ArchiTEX A Preliminary International Page Pattern Maker

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Abstract

TEX was created in the tradition of typesetting printed pages for bound volumes. For hundreds of years, printers considered the page as a block of type surrounded by margins. As adequate margins were required for binding, practical considerations became aesthetic needs applied by strict formulas. Earlier concepts of pages, such as certain Egyptian hieroglyphs, Roman scrolls, and medieval illuminated manuscripts, considered the entire page area as a pattern, to be filled or not, depending on numerous aesthetic, practical, or economic criteria.

New methods of production, such as photomechanical plates, or types of display, such as video terminals, mean that page design and formatting need not be limited by traditional conventions. Instead, pages can be considered for loose-leaf books (especially with on-demand printing), where text, graphics, and space are arranged over multi-page spreads. Or, in another instance, pages can be treated as small blocks, called up and presented in a multi-window environment on a video terminal.

The limitations of the printed page are not intrinsic to TEX. TEX macros can be modified to present text, graphics, and space in blocks on a complete or partial page block (that can be combined or recombined). TEX macros can also free reading order from European conventions. The same macro, for instance, can produce lettered lists using any alphabet in a cartesian coordinate system. A prototype markup language, ArchiTEX, uses select TEX macros to produce flexible, modular page patterns for a variety of output devices.

The evolution of print from rock faces to liquid crystal displays can be characterized in four formats.

- Archaic (rock, bone)
- Classic (scroll, book)
- Modern (newspaper, magazine)
- Hypernian (computer, laser)

Typographic presentations evolved from the process of inscription, which has been limited by tools (such as chisel, pen, laser) and media (such as stone, paper, cathode ray tube). Each format can be characterized by media, speed of transmission, and ubiquity. Each format is also part of a historical sequence as well, and its particular uniqueness is the result of the interaction of unique characteristics. After ten thousand years or more, some archaic peoples still put expressions on rock faces; even modern peoples do so on the walls of buildings in cities—it's called graffiti or art. Books have been printed on clay, wood, leather, and paper for over three thousand years. News format, in newspapers and magazines, for several hundred. Hypermedia, coordinated by computer, for two decades. All four formats exist concurrently.

Traditional Page Shapes

Classic. In Egypt, the pith of papyrus stalks were cut into thin strips, which were dried and then laid out in a row with edges overlapping. Another row was laid crosswise, then the two layers were moistened and pounded together. The sheet was sized, dried and glazed; it was supple and flexible—very suitable for being rolled. Sheets could then be glued together side-by-side to form long sections (possibly several hundred feet long). Ordinarily sheets were 6-7 inches high. The side

with horizontal strips is called the recto side; the vertical is called verso. The recto side was preferred for writing and became the inner side when rolled. The blank verso became the outside. Egyptian papyrus scrolls were written in hieratics (a simplified form of heiroglyphics, and later further simplified in demotics) in vertical columns separated by thin black lines; sometimes illustrations accompanied the text along the top or bottom of the scroll. As illustration assumed more importance it was placed in the text. Many scrolls had a horizontal frieze marked off from text by double ruled lines—for important scenes, the enlarged and extended completely into the text area the full height of the scroll (see Figure 1).

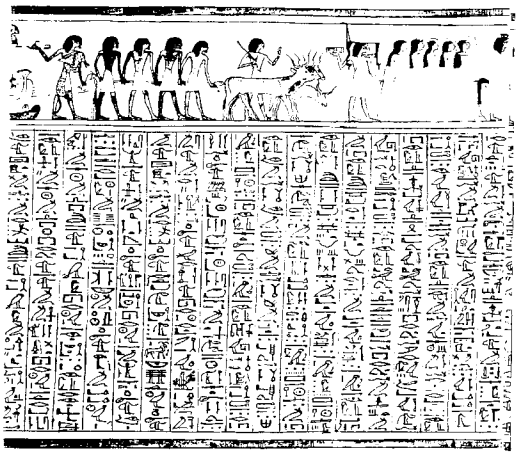


Figure 1. Egyptian *Book of the Dead*

Several hundred years later, the text was presented horizontally from right to left in columns, and the illustrations were put in the columns of text where they were related, sometimes narrower but rarely wider than the column. This format persisted through Greek and Roman manuscripts to medieval and modern books. Thus, columns of text, with illustrations, forms one of the oldest conventions of book formatting. A book was read by unrolling it. The division into columns effectively divided the book into "pages". The text began at the extreme right and moved from right to left. When the book was finished it had to be rerolled.

Although the Chinese (at about the same time) started writing on shell and bone, they made wooden tablets, and later, paper (a silk, cotton, leaf composite) pages into books. Writing began in the upper right corner and ran downward; lines moved from right to left.

Greek scrolls were smaller than Egyptian ones. Although Greek scrolls were also written in columns, characters were presented continuously, in capitals, without breaks between words. Illustrations were included within text (see Figure 2). Punctuation was usually nonexistent. Breaks in thought were sometimes indicated by an underlining stroke known as a *paragraphos* or by a small blank space. Although there was blank space at the beginning of a scroll, to protect the first part of the roll, titles, if any, appeared at the end of the text. As books were more widely read, top and bottom margins became wider to protect the text as the papyrus wore at the edges.

