

Line spacing

Very close (A)

- 3 space
- 2 amount of text
- 2 difficulty of words
- 1 clarity
- 1 no reason

Most difficult

- 3 space
- 3 size of type
- 1 weight of type

Preference

- 1 space
- 2 ease
- 1 attractiveness
- 1 no reason

Number of children

7

Close (B)

Number of children

Normal (C)

Number of children

Wide (D)

Number of children

Number of children able to make a choice

1

Number of children able to give one or more reasons

1

N = 24

\* some children chose more than one version  
\*\* some children gave more than one reason

...then one day he counted sheep.

But Shep was a good doer  
So every day he saw with his nose

one day he counted sheep.

one day he counted sheep.

one day he counted sheep.

Differences

most difficult

Preferred

"[A] are  
with

"it has smaller writing"

"it has a bit smaller  
writing"

"it has smaller letters"

"they're a dark  
and C"

"it's smaller"

"it has teenier line  
than [A]"

"they are all da  
and C]"

"it's blur"

are bigger  
smaller  
n't see the

"they are all d  
and C]"

"has lots of t  
and lots of

[C] are bigger  
the smaller  
you can't see the

"it has five  
words"

"it's got  
words"

"the

has bigger letters"

it has bigger writing"

"it's bigger, better and  
easier"

"not so dark"

the big le  
in [A] a  
d [B]  
I which  
ere"

looks real,  
that it's doing

got funny picto

smaller writing"

is easy,  
over sound

lear"

than [A]

ly

as line spacing, linefeed, inter-line space or leading. The term 'line spacing' is used throughout this paper and it refers to the baseline-to-baseline distance between successive lines of text. This distance is equal to the point size<sup>2</sup> of the type, plus any additional space (or 'leading') in points that is added.

In printed materials intended for adults it is generally accepted that, for type at sizes intended for reading at a normal distance, legibility is improved by the addition of two or three points of extra space between lines (Spencer, 1969).

2 One point is equal

to 1/72in or 0.35mm.

It is argued that the additional space makes it easier to follow each line, and facilitates an accurate return sweep of the eyes to the beginning of each successive line; it may also help with word recognition, as there will be less visual interference or 'contour interaction' from lines above and below that being read (see Hughes and Wilkins, 2002, 223). The optimum amount of space needed has been shown to depend on a number of factors. Tinker (1963) reports a series of experiments involving tests of silent reading speed with adults. He found that while line spacing greater than the point size of the type conferred a significant advantage with some type sizes and line lengths, this was not always the case and too much space could be detrimental. He concluded that optimum line spacing depends on line length, type size and typeface. The greater the line length, the more important it is to add extra space between lines (though very short lines were also shown to benefit from additional space between lines). The spacing also needs to increase in proportion with the size of the type. Tinker (1963), again referring to adults, advised that for optimal sizes of type (9-, 10-, 11-, and 12-point), an interlinear space of one to four points can be added in order to increase legibility. The

# The greater the line length

influence of typeface was confirmed by Becker et al (1970) who found that, according to readers' judgments of attractiveness, sans serif and italic types are likely to benefit from an additional point of line spacing as compared with roman types. The relation between line spacing and word spacing is also important. According to the principles of Gestalt psychology, there is a tendency to group elements in the visual field on the basis of their proximity (Bruce and Green, 1985). Given that the typographer's aim is to group words into lines, the space between lines must therefore be greater than the space between words. If this is not the case, distracting vertical 'rivers' of white space may be created. Hartley (1994) argues that to avoid 'optical bridging' between lines, the minimum line spacing must be increased by an amount equivalent to the specified word spacing.

While research on the issue of line spacing in relation to adult reading material has led to useful insights, it cannot be assumed that these results can

be applied directly to material for beginning readers. It would seem reasonable to suppose that the same factors will operate, but to what degree? As Tinker (1968) points out, much of his work with adults involved tests of the speed of silent reading, which is of course not appropriate for beginning readers. There has been very little experimental work on line spacing in books for children who are learning to read, and the results have generally been inconclusive (Tinker, 1968). Nevertheless, Tinker argues that some level of additional space between lines is indicated for beginning readers because at that stage the return sweep of the eye from the end of one line to the beginning of the next has not been perfected, so generous line spacing 'will promote greater accuracy in doing this and thus reduce regressions of readjustment near the beginning of lines' (Tinker, 1968, 319). His recommendation for 'Grade 1' children (six- and seven-year-olds), based on legibility findings for older children, was 14- to 18-point type in relatively short lines of up to about 22 picas (3.7in or 9.3cm), and 6 to 8 points of additional line space (Tinker 1968, 320). Yule (1988) asserted that in books of the late 1980s the line spacing was usually wide enough to prevent most children's eyes slipping from line to line in reading.

