

AN OVERVIEW OF
SOME NEW PARAGRAPHING AND MICROTYPOGRAPHY
FEATURES FOR TROFF

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The paragraph-at-once line breaking and microtypography features incorporated into Heirloom *troff* by Gunnar Ritter make a significant improvement in the quality of *troff*'s line breaking. With a few modifications the quality of the line breaks, uniformity of word spaces, and overall grayness can be further improved.

The modifications fall into three general categories: 1) The method of calculating the “badness” of word spaces and the corresponding penalty; 2) The method of applying dynamic letter spacing and glyph scaling; and 3) Additional requests to control other aspects of line breaking. This paper describes five methods of calculating the badness of word spaces and five methods of applying microtypography. The new methods can be used alongside the old ones with few limitations. Also implemented are an Heirloom mode and a mode that produces line breaks similar to those of T_EX. The underlying code has not been modified except as necessary to splice in the new functions. The code base is *n-t-roff*, an updated 64-bit fork of Heirloom *troff*; references to Heirloom are to the features introduced by Ritter.

The characteristics of the new methods and requests are demonstrated with pages of sample text made up into two-page spreads. The text is fairly challenging to set: it has a number of obstacles to work around, and the facing pages are quite different in content. The first paragraph is rather lengthy and takes up the entire first page. This gives the algorithm an opportunity to demonstrate its ability to find good breaks that lead to uniform word spaces, or to paint itself into a corner by choosing breaks that are not so good.

One of the major goals is for the word spaces to be as nearly the same size as possible, so in order to make an objective gauge of the space size, a character is printed in the right margin next to each line; this character represents a bin class corresponding to the size of the word spaces for that line. The bins are half the size of a T_EX fitness class, except for the central bin, Bin 5, which contains the nominal space size. Bin numbers greater than 5 denote larger word spaces, bin

Table 1: Bin classes and adjustment ratios with word space from 66.67% to 150%

Bin Class	T _E X		Raw		Normalized	
	Fitness Class	Description	Adjustment Lower	Adjustment Upper	Adjustment Ratio Lower	Adjustment Ratio Upper
0	-	Very tight	0.5000	0.5833	-1.50	
1	-	Very tight	0.5833+	0.6666	-1.25	
2	0	Tight	0.6666+	0.7500	-1.00	
3	0	Tight	0.7500+	0.8333	-0.75	
4	1	Decent	0.8333+	0.9167	-0.50	
5	1	Desired	0.9167+	1.1250	-0.25	0.25
6	1	Decent	1.1250+	1.2500		0.50
7	2	Loose	1.2500+	1.3750		0.75
8	2	Loose	1.3750+	1.5000		1.00
9	3	Very loose	1.5000+	1.6250		1.25
A	3	“ “	1.6250+	1.7500		1.50
B	3	“ “	1.7500+	1.8750		1.75
C	3	“ “	1.8750+	2.0000		2.00
X	3	“ “	2.0000+	-	2.00+	-

numbers less than 5 denote smaller word spaces. Good lines have bin 5
 numbers 2 through 8; bad lines are less than 2 or greater than 8.

The range of good word spaces is defined by the `.wrdspc` request, 5
 which takes two parameters: *lower* and *upper*. These values scale the 5
 raw adjustment ratio (the ratio of the actual space size to the desired 5
 space size) so that the smallest good space has a normalized adjust- 5
 ment ratio $r = -1.0$ and the largest good space has $r = 1.0$; the desired 5
 space size is $r = 0$. Values of $|r| > 1.0$ indicate bad lines. The values of 5
 Table 1 correspond to a range of normal word spaces from 66.67% to 5
 150% of nominal, as defined by the request `.wrdspc 66.67 150`. If 5
 we wish the range of good space sizes to be from 75% to 133% of the 5
 nominal size, we would define it with the request `.wrdspc 75 133`; 5
 we would then have $r_{0.75} = -1.0$ and $r_{1.33} = 1.0$. A penalty t is calcu- 5
 lated from r by one of several methods selected by the user.

LINE BREAKING

The new line breaking methods provide different curves for the bad- 5
 ness of the word spaces and the associated penalty. Heirloom’s line 7
 breaking functions are based on the concepts behind T_EX¹; the dis- 5
 cussion assumes some familiarity with T_EX’s philosophy of assigning 5
 penalties for various undesirable characteristics, keeping track of the 5
 total penalty for each potential line break, and choosing the “best” 7
 paragraph as the combination of breaks with the lowest total penalty. 5

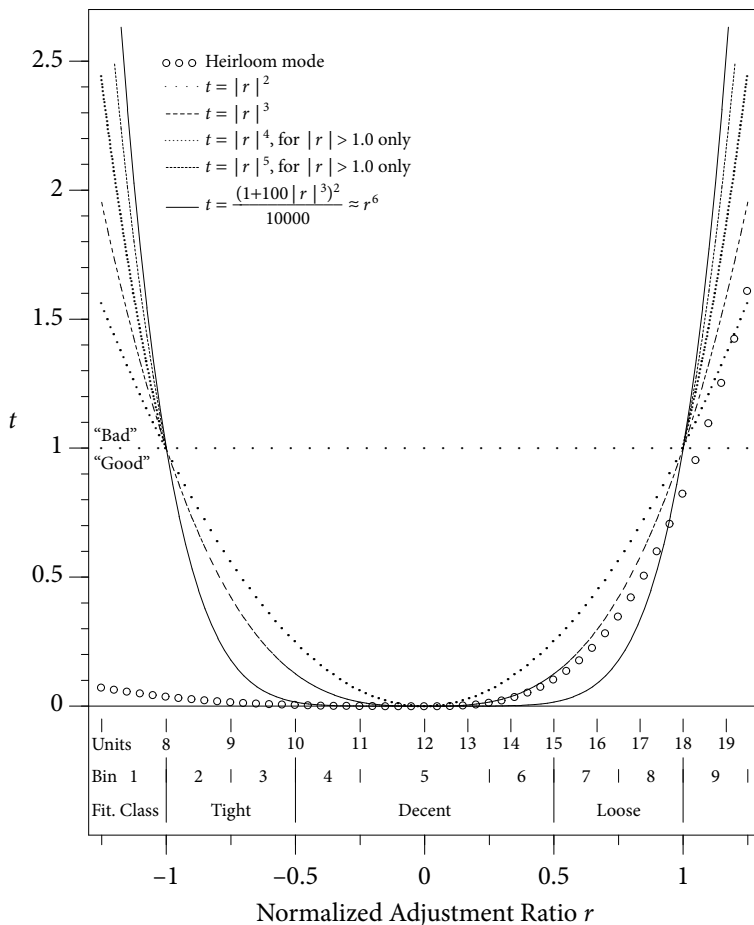


Figure 1: Word space penalty functions $t = f(r)$ for supported curves, and relationships for the normalized adjustment ratio, *troff* space size units, space size bin numbers, and \TeX fitness classes with `.ss 12` and `.wrdspc 66.7 150`. The Heirloom curve is overlaid on the *troff* units scale. Word spaces that are near the desired space size $r = 0$ are penalized only slightly, while larger or smaller spaces are assessed higher penalties as determined by the penalty function of the selected curve. The parameters of the `.wrdspc` request define the lower and upper sizes for “good” word spaces in percent of the nominal space size; at those points the penalty has a value of 1.0. In this figure the desired space size is 12 units, the smallest “good” space is $0.667 \times 12 = 8$ units, and the largest “good” space is $1.50 \times 12 = 18$ units. These values do not establish actual limits for the space size; the minimum allowable space size is defined by `.minss`, the largest space size is limited by the line length.

The paragraphs of Example A use one of the new penalty calculations and microtypography routines.² The methods selected for this example usually result in the most uniform word spaces. The requests that set up Example A are listed in Figure 2. The range of normal word spaces is defined by `.wrdspc` to be from 66.7% to 150% of the nominal value set by `.ss`. The word space calculation method is `.wscalc 26`; 26 is an encoding that means for good lines we want to minimize $|r|$ using a least squares method, and we want to discourage bad lines by applying a much steeper penalty curve. Hyphenation is minimized by adding the penalties p_1 , p_2 , and p_3 from the `.hypp` request. Penalties can be added for any other characteristics we wish to discourage:

$$t = \begin{cases} r^2 + p_1 + p_2 + p_3 + \cdots + p_n, & \text{if } |r| \leq 1; \\ r^6 + p_1 + p_2 + p_3 + \cdots + p_n, & \text{otherwise.} \end{cases}$$

The `.letadj` request works the same as before, except that the third parameter, which defines the threshold space size, is not used with the new methods. The request shown in Figure 2 applies both dynamic letter spacing and glyph scaling. The request `.letcalc 2` selects microtypography method 2; this method attempts to justify the line using letter adjustments first, then adjusts the word spaces if necessary. The request `.letpen 1` directs the algorithm to apply the results of the letter adjustments to the space size before calculating the adjustment ratio; this allows more flexibility when choosing line breaks. The `.adjpenalty` request discourages adjacent lines when one is “loose” and the other is “tight”; the first parameter assigns the penalty, and the second is a threshold value of 100 $|r|$ beyond which the penalty is applied.

```
.ss 12 0
.minss 8
.wrdspc 66.7 150
.wscalc 26
.letadj 99 99 12 102 102
.letcalc 2
.letpen 1
.adjpenalty 100 50
.hypp 64 36 36
```

Figure 2: Paragraph setup requests for Example A.

The word spaces of the examples have been summarized in the form of histograms in Figure 5. The histograms allow the characteristics of the several methods to be easily compared. The examples begin on page 14, the histograms on page 56.

Example B shows the output when the algorithm is put into Heirloom mode and uses the Heirloom microtypography method. The setup is the same as Figure 2, except for:

```
.wscale 0\" automatically sets .letcalc 0
.letadj 99 99 18 102 102
.hypp 40 30 30\" override Heirloom's default (0 0 0)
```

where `.wscale 0` and `.letcalc 0` define Heirloom mode and letter adjustment method. This mode invokes Heirloom's default settings and executes the Heirloom code, thus disallowing the use of `.wrdspace`, `.adjpenalty`, and `.letpen`. The range of normal word spaces in this mode is fixed at 0% to 160% of the nominal value set by `.ss`. Having the lower value set at 0% instead of a more typical 66–75% imparts a bias so that $|r|$ and the corresponding penalty will be small when the spaces are smaller than the nominal size. The result is that Heirloom mode tends to favor word spaces that are as close to the value of *minss* as it can make them, unless *minss* is set to a very small value; this bias is apparent in the first paragraph of Examples B and O.

The Heirloom penalty calculation is based on a cubic curve. It discourages hyphenation by cubing the sum of the `.hypp` penalties:

$$t = (|r| + p_1 + p_2 + p_3)^3 + \dots + p_n$$

Heirloom mode doesn't consider the effect of letter adjustment on the space size when it calculates the penalty, but it does prefer lines that are more full when letter adjustment is active.

The `.wscale 1` request also directs the algorithm to use the Heirloom calculation, but differs in that it does not set any of the Heirloom defaults and it allows the use of all of the new requests.

A conventional cubic calculation is available with `.wscale 3`:

$$t = |r|^3 + p_1 + p_2 + p_3 + \dots + p_n$$

The cubic curve tolerates more variation for decent and moderately loose or tight word spaces than the least squares curve; the performance is otherwise much the same. As with the least squares curve, a steeper penalty can be assessed for bad word spaces by using a second digit in the `.wscale` parameter, e.g. `.wscale 35`.

Example C is the output from the T_EX pseudo-compatibility mode. It is invoked with `.wscal` 5, which automatically sets the values of several requests to T_EX defaults, including:

```
.wrdspc 66.7 150
.hypp 25 100 50\" Equivalent to TeX 50 10000 5000
.adjpenalty 100 50
.lastlinestretch 1
```

Example C also uses the microtypography settings of Figure 2 along with `.letcalc` 2, which is based on the general method used in pdfT_EX. Changes to any of the default settings can be made by making the appropriate requests after invoking `.wscal` 5. There are too many differences between *troff* and T_EX that prevent this mode from being truly compatible, but the paragraphs are usually quite similar with the `.wscal` 5 defaults.