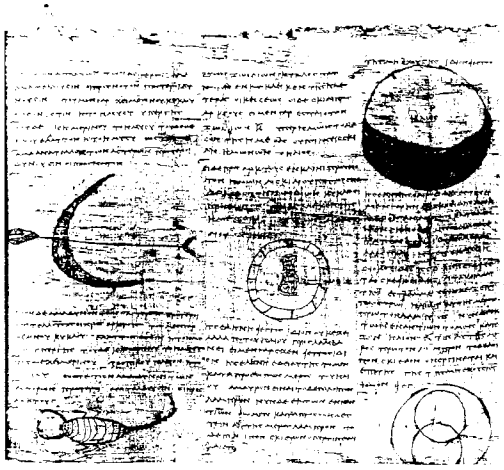


Figure 2.*Eudoxus* Roll

The Greeks copied papyrus books, but also used small tablets of wood for writing exercises. Two or more tablets were bound together sometimes by scribes or traders. After vellum (from animal hide) became available, the form of tablet books was adopted by the Romans—and called a codex. Vellum books were used for small and less expensive editions, especially since both sides could be used. The Egyptians and Greeks also adopted this form of book. Some codices were folded like fabric, but were awkward to read and refold (like maps). Soon, books were divided into simple folds tied together

by string (as later book signatures were to be done). The format of such books was relatively small (the ratio of width to height was about 2:3). The practice of placing the title at the end was continued. By the fifth century A.D., the title was placed at the beginning as well; larger formats were also more common with wider margins, especially at the top and bottom. Foliation was introduced, usually on the front side of each sheet, since the page order could be confusing. Pagination came over a thousand years later as a printer's convenience (*pagina*=page, *folium*=sheet).

The Irish developed an angular, compressed minuscule hand (from the Roman half uncial form), which was disseminated by monks on their travels. After the monks cut vellum into sheets, they scratched guide lines with an awl or drew them with red ink or a graphite pencil to contain the characters (the first baselines and possibly grids); the distance between lines was marked in the margin. There was little standardization, otherwise. The scribe determined the column width (usually 2–3 inches with a half-inch gutter). Larger white areas were left as margins on the more splendid scrolls. Upper and lower margins, as well as gutters, were generous. The entire physical area was regarded as space to be filled, with words, pictures, illuminations, detailing, notes, and designs (see Figure 3).

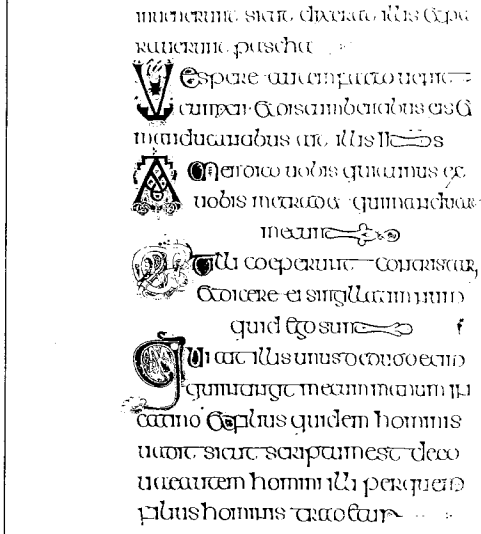


Figure 3. *Book of Kells*

Modern. Moveable type, in the form of a clay disk dating from 1500 B.C., was found in the ruins of the palace of Phaistos on Crete. Later, in China in A.D. 1041, Pi-Sheng developed type characters from hardened clay. Clay, however, did not hold up well under repeated impressions. By 1397 in Korea, type characters were being cast in bronze. Then, in 1440, Johann Gutenberg demonstrated for Europe the commercial possibilities of graphic reproduction with metal type. Gutenberg created a practical apparatus for casting the types. The small sizes of these rectangular blocks of metal type required a fine measuring system (the point system established by le Juene in 1737).

The first printers took manuscripts as their models; the arrangement of the page was followed closely (see Figure 4). Those features that could not be printed (initials or decorations) were added by hand. Pictorial production changed with technology, from drawings and woodcuts to lithograhic processes, photographic etchings, and scanning. In only fifty years, Aldus Manutius had transformed the Gothic type to a roman face and integrated illustration into a "perfect" book, the *Hypnertomachia Poliphili* (see Figure 5). Often, however, graphics dominated print. In many renaissance or rococo books, the illustrations stood out at the expense of the text. This was especially true of botanical or travel books. Later, print dominated graphics, often for economic reasons.

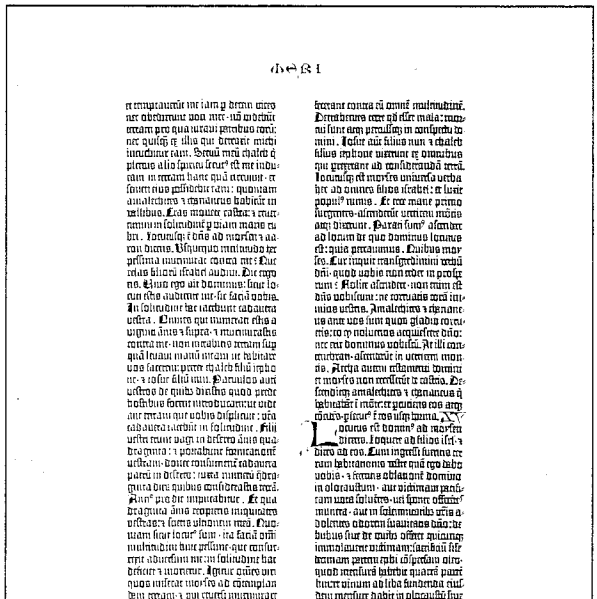


Figure 4. 42-line Gutenberg *Bible*

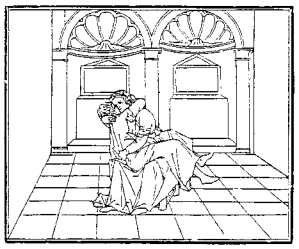


Figure 5. Manutius' *Hypnertomachia*

From Gutenberg's time, the page was regarded as a block of type surrounded by a frame of white space. The white space, margins, were left as printing and binding requirements for single pages. Later, printers put two or four pages on one sheet, which changed the ratio of inside to outside margins. As is so often with technology, practical convenience became interpreted as aesthetic theory, so that "pleasing" margin proportions are taught to apprentices still (as of 1971, when I was a printer's apprentice).

