6 December 1979

STAT   MEMORANDUM FOR: ☐
Chief, OC

STAT   FROM   :   ☐
Chief, Research Branch/PSS-OMS

SUBJECT   : Evaluation of Cable Secretariat Proposal
to Alter Cable Print Format from 6 to
8 Lines per Inch. (UNCLASSIFIED)

1. The purpose of this memorandum is to respond to
your request for our evaluation of the impact of reducing
the format of all electronic cables from the current 6 lines
per inch (LPI) down to a smaller 8-LPI printed format.

2. We have reviewed the results from your informal
questionnaire circulated to offices currently receiving
cables. We have reviewed the open literature on the sub-
ject of print size and legibility. Further, we have dis-
cussed, and find ourselves in substantial agreement on
the likely outcome of your proposed change in print format.
Accordingly, we offer the following observations and
opinions in response to your request.

3. First, it is highly appropriate to forecast a
scenario which often occurs in circumstances similar to
those surrounding your proposed cable format change. As
is usually the case when a well-established standard is
substantially altered, there will almost certainly be some
initial complaints surrounding the change. Then, following
a period of time during which employees become adjusted
to the new format and during which some possible shifts in
employee job assignments catalyzed by the change may occur,
the frequency and intensity of the complaints will gradually
level off and eventually subside to an essentially zero
level. This sequence of status-quo→change→unrest→
adjustment→status-quo is entirely normal and should be
expected following alteration of a long-held standard. The
important matter, however, is not whether the change will

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draw criticism, but rather, what will be the impact of
this change in terms of information availability to those
members of the community utilizing cables as a necessary adjunct
to their respective assignments? Further, can the necessary
adjustments to the change take place in a timely fashion?

4. We believe that the answers to these issues are:

(a) a substantial net gain can result from the
proposed change to an 8-LPI cable format
and that,

(b) so long as a few essential caveats are
observed and recognized, the adjustment by
the community to the new format will take
place in an orderly and timely fashion des-
pite some initial criticism which may appear
at times to be quite impassioned.

5. The following observations are offered in support
of our position outlined in paragraph 4 above. In the pre-
sent 6-LPI format, slightly more than 30% of all printed
cables can fit on a single page (i.e., slightly fewer than
70% require the manual collation of two or more pages in
order to include the entire cable message). With the pro-
posed 8-LPI format, slightly more than 95% of all cables
will fit on a single page. This one fact will represent an
enormous time, manpower, and materials savings to the U.S.
Government. Further, while the shift to 8-LPI does require
the use of smaller print characters and a slight loss in
background space between adjacent lines, the effect on
overall legibility while measureable, is small. The Systems
Analysis Staff of the Office of Central Reference estimates
that 75% of all cable traffic is "scanned" for key words
or phrases while only 25% is read for detail. These figures
may vary considerably across different offices, but they are
probably quite accurate when the entire population of cable
users is considered. If this is true, the 8-LPI format will
probably result in a reduction of time necessary for scanning
cables. At the very least, it will almost surely not impact
negatively on scanning functions. For the minority of cable

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recipients who must read for detail, there may be an initial
but minimal negative impact until adjustments take place.
It may for example, take slightly more initial effort (result-
ing, in some cases, in more eyestrain than was incurred in
the 6-LPI format) to extract the necessary information. This
negative impact can be expected to decrease over time, as
users become increasingly familiar with the new appearance
of the cables and as personnel shifts take place.   In the
latter circumstance, employees who seem unable to adjust
to the somewhat smaller print of the 8-LPI format or who
seem particularly susceptible to headaches or eyestrain in-
duced or aggravated by the smaller 8-LPI format, will prob-
ably find it necessary to accept job assignments which mini-
mize or even eliminate the need to read the new cables. Some
problems notwithstanding, we feel that the shift from 6-LPI to
8-LPI will cause very few serious difficulties and will, for
the vast majority of cable recipients, result in substantially
increased efficiency and dramatic cost savings.

