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DESIGNING INSTRUCTIONAL AND INFORMATIONAL TEXT

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34.1 INTRODUCTION

This chapter is divided into eight sections as follows.

1. Introduction
2. Typographical Considerations in the Design of Text
3. Navigating Text: Structure and Access
4. Making Text Easier to Understand
5. Measuring the Difficulty of Text
6. Designing Text for Readers with Special Needs
7. Using Textbooks
8. Future Directions

My aim in each section is to present a particular argument, supported by references to empirical research. In addition, I hope that these references will allow interested readers to follow up the issues raised more widely, should they wish. Regrettably I have decided that there is no one clear theoretical perspective that I could take in writing this chapter so, accordingly, none is offered. However, references to particular paradigms in text design are made where it seems appropriate. One important aspect of instructional and informational text design omitted in this chapter is that of the design and positioning of elements such as tables, diagrams, graphs, and figures. These issues are discussed in other chapters.

34.2 TYPOGRAPHICAL CONSIDERATIONS IN THE DESIGN OF TEXT

34.2.1 Page Sizes

Printed materials come in many shapes and sizes. There are no specific rules or guidelines that might suggest to writers, designers, or printers why they should choose one particular page size in preference to any other. The research literature on legibility, textbook, and informational design offers little help, for page size is not an issue that features in many books on this topic. Why, then, do I choose to start this chapter by discussing page sizes?

Many people expect a chapter such as this to begin with issues such as type sizes, typefaces, and line lengths. However, it is important to realize that the choices for these variables are already constrained by earlier decisions. Clearly we do not expect to find large type sizes in a pocket dictionary or a single column of print in a daily newspaper. These examples are extreme, but they illustrate the point. The choice of page size comes first, and this affects the choices that are available for subsequent decisions.

The size of the page (and these days, the electronic screen) determines the size of the overall visual display. The reader needs to be able to scan, read, and focus on both the gross and the fine details of this display. The size of the page (or screen) constrains the decisions that writers and designers make about these details.

The choice of an appropriate page size for printed text is not always easy. A number of factors contribute to decisions about which size to employ. Perhaps the most important one is knowledge of how the information is going to be used. Others are reader preferences, the costs of production and marketing, basic paper sheet sizes, and, more generally, the need to conserve resources and avoid waste (Hartley, 1994a; Spencer, 1969).

34.2.2 Standard Page Sizes

The page sizes that we commonly see for printed text are cut from much larger basic sheets that have been folded several

TABLE 34.1. The ISO A Series of Trimmed Paper Sizes

Designation	Size (mm)
A0	841 × 1,189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297
A5	148 × 210
A6	105 × 148
A7	74 × 105
A8	52 × 74
A9	37 × 52
A10	26 × 37

times. The present-day variety in page sizes results from the manufacturers using different sizes for their basic printing sheets and folding them in different ways. If the basic printing sheets were all one standard size, however, and if the method of folding them allowed for little if any wastage at the cutting stage, then great economies could be achieved.

The need to rationalize paper sizes has long been discussed in the history of information printing. In 1798, for example, the French government prescribed a standard for official documents based on the proportion of width:height 1:1.41, with a basic printing sheet $1m^2$ in area. In 1911, Wilhelm Oswald proposed the ratio 1:1.414 (that is, 1: $\sqrt{2}$) as the "world format." In 1922 the German standard, DIN 476, was published. For this standard the ratio of width:height 1: $\sqrt{2}$ was retained, with a basic printing sheet size of $1m^2$. This German standard, together with the A, B, and C series of sizes, was adopted in 1958 by the International Standards Organization (ISO). Today the ISO series is recommended by the 50 or more national standards bodies that together make up the ISO.

The dimensions of the sizes in the ISO A series are set out in Table 34.1. In the United Kingdom the A series is used widely, especially the A4 and A5 sizes. The unifying principle of the ISO-recommended range of sizes is that a rectangle with sides at a 1:$\sqrt{2}$ can be halved or doubled to produce a series of rectangles, each of which retains the proportions of the original. A rectangle of any other proportion will generate geometrically similar rectangles only at every other point in the process of halving or doubling (see Fig. 34.1).

As the pages of a book are made by folding the larger basic printing sheet in half—once, twice, three times, or more—all the pages made from a standard-size basic sheet will be at the ratio 1:$\sqrt{2}$. Basic sheets that do not conform to this standard do not exhibit this property of geometric similarity when folded, and this creates waste.

We may note at this point, of course, that a page can be bound in a vertical (*portrait*) or a horizontal (*landscape*) style. Pages can be also bound at the top (as in a notebook) as well as on the left. These variations allow for a variety of page layouts (see Fig. 34.2). Curiously enough, there is almost no research comparing the effects of setting the same texts in portrait or landscape style (Hartley & Johnson, 2000).

It is considerations such as these that come first when designing instructional and informational text. Once these decisions have been made (but not necessarily finalized) the designer can begin to think more about the details of the typography. The next step is to consider the number of columns of print required, their widths, and that of the margins.

34.2.3 Margins

In many books, the margins appear to be planned like a picture frame around a rectangle of print. Tinker (1965) reported that the space devoted to margins in this way could sometimes occupy as much as 50% of the page. However, if we take a functional approach rather than an aesthetic one, it seems to be fairly well agreed that a margin of about 10 mm is necessary at the top and the bottom of the page. But the inner, or binding-edge, margin is a special case. Here thought needs to be given to factors that suggest the need for a wider margin. For example, the printed page may be copied at some time, and the copies punched or clipped for filing with other material. The binding system itself may involve the punching of pages, or it may be of the kind that causes some part of the edge of the page to be hidden from view. Indeed, the binding system may be such that text or diagrams printed too close to the binding edge may curve inward and be difficult to read (or to copy). So, because text appears on both the front and the back of the page, a margin of about 25 mm is usually necessary for both the left- and the right-hand margins.

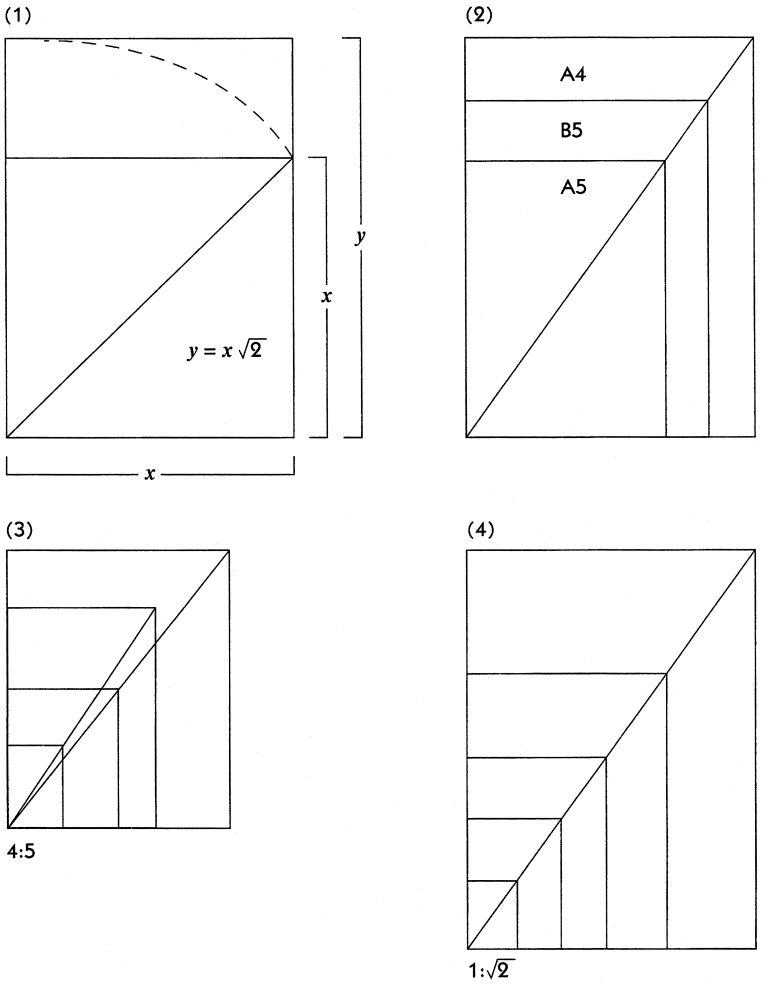
34.2.4 Column Widths

The choice of column widths also depends on the size of the page, the widths of the margins, and the nature of the text. For printed text it is normal to consider one, two, or even three columns of print (depending on the page size and its orientation). A decision to use three columns of print may be appropriate for text that is not very complex (typographically speaking), especially in a landscape format. Other variations, such as one wide column and one narrow one, are possible with larger (portrait) page sizes, and it is useful to consider this when planning the size and positioning of illustrative materials (see Hartley, 1994a, and Misanchuk, 1992, for a fuller discussion).

34.2.5 Type Sizes

Several researchers have made suggestions concerning the appropriate type sizes for reading matter and have given advice on related issues such as line length and line spacing. Tinker (1963, 1965) and Watts and Nisbet (1974) provide good summaries of the earlier literature in this respect, and Black (1990) and Schriver (1997) provide more up to date accounts.

Unfortunately much of the early research on type sizes was not very helpful to designers of instructional or informational text. This was principally because the variables such as type size, line length, and interline space were not studied in the "real-life"



1. This diagram illustrates the principle of construction and shows that the ratio of the sides of the rectangle is the same as that of the side of a square to its diagonal.
2. This illustrates the fit between the A and the B series of sizes. For example, B5 falls between A5 and A4 and is geometrically similar.
3. A rectangle of nonstandard proportions. Note that the process of halving generates two geometrically dissimilar series of rectangles.
4. A rectangle of standard proportions. This case is unique in that halving generates geometrically similar rectangles at each point in the series.

FIGURE 34.1. The principles underlying the recommended page sizes of the International Standards Organization.

context of instructional materials. Most early researchers, for example, considered issues of type size with short, simple settings of continuous prose (e.g., see Paterson & Tinker, 1929). Furthermore, the generalizations that emerged from this research did not take into account the difficulties that arose from the fact that different typefaces with the same designated type sizes do not, in fact, look the same.

There are many different measurement systems used in the printing industry but, with the advent of computer-aided printing, these will undoubtedly be rationalized. One measure that still seems to remain for some reason, however, is the *point*. (A point measures 0.0138 inc.) Typical type sizes in textbooks are 10, 11, and 12 point. The "small print" (in legal documents, for example) may be 6 or 8 point, but this is too small for most people to read with ease. Larger sizes (such as 14, 18, and 24 point) are used for headings and display purposes. The typographic setting of a text is often described, for example, as "10-on-12" point. This indicates that there is an extra space of 2 points between the lines of print to facilitate reading.

However, as noted above, a confusing aspect of past research in this field has been the tendency to recommend the use of specific type sizes without proper regard for the fact that the specified size of a particular typeface (say 12 point) does not actually refer to the size of the image of the printed characters as seen by the reader. The specified size refers instead to the original depth of space that was required by a line of metal type when it was set with minimum line-to-line spacing. Letters were originally carved on the top of the metal shanks that took up this space. Consequently, the size and style of the letters on the top of the shank could vary, although the measure of the particular shank remained the same.

Figure 34.3, for instance, shows the same sentence printed in one size of type but in five different typefaces. As can be seen, at best, type size is but a first approximation to image size. The effect is more dramatic when

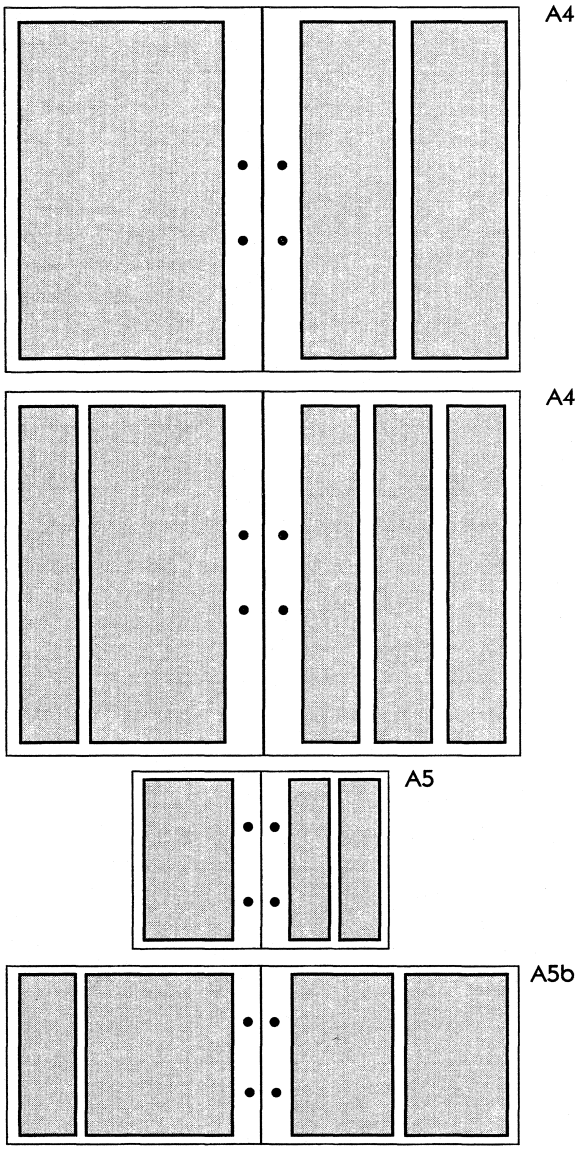


FIGURE 34.2. How a standard-size sheet can be arranged to provide a variety of page layouts.

whole paragraphs, rather than single sentences, are considered. This particular paragraph is printed in 12-point Arial. The following paragraph is printed in 12-point Bookman to illustrate the point.

So it is not my intention here to recommend specific type sizes for use in printing instructional materials. However, I would like to outline one approach to the problem of choosing a type size for a text. At root, this concerns choosing the maximum permissible line length that, when related to the type size, will not obstruct the proper and sensible phrasing of the information.

This is 12-point Times Roman

This is 12-point Palatino

This is 12-point Helvetica

This is 12-point Century Schoolbook

This is 12-point Bookman

FIGURE 34.3. How different typefaces with the same designated type size actually differ in size.

Designers need to examine their text carefully to look for problems that can arise if they choose too large a typeface. For example, in children's reading books, the maximum permissible line length is often limited by the use of large type sizes to being only three or four words long. In this case, it is often difficult to group syntactically the words in the lines. Indeed, some children think that sentences are completed at the end of each line (Raban, 1982). Thus, as shown in the preceding Bookman paragraph, one of the primary dimensions to be considered when thinking about type sizes is the width of the character groups and syntactically structured word strings, and not just the vertical dimension of the characters.

34.2.6 Typefaces

One particular source of confusion for novice designers is how to choose an appropriate typeface from the bewildering range of typefaces currently available. For example, one encyclopedia of typefaces published in 1930 listed over 2,350 entries. Today there must be several thousands of typefaces available, and designers are frequently encouraged to create their own. So how does one decide?

In practice, as Black (1990) points out, choosing a typeface really means

1. considering the purpose of the text,
2. making sure that the chosen sizes and weights required for the text (e.g., light, medium, bold) are available,
3. making sure that the character set contains not only the commonly used signs but also any additional special characters called for by the text (e.g., mathematical symbols), and
4. considering how well particular typefaces will withstand repeated copying.

Certain typefaces seem more appropriate in some situations than others. Neither Gothic nor Balloon, for example, would seem very helpful for instructional text, although they may be appropriate for party invitations. Typefaces thus have emotional connotations (see Lewis & Walker, 1989; Tannenbaum,

Jacobson, & Norris, 1964). Spencer (1969) provides a review of earlier studies in this respect. Furthermore, some readers have personal preferences (see Misanchuk, 1992). These individual differences suggest that it may be wiser to stick to conventional and familiar typefaces than it is to employ idiosyncratic ones. Black (1990) and Schriver (1997) provide useful full-length treatments of these issues.

One way of classifying familiar typefaces is in terms of those that have serifs (finishing strokes at the ends of letters) and those that do not (sans serifs). For example, this paragraph is printed in a serif typeface. The following paragraph is printed in a sans serif face, to illustrate the effects.

The available research gives no clear guidance on which typefaces are best. Some designers recommend that faces with serifs be used for the body of the text and that faces without serifs be used for headings or for other purposes (such as to differentiate examples from the body of the text). Others consider that typefaces without serifs are more legible in the smaller sizes (e.g., 6 and 8 point) and go on to argue that such sans serif typefaces are better for text that is not intended for continuous reading (e.g., reference works, tables, catalogs). Others indeed suggest that sans serif faces are more appropriate for older readers (see below).

Berger (1991), Misanchuk (1992), and Schriver (1997) review the relevant literature in this field. They conclude that one has to make decisions here that are based on good practice and common sense. I would add, too, that there are so many typefaces within each group (serif or sans serif) that it makes little sense to generalize in terms of comparing faces with serifs with those without them. It is better to consider how different typefaces compare and to specify which ones are being discussed.

34.2.7 Capital Letters

Words printed in capital letters contain less distinctive information per unit of space than do words set in lowercase characters of the same type size (Tinker, 1965; Tinker & Paterson, 1928).

