the structure initiated within the table of contents. Locally, the visual structure signals and emphasizes important units or individual items of information within the text—e.g., words, phrases and warnings. Visual cues continuously relay to the reader the status of any one particular piece of text within that document's hierarchy. Ultimately, cues assist readers in directing and allocating their attention while reading a text.

Previously this article introduced the concept of figure-ground. The effectiveness of visual cues and formats can only be viewed within the context of this concept. Ground is the background or *visual norm* against which the figure or visual cue operates. For example, the employment of boldface is only effective when contrasted against a field of lighter weight typefaces. By comparison, if boldface cues were to appear in a field of heavier weight typefaces, the effect would be severely diminished or lost altogether. In terms of typography, the ground is typically the typeface designated for the body copy or continuous text reading. Similarly, the concept of figure-ground holds true in the spatial formatting of text. Vertical formatting, for instance, is only effective when contrasted against the ground of the primary line spacing. In contrast, as the spatial unit separating subheads from body copy approaches that of the unit designated for the primary line spacing, the effectiveness of the cue is compromised. Consequently, for cues and formats to be visually salient, an adequate contrast must be maintained between the visual element and its background. To achieve this end, the reader's

visual processing system must be accommodated, and the visual cues must be employed sparingly to avoid a possible figure-ground reversal.

### Cueing

Duchastel indicates that textual cues assist readers in focussing on important items in the text while enabling readers to process the text selectively when necessary [45, p. 181]. In the specification of visual cues, the designer must accommodate four factors. First, the cues must be compatible with the reader's perception of perceived significance, i.e., size, value, texture, color, orientation, and shape. Second, while determining the optimum level of redundancy in the structural system, the information designer should not exceed the limitations imposed by the reader's short-term memory or the "psychological maximum." Third, text designers must remain conscious that cued material is comprehended more fully at the expense of the uncued material. Fourth, in designating visual cues, the text designer must accommodate the limitations imposed by the perceptual processing system. Cueing techniques include the use of different type sizes, type styles, upper versus lowercase printing, underlining, and the use of color.

### Type Size

In terms of visual significance, the use of different type sizes is one of the most effective techniques for organizing and signaling information. The effectiveness of the technique is directly related to the significance placed on size variation by the reader. The largest sizes are reserved for the most important information and smaller sizes are assigned according to the relative importance of the text in the information hierarchy.

To minimize the complexity of the visual hierarchy, avoid using too many different sizes. Although documents differ in organizational complexity, the assignment of one size for chapter or major heads, a smaller size for sub-heads, a slightly smaller size for body copy, and perhaps still smaller for captions and notations is usually adequate. Because the size of the body copy has the most significant effect on text legibility, first designate the optimal body size. Then, proceed vertically through the hierarchy assigning proportionally larger sizes at each level. The actual assignment of sizes should accommodate the visual processing system and maintain appropriate visual rhythm. Because the visual processing system has difficulty detecting minor differences in size, the actual separation of one level from the next must be two points (1/36") or greater. To establish a rhythmic progression, the size increase from one level to the next is typically made in accordance with an established ratio. This ratio may be as simple as doubling the difference in size from one level to the next; for example, 12 point body copy, 14 point subheads and 18 point major heads. Allow simplicity to be your guide in establishing this ratio.

### Type Styles

The use of different type styles to structure and signal information is a relatively simple yet effective technique. While designating type styles, it is often possible and even desirable to confine selections within a single type family. A family is a collection of type faces that maintains general design characteristics while providing variation through the manipulation of stroke weight, stress, and set width (e.g., Times Roman, Times Bold, Times Medium, Times Italic, Times Condensed). An ideal selection would be a family providing high legibility while offering an adequate selection of weights, set widths and italic variations.