     6. Several caveats should be observed, however, in the
administration of the proposed change. First, the printers
used to produce the 8-LPI cables should be continuously and
closely monitored to ensure clean typeface on the hammers
(in the case of impact printers) and frequently changed rib-
bons so that maximum edge definition and contrast between
the printing and the background paper will be realized. Sec-
ond, the use of a flat-finish ink instead of a glossy ink
would reduce glare. Third, if it were possible to reduce
slightly the space between letters within words, there would
be a noticeable increase in overall legibility of the cables
as the spacing between the lines would then appear greater.
Last, the quality of paper on which the cables are printed
should be carefully controlled so that ink bleed-through is
precluded and maximum opacity is maintained.

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ALL PORTIONS OF THIS DOCUMENT ARE UNCLASSIFIED

ANNOTATED BIBLIOGRAPHY OF

STUDIES RELATING TO LEGIBILITY

OF PRINTED MATTER

Legibility of letters, digits, and other symbols

CROSLAND, H.H., & JOHNSON, GEORGIA. The range of apprehension as affected by inter-letter hair-spacing and by characteristics of individual letters. Journal of Applied Psychology, 1928, 12, 82-124.

Investigates the effects of 1/2 point inter-letter spacing and of position in the group and characteristic form on legibility of letters. The inter-letter spacing did not appreciably affect legibility; but legibility of individual letters in group progressed from left to right. Letters with serifs were significantly more legible than sans-serif letters.

OVINK, G.W. Legibility, atmosphere-value and forms of printing types. Leiden: A.W. Sitjthoff's Uitgeversmaatschappif N.V., 1938.

Studies, using a short exposure technique, the legibility of lower case letters of uniform stroke and of upper and lower case display types. Detailed results are given for each character and suggestions for maintaining or improving legibility of single letters and numbers. A survey of studies on the legibility of print is included in the book.

ROTHLEIN, BARBARA E. The relative legibility of different faces of printing types. American Journal of Psychology, 1912, 23, 1-36.

Investigates by the distance method the legibility of isolated and grouped alphabet letters in 26 different typefaces. Certain typefaces were found to be more legible than others. This was also true for the letters. Factors that influenced legibility were assigned to letter form, size, heaviness of typeface, width of white margin surrounding letter, position of letter in letter group, and shape and size of adjacent letters.

1

SOAR, R. S. Height-width proportion and stroke width
in numerical visibility. Journal of Applied
Psychology, 1955, 39, 43-46.

Determines the effect of different combinations
of height and width, with area constant, on the
visibility of numerals by a short exposure method.
The most visible combinations for all numerals oc-
curred with a height-width ratio of 10:7.5 and a
stroke width to height ratio of 1:10.

TINKER, M. A. The relative legibility of the letters,
the digits, and of certain mathematical signs.
Journal of Applied Psychology, 1928, 1, 472-496.

Uses a short exposure technique to determine
the relative legibility of the alphabet letter,
the digits, and certain mathematical signs. It was
concluded that the following factors influence the
legibility of isolated characters: size, simplicity
or complexity of outline, stroke width, heaviness of
typeface, shading and hairlines, area of white space
included within the outline of a symbol, and emphasis
or lack of emphasis on differentiating parts. This
last seemed most important.

2

Kinds of type or type form

BURT, C. A Psychological study of typography.
Cambridge: Cambridge University Press, 1959.

Studies different styles of printing by tests
of accuracy and speed of reading, observation of
eye movements, blinking, and other symptoms of
eyestrain. Since different characteristics of ty-
pography interact, measurement of one variable at
a time may be misleading. Old Style Antique appeared
most appropriate for chidren under 12; and Imprint,
Plantin, or Times New Roman for children over 12.
With adults, wide variation of typographical factors
seemed permissible without greatly affecting reading
efficiency. Ten or eleven point type with two point
leading in line widths of 20 to 23 ems appeared most
satisfactory. Somewhat wider lines and narrower
margins seemed preferable for technical publications,
and slightly narrower lines and larger sizes of type
for literary works.