THUS IT IS GENERALLY BELIEVED THAT WHOLE PARAGRAPHS OF TEXT SET IN CAPITAL LETTERS ARE MORE DIFFICULT TO READ THAN ARE PARAGRAPHS SET IN NORMAL UPPER- AND LOWERCASE LETTERS. THE USE OF STRINGS OF WORDS IN CAPITALS FOR MAIN HEADINGS (OR SMALL CAPITALS FOR SECONDARY HEADINGS) MAY BE SATISFACTORY BECAUSE SUCH HEADINGS ARE NORMALLY SURROUNDED BY SPACE, WHICH AIDS THEIR PERCEPTION. ON THE WHOLE, THOUGH, THE USE OF CAPITAL LETTERS SHOULD BE KEPT TO A MINIMUM. APART FROM SPECIALIZED USE IN MATHEMATICAL WORK, CAPITAL LETTERS ARE BEST RESERVED FOR THE FIRST LETTER OF A SENTENCE (INCLUDING HEADINGS) AND FOR THE FIRST LETTER OF PROPER NOUNS.

34.2.8 Italicized Letters

Sloping or italic *characters were originally introduced into printed books in the sixteenth century. With italics you could have more characters to the line, the style of letters being more compressed than the vertically drawn and rounded forms of the normal lowercase character set. Again, it is commonly believed that continuous italic text is harder to read than the more conventional typographic settings. (See Misanchuk, 1992, and Schriver, 1997, for further discussion.) Today, italicized characters are often used in instructional text for emphasizing words, for book titles when these appear in the text or in bibliographic references, and sometimes for setting summaries or abstracts.*

34.2.9 Color

Color can be used in textbooks in many ways. Sometimes, for example, colored headings are used simply to make the text more appealing. In other situations subtexts may be set in a different color to differentiate them from the main content.

There is a considerable amount of research on the effectiveness of color in printed instructional text (see Dwyer, 1978; Keys, 1993; Tinker, 1965) and this is an issue that is also prominent in current work with multimedia. As it happens there appear to be few clear generalizations that one can make but it does seem that

- readers have color preferences;
- readers like additional color; and
- color can help learning (see Dwyer, 1978); but
- extra colors have to be used sparingly and consistently if they are not to confuse the readers;
- some colors stand out more than others, so it is unhelpful to use a range of colors on the same page;
- certain combinations of colored inks on colored papers are more legible than others—thus, for example, black ink on white or yellow paper is generally preferable to red ink on these colors, and black ink on dark red or purple paper is generally to be avoided (see Dwyer, 1978, and Keys, 1993, for further details); and
- certain colors and combinations of colors do not copy well in black and white (so details may get lost when black and white copies are made). (This consideration also applies to screens when some readers only have black-and-white visual display units.)

It must be remembered, of course, that young readers cannot be expected to know automatically why any change from the traditional norm has taken place. This particularly applies to the printing of individual words in bold, capitals, italics, or color. Early readers need to be taught these conventions. And, in addition, we need to remember that all of these devices need to be used sparingly—as they can lose their significance when they are used in combination or to excess (see, e.g., Foster, 1979; Hershberger & Terry, 1965; Murphy, Duffy, & Goodrum, Welsh, 1993).

Finally, we should also note in this section that it is not wise to present readers with text that continually changes its size, its

spacing, and its typefaces. A brief rule of thumb might be that there is no need to use three or more additional cues when one or two will do.

34.2.10 Spacing the Text

One of the main arguments in this chapter is that the way in which the designer uses the space on the page greatly affects how easily the reader can understand and retrieve the information from it. Although the text is important—one cannot do without it—I argue that the clarity of the text can be enhanced by a rational and consistent use of the "white space" (Hartley, 1994a).

But first a bit more history. Most people today know what a textbook looks like and how it is arranged. But, as Small (1997) points out, books began originally as vertical rolls. The concept of a page did not exist, and there were no page breaks or page numbers. Furthermore, in Classical Greek times, there were no breaks between words, sentences, or even paragraphs. (The paragraph as a unit of text on the page did not appear until the sixteenth century.) Cross-references were very vague, like "see above" and "see below." The letters forming the words were of the same height and, often, of the same width. Line lengths were equal, and words were split at the ends of lines without hyphenation. Figure 34.4 simulates what such text used to look like. It is clear to our modern eyes that punctuation and spacing, together with upper- and-lowercase letters, make text easier to read.

Space thus plays an important role in clarifying text. It is space that separates letters from each other. It is space that separates words from each other. It is space (with punctuation) that separates phrases, clauses, and paragraphs from each other; and it is space (with headings and subheadings) that separates subsections and chapters from one another.

There is some evidence from eye-movement research that shows that these spatial cues are important aids to understanding text (Rayner, Kambe, & Duffy, 2000). It is argued, for instance, that with increasing maturity and experience, readers come to rely more heavily on such spatial cues to enhance their reading and search efficiency (e.g., see Fisher, 1976). It has been found that the beginning of a line—and not its end—has a more marked effect on eye-movement fixations and that text that starts in an irregular manner, such as poetry, produces more regressive fixations (look backs) than does regularly spaced text (Carpenter & Just, 1977).

BOOKXXXIVCONTENTSCOPPERMETALKINDSOFCOPPERC
ORINTHIANDELIANAEGINETANONBRONZEDININGCOUC
HESONCANDELABRAONTEMPLEDECORATIONSOFBRON
ZEFIRSTBRONZEIMAGEOFAGODMADEATROMEONTHEO
RIGINALSTATUTESA

Book XXXIV. Contents: Copper metal. Kinds of copper: Corinthian, Delian, Aeginetan. On bronze dining couches; on candelabra; on temple decorations of bronze; first bronze. . . .

FIGURE 34.4. The top illustration shows schematically the original way of presenting Classical Greek text. The bottom illustration shows the conventional way of presenting text today. Note that the original text would also have been in handwriting, which would have made it even more difficult to read. (Figure based on illustrations from Small, 1998, and reproduced with permission.)

In this chapter I maintain that consistent spacing helps readers to

1. see redundancies in the text and thus to read faster,
2. see more easily which bits of the text are personally relevant for them,
3. see the structure of the document as a whole, and
4. grasp its organization.

34.2.10.1 Vertical Spacing. The spacing of a page can be considered from both a vertical and a horizontal point of view. Let us consider vertical spacing first. The argument here is that the underlying structure of complex text can be made more apparent to the reader by the consistent and planned use of vertical spacing. In practice this means that predetermined increments of line space can be used consistently to separate out the components of the text—such as sentences, paragraphs, and sub- and major headings.

One simple way of using line space in this way is to use it in a proportional system. One can, for example, separate paragraphs by one line space, separate subheadings from paragraphs by two extra lines above and one below them, and separate main headings from text by four extra lines above and two below them. With more complex text one can even start each sentence on a new line within each paragraph.

What is the effect of such an approach? Figure 34.5a shows a traditionally spaced piece of text, and Figure 34.5b shows a revised version using the system described above. Such a proportional system is an effective way of determining that the amount of space between the component parts of a piece of text is consistent throughout the work. Other systems (not proportional but equally consistent) can be used. Indeed, for even more complex text one might wish to introduce indentation into the text to convey further substructure.

Research has shown that readers usually prefer lengthy paragraphs to be set in a more open manner (e.g., see Hartley, Trueman, & Burnhill, 1980). Readers thus generally prefer text set in the style of Fig. 34.5b to that of Fig. 34.5a. Finally, in this section on vertical spacing, we should note that if the vertical spacing between the components of the text is to be consistent throughout the text, this leads to the idea that the text will have a "floating baseline." This means that, in contrast to most textbooks, the text does not stop at the same place on every page, irrespective of its content. With a floating baseline the stopping point for each page is determined by the content and the structure of the text rather than by the need to fill the page.

As a rule of thumb we can say that each page of a printed text should have a specified number of lines plus or minus two. This flexibility allows the designer to avoid *widows* or *orphans*—where a page starts with the last line of a previous paragraph or ends with a heading or the first line of a new paragraph—without changing the underlying spacing of the

General

This section describes the care, maintenance, and inspection of insulating rubber blankets. This section is reissued to delete reference to the KS-13602 cleaner; this has been superseded by the B cleaning fluid (AT-8236).

Description

An insulating rubber blanket is made of flat, flexible sheets of black rubber. These sheets do not contain either beaded edges or eyelets. The blankets are approximately 36 inches square, 1/10 inch thick, and weigh approximately 7 pounds. The electrical, weather, and chemical resistance properties of the blanket are very good.

Rubber-stamped on each blanket is a "return for test" date. Blankets must be returned for testing by that date to the Western Electric Company or other authorized agent. The blankets should be returned in rolls (3 1/2 inches in diameter) and wrapped properly so as to avoid damage. A replacement blanket will be made available when a blanket is returned for testing.

FIGURE 34.5(a). A traditionally spaced piece of text.

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A replacement blanket will be made available when a blanket is returned for testing.

FIGURE 34.5(b). A revised version of Fig. 34.5a with a proportionally based spacing system.

text. In traditional settings the internal spacing is sometimes stretched or squeezed to force the text to finish at the same point on each page. Normally this has little effect in pages of continuous prose, but Hartley (1991a) provides an illustration of where such a policy can mislead the reader.

34.2.10.2 Horizontal Spacing. One can consider the horizontal spacing of text in much the same way that we have considered the vertical spacing. That is, we can also look to see how we can use the horizontal spacing to separate and to group components of the text and how we can vary the stopping point of horizontal text in accord with its content, rather than using arbitrary rules about line lengths.

In the printed edition of this book all the lines of text are set *justified*. This means that all of the lines within the columns were of equal width and that the columns have straight left- and right-hand edges. Such a procedure is quite typical in printed texts. The straight edges are achieved by varying the spacing between the words on each line and, occasionally, by hyphenating or breaking words at the ends of lines. Indeed, in text that has very narrow columns (e.g., in newspapers or advertising copy), the spaces between the letters forming the words are also often varied to force the text to fit a given length of line.

A different approach to setting the text is to provide a consistent space between each word. Such a procedure produces what is called *unjustified* text. Here there is the same amount of space between each word, and usually there are no word breaks (or hyphenation) at the ends of lines. Consequently the text has a ragged right-hand edge. This kind of text is more common in screen-based presentations.

There has been much debate over the relative merits of justified and unjustified text in printed text. Misanchuk (1992) and Muncer, Gorman, Gorman, and Bibel (1986) provide representative reviews, and Kinross (1994) provides an interesting historical footnote. It would appear that it does not matter much which setting is used as far as understanding conventional text is concerned: the decision concerning which format to use is largely a matter of choice. There is some evidence, however, that unjustified text might be more helpful for less able readers, be they younger children or older adults (see Hartley, 1999; Schriver, 1997).

Nonetheless, it is doubtful whether the studies reviewed by Misanchuk and by Muncer et al. fully considered all of the possible advantages of unjustified text. One clear advantage is that one does not have to fill up each line with text: we can consider (as with vertical spacing) where best to end each line. With unjustified text, for instance, it is possible to specify that no line should end with the first word of a new sentence or that, if the last word on a line is preceded by a punctuation mark, then this last word should be carried over to the next line. And, of course, it is possible to consider the starting points of each line too. Figure 34.6a shows a piece of justified text. Figure 34.6b shows what happens to this text when space is used to show its underlying structure. Research has shown that readers often recall more from text set in the manner shown in Fig. 34.6b than they do from text set in the manner of Fig. 34.6a (see Jandreau & Bever, 1992). And, curiously enough, when asked to write out their recalls of short texts set in these different formats, readers usually write them out in the formats in which they are presented (Hartley, 1993).

Now the sons of Jacob were twelve. The sons of Leah; Reuben, Jacob's firstborn, and Simeon, and Levi, and Judah, and Issachar, and Zebulun. The sons of Rachel; Joseph, and Benjamin: And the sons of Bilhah, Rachel's handmaid; Dan, and Naphtali. And the sons of Zilpah, Leah's handmaid; Gad, and Asher. These are the sons of Jacob, which were born to him in Padan-aram.

FIGURE 34.6(a). A piece of text with a traditional justified setting.

Now the sons of Jacob were twelve:
The sons of Leah;
Reuben, Jacob's firstborn,
and Simeon, and Levi, and Judah,
and Issachar, and Zebulun:
The sons of Rachel;
Joseph, and Benjamin:
And the sons of Bilhar, Rachel's handmaid;
Dan, and Naphtali:
And the sons of Zilpah, Leah's handmaid;
Gad, and Asher:
These are the sons of Jacob, which were born
to him in Padan-aram.

FIGURE 34.6(b). The same text with an unjustified setting. Note here that in this case the settings of both the beginnings and the endings of the lines are determined by syntactic considerations. Normally, of course, only the endings of the lines are unjustified.

34.2.10.3 Combining Vertical and Horizontal Spacing. So far we have discussed vertical and horizontal spacing as though they are separate issues—which, of course, they are not. For all texts interrelated decisions need to be taken that depend on the nature of the text. If the text consists of nothing but continuous prose, then (on a smallish page) a single-column structure with normal paragraph indentation may be perfectly acceptable. If, however, the text consists of numerous small elements, many of which start on new lines, then using traditional indentation to denote new paragraphs can be misleading. It is for reasons such as these that I generally advocate the use of line spacing rather than indentation to denote the start of new paragraphs in instructional and informational text (Hartley, 1994a; Hartley, Burnhill, & Davies, 1972).

34.2.10.4 Common Mistakes. If the text contains a mixture of text, diagrams, instructions, and other typical instructional material, then one has to think much harder about the appropriate way of presenting it. The key point here, of course, is that instructional text should not be designed, as often happens, on a "let's put this here" basis for every page, and text should certainly not be wrapped around a figure or printed over it (Hartley, 1998a). Decisions concerning the vertical and the horizontal spacing of the full text need to be made in advance of keyboarding it, and these decisions have to be adhered to throughout. To help with this many designers advocate using what is called a *typographical reference grid* (e.g., see Hartley, 1994a; Schriver, 1997; Swann, 1989). This tool—where layout decisions are mapped out in terms of grid modules—allows the designer to plan for standard units of space to separate out the components within the text. Thus, for example, one can specify in advance how many units of line space to allow between the text and a table or figure caption.

A good example of the difficulties that can arise when the spacing of the text is not properly considered occurred in the U.S. presidential election in 2000. Here many voters in Florida found themselves voting inadvertently for the wrong candidate because the punch holes for voting for each candidate were not systematically aligned with the candidates' names (Clay, 2001). If the text had been properly aligned and a punch hole placed systematically to the right of each candidate's name, then this mistake would not have occurred.

34.3 NAVIGATING TEXT: STRUCTURE AND ACCESS

So far I have discussed matters of typography that I believe help readers to find their way around a text and to grasp its underlying structure. I now turn to discuss those devices that are specifically used by writers and designers to help readers further in this respect. I have labeled this section "structure and access" because these devices—perhaps unwittingly— both clarify the structure of the text and help the readers gain access to it. Readers do not simply read instructional and informational text from beginning to end: They skim, search, re-read, etc. Devices that help them to do this include titles, contents pages, summaries, outlines, headings and subheadings, and numbering systems. In addition, authors use linguistic devices—such as "signals"—to help readers follow the organization of their arguments (Meyer, 1985; Waller, 1979).

34.3.1 Titles

Titles aim to describe the content of a text in the fewest words possible— but these are often supplemented with a subtitle (Michelson, 1994). Such succinct descriptions help to focus attention and expectations. Niegemann (1982) showed that titles aided the recall of what the text was about and, more recently, Sadoski, Goetz, and Rodriguez (2000) showed that concrete titles rather than abstract ones improved undergraduate students' recall, comprehension, and interest. Other studies have shown that titles can affect the readers' perception and interpretation of ambiguous text (e.g., Bransford, 1979). However, it is to be hoped that the titles for instructional and informational text will not be ambiguous!

Unfortunately, I know of no research on typographic variables connected with the setting of titles (e.g., type sizes, typefaces, weights) and little, apart from the references cited by Michelson (1994) and Zeller and Farmer (1999), on the more interesting problems of using different title formats (e.g., statements, questions, quotations).

34.3.2 Summaries

Summaries in text can have different positions and roles. Beginning summaries tell the readers what the text is about, they help the readers to decide whether or not they want to read it, and they help the readers who do read it to organize their subsequent reading. Interim summaries summarize the argument so far and indicate what is to come. End summaries list or review the main points made and, thus, aid the recall of important points in the text. End summaries can use the more technical vocabulary introduced in the text: Beginning summaries might not. There is considerable research on the effectiveness of *author-provided* summaries (e.g., see Hartley & Trueman,1982; Lorch & Lorch, 1995; Sherrard,1988) and on the effectiveness of *reader-generated* summaries (e.g., see Coleman, Brown, & Rivkin,1997; Kirby & Pedwell, 1991; Thiede & Anderson, 2000). Other research has shown that findings concerning summaries might be less clear-cut, especially when summaries are combined with other variables (Mayer et al., 1996).

Summaries can be typeset in many different ways: in medium, bold, or italic, in large or small type, boxed in, etc. To my knowledge, there is no research on the effect of such typographic variables in this context, although there is some indication that readers dislike journal abstracts set in a smaller type size than the main body of the text (Hartley, 1994b, 2000).