In one of the few experiments conducted with children as participants, Hartley, Burnhill and Fraser (1975) asked ten- and eleven-year-olds to read aloud stories set in different type sizes and with different line spacing, but the same line length. They found no significant differences in terms of either reading time or errors. More recently, Rosemary Sassoon has been particularly concerned with type design and children's perception (Sassoon, 1995). She reports on a study in which one-hundred children, half aged between eight and

# the more important it is to

thirteen with special needs, and half eight-year-olds in mainstream education, were shown text set in five differently spaced versions (which included two different line spacings) and asked which they preferred for reading. Sassoon concluded that where spacing is concerned, presenting findings as an average or norm is not always the most useful way to describe them, as children at different levels of reading have different requirements.

Hughes and Wilkins (2000, 2002) have conducted some of the most recent work on the legibility of children's books. They investigated the effect of type size and spacing on the ability to read at a distance, in order to help with the design of text in children's 'big books' (Hughes and Wilkins, 2002). They varied both letter spacing and line spacing in relation to type size, testing the visual acuity and reading speed of two-hundred children of six to twelve years of age. They concluded that 'children's reading would benefit by increasing the font size of the text and by expanding the spacing horizontally and vertically' (225).

However, they varied the letter spacing and line spacing in such a way that the effects of each cannot be isolated, and while their conclusion might also be valid for materials intended to be read at a normal reading distance, we cannot be certain of it.

Given the lack of experimental evidence on the effect of line spacing as a variable in early reading books, the study described here was intended to provide an insight into the effects of line spacing on children's reading performance and on their subjective responses to appearance of texts with different line spacing. In particular, the aim was to look at the effect of line spacing in realistic reading books when used in a realistic reading situation.

## MATERIALS

Using realistic test material meant that the children's reading performance would be influenced by what Hughes and Wilkins (2000, 316) describe as the 'linguistic and semantic aspects of reading,' as well as the 'visual aspects.' In their studies of typography in children's reading schemes (2000) and 'big books' (2002), they used a Rate of Reading Test specially designed to minimize the influence of linguistic and semantic factors. The text consisted of fifteen randomly repeated common words, appearing as a paragraph but lacking any meaning. They found this method to be highly reliable, and in both studies it was sufficiently sensitive to pick up significant differences in reading performance as a result of variations in type size and spacing (letter and line). Our aim, however, was to examine the effect of line spacing in a normal reading situation. The

# add extra space

testing was intended to replicate, as far as possible, a normal reading situation for children in Years 1 and 2 at UK primary schools. This would typically involve the child reading aloud to an adult on a one-to-one basis from an illustrated reading book produced to a high standard.

For this study, as for the previously mentioned work on typefaces and horizontal spacing, the text used was *A sheepless night* (Oxford, 1999), written by Geraldine McCaughrean and illustrated by Mike Spoor, part of the Oxford Literacy Web designed to fit the UK's National Literacy Strategy requirements in primary schools. It is part of the Oxford Literacy Web's Fiction Strand ('fun-

packed stories every child will love') and is aimed at children around six years old, likely to be in years 1 and 2 in primary schools. This relates to *Individualised reading* stage 7 (Moon, 2005), which is National Curriculum working within level 1, age 6-7.

In choosing the typographic variants to be tested, we were aware of the fact that there are complex inter-relationships between line spacing and other typographic factors. This was observed by Legros and Grant (1916), who discuss the many different factors affecting legibility, and confirmed by Tinker's (1963) extensive series of studies. Watts and Nisbet (1974), reviewing earlier work in this area, also argue that line spacing cannot usefully be studied as a variable in isolation from type size, line length and type weight, and that many studies that do isolate these variables are of limited practical value. However, testing different levels of several variables would result in a very large factorial experiment requiring large numbers of child participants. Our approach in this study, therefore, was to take into account the results of our previous experiments when selecting typographic variants other than line spacing.

In the typeface study referred to above (Walker and Reynolds, 2002/03), comparisons of reading performance revealed no significant differences between text versions in serif and sans serif types with and without infant characters. A previously-used version in Century Educational, a serif type with infant characters, was selected for use in this study because of the popularity of this typeface with publishers of early readers. The text was set in 19-point type (capital-letter height 5mm, x-height 3mm) with the following baseline-to-baseline increments:

# between lines...

|            |           |
|------------|-----------|
| very close | 17 points |
| close      | 21 points |
| normal     | 30 points |
| wide       | 38 points |

The 30-point 'normal' line spacing (10.5mm from baseline to baseline) was the same as that used in the earlier comparison of typefaces; it was decided upon by a process of expert review (see Walker and Reynolds, 2004), taking into account the generous ascenders and descenders of the Century Educational typeface. A survey (by the authors) of line spacing, capital-letter height and x-

But Shep was a good dog.  
So every day he sat with his nose on his  
paws and he counted sheep.  
Then one day he fell fast asleep.

But Shep was a good dog.  
So every day he sat with his nose on his  
paws and he counted sheep.  
Then one day he fell fast asleep.