The T_EX82 penalty curve^{3,4} has a shallow base and steep skirts, with the result that it is more tolerant of word spaces that are moderately tight or loose than either the least squares or cubic curves. The flat central portion of the base allows more flexibility for other optimizations when variations of space size would not be too noticeable. The adapted penalty calculation uses floating point arithmetic and is rescaled to match Heirloom’s range of penalty values:

$$t = \frac{(1 + 100 |r|^3)^2}{10000} + p_1 + p_2 + p_3 + \cdots + p_n$$

T_EX penalties need to be converted so they are on the same scale. The conversion varies with the particular penalty, but in general the T_EX penalty should be divided by 100. In some cases the value must be squared first, then divided by 100: `\hyphenpenalty`, p_1 , must be squared before dividing by 100, but `\doublehyphenpenalty`, p_2 , is just divided by 100.

The fifth penalty calculation is the one described in the 1981 Knuth-Plass paper, “Breaking Paragraphs Into Lines”⁵; it is selected with `.wscal` 4. This calculation was subsequently modified to become the T_EX82 curve shown above. It is included mainly as a historical curiosity, but it is also the basis for the Heirloom penalty curve:⁶

$$t = \frac{(1 + 100 |r|^3 + p_1)^2}{10000} + p_2 + p_3 + \cdots + p_n$$

Examples A, B, and C also demonstrate two of the new requests. Lines 9 and 10 of Example B (*scurest . . . haunts* and *little . . . police*) are tight (2) and loose (7). Heirloom mode does not support the `.adjpenalty` request, but the other modes do: with `.wscale 5` it is enabled by default; with the other modes it must be enabled manually. Comparing Example B (Heirloom) with Examples A and C, we can see that with the new modes line 10 has been tightened to remedy this condition, but there is now one more hyphen.

In Example D, the line “*you has . . . there’s the*” on the right page has very loose bin 9 spaces. Adding *poor* to the line would change the bad line to a bin 3 (tight) line, but the `.adjpenalty` of 100 coupled with the t^2, t^6 word space curve conspire to make the bin 7 / bin 3 line pair worse than the bin 7 / bin 9 pair. In contrast are Example E, which has no adjacent line penalty, and Example F, which uses the T_{EX} t^6 word space penalty curve. This behavior can be mapped on Figure 1.

Another new request is `.lastlinestretch`, which stretches the last line of a paragraph so that it becomes fully justified if its natural length falls within one en of a full line. This feature is also enabled by default with `.wscale 5`, but must be switched on manually with the other modes. The one-line paragraph on the second page of Example C, “*Fearsome! . . . a-thinking.*” has been justified because of this request, while its counterparts in Examples A and B have not.

In Examples D, E, and F, letter adjustment has been turned off so that we can see the paragraphs of examples A, B, and C without the benefit of microtypography. Example G has letter adjustment turned on, but `.letpen` has been set to zero so that the effects of letter adjustment are not taken into account when calculating the word space penalty. This configuration gives the same line breaks as Example D, but uses letter adjustment to “touch up” the lines.

Examples H, A, I, and J demonstrate the characteristics of the new microtypography methods 1, 2, 21 in “automatic,” and 3. These will be described in more detail a little later, but briefly: Method 1 applies letter adjustment only to bad lines; Method 2, shown in Example A, applies the letter adjustment first and then adjusts word spaces if necessary; Method 21 balances letter adjustment with word space adjustment; and Method 3 applies more letter adjustment as the space size deviates from nominal.

Example K shows letter spacing and glyph scaling used with single line adjustment. The setup is the same as in Figure 2 except that paragraph adjustment has been switched off with `.padj 0`. The `.letcalc`

request is supported in single line mode, but `.wscale`, `.wrdspe`, `.letpen`, and other requests that require paragraph adjustment are not. Compared to paragraph adjust mode, the word spaces have more variation and there are more bad lines and word breaks, but the result is much better than if microtypographic adjustments were not used at all, as in Example L.

Incidentally, Example K exhibits what appears to be a logic error in the underlying code for single-line justification. On line twelve, the first line beneath the initial capital (*ing his . . . at differ-*), the line protrudes noticeably into the right margin. The font used for these examples does not have ligatures; instead of using a ligature for `ff`, it defines a negative kern to bring `ff` closer together to form `ff`. In this example, it appears that the line breaking code takes the kern into account when calculating the glyph widths for this line, as it should, but the output code does not actually kern them when the line is written, causing the line to be longer than it should be. This occurs with words that are adjacent to a line break, as in *proffered* and *half-effaced* in Example K (*difference* and *afforded* are correct), and in Example M on the line beginning with *proffered*. The letters are correctly kerned when paragraph justification mode is in effect, as in Example B.

Example M illustrates traditional *troff* output. This example uses single line adjustment, the space size is `.ss 12`, and shrinking the space size is disallowed by requesting `.minss` with no parameters. Applying microtypography again improves the results (Example N).

MICROTYPOGRAPHY

As with the paragraphing methods, the four new microtypography methods were implemented without modifying the underlying code; the methods are simply different ways of calculating the amounts of letter spacing and glyph scaling to be applied to each line, with maximum amounts as defined by the `.letadj` request. All five methods are compared in Figures 3b through 3f. These paragraphs are set up as listed in Figure 2, differing only by the `.letcalc` method and the value of *letss* in the `.letadj` request for the Heirloom method (the new methods, as mentioned previously, do not use this parameter). Letter adjustment has been switched off for the baseline paragraph, Figure 3a, by specifying `.letadj` with no parameters. The line breaks of Figures 3a through 3e are made identical by requesting `.letpen 0` so that the microtypographic effects can be readily compared. As with most of the other examples, the effects are best observed in print: the

subtleties are all but lost when viewed on a monitor. Histograms of the word space distributions are shown in Figure 5. The following paragraphs are set using the microtypography method they describe.

The baseline example, Figure 3a, does not use microtypography. 8
The format is typical of many digital-era books: the type size is 10.5 6
points with baseline-to-baseline spacing of 15 points and line length 5
of 25 picas. The paragraph sets easily; there is only one hyphen and 6
there are no bad lines. As with all of the examples in Figure 3, the word 2
space penalty calculation is `.wscalc 26`, with `.wrdspace 66.7 150`, 6
`.ss 12 0`, `.minss 8`, and `.letpen 0`.

Method 0 is the Heirloom implementation, shown in Figure 3b. It 5
uses both letter spacing and glyph scaling with a range of 99% to 102% 3
(`.letadj 99 99 18 102 102`), as do the other examples. According 8
to the Heirloom documentation,^{6,7} Method 0 should increase letter 8
spacing and stretch the glyphs if the word space exceeds the value of 5
the third parameter, *letss*, of the `.letadj` request and shrink them 8
if the word space is smaller than the value of *minss*. Since *minss* = 8, 6
ss = 12, and *letss* = 18, we would expect letter adjustment to be applied 3
when the word spaces are smaller than 66.7% or larger than 150% of 5
the nominal space size. However, the bin classes of Figure 3b tell us 8
that this method does not behave the way it is documented: it tends 6
to apply letter adjustments to most lines and degrades the spacing of 5
some. If we set *letss* = 12, the word spaces fall into bins 4 and 5; this 6
seems better on the surface, but the glyphs on the bin 4 lines are ac- 6
tually stretched as the result of applying too much letter adjustment.

Method 1 is designed to emulate Method 0's documented behavior 4
using the parameters of the `.wrdspace` request, instead of *minss* and 7
letss, to define the regions where letter adjustments are to be applied 5
(for the new methods 1, 2, 21, and 3, the value of *letss* is irrelevant 7
except that it must be nonzero). Microtypographic adjustments are 8
applied only to bad lines; if *letpen* is nonzero, those adjustments are 6
also made when the penalties are calculated. Good lines are not letter 4
adjusted and retain the font's designed interletter spacing and glyph 6
proportions. Unfortunately, Figure 3c does not have any bad lines in 5
need of letter adjustment, but if any lines had been adjusted, lines 9
with word spaces smaller than 66.7% of the nominal size would have 5
tighter letter spacing and compressed glyphs, and lines with spaces 8
larger than 150% would have looser letter spacing and stretched glyphs. 1
Bin 1 indicates shrinking and Bin 9 or larger indicates stretching. See 5
also Example H.

Method 2 attempts to justify the line by applying letter adjustments first and then adjusting the word spaces if necessary. This approach is similar to one described by Hàn Thế Thành in “Microtypographic Extensions for the T_EX Typesetting System.”⁹ Shown in Figure 3d, Method 2 tends to produce the most uniform word spaces, the best line breaks, and the least hyphenation, but also the most distortion of the font’s native spacing and proportions. It strongly tends to use the maximum amounts of letter spacing and glyph scaling allowed.

Method 21 distributes the justification between letter adjustment and word spaces in a way that can be varied by the user. At its maximum setting it acts like Method 2 except for some application details. At lower settings the effect is more subtle than Method 2, the word spaces tend to have more variation, there is usually less overall letter adjustment, and the glyph spacing and proportions tend to be less distorted. There is also an “automatic” setting, demonstrated in Figure 3e and this paragraph, which produces paragraphs similar to Method 3. The main portion of the text uses Method 21 at its maximum setting.

Method 3, shown in Figure 3f, applies microtypography based on the range of good word spaces defined by `.wrdspc`. The amount of letter adjustment increases as the space size deviates from its nominal value. The effect is more subtle than Method 2, more effective than Method 1, and applies less overall letter adjustment than Method 21; but the word spaces usually have more variation, the line breaks are not quite as good, and there tends to be more hyphenation.

There is some difference of opinion as to whether letter spacing or glyph scaling produces better results. Figures 3g and 3h, and the following two paragraphs, show equal amounts of glyph scaling and letter spacing side by side so the effect can be compared. One of them is clearly better looking than the other.

Figure 3g applies only the glyph scaling portion of the `.letadj` request used in Figure 3e (99.0 to 102 percent). Lines 2–3, 5–6, and 16–18 have adjacent lines with large amounts of stretch and shrink. The maximum stretch and maximum shrink are adjacent on lines 2 and 3. Pages that use glyph scaling tend to have lines that are lighter or darker than normal, and the pages tend to have more sparkle due to the varying stem widths and counters. These characteristics are affected by the print software and hardware, and may not be visible at all at text sizes on a low-resolution monitor.

Figure 3h demonstrates letter spacing only. This example uses the same range of letter spacing as the other examples: 99.0–102 percent

of an en. As with the previous example, lines 2 and 3 show a worst case comparison. Pages that use only letter spacing tend to have more uniform color than those with a similar amount of glyph scaling, and, of course, the glyph shapes are not distorted at all. When combined with glyph scaling, as in Figure 3e, the visible effects can be reduced.

Table 2: Glyph scaling for selected lines of Figure 3g

Line	Keywords	Bin	Adj. Ratio	Point Size ^a	Scale % ^b
2	sional . . . which	7	1.280	10.71	101.99
3	swept . . . along	4	0.851	10.40	99.01
4	the . . . that	5	1.067	10.57	100.63
5	struggled . . . of	5	0.948	10.45	99.56
6	London . . . police,	6	1.142	10.64	101.38
16	as . . . a	7	1.305	10.71	101.99
17	moment . . . might	5	0.997	10.50	99.99
18	do . . . as	5	0.970	10.46	99.63
24	he . . . age,	4	0.849	10.40	99.01

^a As measured by Adobe Acrobat Pro, resolution of 0.01 pt.

^b As recorded in the ditroff output file.

Table 3: Letter spacing for selected lines of Figure 3h

Line	Keywords	Bin	Adj. Ratio	Tracking ^a	% of en
2	sional . . . which	7	1.255	105	102.00
3	swept . . . along	4	0.860	-49	99.07
4	the . . . that	5	1.070	28	100.53
5	struggled . . . of	5	0.945	-19	99.64
6	London . . . police,	6	1.144	64	101.22
16	as . . . a	7	1.270	105	102.00
17	moment . . . might	5	0.996	0	100.00
18	do . . . as	5	0.968	-16	99.70
24	he . . . age,	4	0.859	-52	99.01

^a As recorded in the ditroff output file.

In Tables 2 and 3 it is probably worth commenting on the 0.01% difference between the maximum values applied and the maximums defined by the `.letadj` request.

For Table 2 this is due to a granularity of 0.01% imposed by the glyph scaling mechanism in the Heirloom code and to the behavior of the new code, which does not round its calculations on the basis of these granular units. In the Heirloom implementation, the granularity was set at 0.1%, but it was changed to 0.01% for these modifications.

In comparison, the Heirloom code tends to apply too much scaling, sometimes even when it shouldn't be applying scaling at all.

In Table 3, 99.01% is as close as we can get to the limit without exceeding it; the limit is -52.5 units, which becomes -52 units when converted to an integer as used by *troff*.