34.3.3 Outlines

Outlines can have much the same function as a summary, although it is likely that outlines depict the structure of the text more clearly. Often outlines are provided in a graphic form, sometimes in the form of a tree diagram or flowchart (Guri-Rozenblit, 1989). Such displays facilitate understanding and recall in at least two ways. First, readers can see the organizing structure of the text all at once. Second, readers can follow different routes within this structure. This allows them to compare and contrast different parts in the order of their choice. The argument, as in hypermedia, is no longer linear, and it is not obscured by lengthy paragraphs of text. Research reviewing the effectiveness of outlines has been reported on and summarized by, among others, Foos, Mora, and Tkacz (1994), Hall, Hall, and Saling (1999), and Hofman and van Oostendorp (1999).

34.3.4 The Role of Boxed Asides

Authors frequently seek to extend the reader's comprehension of the main ideas by including supporting material, such as examples, anecdotes, and bibliographies. Often, one way of handling such material is to treat the information as a figure, to box it off from the main body of the text, and to use a different typeface and/or typographic setting. Presumably the idea here is that, by being separated from the main text, the information in the box is seen as separate and adjunct. It is less likely to interfere with either the author's presentation or the reader's comprehension of the main ideas.

Some authors have provided interesting comments on the problems of dealing with ancillary material (e.g., Armbruster & Anderson, 1985; Schumacher, 1885), but there is little research on the effectiveness of boxed asides. Three studies that did examine the effects of boxes in texts for schoolchildren all failed to have control groups that read the texts without them (Boscolo, Cisotto, & Lucca, 1992; Lucca, Boscolo, & Cisotto, 1991, 1994). Nonetheless, even if there is no evidence for or against boxed asides, some people have firm opinions. Consider, for example, this extract from James Thomas' (1984) review of an introductory psychology textbook:

> On the negative side the text includes many boxed inserts presenting "Critical Issues" and "Applications". I object to this common approach for two reasons. First, these inserts disrupt the logical flow of the running text. If the application or issue is important enough for it to be boxed, why not include it in the running text and avoid breaking the reader's train of thought? Second, the boxed inserts exaggerate the importance of single, nonreplicated research findings. In many cases, these boxes report unusual, unexpected, or sensational research or applications that have not been adequately evaluated. Their appearance in an introductory textbook, especially in a highlighted position, seems to legitimize these findings and applications, whereas they should still be regarded as tentative. These concerns apply to three of the texts under review.

34.3.5 Headings

Headings in text may be written in the form of questions or statements or (as here) with one- or two-word labels. Headings may be placed in the margin or in the body of the text.

In a series of experiments with 12- to 14-year-old schoolchildren Mark Trueman and I investigated the role of different kinds of heading (questions versus statements) and their position (marginal versus embedded). We concluded that headings significantly aided search, recall, and retrieval but that the position and the kinds of heading that we used had no significant effects with the texts that we employed (Hartley & Trueman, 1985). More studies still need to be carried out on factors such as

- the nature of the text (technical versus semi-literary),
- the frequency of headings, and
- the typographic denotation of headings of different levels (primary, secondary, tertiary: see Spyridakis & Williams, 1992).

Additional research indicating the effectiveness of headings has been provided (see, e.g., Lorch & Lorch, 1995; Spyridakis,1989a, 1989b; Townsend, Moore, Tuck, & Wilton, 1990). Wilhite (1989) showed, intriguingly, that headings were particularly effective with students who had high prior knowledge of the topic in question.

34.3.6 Questions

Questions may be interspersed in the text itself—or presented in a list at the end of a chapter to provide material for exercises. There is some indication that readers tend to ignore questions given at the ends of chapters (see the following), so it might be more appropriate to consider how they can best be embedded in the text. It appears that factual questions, placed in a passage before paragraphs of relevant material, often lead to specific learning, whereas similar questions placed in the passage after the relevant content will sometimes lead to more general learning as well (see Allington & Weber, 1993; Hamaker, 1986; Hamilton, 1985). The level of difficulty of these questions, too, may be important (see Allington & Weber, 1993; Armbruster & Ostertag, 1993; Lee & Hutchison, 1998). Lockwood (1995) and Martens and Valcke (1995) emphasize the value of such embedded study support devices in materials produced for distance learning.

Some early research suggested that headings written in the form of questions were particularly suitable for less able readers, but later (better designed) studies failed to confirm this (see Hartley & Trueman, 1985). Nonetheless, it might be important to consider headings in this form for certain kinds of text. Cataldo and Cornoldi (1998) for instance found that headings in the form of questions helped the self-monitoring of both poor and good readers.

34.3.7 Sequencing Information

Information in printed texts is—normally—presented in a linear sequence. But the sequencing of the items within a text can be considered at different levels. For example, we might move from considering the order of the chapters in a book, to the subdivisions within the chapters, to the paragraphs within the subdivisions, to the sentences within the paragraphs, and, finally, to the sequence of the actual words themselves within the sentences. Research has taken place at different levels in this sequencing. Some people have been interested in how a sequence within sections might be interrupted by the positioning of other components, such as tables and pictures (Hartley, 1991b). Another set of researchers has been interested in the sequencing of information within paragraphs, with the aim of putting higher-order or more important information before lower-order information (e.g., Isakson & Spyridakis, 1999; Meyer, 1997; Meyer, Young, & Bartlett, 1989). Others have examined the sequencing of individual sentences: These people suggest that sentences that are coherently ordered are better understood than sentences that are not (e.g., Bransford & Johnson, 1972; Carroll & Korukina, 1999). However, these effects might be greater in narrative than they are in expository text.

Another body of early work, in the context of programmed instruction, suggested that violations in natural sequences provided little difficulty for most readers. But what is a "natural" sequence? Posner and Strike (1978) contrasted 17 ways of sequencing text to show that sequencing is not a simple matter, and Van Patten, Chao, and Reigeluth (1986) developed their arguments further.

One thing, however, that does seem to be generally agreed is that readers find it easier to follow a sequence in which the events in the sequence match the temporal order in which they occur. Compare "Before the machine is switched on, the lid must be closed and the powder placed within its compartment" with "The powder must be placed within its compartment, and the lid closed, before the machine is switched on." And consider this odd sequence of instructions that I once found for using an electric razor.

1. To gain access to the heads for cleaning, press the button on the side of the appliance (see Fig. 4).
2. To remove the razor from its packaging . . .

Finally, in this section it is worth noting that the ordering of information in instructional and informational text can have considerable practical significance. Morrow and Leirer (1999), for example, showed how important it was for the order of information presented in patient information leaflets to match the order expected by the reader. Prentice-Dunn, Floyd, and Flournoy (2001) found that it was better—in leaflets about breast cancer—to present more threatening information before information on how to cope.

34.3.8 Itemizing Lists

It is fairly common in instructional writing to find sentences containing embedded lists of items such as this:

> Five devices that aid the reader are (i) skeleton outlines for each chapter, (ii) headings in the text, (iii) an end summary, (iv) a glossary for new technical terms, and (v) a comprehensive subject and author index.

However, research suggests that readers prefer text that has such lists or numbered items spaced out and separated, rather than run-on in continuous prose. The above example would be better thus:

Five devices that aid the reader are:

- skeleton outlines for each chapter;
- headings in the text;
- an end summary;
- a glossary for new technical terms; and
- a comprehensive subject and author index.

34.3.9 Numbers in Text

Numbers are often used to clarify the structure of a piece of text. Lorch and Chen (1986) showed that when making a series of points within paragraphs, it was helpful to list and enumerate them. Other commentators have suggested that it is best to use Arabic numbers when there is an order or sequence to the points being made—and that *bullets,* as used in the preceding list, are more appropriate when each point is of equal value (Seki, 2000).

The structure and the organization of a piece of text can often be made clearer for the reader by the use of numbered paragraphs (as in this text). Such numbering systems can be used

to organize information in many ways, e.g., Section 1, 2, 3 or 1.01, 1.02, 1.03, etc. However, there has been little research on the effectiveness of such systems. Many people undoubtedly feel that they are useful—particularly for cross-reference purposes. But such systems can be abused if they are overdone and they can lead to extraordinary confusion (see Smith & Aucella, 1983; and Waller, 1980).

34.3.10 Signaling

A rather different way of making text organization more explicit is to use verbal *signals*. Signals have been defined by Meyer et al. (1989) as "non-content words that serve to emphasize the conceptual structure or organization of the passage." Words and phrases such as *however, but,* or *on the other hand* signal to the reader that some form of comparison is to be made. Similarly, words and phrases such as *first, second, three reasons for this are . . .* , and *a better example, however, might be . . .* signal the structure of the argument (and comparisons with subsections). Likewise, words and phrases such as *therefore, as a result, so that, in order to,* and *because* signal causal relationships. Studies have shown that such signals help readers to grasp the underlying structure of the author's argument (e.g., see Meyer et al., 1989; Rice, Meyer, & Miller, 1989; Spyridakis & Standal, 1987). However, there may be some confusion over the use of the term *signal*. Ii is now common to find it being used to cover a range of devices such as headings, overviews, previews, and summaries, as well as "noncontent" words and logical connectives (Glover et al., 1988; Lorch, Lorch, & Inman, 1993; Spyridakis, 1989a, 1989b).

34.3.11 Conclusions

This section on navigating text has shown that there is a good deal of research available on the variety of methods that have been used to help readers to grasp the structure of a text and to gain access to it. However, most of this research is uncoordinated and atheoretical. Most researchers focus on one device or another in a single study, and few consider systematically the myriad factors affecting the effectiveness of one or other particular device. Even fewer consider effects of several such devices in combination. Exceptions to these general criticisms are Dwyer's work on illustrations, Dansereau's work on outlines, Meyer's work on signals, Spyridakis' work on headings, previews, and logical connectives, and possibly my own on headings. Such theories as there are are thus buried below a welter of specific instances rather than being subjected to any rigorous analysis that might, in the long term, lead to deeper understanding.

34.4 MAKING TEXT EASIER TO UNDERSTAND

A separate area of research relevant to the design of instructional and informational text concerns itself with assessing how difficult or easy a text might be for its intended readers and, indeed, whether or not difficulty per se is a bad thing. The title of a book by Chall and Conard (1991) puts the question succinctly: *Should Textbooks Challenge Students? The Case for Easier or Harder Books.* Making text easier to understand has been examined from numerous points of view (e.g., see Chall & Conard, 1991; Davison & Green, 1988; Schriver, 1997). Here I want simply to report on some of the issues and findings.

Again, if we start with an historical perspective, it is probably true to say that the instructional and informational materials available today are more spaciously arrayed. Furthermore, they also contain shorter paragraphs, sentences, and words than did similar texts published some 50 years ago. What can research tell us about these features of text difficulty?

34.4.1 Paragraph Length and Denotation

Few researchers have commented on the effects of long chapters and long paragraphs on readability. It would seem, other things being equal, that short chapters, and short paragraphs within them, make a text easier to read. In addition, the ways in which new paragraphs are denoted may be important. One problem is knowing how best to format paragraphs without unduly breaking the readers' flow. In an early study, Hartley et al. (1978) suggested that different methods of paragraph denotation can affect the speed and accuracy of location and access, as well as the recall of information. Four methods were compared in both single- and double-column texts on an A4 page:

1. indent,
2. indent plus line space,
3. line space without indent, and
4. no line space and no indent.

The results showed that readers did best (at finding information) with the two-column text in condition 1, that is, with indentation to display the start of new paragraphs. However, the authors commented that their prose materials were not typographically complex and that they did not contain any large tables, diagrams, or figures—which can cause problems for two-column settings.

34.4.2 Sentence Length

It is generally considered that long sentences—such as the one you are now reading—are difficult to understand because they often contain a number of subordinate clauses that, because of their parenthetical nature, make it difficult for you to bear all of their points in mind and, in addition, because there are often so many of them, make it harder for you to remember the first part of the sentence when you are reading the last part. Long sentences overload the memory system. Short sentences do not. I once wrote,

> As a rule of thumb, sentences less than 20 words long are probably fine. Sentences 20 to 30 words long are probably satisfactory. Sentences 30 to 40 words long are suspect, and sentences containing over 40 words will almost certainly benefit from rewriting.

Perceptive readers will notice that many of my sentences contain more than 30 words—but at least they have been scrutinized! I am now inclined to the view that the length of sentences is also a function of the topic being written about and the level at which it is pitched. Furthermore, my advice ignores the advice given by many other commentators (e.g., Berger, 1993; Williams, 1997), that sentences (and paragraphs) should vary in length if they are to entertain the reader. Nonetheless, long sentences today are often flagged in computer aided writing systems and it seems unwise to ignore this information.

34.4.3 Word Length

Long words—like long sentences—can also cause difficulty. It is easier to understand short, familiar words than technical terms that mean the same thing. If, for example, you wanted to sell thixotropic paint, you would probably do better to call it nondrip! One author on style quoted a letter writer in *The Times* who had asked a government department how to obtain a book. He was "authorized to acquire the work in question by purchasing it through the ordinary trade channels"—in other words, "to buy it." Concrete words and phrases are shorter and clearer than abstract ones. Fowler and Fowler (1906)—almost 100 years ago—put the matter well when they said, "Anyone who wishes to become a good writer should endeavor, before he allows himself to be tempted by the more showy qualities, to be direct, simple, brief, vigorous and lucid."

34.4.4 Difficult Short Sentences

It does not necessarily follow, of course, that passages written in short sentences and short words will always be better understood. Alphonse Chapanis (1965, 1988) provides many examples of short pieces of text that are difficult to understand. The one I like best is the notice that reads

PLEASE
WALK UP ONE FLOOR
WALK DOWN TWO FLOORS
FOR IMPROVED ELEVATOR SERVICE

People interpret the notice as meaning "To get on the elevator I must either walk up one floor or go down two floors" or even "To get on the elevator I must first walk up one floor and then down two floors." When they have done this they find the same notice confronting them! What this notice means, in effect, is "Please, don't use the elevator if you are only going a short distance." Chapanis' articles are well worth studying. They are abundantly illustrated with short sentences that are hard to understand and (in some cases) potentially lethal. Later research using this particular warning notice showed how the principles of text design advocated in this chapter led to significant improvements (Wogalter, Begley, Scancorelli, & Brelsford, 1997).

34.4.5 Reducing Ambiguities

Many short (and indeed many long) sentences can turn out to be ambiguous. Consider "Then roll up the three additional blankets and place them inside the first blanket in the canister." Does this sentence mean that each blanket should be rolled inside the other or that the three rolled blankets should be placed side by side and a fourth one wrapped around them? (An illustration would clarify this ambiguity.)

Ambiguities, or at least difficulties, often result from the use of abbreviations or acronyms (strings of capital letters that form real or pseudo-words, e.g., NATO). I once counted over 20 such acronyms in a two-page text distributed by my university computer center. Chapanis (1988) provides additional examples, also from the field of computing. The meanings of acronyms may be familiar to the writer but they need to be explained to the reader. Furthermore, readers easily forget what an author's abbreviations stand for when they are not familiar with the material and when they come from another country.

34.4.6 Verbal Quantifiers

Numerical data in text are often difficult to understand and prose descriptions of them seem more helpful. Everyday words that act as rough quantifiers, e.g., "nearly half the group," seem adequate for most purposes and are handled with reasonable consistency (Moxey & Sanford, 1993; Windschitl & Wells, 1996). Young children, of course, may have greater difficulty with some of these terms (Badzinski, Cantor, & Hoffner, 1989).

Issues such as these are important because verbal quantifiers are widely used in a variety of situations, including surveys, questionnaires, and educational materials. Furthermore, people forget that the interpretation and use of these verbal quantifiers are affected by the context in which they appear. For example, how we respond to one quantifier in a questionnaire may well be affected by the other choices in the set (Haddock, 1998; Hartley, Trueman, & Rodgers, 1984) as well as by what is being discussed. Thus we might reply "often" to situations that vary widely in their frequency (e.g., compare "We often go abroad for our summer holidays" with "We often eat out during the week"), and what is "often" for some might be "rarely" for others.

Nonetheless, research by Hartley et al. (1984) suggested that the following phrases could be used with reasonable confidence with adults.

Numerical value to be conveyed	Suitable phrase
Above 85%	Almost all of . . .
60%–75%	Rather more than half of . . .
40%–50%	Nearly half of . . .
15%–35%	A part of . . .
Under 10%	A very small part of . . .

However, it may be better (or at least clearer for the reader) if more exact verbal equivalents of numbers are given, as follows.

Numerical value to be conveyed	Suitable phrase
100%	All of . . .
75%	Three-quarters of . . .
50%	Half of . . .
25%	A quarter of . . .
0%	None of . . .

Verbal descriptions of probabilities are also more comfortable for most people than are actual probability statements. People are less consistent, however, in their interpretations of verbal descriptions of probability than they are in their interpretations of verbal descriptions of quantity (Moxey & Sanford, 1993). Some people, for example, say "fifty-fifty" when they mean that the chances are equal, and others say "fifty-fifty" when they mean that they have no idea of what the probability might be (Bruine de Bruin, Fischoff, Millstein, & Halpern-Felsher, 2000). If precision is required, actual quantities can be given with a verbal quantifier. For example, one can say, "Nearly half the group—43%—said . . . " or "There was a distinct chance ($p < 0.06$) that. . . ."