But Shep was a good dog.  
So every day he sat with his nose on his  
paws and he counted sheep.  
Then one day he fell fast asleep.

height in twenty-two contemporary early reading books from seven different publishers indicated that the most frequently occurring values were 10mm line spacing with a 5mm capital-letter height and an x-height of 3.5 or 3mm (see table 1). Our material was therefore representative of books currently in use for five- to seven-year-olds. The 17-point line spacing gave negative spacing and was designed to represent an extreme, while the 21-point spacing was just sufficient to give clear separation of ascenders and descenders. The 38-point spacing was included to discover whether wider spacing than that typically used might be helpful to children learning to read. The four versions are shown

But Shep was a good dog.  
So every day he sat with his nose on his  
paws and he counted sheep.  
Then one day he fell fast asleep.

in figure 1. Four complete books were printed and bound, the text in each book being set through-out according to one of the line spacing variables under test. The cover and illustrations were the same as in the original OUP version of *A sheepless night*.

As each child taking part in the study was to be asked to read from all four line spacing versions, four different text passages were required. Four double-page spreads were selected for use, with lengths of 110, 99, 138 and 107 words. While four texts of the same length would have been preferable, it was felt that using a 'real' book rather than specially constructed and highly controlled text would offer benefits in terms of validity and child-friendliness.

## METHOD

### PARTICIPANTS

Testing was carried out in a local education authority urban primary school in the south of England. Twenty-four children in Years 1 and 2 and aged between five and seven years took part. They were selected in consultation with their teacher who confirmed that they were of a comparable reading standard, able to read books from level 6 to level 8 of the Oxford Reading Tree, and from an appropriate National Curriculum-specified word list with an error rate of no less than five per cent and no more than twenty per cent.

### PROCEDURE

Testing was carried out in a quiet area near the classroom, where the children were used to reading to their teacher or other adults on a one-to-one basis. The children were reassured that they were not being tested and that help would be given if necessary. Each child was first asked to read aloud from all four books (i.e., from all four line spacing versions), reading from a different double-page spread in each book as determined by the test design (see below). They were prompted only when they were unable to continue without help.

**Figure 1** Examples of the test material. From the top, the line spacing values are: very close (17 points), close (21 points), normal (30 points), and wide (38 points). The type is 19 point Century Educational.



Each child's four readings were audio-taped for later analysis. When a child had completed the reading task, all four books were opened at the same double page spread (for ease of comparison), and laid out in the order in which the child had read from them. The following questions were then asked:

- 1 'Can you spot any differences in the way the writing looks in each of these books?'  
If yes: 'What differences can you see? Can you tell me about them?'
- 2 'Do you think any of the writing styles is easier or more difficult to read than the others?'  
If yes: 'Which did you think was the easiest?'  
'Why do you think that was?' 'And which did you think was the most difficult?' 'Why do you think that was?'
- 3 'If you could choose one of these books to take home and keep, which one would you choose?' 'Why would you choose that one?'

If a child had difficulty in answering the first question, the texts with the widest and closest line spacing were placed together and the question was repeated.

**Table 1** Linefeed, capital letter height and x-height in a sample of twenty-two contemporary early reading books from seven different publishers.

| linefeed (mm) | cap height (mm) | x-height (mm) |
|---------------|-----------------|---------------|
| 7             | 4               | 3             |
| 7             | 4               | 3             |
| 7             | 4               | 2             |
| 7.5           | 4.5             | 3             |
| 9             | 4.5             | 3             |
| 9             | 4.5             | 3             |
| 9.5           | 4.5             | 3             |
| 9.5           | 5               | 3             |
| 10            | 6               | 4             |
| 10            | 5               | 3.5           |
| 10            | 5               | 3.5           |
| 10            | 5               | 3.5           |
| 10            | 5               | 3.5           |
| 10            | 5               | 3             |
| 10            | 5               | 3             |
| 10.5          | 5               | 3.5           |
| 10.5          | 4.5             | 2.5           |
| 11            | 4               | 3             |
| 12            | 6               | 4             |
| 12            | 6               | 4             |
| 15            | 7               | 4.5           |
| single lines  | 6               | 4             |

## TEST DESIGN

The particular combinations of double-page spread and line spacing seen by each child, and the order in which they were presented, were determined by a test design comprising six 4 x 4 Graeco-Latin squares, requiring twenty-four children in total. The design was balanced in relation to: the number of times each of the sixteen possible combinations of line spacing and double-page spread occurred (six times overall); the number of times each line spacing version was read first, second, third or fourth (six); the number of times each line spacing version was preceded by every other line spacing version (six); the number of times each double page spread was read first, second, third or fourth (six); the number of times each double-page spread was preceded by every other double-page spread (six). Children were randomly assigned to the twenty-four different reading sequences.

## RESULTS

### READING PERFORMANCE

The time taken to read from each double-page spread was not analyzed, as in previous tests in this series by the authors it had not revealed any significant differences as a result of typographic variants (Walker and Reynolds, 2002/05; Reynolds and Walker, 2004). With realistic test material we have found that children tend to pause in their reading to ask questions or comment on the story or the illustrations, making it very difficult to obtain accurate or meaningful timings.