The Heirloom microtypography method, Method 0, was designed for use with the Heirloom paragraphing function; but the line breaks are quite a bit different with this configuration, and that makes it difficult to compare just the microtypographic effects. Figure 3i was composed in Heirloom mode without letter adjustment; the line breaks are the same as the baseline, Figure 3a. Figure 3j shows Heirloom mode and the Heirloom microtypography method with the `.letadj` word space threshold *letss* = 12 (equivalent to the effective value used by `.letcalc 2`); the line breaks are substantially different. With glyph scaling only, Figure 3k, the original line breaks are not altered; lines with large word spaces have stretched glyphs, but lines with small word spaces do not have shrunk glyphs—the glyphs are stretched. However, shrinking does occur if *letss* ≥ 17 . With letter spacing only, Figure 3l, many of the line breaks and word spaces are the same as in Figure 3j.

OTHER FEATURES

The `.adjpenalty` and `.lastlinestretch` requests have already been demonstrated. Another new request, `.looseness`, is useful when the length of a paragraph needs to be altered to avoid some obstacle, such as a widow line, or to balance the length of two columns or pages. Figure 4a demonstrates this request with parameters -1 , 0 , and $+1$ to make the paragraph one line shorter, its natural length, and one line longer; this figure is after Figure 18 of Knuth-Plass.¹⁰ Unlike T_EX, which keeps many feasible solutions for each breakpoint when `\looseness` is in effect, Heirloom retains only the best solution for each breakpoint; therefore, it does not have any suboptimal lines to choose from, just optimal lines for suboptimal breakpoints. In the `.looseness +1` example, the paragraph is so bad that it had to be coerced by increasing the minimum space size. Nonetheless, the request has proven quite useful in practice. Figure 4b applies the microtypography method based on pdfT_EX, `.letcalc 2`.

Several other requests are not demonstrated, largely because they do not affect any of the examples. There are two requests to control overruns (short lines at the end of a paragraph): `.linepenalty` and `.overrunpenalty`. The `.linepenalty` request is borrowed from

TEX; it adds a small penalty to each line to favor a shorter paragraph if it is nearly as good. The `.overrunpenalty` request assigns a variable penalty if the last line is shorter than a specified threshold; this feature can move the overrun up a line to make the last line shorter, move words down from the previous line to make it longer, or leave it alone if the paragraph would be degraded too much by changing it.

The `.elchp` request favors lines that end with a sentence-ending character, a transparent character, or other punctuation (excluding hyphens). With a small penalty value this request discourages lines that end with one or two letters following a punctuation mark, and it has the side benefit of working to reduce hyphenation.

The `.exhyp` request assigns a penalty for breaking a line at an explicit hyphen (a ‘-’ that is part of the text), such as is used with some compound words.

The `.hypp` hyphenation penalties are now meaningful for the new line breaking methods. All penalties input via a request have the same scale—the input value divided by 100. They can be directly related and can be positioned on the penalty graph of Figure 1 to gauge the effect they have on a given curve. However, inline penalties, such as those embedded in the text with `\j`, are still divided by 50, as are the `.hypp` penalties when in Heirloom mode.

The `.letspc` and `.letshp` requests are useful for changing one or both values of the letter spacing and glyph scaling portions of the `.letadj` request when correcting troublesome paragraphs.

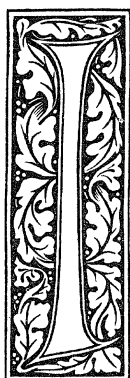
The `.wsmark` request writes the word space bin in the margin.

SUMMARY

The addition of just a few features allows *troff* to compose paragraphs that are competitive with leading applications. Requests already built into the Heirloom code allow a great deal of flexibility with paragraph composition and make it easy to customize *troff*'s behavior in ways that may be convoluted or impossible in other applications.

The use of microtypography is very important for obtaining high quality paragraphs. This paper demonstrates and compares the existing Heirloom method and four new methods, each with different capabilities and aesthetics. A small amount of letter adjustment can improve paragraph quality with both paragraph-wide and single-line justification; if the effects of letter adjustment are taken into account when calculating the line breaks in paragraph adjust mode, the improvement can sometimes be substantial.

PAUL CLIFFORD · A NOVEL BY SIR EDWARD
 GEORGE EARLE LYTTON BULWER-LYTTON



IT WAS A DARK AND STORMY NIGHT; 5
 the rain fell in torrents—except at occasional 5
 intervals, when it was checked by a violent 6
 gust of wind which swept up the streets (for 5
 it is in London that our scene lies), rattling 6
 along the house-tops, and fiercely agitating 7
 the scanty flame of the lamps that struggled 5
 against the darkness. Through one of the ob- 5
 scurest quarters of London, and among haunts 4
 little loved by the gentlemen of the police, a 5
 man, evidently of the lowest orders, was wend- 4
 ing his solitary way. He stopped twice or thrice at dif- 5
 ferent shops and houses of a description correspondent 5
 with the appearance of the quartier in which they were 5
 situated, and tended inquiry for some article or another 5
 which did not seem easily to be met with. All the an- 5
 swers he received were couched in the negative; and as 5
 he turned from each door he muttered to himself, in 5
 no very elegant phraseology, his disappointment and dis- 5
 content. At length, at one house, the landlord, a sturdy 5
 butcher, after rendering the same reply the inquirer 6
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 nest of low and dingy buildings, at the entrance to which, 4
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 or ale-house, through the half-closed windows of which 5
 blazed out in ruddy comfort the beams of the hospitable 5
 hearth, he knocked hastily at the door. He was admitted 5

by a lady of a certain age, and endowed with a comely 5
rotundity of face and person.

"Hast got it, Dummie?" said she, quickly, as she closed the 5
door on the guest.

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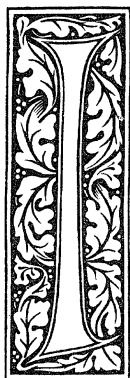
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"Vell, I'll track up the dancers!"

So saying, Dummie ascended a doorless staircase, across 5
the entrance of which a blanket, stretched angularly 6
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and presently he stood within a chamber which the dark 4
and painful genius of Crabbe might have delighted to 5
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 GEORGE EARLE LYTTON BULWER-LYTTON



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 intervals, when it was checked by a violent 7
 gust of wind which swept up the streets (for 5
 it is in London that our scene lies), rattling 7
 along the house-tops, and fiercely agitating 7
 the scanty flame of the lamps that struggled 5
 against the darkness. Through one of the ob- 5
 scurest quarters of London, and among haunts 2
 little loved by the gentlemen of the police, 7
 a man, evidently of the lowest orders, was 8
 wending his solitary way. He stopped twice or thrice at 5
 different shops and houses of a description correspondent 2
 with the appearance of the quartier in which they were 4
 situated, and tended inquiry for some article or another 5
 which did not seem easily to be met with. All the answers 2
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 turned from each door he muttered to himself, in no very 2
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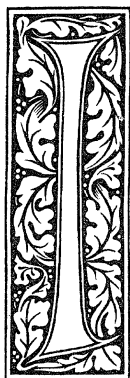
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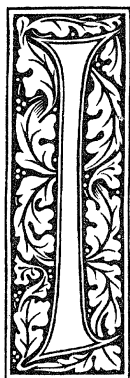
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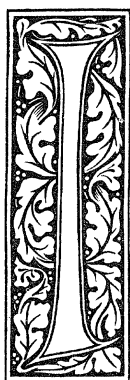
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Figure E: Heirloom mode, .wscal 0, no letter adjustment

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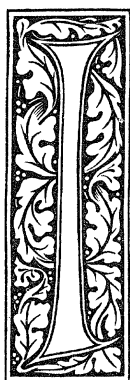
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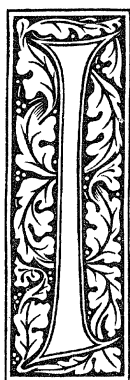
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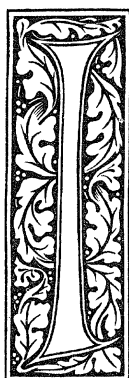
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"Vell, I'll track up the dancers!"

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the entrance of which a blanket, stretched angularly 6
from the wall to the chimney, afforded a kind of screen; 5
and presently he stood within a chamber which the dark 4
and painful genius of Crabbe might have delighted to 5
portray. The walls were white-washed, and at sundry 5
places strange figures and grotesque characters had been 5
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PAUL CLIFFORD · A NOVEL BY SIR EDWARD
GEORGE EARLE LYTTON BULWER-LYTTON



IT WAS A DARK AND STORMY NIGHT; 2
 the rain fell in torrents—except at occasional 5
 intervals, when it was checked by a violent 9
 gust of wind which swept up the streets (for 5
 it is in London that our scene lies), rattling 9
 along the house-tops, and fiercely agitating 9
 the scanty flame of the lamps that struggled 5
 against the darkness. Through one of the ob- 5
 scurest quarters of London, and among haunts 1
 little loved by the gentlemen of the police, 9
 a man, evidently of the lowest orders, was 9
 wending his solitary way. He stopped twice or thrice at 5
 different shops and houses of a description correspon- 8
 dent with the appearance of the quartier in which they 4
 were situated, and tended inquiry for some article or an- 4
 other which did not seem easily to be met with. All the 5
 answers he received were couched in the negative; and 6
 as he turned from each door he muttered to himself, in 5
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 content. At length, at one house, the landlord, a sturdy 6
 butcher, after rendering the same reply the inquirer 9
 had hitherto received, added, “But if this vill do as vell, 6
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 for a moment, Dummie responded that he thought the 5
 thing proffered might do as well; and thrusting it into 7
 his ample pocket, he strode away with as rapid a motion 4
 as the wind and the rain would allow. He soon came to a 5
 nest of low and dingy buildings, at the entrance to which, 2
 in half-effaced characters, was written “Thames Court.” 5
 Halting at the most conspicuous of these buildings, an inn 1
 or ale-house, through the half-closed windows of which 6
 blazed out in ruddy comfort the beams of the hospitable 2
 hearth, he knocked hastily at the door. He was admitted 3

by a lady of a certain age, and endowed with a comely ro- 3
tundity of face and person.

"Hast got it, Dummie?" said she, quickly, as she closed the 3
door on the guest.

"Noa, noa! not exactly—but I thinks as 'ow ——"

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you has not been arter the book at all. So there's the 9
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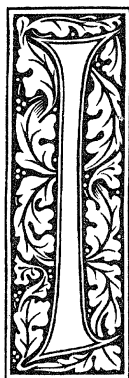
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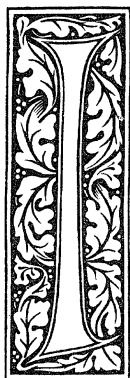
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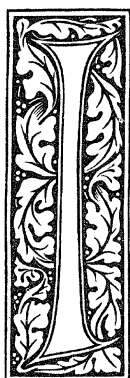
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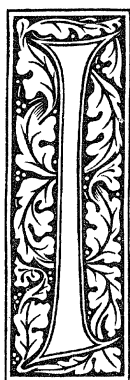
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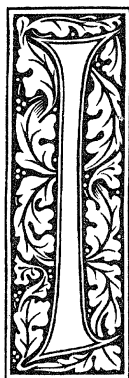
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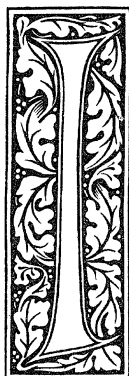
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PAUL CLIFFORD · A NOVEL BY SIR EDWARD
GEORGE EARLE LYTTON BULWER-LYTTON



IT WAS A DARK AND STORMY NIGHT; the rain fell in torrents—except at occasional intervals, when it was checked by a violent gust of wind which swept up the streets (for it is in London that our scene lies), rattling along the house-tops, and fiercely agitating the scanty flame of the lamps that struggled against the darkness. Through one of the obscurest quarters of London, and among haunts little loved by the gentlemen of the police, a man, evidently of the lowest orders, was wending his solitary way. He stopped twice or thrice at different shops and houses of a description correspondent with the appearance of the quartier in which they were situated, and tended inquiry for some article or another which did not seem easily to be met with. All the answers he received were couched in the negative; and as he turned from each door he muttered to himself, in no very elegant phraseology, his disappointment and discontent. At length, at one house, the landlord, a sturdy butcher, after rendering the same reply the inquirer had hitherto received, added, "But if this vill do as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a moment, Dummie responded that he thought the thing proffered might do as well; and thrusting it into his ample pocket, he strode away with as rapid a motion as the wind and the rain would allow. He soon came to a nest of low and dingy buildings, at the entrance to which, in half-effaced characters, was written "Thames Court." Halting at the most conspicuous of these buildings, an inn or ale-house, through the half-closed windows of which blazed out in ruddy comfort the beams

X
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B
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X
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A
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5

of the hospitable hearth, he knocked hastily at the 9
door. He was admitted by a lady of a certain age, and 6
endowed with a comely rotundity of face and person.