Modern Page Conventions. On a page, a group of elements is arranged in a hierarchy according to emphasis, which is often achieved by contrasts. Each element is related in the whole page.

The difference between the type page (text area) and page size (paper area) is the margin area. Deluxe and expensive editions of a book still tend to have wider margins. A traditional margin ratio, as the result of printing four-up (or more), is two units for the inside, three units for the top, four units for the outside, and six units for the bottom; this series (2/3/4/6) of column-to-margin ratios is based on the golden section (1/1.618) and can be found in some classic and medieval manuscripts.

There is a relatively small range of book sizes, centered around a comfortable human scale; few archaic or classic books were larger than nine by thirteen inches. The size of a book can be manipulated by type size and style; some typefaces have long alphabet lengths and may require extra leading between lines. The placement of headings, graphics, and white-space can add or subtract to the length of a book.

Ophthalmological studies show that reading is easier when letters are different from each other. Serif letters are easier to read than sans-serif; mixed upper and lower case easier than upper case. Size is also important. Very large or small sizes are difficult to read as text. Type size is recommended to be 10 to 12 points (for adults) for legibility. Small type may make word recognition more difficult; large type may make sentence recognition more difficult (by focusing perception on a small section of the whole). Weight (stroke thickness) affects legibility, as does kinds of face (italic, bold) and amount of leading.

The measure, or line length, is important to achieve a pleasant reading rhythm. Lines too short or too long may be tiresome to read. There are a number of rules to determine the appropriate line length: Mergenthaler Linotype suggest 40 characters at any size; Skillin et al. suggest a line range of 18 to 24 picas for 10-point type, with the ideal width being 22 picas; an alphabet length (which is the horizontal measure, in points, of the lower case alphabet set in type of one size and face), can be used to describe an optimum text width; it has been set to 1.6 alphabet lengths.

After the width of the page is determined, the length is chosen, usually intuitively, to be of good proportion. Skillin et al. note that a ratio of 1 to the square root of 2 (1.418) is pleasing.

Color combinations affect legibility. Although one government study showed that dark brown ink on light brown paper is easiest on the eye, black on white is traditional and considered the most legible combination. The typographic properties of text are partly defined by the white space on a page. The tone is set by the lightness or darkness of type.

Eye movement is influenced by the visual qualities of text. The text area can have different kinds of alignment (the way text lines up on a column or page): align left (also called flush left or raggedright), align center, align right, or justify (flush right and left). Ragged right provides visual cues that increase legibility. The rhythmic line breaks provide visual points of reference.

The basic findings of legibility research are still valid: interword spacing should be constant, lines of words should be optimum length (see previous formula), and interword space should be less than interline space. Often the readability and "friendliness" of a work can be increased with good

margins, especially as long as books continue to be presented in bound paper form. Margins are not necessarily obselete for design purposes.

There is no one way of designing a document. Many ways are effective, and many are ineffective; the effectiveness depends largely on the purpose: communication, impression, shock value, instigation, inspiration, formality. Typography is usually serial and straight-line. The magazine, *BLAST*, put out by Wyndham Lewis (1914) broke most typographic conventions with its style. Each letter could have a separate baseline, at random or circular for instance (see Figure 6). Some books, notably those by Marshall McLuhan on the media of communication and the architectural notebooks of Paolo Soleri (see Figure 7), consciously violate the conventions of margin and typography, preferring to communicate as much between the lines. Changing styles influenced book design. The functionalism in the 1920s, with its principle that the practical is the aesthetically correct, divided text into irregular sections and favored unsymmetrical arrangements (to emphasize the important material). The elemental typography of that period was used for commercial purposes, like posters. It had the effect of freeing books from dependence on traditional typefaces. The democratization of typesetting, with new programs, may also free us from conventions, as many practitioners are ignorant of the history and standards.