The audio-taped readings were, however, analyzed for miscues. The miscues were categorized on the basis of standard lists used by teachers to assess children's reading (Arnold, 1984; Campbell, 1995). We have found it helpful to group the miscue categories according to their likely significance in relation to typographic features:

- 1 Errors that may be caused by confusion over word profile (which could, for example, be affected by the length of the ascenders and descenders or the confusibility of some letters with others)
  - substitution
  - omission of a syllable
  - transposition
  - hesitation
  - non-response
  - partial response
- 2 Errors that may be caused by confusion as a result of inappropriate horizontal or vertical spacing
  - omission of a word
  - repetition of a word
  - omission of a line

- 5 Errors that may result from a general uneasiness with the text and which may or may not be due to typography
- insertion
  - change of word order [reversal]
  - self-correction

The miscues considered likely to be of most relevance in relation to line spacing were line omission and word repetition at the beginning or end of a line.

As the texts differed somewhat in length, the number of miscues per reading (a total that included all categories of miscue) was transformed into miscues per 100 words (number of miscues divided by number of words on the relevant double-page spread, multiplied by 100). The analysis of variance on numbers of miscues per 100 words did not indicate a significant difference between the four line spacing versions or between the four double page spreads, the average over the twenty-four children being around nine miscues per 100 words on each spacing. Line omissions and word repetitions at the beginning or end of a line were then analysed further, but once again there was no apparent relationship between the line spacing version and the number of miscues. However, although there were no statistically significant differences between the line spacing versions in terms of miscues, the qualitative responses given by the children are of considerable interest.

#### THE CHILDREN'S VIEWS

It is worth noting that each child had had the experience of reading from an example of each line spacing version, rather than having merely been shown the four different versions and asked to voice an opinion. Although the children had read from a different double-page spread for each spacing version, when answering questions afterwards they were shown four versions of the same spread.

#### **Responses to Question 1: 'Can you spot any differences in the way the writing looks in each of these books?'**

Responses to this question are summarized in table II. It may be seen that eight children could see differences when shown all four spacing versions together (though only one of these could distinguish between all four versions), a further ten could see differences when shown the two extreme versions together and six could not see any differences even when shown the two extremes. In other words, two-thirds of the children could not distinguish between line spacing versions that were only one step apart. This would seem to be in keeping with the lack of significant differences between the four spacing versions as a result of the miscue analysis of the children's reading. However, three-quarters of them could see differences when shown the two extreme versions together. Thus

**Table II** Number of children perceiving differences between the four line spacing versions.

| nature of difference perceived                        | number of children perceiving differences when shown all four versions | number of children perceiving differences only when shown the two extreme versions | total number of children perceiving each kind of difference |  |
|---|--|--|---|--|
| line spacing  | 4  | 5  | 9   |  |
| word spacing  | 1  |  | 1   |  |
| type size   | 2  | 4  | 6   | 3 One child compared the very  |
| type weight   | 1  | 1  | 2   | close and normal line spacings,  |
| amount of text  |  | 1  | 1   | saying that in the former the  |
| other   | 1  |  | 1   | 'lines are near to each other' and   |
| Number of children perceiving one or more differences | 8*   | 10*  |   | in the latter 'there are spaces between the sentences'. The perception of lines as sentences |

N = 24 (13 boys, 11 girls)  
\* Two children perceived more than one kind of difference

although there were no measurable performance differences given the material and measures used in this study, the majority of the children were nevertheless aware of differences in the typography between at least the extreme versions. Their perceptions of the nature of the differences were not always 'correct,' but are of considerable interest.

Ten children commented on the differences in spacing between the texts, though five of them could only identify these differences after being shown the two extreme versions together. Nine of the ten correctly pointed out differences in the line spacing, whereas one child perceived the words to be spaced differently. (The children's comments relating directly to spacing are summarized in table IV.) It may be seen that in general, in response to Question 1, the very close line spacing was regarded as 'squashed' and the wide spacing was regarded as 'spread out.'<sup>15</sup> One child was very specific, looking at the distance between the first letters of two consecutive lines in two versions; she concluded that the letter 'O' was further away from the 'I' (directly below) in the normal spacing than it was in the very close spacing. Another

is interesting. Line breaks were often at the end of sentences, but each of the four reading passages included three or four sentences with a line break in them. These breaks were positioned so as to cause the least disruption of fluency, according to the principles recommended by Raban (1982).

child recognized that there were differences in the amount of space in each version, but thought that it was the amount between words rather than lines; she did perceive the very close line spacing as having the closest word spacing, however.

Six children thought that the four versions differed in type size. All of these children thought that the more widely spaced text had 'bigger writing' than the more closely spaced text, and three of them also described the very close and close spacing as having writing that was 'smaller' or 'a bit smaller' than the normal and wide spacing. The relation between line spacing and

**Table III** Numbers of children choosing each line spacing version as easiest, most difficult and preferred (bold type), and numbers of children giving each reason.

