

Less is More: Complex Page Layouts and Shapes with T_EX

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Abstract

This presentation discusses by means of several examples the ability of T_EX to generate complex page layouts in a special case of text. In this special case of restricted text, no tall characters or stretchable vertical glue is allowed and all lines are assumed to have the same height and depth. To anyone accustomed to T_EX's generality, this may seem overwhelmingly restrictive, but probably 99% of all typesetting—letters, novels, non-technical material, etc.—conforms to this model. Examples I'll discuss include line numbering of text, changebars, flowing text entirely around a special shape, and fine control over inter-column cutouts (*à la The New Yorker* magazine). I'll also how to include material which does *not* conform to this model (such as section heads, display material, and so on), so this model is more flexible than it appears.

Introduction

An imaginary conversation between the author and a 'conventional' desktop publisher inspired this article. The discussion involves the ability to typeset fancy column shapes. Consider:

DTPUB: My software can create fancy column shapes.

I can 'synchronize' the shapes so that pairs of columns can perfectly enclose an odd-shaped figure.

AU: Sounds impressive. But how do you account for displayed equations, tall characters, stretchable white space, and other items that might louse up the alignment of the lines on the right to the lines on the left? And what happens if the column break leads to a lonely widow or club line at the top or bottom of a column?

DTPUB: What are you talking about? I only set material so that each line is exactly the same height as any other. As far as math goes, why would it appear in this kind of context? I don't care about 'lonely' lines because horizontal alignment of lines across columns takes precedence. And what the heck's stretchable glue?

Designers of macro packages bend over backwards to make their macros as general purpose as possible, but there are still typographic effects that remain difficult if not outright impossible in the general case. This mini-conversation made me realize that complete generality may not be a virtue, at least not 100% of the time. I decided to imagine that my typesetting was restricted to the same universe as that of the desktop publisher to see if giving up some flexibility led to the ability to do new things with T_EX.

In what follows, I shall use the term 'restricted text' to refer to text conforming to that of the desk-

top publisher above. Specifically, restricted text consists only of prose such that the total height of each line—the sum of the depth and height—does not exceed some certain amount. Tall characters and stretchable vertical glue make no appearance in this text, and nor does a reluctance to leave widows and club lines dangling fore or aft of a column. Although this is quite restrictive, much (if not most) printed matter does conform to this model. Furthermore, it turns out that section heads, extended quotations, and so on—elements which do not conform to this restricted model—can be incorporated into a restricted document, so restricted text is not quite so restrictive after all.

I will present some examples whereby complex and unusual page layouts can be done with T_EX providing that the text conforms to the restrictions we mentioned above. Using this model, I am cautiously optimistic that that anything any other desktop publishing program can do, T_EX can also.

To no one's surprise, several of the crucial ideas have been lifted from work done by Don Knuth. Several additional ideas are identical or similar to ones discussed by David Salomon in his ongoing series of tutorials on the `\output` routine which can be found in *TUGboat*.

Purpose of This Presentation

It is not my purpose here to present a finished set of macros to accomplish the tasks I will discuss. Rather, I hope to suggest a philosophy—that reining in T_EX can sometimes be beneficial—and to present examples showing some advantages of this thinking. Readers may decide for themselves whether the benefits really do outweigh the disadvantages.

Nevertheless, readers who agree with the author that it sometimes pays to restrict certain of T_EX's abilities may wish to recreate these effects. The examples of the first portion of the paper can be integrated into personal style files using the macro snippets that appear. The final example (magazine layout) is a different matter, and here the author has an additional agenda. I seek feedback that the user interface—the way that macro names and macro arguments have been organized—is reasonable. After incorporating comments, I hope to make these macros available shortly thereafter.

A New Output Routine

It seemed likely to me that T_EX would have to be re-configured a bit to make dealing with restricted text easier. A new output routine, suggested by Don Knuth (Knuth 1987) in another context, seemed to fit the bill. The height of a strut, `\strutht`, is usually the maximum height of a line of text in the restricted text under discussion. If we set the `\vsize` of the document to be `\strutht`, then T_EX's output routine will obligingly slice up the text into line-sized morsels. It will be up to this restructured `\output` routine to collect these lines, stack them together, and actually ship out a page only when the line count equals the capacity of a single page.

Of course, as T_EX passes each line to the collecting area, perhaps using code in the output routine something like

```
\ifnum\lineno < \linesperpage
  \global\setbox\partialpage=
  \vbox{\unvbox\partialpage \box255}
\else ...
```

it's possible to include a macro to do something special to each line, much as the token list `\everypar` can at the start of each paragraph. (In this way, we can mimic the structure of an `\everyline` token list, something that features high on many people's T_EX wish list. *Mimic* is the key word, for source file tokens have long been processed by T_EX.) That is, the above `\output` fragment should better look like

```
\ifnum\lineno < \linesperpage
  \setbox\partialpage=\vbox{
  \unvbox\partialpage\processline}
\else ...
```

Let's pause to consider some of the ways we can exploit `\processline` (which can be thought of as a mock-`\everyline`).

