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## The Effects of Line Length and Paragraph Denotation on the Retrieval of Information from Prose Text

*James Hartley, Peter Burnhill, and Lindsey Davis*

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*Grade-school children read either two-column (each column 20 ems) or a single-column (42 ems) of text in one of four ways that indicates new paragraphs. Students were assigned to find missing words to measure the readability of the various systems. The results suggest that a two-column layout with traditional paragraphing denotation is preferable to a single-column in terms of cost-effectiveness; however, an extreme line-length does not place an undue strain on the reader.*

In this study four pages of text (excerpts from Maclean's [1965] *Master of Morgana*) were printed in 10 point on 12 point Mono-type Baskerville on ISO standard size A4 pages (210 x 297 mm) in either a two-column unjustified setting (each column 20 ems) or in a single-column unjustified setting (42 ems). For each setting the start of new paragraphs was denoted in one of four ways:

- (i) new line of text after a one line space, with no indent;
- (ii) new line plus indent but no line space (the traditional method);
- (iii) new line, but no indent and no line space;
- (iv) no indication: i.e., the text was set as a solid "slab."

These different systems produce variations in the amount of horizontal space that is available to cue the reader, and the aim of the study was to see whether or not this would affect the readability of the text. Of particular interest was the effect of these different systems of paragraph denotation on the readability of the single-column print – for a line-length of 42 ems lies far beyond M. A. Tinker's "margin of safety" (Tinker, 1963). These settings were chosen because A4 is the most commonly used page-size of the ISO page-sizes, and a line-length of 42 ems is about the maximum one can comfortably get on a page of this size. (Xeroxed copies of the materials used are available from the authors.)

### *Method.*

Approximately five-hundred Grade 6 and 7 schoolchildren with a wide-ability range participated in this study. Classes were taken separately, and in each class the children were randomly allocated into one of eight conditions, paragraph system (i) to (iv) in single or double-column layouts. The children were asked first to read the extract as naturally as possible for a period of ten minutes, and then to mark where they had reached. After this they were then asked to scan the passage for a further period of ten minutes. (Scanning is a technique devised by Poulton [1967] which involves presenting readers with a list of phrases taken in order from the passage, each phrase with a word missing. The task of the readers is to scan the passage to find the phrases and to write down the missing words as quickly as they can.) The target words occurred on average every 4 to 5 lines apart on the single-column layout, and every 7 to 9 lines apart on the double-column format. Target words occurring at the beginning or the ends of lines were avoided and the position of the words in the lines was varied so that readers could not retrieve them by simply scanning vertically. Three target words were first done in class for practice, a total of forty target words provided on the search list.



## 2 Extract using layout *i*. Line length is 20 ems maximum: paragraphs denoted by line space, no indent.

As soon as Big Willie had gone, I made for the cliff top, keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait.

I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator.

There was a haze over the Sound. The hills of the mainland had disappeared behind a thick wall of cotton-wool clouds. Far to the north, a fog hooter blared out. There was a sea mist creeping in, a sure sign of good weather at this time of year, but the worst thing that could have happened from my point of view.

At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay.

could still see a patch of clear water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge.

It may have been the mist blanketing my view, or my cramped position under the bushes; whatever it was I felt as if time had come to a standstill. It seemed not only hours, but days since I had parted from Big Willie in the quarry. I was lost in a strange half-world, suspended between land and sea, it seemed, in a mist-shrouded world of absolute silence. I strained my ears for the sound of oars or an engine, but I could not hear a thing.

I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of my eye I saw something move.

I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret.

He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly and he had his hands spread

3 Extract using layout *ii*. Line length is 42 ems maximum: paragraphs denoted by indent and new line.

As soon as Big Willie had gone, I made for the cliff top, keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait.

I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator.

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At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay.

The sea mist was coming in fast. Directly below me I could still see a patch of clear water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge.

It may have been the mist blanketing my view, or my cramped position under the bushes; whatever it was I felt as if time had come to a standstill. It seemed not only hours, but days since I had parted from Big Willie in the quarry. I was lost in a strange half-world, suspended between land and sea, it seemed, in a mist-shrouded world of absolute silence. I strained my ears for the sound of oars or an engine, but I could not hear a thing.

I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of the corner of my eye I saw something move.

I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret.

He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly, and he had his hands spread wide to brake himself if he slipped. He was looking around for footholds, and he did not see me at first. When he saw me watching him, he stopped.

We stared at each other for a long time, neither of us moving. He never said a word, just drew in his bottom lip on

#### 4 Extract using layout *ii*. Line length is 20 ems maximum: paragraphs denoted by indent and new line.

As soon as Big Willie had gone, I made for the cliff top keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait.

I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator.

There was a haze over the Sound. The hills of the mainland had disappeared behind a thick wall of cotton-wool clouds. Far to the north, a fog hooter blared out. There was a sea mist creeping in, a sure sign of good weather at this time of year, but the worst thing that could have happened from my point of view.

At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay.

The sea mist was coming in fast. Directly below me I could still see a patch of clear water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge.