| Line spacing  | Easiest   | Most difficult   | Preferred   |
|---|---|--|---|
| <b>Very close (A)</b>                               | 1 <i>space</i><br>2 <i>amount of text</i><br>2 <i>difficulty of words</i><br>1 <i>clarity</i><br>1 <i>no reason</i> | 3 <i>space</i><br>3 <i>size of type</i><br>1 <i>weight of type</i>                                       | 1 <i>space</i><br>2 <i>ease</i><br>1 <i>attractiveness</i><br>1 <i>no reason</i>  |
| Number of children                                  | <b>7</b>  | <b>7</b>   | <b>5</b>  |
| <b>Close (B)</b>                                    |   | 2 <i>size of type</i><br>1 <i>weight of type</i><br>1 <i>other</i>                                       | 1 <i>amount of text</i>   |
| Number of children                                  | <b>0</b>  | <b>4</b>   | <b>1</b>  |
| <b>Normal (C)</b>                                   | 1 <i>size of type</i><br>1 <i>amount of text</i><br>1 <i>no reason</i>  | 1 <i>weight of type</i><br>1 <i>amount of text</i><br>1 <i>difficulty of words</i><br>1 <i>no reason</i> | 1 <i>space</i><br>2 <i>size of type</i><br>3 <i>other</i><br>2 <i>no reason</i>   |
| Number of children                                  | <b>3</b>  | <b>3**</b>   | <b>8</b>  |
| <b>Wide (D)</b>                                     | 2 <i>space</i><br>4 <i>size of type</i><br>1 <i>weight of type</i><br>2 <i>no reason</i>                            | 1 <i>space</i><br>1 <i>amount of text</i><br>2 <i>difficulty of words</i><br>1 <i>no reason</i>          | 4 <i>space</i><br>1 <i>size of type</i><br>1 <i>difficulty of words</i><br>2 <i>clarity</i><br>1 <i>ease</i><br>1 <i>attractiveness</i><br>1 <i>other</i> |
| Number of children                                  | <b>9</b>  | <b>5</b>   | <b>8**</b>  |
| Number of children able to make a choice            | <b>18*</b>  | <b>17*</b>   | <b>22</b>   |
| Number of children able to give one or more reasons | <b>14</b>   | <b>15</b>  | <b>19</b>   |

N = 24

\* some children chose more than one version

\*\* some children gave more than one reason

apparent type size has been reported previously. For example, Hartley, Young and Burnhill (1975) carried out a small study using type sizes from 8 to 12 points and line spacing from 9 to 14 points. They found that half of a group of fourteen undergraduates showed a significant tendency to judge type size as larger when the line spacing was greater than the point size of the type.

A further two children described the differences they saw in terms of the weight of the text. Both commented that the more closely spaced versions were darker than the more widely spaced. One of the two thought that the very close, close and normal versions were all dark and the wide version light, without noticing any differences between the former three. The other perceived a difference after being shown the two extreme versions together; he also thought that the very close spacing had 'a lot of writing,' and the wide spacing did not.

Although only half of the children who noticed a difference between at least the extreme versions were able to correctly identify the source of the difference (9 out of 18), the fact that three-quarters of the group were aware that there was a difference of some kind suggests that typographical factors such as line spacing can affect the child's perception of text. If this results in differences in perceived difficulty or attractiveness, it could in turn affect the child's motivation to read.

#### **Responses to Questions 2 and 3: Easiest, most difficult and preferred versions**

When the children were answering these questions, the four books (representing the four line spacing versions) were once again open at the same double-page spread. Of those who made choices in response to the questions, most were able to give one or more reasons. These can be categorized as follows (see table III):

- amount of space on the page (space)
- apparent size of the type (type size)
- apparent lightness or darkness of the type (type weight)
- how 'clear' the text was (clarity)
- apparent amount of text (amount of text)
- apparent number of 'hard words' (difficulty of words)
- how 'easy' the text was (this may have related either to the appearance of the text or its content) (ease)
- how attractive the text was (attractiveness)
- miscellaneous comments, for example on illustrations (other)
- no reason given (this includes comments such as 'because I like it') (no reason)

Table III shows the number of children who chose each version (bold type), and the numbers of children who cited each of the above reasons for their choices. It may be seen that eighteen of the twenty-four children were able to identify one

or more easiest versions, and twelve (two thirds) of these chose either the wide or normal spacing. Interestingly, while nine children chose the wide spacing and seven chose the very close, only three chose the normal and none chose the close. It may be that when asked which was 'the easiest' it was natural for them to choose an extreme version. Fourteen of the eighteen children were able to give one or more reasons for their choice. Their comments are given in tables IV and V.

The reasons given for choosing the wide or the very close spacing are of particular interest (*see table III*). Two children chose the wide line spacing version explicitly because of the spacing. Four children chose the wide spacing because they thought the type looked bigger, a previously documented illusion referred to above. A further child chose the wide spacing because she thought that the type did not look as dark. These are all reasons that are either 'correct' or easily explicable. On the other hand, of the children who chose the very close spacing as easiest, two thought that the amount of text varied between versions, one saying that the very close spacing 'has got not a lot of writing,' and the other somewhat curiously remarking that it was easier because it had more writing. Two children thought they saw differences in the number of 'hard words,' even though the content of the four spreads they were shown when answering these questions was the same. Another reason given was that the very close spacing version was 'more clear,' which seems an odd choice as the lines are so close together. Only one child referred to the line spacing, arguing that the very close line spacing was easiest because 'you don't have to search for which line you're on.' By this she presumably meant that she did not have to scan so far to get to the next line. These comments may suggest that the children who chose the very close line spacing as the easiest were having some difficulty in finding reasons for their choice.