34.4.7 Clarifying Text

Generally speaking, text is usually easier to understand when:

1. Writers produce few sentences containing more than two subordinate clauses. The more subordinate clauses or modifying statements there are, the more difficult it is to understand a sentence. Consider, for example, the problems posed for an anxious student by this examination rubric: "Alternative C: Answer four questions including at least one from at least two sections (1–5)."
2. Writers use the active rather than the passive voice. Compare the active form, "We found that the engineers had a significantly higher interocular transfer index than the chemists" with the passive form, "For the engineers, as compared with the chemists, a significantly higher interocular transfer index was found." (Riggle, 1998, provides qualifications to this general view.)
3. Writers use positive terms (e.g., more than, heavier than, thicker than) rather than negative ones (e.g., less than, lighter than, thinner than). Compare "The rain is heavier today" with "The rain was lighter yesterday."
4. Writers avoid negatives, especially double or triple ones. Negatives can often be confusing. I once saw, for example, a label fixed to a machine in a school workshop that read, "This machine is dangerous: it is not to be used only by the teacher." Harold Evans (1972) provides another example. Compare "The figures provide no indication that costs would have not been lower if competition had not been restricted" with "The figures provide no indication that competition would have produced higher costs." Negative qualifications can be used, however, for particular emphasis and for correcting misconceptions. Double negatives in imperatives (e.g., "Do not . . . unless . . . ") are sometimes easier to understand than single ones. Jordan (1998) offers an interesting discussion of these points.
5. Writers use concrete phrases and terminology rather than abstract expressions (Sadoski et al. 2000; Hartley, 1998a). Compare "Tell people quickly if there is a fire" with "It is of the utmost importance that persons in a building which is on fire should be given immediate warning."
6. Writers avoid nominalizations. Nouns derived from verbs are called nominalizations. Williams (1997) wittily points out that the word "nominalization" itself is a nominalization from the verb to nominalize. Other, simpler examples, are nouns typically ending in *–tion, -ment, -ence,* and so on. So, it would be easier to read "The agency investigated the matter" than "the agency conducted an investigation into the matter." Spyridakis and Isakson (1998) reviewed the early research on nominalizations and conducted their own experiment with nominalizations in technical text. They concluded that denominalized text was more helpful for native speakers of English but that nominalized text worked well with nonnative speakers.
7. Writers include examples. Students often rely heavily on examples to learn materials. The research suggests that examples can be made clearer by including greater detail, by increasing their frequency, and by making them more familiar. Students also learn more if they have to answer questions about the examples (Atkinson, Derry, Renkl, & Wortham, 2000; Lee & Hutchison, 1998; Robertson & Kahney, 1996). It is also helpful to place examples close to where they are referred to in the text.
8. Writers make text more interesting. Lively examples and anecdotes make the text more memorable—or do they? Research has indicated that vivid anecdotes and the like can indeed make text more interesting (e.g., see Hidi & Harackiewicz, 2000; McDaniel, Waddill, Finstad, & Bourg, 2000) but this is often at a cost. Apparently many readers tend to recall such "seductive details" at the expense of the main information in the passage (Harp & Mayer, 1998; Schraw, 1998). Boostrom (2001) provides another—interesting—perspective on this discussion.
9. Writers personalize texts. In one unpublished study Cathryn Brown and I compared two medical audiotapes. The first tape began

> Welcome to the Health Department's Medical Directory. This tape is about multiple sclerosis: what causes it, and what you can do about it.

The second tape began

> Welcome to the Health Department's Medical Directory. My name is Nick and I want to tell you about multiple sclerosis. I am able to do this because I am suffering from the disease. In this tape I will tell you about what causes multiple sclerosis and what you can do about it.

Both tapes contained the same information but, while the first tape was formal, the second tape conveyed the information in a more personal way. Students listening to this tape recalled more information from it than they did from the first one. Czuchry and Dansereau (1998), Moreno and Meyer (2000), and Rook (1987) provide similar results.

Personalizing instruction, of course, can take many forms. It is possible to insert the appropriate names of people and places in computer-generated texts (Jones et al, 1999; Lucke, 1998) and problems can be tailored to students' backgrounds. For example, the same mathematical problems can be presented in different contexts for nursing, teaching, and psychology students (e.g., see Davis-Dorsey, Ross & Morrison, 1991). Again, age and ability differences are important considerations in this field. Bracken (1982), for example, found that personalizing stories helped less able fourth graders but had no effect with those of average ability.

34.5 MEASURING TEXT DIFFICULTY

Much of the text that we see around us—on screen as well as on paper—can be written and presented more effectively. And, in order to help us achieve these goals, psychologists (and others) have devised numerous tools and methods for measuring the difficulty text. Schriver (1989, 1997) has grouped these methods under three headings: expert-based, reader-based, and text-based methods, respectively.

- *Expert-based* methods are ones that use experts to make assessments of the effectiveness of a piece of text. Subject-matter experts might be asked to use checklists to evaluate the quality of an instructional textbook. Referees might complete rating scales to judge the quality of an article submitted for publication in a scientific journal.
- *Reader-based* methods are ones that involve actual readers in making assessments of the text. Readers might be asked to complete questionnaires, to comment on sections of text that they find difficult to follow, or to carry out instructions or be tested on how much they can remember.
- *Text-based* measures are ones that can be used without recourse to experts or to readers. They examine the text on its own. Such measures include computer-based readability formulas and computer-based measures of style and grammar.

34.5.1 Expert-Based Measures

Experts in this context are people who have a high level of knowledge about (a) a particular subject matter, (b) the potential readership of a text, and (c) the skills of writing. Such people typically use their judgment to assess texts. Teachers, for example, may want to decide if a textbook is suitable for their students. In examining a particular textbook they will be concerned about whether it meets their teaching objectives and if it is written at an appropriate level. They will also be concerned with whether or not there are any outdated materials, important omissions, or biases of any kind— academic, national, racial, and sexual. They will consider the depth and breadth of the contents and how much the text may need to be supplemented by other materials.

Making such judgments is a subjective activity. However, there are ways of making them more objective. One way to do this is to increase the number of judges. Another is to provide some sort of checklist to ensure that all the judges evaluate the same concerns. Figure 34.7 provides an example of part of such a checklist. This kind of approach is commonly used in evaluating school textbooks in countries with state-controlled school systems such as the United States. Although such checklists are useful in making the judges' ratings more systematic and consistent, there are no *standard* tools that everyone can use. Different people with different interests tend to create their own measures. In one early study, for instance, Farr and Tulley

Please rate the book in the spaces provided on each of the items given, using a scale of 0 (very poor) to 5 (very good).

___ General appearance	___ Relevance of content
___ Practicality of size	___ Ease of reading
___ Durability of binding	___ Use of chapter subheadings
___ Quality of paper	___ Use of illustrative materials (tables, figures, and graphs)
___ Appeal of page layout	___ Degree of challenge for able students
___ Legibility of typefaces	___ Suitability for less able students
___ Usability of index	

FIGURE 34.7. An excerpt from a typical checklist for judging the quality of a textbook.

TABLE 34.2. Some Examples of Concurrent and Retrospective Reader-Based Text Evaluation Measures

Concurrent	Retrospective
Eye-movement patterns	Comprehension tests (including cloze)
Verbal commentaries	Readers' judgments of difficulty
Oral reading errors	Readers' preferences
Search tasks	Readers' feedback sheets
Reading times	
Cloze tests	

(1985) reported that the number of items on the checklists that they studied for evaluating school textbooks ranged from 42 to 180, with an average number of 73.

Such checklists are usually completed *before* recommending a particular textbook for use. However, this kind of information can also be collected *after* textbooks have been used by teachers and students. Information gained in this way is helpful in deciding whether or not to use a book again and in informing authors who are planning subsequent editions. Indeed, information can also be collected from colleagues and readers concerning chapters as they are being written. The information collected in this way can be used by authors in finalizing their chapters.

34.5.2 Reader-Based Measures

Reader-based tools for evaluating text require the readers to carry out some activities. Such activities can be many and varied. Schriver (1989, 1997) distinguishes between those that are *concurrent* with the reading activities and those that are *retrospective,* or come after them. Table 34.2 lists examples of different reader-based measures under these two headings. Here I consider two of them in more detail.

34.5.2.1 Cloze Tests. The cloze test was originally developed by Taylor (1953) to measure people's understanding of text. Here samples of a passage are presented to readers with, say, every sixth word missing. The readers are then required to fill in the missing words.

Technically speaking, if every sixth word is deleted, then six versions should be prepared with the gaps each starting from a different point. However, it is more common _____ prepare one version and, perhaps _____ to focus the gaps on _____ words. Whatever the procedure, the _____ are scored either (a) by _____ accepting as correct those responses _____ directly match what the original _____ actually said, or (b) by _____ these together with acceptable synonyms. Because the two scoring methods, a and b, correlate highly, it is more objective to use the tougher measure of matching exact words (in this case, "to," "even," "important," "passages," "only," "which," "author," and "accepting").

The scores obtained can be improved by

- having the gaps more widely dispersed (say every tenth word),
- varying the lengths of the gaps to match the lengths of the missing words,
- providing dashes to indicate the number of letters missing in each word,
- providing the first of the missing letters,
- providing multiple-choice alternative solutions, and
- having readers work in pairs or small groups.

These minor variations, however, do not affect the main purpose of the cloze procedure, which is to assess readers' comprehension of the text and, by inference, its difficulty.

The cloze test can be used by readers both concurrently and retrospectively. It can be presented concurrently (as above) as a test of comprehension, and readers required to complete it. It can be presented retrospectively and readers asked to complete it after they have read the original text. In the latter case the test can serve as a measure of recall as well as comprehension. The cloze test can also be used to assess the effects of different textual organization, readers' prior knowledge, and other textual features, such as illustrations, tables, and graphs (e.g., see Couloubaritsis, Moss, & Abouserie,1994; Reid, Briggs, & Beveridge, 1983).

34.5.2.2 Readers' Judgments and Preferences. A rather different but useful measure of text difficulty is to ask readers to judge the difficulty for themselves. One simple procedure here is to ask readers to circle in the text those areas, sentences, or words that they think *readers less able than themselves* will find difficult. In my experience, if you ask readers to point out difficulties *for others* they will be much more forthcoming than if you ask them to point out their own difficulties.

An elaboration of this technique is to ask readers to give a running commentary on the difficulties that they experience as they are using or reading a text. This technique has proved extremely valuable in evaluating complex text such as that provided in instructional manuals, where there can be a rich interplay between text and diagrams (see Shriver, 1997). Some critics of this approach suggest that talking about a task while trying to do it can cause difficulties, and this does seem to be a reasonable objection. However, such problems can be partly overcome by videotaping readers using the text to complete a particular task and then asking them to talk through the resulting tape—which can be stopped at any point to allow them to make an extended commentary.

Readers can also be asked to state their preferences for different kinds of texts and for different layouts of a specific text. Some experts dismiss such preference judgments by readers because they think that their preferences might be based on inappropriate considerations (such as a lavish use of different colors rather than the clarity of the wording). However, most people have clear views about what they like in texts and how they expect texts to perform.

A common method of measuring preferences is to ask people to rate (on a scale of 1–10) original and revised texts. The results can tell you whether a revised text is preferred to the original, whether people see no difference, or whether people prefer the original version. However, one has to be careful here. For some reason or other, when people rate two things on a scale

of 1–10, they often rate one of them 5 or 6 and the other one 8 (Hartley and Ganier, 2000). So it is useful to have a baseline text for comparison. The same text might be rated 5 or 8, depending on what it is being compared with.

Another useful tool to use here, if you want preference judgments for a number of texts that vary in different ways, is the method of *paired comparisons.* Suppose, for example, that you have 15 designs for a poster. You could ask potential readers to judge them (overall or on some specific aspect) and to make paired comparisons. Essentially this involves each judge comparing design 1 with design 2 and recording the preference, then design 1 with design 3, 1 with 4, 1 with 5, and so on, until 1 with 15 is reached. Then the judge starts again, this time comparing 2 with 3, 2 with 4, 2 with 5, and so on, until 2 with 15. This procedure is repeated again, starting with 3 with 4, 3 with 5, 3 with 6, etc., 4 with 5, 4 with 6, 4 with 7, etc., until all the designs have been systematically compared. Finally, you total the number of preferences recorded for each design to see which one has been preferred the most.

34.5.3 Text-Based Measures

Text-based tools for evaluating text can be used without recourse to readers. These measures, too, can be applied concurrently—while one is writing the text and, retrospectively, once it has been written—either by the author(s) or by others who might be thinking of using it. Here I describe two computer-based tools for evaluating written text.

34.5.3.1 Computer-Based Measures of Readability. Readability formulas were originally developed to predict the age at which children, on average, would have the necessary reading skills and abilities to understand a particular text. And this is still their main aim today, although the scope of application has widened.

Most readability formulas are in fact not as accurate at predicting this age as one might wish (and different formulas produce slightly different results), but the figures they provide do give a rough guide. Furthermore, if the same formula is used to compare two different texts, or to compare an original with a revised version, then you do get a good idea of the relative difficulty of the texts.

Readability formulas typically combine two main measures to predict the difficulty of text. These are (a) the average sentence length of samples of the text, and (b) the average word length in these samples. One simple formula—the Gunning Fog Index—is as follows.

- Take a sample of 100 words.
- Calculate the average number of words per sentence in the sample.
- Count the number of words with three or more syllables in the sample.
- Add the average number of words per sentence to the total number of words with three or more syllables.
- Multiply the result by 0.4.

TABLE 34.3. The Relationship Among the Flesch Reading Ease (RE) Score, Difficulty, and Suggested Reading Ages

RE Value	Description of Style	Required Reading Skill
90–100	Very easy	5th grade
80–90	Easy	6th grade
70–80	Fairly easy	7th grade
60–70	Standard	8th–9th grade
50–60	Fairly difficult	10th–12th grade
30–50	Difficult	13th–16th grade
0–30	Very difficult	College graduate

The result is the "reading grade level" as used in U.S. schools (Grade 1, 6 years old; Grade 2, 7 years old; etc.). Most readability formulas, however, are much more complex to calculate than the Gunning Fog Index—hence the interest in computer-based methods. One better-known formula, but one that is harder to calculate by hand, is the Flesch Reading Ease (RE) formula:

$$RE = 206.835 - 0.846w - 1.015s,$$

where w is the number of syllables per 100 words and s is the average number of words per sentence.

In this case, the higher the RE score, the easier the text. Table 34.3 shows the relationship among RE, difficulty, and suggested reading ages. One computer program—Microsoft's *Office 97*—gives the results from the Flesch RE formula. (Other programs sometimes give the measures from several formulas.) When I tried *Office 97* on an earlier section in this chapter the outcome was 41.1, suggesting that that section was relatively easy to read for the audience of this text—but that it might be difficult for thirteenth to sixteenth graders. Different formulas will produce slightly different results. Furthermore, an additional difficulty has arisen with computer-based readability formulas because different programmers have worked out different ways of computerizing what are ostensibly the same formulas. Thus you might find that, for example, if you use the *Word for Windows* version of the Flesch RE measure, you will get an RE result slightly different from that provided by, say, *Grammatik 5* or *Office 97*. This problem is not too serious with simple texts, but it can become more of an issue when working with complex ones (Sydes & Hartley, 1997). So the moral is always use the same computer program when evaluating different texts.

To summarize, the basic idea underlying readability formulas is that the longer the sentences and the more complex the vocabulary in these sentences, the more difficult the text will be. Clearly such a notion, although generally sensible, has its limitations. For example:

- Some technical abbreviations are short (e.g., "DNA") but difficult for people who have not heard of them.
- Some words are long but, because of their frequent use, become quite familiar (e.g., "readability" in this context).
- Clearly there is more to text than just sentence and word lengths—otherwise it would be easy to make text simple

Scientists divide the different forms of life into two main groups. There are animals called *vertebrates* that have backbones, and there are animals called *invertebrates* that do not. *Vertebrates* can be divided into several subgroups. There are *reptiles* such as snakes and crocodiles; *amphibians*, such as frogs and toads; *fish*, such as salmon and sharks; *birds*, such as sparrows and eagles; and *mammals*, such as dogs, horses, and people.

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FIGURE 34.8. The effects on readability measures achieved simply by shortening sentences. The top passage has a Flesch reading age of 15–17 years. The bottom passage has one of 13–14 years. But the top passage flows more easily than the bottom one.

by just shortening the words and the sentences (Davison & Green, 1988). However, studies by Beck and her colleagues have shown that in some circumstances more readable texts can score less well on readability formulas than less readable ones (Beck, McKeown, & Worthy, 1995; Loxterman, Beck, & McKeown, 1994).

- Text that has short, choppy sentences can be difficult to read (see Fig. 34.8).
- Readability formulas do not take into account the order of the words and the sentences, nor do they assess the effects of other devices used to aid comprehension (e.g., typographical layout, tables, graphs, and illustrations).
- Most importantly (unlike reader-based tools), readability formulas ignore the readers' motivation, abilities, and prior knowledge.

34.5.3.2 Computer-Based Style and Grammar Checkers. Most readers who use word processors will be familiar with spelling checkers, tools that enable you to check the spelling in your documents. Style and grammar checkers, as their names suggest, are but an extension of this idea—they aim to help with style and grammar. Essentially the procedure is to run these checkers over the text once you have completed it (but it can be done concurrently). The checker stops at every point where the program detects a possible stylistic or grammatical error. Figure 34.9 indicates the kinds of errors picked up by the program *Grammatik 5*.