LUCKIESH, M., & MOSS, F.K. The visibility of various
type faces. Journal of the Franklin Institute, 1937,
223, 77-82.

Studies the relative visibility of 20 type faces
and the effect of changes in light intensity on
visibility . Garamond Bold was the most visible and
Caslon Light Italic the least visible. It was con-
cluded that increases in illumination could compen-
sate for deficiencies in visibility for type sizes
between 6 and 12 point, and for differences between
various type faces.

3

LUCKIESH, M., & MOSS, F.K. Boldness is a factor in type design and typography. Journal of Applied Psychology, 1940, 23, 170-183.

   Obtains visibility, blink rate, and speed of reading scores for 10 point Memphis Light, Medium, Bold, and Extra Bold types. The visibility and frequency of blinking scores indicated that Memphis Medium was the optimum degree of boldness. Speed of reading results were equivocal.

PATERSON, D.G., & TINKER, M.A. Studies of typographical factors influencing speed of reading: X. Style of type face. Journal of Applied Psychology, 1932, 16, 605-613.

   Measures the relative legibility of the following ten typefaces: Scotch Roman, Garamond, Antique, Bodoni, Old Style, Caslon Old Style, Kabel Light, Cheltenham, American Typewriter, and Cloister Black. The text in American Typewriter and Cloister Black significantly retarded speed of reading, but the other type faces in common use were equally legible.

POULTON, E.C. Effects of printing types and formats on the comprehension of scientific journals. Cambridge: Cambridge University Press, 1959.

   Reports an experiment. A test of the relative comprehensibility in scientific papers for the four different styles of printing used revealed one arrangement (11 point type with 2 point leading in a 30 pica line width) superior to the others.

POULTON, E.C. Letter differentiation and rate of com-
prehension in reading. Journal of Applied
Psychology, 1965, 49, 358-362.

Reports experiment where subjects read passages
in one of seven typefaces, four without serifs and
three with serifs. Of those without serifs, Gill
Medium was read significantly faster. There were
no significant differences in rate between the serif
typefaces, nor between the serif and serifless faces.

PRINCE, J.H. Relationships of reading types to uncorrect-
able visual acuity. American Journal of Optometry
and Archives of American Academy of Optometry, 1957,
34, 581-595.

Presents evidence concerning the effect of
scientifically planned inter-letter spacing on
visibility of print by people with subnormal vision.
With the planned spacing, print that is ordinarily
visible only to people with emmetropia (normal
vision) was made visible to subjects with a certain
degree of uncorrected low visual acuity.

PYKE, R.L. Report on the legibility of print. London:
H.M. Stationery Office, September 1926.

Investigates the relative legibility of eight
type faces. The least legible types (Modern Condensed
No. 39 and Caslon Modern Series No. 23). Pyke ques-
tions the validity of this difference. He states
that there must be marked differences in typefaces
to produce significant differences in legibility in
ordinary reading.

5

RADOJEVIC, S. Die Erkennbarkeit von Antiqua und
Frakturbuckstaben im indirecten Sehen. Archiv
fur Augenheilkunde, 1921, 88, 192-197.

Reports a study on the relative legibility of
Roman and German type. The results of this and of
other studies showed a slight advantage for the
German type (practically no difference) for lower
case letters but an advantage for capitals for the
Roman type. More recent studies tend to give an
advantage to the Roman type for both lower case and
for capitals.

SOAR, R.S. Readability of typography in psychological
journals. Journal of Applied Psychology, 1951, 35,
64-67.

Examines eighteen journals for conformity with
optimal printing practices. Certain non-optimal
practices were found to be widespread or even had
increased. Little evidence was found that available
research findings were being applied although this
would have resulted in more legible printing.