Numbering lines of text. Numbering lines in an `\obeylines` environment has always been straightforward. Now it's simple enough for regular text, at least in our restricted case. Simply invoke definitions like

```
\newcount\linesdone
\newif\ifdivisiblebyfive
```

```
\newcount\scr
\def\ModFive{% Is \linesdone div by 5?
  \global\divisiblebyfivefalse
  \scr=\linesdone \divide\scr by 5
  \multiply\scr by-5
  \advance\scr by\linesdone
  \ifnum\scr=0
  \global\divisiblebyfivetrue \fi}
\def\processline{%
  \global\advance\linesdone by 1
  \ModFive \ifdivisiblebyfive
  \hbox{\llap{%
  \oldstyle\the\linesdone\ }\box255}
  \else\box255 \fi}
```

which will print line numbers every five lines across paragraph and page boundaries. Figure 1 displays an example of typography showing line numbering.

Change bars. Most change bar styles use PostScript. Here's one way that we can implement it independently of PostScript.

Even with our restrictions in effect, this problem highlights an important set of problems. Because of T_EX's asynchronous mode of processing, output occurs at very different times than when the source file is chewed by T_EX's mouth. So a `\changebar` macro has to contain instructions to the output routine which `\processline` will then execute.

Of the several methods available for this communication, I chose the following. The command `\changebar` inserts a strut whose depth is ever so slightly greater than the normal depth of a line. The depth is so slight that no reader will ever be able to see it, but it is great enough so that T_EX can perceive it. The slight amount we use is two scaled points; we recall that one printer's point contains 64k scaled points.

If we code `\changebar` to act like a font change, so that a group must enclose the change'd text, then a simplified coding might look as follows. First, we define deep struts.

```
\newbox\varstrutbox \newdimen\lostrutdp
\def\varstrut{\relax
  \ifmmode\copy\varstrutbox\else
  \unhcopy\varstrutbox\fi}
\def\lostrut#1{%
  \global\lostrutdp=\strutdp
  \global\advance\lostrutdp by#1 sp
  \global\setbox\varstrutbox=
  \hbox{\vrule width0pt height\strutht
  depth\lostrutdp}\varstrut}
```

And now, here is T_EX code for `\changebar`. The `\aftergroup` hack ensures that the increase to the height of a line happens after the `\changebar` group has been concluded. The output routine will check the depth of the line. A surplus depth of two scaled points signals the beginning of a change bar, and a surplus of three scaled points signals its end.

HERMAN MELVILLE MOBY-DICK CHAPTER I

head. True, they rather order me about some, and make me jump from spar to spar, like a grasshopper in a May meadow. And at first, this sort of thing is unpleasant enough. It touches one's sense of honor, particularly if you come of an old established family in
 115 the land, the van Rensselaers, or Randolphs, or Hardicanutes. And more than all, if just previous to putting your hand into the tarpot, you have been lording it as a country schoolmaster, making the tallest boys stand in awe of you. The transition is a keen one, I assure you, from the schoolmaster to a sailor, and requires a strong
 120 decoction of Seneca and the Stoics to enable you to grin and bear it. But even this wears off in time.

What of it, if some old hunks of a sea-captain orders me to get a broom and sweep down the decks? What does that indignity amount to, weighed, I mean, in the scales of the New Testament?
 125 Do you think the archangel Gabriel thinks anything the less of me, because I promptly and respectfully obey that old hunks in that particular instance? Who aint a slave? Tell me that. Well, then, however the old sea-captains may order me about—however they may thump and punch me about, I have the satisfaction of knowing that
 130 it is all right; that everybody else is one way or other served in much the same way—either in a physical or metaphysical point of view, that is; and so the universal thump is passed round, and all hands should rub each other's shoulder-blades, and be content.

Again, I always go to sea as a sailor, because they make a point
 135 of paying me for my trouble, whereas they never pay passengers a single penny that I ever heard of. On the contrary, passengers themselves must pay. And there is all the difference in the world between paying and being paid. The act of paying is perhaps the most uncomfortable infliction that the two orchard thieves entailed upon
 140 us. But being paid,—what will compare with it? The urbane activity with which a man receives money is really marvellous, considering that we so earnestly believe money to be the root of all earthly ills, and that on no account can a monied man enter heaven. Ah! how cheerfully we consign ourselves to perdition!