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I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of my eye I saw something move.

I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret.

He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly, and he had his hands spread wide to brake himself if he slipped. He was looking around for footholds, and he did not see me at first. When he saw me watching him, he stopped.

We stared at each other for a long time, neither of us moving. He never said a word, just drew in his bottom lip on his stained teeth, and stared at me. There was no need for him to speak. I could see all I needed to know on his face, and the sight of it made me tremble. With his eyes still on my face, he started to edge down the

5 Extract using layout *iii*. Line length is 42 ems maximum: paragraphs denoted by new line.

As soon as Big Willie had gone, I made for the cliff top, keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait.

I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator. There was a haze over the Sound. The hills of the mainland had disappeared behind a thick wall of cotton-wool clouds. Far to the north, a fog hooter blared out. There was a sea mist creeping in, a sure sign of good weather at this time of year, but the worst thing that could have happened from my point of view.

At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay.

The sea mist was coming in fast. Directly below me I could still see a patch of clear water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge.

It may have been the mist blanketing my view, or my cramped position under the bushes; whatever it was I felt as if time had come to a standstill. It seemed not only hours, but days since I had parted from Big Willie in the quarry.

I was lost in a strange half-world, suspended between land and sea, it seemed, in a mist-shrouded world of absolute silence. I strained my ears for the sound of oars or an engine, but I could not hear a thing.

I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of the corner of my eye I saw something move.

I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret.

He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly, and he had his hands spread wide to brake himself if he slipped. He was looking around for footholds, and he did not see me at first. When he saw me watching him, he stopped.

We stared at each other for a long time, neither of us moving. He never said a word, just drew in his bottom lip on his

6 Extract using layout *iii*. Line length is 20 ems maximum: paragraphs denoted by new line.

As soon as Big Willie had gone, I made for the cliff top, keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait.

I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator.

There was a haze over the Sound. The hills of the mainland had disappeared behind a thick wall of cotton-wool clouds. Far to the north, a fog hooter blared out. There was a sea mist creeping in, a sure sign of good weather at this time of year, but the worst thing that could have happened from my point of view. At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay.

The sea mist was coming in fast. Directly below me I could still see a patch of water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge.

It may have been the mist blanketing my view, or my

cramped position under the bushes; whatever it was I felt as if time had come to a standstill. It seemed not only hours, but days since I had parted from Big Willie in the quarry. I was lost in a strange half-world, suspended between land and sea, it seemed, in a mist-shrouded world of absolute silence. I strained my ears for the sound of oars or an engine, but I could not hear a thing.

I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of my eye I saw something move.

I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret.

He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly, and he had his hands spread wide to brake himself if he slipped. He was looking around for footholds, and he did not see me at first. When he saw me watching him, he stopped.

We stared at each other for a long time, neither of us moving. He never said a word, just drew in his bottom lip on his stained teeth, and stared at me. There was no need for him to speak. I could see all I needed to know on his face, and the sight of it made me tremble. With his eyes still on my face, he started to edge down the

7 Extract using layout *iv*. Line length is 42 ems maximum: no paragraph denotation.

As soon as Big Willie had gone, I made for the cliff top, keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait. I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator. There was a haze over the Sound. The hills of the mainland had disappeared behind a thick wall of cotton-wool clouds. Far to the north, a fog hooter blared out. There was a sea mist creeping in, a sure sign of good weather at this time of year, but the worst thing that could have happened from my point of view. At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay. The sea mist was coming in fast. Directly below me I could still see a patch of clear water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge. It may have been the mist blanketing my view, or my cramped position under the bushes; whatever it was I felt as if time had come to a standstill. It seemed not only hours, but days since I had parted from Big Willie in the quarry. I was lost in a strange half-world, suspended between land and sea, it seemed, in a mist-shrouded world of absolute silence. I strained my ears for the sound of oars or an engine, but I could not hear a thing. I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of the corner of my eye I saw something move. I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret. He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly, and he had his hands spread wide to brake himself if he slipped. He was looking around for footholds, and he did not see me at first. When he saw me watching him, he stopped. We stared at each other for a long time, neither of us moving. He never said a word, just drew in his bottom lip on his stained teeth, and stared at me. There was no need for him to speak. I could see all I needed to know on his face, and the sight of it made me tremble. With his eyes still on my face, he started to edge down the cliff towards me. As he moved, I snapped out of my trance. I climbed up out of the bushes and moved awkwardly to the right, my legs feeling as if they did not belong to me. He worked across to his left, to cut me off. I stopped, panting, realizing that I would be within his reach before I could gain the safety of the cliff top. He took a