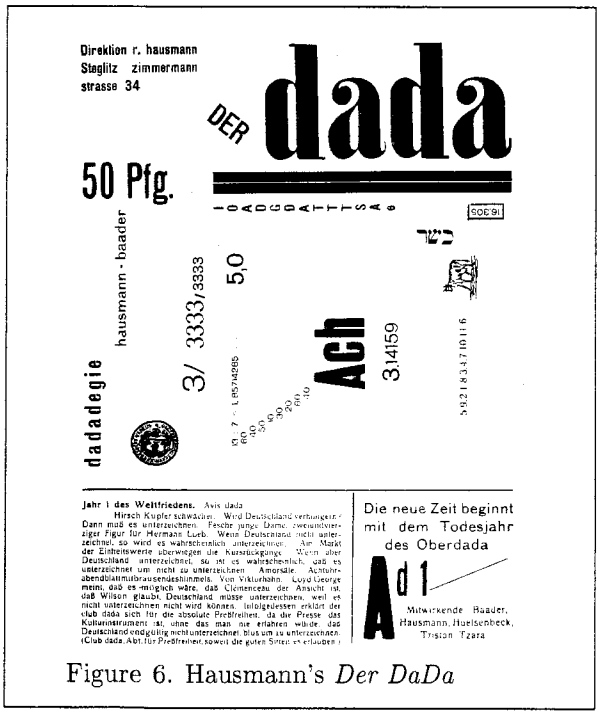


Figure 6. Hausmann's *Der DaDa*

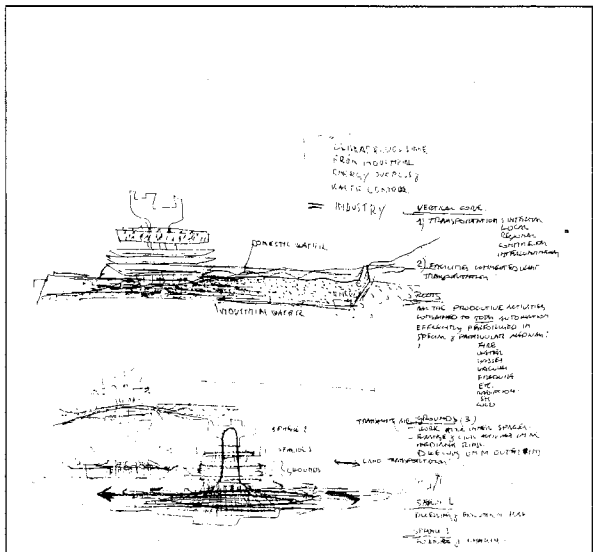


Figure 7. Soleri's Cosanti II

Technological Platforms.

Limitations Early concepts of "pages", such as certain Egyptian hieroglyphs, Roman scrolls, and medieval illuminated manuscripts, considered the entire page area as a pattern to be filled depending on numerous aesthetic, practical, or economic criteria. The illustrations of Newton and da Vinci were integrated into the text of their manuscripts (which were done by hand). Printing technology, however, found some copy, illustrations and tables for instance, difficult to integrate into text (and they charged higher prices for such penalty copy). Graphics was done separately from text; the positioning was often determined by page layout and so the graphics were often displaced from the text.

Traditionally, the size of paper (or tablets or papyrus) was determined by what was available and affordable. With typesetting, pages became larger, especially newspages, reference books, or folio (de luxe versions or coffee table) books—or smaller; Aldus Manutius started a printing business to issue critical editions ("pocketbooks") of classical authors. At that time, most books were done in a folio (two-up) or quarto (four-up) format, but Manutius printed in an octavo (eight-up) format with a reduced typeface based on cursive handwriting and adapted to the smaller size of pages (referred to as Aldine by Italians and italic by everyone else). Computer design seems to be limited by standard output devices, which use

predominantly type A pages in North America or A4 in Europe. If the recommendations of legibility research are followed, then most designs are limited to two-columns or one column with very wide margins.

Potential Three basic structures for presenting information can be identified: words, tables, and graphics, according to Tufte (as well as combinations of the three). From early times, the author was responsible for putting thought into graphic and typographic form. With the advent of traditional typesetting, the form of the thought was redesigned within the limitations (physical and financial) of the technology. With computer technology, the form is often determined first and depends on the limitations of the program (as well as of the devices and finances).

New forms of display, such as video terminals, mean that page design and formatting need not be limited by traditional conventions. Instead, pages can be considered for loose-leaf books (especially with on-demand printing), where text, graphics, and space are arranged over multi-page spreads. Or, in another instance, pages can be treated as small blocks (that have pop-up tables and graphics blocks), called up and presented in a multi-window environment on a video terminal (as in Digital's on-line bookreader). or in a specific hypermedia context.

As computation is adapted more to human needs, interfaces may become friendlier, then transparent. In a virtual world, publications may be more accessible and manipulatable. Publications may regain a concern for overall pattern. Importantly, pattern recognition is one way of dealing with information overload.

Trends

Writing, arising from a phonetic alphabet, is an abstract kind of tool. The sound and letter elements of writing are divorced from meaning. *Printing is the mechanization of writing.* As writing became more mechanized, words became more like data, from the dead and living alike, with seemingly equal weight. Mechanization had an effect on the style of publication. With technological changes, the shape of publications, as well as attitudes towards them, has changed. Technology drove publications to a simpler appearance. Speed in production has often been detrimental to the quality and aesthetics of bookmaking. According to McLuhan, typing reduced expression from art to craft, from personal to the impersonal. It transcribed thought instead of expressing it. Linear and rectilinear layout of words in books was efficient and fast. Thought transposed into type became published, removed from the personal to the public sphere. Typing, or keyboarding, also changes the form of expression, favoring shorter sentences and more colloquial, less thoughtful expression.

Then, *the telegraph provided the electrification of writing*, according to McLuhan. And, the newspaper mirrored the form of telegraphic communication. The news format dislodged the book format as the format of perception. News format created daily snapshots across society, simultaneous, not sequential or historical. The news page set up many book pages on one, then continued them elsewhere, simulating simultaneity and nonlineality. It telegraphed information in blocks. The news format has influenced artists from Browning to Poe, Mallarme, Dickens, and James Joyce. The newspaper form structures awareness in its own *patterns*, from important to less, from front to back, from section to section. The application of the form of newspapers shaped meaning.

Finally, computer-based *hypertext is the electronification of literary connections* (or "nonsequential writing") according to Ted Nelson. It is just a small step from news forms to a hypermedia of computer data. The hypermedium seems to bypass the reading step and proceed directly to reference. Most hypertext systems rely on advanced hardware such as workstation windows and the possibility of connection nodes of different media, such as text, data, video, audio, graphics, and spreadsheets. Currently most output is designed for CRT screens, although printing is possible and other forms, such as holographic displays, are talked about. Hypermedia is a conceptual connection of different forms in an explicit medium.