145 Finally, I always go to sea as a sailor, because of the wholesome exercise and pure air of the forecastle deck. For as in this world, head winds are far more prevalent than winds from astern (that is,

Figure 1: Typography similar to John Baskerville's 1757 edition of the *Bucolics and Georgics of Virgil*. This sample is set in Monotype Baskerville.

```
\def\changebar{\aftergroup\endchangebar
\lostrut2}
\def\endchangebar{\lostrut3}
```

The `\processline` macro must examine the depth of the current line and take action accordingly. It's the responsibility of a macro to add the actual changebar segment to `\box255` which contains a single line of text.

```
\def\addchangebar{\hbox{\llap{\vrule
width4pt height\strutht
depth\strutdp\quad}%
\box255}}
```

Our routine will examine the register `\DeltaDP` which stores the surplus depth and sets flags as appropriate. We will also assume that the last line of the changebar group needs a changebar segment, and therefore another switch `\iffflushing` is necessary for that purpose. (Without this switch, the last typeset line of changed text would appear without the changebar segment.)

```
\newif\ifchanging \newif\iffflushing
\def\processline{%
\ifnum\DeltaDP=2
\global\changingtrue \fi
\ifnum\DeltaDP=3
\global\changingfalse
\global\flushingtrue \fi
\ifchanging \addchangebar \else
\iffflushing \addchangebar
\global\flushingfalse
\else\box255
\fi\fi}
```

The `\output` routine needs a hook to check on surplus depth. Macro `\identity` simply typesets `\box255` without doing anything to it.

```
\def\checkline{%
\dimen0=\dp255
\advance\dimen0 by-\strutdp
\DeltaDP=\dimen0
\ifnum\DeltaDP=1
\global\let\processline=\identity \fi
}
```

We reserve a surplus depth of 1 as a signal to return to normal, standard typesetting. A redefined `\bye` command will automatically cancel out any special effects.

```
\outer\def\bye{\finish
\vfill\supereject\end}
\def\finish{\endgraf
\leavevmode\lostrut1 \endgraf}
```

Source marked up similar to
... end, {\changebar for ...
... is wrong}. It follows that ...
generated the changebars (and the text) displayed in figure 2.

Section heads; escaping the restrictions. A section head is an example of a document component that would escape the restrictions we have imposed upon ourselves. This is a good time to explore ways to include these elements in our document.

The previous example suggests ways that signals to the output routine can allow us to build up the partial page out of non-restricted components. These components should have a total height equal to a whole number of single line heights.

Let us suppose that we want to leave a total vertical separation of two lines between the sections. In this white space we insert the section head, which should be 12-point bold type. Furthermore, we want to leave a little extra space between the section head and the following line, and we don't want to print the section head unless there is room for at least one additional line following the section head. It would appear to be straightforward to write a `\section` macro to create a `\vbox` to create the vertically spaced heading and to send a signal to `\output` which can determine whether there is room enough for the heading and act accordingly.

But a problem could arise. What if there were several headings to be very close to one another in the document? In that case, because \TeX 's mouth often gets ahead of the processing done by `\output`, new contents of a `\sectbox` would over-write previous contents before \TeX would have typeset them. We can be sure, though, that `\output` will process these special boxes in the order in which they appear in the document, and so we adopt a subtler strategy. We will use a single special `\vbox` to hold these insertions, and we will take care to add new boxes to it from the bottom. Whenever `\output` needs to take a special box for typesetting, we will take off the top of this box. This special `\insertbox` acts like a "first in first out" (FIFO) queue containing insertions. In this way, we can be sure that no headings get lost in the asynchronous maze which is \TeX .

Incidentally, we can use this method to include displayed equations, tables, extended quotations, and other non-restricted text in the body of a 'restricted' document, so that our restricted document is not so restricted after all. (Note that the term 'insertion' that I've used refers to text that does not conform to a restricted format but which I wish to include. It is quite different in spirit and scope from the usual \TeX insertion whose eventual appearance on the page is unpredictable.)

```
\def\section#1{\setbox\sectbox=
\vbox to2\baselineskip{%
\vss \leftline{\strut\bigbf #1}%
\vskip1pt\hrule height0pt}%
\global\setbox\insertbox=
\vbox{\unvbox\insertbox
\goodbreak \box\sectbox}%
```

~~TYPOGRAPHY~~ Typography may be defined as the art of rightly disposing printing material in accordance with specific purpose; of so arranging the letters, distributing the space and controlling the type as to aid to the maximum the reader's comprehension of the text. Typography is the efficient means to an essentially utilitarian and only accidentally aesthetic end, for enjoyment of patterns is rarely the readers' chief aim. ~~Therefore, any disposition of printing material which, whatever the intention, has the affect of coming betwixt author & reader is rong~~ for enjoyment of patterns is rarely the reader's chief aim. Therefore, any disposition of printing material which, whatever the intention, has the effect of coming between author and reader is wrong. It follows that in the printing of books meant to be read there is little room for 'bright' typography. Even dullness and monotony in the typesetting are far less vicious to a reader than typographical eccentricity or pleasantry. ~~Cunning of this sort is desirable, even essential in the typography of propaganda, whether for commerce, politics, or religion, because in such printing only the freshest survive inattention. But the typography of books, apart from the category of narrowly limited editions, requires an obedience to convention which is almost absolute—and with reason.~~

~~The laws governing the typography of books intended for general circulation are based first upon the essential nature of alphabetical writing; and secondly upon the traditions, explicit, or implicit prevailing in the society for which the printer is working.~~ But the typography of books, apart from the category of narrowly limited editions, requires an obedience to convention which is almost absolute—and with reason.