8 Extract using layout *iv*. Line length is 20 ems maximum: no paragraph denotation.

As soon as Big Willie had gone, I made for the cliff top, keeping well away from the side of the gorge. I lowered myself over the edge of the cliff, and climbed down to the clump of bushes on the lip of the overhang. The thick branches of the centre bush formed a Y. I wedged my feet against them, my back to the cliff. Shielded by the leafy branches I settled down to wait. I had intended to let Long John know of my plan but I had not got a chance to speak to him alone. Perhaps it was just as well, for I had a feeling that he would not have approved of it. That was the trouble, now that I had got him firmly on my side he would want to plan everything himself, and I would become no more than an idle spectator. There was a haze over the Sound. The hills of the mainland had disappeared behind a thick wall of cotton-wool clouds. Far to the north, a fog hooter blared out. There was a sea mist creeping in, a sure sign of good weather at this time of year, but the worst thing that could have happened from my point of view. At first I had been glad of the leafy shade of the bushes, but I soon started to chill. I could not have been there more than an hour or so when I started to get cramp in my legs. I tried bending them, one at a time, but I could not keep the cramp at bay. The sea mist was coming in fast. Directly below me I could still see a patch of clear water, but great clouds of thick white vapour were rolling up to the river mouth, and drifting into the gorge. It may have been the mist blanketing my view, or my cramped position under the

standstill. It seemed not only hours, but days since I had parted from Big Willie in the quarry. I was lost in a strange half-world, suspended between land and sea, it seemed, in a mist-shrouded world of absolute silence. I strained my ears for the sound of oars or an engine, but I could not hear a thing. I think it was an insect that had got down my back, for I had a sudden, terrible itch between my shoulder blades. I twisted round to scratch it the better. Out of my eye I saw something move. I pushed myself up out of the bushes, feeling my legs weak and helpless, and flattened round against the cliff. It was the red fellow. He was climbing carefully down the cliff towards me. My stomach turned to water. I stared up at him, immovable as a rabbit before a ferret. He had his back to the cliff face, and he was letting himself down only inches at a time. With every step he dug his heels in firmly, and he had his hands spread wide to brake himself if he slipped. He was looking around for footholds, and he did not see me at first. When he saw me watching him, he stopped. We stared at each other for a long time, neither of us moving. He never said a word, just drew in his bottom lip on his stained teeth, and stared at me. There was no need for him to speak. I could see all I needed to know on his face, and the sight of it made me tremble. With his eyes still on my face, he started to edge down the cliff towards me. As he moved, I snapped out of my trance. I climbed up out of the bushes and moved awkwardly to the right, my legs feeling as if they did not belong to me. He

### *Results.*

The data from the reading speed measure did not meet the requirements of homogeneity of variance required by the statistical analyses, so in this report we shall concern ourselves only with the data from the scanning measure.

With these data we conducted an analysis of covariance: columns  $\times$  paragraph version  $\times$  sex with E.Q. as the co-variate. (E.Q. = English Quotient, a verbal intelligence measure available from the school records : these data were obtained one to two years before our experiment.) The results of this analysis were as follows:

1. There was a significant difference ( $p < .05$ ) in favour of the two-column layout – although this difference was small. The average number of items scanned in the two-column versions (in ten minutes) was 17.6 and in the single-column versions it was 16.7.

2. There was a significant difference in the amount scanned which reflected the denotation of new paragraphs. The average scores obtained were as follows:

System (i) 18.2

System (ii) 17.6

System (iii) 16.2

System (iv) 16.7

System (i) was significantly superior to System (iii) ( $p < .01$ ) and System (iv) ( $p < .05$ ) (Tukey test), but it was not significantly different from System (ii).

3. There was a statistically significant sex difference, girls doing better than boys ( $p < .01$ ). The average score for the girls was 18.2 and for the boys it was 16.2.

4. There were no interactions between these three different measures: i.e., scores on the single-column layout for the different paragraph systems did not differ significantly from scores obtained on the two-column one for the different paragraph systems, and boys did not score differently from girls on the different paragraph systems.

### *Discussion.*

These results suggest that a two-column layout is probably preferable to a single-column one for the setting of straightforward prose, although the actual data suggest that a line-length of 42 ems does not cause a great deal of additional difficulty. In terms of cost-effectiveness, a two-column layout with paragraphs denoted by indentation (the traditional method) seems best because (1) it is possible to get more words on a page with a two-column layout, and (2) this layout uses less space than one which uses line-spacing for denoting paragraphs.

However, decisions concerning the number of columns for a page must not be determined solely by a concern for line-length but also by a concern for the structural requirements of the text. When material is typographically complex (as say in a hierarchically arranged technical document) or when it contains large tables, diagrams, and figures

that could cut across a two-column layout, then — as we have shown elsewhere — it seems preferable to use a single-column layout with line-spacing to denote the paragraphs (Burnhill, *et al*, 1976; Hartley, 1978).

For us, the importance of the results reported in this paper lies in the fact that our readers did not seem to experience any great difficulty in handling the single-column layout. (Very few errors were made in the experiment.) This does *not* suggest that everything should be printed in lines of 42 ems on an A4 page, but that if it is necessary to use this extreme line-length (because of the nature of the text) then this can be done without placing an undue strain on the reader.

#### *Acknowledgements.*

We are grateful to the teachers and pupils who participated in this study and to Penguin Education for permission to reproduce the materials used in this experiment. The research was funded by the Social Science Research Council, U.K.

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