Each of the four formats, archaic, classic, modern, and hypernian, has advantages and disadvantages, and each encourages a unique style of thought and expression. Inscription on rock had mystical overtones or unknown purposes. The sense of participation must have been high. Often, the rock surface was in caves and not easily accessible. Reading the inscriptions might have been a formal rite.

Books have their own romance, from wonderful textures to experienced imaginary dialogues. Book production is fast and standardized (the standards encourage ease of reading for the most part). The type is standardized and interchangeable, a precursor of manufacturing assembly lines. Books themselves are portable and familiar. They require

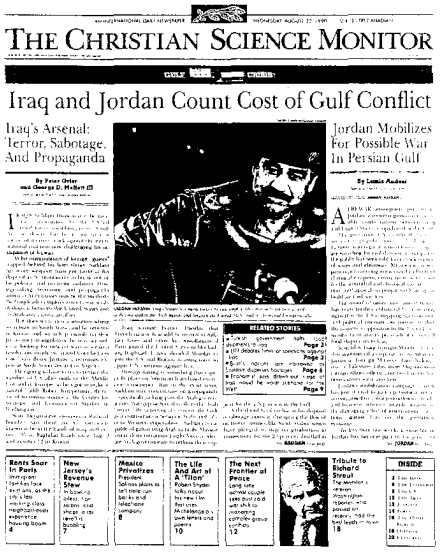
a level of sophistication and participation of the imagination. Many books are not limited by the linearity of the presentation; double page spreads with graphics and notes can create a form of hypertext. Even sequential texts can produce a feeling of hypertext, where the reader makes a complex conceptual model of the subject (—this sort of involvement McLuhan regarded as characteristic of a hot medium). But, they can be static and simple—even dull.

Newspapers and magazines are often more visual and interesting. The news format presents the surfaces of many subjects. Their production is even faster than books. They are more flexible in format. But, the news format often is limited by the amount of commercial and dated material.

Computer-based hypertext can be comprehensive and dynamic in a way that no book or magazine ever can be. Hypertext is consciously nonlinear and pluralistic. A typical (planned) hypertext system offers a great diversity of content from a variety of media. The material can be shared interactively, altered constantly, tailored to individual needs, and displayed in sophisticated ways. But, its development is slow and incomplete; nodes are often too large and not object-oriented; the lack of standardization or traditional order can overwhelm users with information; the screen fonts are poor compared to print fonts; and, effective output is limited to screens.

Some trends, speed for instance, are easily distinguishable in the history of patterns. Reading a manuscript roll or codex was laborious and slow. The book speeded up reading as a form of communication, but was a more solitary activity. In general, simple books offer a linear perspective, with a single tone and attitude. Early manuscript culture, based on scarcity of materials, encouraged memorization. Then, manuscripts became designed for speed of reading. No more dallying through abbreviations and notations. The scope of historical awareness increased with printing, until with the newspapers and television, the past 24 hours are history (see Figure 8). Books were fast and convenient to reference. They could be read fast, then keep for reference. Hypermedia promise immediate referencing.

Material has become more accessible to readers (or viewers, interpreters, or writers). Readers have more control over what they read. The tools and the media (and possibly the ideas) have become more complex. But, technology has also opened the possibility of returning the cycle. Writing became remote from the authors, printing even more so; now, technology is offering author control over many stages. Computer technology is not necessarily a limitation, if the author participates in the programming and design as well. New methods of production, such as photomechanical plates, need not adhere to the mechanical limitations of the hand press. New programs, like TEX, offer much potential. Other possibilities of shape and position of type areas can be pursued. The electric age hints at an organic metaphor from a mechanical one. Voice into print is possible; perhaps words may become three-dimensional and multi-layered when the output is hologrammatic. The words may reflect pauses and volume typographically. The form of print has been culturally biased. Possibly new technology can free us from the bias.


THE CHRISTIAN SCIENCE MONITOR

Iraq and Jordan Count Cost of Gulf Conflict

Iraq's Arsenal: Terror, Sabotage, And Propaganda

Jordan Mobilizes For Possible War In Persian Gulf

Figure 8. The *Monitor*

Requirements for an International Program

Any program that is to be used across cultural boundaries has to be able to express the direction and alphabets of the languages in use.

Direction. Most occidental languages move from left to right and top to bottom. Semitic languages, like Arabic, are written from right to left and move from top to bottom. Expressions may be useful from bottom to top, in either direction (see McLuhan's books).

Alphabets. A language often has its own unique alphabet, which is usually hard-coded into macros for alphabetical lists. Some languages use ideograms instead of phonograms to represent characters. A language representation should not be tied to a specific keyboard.

The Advantages of TEX

TEX is part of a long history in putting printed words on a page. Many of the conventions of book and journal production, such as paragraphs and columns, have roots in Mesopotamia and Egypt, Greece and Italy. Many TEX terms, from baseline to points, are based on the special nomenclature of typography.

The limitations of the printed page, however, are not intrinsic to TEX. TEX macros can be modified to present text, graphics, and space in blocks on a complete or partial page block (that can be combined or recombined). Regardless of the formal elements, TEX has the ability to put them on paper. TEX macros can free reading order from European conventions. A special TEX macro can produce lettered lists using any alphabet in a cartesian coordinate system.