STARCH, D. Principles of advertising. Chapter XXV.
Layout and Typography. Chicago: A.W. Shaw Company,
1923, Pp. 657-669.

Uses speed of reading to compare the effects
of type styles, line widths, and variation of back-
ground on legibility of print. Roman type was read
more rapidely than italic, and text in lower case
was read 10 per cent faster than in all capitals.
Material set in 2 3/4 inch lines was read more rapidly
than that in 1 1/2 or 5 inch lines. Black print
on a white background was read 42 per cent faster
than white print on a dark grey background.

TINKER, M.A.   The influence of form of type on the
    perception of words.   Journal of Applied
    Psychology, 1932, 16, 167-174.

    Uses the distance method to compare the per-
ceptibility of words and letters in lower case
and in all capital printing. The results indicated
that word form is more important in reading text
in lower case print than in reading text printed
in capitals.

TINKER, MA., & PATERSON, D.G.   Influence of type form
    on speed of reading.   Journal of Applied
    Psychology, 1928, 12, 359-368.

    Obtains the speeds of reading lower case print
versus all capitals and italics. Lower case print
was read 13.4 percent faster than all capitals and
2.8 per cent faster than italics.

TINKER, M.A. & PATERSON, D.G.   Influence of type form
    on eye movements.   Journal of Experimental
    Psychology, 1939, 25, 528-531.

    Examines the specific patterns responsible
for the disclosed 13.4 per cent retardation in rate
of reading all capital text in comparison with
text in lower case through recording eye movements
photographically. The slower reading of all capi-
tals was due mainly to an increase in the number of
fixations, and an increase in total perception time.

TINKER, M.A. & PATERSON, D.G. Reader preferences and
    typography. *Journal of Applied Psychology*, 1942,
    26, 38-40.

    Compares ordinary lower case versus boldface
lower case, and lower case versus all capital print-
ing to find the extent of agreement between judged
legibility and judged pleasingness. Readers place
high esthetic value on the printing arrangements
which appear most legible. Consequently, there was
close agreement between judged legibility and judged
pleasingness.

TINKER, M.A. & PATERSON, D.G. Readability of mixed type
    forms. *Journal of Applied Psychology*, 1946, 30,
    631-637.

    Obtains speed of reading scores for two medley
typographical arrangements versus straightforward
lower case type. The medley arrangements retarded
reading speed 8.35 and 11.39 per cent. Judged
legibility agreed with the readability measurements
but judged pleasingness disagreed with both judged
legibility and speed of reading scores.

TINKER, M.A. Prolonged reading tasks in visual re-
    search. *Jounal of Applied Psychology*, 1955, 39,
    444-446.

    Demonstrates the usefulness of longer periods of
reading in investigating the effects of typographical
variations on speed of perception in reading. With
periods of 10 minutes or more, italic print signifi-
cantly retarded speed of reading in comparison with
Roman print. All capital print retarded reading rate
significantly regardless of length of work period
between four and sixteen minutes.

WEBSTER, HELEN A., & TINKER, M.A. The influence of
typeface on the legibility of print. Journal of
Applied Psychology, 1935, 19, 43-52.

Determines the relative legibility of the follow-
ing typefaces by the distance method: Scotch Roman,
American Typewriter, Cheltenham, Antique, Old Style,
Caslon Old Style, Garamond, Bodoni, Kabel Lite, and
Cloister Black. American Typewriter was the most
legible typeface and Cloister Black the least legible.
The results are considerably different from those
obtained by speed of reading measurements and suggest
that certain factors which increase perceptibility
of words at a distance reduce speed of reading.

Size of type, line width, and leading

ALDERMAN, E. The effect of size of type on speed of
reading and the determination of various factors
that may influence the results. The Pittsburgh
Schools, 1938, 13, (11 & 12), 33-63.