Early investigations of style and grammar checkers focused on assessing how useful they were to writers. This research suggested that many people found them rather tedious to use but that they did find them helpful (Hartley, 1994a). More recent research has focused on making comparison studies between different programs to see which is the most effective. Typically what one does here is to assemble a set of ungrammatical or poorly written sentences or passages and then try out different grammar checkers on them to see which errors are detected and what sort of advice is given (e.g., see Kohut & Gorman, 1995; Pedler, 2001). Other, more theoretical research in this

Programs that indicate grammatical errors:

- Adjective errors
- Adverb errors
- Article errors
- Clause errors
- Comparative/superlative use
- Double negatives
- Incomplete sentences
- Noun phrase errors
- Object of verb errors
- Possessive misuse
- Preposition errors
- Pronoun errors
- Sequence of tense errors
- Subject-verb errors
- Tense changes
- etc.

Programs that indicate mechanical errors:

- Spelling errors
- Capitalization errors
- Double word
- Ellipsis misuse
- End-of-sentence punctuation errors
- Incorrect punctuation
- Number style errors
- Question mark errors
- Quotation mark misuse
- Similar words
- Split words
- etc.

Programs that indicate stylistic errors:

- Long sentences
- Wordy sentences
- Passive tenses
- End-of-sentence prepositions
- Split infinitives
- Cliched words/phrases
- Colloquial language
- Americanisms
- Archaic language
- Gender-specific words
- Jargon
- Abbreviation errors
- Paragraph problems
- Questionable word usage
- etc.

FIGURE 34.9. Examples of different errors detected by *Grammatik 5*.

area concerns itself with developing more sophisticated programs than the ones currently available (e.g., see Harrison & Bakker, 1998; Pennebaker & King, 1999; Woolls & Coulthard, 1998).

Grammar checkers are good at spotting the minutiae of errors in punctuation and grammar, but naturally, they cannot help with matters of content. In my experience it is best to use both computer-based and human editors (experts and readers) to evaluate the effectiveness of style.

34.5.4 Combining Different Measures

Experiments have been carried out to see whether or not the information provided from these different kinds of measure is equally effective in improving texts. de Jong and Lentz (1996), for instance, compared the usefulness of expert versus reader feedback in assessing the effectiveness of a public information brochure about rent subsidies. Here the criticisms of 15 expert technical writers were compared with those of 15 members of the public. The main conclusions of this study were that criticisms of the two groups were very different. The readers pointed out significantly more problems associated with the typographic design of the brochure and with their understanding of it. The technical writers pointed out significantly more problems with the use of appropriate expressions and conventions and with matters of writing style.

In another study, Weston, Le Maistre, McAlpine, and Bordonaro (1997) gave suggestions from experts, readers, and instructional designers for rewriting a six-page instructional unit on diet and cancer to a new set of instructional designers. These new designers most frequently used the suggestions from the readers and the previous instructional designers in making their revisions. However, subsequent comprehension tests showed that the most important information for improving the comprehension of the passage came from the readers' earlier comments.

In a third study, Wilson et al. (1998) reported, among other things, the responses of medical practitioners and patients to questions concerning the content and usefulness of patient information leaflets. Both the practitioners and the patients thought that the leaflets were useful, but they had widely disparate views about the content. Thus, for example, 80% of the practitioners responded "No" and 75% of the patients responded "Yes" to the question, "Is there anything you feel is essential to include but is omitted?" Similarly, 86% of the practitioners responded "No" and 46% of the patients responded "Yes" to the question, "Is there anything you feel should be left out that is included?" Finally, 86% of the practitioners responded "No" and 50% of the patients "Yes" to the question, "Is there anywhere where you feel the style of the language is not appropriate (e.g., patronising/confusing)?" Berry, Michas, Gillie, and Forster (1997) reported similar results.

A different kind of study (Hartley & Benjamin, 1998) showed how using multiple measures could be more informative than using single ones. Here comparisons were made between traditional abstracts (summaries) of journal articles and what are called *structured* abstracts. (These contain subheadings, such as Background to the Study, Aims, Methods, Results, and Conclusions.) In this investigation the effects of these changes were assessed in five ways. The results showed the following.

- In terms of *length* the structured abstracts were significantly longer.
- In terms of *information content* the structured abstracts were significantly more informative—as assessed by readers.
- In terms of *readability* the structured abstracts were significantly more readable—as assessed by computer-based readability formulas.
- In terms of *searchability* the readers were able to find information more quickly with the structured abstracts.
- In terms of *preferences* the authors of the abstracts were almost unanimous in their preferences for the structured versions.

The results from combining these measures suggested that the structured abstracts were more effective than the traditional ones—but that they took up more journal space to achieve this. This use of several evaluation methods—rather than just one—strengthened this conclusion.

34.6 DESIGNING TEXT FOR READERS WITH SPECIAL NEEDS

In this section I turn to issues of text design for two sets of readers with special needs—the elderly and the visually impaired. These two groups of people can, of course, overlap.

34.6.1 Text Design for Older Readers

The proportion of elderly people in society has been gradually increasing over the years. Life expectancy at birth in the United Kingdom increased by over 50% in the last century, and 4 in every 10 British people are now over 50. In the United States currently 12% of the population is 65 years of age or older, and the number of Americans 65 years of age or older is expected to double to 65 million by the year 2030 (Qualls & Abeles, 2000). Thus people are living longer and the number of elderly people in the community is getting larger. Consequently there are more older people reading traditional and screen-based texts and more materials being produced especially for them.

Research on the effects of aging can be described in terms of three overlapping areas, physiological, cognitive, and social. *Physiological* research looks at the biology of aging and its physiological correlates. Most people, for example, experience a decline with age in eyesight and other senses. *Cognitive* research on aging focuses on changes in memory, learning, and judgment. Such cognitive changes have implications for text design, as we shall see. *Social* research on aging examines, for example,

how societies expect their older members to perform. Studies of "agism," for example, focus on how commonly held attitudes and beliefs about what elderly people should do (and should *not* do) determine to a considerable extent what, in fact, they do do.

It is difficult to summarize in a few lines the main findings of studies on aging and their implications for text design. (Fuller expositions are given by Hartley, 1999, Morrell, 2001, and Wright, 2000). Here, for the sake of argument, I would like to suggest two points that I think it helpful to bear in mind when thinking about these issues.

1. Working memory capacity (i.e., information held in memory and used in ongoing tasks) declines as people get older.
2. The more difficult the task and the older the person, the more disproportionally difficult that task becomes.

Thus, for example, older people may recall narrative texts relatively well but find expository texts more difficult. But summarizing these expository texts will be much more difficult the older the readers are (Byrd, 1985).

Meyer et al. (1989) and Meyer (1997) suggest that it is important to consider three overlapping variables when considering designing instructional and informational texts for older learners.

- Reader variables—such as verbal ability and prior knowledge
- Text variables—such as text structure, genre, and difficulty
- Task variables—such as remembering and following instructions

Thus one might not expect differences between older and younger readers when the verbal ability of the readers is high, when they have good prior knowledge, when the texts are clearly presented, and when the tasks are relatively straightforward. Differences, however, might be expected to emerge with less able readers, less familiar materials, poorly designed text, and more complex tasks.

34.6.1.1 Improving Typographically Simple Layouts. Generally speaking, studies on the effects of aging suggest that texts will be easier for older people when their perceptual and memory-processing loads are reduced. One would imagine, therefore. that this might be achieved by, for example,

- using larger type sizes;
- using clearer layouts;
- using more readable text; and
- clarifying the structure of the text by using, for example, summaries, headings, systematic spacing, and signals.

In another review I summarized the results from some 15 studies that examined these various aspects of text design with older readers (Hartley, 1999). These studies used what I call relatively simple typographic layouts, that is, mainly continuous run-on text. Table 34.4 shows that, unfortunately, there were insufficient studies to make any clear generalizations from their findings, except for the area of type size.

TABLE 34.4. The Number of Studies with Older People for Each Aspect of Text Design Listed in the Text

Number of Studies	Text Design Feature
5	Type size
3	Unjustified text
2	Underlining
2	Advance organizers
1	Signals
1	Questions in text
1	Text structure and organization

Note. From "What Does It Say? Text Design, Medical Information and Older Readers," by J. Hartley, 1999, in D. C. Park, R. W. Morrell, and K. Shifrin (Eds.), *Processing of Medical Information in Aging Patients* (pp. 233–247), Mahwah, NJ: Lawrence Erlbaum Associates. Reproduced by permission.

All five studies on type size indicated that larger type sizes were suitable for older readers. It appears—ignoring my earlier caveats about measuring type sizes—that 12- or 14-point type is more appropriate for older readers.

The three studies with unjustified text suggested that there were advantages for unjustified text with *less able* older readers when the line lengths were short (seven or eight words).

The two studies on underlining and the two on advanced organizers had mixed results: one positive and one neutral in each case. The two studies on making texts more readable showed that, in these studies, this had no effect with age. However, there were age effects for the studies with questions, signals, and variations in text structure. Older readers did less well than younger ones, but high-ability older readers were helped by the textual variable being considered.

My review highlighted three issues in this research.

1. There were ability effects rather than age effects in about half of these studies. The more able participants did better than the less able ones, irrespective of age.
2. Six of the studies showed interactions between conditions and ability. Three of them showed that the text device in question helped the more able participants, and three of them showed that it helped the less able ones.
3. Very few of the investigators reported working with text that was appropriately designed to take into account the visual problems of their older readers. Only one or two checked that their participants could in fact read the texts. None reported on increasing the type size when looking at other variables, and none appeared to consider the value of improving the lighting. Thus, one might argue, the older readers in many of these studies were probably working under additional handicaps.

34.6.1.2 Improving Typographically Complex Texts. So far I have discussed research with texts that had a relatively simple typographic structure. I now turn to studies of older people using materials that are more complex—both typographically and literally. Such materials include, for example, bus and train schedules, labels on medicine bottles, food packaging, and government forms. In my earlier review (Hartley, 1999)

I examined the results from 10 studies in this more complex area. These covered work on medical insurance policies, informed consent forms, medicine bottle labels, prescription information, food labels, inland revenue forms in the United Kingdom, diagrams, models, flowcharts, and procedural instructions for assembly tasks.

Eight of the ten studies with these more complex materials found that their older participants fared worse than their younger ones when using this kind of text (but not always significantly so). And the two of them that reported ability data reported that high-ability participants did better than low-ability ones, irrespective of age. What was of more interest, however, was that the changes made ostensibly to help older people with these materials *actually appeared to make the texts more difficult for them*. Further work is need with elderly people on the use of diagrams, charts, and tables, for example, to see if this really is the case.

In the light of these findings it is likely—although this has not been studied—that presentation methods that hinder legibility for the young (e.g., printing text over photographs, using poor color contrast, using three-dimensional bar charts instead of two-dimensional ones) might cause even more difficulty for elderly readers.

Clearly, more work needs to be done in this area of instructional and informational design. Indeed, it would be wise to ensure that older people are included in the evaluation studies of any textual materials. Text designed for older readers is unlikely to confuse younger ones. However, text designed for younger readers may well confuse older ones.

34.6.2 Designing Text for the Visually Impaired

During 1986 and 1987 the Royal National Institute for the Blind (RNIB) conducted a survey of the needs of blind and partially sighted adults in Britain, and a final report was published in 1991 (Bruce, McKennell, & Walker, 1991). A similar report on the needs of blind and partially sighted children was published in 1992 (Walker, Tobin, & McKennell, 1992). And, although these reports describe the situation in the United Kingdom, we can anticipate that the problems are similar in other developed countries and worse in developing ones.

The 1991 U.K. report indicated that the number of blind and partially sighted adults in Great Britain, was approaching 1 million (960,000), many more than were actually registered (239,000). The prevalence rates (for those registered) were as follows:

- 3 per 1,000 among 16- to 59-year-olds,
- 23 per 1,000 among 60- to 74-year-olds, and
- 152 per 1,000 among those over 75 years of age.

Thus one person in seven aged 75 or over was blind or partially sighted, and this prevalence rate was almost certainly higher among those over 80 and those over 85.

It is, of course, important to realize that the great majority of these people are not completely blind but are, in fact, partially sighted. The RNIB 1991 report estimated that only 20% of "blind" people are completely blind (and this number includes people who can perceive light but nothing more). Thus 80% of the blind have varying degrees of visual impairment and, as we shall see, many can read large print.

Similar findings were presented in the 1992 report on blind and partially sighted children. It was estimated that there were at least 10,000 children in Great Britain with significant visual impairments, and possibly as many as 25,000. As many as 80% of the children in the sample were reported to have had their sight problems from birth.

For some children (and adults for that matter) spectacles, contact lenses, and other magnifying devices mean that they can in fact read and write using print and new technological devices rather than Braille. In this children's sample,

- over 80% used tape recordings for learning and/or entertainment,
- 40% could read normal-size print,
- 63% were using microcomputers in school,
- 36% were using microcomputers at home, and
- 90% liked listening to the radio and listening to and watching television.

Today, of course, new technology allows print to be turned into Braille or speech, and speech to be turned into print or Braille. These developments, of course, are beyond the scope of this chapter, but Nisbet, Spooner, Arthur, and Whittaker (1999) provide a useful summary.

The RNIB reports point out that the needs of blind and partially sighted are complex. Many of them have additional disabilities, and many cannot use Braille or computers because of additional learning or physical difficulties.

34.6.2.1 Large Print. The RNIB considers that 10-point type (as used in many textbooks) is too small for many readers, not just the blind and partially sighted. They recommend 12-point type for most documents and 14 point as the minimum type size for material intended for the blind and partially sighted. Other recommendations are given in Fig. 34.10. Similar guidelines have been produced in the United States by the American Association of Retired Persons (AARP, 1986), by the Civil Rights Division of the U.S. Department of Justice (1988), and by the Society for Environmental Graphic Design (1993). These guidelines share some common characteristics: They make good sense but occasionally imply too strongly that they are based on known research findings. It is important to remember, as noted earlier, that with large print the width of the text expands as well as the depth. This may make it difficult to perceive the syntactical groupings of words if the page size stays the same. So, simply enlarging a text may not always be a sensible solution to the problem: One might take the opportunity to reconsider its design (see Hartley, 1994a).

There have been few actual studies of designing printed instructional and informational texts for the partially sighted. Mansfield, Legge, and Bane (1996) compared the legibility of two typefaces—Courier and Times. They found that there were

- *Contrast*. There needs to be good contrast between the type and the paper on which it is printed or photocopied. Contrast is affected by paper color, print color, type size, and weight. Black type on white or yellow paper gives a very good contrast. Pale-colored papers provide better contrast than dark ones. Black or very dark-colored print can be used if the paper is very pale. The print should not run across photographs or illustrations.

- *Type sizes.* 14 or 16 point is acceptable when printing for the partially sighted (see the text).

- *Type weights.* Avoid light typefaces, especially in small sizes. Medium and bold type weights are more appropriate in this context.

- *Typefaces.* Most typefaces in common use are suitable. Avoid bizarre or indistinct typefaces. Numbers need to be printed clearly: Blind and partially sighted people can easily misread 3, 5, and 8 in some faces, and even 0 and 6.

- *Capital letters.* Avoid long strings of text in capital letters, as they are harder to read than lowercase ones.

- *Line lengths*. These, ideally, should be in the range of 50–65 characters. Blind and partially sighted people may prefer shorter lines than this. Avoid hyphenation at the ends of lines.

- *Spacing*. Keep to regular word spacing: Do not stretch or condense lines of type, that is, avoid justified typesettings. Allow the line spacing to be equivalent to the type size plus the word spacing. Use a line space between paragraphs, and use space to show the underlying structure of the text. Additional lines or "rules" may help keep separate unrelated sections. Do not rotate text or wrap it around illustrations. (It is also worth noting that blind and partially sighted people often need more generous space on forms for handwritten responses, as their handwriting tends to be larger than average.)

- *Paper*. Print on glossy paper can be difficult to read. Very thin papers also cause problems because text can show through from the reverse.

FIGURE 34.10. Recommendations for designing text for the visually impaired. Guidelines adapted from the RNIB's *See It Right: Clear Print Guidelines, Fact Sheet 2.* Reproduced with permission of the RNIB.

small but significant advantages for Courier for low-vision participants but that the two typefaces were more or less equivalent for participants with normal vision. DeMarco and Massof (1997) assessed the distribution of print sizes used in American newspapers and noted that the print size for front-page articles had increased by 20% over the past 50 years. Nonetheless, they concluded, much text in newspapers was printed in a type size too small for elderly and visually impaired readers. Other investigators have commented on how keyboards, smart cards, and screen-based text presents particular problems for readers with special needs (e.g., see Gill, 1997, 2001).

Shaw (1969) provides a good review of the earlier literature and reports on a detailed study with adults. Shaw asked her participants to read aloud short passages that varied in typeface (Gill and Plantin), type size (from 10 to 24 point), weight (bold and medium), and spatial settings (see Fig. 34.11).

Shaw reported that an increase in type size achieved a 16% improvement in reading performance; an increase in weight, 9%; and a change from Plantin (a serif face) to Gill Sans (a sans serif face), a 4% improvement. (This typeface change was particularly helpful for readers over 50 years of age.)

These results must, of course, be considered with caution in view of the fact that the participants were asked to read the texts out loud and that the texts themselves, as shown in Fig. 34.11, were very odd.