Knuth and MacKay mention that TEX can handle documents that are read from left-to-right and top-to-bottom—English and other Western languages (MacKay, 1986, Knuth and MacKay, 1987). They also say, "If such documents are turned 90 degrees, they can also be read from top-to-bottom and right-to-left, as in Japan. Another 90 degree or 180 degree turn yields documents that are readable from right-to-left and bottom-to-top, or from bottom-to-top and left-to-right, in case a need for such conventions ever arises." They then describe a way to mold TEX to handle languages, like Hebrew or Arabic, which are right-to-left and top-to-bottom. They clarify the issues involved in mixed-direction documents and consider changes to TEX to extend it for bidirectional formatting. Digital uses TEX as the formatting engine for its documentation program, VAX Document, to take advantage of this directional capability.

At Digital, the Online Bookreader can display VAX Document (TEX formatted) files in an indefinite (but not infinite) series of windows. The book is chosen from an online library, then opened in a directory window, which includes contents, index, figure, table, and example icons (that can be contracted or expanded). Clicking on a chapter title in the contents, for example, results in a topic window opening. The text in the topic window contains hot spots and extensions that can be explicit or implicit. If a hot spot, a formal figure for instance, is clicked on, a subtopic or popup window opens with the figure. The TEX macros for the Bookreader have been modified for a unique screen environment. The concept of individual pages no longer exists, although each paragraph causes a page eject (so that TEX pages can be mapped to information chunks that make up topics). The fonts are larger for readibility on a screen. The Bookreader has experimental hooks for hypertext.

TEX has the capability to produce many kinds of designs. Often, authors and the programmers are ignorant of design, while designers are ignorant of programming. The vocabularies and styles are different. But, more often then not, neither group formally articulates complete design requirements; most designers mock-up typical pages, often leaving out many less common cases. TEX can be integrated into interfaces that solve this difficulty.

ArchiTEX as Page Pattern Maker

Requirements. A prototype markup language, ArchiTEX, uses select TEX macros to produce flexible, modular page patterns for a variety of output devices. These page patterns should be able to mimic book, newspaper, and hypermedia formats. The macros should be able to: use any alphabet for text as well as lettered lists; put text in any location on a page; describe page patterns for each individual page; and, continue text groups onto subsequent pages.

Samples.

Alphabets Creating an alphabet series for any alphabet is fairly simple. Referring to a clue in the *The TEXbook* (page 379) about stripping characters off a string, one need only define a string that can be stripped and recombined in numerous ways. The alphabet string needs to be defined first, with any special characters or accents (in Figure 9).

```
\def\bahbah{\\a\\b\\d\\g\\{jk}\\x}
```

Figure 9. Definition of Alphabet

An item in list can be selected by its position from the left and stripped off. Then, the alphabet length can be counted and assigned to a counter (see Figure 10).

Now, you can make a macro that offers the author a choice in numbering schemes, either a-z, then ab, ac, az—or aa, bb, zz, up to several hundred items (an English alphabet, with 26 letters results

```
\def\outofrange{ }% to prevent err
\def\pullet#1\of#2\to#3{%
    \def\#3{\outofrange\}%
    \long\def\\##1{\advance#1-1
    \ifnum\#1=0 \def#3{##1}\fi}#2}
\def\findalen#1\to#2{\#2=0
    \long\def\\##1{\advance#2 by1 }#1}
\findalen\alphasoup\to\alphalen
```

Figure 10. Alphabet Set-up

```
\def\alphacon{\global\advance\thingnum
                by 1
\ifnum \thingnum < \alphalen
\pullet\thingnum\of\alphasoup%
                \to\signifier
\unskip\signifier%
\else
%...
\}%
```

Figure 11. Alphabet Style Macro

in 703 items, before going to a star signifier). The code is in Figure 11.

The macro, alphacon, could then be put in a list macro for alphabetic lists (as in Figure 12) or combined with page numbers to indicate added pages. The complete macros are found in Appendix A.

ccc. Carneades
ddd. Protagoras
eee. Antiochus Posidonius

Figure 12. Alphabet Macro Output

Text location. Putting the text on any part of the page is a problem. Knuth gives a clue in *The TEXbook* (page 389—PICTEX and other programs use this clue for graphics); the labelling of points in a cartesian coordinate system can be expanded to place text in boxes with the top left corner of a box as the reference point. The first thing to do is set up the page to be the entire print area without margins. Then, set up units for moving, either using scaled points or baselineskips. And, define paragraph and page characteristics (in Figure 13).

The construction in Figure 14 starts in upper lefthand corner of the page, then moves down and right by units, then places a zero-width box at the specified x/y coordinates. This makes it easy to emulate a grid, a graphic device useful in the composition of pages (a recent development by Swiss designers, as a conscious application of imaginary lines to divide space, it imposes discipline on the

```
\hoffset=-60pt\voffset=-60pt% no margs
\hsize=612pt  \vsize=792pt  % h=51,v=66
\baselineskip=12pt          % standard
\newdimen\unit  \unit=\baselineskip
% ...
\def\pargoods{\raggedright
  \tolerance=5000\hyphenpenalty=-50
  \parindent=0pt\parskip=0pt\}% close
% ...
\long\def\go#1 #2 #3\stop{%
  \vbox to 0pt{\kern#2\unit%
    \hbox{\kern\#1\unit
    \vtop{\leftjump=#1\unit
          \downjump=#2\unit
          \for=\uhsize-\leftjump
          \dow=\uvsize-\downjump
          \hsize=\for\vsize=\dow
          \goods \#3\}\}\vss\}%
    \nointerlineskip\}% close go
% ...
```