The laws governing the typography of books intended for general circulation are based first upon the essential nature of alphabetical writing, and secondly upon the traditions, explicit, or implicit prevailing in the society for which the printer is working. While a universal character or typography applicable to all books produced in a given national area is practicable, to impose a universal detailed formula upon all books printed in roman types is not. National tradition expresses itself in the varying separation of the book into ~~preliminaries~~ prelims, chapters, etc., no less than in the design of the type. But at least there are physical rules of linear composition which are obeyed by all printers who know their job.

Figure 2: Text decorated with changebars. Strike outs indicate the revised material. (This text is set in Adobe Garamond.)

```
% build \sectbox from bottom
\signal % message to output routine
}
\def\signal{\line{\hss\lostrut2}%
\endgraf}
A box called \sectbox holds the current heading.
Back in the output routine, we use a definition
like this for \processline.
\def\processline{\ifnum\scr=2
\writesection \else
\hbox{\strut\box255}\fi}
Here, \scr is a scratch counter which will hold the
excess depth of the most recent \box255. Any value
of \scr other than zero is a signal to be acted upon
in some way. Macro \writesection is actually re-
sponsible for printing the section head or saving it
for the top of the next page.
\def\writesection{%
% \box255 has a deep strut--discard it.
\setbox\nullbox=\box255
\setbox255=
\vsplit\sectbox to 2\baselineskip
%% see is there room?
\global\scr=\linesperpage
\global\advance\scr by-\lineno
\ifnum\scr>3 % there is room
\box255 \global\advance\lineno by 1
\else %
% spit out empty lines, go to next page
\global\lineno=\linesperpage
\loop \copy\emptyline
\advance\scr by-1 \ifnum\scr>0
\repeat
\global\setbox\sectbox=
\vbox{\box255
\goodbreak\unvbox\sectbox}%
\aftergroup\signal
\fi \global\scr=0 }
```

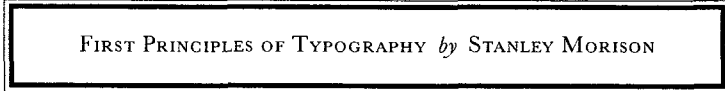
Complex Page Shapes

Setting `\vsize` to `\baselineskip` is a simple but powerful tool, but we need more help to have extensive control over the appearance of the page. T_EX's basic `\parshape` command is useful for single paragraphs but appears to be useless in case a shape should extend across paragraph boundaries. We can extend `\parshape` but to do so, we need to recall some useful facts: at the conclusion of each paragraph, the register `\prevgraf` has been increased by the number of lines in the paragraph; T_EX uses the value of `\prevgraf` at the start of a paragraph as the index into the list of line dimensions which accompany any `\parshape`; and all paragraph shaping commands—`\parshape` and `\hangafter`—are reset to their standard values. Extending this paragraph shaping capability involves making T_EX ignore this usual resetting procedure.

The following lines provide a `\pageshape` command, whose syntax mirrors that of `\parshape`.

```
\newcount\totallines
```

TYPOGRAPHY may be defined as the art of rightly disposing printing material in accordance with specific purpose; of so arranging the letters, distributing the space and controlling the type as to aid to the maximum the reader's comprehension of the text. Typography is the efficient means to an essentially utilitarian & only accidentally aesthetic end, for enjoyment of patterns is rarely the reader's chief aim. Therefore, any disposition of printing material which, whatever the intention, has the effect of coming between author & reader is wrong. It follows that in the print-ness and monotony in the typesetting are far less vicious to a reader than typographical eccentricity or pleasantry. Cunning of this sort is desirable, even essential in the typography of propaganda, whether for commerce, politics, or religion, because in such printing only the freshest survive inattention. But the typography of books, apart from the category of narrowly limited editions, requires an obedience to convention which is almost absolute—and with reason. § The laws governing the typography of books intended for general circulation are based first upon the essential nature of alphabetical writing, and secondly upon the traditions, explicit, or implicit prevailing in the society for which the printer is working. While a universal character or typography applicable to all books produced in a given national area is practicable, to impose a universal detailed formula upon all books printed in roman types is not. National tradition expresses itself in the varying separation of the book into prelims, chapters, etc., no less than in the design of the type. But at least there are physical rules of linear composition which are obeyed by all printers who know their job.



abcdefghijklmnopqrstuvwxyz ABCDEFGHIJKLMNOPQRSTUVWXYZ nopqrstuvwxyz

Figure 3: Hermann Zapf designed this page before 1954. It originally appeared in his *Manuale Typographicum*. Zapf's original specimen appeared in some flavor of Baskerville; this is set in Monotype Baskerville.

```
\def\pageshape{\afterassignment
\do\pageshape \scr }
\def\do\pageshape{%
\ifnum\scr=0\def\par{\endgraf}
\else\def\par{{\endgraf
\global\totallines=\prevgraf}}}%
\fi
\everypar={\prevgraf=\totallines}%
\parshape \scr }
```

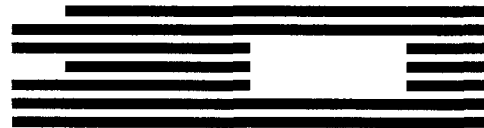
The `\afterassignment` hack in `\pageshape` allows us to obtain the numeric value for `\pageshape`. In case it is zero, standard paragraph shaping is invoked. Interesting things occur otherwise. We use `\totallines` to remember the final value of `\prevgraf`, and then use `\everypar` to set `\prevgraf` as each paragraph commences.