"Hast got it, Dummie?" said she, quickly, as she closed 6
the door on the guest.

"Noa, noa! not exactly—but I thinks as 'ow ——"

"Pish, you fool!" cried the woman, interrupting him 9
peevisly: "Vy, it is no use desaving of me. You knows 5
you has only stepped from my boosing-ken to another, 5
and you has not been arter the book at all. So there's 6
the poor cretur a-raving and a-dying, and you ——"

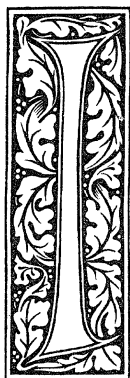
"Let I speak!" interrupted Dummie in his turn. "I tells 5
you I vent first to Mother Bussblone's, who, I knows, 6
chops the whiners morning and evening to the young 5
ladies, and I axes there for a Bible; and she says, says 6
she, 'I 'as only a "Companion to the Halter," but you'll 6
get a Bible, I think, at Master 'Talkins',—the cobbler, as 5
preaches.' So I goes to Master 'Talkins, and he says, says 5
he, 'I 'as no call for the Bible—'cause vy?—I 'as a call 7
vithout; but mayhap you'll be a-getting it at the X
butcher's hover the vay,—'cause vy?—the butcher 'll be 5
d———d! So I goes hover the vay, and the butcher says, 5
says he, 'I 'as not a Bible, but I 'as a book of plays bound 5
for all the world just like 'un, and mayhap the poor cre- 5
tur mayn't see the difference.' So I takes the plays, Mrs. 5
Margery, and here they be surely! And how's poor B
Judy?"

"Fearsome! she'll not be over the night, I'm a-thinking."

"Vell, I'll track up the dancers!"

So saying, Dummie ascended a doorless staircase, across 5
the entrance of which a blanket, stretched angularly 6
from the wall to the chimney, afforded a kind of X
screen; and presently he stood within a chamber which 5
the dark and painful genius of Crabbe might have de- 5
lighted to portray. The walls were white-washed, and 5
at sundry places strange figures and grotesque charac- 5
ters had been traced by some mirthful inmate, in such 5
sable outline as the end of a smoked stick or the edge of 5
a piece of char-

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 which did not seem easily to be met with. All the an- 5
 swers he received were couched in the negative; and as he 2
 turned from each door he muttered to himself, in no very 2
 elegant phraseology, his disappointment and discontent. 5
 At length, at one house, the landlord, a sturdy butcher, 4
 after rendering the same reply the inquirer had hitherto 2
 received, added, "But if this vill do as vell, Dummie, it is 5
 quite at your sarvice!" Pausing reflectively for a moment, 2
 Dummie responded that he thought the thing proffered 5
 might do as well; and thrusting it into his ample pocket, 5
 he strode away with as rapid a motion as the wind and 4
 the rain would allow. He soon came to a nest of low and 4
 dingy buildings, at the entrance to which, in half-effaced 4
 characters, was written "Thames Court." Halting at the 5
 most conspicuous of these buildings, an inn or ale-house, 5
 through the half-closed windows of which blazed out in 5
 ruddy comfort the beams of the hospitable hearth, he 4
 knocked hastily at the door. He was admitted by a lady 5

of a certain age, and endowed with a comely rotundity
of face and person. 4

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at Master Talkins',—the cobbler, as preaches.' So I goes to 5
Master Talkins, and he says, says he, 'I 'as no call for the 4
Bible—'cause vy?—I 'as a call vithout; but mayhap you'll 5
be a-getting it at the butcher's hover the vay,—'cause 6
vy?—the butcher'll be d-----d! So I goes hover the vay, 5
and the butcher says, says he, 'I 'as not a Bible, but I 'as 5
a book of plays bound for all the world just like 'un, and 4
mayhap the poor cretur mayn't see the difference.' So I 5
takes the plays, Mrs. Margery, and here they be surely! 5
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So saying, Dummie ascended a doorless staircase, across 5
the entrance of which a blanket, stretched angularly 6
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and painful genius of Crabbe might have delighted to por- 2
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strange figures and grotesque characters had been traced 2
by some mirthful inmate, in such sable outline as the end 2
of a smoked stick or the edge of a piece of char-

This example is set up to be similar to Examples A and C, with the same letter adjust threshold and approximately the same number of hyphens. Example B has a typical Heirloom configuration (letter adjust threshold = upper word space); this example has the same letter adjust threshold as .letcalc 2 (desired word space).

No Letter Adjustment

It was a dark and stormy night; the rain fell in torrents, except at occasional intervals, when it was checked by a violent gust of wind which swept up the streets (for it is in London that our scene lies), rattling along the house-tops, and fiercely agitating the scanty flame of the lamps that struggled against the darkness. Through one of the obscurest quarters of London, and among haunts little loved by the gentlemen of the police, a man, evidently of the lowest orders, was wending his solitary way. He stopped twice or thrice at different shops and houses of a description correspondent with the appearance of the quartier in which they were situated, and tended inquiry for some article or another which did not seem easily to be met with. All the answers he received were couched in the negative; and as he turned from each door he muttered to himself, in no very elegant phraseology, his disappointment and discontent. At length, at one house, the landlord, a sturdy butcher, after rendering the same reply the inquirer had hitherto received, added, "But if this vill do as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a moment, Dummie responded that he thought the thing proffered might do as well; and thrusting it into his ample pocket, he strode away with as rapid a motion as the wind and the rain would allow. He soon came to a nest of low and dingy buildings, at the entrance to which, in half-effaced characters, was written "Thames Court." Halting at the most conspicuous of these buildings, an inn or alehouse, through the half-closed windows of which blazed out in ruddy comfort the beams of the hospitable hearth, he knocked hastily at the door. He was admitted by a lady of a certain age, and endowed with a comely rotundity of face and person.

Figure 3a: Microtypography Methods, Baseline (No Letter Adjustment)

Method 0: Heirloom Method with .wscal 26

It was a dark and stormy night; the rain fell in torrents, except at occa- 7
sional intervals, when it was checked by a violent gust of wind which 7
swept up the streets (for it is in London that our scene lies), rattling along 3
the house-tops, and fiercely agitating the scanty flame of the lamps that 6
struggled against the darkness. Through one of the obscurest quarters of 4
London, and among haunts little loved by the gentlemen of the police, 8
a man, evidently of the lowest orders, was wending his solitary way. He 6
stopped twice or thrice at different shops and houses of a description 7
correspondent with the appearance of the quartier in which they were 8
situated, and tended inquiry for some article or another which did not 8
seem easily to be met with. All the answers he received were couched in 5
the negative; and as he turned from each door he muttered to himself, 7
in no very elegant phraseology, his disappointment and discontent. At 8
length, at one house, the landlord, a sturdy butcher, after rendering the 8
same reply the inquirer had hitherto received, added, "But if this vill do 5
as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a 7
moment, Dummie responded that he thought the thing proffered might 5
do as well; and thrusting it into his ample pocket, he strode away with as 5
rapid a motion as the wind and the rain would allow. He soon came to a 5
nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 2
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 3
he knocked hastily at the door. He was admitted by a lady of a certain age, 3
and endowed with a comely rotundity of face and person.

Figure 3b: Microtypography Methods, Method 0, .letadj 99 99 18 102 102

Method 1: Letter Adjustment Last

It was a dark and stormy night; the rain fell in torrents, except at occa- 6
sional intervals, when it was checked by a violent gust of wind which 8
swept up the streets (for it is in London that our scene lies), rattling along 3
the house-tops, and fiercely agitating the scanty flame of the lamps that 6
struggled against the darkness. Through one of the obscurest quarters of 4
London, and among haunts little loved by the gentlemen of the police, 7
a man, evidently of the lowest orders, was wending his solitary way. He 6
stopped twice or thrice at different shops and houses of a description 8
correspondent with the appearance of the quartier in which they were 7
situated, and tended inquiry for some article or another which did not 7
seem easily to be met with. All the answers he received were couched in 5
the negative; and as he turned from each door he muttered to himself, 7
in no very elegant phraseology, his disappointment and discontent. At 7
length, at one house, the landlord, a sturdy butcher, after rendering the 6
same reply the inquirer had hitherto received, added, "But if this vill do 5
as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a 8
moment, Dummie responded that he thought the thing proffered might 5
do as well; and thrusting it into his ample pocket, he strode away with as 5
rapid a motion as the wind and the rain would allow. He soon came to a 5
nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 2
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 3
he knocked hastily at the door. He was admitted by a lady of a certain age, 3
and endowed with a comely rotundity of face and person.

Figure 3c: Microtypography Methods, Method 1

Method 2: Letter Adjustment First

It was a dark and stormy night; the rain fell in torrents, except at occa- 5
sional intervals, when it was checked by a violent gust of wind which 5
swept up the streets (for it is in London that our scene lies), rattling along 5
the house-tops, and fiercely agitating the scanty flame of the lamps that 5
struggled against the darkness. Through one of the obscurest quarters of 5
London, and among haunts little loved by the gentlemen of the police, 5
a man, evidently of the lowest orders, was wending his solitary way. He 5
stopped twice or thrice at different shops and houses of a description 5
correspondent with the appearance of the quartier in which they were 5
situated, and tended inquiry for some article or another which did not 5
seem easily to be met with. All the answers he received were couched in 5
the negative; and as he turned from each door he muttered to himself, 5
in no very elegant phraseology, his disappointment and discontent. At 5
length, at one house, the landlord, a sturdy butcher, after rendering the 5
same reply the inquirer had hitherto received, added, "But if this vill do 5
as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a 5
moment, Dummie responded that he thought the thing proffered might 5
do as well; and thrusting it into his ample pocket, he strode away with as 5
rapid a motion as the wind and the rain would allow. He soon came to a 5
nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 5
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 5
he knocked hastily at the door. He was admitted by a lady of a certain age, 5
and endowed with a comely rotundity of face and person.

Figure 3d: Microtypography Methods, Method 2

Method 21 (Automatic)

It was a dark and stormy night; the rain fell in torrents, except at occa- 5
sional intervals, when it was checked by a violent gust of wind which 5
swept up the streets (for it is in London that our scene lies), rattling along 5
the house-tops, and fiercely agitating the scanty flame of the lamps that 5
struggled against the darkness. Through one of the obscurest quarters of 5
London, and among haunts little loved by the gentlemen of the police, 5
a man, evidently of the lowest orders, was wending his solitary way. He 5
stopped twice or thrice at different shops and houses of a description 5
correspondent with the appearance of the quartier in which they were 5
situated, and tended inquiry for some article or another which did not 5
seem easily to be met with. All the answers he received were couched in 5
the negative; and as he turned from each door he muttered to himself, 5
in no very elegant phraseology, his disappointment and discontent. At 5
length, at one house, the landlord, a sturdy butcher, after rendering the 5
same reply the inquirer had hitherto received, added, "But if this vill do 5
as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a 5
moment, Dummie responded that he thought the thing proffered might 5
do as well; and thrusting it into his ample pocket, he strode away with as 5
rapid a motion as the wind and the rain would allow. He soon came to a 5
nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 5
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 5
he knocked hastily at the door. He was admitted by a lady of a certain age, 5
and endowed with a comely rotundity of face and person.

Figure 3e: Microtypography Methods, Method 21

Method 3: Proportional Letter Adjustment

It was a dark and stormy night; the rain fell in torrents, except at occa- 5
sional intervals, when it was checked by a violent gust of wind which 5
swept up the streets (for it is in London that our scene lies), rattling along 5
the house-tops, and fiercely agitating the scanty flame of the lamps that 5
struggled against the darkness. Through one of the obscurest quarters of 5
London, and among haunts little loved by the gentlemen of the police, 5
a man, evidently of the lowest orders, was wending his solitary way. He 5
stopped twice or thrice at different shops and houses of a description 5
correspondent with the appearance of the quartier in which they were 5
situated, and tended inquiry for some article or another which did not 5
seem easily to be met with. All the answers he received were couched in 5
the negative; and as he turned from each door he muttered to himself, 5
in no very elegant phraseology, his disappointment and discontent. At 5
length, at one house, the landlord, a sturdy butcher, after rendering the 5
same reply the inquirer had hitherto received, added, "But if this vill do 5
as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a 5
moment, Dummie responded that he thought the thing proffered might 5
do as well; and thrusting it into his ample pocket, he strode away with as 5
rapid a motion as the wind and the rain would allow. He soon came to a 5
nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 5
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 5
he knocked hastily at the door. He was admitted by a lady of a certain age, 5
and endowed with a comely rotundity of face and person.