Figure 13. Text Placement

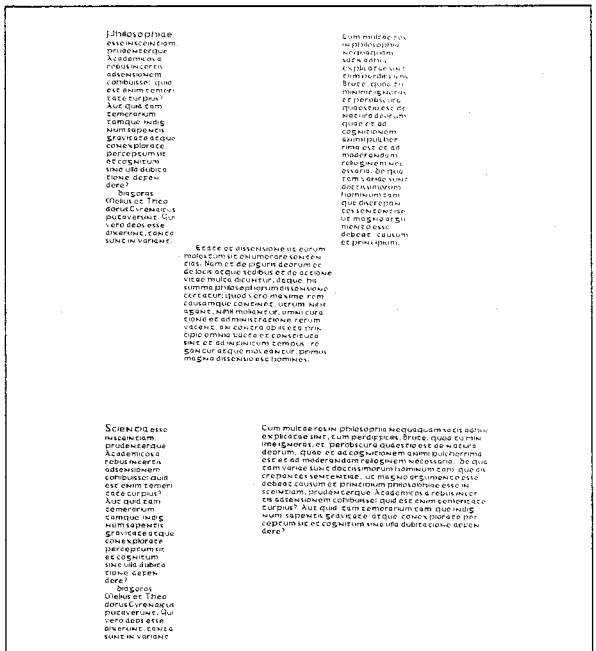


Figure 14. Text Placement Ouput

designer). Many patterns, from Egyptian scrolls to the *Book of Kells* and *Der DaDa*, can be examined and explained in terms of a grid.

Page patterns. Although usually every page can have a typical pattern, each page may have a unique pattern. The text, however, needs to flow sequentially from page to page or from section to section. Page layouts are defined after a scheme by August Mohr (see Figure 15). Each page has to be

defined according to a format. A run file loads the definitions and text. A separate file describes how the finished page is to be built.

```
\def\I{1\}      \def\II{2\}
% ...
\def\beginsheet#1{\xdef\sheet{#1}%
      \setcount0 \sheet%
      \ifx\sheet\I  {\setIvone}
\else{\ifx\sheet\II {\setIIvone}
% ...
\def\setXIvdefs{%
    \gdef\setvone{\setXIvone}
% ...
\def\setXIvone{\vsize 99pc
    \hsize\twowide} % unboxed in set7
% ...
```

Figure 15. Page Macros (after Mohr)

The pieces are put together in the output routine, where the vsizes are defined. The output routine also adds the headers and footers.

Breaking and continuation. Breaking material on one page and continuing it on a later page also poses difficulties. Alan Hoenig set up a series of macros for newspaper layouts that takes care of breakage and continuation (see Figure 16). The entire story page is shaped, although the two pieces, the lead and the jump, may have different widths, and the story is divided with the vsplit command. The second half of the story is placed explicitly with a keyword-coded jump command.

```
\def\beginstory[title:#1][key:#2][main:%
    #3][jump:#4]{%
\setbox0=\hbox{\quad See #2 on page ??}
\setbox0=\vbox to2\baselineskip{\hbox
   to\mainhsize{\hss #1\hss}\vss}%
% ...
  \ifnum\count10\>0
   \goalheight=\count10\baselineskip
   \n=\count10   \else
   \whereami \computegoalheight
   \n=\count10
  \fi
  \advance\n by1
  \createparshapespec\makeboxident{#2}%
  \global\keyword={#2}%
  \partoks=% control typesetting
    {\tolerance=5000\pageshape=%
              \n\the\parshapespec}
  \putinvbox{#2}%
\} % end beginstory
% ...
```

Figure 16. Page Splits (after Hoenig)

Hoenig also creates a macro that is useful for defining page shapes. Macros from Thomas Reid are also included. A sample for input specifies the title, depth, width, and continuation page (see Figure 17).

```
\beginstory[title: Natura Deorum][key:
   cicero][main: XI][jump: XXIV]%
\input cicero.tex
\endstory
\beginstory[title: Natura Universum][key:
   lucretius][main XIII][jump: XXV]%
\input lucretius.tex
\endstory
```

Figure 17. Sample file

The output on the first page is presented in Figure 18. The second page, much like any newspaper page, has blocks of continued articles (see Figure 19).


de Natura Deorum

M. T. Cicero

Metamorphoses

Creatio Mundi

P. Ovidius Naso

Figure 18. Text Placement Ouput

Summary

Page patterns have not changed greatly over three thousand years; most thoughts are presented in paragraphs in columns with graphics, and the page size seems to be relatively constant at seven by ten inches. Even hypertext pages seem to follow these conventions, although such pages also include cue identifiers and hot-spots.

The ArchiTEX program is intended to be a multi-directional, international page pattern maker.

Figure 19. Text Continuation Ouput

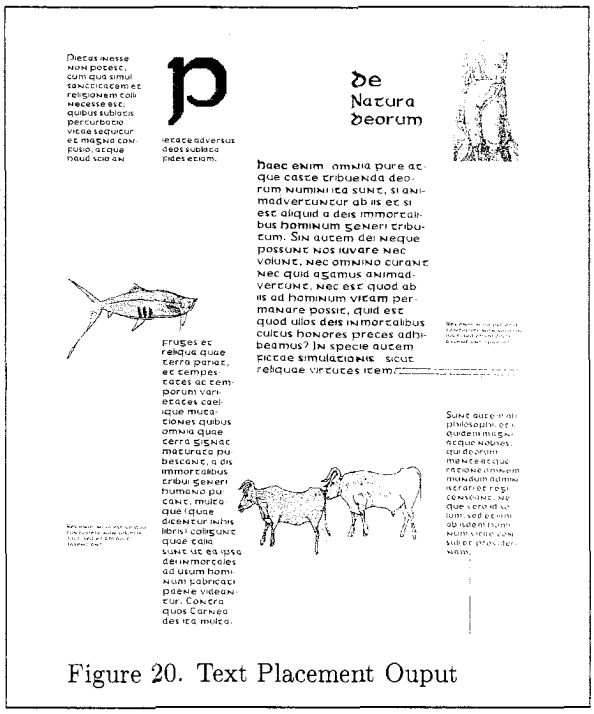


Figure 20. Text Placement Ouput

It defines one or more alphabets for text. It creates flexible, modular page patterns for single pages and places text in a grid. It also creates blocks for on-screen reference.