`\par` has been redefined to end the paragraph, but to do so within a group (which is why the `\totallines` equation needs a `\global` prefix). What is the purpose of this additional level of grouping? As the paragraph concludes, `TEX` restores the standard value for `\parshape`. But this restoration occurs within a group—which means that the former value prevails when the group is exited. This former value is precisely the `\parshape` specified within the “`\pageshape`” command. It's as if we included a `\parshape` specification within `\everypar`.

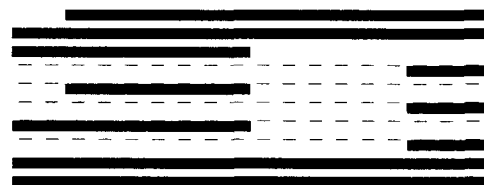
(As far as the current author knows, this method was first elucidated by the author of `TEX` and communicated in a private letter to Elizabeth Barnhart of *TV*

Guide in about 1987. I am grateful to her for having made this letter available to me.)

An immediate application is toward the creation of windows within paragraphs. How so? Suppose we wanted text with a window like this:



We simply use `\pageshape` to create text which looks as follows.



(The dashed lines emphasize the the position of the interline glue.) Then, macros in `\output` have to be smart enough to backspace up (via a command like `\vskip-\baselineskip`) after adding the left side of the window to the partial page but before adding the right side.

Figure 3 shows how I used `TEX` to typeset a page originally typeset by Hermann Zapf some years ago. This method can be generalized to form windows of arbitrary shape; see, for example, (Hoenig 1992) and (Hoenig 1987).

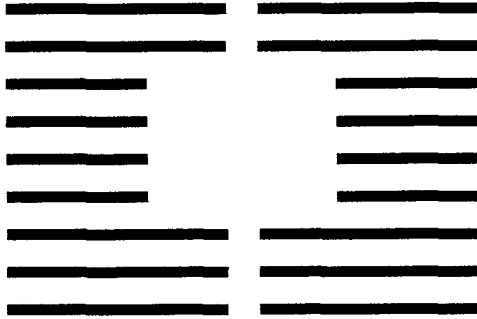


Figure 4: A simple symmetric straddle between two columns.

Magazine layout. My last example was inspired by layouts of magazines like *The New Yorker* and *Scientific American*. These layouts are deceptively simple. Both magazines fit into our model of restricted text. Both magazines employ a multiple-column format, but both also depend on sophisticated methods of leaving space for figures, author biographies, ads, cute drawings, and the like. Part of a two-column spread for *The New Yorker*, for example, might schematically appear as in figure 4. Can we get T_EX to do it, and, if yes, using a reasonable set of mark-up conventions? Based on my investigations, we can be optimistic that such macros are possible.

It has proven possible to design macros with a reasonable interface. Before the text begins, all such commands are sandwiched between two commands, `\layout` and `\endlayout`. The layout commands recognize two kinds of layout ‘events’, namely skipping lines and straddles, which are spaces straddling an intercolumn boundary and requiring indentations in the columns which must match across columns. Miscellaneous other commands can be included, such as `\nextcolumn` or `\nextpage`, which make the task of anchoring the layout to the page, easier.

How may we specify a layout event? All such events have a vertical extent—how many lines are they supposed to last. In addition, for straddles, we need to specify a horizontal extent plus information as to how to position the straddle to the left or right of the column boundary. Finally, T_EX needs to know how far down from the top of the page (or up from the bottom of the page) to begin the skip or straddle.

Commands controlling layout. Here follows a brief glossary of the major layout commands that I have (so far) been able to implement. All of the commands controlling layout events occur in two varieties. The first specifies that the beginning of the event (straddle or skip) should occur so many lines down from the first line of the page; these have `...FromTop` in their names. The second says that the bottom of the

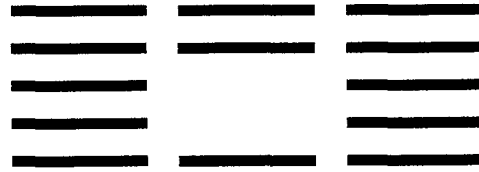


Figure 5: A small gap in a short page containing three columns.



Figure 6: A straddle across one column in a page containing three columns.

event begins so many lines up from the bottom of the page and have `...FromBottom` in their names.