Figure 3f: Microtypography Methods, Method 3

Methods 2 and 21 (Automatic)
Glyph Scaling Only

It was a dark and stormy night; the rain fell in torrents, except at occa- 5
sional intervals, when it was checked by a violent gust of wind which 7
swept up the streets (for it is in London that our scene lies), rattling along 4
the house-tops, and fiercely agitating the scanty flame of the lamps that 5
struggled against the darkness. Through one of the obscurest quarters of 5
London, and among haunts little loved by the gentlemen of the police, 5
a man, evidently of the lowest orders, was wending his solitary way. He 5
stopped twice or thrice at different shops and houses of a description 7
correspondent with the appearance of the quartier in which they were 5
situated, and tended inquiry for some article or another which did not 5
seem easily to be met with. All the answers he received were couched in 5
the negative; and as he turned from each door he muttered to himself, 5
in no very elegant phraseology, his disappointment and discontent. At 5
length, at one house, the landlord, a sturdy butcher, after rendering the 5
same reply the inquirer had hitherto received, added, "But if this vill do 5
as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a 7
moment, Dummie responded that he thought the thing proffered might 5
do as well; and thrusting it into his ample pocket, he strode away with as 5
rapid a motion as the wind and the rain would allow. He soon came to a 5
nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 4
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 4
he knocked hastily at the door. He was admitted by a lady of a certain age, 4
and endowed with a comely rotundity of face and person.

Figure 3g: Microtypography Methods, Methods 2 and 21, Glyph Scaling Only

Methods 2 and 21 (Automatic)
Letter Spacing Only

It was a dark and stormy night; the rain fell in torrents, except at occa- 5
sional intervals, when it was checked by a violent gust of wind which 7
swept up the streets (for it is in London that our scene lies), rattling along 4
the house-tops, and fiercely agitating the scanty flame of the lamps that 5
struggled against the darkness. Through one of the obscurest quarters of 5
London, and among haunts little loved by the gentlemen of the police, 5
a man, evidently of the lowest orders, was wending his solitary way. He 5
stopped twice or thrice at different shops and houses of a description 7
correspondent with the appearance of the quartier in which they were 5
situated, and tended inquiry for some article or another which did not 5
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length, at one house, the landlord, a sturdy butcher, after rendering the 5
same reply the inquirer had hitherto received, added, "But if this vill do 5
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nest of low and dingy buildings, at the entrance to which, in half-effaced 5
characters, was written "Thames Court." Halting at the most conspicuous 4
of these buildings, an inn or alehouse, through the half-closed windows 5
of which blazed out in ruddy comfort the beams of the hospitable hearth, 4
he knocked hastily at the door. He was admitted by a lady of a certain age, 4
and endowed with a comely rotundity of face and person.

Figure 3h: Microtypography Methods, Methods 2 and 21, Letter Spacing Only

Method 0: Heirloom Mode Without Microtypography

It was a dark and stormy night; the rain fell in torrents, except at occasional intervals, when it was checked by a violent gust of wind which swept up the streets (for it is in London that our scene lies), rattling along the house-tops, and fiercely agitating the scanty flame of the lamps that struggled against the darkness. Through one of the obscurest quarters of London, and among haunts little loved by the gentlemen of the police, a man, evidently of the lowest orders, was wending his solitary way. He stopped twice or thrice at different shops and houses of a description correspondent with the appearance of the quartier in which they were situated, and tended inquiry for some article or another which did not seem easily to be met with. All the answers he received were couched in the negative; and as he turned from each door he muttered to himself, in no very elegant phraseology, his disappointment and discontent. At length, at one house, the landlord, a sturdy butcher, after rendering the same reply the inquirer had hitherto received, added, "But if this vill do as vell, Dummie, it is quite at your sarvice!" Pausing reflectively for a moment, Dummie responded that he thought the thing proffered might do as well; and thrusting it into his ample pocket, he strode away with as rapid a motion as the wind and the rain would allow. He soon came to a nest of low and dingy buildings, at the entrance to which, in half-effaced characters, was written "Thames Court." Halting at the most conspicuous of these buildings, an inn or alehouse, through the half-closed windows of which blazed out in ruddy comfort the beams of the hospitable hearth, he knocked hastily at the door. He was admitted by a lady of a certain age, and endowed with a comely rotundity of face and person.

Figure 3i: Microtypography Methods, Heirloom, no letadj

Method 0: Heirloom Mode and Microtypography
 Glyph Scaling and Letter Spacing

It was a dark and stormy night; the rain fell in torrents, except at occasional 2
 intervals, when it was checked by a violent gust of wind which swept up 5
 the streets (for it is in London that our scene lies), rattling along the house- 2
 tops, and fiercely agitating the scanty flame of the lamps that struggled 4
 against the darkness. Through one of the obscurest quarters of London, 5
 and among haunts little loved by the gentlemen of the police, a man, 6
 evidently of the lowest orders, was wending his solitary way. He stopped 5
 twice or thrice at different shops and houses of a description correspon- 5
 dent with the appearance of the quartier in which they were situated, and 5
 tended inquiry for some article or another which did not seem easily to be 5
 met with. All the answers he received were couched in the negative; and 5
 as he turned from each door he muttered to himself, in no very elegant 4
 phraseology, his disappointment and discontent. At length, at one house, 5
 the landlord, a sturdy butcher, after rendering the same reply the inquirer 5
 had hitherto received, added, "But if this vill do as vell, Dummie, it is quite 1
 at your sarvice!" Pausing reflectively for a moment, Dummie responded 5
 that he thought the thing proffered might do as well; and thrusting it into 5
 his ample pocket, he strode away with as rapid a motion as the wind and 5
 the rain would allow. He soon came to a nest of low and dingy buildings, 5
 at the entrance to which, in half-effaced characters, was written "Thames 5
 Court." Halting at the most conspicuous of these buildings, an inn or 5
 alehouse, through the half-closed windows of which blazed out in ruddy 5
 comfort the beams of the hospitable hearth, he knocked hastily at the door. 2
 He was admitted by a lady of a certain age, and endowed with a comely 4
 rotundity of face and person.

Figure 3j: Microtypography: Heirloom/Heirloom, .letadj 99 99 12 102 102

Method 0: Heirloom Mode and Microtypography
Glyph Scaling Only

It was a dark and stormy night; the rain fell in torrents, except at occa- 5
 sional intervals, when it was checked by a violent gust of wind which 7
 swept up the streets (for it is in London that our scene lies), rattling along 1
 the house-tops, and fiercely agitating the scanty flame of the lamps that 5
 struggled against the darkness. Through one of the obscurest quarters of 1
 London, and among haunts little loved by the gentlemen of the police, 5
 a man, evidently of the lowest orders, was wending his solitary way. He 5
 stopped twice or thrice at different shops and houses of a description 7
 correspondent with the appearance of the quartier in which they were 5
 situated, and tended inquiry for some article or another which did not 5
 seem easily to be met with. All the answers he received were couched in 4
 the negative; and as he turned from each door he muttered to himself, 5
 in no very elegant phraseology, his disappointment and discontent. At 5
 length, at one house, the landlord, a sturdy butcher, after rendering the 5
 same reply the inquirer had hitherto received, added, “But if this vill do 4
 as vell, Dummie, it is quite at your sarvice!” Pausing reflectively for a 7
 moment, Dummie responded that he thought the thing proffered might 1
 do as well; and thrusting it into his ample pocket, he strode away with as 1
 rapid a motion as the wind and the rain would allow. He soon came to a 4
 nest of low and dingy buildings, at the entrance to which, in half-effaced 1
 characters, was written “Thames Court.” Halting at the most conspicuous 1
 of these buildings, an inn or alehouse, through the half-closed windows 1
 of which blazed out in ruddy comfort the beams of the hospitable hearth, 1
 he knocked hastily at the door. He was admitted by a lady of a certain age, 1
 and endowed with a comely rotundity of face and person.

Figure 3k: Heirloom/Heirloom, Glyph Scaling Only, .letadj 100 99 12 100 102

Method 0: Heirloom Mode and Microtypography
Letter Spacing Only

It was a dark and stormy night; the rain fell in torrents, except at occasional 2
intervals, when it was checked by a violent gust of wind which swept up 5
the streets (for it is in London that our scene lies), rattling along the house- 2
tops, and fiercely agitating the scanty flame of the lamps that struggled 5
against the darkness. Through one of the obscurest quarters of London, 5
and among haunts little loved by the gentlemen of the police, a man, 7
evidently of the lowest orders, was wending his solitary way. He stopped 5
twice or thrice at different shops and houses of a description correspon- 5
dent with the appearance of the quartier in which they were situated, and 5
tended inquiry for some article or another which did not seem easily to be 5
met with. All the answers he received were couched in the negative; and 5
as he turned from each door he muttered to himself, in no very elegant 5
phraseology, his disappointment and discontent. At length, at one house, 5
the landlord, a sturdy butcher, after rendering the same reply the inquirer 5
had hitherto received, added, "But if this vill do as vell, Dummie, it is quite 2
at your sarvice!" Pausing reflectively for a moment, Dummie responded 5
that he thought the thing proffered might do as well; and thrusting it into 5
his ample pocket, he strode away with as rapid a motion as the wind and 5
the rain would allow. He soon came to a nest of low and dingy buildings, 5
at the entrance to which, in half-effaced characters, was written "Thames 5
Court." Halting at the most conspicuous of these buildings, an inn or 7
alehouse, through the half-closed windows of which blazed out in ruddy 5
comfort the beams of the hospitable hearth, he knocked hastily at the 6
door. He was admitted by a lady of a certain age, and endowed with a 6
comely rotundity of face and person.

Figure 31: Heirloom/Heirloom, Letter Spacing Only, .letadj 99 100 12 102 100

In olden times when wishing still helped one, there lived a 7
king whose daughters were all beautiful; and the youngest was so 2
beautiful that the sun itself, which has seen so much, was aston- 3
ished whenever it shone in her face. Close by the king's castle lay 2
a great dark forest, and under an old lime-tree in the forest was 4
a well, and when the day was very warm, the king's child went 5
out into the forest and sat down by the side of the cool fountain; 3
and when she was bored she took a golden ball, and threw it up 4
on high and caught it; and this ball was her favorite plaything. 5

In olden times when wishing still helped one, there lived a 7
king whose daughters were all beautiful; and the youngest was 5
so beautiful that the sun itself, which has seen so much, was 7
astonished whenever it shone in her face. Close by the king's 7
castle lay a great dark forest, and under an old lime-tree in the 5
forest was a well, and when the day was very warm, the king's 5
child went out into the forest and sat down by the side of the 6
cool fountain; and when she was bored she took a golden ball, 5
and threw it up on high and caught it; and this ball was her 6
favorite plaything.

In olden times when wishing still helped one, there lived 9
a king whose daughters were all beautiful; and the young- A
est was so beautiful that the sun itself, which has seen so A
much, was astonished whenever it shone in her face. Close A
by the king's castle lay a great dark forest, and under an A
old lime-tree in the forest was a well, and when the day B
was very warm, the king's child went out into the forest C
and sat down by the side of the cool fountain; and when B
she was bored she took a golden ball, and threw it up on A
high and caught it; and this ball was her favorite play- X
thing.