Alas, ArchiTEX is not finished. Placing continued text in large blocks across individually designed pages is still a major implementation problem (small tests work, however). Placing directional text with other directional text has not been implemented, yet, although others have done so already. Other parts of the program are still planned. Cues can be added for hypertext use (see Figure 20). ArchiTEX's bookmaker interface (in C) is planned to permit designers to manipulate the objects elements visually, and to enforce both formality and completeness for designers and programmers. Since ArchiTEX is a part-time, independent project, there is no time-frame for its completion.

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Appendix A: Alphabet Macros

```
% alphanum.mac  a macro for alphabetical counts using
% NA and foreign alphabets as defined in language strings
\def\english{\\a\\b\\c\\d\\e\\f\\g\\h\\i\\j\\k\\l\\m\\n\\o%
   \\p\\q\\r\\s\\t\\u\\v\\w\\x\\y\\z}
\def\bahbah{\\a\\b\\c\\{jk}\\x\\y\\z}
%
% define signifier for the text lists and signs for double letters
\def\signifier{ }
\def\alphasoup{\english}
\let\language=\alphasoup
%
\def\outofrange{ }% added 5/5 to prevent undef error
\def\pullet#1\of#2\to#3{\def#3{\outofrange}%
  \long\def\\##1{\advance#1-1 \ifnum#1=0 \def#3{##1}\fi}#2}
% sample: \pullet\MLa\of\alphasoup\to\signifier
%
% start new counter for the length of the alphabet
%\newcount\alphalen     \alphalen=30
% count alphabet length (after K378)
\def\findalen#1\to#2{#2=0 \long\def\\##1{\advance#2 by1 }#1}
% use immediately
\findalen\alphasoup\to\alphalen
%
% optional method to create aa, ab--az, or  aa, bb--zz
% start new counters for internal fixing of double letters
\newcount\SL        \SL=0         % letter
\newcount\MLa       \MLa=0        % double letter part
\newcount\MLb       \MLb=0        % double letter part
\newcount\SLm       \SLm=0        % multiplicand for mult signifiers
\newcount\thingnum  \thingnum=0   % list, update pages, etc
\newcount\maxthing  \maxthing=121 % maximum multiple alphabet lengths
   \maxthing=\alphalen \multiply\maxthing by \alphalen
   \advance\maxthing by \alphalen  \advance\maxthing by 1
% e.g., English (26 letters) results in 703 max
% new dimensions and boxes for letters, which are actually produced
% as leaders, not translated numbers
\newdimen\eachletwd   \eachletwd=10pt
\newbox\eachlet
\newif\ifab           \abfalse       % if letters are to be aa-az
%
\def\alphacon{\global\advance\thingnum by 1
    \ifnum \thingnum < \alphalen         % single letter
      \pullet\thingnum\of\alphasoup\to\signifier%  same for both
      \unskip\signifier%
    \else
      \ifab                              % for aa-az, za-zz
        \ifnum\thingnum < \maxthing      % less than absolute max
          \SL = \thingnum                % it's a double letter
              \divide\SL by \alphalen    % hold first letter
          \MLa = \thingnum               % prepare second
          \MLb = \thingnum
          \divide\MLb by \alphalen       % check for last letter
```

```
          \multiply\MLb by \alphalen
             \ifnum \thingnum = \MLb
                \advance\SL by -1        % back to last letter
                \MLa = \alphalen
             \else\advance\MLa by -\MLb  % identify second
             \fi
          \pullet\SL\of\alphasoup\to\signifier%
          \unskip\signifier%
          \pullet\MLa\of\alphasoup\to\signifier%
          \unskip\signifier%
        \else
          \message{Maximum alphabet use, * used} % too many things
          \signifier{*}
        \fi
      \else                          % for aa-zzzzz
        \MLa = \thingnum             % prepare second for mult.
        \MLb = \thingnum             % only second used
        \divide\MLb by \alphalen
               \SLm = \MLb           % get number to mult signif
               \advance\SLm by 1
        \multiply\MLb by \alphalen
           \ifnum \thingnum = \MLb
               \MLa = \alphalen
               \advance\SLm by -1    % back to end of alphabet
           \else\advance\MLa by -\MLb
           \fi
          \pullet\MLa\of\alphasoup\to\signifier% get letter
            \setbox\eachlet=\hbox{\signifier}%  put in box
            \eachletwd=\wd\eachlet%            measure width
            \multiply\eachletwd by \SLm%       multiply
            \unskip\hbox to \eachletwd{\unskip\leaders\hbox{%
                \signifier}\hfill}%
    \fi%
 \fi%
}%
%
% define macro to make the alphabetized list.
% do by counter but strip off letters to replace numbers
% \long\def\allist{\hangindent100pt\noindent
%                  \hbox to 100pt{\alphacon\hfill}}%
% [or]
%           \number\pageno.\alphacon
% [or]
% \ifdoingpopps\alphacon\else\number\pageno\fi}
```