34.6.3 Presenting Text in Braille

The Braille system—where each character is conveyed by one of six embossed dots in a 2×3 matrix—is well known to many and is illustrated in Fig. 34.12. Braille text was originally produced on thick card, but today it is more likely to be produced by a thermoform system with heated, paper-thin plastic sheets. This system also allows one to produce tactile maps and line drawings. To the sighted reader a page of Braille may look like a large and cumbersome equivalent of a piece of conventionally printed text. But this would be naive. Completely blind readers cannot see the top and the bottom of the page simultaneously—they have to work out which is which. They cannot see headings and subheadings at a glance. They cannot see at a glance how many paragraphs there are on the page and, thus, how dense the text is. They cannot tell until they start whether the language of the text is going to be easy or difficult. To discover what is there blind readers must start at the beginning and work through to the end without knowing (for the most part) when the end is coming.

Face: GILL
Weight: ROMAN
Size: 12 POINT

Main floors escape special loads. Foreign glories arrange careful bills. Returning fathers concern large merchants. Valuable shadows know frequent corn. Lower money beats straight diseases. Last oils enjoy

Spacing: "normal"

Wild life claims perfect witnesses. Loud beauties move demanding chairs. Sad wages attract silent populations. Exact spaces please ideal dinners. Appointed plates see lost farms. Deep newspapers expect square

Spacing: extra space between letters and words

Next season allows set companions. Modern banks paint vain trade. Brave adventures marry extreme churches. Ancient machinery shoots future currents. Important stories take late posts. Black clubs seize twenty

Spacing: extra space between words only

Noble ways sing other bread. Long stores perform second teeth. Religious fashions compose wide factories. Excellent officials appear usual towns. Sorry coals walk five defences. Numerous flowers speak wrong

Spacing: extra space between lines only

FIGURE 34.11. An example of the materials used in Alison Shaw's experiments. Note that the experimental design meant that each participant read 4 texts of a possible 32. (Figure reproduced with permission of the U.K. Library Association.)

In this chapter I have described how instructional text can be improved by paying attention to the typographic layout, to the wording or language of the text, and to the use of headings, summaries, numbering systems, and other such devices. Much of the research that I have described seems to be applicable to the setting of Braille text. Despite the fact that many Braille texts seem to be devoid of clear spatial cues—perhaps because of the assumption that there is no need to include space because blind people cannot see it—it seems to me that the structure of Braille texts could be clarified by the methods discussed above. My observations of skilled Braille readers indicate that they can indeed "look ahead" by quickly scanning (with both forefingers) and that they welcome devices such as headings (Hartley, 1989).

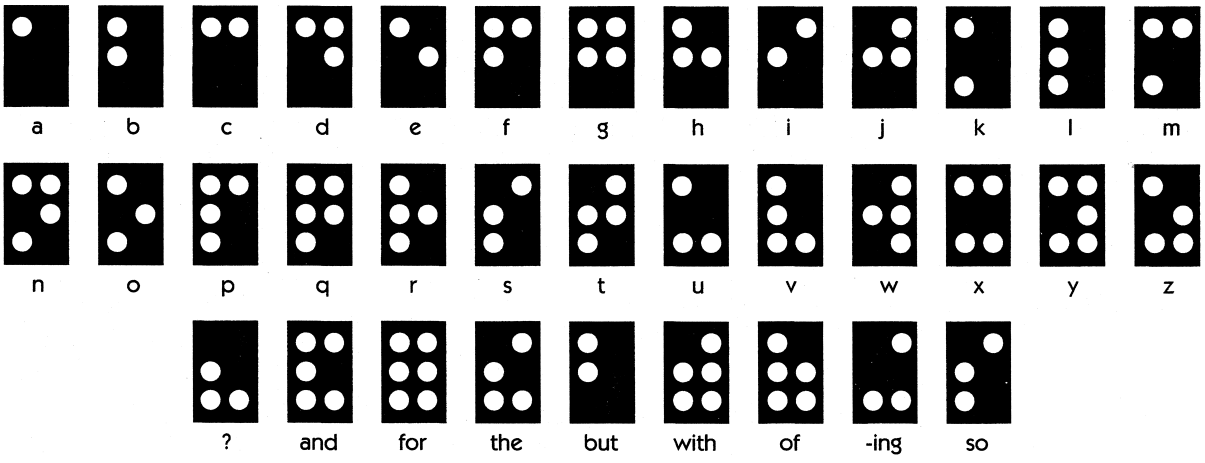

FIGURE 34.12. The Braille code.

Version A

Kanski, J. J. and Packard, R. B. S., **Cataract and Lens Implant Surgery**, Churchill Livingstone, 1985, 60pp, £26.00, ISBN 0 443 03205.

Gilbert, P., **Mental Handicap: a practical guide for social workers**, Community Care, 1985, 130pp, pbk £3.95, ISBN 0617 00447 1.

Dechesne, B. H. H, Pons, C. and Schellen, A. M. C. M. (eds.), **Sexuality and Handicap: problems of motor handicapped people**, Woodhead-Faulkner, 1985, 234pp, pbk £19.95, ISBN 0 85941 231 8.

Holloway, C. and Otto, S., **Getting Organised**, Bedford Square Press, 1985, 70pp, pbk £4.95, ISBN 0 7199 1162 1.

Version B

Cataract and Lens Implant Surgery,
Kanski, J. J. and Packard, R. B. S.
Churchill Livingstone, 1985,
60pp, £26.00, ISBN 0 443 03205.

Mental Handicap: a practical guide for social workers,
Gilbert, P.
Community Care, 1985,
130pp, pbk £3.95, ISBN 0617 00447 1.

Sexuality and Handicap: problems of motor handicapped people,
Dechesne, B. H. H, Pons, C. and Schellen,
A. M. C. M. (eds.),
Woodhead-Faulkner, 1985,
234pp, pbk £19.95, ISBN 0 85941 231 8.

Getting Organised,
Holloway, C. and Otto, S.,
Bedford Square Press, 1985,
70pp, pbk £4.95, ISBN 0 7199 1162 1.

FIGURE 34.13. Version A shows an excerpt from a list of references as typically presented in the *British Journal of Visual Impairment.* Version B shows the same text using space rather than typographic cueing to show the structure of the entries in the list. The argument is that Version B would be more helpful in Braille than Version A.

Blind readers require practical information (e.g., telling them how long an article is going to be) and contextual information (e.g., the use of overview summaries). If headings are numbered and phrased in the form of questions (e.g., who, what, when, where, why, how), then blind and visually impaired readers can read with such questions in mind and they will know when they have reached the end of particular sections. Overview summaries and headings enable readers to look ahead more easily and, thus, to reduce their memory load while reading.

In addition, it might also be profitable to think of how one can convey information differently without the array of typographical devices available in printed text. In Fig. 34.13, for instance, I contrast the traditional sequence used in presenting references in a scientific journal with what might be appropriate in a Braille version. In Version A—the traditional setting—the text is continuous and different sections of the references are denoted by different typographic cues. In Braille versions of this material it is conventional to follow this continuous sequence of the printed version. In Version B, however, I have shown that resequencing the elements, and placing the key elements on different lines, makes the text easier to search even though it has no typographic cues. Clearly making changes such as these may be costly in terms of the additional space required but such changes may be more cost-effective if readers find the resulting text easier to read.

At present, of course, we do not know whether respacing traditional Braille settings would be of value to blind readers: it may make little difference to those blind from birth. However, it is likely that those who become blind in later life and who wish to learn to read Braille do carry with them a repertoire of expectations about text layout that is currently not realized in Braille.

34.7 USING TEXTBOOKS

In this penultimate section of this chapter I want to turn from discussing textbook design, where design is taken to be the equivalent of typography, to considering the situation where design is taken to be synonymous with control. In short, I am interested in how one might use the knowledge we have gained to manipulate the text so that learners can read and use it more effectively.

One aspect of this research that is of interest here is to find out what readers actually value in different text features, both separately and in combination. For example, Thompson and Maniam (two of my undergraduates) asked a group of university students to indicate their preferences for four various designs for tabular layouts presented by Ehrenberg (1977) and illustrated in Hartley (1994a). Strong support was found for Ehrenberg's personal judgments. In another study, Kim Little (another undergraduate) asked 87 adolescents aged between 12 and 16 for their preferences for various features of the design of textbooks. Access structures were clearly appreciated, but devices that required work (tables, graphs, questions, and suggestions for further reading) were not as popular.

Several authors have examined the features of text design present in various introductory textbooks in psychology, and some have collected student ratings of their value and their probable use (e.g., Griggs & Koenig, 2001; Schallert, Anderson, & Goetz, 1988). Table 34.5 shows the percentage of features found in introductory psychology textbooks by Marek, Griggs, and Christopher (1999) and the rank orderings of students' estimates of their probability of use in both this study and one (of several) by Weiten, Deguara, Rehmke, and Sewell (1999).

TABLE 34.5. The Rank Ordering of Pedagogical Features in Introductory Psychology Textbooks and Students' Estimates of Their Probability of Using Them

	Rank Probability of Estimated Use	
Feature (%)	Study 1	Study 2
Chapter outlines (100)	15	10
Boldface terms (100)	1	1
Italicized terms (97)	7	4
Chapter summaries (84)	4	2
Discussion questions (70)	14	3
Running glossaries (54)	2	6
Learning checks (46)	8	11
Section summaries (35)	6	13
Glossaries with pronunciations (22)	11	11
Questions as organizers (19)	8	15
Chapter glossaries (16)	3	7
Demonstrations (14)	12	14
Learning objectives (14)	13	9
Review exercises (11)	10	7
Self-tests (8)	4	4

Note. From "Pedagogical Aids in Textbooks: Do College Students' Perceptions Justify Their Prevalence?" by P. Marek, R. A. Griggs, and N. Christopher, 1999, *Teaching of Psychology, 26*(1), pp. 11–18. Also from "University, Community College, and High-School Students' Evaluations of Textbook Pedagogical Aids," by W. Weiten, D. Deguara, E. Rehmke, and L. Sewell, 1999, *Teaching of Psychology, 26*(1), pp. 19–21. Adapted by permission.

It is clear that different groups of students make different estimates but that some features are clearly judged more useful than others in both studies. Marek et al. also noted that the number of pedagogical aids increased in inverse proportion to the instructors' perceived difficulty level of the text.

There have also been detailed reports—with case-histories—of how students use distance-learning materials (e.g., see Marland, Patching, Putt, & Store, 1984; Marland, Patching, Putt, & Putt, 1990; Marland, Patching, & Putt, 1992). These studies have tended to focus on how such students allocate their time, what sections they read (or do not read), and in what order they carry out the assignments requested of them. Marland et al. (1990) drew attention to the fact that different groups of students paid attention to different features. Some focused on the course objectives, but others never looked at these. Few paid much attention to the headings, but tables were inspected closely. Some students were bemused by author-provided underlining. Overall there was little indication that any of the students sought to develop a broad, integrated understanding of the text.

Newton (1984) described some early British studies with university students and with teacher training college students reading science textbooks. In the 1984 report he outlined the results he obtained from examining how twelfth-grade pupils used textbooks in physics, chemistry, and biology. Basically Newton found—in these British studies—that it was rare for students to be asked to read the complete texts. It appeared that on average just over one-third of the physics text was read, slightly less than half of the chemistry text, and just over one-half of the biology text. In all cases it was common for the texts to be read after the appropriate lessons rather then before them, and there were great variations in the amounts read by individual students. The main uses that the students made of the texts were to help them answer specific questions, to help them revise, and to provide supplementary reading. Newton concluded that the main role of the textbook in this study was to act as "a surrogate teacher" and a provider of supplementary reading.

In fact there has been surprisingly little research on how teachers, as opposed to students, actually use textbooks and on which features they appreciate. Three early American studies (Alverman,1989; Hinchman, 1987; Zahorik, 1991) suggested that teachers, overall, appeared to have three ways of using textbooks in class:

- to provide authoritative content,
- to provide basic material that they could embellish, and/or
- to provide material for discussion.

Zahorik found that over 80% of the teachers in his sample said that they would use a textbook when teaching a particular lesson but that over 40% said that they would not have their pupils read it from cover to cover. Other investigators have provided accounts—with case histories—of how teachers use textbooks in class (e.g., see DiGisi & Willett 1995; Garner & Alexander, 1994; Roth & Anderson, 1988).

Newton (1984) suggested that the ways that textbooks were used in class restricted the ways in which textbooks were written and designed. Authors, he wrote, "can assume nothing," and "the expositional style adopted has tended to give the reader a passive role." There is, indeed, some evidence to support these notions as is apparent from the listing of the percentage of pedagogical aids in Table 34.5. Features that require students to do something (such as review exercises and self-test questions) have low ranks in the hierarchy. Similar findings were reported by Schallert et al. (1988). These authors examined the strategies designed to encourage text processing in five popular introductory psychology and biology texts. Table 34.6 shows the strategies that they found, together with estimates of their approximate frequency. Schallert et al. concluded that, despite the presence of these cues, these authors generally required little effort and activity from their readers. They wrote,

> Pictures and graphs were provided. Directed imagery where an author might ask readers to imagine or construct a mental representation, was never used in our sample. Summaries were provided, but readers were not asked to summarize for themselves. . . . The most effort demanding cues that were used with any substantial frequency were questions to be answered by the reader. These were usually found at the ends of chapters and may have been easily overlooked during studying.

Armbruster and Ostertag (1993) and Turner (1989) point out that the quality of these questions may leave something to be desired.

It appears, then, that such a passive view of studying is fairly common among textbook authors. This view neglects the fact that readers vary enormously in their reasons for studying, in their ability and motivation, and in their methods of approach.

One particular distinction currently receiving much attention in Europe is that between "surface" and "deep" approaches

TABLE 34.6. The Strategies Used by Authors of Five Psychology and Five Biology Introductory Textbooks to Help Their Readers

Proportion of Use:		
Psychology Textbooks	Biology Textbooks	Strategies Used by Authors
45%	29%	Cues that direct the reader's attention (e.g., objectives, questions, boldfaces, italics)
25%	31%	Cues to signal content and organization (e.g., headings, summaries, overviews, outlines, intertextual references, text to graphic references)
10%	22%	Cues that help the reader to elaborate (e.g., examples, paraphrases, applications, marginal comments)
5%	11%	Cues to support the communication (e.g., tables, graphs, referenced drawings, photographs)
3%	5%	Cues that relate text material to familiar information (e.g., familiar quotes, allusions to common experiences and comparisons)
6%	2%	Cues that arouse and motivate the reader (e.g., humor, unreferenced illustration, photographs)

Note. Data based on Schallert et al. (1988).

to studying and reading (Hartley, 1998b; Richardson, 2000). Readers with a surface approach skim the text, retain isolated facts, and are not much concerned with the overall structure or argument of the text. Readers with a deep approach, however, search for the underlying structure of the text, question it, relate ideas in the text to their own prior knowledge and experience, and so on. Table 34.7 suggests how these different study strategies may manifest themselves. This distinction between deep and surface learning, of course, is only one of many similar ones. Whatever the terminology used, the question I am asking here is, How can one design instructional text to encourage readers to take a deeper and a more active approach to reading? One answer, I think, is to identify successful learning strategies for reading and to write the text in such a way that it encourages readers to practice them.

TABLE 34.7. The Effects of the Two Study Orientations on Reading

	Study Orientations	
Characteristics	*X*	*Y*
Motivation	Intrinsic, professional • Improve teaching • Improve self-knowledge • Develop understanding of teaching • Get more out of course • Put more effort into course (not concerned about grades)	Extrinsic • Obtain graduate qualifications • Achieve higher status • Get salary increment • Enhance employment prospects
Study strategies	Optimizing • Read beyond course materials • Process material three times • Generate own questions • Use textual material to evaluate own teaching whenever appropriate or interested	Satisficing • Select textual material for study that is relevant to assessment • Process material once • Complete minimal requirements • Use textual material to evaluate own teaching when required • Evaluate ideas in text when required
Student role	• Diverge from assigned or implied student role when necessary, appropriate	
General characteristics	Information processing is generally deep Student is: • More professionally oriented • Not text bound • An optimizer (that is, tries to get the most out of study)	Information processing is generally surface unless otherwise required Student is: • Assessment oriented • Text bound • A satisficer (that is, is satisfied with getting by on what is required by assessment)

If, as Newton (1984) suggested, we consider a book as a device to think with, and if we consider that active participation is more likely to foster understanding than is a passive role, then we must consider how, as textbook designers, we might achieve this. Newton suggested, for example, that we can use self-test questions ("not necessarily difficult ones"), outlines, and advance organizers to help pupils enter into a dialogue with the author. Also, he suggested, pupils can be encouraged to use the materials provided in an active way (for example, by constructing tables and drawing diagrams). Marland et al. (1990), in their study of distance-learning materials, similarly suggested that their findings had implications for text design. They wrote,

> It may be helpful if writers were to: reduce the scope of the content to allow for more in-depth study of the text; be explicit about the expectations as to study strategies to be employed, level or quality of student response and types of cognitive processes to be used when completing the in-text activity; structure the text in such a way that emphasises a cumulative, interactive organic view of learning rather than a view of learning as the acquisition of isolated bits of knowledge; design assessment activities which require re-interpretation and integration of substantial chunks of content; use outcomes of in-text activities as prerequisite knowledge for further study and make completion of some in-text activities compulsory.