Uses speed of reading to study legibility of
sizes of type and to investigate the role of mental
age, intelligence, etc., in reading performance.
For all groups and all variables, smaller type sizes
were read faster than larger. It was concluded that
the printing of primary grade textbooks in large
type sizes is unwarranted.

9

GILLILAND, A.R. The effect on reading of changes in the
size of type. Elementary School Journal, 1923, 24,
138-146.

Studies the effect of changes in type sizes on
reading. The reading of adults was not much affected
by changes in type size between 6 and 36 point. In-
dividual variations in the effects of type size were
considerable. It was concluded that type size is not
as important a factor in the reading of children as
has sometimes been supposed. The photographic reduction
and enlargement of type sizes did not duplicate printing
conditions.

GLANVILLE, A.D., KREEZER, G.L., & DALLENBACH, K.M. The
effect of type size on accuracy of apprehension and
speed of localizing words. American Journal of
Psychology, 1946, 59, 220-235.

Studies accuracy of apprehension and speed of
locating dictionary words printed in 6 to 12 point
type. Printing vocabulary words in 12 point bold-
face is better than 6 point boldface since the
former can be more quickly and easily located. Both
adults and children preferred the larger type size.

PATERSON, D.G., & TINKER, M.A. Studies of typographical
factors influencing speed of reading: II. Size of
type. Journal of Applied Psychology, 1929, 13,
120-130.

Obtains speed of reading for 6, 8, 10, 12, and
14 point type in a 19 pica line width. Text in the
6, 8, 12, and 14 point type was read significantly
slower than text in the 10 point type.

10

PATERSON, D.G., & TINKER, M.A.   Influence of size of
    type on eye movements. Journal of Applied
    Psychology, 1942, 26, 227-230.

        Compares oculomotor patterns for reading 6
    point and 14 point type versus patterns for reading
    10 point type. Text in 10 point type was read more
    efficiently than text in either 6 or 14 point. Re-
    duced visibility apparently caused the lessened
    efficiency in reading the 6 point type. For the
    14 point type, the loss in efficiency was primarily
    due to the increased amount of printing area that
    had to be covered by the eyes in reading a given
    amount of text.

TINKER, M.A., & PATERSON, D.G.   Studies of typographical
    factors influencing speed of reading: IX. Reduction
    of size of newspaper print. Journal of Applied
    Psychology, 1932, 16, 525-531.

        Compares the legibility of 7 point Ionic lino-
    type and photographic reproductions of it at 80,
    50, and 30 per cent of the original size. Reductions
    to 80 per cent did not significantly lessen speed
    of reading, and reduction to 50 per cent did not
    reduce reading rate enough to make it impractical
    to use. Reduction to 30 per cent yielded print
    close to the lower limits of perceptibility.

Width of line

DEARBORN, W.F. The psychology of reading: Chapter XII.
The length of text-lines and motor habits. Archives
of Philosophy, Psychology and Scientific Methods,
1906, 4, 8; 13-14; 99-115.

Determines the effect of variation in line
width on eye movements in reading. It took more
fixations to read the same amount of material in
short lines, the attention span was smaller and
pause duration was less. Line width appeared to
be a major determinant of the distribution of time
given to parts of a sentence. It was concluded
that regular, uniform motor habits were more
readily formed in reading short lines, and the
field of attention could be expanded more frequently
and easily.

LUCKIESH, M., & MOSS, F.K. The effect of line length
on readability. Journal of Applied Psychology,
1941, 25, 67-75.

Obtains blink rate, eye movements, and speed
of reading while reading materials set in 10 point
Textype in 13, 17, 21, 25, and 29 pica line widths.
The blink rate scores indicated that readability
improved from 13 to 21 picas. The eye movements
and speed of reading failed to show marked differences.

PATERSON, D.G., & TINKER, M.A. Influence of line width on eye movements. Journal of Experimental Psychology, 1940, 27, 572-577.