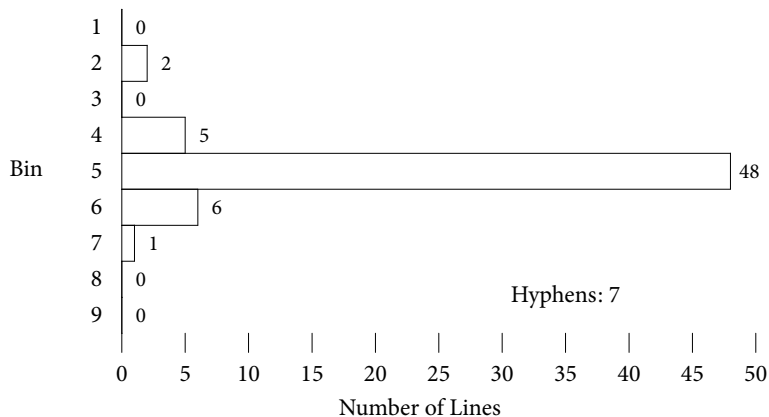
Figure 4a: Looseness at -1 , 0 , and $+1$, .wscal5, no microtypography

In olden times when wishing still helped one, there lived a 5
king whose daughters were all beautiful; and the youngest was so 4
beautiful that the sun itself, which has seen so much, was aston- 5
ished whenever it shone in her face. Close by the king's castle lay 4
a great dark forest, and under an old lime-tree in the forest was 5
a well, and when the day was very warm, the king's child went 5
out into the forest and sat down by the side of the cool fountain; 4
and when she was bored she took a golden ball, and threw it up 5
on high and caught it; and this ball was her favorite plaything. 5

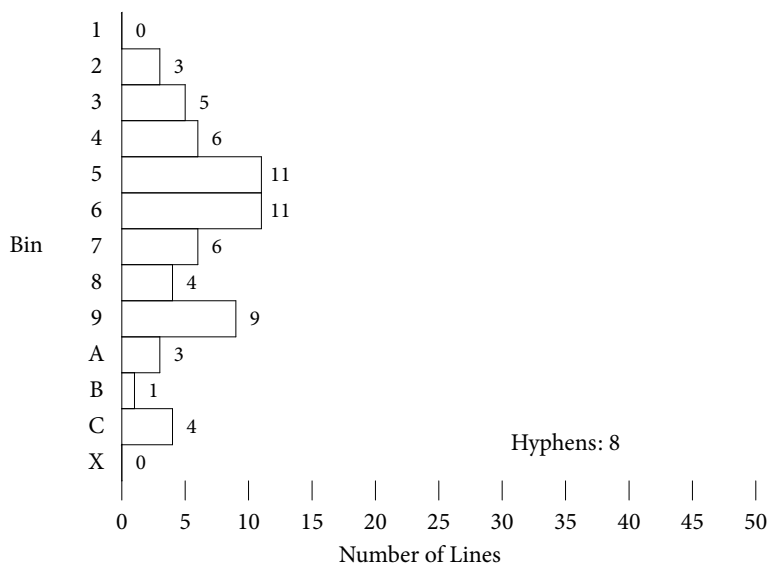
In olden times when wishing still helped one, there lived a 5
king whose daughters were all beautiful; and the youngest was 5
so beautiful that the sun itself, which has seen so much, was 5
astonished whenever it shone in her face. Close by the king's 5
castle lay a great dark forest, and under an old lime-tree in the 5
forest was a well, and when the day was very warm, the king's 5
child went out into the forest and sat down by the side of the 5
cool fountain; and when she was bored she took a golden ball, 5
and threw it up on high and caught it; and this ball was her 5
favorite plaything.

In olden times when wishing still helped one, there lived 7
a king whose daughters were all beautiful; and the young- 8
est was so beautiful that the sun itself, which has seen so 8
much, was astonished whenever it shone in her face. Close 8
by the king's castle lay a great dark forest, and under an 8
old lime-tree in the forest was a well, and when the day A
was very warm, the king's child went out into the forest A
and sat down by the side of the cool fountain; and when 9
she was bored she took a golden ball, and threw it up on 8
high and caught it; and this ball was her favorite play- B
thing.

Figure 4b: Looseness at -1, 0, and +1, .wscal 5, .letcalc 2, letadj 99 99 x 102 102

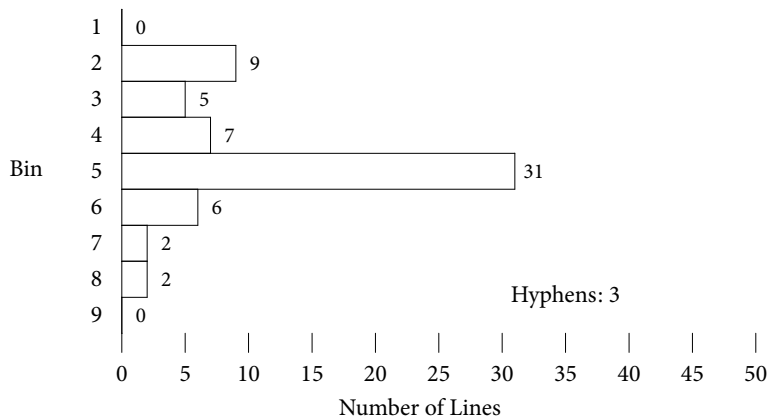


Example A: wscalcalc 26, letcalc 2, letadj 99 99 12 102 102

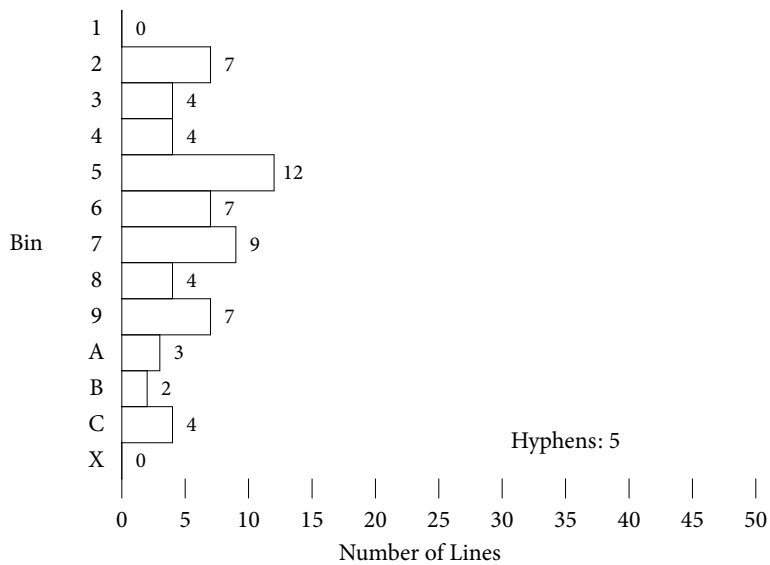


Example D: wscalcalc 26, no letter adjustment

Figure 5: Word space histograms for Examples

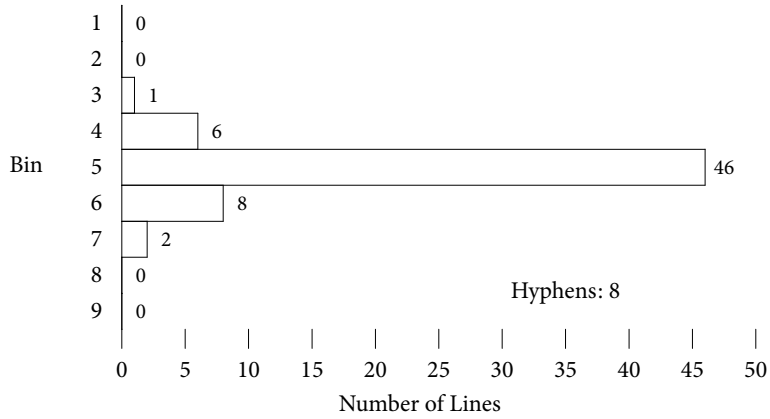


Example B: Heirloom, wscalc 0, letcalc 0, letadj 99 99 18 102 102

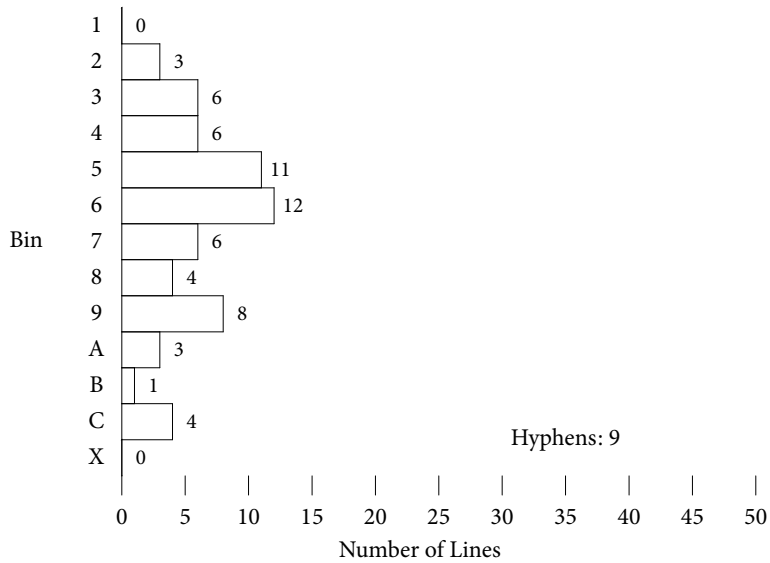


Example E: Heirloom, no letter adjustment

Figure 5: Word space histograms for Examples

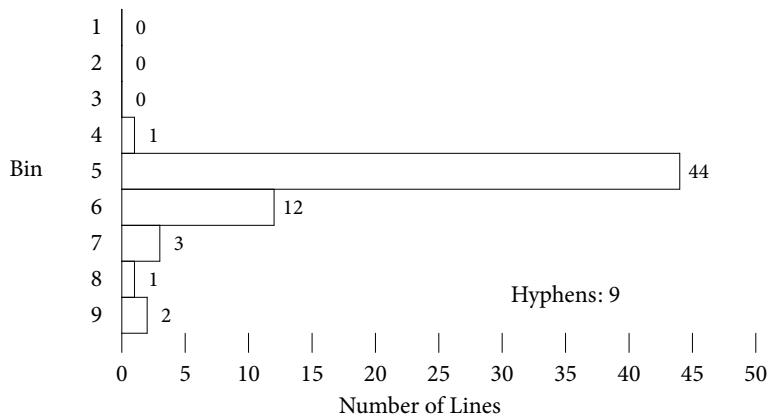


Example C: TeX Compatibility, wscalc 5, letcalc 2, letadj 99 99 12 102 102

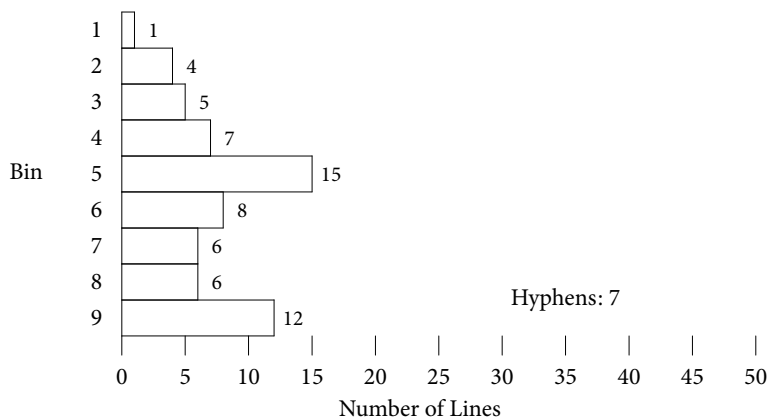


Example F: TeX, no letter adjustment

Figure 5: Word space histograms for Examples

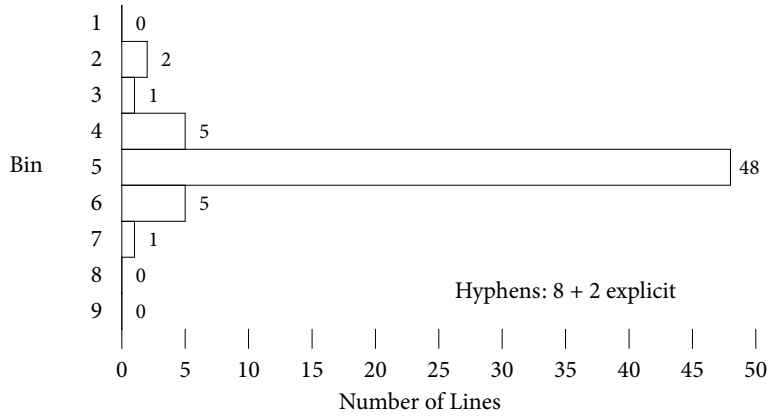


Example G wscalc 26, letcalc 2, letpen = 0
 (Same as Example A, except letpen = 0)