Seventeen children were able to choose one or more most difficult versions. Seven thought that the very close spacing was the most difficult, four chose the close spacing, three the normal and five the wide spacing (*see table III*). Fifteen children were able to give one or more reasons for their choice. The pattern of reasons given for these choices is again interesting. Space, apparent size of type and apparent weight of type were the predominant reasons for choosing the very close and close spacing as the most difficult. Those children who chose the wide or normal versions as the most difficult gave reasons such as the relative amount of text or the difficulty of words. Given that they were comparing double-page spreads with identical content, this might again suggest that having made a choice (which was in five out of eight cases the opposite of their choice of 'easiest'), they were looking for a reason. Only one child mentioned space, arguing somewhat surprisingly that in the wide line spacing 'lots of lines get muddled up, you start reading the same line again.'

More children were able to say which book they would choose to take home and keep than to identify an easiest or a most difficult version. Twenty-two children identified a preferred version (*see table III*): eight children chose the wide spacing, eight chose the normal spacing, one chose the close spacing and five chose the very close spacing. Thus more than two-thirds of the group of twenty-four children chose either the wide or normal spacing versions. Nineteen of the twenty-two children expressing a preference were able to give one or more reasons for their choice. Of the eight who chose the wide spacing, all were able to give at least one reason for their choice; among the eight who chose the normal version there was a little less certainty, with two children unable to give a reason. Once again the spacing and the apparent size of the type accounted for a substantial number of choices but this question, being less specific than

**Table IV** Words used to describe perceived differences in spacing.

|                | Differences  | Easiest   | Most difficult   | Preferred   |
|----------------|--|---|--|---|
| Very close (A) | "doesn't have spaces, [D] does"  | "you don't have to search for which line you're on" | "it's quite squashed"  | "the writing is really near together"   |
|                | "is line after line"   |   | "all squashed up together"   |   |
|                | "pretty squashed, pretty close together"   |   | "[A] has no gap, [B] is less squashed together"                                      |   |
|                | "squashed, [C] isn't"  |   | has "teenier lines"  |   |
|                | "together"   |   | "it's all squashed up together"  |   |
|                | "close together, and [D] is not"   |   |  |   |
|                | "[sentences] are near to each other"   |   |  |   |
|                | "the words are closer together"  |   |  |   |
| Close (B)      | has "little sized spaces"  |   | "[A] has no gap, [B] is less squashed together"                                      |   |
|                | "close, [D] is not"  |   |  |   |
|                | "[D] is spread out and [B] is together"  |   |  |   |
|                | "has small spaces, tinier than [C]"  |   |  |   |
|                | "not spreaded, [D] is"   |   |  |   |
| Normal (C)     | has "middle-size spaces"   |   |  | "it's got the most spaces, I like middle-sized [spaces]"  |
|                | "there are spaces between the sentences"   |   |  |   |
|                | "has tinier spaces than [D]"   |   |  |   |
|                | "more spreaded than [A]"   |   |  |   |
|                | "the 'O' is further away from the 'I' [at the start of two consecutive lines] than in [A]" |   |  |   |
| Wide (D)       | has "big spaces, [A] doesn't"  | "it's more spreaded out"                            | "big spaces, so lots of lines get muddled up, you start reading the same line again" | "it's more spaced out than [B]; [B] is pretty close, [D] is pretty spaced out"                            |
|                | "spreaded"   | "there are holes to tell which line you're on"      |  | "it has bigger holes"   |
|                | "[D] is spread out and [B] is together"  |   |  | "it's the more spread one"  |
|                | "those bits [lines] are apart"   |   |  |   |
|                | "not close"  |   |  | "to see the pictures I only have to move my head that much; in [A] and [B] it's up and down, up and down" |
|                | "there's a space between the words"  |   |  |   |

# perception of the

'easiest' or 'most difficult,' elicited several comments on less well defined attributes such as 'clarity,' 'ease' and 'attractiveness' (see tables III, IV and V).

Of the children who chose the wide version, three mentioned the spacing (see tables III and IV). One of them commented that she only had to move her head a little bit to see the pictures, because the bottom of the text was nearer the picture than in the more closely spaced versions. Unusually, the child who chose the wide spacing on the basis of apparent type size thought that it had 'smaller writing.' Two children liked the wide spacing best because it looked 'more clear' to them, and this may be related to their perception of the space or the size of the type even if they could not explain exactly why it was clearer. One thought that the wide spacing 'is really attractive.'

# functionality and

Reasons for choosing the normal version included comments on spacing, apparent type size and illustrations. The two children who chose the normal spacing on the basis of the apparent type size did so because they thought the writing was 'slightly bigger' or had 'big letters.' Perhaps related to overall impressions of the attractiveness of the books was the choice of the normal spacing book because of its 'funny pictures,' and because it 'looks real.' The

# attractiveness

former was a mistaken perception as all four books were open at the same double-page spread, but the latter comment is interesting. The normal spacing was the default version and perhaps more similar to the texts the child was used

# of the text was

to reading, suggesting that some children may prefer what they are used to.