`\n` tells the macros how many columns to set the text in. No attempt is made to balance columns on the last page (although such a capability could be added); we assume that editors need to know by how much an article exceeds or falls short of its allotted space.

`\StraddleFromTop#1#2#3` creates a straddle similar to that of figure 4. Here, #1 is the total width of the straddle, #2 is total height of the straddle in lines, and #3 is the number of lines from the top of the page at which point the straddle begins. The straddle of figure 4 could have been specified with a command like `\StraddleFromTop{6pc}{4}{2}`.

`\StraddleFromBottom#1#2#3` Here, parameter #3 is the number of lines of the *bottom* of the indent from the bottom of the page. Using this command, the straddle of figure 4 would be `\StraddleFromBottom{6pc}{4}{3}`.

`\AstraddleFromBottom#1#2#3#4` This command yields an asymmetric straddle. Here, #4 is the length of the left portion of the indent. There is also an `\AstraddleFromTop` command.

`\SkipFromTop#1#2` will skip #1 lines (leave a vertical gap of that many lines) starting #2 lines from the top. There is a companion command `\SkipFromBottom#1#2` where the second parameter #2 specifies the number of lines below the bottom of the gap.

The vertical gap in figure 5 comes from either of the commands `\SkipFromTop{2}{2}` or `\SkipFromBottom{2}{1}`.

`\StraddlesFromTop#1#2#3#4` This and the following commands control layout events that span

several columns. Here, parameter #1 is the total width of cutout; #2 should be the number of full columns straddled; #3 is the vertical height in lines; and #4 is the number of lines from the top of the page. Figure 6 displays a straddle across a single column; either of `\StraddlesFromTop{1.3\C}{1}{2}{2}` or `\StraddlesFromBottom{1.3\C}{1}{2}{1}` (where `\colwd` is some hypothetical register containing the width of a column) could have generated it.

`\SpanColumnsFromTop#1#2#3` requests T_EX to create a vertical gap, but a gap which spans several columns horizontally. Here, #1 is the number of columns spanned, #2 is the number of vertical lines to be skipped, and #3 is the number of lines from the top of the page at which to begin the span. A companion command, `\SpanColumnsFromBottom` also exists in case it is easier to relate gaps to the page bottom. It also requires three parameters, the third one being the number of lines from the page bottom.

`\TwoEyesFromTop#1#2#3` generates the peculiar formation shown in figure 9. The three parameters refer to the total length of the eye, the vertical duration of the eye in lines, and the number of lines down from the page. Its companion is `\TwoEyesFromBottom`.

`\nextcolumn` and `\nextpage` tells the macros to resume its line counting on the next column or page. If several columns are set plain with no layout events, then several `\nextcolumn` commands will need to follow each other in the `\layout` section of the document.

In addition to these high level commands, there are three others which lurk behind the scenes: `\AtLeftFromBottom`, `\AtRightFromBottom`, and `\LeftRightFromBottom` (plus their Top companions). These control indentations at the sides of a column. These together with the `\SkipFrom...` commands combine to produce all the commands listed above.

Other weird shapes. Although I have described several kinds of layout cutouts, all are combinations of two kinds of basic shapes—a command to create a vertical gap in a single column, and two commands to create either a left or right indentation in a column. Careful study of the macros shows how to combine these to create a larger palette of layout commands. However, commands can be ‘stacked’. That is, it is possible to create odd cutouts by combining several commands together. For example, an asymmetric straddle lasting for a single line is the result of a command like

```
\ASTraddleFromTop{10pc}{1}%
{\scratch}{\dimen0}
```

where `\dimen0` contains the amount of the left indent and `\scratch` is a scratch count register. This was the basic component that produced the layout of figure 7.

An example. Figures 8 through 10 show the first few pages of *Moby-Dick* which have been formatted with these macros. This is offered as an example of the use of these macros, *not* as an example of good typography. Even with absurd values of `\tolerance` and `\hyphenpenalty` (9600 and -100) and with nine-point type, it is difficult for T_EX to generate acceptable line breaks. Furthermore, no claim is made that the placement of column cutouts is in any way pleasing.

In general, cutouts are specified starting at the top of a column and proceeding downward. Proceed to the next column on the right when this column is finished. Use `\nextcolumn` and `\nextpage` commands to get to the next column or page. After the last layout element has been specified, conclude with `\endlayout`. The following lines provide one way to generate the pages shown in figures 8 through 10.

```
\layout
\SpanColumnsFromTop{2}{4}{0}
\StraddleFromBottom{16}{4}{16}
\nextcolumn
\nextcolumn
\SkipFromBottom{\bioht}{0}
\nextpage %%
\TwoEyesFromTop{4.5pc}{7}{5}
\TwoEyesFromBottom{4.5pc}{7}{5}
\nextpage %%
\StraddleFromTop{\colwd}{4}{5}
\StraddlesFromBottom{%
  2\colwd}{1}{4}{5}
\nextcolumn
\StraddleFromBottom{%
  \colwd}{4}{13}
\endlayout
```

Limitations and bugs. No error checking to speak of has been built in to these macros. If you specify incorrect or contradictory layout parameters, you get unpredictable output rather than error messages.