Compares oculomotor patterns employed in reading a very short 9 pica line and a very long 43 pica line to those for an optimal 19 pica line. The very short and very long line produced less efficient reading. Apparently the readers were unable to make maximum use of horizontal perceptual cues in reading the short lines. In the long lines there was difficulty in locating the beginning of each new line at the end of the back sweep.

PATERSON, D.G., & TINKER, M.A. Influence of line width on eye movements for six point type. Journal of Educational Psychology, 1942, 33, 552-555.

Reports an experiment in which eye movements were photographed while reading text in 6 point type in 5, 36, and 13 pica line widths. The oculomotor patterns revealed less efficiency in reading the very short and very long lines than for the 13 pica line. The conclusion is that difficulty in reading the short lines was due to the inability to make maximum use of horizontal perceptual cues, and that the difficulty in reading the long lines was due to inability of the eyes to locate accurately the beginning of successive lines of print.

TINKER, M.A., & PATERSON, D.G. Studies of typographical factors influencing speed of reading: III. Length of line. Journal of Applied Psychology, 1929, 13, 205-219.

Investigates speed of reading 10 point type in line widths (lengths) varying from 59 to 186 millimeters. An 80-millimeter line was read fastest.

13

Leading

BENTLEY, M. Leading and legibility. Psychological
Monographs, 1921, 30, 48-61.

     Measures the influence of 10 different amounts
of leading upon legibility of three type sizes read
at various distances from the eyes. Rate and ease
of reading depended to some degree upon leading.
Material set solid (no leading) was read relatively
slowly. Speed of reading increased with each addition
of leading up to 7 point and then declined rapidly.

LUCKIESH, M., & MOSS, F.K. Effects of leading on read-
ability. Journal of Applied Psychology, 1938, 22,
140-160.

     Obtains legibility of 10 point Linotype Textype
with 0, 1, 2, 3, and 6 point leading by tests of
reading rate and blink frequency. The speed of
reading criteria failed to show any significant
differences with variation in leading. But the
blink techniques suggested that the practical opti-
mum in legibility was with 3 point leading.

PATERSON, D.G. & TINKER, M.A. Studies of typographical
factors influencing speed of reading: VIII. Space
between lines or leading. Journal of Applied
Psychology, 1932, 16, 388-397.

     Obtains speed of reading 10 point type in a
19 pica line width with 0, 1, 2, and 4 point leading.
In comparison with set solid, 1 point leading did
not improve speed of reading. But text with 2
point leading was read 7.5 per cent faster, and
with 4 point leading 5.0 per cent faster than for
set solid text.

14

Coordination: type, size, line width, and leading

GREEN, E.B. The legibility of typewritten materials.
   Journal of Applied Psychology, 1933, _17_, 713-728.

     Reports an experiment in which measurements of
speed of reading 7, 10, 12, and 14 point typewriter
type with variations in line width and leading were
made. No differences in speed and accuracy of read-
ing texts in the various type sizes were found.
Leaded samples were read 3.3 per cent faster than
the material set solid. The 21 pica line was read
1.1 per cent faster than the 41 pica line.

LUCKIESH, M., & MOSS, F.K. The extent of the perceptual
   span in reading. _Journal of General Psychology_,
   1941, _25_, 267-272.

     Studies the effects of varying type size and
line width on the perceptual span in reading. The
number of characters per fixation decreased from
8.50 to 7.84 as type size was increased from 4 to
10 points. The span increased from 8.14 to 9.31
characters as the line width was increased fom 13
to 29 picas. It was concluded that the number of
characters recognized in a typical fixation seemed to
be largely independent of type size and line width.

15

PATERSON, D.G., & TINKER, M.A. How to make type
readable. New York: Harper and Row, 1940.