The actual selection of typefaces as visual cues is guided by the reader's hierarchy of perceived significance and a desire to maintain optimal legibility. Because of their proven legibility, medium weight faces are generally ideal for body copy [46]. Once designated, the medium weight body copy serves as the ground against which the remaining selections are applied. Next, because of their darker value and superior contrast, heavier weight styles are an excellent selection for headlines and the cueing of important information. Styles of a lighter weight than the body copy are, by comparison, viewed less-important because of their lighter value and diminished contrast. The use of lighter weight styles should be consistent with this effect. The italic variation is traditionally employed to emphasize words within the text because of the contrast they offer to the remaining body copy. Although the italic variation offers visual contrast, its use should be restricted to small quantities of text because of its lower legibility and readers' general dissatisfaction with the visual appearance of the style [46]. On the other hand, boldface styles score higher on both legibility and reader preference tests when compared to italics. When faced with a choice, boldface is typically the most appropriate selection. And finally, because of their narrow set-width, condensed styles are best suited for captions and notations.

Confining selections to a single type family preserves consistency and harmony within the document while providing adequate variation to organize the information. Additionally, by minimizing the pale-grey appearance of a document set in a single style, the variation provided by the family satisfies the reader's desire for complexity and novelty within a layout. Furthermore, the family fulfills this requirement without creating an overly complex layout. The introduction of too many type styles increases the visual complexity of the document resulting in reader uncertainty and confusion. Consequently, the reader's desire for novelty must be carefully balanced against appropriate complexity and maximum legibility.

### Upper Case

The use of all upper case letters (capitals) is widely accepted as means of signalling important text. Because upper case printing occupies 27-35 percent more space than lowercase printing, this format is ideally suited for signalling

high-level information. However, caution must be exercised while employing this format because of its lower legibility. Tinker indicates the use of uppercase printing retards reading speed by as much as 12 percent and that readers prefer the visual appearance of the lower case format [41]. The use of uppercase printing, therefore, should be reserved for small quantities of text such as that found in major headlines.

### Underlining

Similar to that of uppercase printing, the underlining of text is also widely accepted as a means of signalling important text. However, unlike uppercase printing, most legibility experts advocate the elimination of underlining as a signalling device. The use of underlining makes the signaled text harder, not easier, to read by decreasing the amount of white space between lines and by disrupting the characteristic word shapes of the underlined text. The current popularity of the underlining technique is more than likely a holdover from the days of typewriters when alternative cueing techniques were unavailable. Because superior cueing techniques are available with current technology, the use of underlining should be restricted in visual systems of organization.

### Color

When budget allows and the situation is appropriate, color is an effective cueing option. Colors are useful for distinguishing headlines from body copy or in highlight warnings and areas of extreme importance. Text designers, however, must be cautious in their use of color. Because color is lower in Berlin's hierarchy of perceived significance and due to the prevalence of chromatic anomalies in readers, the use of color independent of other visual cues is not recommended. The one exception to this restriction on the use of color is for search related tasks. The findings of Kanarick and Peterson [47] and Saenz and Riche [48] identified color as the superior cueing device in products where the reader is regularly engaged in search strategies.

At the most basic level, colors are selected to achieve maximum contrast between type color and background, with the type being the darker of the two. Quite simply, maximum contrast yields maximum legibility. The highest possible contrast is achieved in the printing of black ink on white paper. When combinations other than black and white are selected, select the darkest possible color on the lightest background.

At a considerably higher level of analysis, the limitations of the perceptual processing system must be addressed and accommodated in the use of color. Marcus estimates that in the United States and Europe, approximately 8 percent of the population is color-blind [37]. Naturally, information products organized with color cues are significantly more error-prone for color-blind readers unless the color-cued information is reinforced by another visual element. In addition, when different shades of a single color are used to categorize information, the variations

must be adequate to distinguish one category from the next. Because the reader's ability to detect differences in color, measured in hue, is not uniform for equal changes along the visible light spectrum, the adequacy of specific variations must be evaluated on a color-by-color basis. Sensitivity to hue difference is greatest in the yellow region and least sensitive at either extreme in the violet, red and green regions.

By designating and employing appropriate visual cues, a structural hierarchy begins to form. This hierarchy will be further developed through the careful employment of spatial formatting techniques.