There is no good way to currently place logos or other typeset snippets in the gaps created by these layout commands. A rudimentary facility does exist, but it is not robust enough to report on at present.

References

- Hoenig, Alan, “T_EX does windows—conclusion,” *TUGboat*, 8(2), pages 212–216, July 1987.
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him. Go visit the Prairies in June, when for scores on scores of miles you wade knee-deep among Tiger-lilies—what is the one charm wanting?—Water—there is not a drop of water there! Were Niagara but a cataract of sand, would you travel your thousand miles to see it? Why did the poor poet of Tennessee, upon suddenly receiving two handfuls of silver, deliberate whether to buy him a coat, which he sadly needed, or invest his money in a pedestrian trip to Rockaway Beach? Why is almost every robust healthy boy with a robust healthy soul in him, at some time or other crazy to go to sea? Why upon your first voyage as a passenger, did you yourself feel such a mystical vibration, when first told that you and your ship were now out of sight of land? Why did the old Persians hold the sea holy? Why did the Greeks give it a separate deity, and own brother of Jove? Surely all this is not without meaning. And still deeper the meaning of that story of Narcissus, who because he could not grasp the tormenting, mild image he saw in the fountain, plunged into it and was drowned. But that same image, we ourselves see in all rivers and oceans. It is the image of the ungraspable phantom of life; and this is the key to it all.

Now, when I say that I am in the habit of going to sea whenever I begin to grow hazy about the eyes, and begin to be over conscious of my lungs, I do not mean to have it inferred that I ever go to sea as a passenger. For to go as a passenger you must needs have a purse, and a purse is but a rag unless you have something in it. Besides, passengers get sea-sick—grow quarrelsome—don't sleep of nights—do not enjoy themselves much, as a general thing;—no, I never go as a passenger; nor, though I am something of a salt, do I ever go to sea as a Commodore, or a Captain, or a Cook. I abandon the glory and distinction of such offices to those who like them. For my part, I abominate all honorable respectable toils, trials, and tribulations of every kind whatsoever. It is quite as much as I can do to take care of myself, without taking care of ships, barques,

brigs, schooners, and what not. And as for going as cook,—though I confess there is considerable glory in that, a cook being a sort of officer on ship-board—yet, somehow, I never fancied broiling fowls;—though once broiled, judiciously buttered, and judgmatically salted and peppered, there is no one who will speak more respectfully, not to say reverentially, of a broiled fowl than I will. It is out of the idolatrous dotings of the old Egyptians upon broiled ibis and roasted river horse, that you see the mummies of those creatures in their huge bake-houses the pyramids.

No, when I go to sea, I go as a simple sailor, right before the mast, plumb down into the fore-castle, aloft there to the royal mast-head. True, they rather order me about some, and make me jump from spar to spar, like a grasshopper in a May meadow. And at first, this sort of thing is unpleasant enough. It touches one's sense of honor, particularly if you come of an old established family in the land, the van Rensselaers, or Randolphs, or Hardicanutes. And more than all, if just previous to putting your hand into the tar-pot, you have been lording it as a country schoolmaster, making the tallest boys stand in awe of you. The transition is a keen one, I assure you, from the schoolmaster to a sailor, and requires a strong decoction of Seneca and the Stoics to enable you to grin and bear it. But even this wears off in time.

What of it, if some old hunks of a sea-captain orders me to get a broom and sweep down the decks? What does that indignity amount to, weighed, I mean, in the scales of the New Testament? Do you think the archangel Gabriel thinks anything the less of me, because I promptly and respectfully obey that old hunks in that particular instance? Who aint a slave? Tell me that. Well, then, however the old sea-captains may order me about—however they may thump and punch me about, I have the satisfaction of knowing that it is all right; that everybody else is one

Figure 7: An odd inter-column cutout (text face is Monotype Baskerville).

Chapter I LOOMINGS

Call me Ishmael. Some years ago—never mind how long precisely—having little or no money in my purse, and nothing particular to interest me on shore, I thought I would sail about a little and see the watery part of the world.

It is a way I have of driving off the spleen, and regulating the circulation. Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principle to prevent me from deliberately stepping into the street, and methodically knocking people's hats off—then, I account it high time to get to sea as soon as I can.

This is my substitute for pis-

tol and ball. With a philosophical flourish Cato throws himself upon his sword; I quietly take to the ship. There is nothing surprising in this. If they but knew it, almost all men in their degree, some time or other, cherish very nearly the same feelings towards the ocean with me. There now is your insular city of the Manhattoes, belted round by wharves as Indian isles by coral reefs—commerce surrounds it with her surf.

Right and left, the streets take you waterward. Its extreme downtown is the battery, where that noble mole is washed by waves, and cooled by breezes, which a few hours previous were out of sight of land. Look at the crowds of water-gazers there.