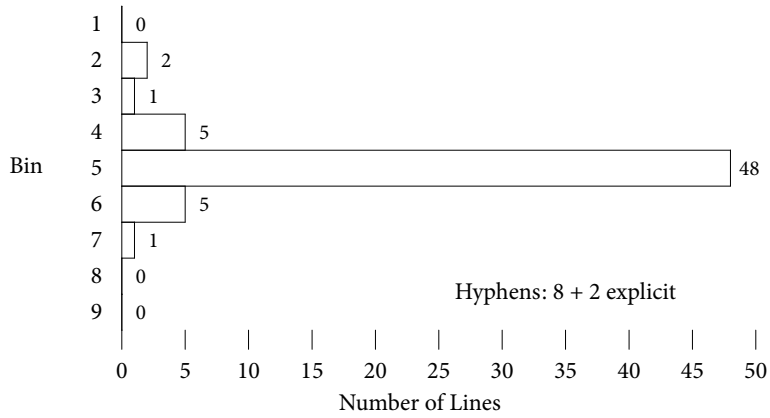


Example H: wscalc 26, letcalc 1, ls & gs
 (Same as Example A except letcalc = 1)

Figure 5: Word space histograms for Examples

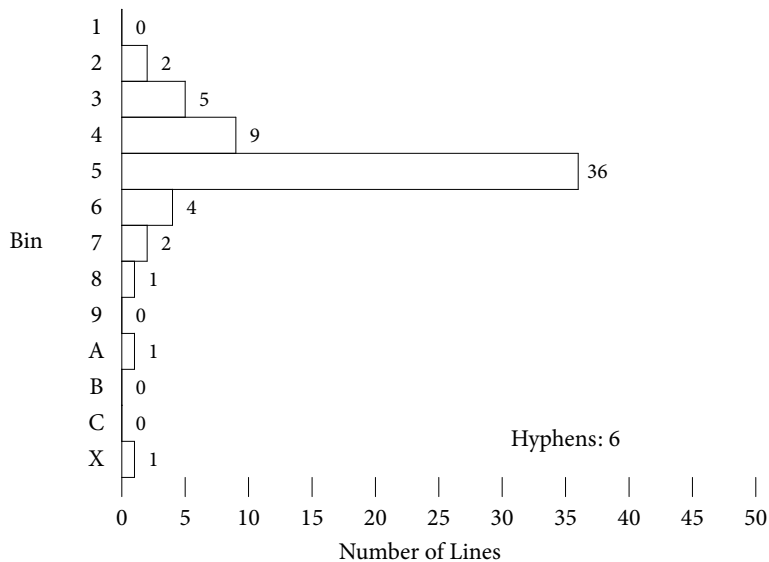


Example I: wscalc 26, letcalc 21 0, ls & gs
 (Same as Example A, except letcalc = 21 automatic)

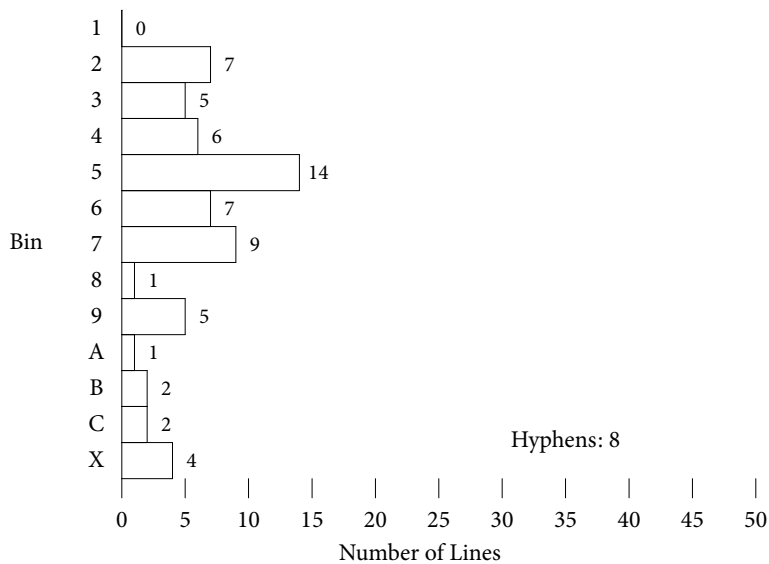


Example J: wscalc 26, letcalc 3, ls & gs
 (Same as Example A, except letcalc = 3)

Figure 5: Word space histograms for Examples

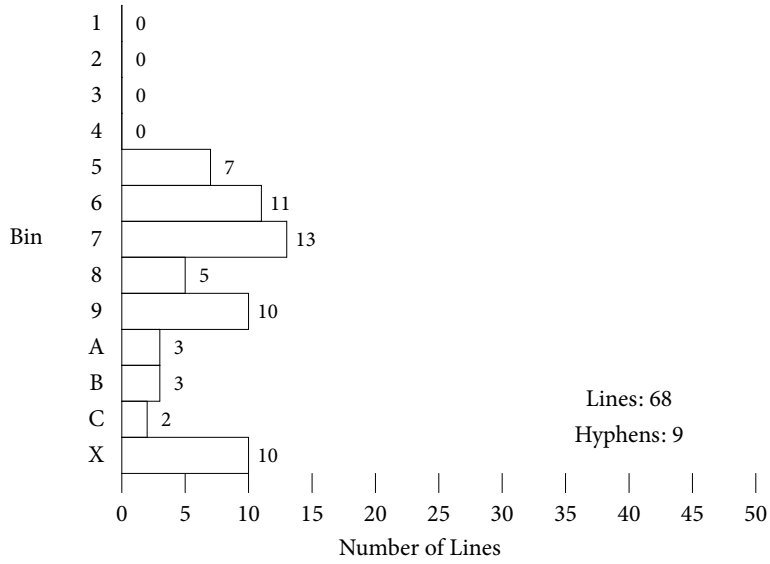


Example K: Single line justification, letcalc = 2

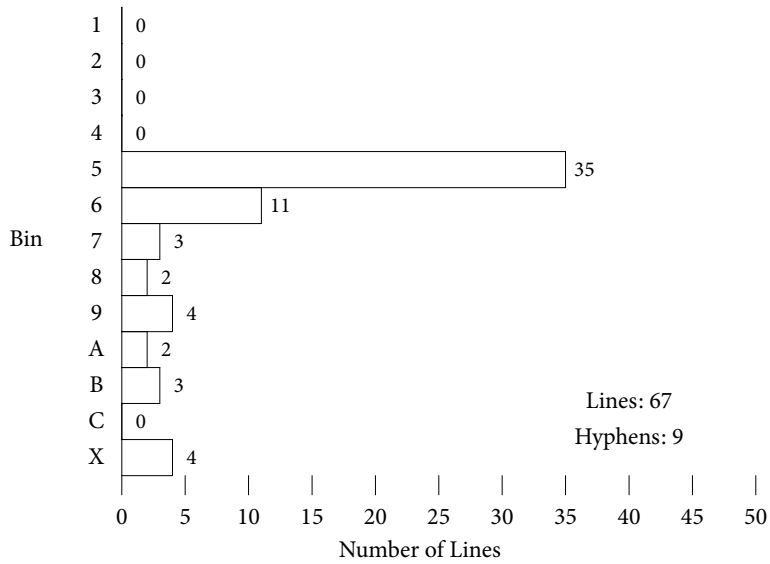


Example L: Single line justification, no letter adjustment

Figure 5: Word space histograms for Examples

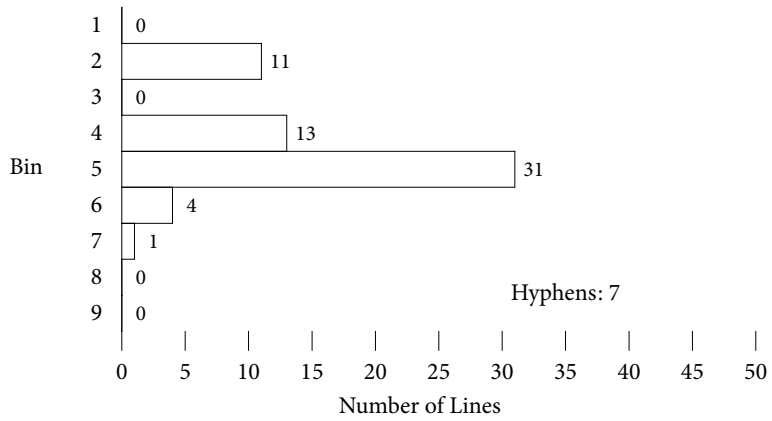


Example M: Traditional Troff



Example N: Traditional Troff with letcalc = 2

Figure 5: Word space histograms for Examples



Example O: Heirloom mode, wscalc 0, letcalc 0, letadj 99 99 12 102 102

Figure 5: Word space histograms for Examples

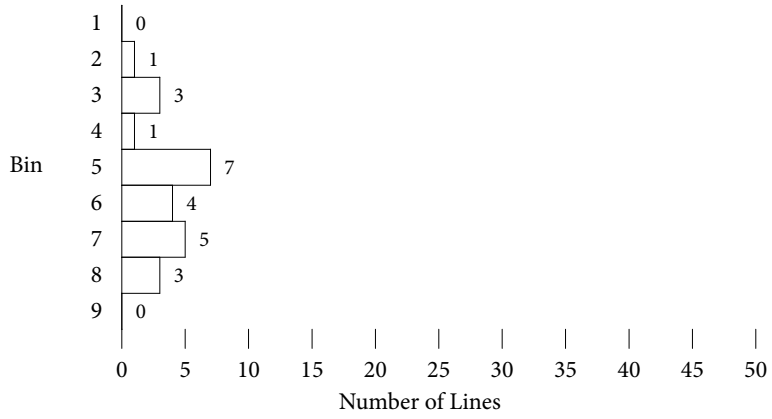


Figure 3a: No Letter Adjustment

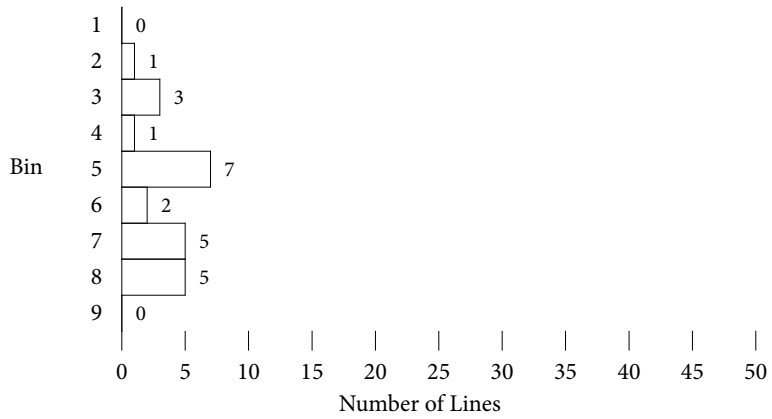


Figure 3b: Method 0 (Heirloom)
with .wscal 26, .letadj 99 99 18 102 102

Figure 6: Word space histograms by microtypography method

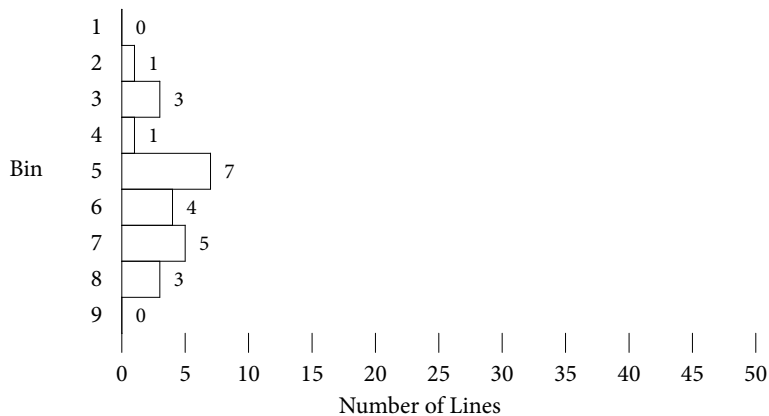


Figure 3c: Method 1
.wscalcalc 26, .letadj 99 99 12 102 102

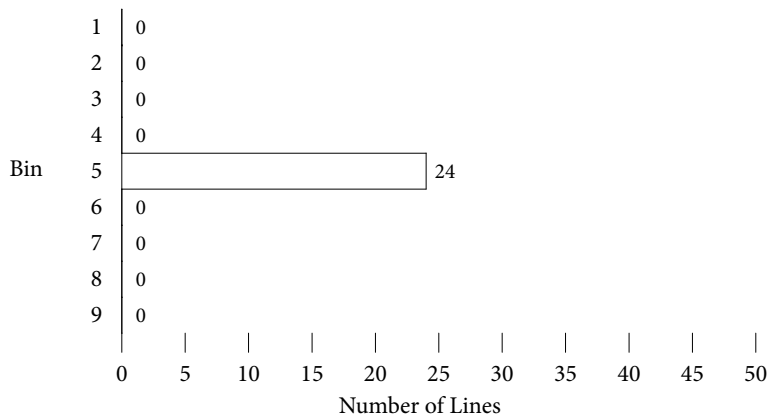


Figure 3d: Method 2
.wscalcalc 26, .letadj 99 99 12 102 102

Figure 6: Word space histograms by microtypography method

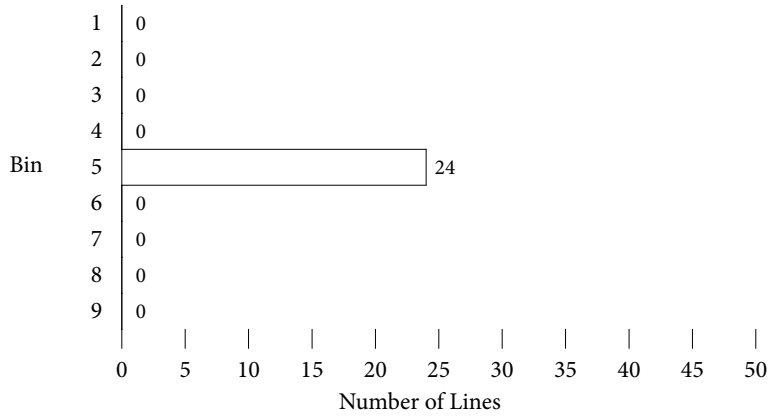


Figure 3e: Method 21 (Automatic), LS & GS
 .wscalcalc 26, .letadj 99 99 12 102 102