### Spatial Formatting

The spatial formatting of text is extremely effective in communicating the structural hierarchy of information. The consistent and logical allocation of vertical and horizontal white space creates a visual hierarchy separating major headlines from subheads, subheads from body copy, and one paragraph from the next. The designation of vertical and horizontal cues is guided by three factors. First, horizontal positioning should accommodate and exploit the significance the reader places on the left-most portion of the page. Second, vertical cues should accommodate and exploit the Gestalt principle of proximity. And lastly, the employment of spatial formatting must complement the structure previously established by the designation of visual cues.

### Horizontal Formatting

As previously cited, the reader assigns the greatest importance to the left-most portion of any visual display. To exploit this tendency, the text designer structures information through a series of nested units indented from the left hand margin. The area in proximity to the left-most margin is reserved for the most important information or high-level information. Headlines, important warnings, and graphics may be assigned a position of visual importance through isolation in the left-most portion of the page. As subsequent sections are indented from the left-most margin, they become, by reason of their placement, less important or lower in the information hierarchy. The optimal unit of measure used to designate the indent as well as the number of indents is a balance struck between the complexity of the information, the desire to maintain optimum line measures, the width of a page, and desire to achieve a horizontal separation easily distinguished by the eye.

### Vertical Formatting

In the formulation of the vertical hierarchy, a proportional system of spacing distinguishes one section from another, major headlines from subheads, subheads from body copy, and one paragraph from the next. In keeping with the Gestalt principle of proximity and the notion that the visual processing system is a

difference detector, the largest spatial unit is employed between conceptual units with the greatest difference while the smallest unit is reserved for closely related information. For example, the largest amount of space should separate sections or chapters while the smallest spatial unit separates lines in a paragraph. Because spacing between lines in a paragraph has the greatest effect on text legibility, optimum spacing is first allocated here and then increased proportionally and sequentially up the hierarchy to the largest conceptual separation. The ratios employed to distinguish levels of the hierarchy can be as simple as doubling each unit while ascending each level of the hierarchy. For example, two points of leading allocated between lines of type in the body, four points between paragraphs, eight points between subhead and body copy, and sixteen points between subhead and major headlines.

In addition to structuring the information, the variation offered by the manipulation of vertical and horizontal space reduces the visual monotony of the display. As cited earlier, readers are naturally attracted to displays offering novelty and certain degree of complexity. Rather than providing this novelty in a haphazard fashion, the proposed system produces the multiple benefits of organization and variation or in the words of Burt "variety organized into unity."

The employment of vertical and horizontal formatting complements and reinforces the previous assignment of visual cues and completes the visual system of organization.

## Conclusion

This article proposes a system of document organization based on cueing and page formatting techniques. The logical use of cueing and formatting creates a visual hierarchy organizing and signalling the information for readers. Together, cueing and formatting techniques reinforce and complement one another to form a visually redundant system. Ultimately, the cumulative effect of this visual system reinforces the inherent structure of the information as communicated through the orthographic code. The success of this system is dependent on the identification of optimum cues and formats as well as the determination of the optimum level of visual redundancy. When these techniques are properly applied the result is a well organized, legible, and visually pleasing document.

## REFERENCES

1. P. Kolers, *The Processing of Visible Language*, P. Kolers, M. Wrolstad, and H. Bouma (eds.), Plenum, New York, 1979.
2. A. North and L. B. Jenkins, Reading Speed and Comprehension as a Function of Typography, *Journal of Applied Psychology*, 35, pp. 225-228, 1951.