# influenced by variations

**Table V** Comments on perceived differences other than spacing.

|                | Differences                        | Easiest  | Most difficult                                 | Preferred   |
|----------------|------------------------------------|--|--|---|
| Very close (A) | "[A] and [B] have smaller writing" | "it has more writing"  | "it has smaller writing"                       | "it's easier to read"   |
|                | "a bit smaller than [B]"           | "has not a lot of writing"   | "it has a bit smaller writing"                 | "it's the easiest"  |
|                | "medium writing"                   | "it's got not many hard words"   | "it has smaller letters"                       | "it looks good"   |
|                | "dark" [A, B and C]                | "the writing looks easier"   | "they are all dark" [A, B and C]               |   |
|                | "darker than [D]"                  | "more clear"   |  |   |
| Close (B)      | "[A] and [B] have smaller writing" |  | "it's smaller"                                 | "it looks like it's got more writing"   |
|                | "a bit smaller than [D]"           |  | "it has teenier lines than [A]"                |   |
|                | "dark" [A, B and C]                |  | "they are all dark" [A, B and C]               |   |
|                | "has lots of writing"              |  | "it's blurry"                                  |   |
| Normal (C)     | "big"                              | "[D] and [C] are bigger – [with] the smaller ones you can't see the words" | "they are all dark" [A, B and C]               | "it has big letters"  |
|                | "[C] and [D] have bigger writing"  |  | "has lots of hard words and lots of sentences" | "it's slightly bigger than [D] and than [A] and [B] – you can tell which words are there" |
|                | "dark" [A, B and C]                | "it only has three sentences"  |  | "it looks real; it tells you what it's doing"   |
|                | "a bit scribbly"                   |  |  | "it's got funny pictures"   |
| Wide (D)       | "big"                              | "[D] and [C] are bigger – [with] the smaller ones you can't see the words" | "it has five sentences"                        | "it's got smaller writing"  |
|                | "[C] and [D] have bigger writing"  |  | "it's got lots of hard words"                  | "the words are easy, words you can sound out"   |
|                | "bigger than [A]"                  | "it has bigger letters"  | "the words look harder"                        | "it's more clear"   |
|                | "a bit bigger than [A]"            | "it has bigger writing"  |  | "it's more clear than [B]"  |
|                | "light"                            | "it's bigger, better and easier"   |  | "the writing is really attractive and good to read"                                       |
|                | "has lots of writing"              | "not so dark"  |  | "because you can see everywhere"  |
|                | "the 'O's don't have flicks"       |  |  | "it has nicer pictures"   |

The one child who chose the close spacing claimed that it had 'more writing' and presumably saw this as an advantage. Of the five who chose the very close spacing, only one gave the spacing as a reason. The others gave less well-defined reasons such as 'ease' and 'attractiveness.'

## CONCLUSIONS

The lack of significant differences in the number of miscues as a result of the four typographic arrangements tested here suggests that, with realistic reading

materials used in a normal reading situation, children's reading performance is unlikely to be measurably affected by variations in line spacing comparable with those used here. This is not to deny that differences might be revealed by more sensitive methods using specially constructed nonsense text (as used by Hughes and Wilkins, 2000, 2002)), but our aim in this instance was to gauge the effect of line spacing on children's reading in a typical school or home situation.

## line spacing

While the children's reading performance was not significantly affected by the four line spacing versions, the qualitative data indicate that around three quarters of the children were sensitive to the variations in spacing even if they were unable to correctly identify the nature of the difference. Overall the

## the child's

children's comments suggest that line spacing comparable with our normal or wide versions is likely to be the most acceptable for the majority. Given that the normal spacing was typical of that seen in contemporary reading schemes for beginning readers, it would appear that current practice is generally appropriate

## text. If this

but that no harm would be done by using slightly more generous spacing. However, some of the comments made by the children in this study do suggest that line spacing can be too open as well as too tight.

## differences

Some children were able to relate their judgments and preferences explicitly to the differences in line spacing, particularly those who found the very

## difficulty or

close spacing most difficult and the wide spacing easiest and who

## it could in turn motivation

preferred the wide spacing; others referred to perceived differences in other aspects of the text and its content. Most children based their comments on what they thought made the text easier or more difficult to read, while others appeared to be more concerned with visual appeal in a more general sense. Whatever the children's reasons, the fact remains that their perception of the functionality and attractiveness of the text was influenced by the variations in

## can affect

line spacing tested. This may have implications when considering how best to make books appealing and increase motivation. It was clear from the comments made by some children that young readers may associate appearance and content. If the content is perceived to be difficult because of the appearance

## perception of

of the text, this is likely to reduce the initial appeal of the book and may discourage children who attempt to read from it.

It is interesting to speculate about the extent to which children's opinions and preferences may be conditioned by the books that are currently available to

## results in

them. While there was the occasional comment that suggested that a child had a notion of what a 'real' reading book should look like, many of the comments were clearly spontaneous and reasoned responses to the experience of reading

## in perceived

from the different versions. It is important that publishers and teachers should be aware of such responses so that appropriate and appealing material can be

## attractiveness,

produced and selected for beginning readers.