Reports the results of 12 years of research
by the authors on legibility of print as measured
by a speed of reading technique. The legibility
factors investigated includ: type forms - type
faces, italics versus lower case, all capitals
versus lower case, boldface versus ordinary lower
case; size of type, width of line, and leading and
the relationship between two or more of these factors;
spatial arrangement of the printed page, including
size of full page, size of printed page, margins,
single versus double column composition; intercolumnar
space and rules, and paragraph arrangement; black
versus white print; color of print and background
and color combinations; printing surfaces; and optimal
versus non-optimal printing arrangements for three
type sizes. Specifications for a printed page of
optimal legibility were given.

PATERSON, D.G. & TINKER, M.A. Eye movements in reading
type sizes in optimal line widths. Journal of
Educational Psychology, 1943, 34, 547-551.

Records eye movements while reading text in 6,
8, and 11 point type set in optimal line widths.
With 8 versus 11 point type there were significant
increases in fixation frequency, pause duration, and
perception time, and a decrease in words per fixation
for the 8 point type. Reading the text in 6 point
type produced significant inc eases in pause duration
and perception time over that for the 11 point type,
an optimum type size.

16

PATERSON, D.G., & TINKER, M.A. Eye movements in reading optimal and non-optimal typography. Journal of Experimental Psychology, 1944, 34 80-83.

 Compares eye movements in reading optimally arranged 10 point type with eye movements for reading text in non-optimally arranged 6 point type. Reading the non-optimal arrangement resulted in highly significant differences in all eye-movement measures except pause duration. When several undesirable typographical factors are combined, they operate together to produce exceedingly inefficient oculomotor patterns.

PATERSON, D.G., & TINKER, M.A. The effect of typography upon the perceptual span in reading. American Journal of Psychology, 1947, 60, 388-396.

 Reports eight studies completed to determine the effect of various typographical factors on the perceptual span in reading. Eye movement patterns were compared while reading text varying in type form, line width, and other factors. It was concluded that variation in typographical factors influence the size of the perceptual span.

TINKER, M.A., & PATERSON, D.G. Studies of typographical factors influencing speed of reading: V. Simultaneous variation of type size and line length. Journal of Applied Psychology, 1931, 15, 72-78.

 Investigates the speed of reading text in Scotch Roman type in various line widths and type sizes. A line printing arrangement was employed. The 8 and 10 point types were read equally fast and the larger type sizes were nearly as good. But 6 point type in its short line width reduced reading efficiency significantly.

17

TINKER, M.A., & PATERSON, D.G. Speed of reading nine
   point type in relation to line width and leading.
   Journal of Applied Psychology, 1949, 33, 81-82.

   Measures the speed of reading 9 point Scotch
Roman type set with 0, 1, 2, and 4 point leading
in 8, 14, 18, 30, and 40 pica line widths. The
optimal arrangements fell within a 14 to 30 pica
line width with 1 to 4 point leading.

Summaries and Surveys

BOWERMAN, G.W. et al. Report of the committee appointed
    to select the best faces of type and modes of display
    for government printing. London: H.M. Stationery
    Office. 1922.

    Deals with the best typefaces to be used in
government printing as revealed in various discussions
and experiments.

BURTT, H.E. Typography and readability. Elementary
    English, 1949, 26, 212-221.

    Presents a critical survey of legibility of print
studies with special emphasis upon the University of
Minnesota investigations (Paterson and Tinker experi-
ments).

GAGE, H.L. Research in readability: I. The program for
    research. Linotype News, 1937, 16, 2.

    Suggests research on the legibility of print.

GAGE, H.L. Research in readability: II. Effects of
    Leading. Linotype News, 1938, 16, 2.

    Surveys some of the factors involved in the
effects of leading on the legibility of print.

HUEY, E.B. The psychology and pedagogy of reading. New
    York: The Macmillan Company, 1908.

    Contains a chapter that surveys and evaluates
the legibility of print as reported in studies prior
to 1908.

19

LUCKIESH, M., & MOSS, F.K. The science of seeing. Chapter
    XII. Reading as a visual task (Typography). New York:
    D. Van Nostrand Company, 1937. Pp. 455-467.