3. G. Klare, J. Mabry, and L. Gustafson, The Relationship of Patterning (Underlining) to Immediate Retention and to Acceptability of Technical Material, *The Journal of Applied Psychology*, 39, pp. 40-42, 1955.
4. J. Crouse and P. Idstein, Effects of Encoding Cues On Prose Learning, *Journal of Educational Psychology*, 63, pp. 309-313, 1972.
5. R. Fowler and A. Barker, Effectiveness of Highlighting for Retention of Text Material, *Journal of Applied Psychology*, 59, pp. 358-364, 1974.
6. P. Coles and J. Foster, Typographic Cueing as an Aid to Learning from Typewritten Text, *Programmed Learning and Educational Technology*, 12, pp. 102-108, 1975.
7. J. Foster and P. Coles, An Experimental Study of Typographic Cueing in Printed Text, *Ergonomics*, 20:1, pp. 57-66, 1977.
8. S. Glynn, Capturing Reader's Attention by Means of Typographical Cueing Strategies, *Educational Technology*, 18:11, pp. 71-12, 1978.
9. J. Foster, The Use of Visual Cues in Text, *The Processing of Visible Language*, P. Kolers, M. Wrolstad, and H. Bouma (eds.), Plenum, New York, 1979.
10. L. Frase and B. Schwartz, Typographical Cues that Facilitate Comprehension, *Journal of Educational Psychology*, 71:2, pp. 197-206, 1979.
11. W. Crowell, Typography: A Technique of Making a Text Legible, *The Processing of Visible Language*, P. Kolers, M. Wrolstad, and H. Bouma (eds.), Plenum, New York, 1979.
12. J. Hartley, M. Trueman, and P. Burnhill, The Role of Spatial Cues in the Layout of Journal References, *Applied Ergonomics*, 10:3, pp. 165-169, 1979.
13. R. Waller, Typographic Access Structures for Educational Texts, *Processing of Visible Language*, P. Koler, M. Wrolstad, and H. Bouma (eds.), Plenum, New York, pp. 175-186, 1979.
14. R. Waller, Graphic Aspects of Complex Tests: Typography as Macropunctuation, *Processing of Visible Language*, P. Koler, M. Wrolstad, and H. Bouma (eds.), Plenum, New York, pp. 241-253, 1980.
15. J. Hartley, Spatial Cues in Text, *Visible Language*, 14, pp. 62-79, 1980.
16. R. Waller, Using Typography to Structure Argument: A Critical Analysis of Some Examples, *The Technology of Text*, 2, D. Jonassen (ed.), Educational Technology Publications, Inc., Englewood Cliffs, New Jersey, pp. 105-125, 1985.
17. S. Glynn, B. Britton and M. Tillman, Typographical Cues in Text: Management of the Reader's Attention, *The Technology of Text*, 2, D. Jonassen (ed.), Educational Technology Publications, Inc., Englewood Cliffs, New Jersey, pp. 192-209, 1985.
18. P. Hawwk, N. McLeod and D. Jonassen, Graphic Organizers in Texts, Courseware, and Supplemental Materials, *The Technology of Text*, 2, D. Jonassen (ed.), Educational Technology Publications, Inc., Englewood Cliffs, New Jersey, pp. 158-185, 1985.
19. P. Burnhill and J. Hartley, Psychology and Textbook Design: A Research Critique, *Aspects of Educational Technology*, J. Baggaley, H. Jamieson, and H. Marchant (eds.), Pitman, New York, pp. 65-79, 1975.
20. M. Macdonald-Ross and R. Waller, Criticism, Alternative and Tests: A Conceptual Framework for Improving Typography, *Programmed Learning and Educational Technology*, 12:2, pp. 75-83, 1975.