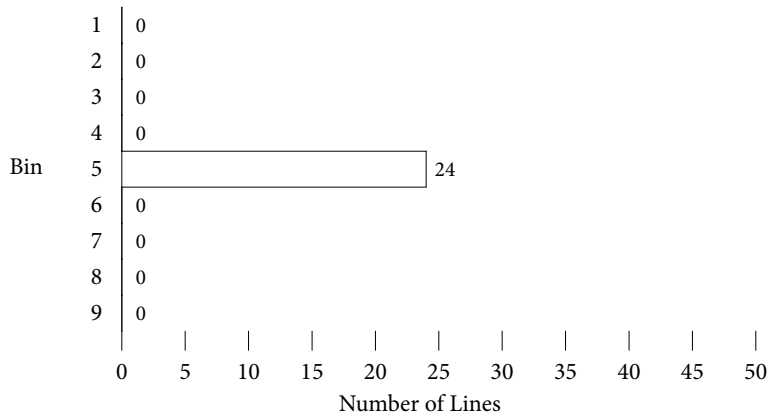


Figure 3f: Method 3, LS & GS
 .wscalcalc 26, .letadj 99 99 12 102 102

Figure 6: Word space histograms by microtypography method

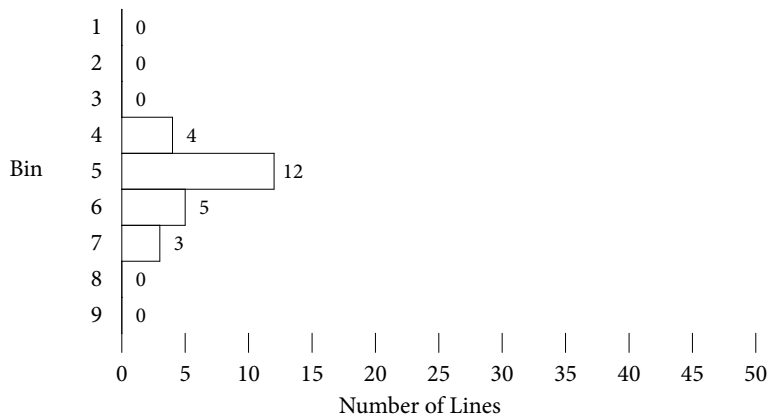


Figure 3g: Methods 2 and 21 (Automatic), Glyph Scaling Only
.wscal 26, .letadj 100 99 x 100 102

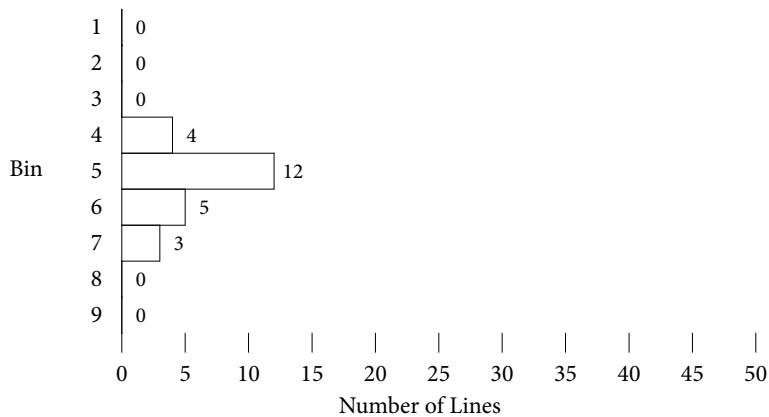


Figure 3h: Methods 2 and 21 (Automatic), Letter Spacing Only
.wscal 26, .letadj 99 100 x 102 100

Figure 6: Word space histograms by microtypography method

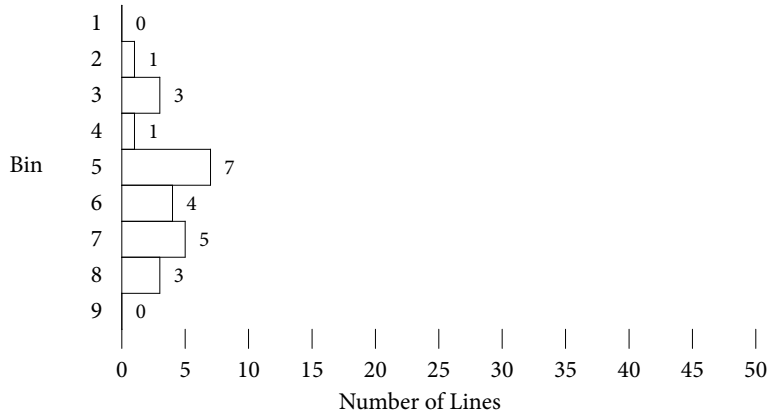


Figure 3i: Heirloom Mode, No Letter Adjustment

.wscal 0

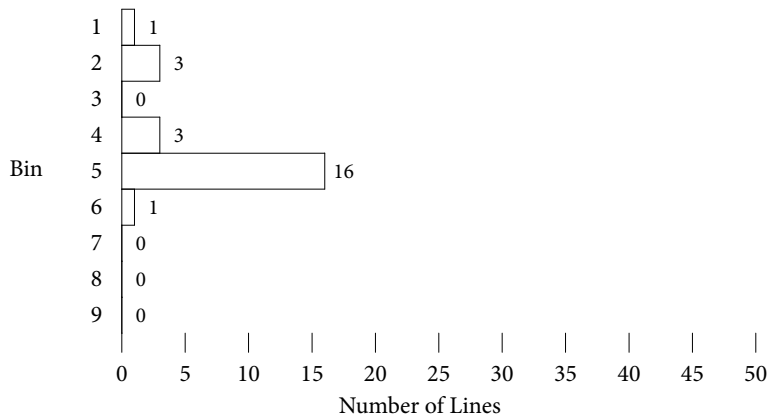


Figure 3j: Heirloom Mode, GS & LS

.wscal 0, .letadj 99 99 12 102 102

Figure 6: Word space histograms by microtypography method

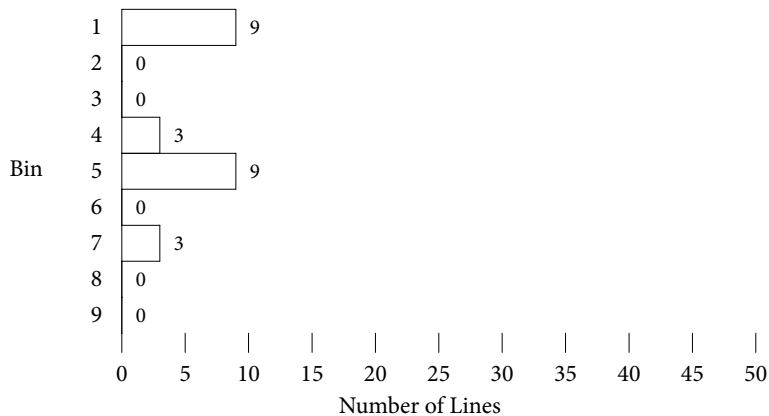


Figure 3k: Heirloom Mode, Glyph Scaling Only
.wscalc 0, .letadj 100 99 12 100 102

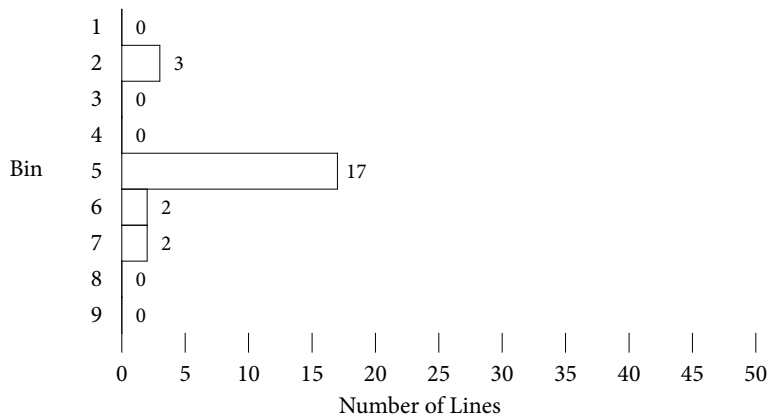


Figure 3l: Heirloom Mode, Letter Spacing Only
.wscalc 0, .letadj 99 100 12 102 100

Figure 6: Word space histograms by microtypography method

REFERENCES

1. Donald E. Knuth and Michael F. Plass, “Breaking Paragraphs into Lines,” *Software—Practice and Experience*, Vol. 11, 1119–1184 (1981).
2. Edward George Bulwer-Lytton, *Paul Clifford*, 1832. The extracts are from the Project Gutenberg version with occasional punctuation from the first edition and some minor bowdlerization.
3. Donald E. Knuth, “T_EX82,” §859, February 3, 2014 (PDF).
www.tug.org/texlive//devsrc/Master/texmf-dist/doc/generic/knuth/tex/tex.pdf
4. Donald E. Knuth, “The Errors of T_EX,” bug #554, February 3, 2014 (PDF).
www.tug.org/texlive//devsrc/Master/texmf-dist/doc/generic/knuth/errata/errorlog.pdf
5. Knuth and Plass, “Breaking Paragraphs into Lines,” 1128, 1181.
6. Gunnar Ritter, “Justification in Heirloom Troff,” November, 2006. (PDF created April 7, 2008.)
7. Joseph F. Osanna, Brian W. Kernighan, Gunnar Ritter, “Heirloom Documentation Tools: Nroff/Troff User’s Manual,” 28, September 17, 2007. (PDF created April 7, 2008.)
9. Hàn thế Thàn, “Microtypography Extensions for the TeX Typesetting System,” PhD diss., Masaryk University Brno, 2000 (PDF). The general approach is a variation of Tolbert Lanston’s patent, “Producing Justified Lines of Type,” U.S. Patent No. 364,521, June 7, 1887.
10. Knuth and Plass, “Breaking Paragraphs into Lines,” 1154. The text of this figure is from Jakob Ludwig Karl Grimm and Wilhelm Karl Grimm, “Der Froschkönig (The Frog King),” in *Kinder- und Housmärchen*, first published in Berlin, 1812.

The text is set in Adobe Minion Pro (.otf), 11/13, with paragraph configuration per Figure 1, except for using `.wscalc 36`, dynamic letter spacing 99.4% to 101.4%, no glyph scaling, and `.letcalc 21`. The constant width typeface is Prestige Elite Bold (.otf). The sample text of *Paul Clifford* is set in Kelmscott Roman (.ttf), 12/13; the initial capital was scanned from a drawing by William Morris. The “Frog King” paragraphs are Computer Modern 10 (.pfb), 10/12. Graphs were made with `grap`, tables with `tbl`, and equations with `eqn`. This page is 10 point Minion with `.letadj 99.5 99.25 12 101.3 101`.