        Contains a chapter in which early studies on the
    legibility of print are discussed and evaluated.

LUCKIESH, M., & MOSS, F.K. Reading as a visual task. New
    York: D. Van Nostrand Company, 1942.

        Contains an extensive report of studies completed
    by the authors and colleagues on various factors
    affecting the legibility of print and visual fatigue.

MERGENTHALER LINOTYPE COMPANY. The legibility of print.
    Brooklyn: Author, 1935.

        Presents a small treatise on legibility of print
    from the viewpoint of the printer.

PYKE, R.L. Report on the legibility of print. London:
    H.M. Stationery Office, 1926.

        Contains an excellent summary of legibility studies
    published prior to 1926.

TINKER, M.A. Legibility and eye movements in reading.
    Psychological Bulletin, 1927, 24, 621-639.

        Surveys the studies published prior to 1927 on the
    legibility of print.

TINKER, M.A. Physiological psychology of reading.
    Psychological Bulletin, 1931, 28, 81-97.

        Reviews certain studies that have a bearing on the
    legibility of print.

TINKER, M.A. Experimental study of reading. Psychological Bulletin, 1934, 31, 98-110.

    Presents a critical review of experiments on eye movements, perception, etc., in the field of reading. Some of the studies have a bearing on the legibility of print.

TINKER, M.A. Eye movements, perception, and legibility in reading. Psychological Bulletin, 1936, 33, 279-290.

    Gives a critical review of reports on the legibility of print and certain other related materials.

TINKER, M.A. Recent studies of eye movements in reading. Psychological Bulletin, 1958, 54, 215-231.

    Presents a critical review of studies on eye movements in reading, including eye movements as related to legibility of print.

TINKER, M.A. Legibility of print. Ames, Iowa: Iowa State University Press, 1963.

    Summarizes in detail investigations on the legibility of print published prior to 1960.

TRAXLER, A.E. Ten years of research in reading. New York: Educational Records Bureau, 1941.

    Presents a summary of reading investigations with a section on legibility or hygiene of reading.

TRAXLER, A.E., & TOWNSEND, AGATHA. Another five years of research in reading. New York: Educational Records Bureau, 1946.

    Summarizes reading investigations, including a section on legibility or hygiene of reading.

TRAXLER, A.E., & TOWNSEND, AGATHA. Eight more years or research in reading. New York: Educational Records Bureau, 1955.

    Summarizes reading investigations including a section on legibility or hygiene of reading.

TRAXLER, A.E., & JUNGEBLUT, ANN. Research in reading during another four years. New York: Educational Records Bureau, 1960.

    Contains a summary of reading investigations with a section on the legibility of print.

VERNON, M.D. The experiment study of reading. Cambridge: Cambridge University Press, 1931.

    Presents a systematic treatise on reading, including a section on the legibility of print.

ZACHRISSON, B. Studies in the readability of printed text with special reference to type design and type size: survey and some contributions. Stockholm: The Graphic Institute, 1957.

    Reviews studies on the legibility of printed material.

ROUTING AND RECORD SHEET

DD/A REGISTRY
FILE: Commo

SUBJECT: (Optional)

FROM:

Deputy Director for Operations

EXTENSION

NO.

DATE   26 December 1979

STAT

TO: (Officer designation, room number, and building)	DATE		OFFICER'S INITIALS	COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)
	RECEIVED	FORWARDED		
1. Deputy Director for Administration				
2. 3x-4		12/7		
3.				
4. DDA				
5.				
6. D/OC				
7. STAT				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

STAT

1-4. Alan:

I think we need to stand firm on our plan to evaluate the new format for 90 days. John's reaction is consistent with Dan prediction. We need to keep in mind that — if the 8 lines per inch in the new format is unacceptable — we will have to review our plans for APARS. The full value of APARS can only be realized in an 8 lines per inch format.

Danny

12/27

STAT