21. P. Wright, Feeding the Information Eaters: Suggestions for Integrating Pure and Applied Research on Language Comprehension, *Instructional Science*, 7, pp. 249-312, 1978.
22. A. Ambaradar, Reading Efficiency: Analysis of Techniques for Adult Readers, *Reading Improvement*, 21:1, pp. 21-27, 1984.
23. M. Just and P. Carpenter, *The Psychology of Reading and Language Comprehension*, Allyn and Bacon, Inc., Boston, 1987.
24. R. Calfee, Cognitive Psychology and Educational Practice, *Review of Research in Education*, FE Peacock Publishers, Iasca, Illinois, 1981.
25. R. Gagne, *The Conditions of Learning* (3rd Edition), Holt, Rinehart and Winston, New York, 1977.
26. A. K. Pugh, *Silent Reading*, Heinemann, London, 1978.
27. W. Diehl and L. Mikulecky, Making Written Information Fit Workers Purposes, *IEEE Transactions on Professional Communication*, PC 24:1, pp. 5-9, 1981.
28. T. Huckin, A Cognitive Approach to Readability, *New Essays in Technical and Scientific Communication: Research, Theory and Practice*, P. Anderson, J. Brockman, and C. Miller (eds.), Baywood Publishing Company, Amityville, New York, pp. 90-108, 1983.
29. M. Samuels, Technical Reading Processes and Collaborative Learning: New Approaches to Structuring Readable Texts, *Technical Communication*, First Quarter, pp. 10-15, 1988.
30. E. C. Poulton, Searching for Newspaper Headlines Printed in Capitals or Lower-case Letters, *Journal of Applied Psychology*, 51:5, pp. 417-425, 1967.
31. H. Spencer, L. Reynolds, and B. Coe, *A Comparison of the Effectiveness of Selected Typographic Variations*, Readability of Print Research Unit, Royal College of Art, London, 1973.
32. D. Ausubel, J. Novak, and H. Hanesian, *Educational Psychology: A Cognitive View*, Holt, Rinehart and Winston, New York, 1978.
33. R. Anderson, Schema-Directed Processes in Language Comprehension, *The Psychology of Written Communication: Selected Readings*, J. Hartley (ed.), Kogan Page, New York, 1980.
34. J. Bertin, *Semiology of Graphics*, W. Berg (trans.), The University of Wisconsin Press, Madison, 1983.
35. S. Kosslyn, S. Pinker, W. Simcox, and L. Parkin, *Understanding Charts and Graphs: A Project in Applied Cognitive Science*, Washington, D.C., 1983.
36. D. Dondis, *A Primer of Visual Literacy*, The MIT Press, Cambridge, Massachusetts, 1973.
37. A. Marcus, Tutorial on use of Color to Improve Instruction, *Computer Graphics Today*, May, pp. 11-12, 48-49, 1986.
38. G. Miller, The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information, *Psychological Review*, 3:2, pp. 81-97, 1956.
39. E. Gibson and H. Levin, *The Psychology of Reading*, The MIT Press, Cambridge, Massachusetts, 1975.
40. C. Burt, *A Psychological Study of Typography*, The University Press, Cambridge, England, 1959.
41. M. Tinker, *Legibility of Print*, Iowa State University Press, Ames, 1963.

42. J. Hartley and B. Burnhill, Understanding Text: Typography, Layout and Design, in *Adult Learning: Psychological Research and Applications*, M. Howe (ed.), John Wiley and Sons, New York, 1977.
43. T. Anderson and B. Armbruster, Studying Strategies and Their Implications for Textbook Design, in *Designing Usable Texts*, T. Duffy and R. Waller (eds.), Academic Press, New York, pp. 159-177, 1985.
44. W. A. Hersberger and D. F. Terry, Typographical Cueing in Conventional and Programmed Texts, *Journal of Applied Psychology*, 40, pp. 55-60, 1965.
45. P. C. Duchastel, Textual Display Techniques, *The Technology of Text*, Vol. 1, D. Jonassen (ed.), Educational Technology Publications, Inc., Englewood Cliffs, New Jersey, pp. 167-19, 1982.
46. R. Rehe, *Typography: How to Make It Most Legible*, Design Research International, Carmel, Indiana, 1974.
47. N. Saenz and C. Riche, Shape and Color Dimensions of a Visual Redundant Code, *Human Factors*, 16:3, pp. 308-313, 1974.
48. A. Kanarick and R. Peterson, Redundant Color Coding and Keeping Track Performance, *Human Factors*, 13:2, pp. 183-188, 1971.

#### Other Articles On Communication By This Author

- Gribbons, W. M., Visual Literacy in Corporate Communication: Some Implications for Information Design, *IEEE Transactions on Professional Communication* 34:1, 42-50, 1991.
- Gribbons, W. M., Electronic Publishing: Issues for the Technical Publication Manager, *Technical Communication*, 4:1, pp. 300-304, 1988.

Direct reprint requests to:

Professor William M. Gribbons  
Bentley College  
Forest Street  
Waltham, MA 02254