Circumambulate the city of a dreamy Sabbath afternoon. Go from Corlears Hook to Coenties Slip, and from thence, by White-

hall northward. What do you see?—Posted like silent sentinels all around the town, stand thousands upon thousands of mortal men fixed in ocean reveries. Some leaning against the spiles; some seated upon the pier-heads; some looking over the bulwarks of ships from China; some high aloft in the rigging, as if striving to get a still better seaward peep. But these are all landmen; of week days pent up in lath and plaster—tied to counters, nailed to benches, clinched to desks. How then is this? Are the green fields gone? What do they here?

HERMAN MELVILLE (1819-1891) was born in New York City, the descendant of English and Dutch families. He won fame for many of his novels, but *Moby-Dick* (1851), his greatest novel, has overshadowed almost all of them. His popularity began to decline after 1851, and he died in 1891 (in New York City) in total obscurity. This century saw a favorable reevaluation of his work, and he is generally regarded now to be an outstanding writer of the sea and a master of realistic narrative and rhythmical prose.

Figure 8: An example of the use of column cutouts. The type is Monotype Columbus.

But look! here come more crowds, pacing straight for the water, and seemingly bound for a dive. Strange! Nothing will content them but the extremest limit of the land; loitering under the shady lee of yonder warehouses will not suffice. No. They must get just as nigh the water as they possibly can without falling in. And there they stand—miles of them—leagues. Inlanders all, they come from lanes and alleys, streets and avenues,—north, east, south, and west. Yet here they all unite. Tell me, does the magnetic virtue of the needles of the compasses of all those ships attract them thither?

Once more. Say, you are in the country; in some high land of lakes. Take almost any path you please, and ten to one it carries you down in a dale, and leaves you there by a pool in the stream. There is magic in it. Let the most absent-

minded of men be plunged in his deepest reveries—stand that man on his legs, set his feet a-going, and he will infallibly lead you to water, if water there be in all that region. Should you ever be athirst in the great American desert, try this experiment, if your caravan happen to be supplied with a metaphysical professor. Yes, as every one knows, meditation and water are wedded for ever.

But here is an artist. He desires to paint you the dreamiest, shadiest, quietest, most enchanting bit of romantic landscape in all the valley of the Saco. What is the chief element he employs? There stand his trees, each with a hollow trunk, as if a hermit and a crucifix were within; and here sleeps his meadow, and there sleep his cattle; and up from yonder cottage goes a sleepy smoke. Deep into distant woodlands winds a mazy way, reach-

ing to overlapping spurs of mountains bathed in their hill-side blue. But though the picture lies thus tranced, and though this pine-tree shakes down its sighs like leaves upon this shepherd's head, yet all were vain, unless the shepherd's eye were fixed upon the magic stream before him. Go visit the Prairies in June, when

for scores on scores of miles you wade knee-deep among tiger lilies—what is the one charm wanting?—Water—there is not a drop of water there! Were Niagara but a cataract of sand, would you travel your thousand miles to see it? Why did the poor poet of Tennessee, upon suddenly receiving two handfuls of silver, deliberate whether to buy him a coat, which

he sadly needed, or invest his money in a pedestrian trip to Rockaway Beach? Why is almost every robust healthy boy with a robust healthy soul in him, at some time

Figure 9: An example (continued) of the use of column cutouts.

or other crazy to go to sea? Why upon your first voyage as a passenger, did you yourself feel such a mystical vibration, when first told that you and your ship were now out of sight of land? Why did the old Persians hold the sea holy? Why did the Greeks give it a separate deity, and own brother of Jove? Surely all this is not without meaning. And still deeper the meaning of that story of Narcissus, who because he could not grasp the tormenting, mild image he saw in the fountain, plunged into it and was drowned. But that same image, we ourselves see in all rivers and oceans. It is the image of the ungraspable phantom of life; and this is the key to it all.

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sleep of nights—do not enjoy themselves much, as a general thing;—no, I never go as a passenger; nor, though I am something of a salt, do I ever go to sea as a Commodore, or a Captain, or a Cook. I abandon the glory and distinction of such offices to those who like them. For

my part, I abominate all honorable respectable toils, trials, and tribulations of every kind whatsoever. It is quite as much as

I can do to take care of myself, without taking care of ships, barques, brigs, schooners, and what not. And as for going as cook,—though I confess there is consider-

able glory in that, a cook being a sort of officer on ship-board—yet, somehow, I never fancied broiling fowls;—though once broiled, judiciously buttered, and judgmatically salted and peppered, there is no one who will speak more respectfully, not to say reverentially, of a broiled fowl than I will. It is out of the idolatrous dotings of the old Egyptians upon broiled ibis and roasted river horse, that you see the mummies

of those creatures in their huge bake-houses the pyramids.

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order me about some, and make me jump from spar to spar, like a grasshopper

in a May meadow. And at first, this sort of thing is unpleasant enough. It touches one's sense of honor, particularly if you come of an old established family in

Figure 10: An example (concluded) of the use of column cutouts.