Just how this might be achieved can be seen in a study by Portier and van Buuren (1995). These authors described a computer-aided text prepared for a distance-learning course that allowed students to access the course materials in a flexible way. Students using this text were able to choose whether or not they wished to read any of the text support devices such as examples, exercises, illustrations, and simulations. The authors found that students with high prior knowledge made *greater* use of the support devices in the electronic text than did students with low prior knowledge. Students with low prior knowledge preferred to stick to the basics; students with high prior knowledge were able to accommodate the extra information more easily.

In a chapter that I wrote in 1987 I listed 13 such strategies that writers, teachers, and students might use that would encourage deeper text processing. Jones (1988) similarly described a curriculum with such learning strategies embedded within it. Thus Newton, Marland, Jones, and I were arguing, along with others (e.g., Armbruster & Anderson, 1985; Rowntree, 1992), for what we called more *coherent* texts. Such texts

- are written for specific groups of readers;
- use language with which the readers are familiar;
- include experiences that readers share;
- provide meaningful examples;
- ask readers questions as they go along—not just in the headings or at the; end;
- provide examples and problems that readers actually have to work through in order to follow the exposition; and
- can be supplemented by other kinds of reading materials (see Lapp, Flood, & Ranck-Buhr, 1995).

I have written elsewhere chapters that illustrate how writers can use questions that readers have to answer in order to understand the following exposition (Hartley, 1985, 1986). More recent examples of coherent texts include Collins and Kneale's (2001) *Study Skills for Psychology Students,* Girden's (2001) *Evaluating Research Articles,* and books in the American Psychological Association's series, *Psychology in the Classroom.* Given the preponderance of textbooks in our schools, changing the ways in which we write them can make a major improvement to instructional practice.

34.8 FUTURE DIRECTIONS

In the sections above I have described a good deal of research on designing instructional and informational text. Much of this research, however, as I noted previously, is uncoordinated and atheoretical. Most researchers focus on one particular feature of text design, few consider the effects of several features in combination, few focus on what readers do with particular features and thus concentrate solely on the outcomes, and few carry out carefully developed programmatic studies.

In addition, most researchers work within a particular framework. Researchers with a leaning toward a cognitive approach, for instance, might look, for example, at how prior knowledge affects the usefulness of headings or other support devices (e.g., Portier & van Buuren, 1996; Wilhite, 1989). In contrast, researchers following a constructivist approach might focus on how getting readers to generate their own outlines, headings, or questions might be more advantageous than simply reading author-provided ones (e.g., see Foos et al., 1994; Speigel & Barufaldi, 1994). This distinction between author-provided and reader-provided devices occurs in research on summaries, outlines, headings, questions, and underlining. Presumably, too, it also affects how one writes instructional text.

Furthermore, we need to remember that textbooks are constantly evolving. Weiten and Wight (1992) provided a good example of this in their historical analysis of introductory textbooks in psychology. Currently British textbooks lag behind American ones in this evolutionary process. British textbooks use far less color and far fewer graphics, although things are changing. In 5 to 10 years, no doubt, our schoolchildren and our university students will be familiar with multimedia interactive text that they will read on colorful screens. Textbooks, *as we currently know them,* may become a thing of the past. Some people (e.g., Jonassen, 1992; Schlosser, 1994) have already predicted the demise of the textbook and described current textbooks as obsolescent. Although I think these people go too far, I do agree that the physical nature of instructional and informational text may change. New technology already allows visually handicapped students to print out text in the type sizes and typefaces that they prefer. Readers are already able to download or read on screen materials in their preferred fonts, type sizes, line lengths, margins, etc. Thus, with the help of new technology, students can customize their own materials (Lucke, 1998; MacArthur & Haynes, 1995). They can choose, for example,

- different typefaces,
- different type sizes,
- the presence or absence of inserted questions,
- summaries listed before or after the text prose,
- concept maps or outlines,
- embedded or marginal headings,
- headings written as statements or questions, and
- specific chapters from the ones available.

In other words, the future directions of instructional and informational design may be more under the control of the readers than the authors. Research in instructional design may never answer the question "Which typeface/type size/line length/etc. is best?" for every individual occasion, but it may allow us to present readers of the future with appropriate menus from which to choose.

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References

AARP (1986). *Truth about aging: Guidelines for accurate communications*. Washington, DC: American Association of Retired Persons.

Allington, R. L., & Weber, R. (1993). Questioning questions in teaching and learning from text. In B. K. Britton, A. Woodward, & M. Binkley (Eds.), *Learning from textbooks: Theory and practice* (pp. 47–68). Hillsdale, NJ: Erlbaum.

Alverman, D. (1989). Teacher-student mediation of content area texts. *Theory into Practice, 27,* 142–147.

Armbruster, B. B., & Anderson, T. H. (1995). Producing "considerate" expository text: Or easy reading is damned hard writing. *Journal of Curriculum Studies, 17,* 247–274.

Armbruster, B. B., & Ostertag, J. (1993). Questions in elementary science and social studies textbooks. In B. K. Britton, A. Woodward, & M. Binkley (Eds.), *Learning from textbooks: Theory and practice* (pp. 69–94). Hillsdale, NJ: Erlbaum.

Atkinson, R. A., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional principles from worked examples research. *Review of Educational Research, 70, 2,* 181–214.

Badzinski, D. M., Cantor, J., & Hoffner, C. (1989). Children's understanding of quantifiers. *Child Study Journal, 19*(4), 241–258.

Beck, I. L., McKeown, M. G., & Worthy, J. (1995). Giving a text voice can improve students' understanding. *Reading Research Quarterly, 30*(2), 220–238.

Berger, A. A. (1993). *Improving writing skills: Memos, letters, reports and proposals.* Newbury Park, CA: Sage.

Berger, S. (1991). *The design of bibliographies: Observations, references and examples.* London: Mansell.

Berry, D. C., Michas, I. C., Gillie, T., & Forster, M. (1997). What do patients want to know about their medicines, and what do doctors want to tell them? A comparative study. *Psychology and Health, 12*(4), 467–480.

Black, A. (1990). *Typefaces for desktop publishing: A user guide*. London: Architecture Design and Technology Press.

Boostrom, R. (2001). Wither textbooks? *Journal of Curriculum Studies, 33*(2), 229–245.

Boscolo, P., Cisotto, L., & Lucca, A. (1992). Text comprehension and typographical features of elementary school textbooks. In B. van Hout-Wolters & W. Schnotz (Eds.), *Text comprehension and learning from text* (pp. 72–83). Amsterdam: Swets & Zeitlinger.

Bracken, B. A. (1982). Effect of personalized basal stories on the reading comprehension of fourth-grade poor and average readers. *Contemporary Educational Psychology, 7,* 320–324.

Bransford, J. D. (1979). *Human cognition.* Belmont, CA: Wadsworth.

Bransford, J. D., & Johnson, M. K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior, 11* 716–726.

Bruce, I., McKennell, A., & Walker, E. (1991*). Blind and partially sighted adults in Britain: The RNIB Survey, Vol. 1.* London: HMSO.

Bruine de Bruin, W. B., Fischhoff, B., Millstein, S. G., & Halpern-Felsher, B. L. (2000). Verbal and numerical expressions of probability: "It's a fifty-fifty chance." *Organizational Behavior and Human Decision Processes, 81*(1), 115–131.

Byrd, M. (1985). Age differences in the ability to recall and summarize textual information. *Experimental Aging Research, 16*(3), 151–154.

Carpenter, P. A., & Just, M. A. (1977). Reading comprehension as the eyes see it. In M. A. Just & P. A. Carpenter (Eds.), *Cognitive processes in comprehension* (pp. 109–139). Hillsdale, NJ: Erlbaum.

Carroll, M., & Korukina, S. (1999). The effect of text coherence and modality on metamemory judgements. *Memory, 7*(3), 309–322.

Cataldo, M. G., & Cornoldi C. (1998). Self-monitoring in poor and good reading comprehenders and their use of strategy. *British Journal of Developmental Psychology, 16* 155–165.

Chall, J. S., & Conard, S. S. (1991). *Should textbooks challenge students? The case for easier or harder books.* New York: Teachers College Press.

Chapanis, A. (1965). Words, words, words. *Human Factors, 7*(1), 1–17.

Chapanis, A. (1988). "Words, Words, Words" revisited. *International Review of Ergonomics, 2* 1–30.

Clay, R. A. (2001). It was bad design, not dumb voters. *Monitor on Psychology, 32*(3), 30–31.

Coleman, E. B., Brown, A. L., & Rivkin, I. D. (1997). The effect of instructional explanations on learning from scientific texts. *Journal of the Learning Sciences, 6*(4), 347–365.

Collins, S. Y., & Kneale, P. E. (2001). *Study skills for psychology students.* London: Arnold.

Couloubaritsis, A., Moss, G. D., & Abouserie, R. (1994). Evaluating curriculum materials: Do Greek children understand their history textbook? *Education Training and Technology International, 31*(4), 268–275.

Czuchry, M., & Dansereau, D. F. (1998). The generation and recall of personally relevant information. *Journal of Experimental Information, 66*(4), 293–315.

Davis-Dorsey, J. D., Ross, S. M., & Morrison, G. R. (1991). The role of rewording and context personalization in the solving of mathematical word problems. *Journal of Educational Psychology, 83,* 61–68.

Davison, A., & Green, G. (Eds.). (1988). *Linguistic complexity and text comprehension: Readability issues re-considered.* Hillsdale, NJ: Erlbaum.

de Jong, M. D. T., & Lentz, L. R. (1996). Expert judgements versus reader feedback: A comparison of text evaluation techniques. *Journal of Technical Writing, 26*(4), 507–519.

DeMarco, L. M., & Massof, R. W., (1997, January–February). Distributions of print sizes in U.S. newspapers. *Journal of Visual Impairment and Blindness,* 9–13.

DiGisi, L. L., & Willett, J. B. (1995). What high school biology teachers say about their textbook use: A descriptive study. *Journal of Research in Science Teaching, 32*(2), 123–142.

Dwyer, F. M. (1978). *Strategies for improving visual learning*. State College, PA: Learning Services.

Ehrenberg, A.S.C. (1977). Rudiments of numeracy. *Journal of the Royal Statistical Society, A, 140,* 227–297.

Evans, H. (1972). *Editing and design, Vol. 1*. London: Heinemann.

Farr, R., & Tulley, M. A. (1985). Do adoption committees perpetuate mediocre textbooks? *Phi Delta Kappan, 66*(7), 467–471.

Fisher, D. (1976). Spatial factors in reading and research: the case for space. In R. A. Monty & J. W. Senders (Eds.), *Eye-movements and psychological processes* (pp. 417–428). Hillsdale, NJ: Erlbaum.

Foos, P. W., Mora, J. J., & Tkacz, S. (1994). Student study techniques and the generation effect. *Journal of Educational Psychology, 86*(4), 567–576.

Foster, J. J. (1979). The use of visual cues in text. In P. A. Kolers, M. E. Wrolstad, & H. Bouma (Eds.), *Processing of visible language, Vol. 1* (pp.189–203). New York: Plenum.

Fowler, H. W., & Fowler, F. G. (1906). *The King's English* (1st ed.). Oxford: Clarendon Press.

Garner, R., & Alexander, P. A. (Eds.). (1994). *Beliefs about text and instruction with text.* Hillsdale, NJ: Erlbaum.

Gill, J. (1997). *Access prohibited? Information for designers of public access terminals.* London: RNIB.

Gill, J. (2001). *Keeping step? Scientific and technological research for visually impaired people.* London: RNIB.

Girden, E. R. (2001). *Evaluating research articles* (2nd ed.). Thousand Oaks, CA: Sage.

Glover, J. A., Dinnel, D. L., Halpain, D. R., McKee, R. K., Corkhill, A. J., & Wise, S. L. (1988). Effects of across-chapter signals on recall of text. *Journal of Educational Psychology, 80*(1), 3–15.

Griggs, R. A., & Koenig, C. S. (2001). Brief introductory textbooks: A current analysis. *Teaching of Psychology, 28*(1), 36–40.

Guri-Rozenblit, S. (1989). Effects of a tree diagram on students' comprehension of main ideas in an expository text with multiple themes. *Reading Research Quarterly, 14*(2), 226–247.

Haddock, G. (1998). The influence of response scale alternatives on judgements of future academic expectations. *British Journal of Educational Psychology, 68,* 113–119.

Hall, R. M., Hall, M. A., & Saling, C. B. (1999). The effects of graphical postorganization strategies on learning from knowledge maps. *Journal of Experimental Education, 67*(2), 101–112.

Hamaker, C. (1986). The effects of adjunct questions on prose learning. *Review of Educational Research, 56*(2), 212–242.

Hamilton, R. J. (1985). A framework for the evaluation of the effectiveness of adjunct questions and objectives. *Review of Educational Research, 55*(1), 47–85.

Harp, S. F., & Mayer, R. E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. *Journal of Educational Psychology, 90*(3), 414–434.

Harrison, S., & Bakker, P. (1998). Two new readability predictors for the professional writer. *Journal of Research in Reading, 21*(2), 121–138.

Hartley, J. (1985). Developing skills of learning. In A. Branthwaite & D. Rogers (Eds.), *Children growing up* (pp. 112–121). Milton Keynes, UK: Open University Press.

Hartley, J. (1986). Learning skills and their improvement. In A. Gellatly (Ed.), *The skillful mind* (pp. 143–155). Milton Keynes, UK: Open University Press.

Hartley, J. (1989). Text design and the setting of Braille (with a footnote on Moon). *Information Design Journal, 5*(3), 183–190.

Hartley, J. (1991a). Thomas Jefferson, page design and desktop publishing. *Educational Technology, XXXI*(1), 54–57.

Hartley, J. (1991b). Tabling information. *American Psychologist, 46*(6), 655–656.

Hartley, J. (1993). Recalling structured text: Does what goes in determine what comes out? *British Journal of Educational Technology, 24*(3), 85–91.

Hartley, J. (1994a). *Designing instructional text* (3rd ed.). East Brunswick, NJ: Nichols.

Hartley, J. (1994b). Three ways to improve the clarity of journal abstracts. *British Journal of Educational Psychology, 64*(2), 331–343.

Hartley, J. (1998a). Return to sender. Why written communications fail. *The Psychologist, 11*(10), 477–480.

Hartley, J. (1998b). *Learning and studying: A research perspective.* London: Routledge.

Hartley, J. (1999). What does it say? Text design, medical information and older readers. In DC. Park, R. W. Morrell, & K. Shifrin (Eds.), *Processing of medical information in aging patients* (pp. 233–247). Mahwah, NJ: Erlbaum.

Hartley, J. (2000). Typographic settings for structured abstracts. *Journal of Technical Writing and Communication, 30*(4), 355–365.

Hartley, J., & Benjamin, M. (1998). An evaluation of structured abstracts in journals published by the British Psychological Society. *British Journal of Educational Psychology, 68*(3), 443–456.

Hartley, J., Burnhill, P., & Davies, L. (1978). The effects of line-length and paragraph denotation on the retrieval of information from prose text. *Visible Language, 12*(2), 183–194.

Hartley, J., & Ganier, F. (2000). Which do you prefer? Some observations on preference measures in studies of structured abstracts. *European Science Editing, 26*(1), 4–7.

Hartley, J., & Johnson, M. (2000). Portrait or landscape? Typographical layouts for patient information leaflets. *Visible Language, 34*(3), 296–309.

Hartley, J., & Trueman, M. (1982). The effects of summaries on the recall of information from prose text. *Human Learning, 1,* 63–82.

Hartley, J., & Trueman, M. (1985). A research strategy for text designers: The role of headings. *Instructional Science, 14*(2), 99–155.

Hartley, J., Trueman, M., & Burnhill, P. (1980). Some observations on producing and measuring readable writing. *Programmed Learning and Educational Technology, 17*(3), 164–174.

Hartley, J., Trueman, M., & Rodgers, A. (1984). The effects of verbal and numerical quantifiers on questionnaire responses. *Applied Ergonomics, 11,* 149–155.

Hershberger, W. A., & Terry, D. F. (1965). Typographic cueing in conventional and programmed texts. *Journal of Applied Psychology, 49*(1), 55–60.

Hidi, S., & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research, 70*(2), 151–179.

Hinchman, K. (1987). The textbook and those content-area teachers. *Reading Research and Instruction, 26,* 247–263.

Hofman, R., & van Oostendorp, H. (1999). Cognitive effects of a structural overview in a hypertext. *British Journal of Educational Technology, 30*(2), 129–140.

Isakson, C. S., & Spyridakis, J. H. (1999). The influence of semantics and syntax on what readers remember. *Technical Communication, 3rd Quarter,* 366–381.

Jandreau, S., & Bever, T. G. (1992). Phrase-spaced formats improve comprehension in average readers. *Journal of Applied Psychology, 77,* 143–146.

Jonassen, D. H. (1982). Introduction to Section III: Electronic text. In D. H. Jonassen (Ed.), *The technology of text: Principles for structuring, designing and displaying text* (pp. 379–381). Englewood Cliffs, NJ: Educational Technology.

Jones, B. F. (1988). Text learning strategy instruction: guidelines from theory and practice. In C. E. Weinstein, E. Goetz, & P. A. Alexander (Eds.), *Learning and study strategies* (pp. 233–260). San Diego, CA: Academic Press.