## affect the child's to read.

## REFERENCES

- Arnold, H. 1984. *Making sense of it: miscue analysis during oral reading*. London: Hodder and Stoughton.
- Becker, D., J. Heinrich, R. von Sichowsky and D. Wendt. 1970. Reader preferences for typeface and leading. *Journal of Typographic Research*, 4, 61–66.
- Bruce, V. and P. Green. 1985. *Visual perception: physiology, psychology and ecology*. London: Lawrence Erlbaum, 102.
- Campbell, R. 1993. *Miscue analysis in the classroom*. Widnes: United Kingdom Reading Association.
- Hartley, J., P. Burnhill and S. Fraser. 1973. Typographical aspects of instructional design. In R. Budgett and J. Leedham, editors. *Aspects of Educational Technology*, 7. London: Pitman, 149–157.
- Hartley, J., S. Fraser and P. Burnhill. 1975. Some observations on the reliability of measures used in reading and typographic research. *Journal of Reading Behavior*, 7, 283–296.
- Hartley, J., M. Young and P. Burnhill. 1975. The effects of interline space on judgements of typesize. *Programmed Learning and Educational Technology*, 12, 115–119.
- Hartley, J. 1994. *Designing instructional text*. Third edition. London: Kogan Page, 26.
- Hughes, L. and A.J. Wilkins. 2000. Typography in children's reading schemes may be suboptimal: Evidence from measures of reading rate. *Journal of Research in Reading*, 23, 314–324.
- Hughes, L. and A.J. Wilkins. 2002. Reading at a distance: Implications for the design of text in children's big books. *British Journal of Educational Psychology*, 72.2, 213–226.
- Legros, L.A. and J.C. Grant. 1916. *Typographical printing surfaces*. London: Longmans, Green & Co.
- Moon, C. 2005. *Individualised Reading 2005: a teacher guide to readability levels at key stages 1 & 2*. Reading: National Centre for Language and Literacy.
- Raban, B. 1982. Text display effects on the fluency of young readers. *Journal of Reading Research*, 5, 7–28.
- Raban, B. 1984. Survey of teachers' opinions: children's books and handwriting styles. In D. Dennis, editor. *Reading: meeting children's special needs*. London: Heinemann, 123–129.
- Reynolds, L. and S. Walker. 2004. 'You can't see what the words say': word spacing and letter spacing in children's reading books. *Journal of Research in Reading*, 27.1, 87–98.
- Sassoon, R. 1993. Through the eyes of a child: perception and type design. In R. Sassoon, editor. *Computers and typography*. Oxford: Intellect Books, 150–177.
- Spencer, H. 1969. *The visible word*. London: Lund Humphries.
- Tinker, M. 1963. *Legibility of print*. Ames, IA: Iowa State University Press.
- Tinker, M. 1968. Suitable typography for beginners in reading. *Education*, 88.4, 317–320.
- Walker, S. and L. Reynolds. 2002/03. Serifs, sans serifs and infant characters in children's reading books. *Information Design Journal*, 11:2/3, 106–122.
- Watts, L. and J. Nisbet. 1974. *Legibility in children's books: a review of research*. Windsor: National Foundation for Educational Research.
- Wilkins, A.J. and M.I. Nimmo-Smith. 1987. The clarity and comfort of printed text. *Ergonomics*, 30.12, 1705–1720.
- Yule, V. 1988. The design of print for children: sales appeal and user appeal. *Reading*, 22, 96–105.
- Zachrisson, B. 1965. *Studies in the legibility of printed text*. Stockholm: Almqvist and Wiksell.

## **AUTHOR NOTES**

Linda Reynolds is a lecturer in the Department of Typography & Graphic

Communication at the University of Reading. Her background is in psychology and information science. For a number of years she was Senior Research Fellow in the Graphic Information Research Unit at the Royal College of Art, where she undertook funded research on a range of information design problems. Her current research interests include the use of color in documents, as well as typography for children.

Sue Walker is Professor of Typography and Head of the Department of Typography & Graphic Communication at The University of Reading. Her research interests include linguistic aspects of typography as well as typography for children. She is a founding partner of Text Matters, an information design consultancy in the UK.

Alison Duncan has a BA in History and an MA in Educational Studies. Her interest in typography for children stems from her MA dissertation on children's reading choices.

## **ACKNOWLEDGEMENTS**

The work described here was part of a series of studies on the theme of 'Typographic Design for Children,' funded by the AHRC (Applied Humanities Research Council) from 2002 to 2005. The authors would like to thank the School of Applied Statistics at The University of Reading for the test design and Mary Dyson of the Department of Typography & Graphic Communication for advice on the statistical analyses. We would like to thank teachers and children at Aldryngton Primary School in Reading for their help with the testing. Oxford University Press kindly supplied text and illustrations for the test materials, which were printed by the Design and Print Unit in the Department of Typography & Graphic Communication at The University of Reading. We are also grateful to colleagues in the Department for their advice and support.