Jones, R., Pearson, J., McGregor, S., Cawsey, A. J., Barrett, A, Craig, N., Atkinson, J. M., Gilmour, W. H., & McEwen, J. (1999). Computers that personalise: Randomised trials of personalised computer-based information for cancer patients. *British Medical Journal, 319,* 1241–1247.

Jordan, M. P. (1998). The power of negation in English: Text, context and relevance. *Journal of Pragmatics, 29,* 705–702.

Keys, E. (1993). Typography, color and information structure. *Technical Communication, 40*(4), 638–654.

Kinross, R. (1994). Unjustified text and the zero hour. *Information Design Journal, 7*(3), 243–252.

Kirby, J. R., & Pedwell D. (1991). Students' approaches to summarisation. *Educational Psychology, 11,* 297– 307.

Kohut, G. F., & Gorman, K. J. (1995). The effectiveness of leading grammar/style software packages in analysing business students' writing. *Journal of Business and Technical Communication, 9*(3), 341–361.

Lapp, D., Flood, J., & Ranck-Buhr, W. (1995). Using multiple text formats to explore scientific phenomena in middle school classrooms. *Reading and Writing Quarterly*: *Overcoming Learning Difficulties, 11,* 173–186.

Lee, A. Y., & Hutchison, L. (1998). Improving learning from examples through reflection. *Journal of Experimental Psychology: Applied, 4*(3), 187–210.

Lewis, C., & Walker, P. (1989). Typographic influences on reading. *British Journal of Psychology, 80*(2), 241–258.

Lockwood, F. (1995). A cost benefit analysis model to describe the perception and use of activities in self-instructional texts. *European Journal of the Psychology of Education, 10*(2), 145–152.

Lorch, R. F., & Chen, A. H. (1986). Effects of number signals on reading and recall. *Journal of Educational Psychology, 78*(4), 263–270.

Lorch, R. F., & Lorch, E. P. (1995). Effects of organizational signals on text-processing strategies. *Journal of Educational Psychology, 87*(4), 537–544.

Lorch, R. F., Lorch, E. P., & Inman, W. I. (1993). Effects of signalling topic structure on text recall. *Journal of Educational Psychology, 85*(2), 281–290.

Loxterman, J. A., Beck, I. L., & McKeown, M. G. (1994). The effects of thinking aloud during reading on students' comprehension of more or less coherent text. *Reading Research Quarterly, 29*(4), 353–368.

Lucca, A., Boscolo, P., & Cisotto, L. (1991). Unpublished paper. (Cited in Lucca, Boscolo, & Cisotto, 1994.)

Lucca, A., Boscolo, P., & Cisotto, L. (1994). Typographical cueing and text comprehension: The effect of written signalling and text structure. In F. P. C. M. de Jong & B. van Hout-Walters (Eds.), *Process oriented instruction and learning from text* (pp. 205–214). Amsterdom: V. U. University Press.

Lucke, K. (1998). Customized digital books on demand: Issues in the creation of a flexible document format. *Visible Language, 32*(2), 128–149.

MacArthur, C. A., & Haynes, J. B. (1995). Student assistant for learning from text (SALT): A hypermedia reading aid. *Journal of Learning Disabilities, 28*(3), 150–159.

Mansfield, J. S., Legge, G., & Bane, M. C. (1996). Psychophysics of reading XV: Font effects in normal and low vision. *Investigative Ophthalmology & Visual Science, 37*(8), 1492–1591.

Marek, P., Griggs, R. A., & Christopher, N. (1999). Pedagogical aids in textbooks: Do college students' perceptions justify their prevalence? *Teaching of Psychology, 26*(1), 11–18.

Marland, P., Patching, W., Putt, I., & Store, R. (1984). Learning from distance-teaching materials: A study of students' mediating responses. *Distance Education, 5*(2), 215–236.

Marland, P., Patching, W., Putt, I., & Putt, R. (1990). Distance learners' interactions with text while studying. *Distance Education,11*(1), 71–91.

Marland, P., Patching, W., & Putt, I. (1992). *Learning from text: Glimpses inside the minds of distance learners.* Townsville, Australia: James Cook University of North Queensland.

Martens, R., & Valcke, M. (1995). Validation of a theory about functions and effects of embedded support devices in distance learning materials. *European Journal of the Psychology of Education, 10*(2), 181–196.

Mayer, R. E., Bove, W., Bryman, A., Mars, R., & Tapangeo, L. (1996). When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. *Journal of Educational Psychology, 88*(1), 64–73.

McDaniel, M. A., Waddill, P. J., Finstad, K., & Bourg, T. (2000). The effects of text-based interest on attention and recall. *Journal of Educational Psychology, 92*(3), 492–502.

Meyer, B. J. F. (1985). *The organisation of prose and its effects upon memory.* New York: Elsevier.

Meyer, B. J. F. (1997). Contextualization—Text structure. In A. Ram (Ed.), *Computational models of reading and understanding.* Cambridge, MA: MIT Press.

Meyer, B. J. F., Young, C. J., & Bartlett, B. J. (1989). *Memory improved: Reading and memory enhancement across the life-span through strategic text structures*. Hillsdale, NJ: Erlbaum.

Michelson, G. (1994). Use of colons in titles and journal status in industrial relations journals. *Psychological Reports, 74,* 657–578.

Miles, J. (1987). *Design for desktop publishing*. San Francisco: Chronicle Books.

Misanchuk, E. R. (1992). *Preparing instructional text: Document design using desktop publishing.* Englewood Cliffs, NJ: Educational Technology.

Moreno, R., & Mayer, R. E. (2000). Engaging students in active learning: The case for personalized multi-media messages. *Journal of Educational Psychology, 92*(4), 724–733.

Morrell, R. W. (2001). *Older adults, health information, and the World Wide Web.* Mahwah, NJ: Erlbaum.

Morrow, D., & Lierer, V. (1999). Designing medical instructions for older adults. In D. C. Park, R. W. Morrell & K. Shifren (Eds.), *Processing of medical information for aging patients* (pp. 249–265). Mahwah, NJ: Erlbaum.

Moxey, L. M., & Sanford, A. J. (1993). *Communicating quantities: A psychological perspective.* London: Erlbaum.

Muncer, S. J., Gorman, B. S., Gorman, S., & Bibel, D. (1986). Right is wrong: An examination of the effect of right justification on reading. *British Journal of Educational Technology, 17*(1), 5–10.

Newton, D. P. (1994). Textbooks in science teaching. *School Science Review, 66,* 235, 388–391.

Niegemann, H. M. (1982). Influences of titles on the recall of instructional texts. In A. Flammer & W. Kintsch (Eds.), *Discourse processing.* Amsterdam: North-Holland.

Nisbet, P., Spooner, R., Arthur, E., & Whittaker (1999). *Supportive writing technology.* Edinburgh: CALL Centre, University of Edinburgh.

Paterson, D. G., & Tinker, M. (1929). Studies of typographical factors influencing speed of reading. II. Size of type. *Journal of Applied Psychology, 13,* 120–130.

Pedler, J. (2001). Computer spellcheckers and dyslexics—A performance survey. *British Journal of Educational Technology, 32*(1), 23–37.

Pennebaker, J. W., & King, L. A. (1999). Linguistic styles: Language use as an individual difference. *Journal of Personality and Social Psychology, 77*(6), 1296–1312.

Portier, S. J., & van Buuren, H. A. (1995). An interactive learning environment (ILE) to study statistics: effects of prior knowledge on the use of embedded support devices. *European Journal of Psychology of Education, X*(2), 197–207.

Posner, G. J., & Strike, K. A. (1976). A categorisation scheme for principles of sequencing content. *Review of Educational Research, 46,* 685–690.

Prentice-Dunn, S., Floyd, D. L., & Flournoy, J. M. (2001). Effects of persuasive message order on coping with breast cancer information. *Health Education Research, 16*(1), 81–84.

Qualls, S. H., & Abeles, N. (Eds.). (2000). *Psychology and the aging revolution: How we adapt to longer life.* Washington, DC: American Psychological Association.

Raban, B. (1982). Text display effects on the fluency of young readers. *Journal of Research in Reading, 5*(1), 7–28.

Rayner, K., Kambe, G., & Duffy, S. A. (2000). The effect of clause wrap-up on eye-movements during reading. *Quarterly Journal of Experimental Psychology, 53A*(4), 1061–1080.

Reid, D. J., Briggs, N., & Beveridge, M. (1983). The effects of pictures upon the readability of a school science topic. *British Journal of Educational Psychology,* 53, 327–335.

Rice, G. E., Meyer, B. J. F., & Miller, D. C. (1989). Using text structure to improve older adults' recall of important medical information. *Educational Gerontology, 15,* 527–542.

Richardson, J. T. E. (2000). *Researching student learning.* Buckingham, UK: Open University Press.

Riggle, K. B. (1998). Using the active and passive voice appropriately in on-the-job writing. *Journal of Technical Writing and Communication, 28*(1), 85–117.

Robertson, I., & Kahney, H. (1996). The use of examples in expository texts: Outline of an interpretation theory for text analysis. *Instructional Science, 24,* 93–123.

Rook, K. (1987). Effects of case-history versus abstract information on health attitudes and behaviors. *Journal of Applied Social Psychology, 17*(6), 533–553.

Roth, K., & Anderson, C. (1988). Promoting conceptual change learning from science textbooks. In Ramsden, P. (Ed.), *Improving learning: New perspectives* (pp. 109–141). London: Kogan Page.

Rowntree, D. (1992). *Exploring open and distance learning*. London: Kogan Page.

Sadoski, M., Goetz, E. T., & Rodriguez, M. (2000). Engaging texts: Effects of concreteness on comprehensibility, interest, and recall in four text types. *Journal of Educational Psychology, 92*(1), 85–95.

Schallert, D. L., Alexander, P. A., & Goetz, E. (1988). Implicit instruction of strategies for learning from text. In C. E. Weinstein, E. Goetz, & P. A. Alexander (Eds.), *Learning and study strategies* (pp. 193–214). San Diego, CA: Academic Press.

Schlosser, B. (1994, August). Books have already entered the stage of obsolescence. *APA Monitor 25*(8).

Schraw, G. (1998). Processing and recall differences among seductive details. *Journal of Educational Psychology, 90*(1), 3–12.

Schriver, K. A. (1989). Evaluating text quality: The continuum from text-focused to reader-focused methods. *IEEE Transactions on Professional Communication, 32*(4), 238–255.

Schriver, K. A. (1997). *Dynamics of document design.* New York: Wiley.

Schumacher, G. M. (1985). Reaction to "Americans Develop Plans for Government." *Journal of Curriculum Studies, 17*(3), 263–267.

Seki, Y. (2000). Using lists to improve text access: The role of layout in reading. *Visible Language, 34*(3), 280–295.

Shaw, A. (1969). *Print for partial sight.* London: Library Association.

Sherrard, C. (1988). What is a summary? *Educational Technology, 28*(9), 47–50.

Small, J. P. (1997). *Wax tablets of the mind: Cognitive studies of classical antiquity.* New York: Routledge.

Smith, S. L., & Aucella, A. F. (1983). Numbering formats for hierarchic lists. *Human Factors, 25*(3), 343–348.

Society for Environmental Graphic Design. (1993). The Americans with Disabilities Act white paper: *SEGD's clarification and interpretation of the ADA signage requirements*. Cambridge, MA: Society for Environmental Graphic Design.

Spencer, H. (1969). *The visible word*. London: Lund Humphries.

Spiegel, G., & Barufaldi, J. P. (1994). The effects of a combination of text structure awareness and graphic postorganizers on recall and retention of scientific knowledge. *Journal of Research in Science Teaching, 31*(9), 913–932.

Spyridakis, J. H. (1989a). Signaling effects: A review of the research—Part 1. *Journal of Technical Writing and Communication, 19*(3), 227–240.

Spyridakis, J. H. (1989b). Signaling effects: increased content retention and new answers—Part 2. *Journal of Technical Writing and Communication, 19*(4), 395–415.

Spyridakis, J. H., & Isakson, C. S. (1998). Nominalizations vs. denominalizations: Do they influence what readers recall? *Journal of Technical Writing and Communication, 28*(2), 163–188.

Spyridakis, J. H., & Standal, T. C. (1987). Signals in expository prose: Effects on reading. *Reading Research Quarterly, 12*(3), 285–298.

Spyridakis, J. H., & Williams, T. R. (1992). Text headings: Do readers perceive what we think they do? In *Proceedings of the 39th Conference of the Society for Technical Communication, Atlanta, May* (pp. 433–435).

Swann, A. (1989). *How to design grids*. London: Phaedon.

Sydes, M., & Hartley, J. (1997). A thorn in the Flesch: Observations on the unreliability of computer-based readability formulae. *British Journal of Educational Technology, 28*(2), 143–45.

Tannenbaum, P., Jacobson, H., & Norris, E. (1964). An experimental investigation of typeface connotations. *Journalism Quarterly, 41*(1), 65–73.

Taylor, W. L. (1953). Cloze procedure: A new tool for measuring readability. *Journalism Quarterly, 30,* 415–433.

Thiede, K. W., & Anderson, M. C. M. (2001). *Summarizing can improve metacomprehension accuracy.* Paper presented at the Annual Convention of the American Educational Research Association.

Thomas, J. M. (1984). Four introductions to psychology. *Contemporary Psychology, 29*(8), 629–632.

Tinker, M. A. (1963). *Legibility of print.* Ames: Iowa State University Press.

Tinker, M. A. (1965). *Bases for effective reading*. Ames: Iowa State University Press.

Tinker, M. A., & Paterson, D. G. (1928). Influence of type form on speed of reading. *Journal of Applied Psychology, 12*(4), 359–368.

Townsend, M. A. R., Moore, D. W., Tuck, B. F., & Wilton, K. M. (1990). Headings within multiple-choice tests as facilitators of test performance. *British Journal of Educational Psychology, 60,* 153–160.

Turner, T. N. (1989). Using textbook questions intelligently. *Social Education, 53,* 58–60.

U.S. Department of Justice. (1988). *Access to printed information by visually-impaired persons.* Technical Assistance Guide: Civil Rights Division.

Van Patten, B., Chao, C. I., & Reigeluth, C. M. (1986). A review of strategies for sequencing and synthesising information. *Review of Educational Research, 56,* 437–472.

Walker, E., Tobin, M., & McKennell, A. (1992). *Blind and partially sighted children in Britain: The RNIB survey, Vol. 2.* London: HMSO.

Waller, R. (1979). Typographic access structures for educational texts. In P. A. Kolers, M. E. Wrolstad, & H. Bouma (Eds.), *Processing of visible language, Vol. 1* (pp. 175–188). New York: Plenum.

Waller, R. (1980). Notes on transforming No. 4: Numbering systems in text. In J. Hartley (Ed.), *The psychology of written communication* (pp. 145–153). London: Kogan Page.

Watts, L., & Nisbet, J. (1974). *Legibility in children's books*. London: National Foundation for Educational Research.

Weiten, W., & Wight, R. D. (1992). Portraits of a discipline: An examination of introductory textbooks in America. In A. E. Puente, J. R. Matthews, & C. L. Brewer (Eds.), *Teaching psychology in America: A history.* Washington, DC: American Psychological Association.

Weiten, W., Deguara, D., Rehmke, E., & Sewell, L. (1999). University, community college, and high-school students' evaluations of textbook pedagogical aids. *Teaching of Psychology, 26*(1), 19–21.

Welsh, T., Murphy, K., Duffy, T. M., & Goodrum, D. A. (1993). Accessing elaborations on core information in a hypermedia environment. *Educational Technology Research and Development, 41*(2), 19–34.

Weston, C., Le Maistre, C., McAlpine, L., & Bordonaro, T. (1997). The influence of participants in formative evaluation on the learning from written instructional materials. *Instructional Science, 25,* 368–386.

Wilhite, S. C. (1989). Headings as memory facilitators: The importance of prior knowledge. *Journal of Educational Psychology, 81,* 115–117.

Williams. J. M. (1997). *Style: Ten lessons in clarity and grace* (5th ed.). New York: Longman.

Wilson, R., Kenny, T., Clark, J., Moseley, D., Newton, L., Newton, D., & Purves, I. (1998). Ensuring the readability and understandability and efficacy of patient information leaflets. *Prodigy Publication, No. 30.* Newcastle, UK: Sowerby Centre for Health Informatics, Newcastle University.

Windschitl, P. D., & Wells, G. L. (1996). Measuring psychological uncertainty: Verbal versus numeric methods. *Journal of Experimental Psychology: Applied, 2*(4), 343–364.

Wogalther, M. S., Begley, P., Scancorelli, L. F., & Brelsford, J. W. (1997). Effectiveness of elevator signs: Measurement of perceived understanding, willingness to comply and behaviour. *Applied Ergonomics, 28*(3), 181–187.

Woolls, D., & Coulthard, R. M. (1998). Tools for the trade. *Forensic Linguistics: The International Journal of Speech, Language and Law, 5*(1), 33–57.

Wright, P. (2000). Supportive documentation for older people. In P. Westendorp, C. Jansen, & R. Punselie (Eds.), *Interface Design and Document Design* (pp. 81–100). Amsterdam: Rodopi.

Zahorik, J. A. (1991). Teaching styles and textbooks. *Teaching and Teacher Education, 7*(2), 185–196.

Zeller,N., & Farmer, F. M. (1999). Catchy, clever titles are not acceptable: Style, APA, and qualitative reporting. *International Journal of Qualitative Studies in Education, 12*(1), 3–21.