

Why is lower case better?

Some data from a search task

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Words set in capital letters are less legible than in lower case when reading text, searching for newspaper headlines, or finding a name on a map. The difference is usually attributed to the distinctive shape of lower case words, but lower case setting also emphasises capital letters at the start of sentences and for proper names. In the experiment reported here people searched for names on a map-like display. Names set entirely in lower case (eg, southampton) took significantly longer to find than those set in small capitals with a large initial capital (eg, SOUTHAMPTON) and so, for this task, emphasis given to the initial letter is clearly more important than word shape. This calls into doubt the word shape explanation in other contexts.

Introduction

A well established result from experiments on typography is that words printed entirely in capitals (eg, LONDON) are less legible than those set in lower case with capitals used only for the start of sentences and proper names (eg, London). In text, capitals take about 12% longer to read than lower case setting (Tinker and Paterson, 1928; Tinker, 1955), and both newspaper headlines and names on maps are about 10% faster to search for when set in lower case (Poulton, 1967; Phillips, Noyes and Audley, 1977; Phillips and Noyes, 1977). Usually capitals are compared with lower case letters of the same point size, although Poulton used capitals of the same size as the lower case x-height. Phillips *et al* found that when people were searching on a map for unpronounceable names (eg, Tlerseeokv) the lower case advantage disappeared and under these conditions search was faster when names on the map appeared in the same case condition as names on the search list. Clearly, lower case is not always better and there is little research to tell us under what conditions the lower case advantage holds.

Paterson and Tinker (1940) have argued that lower case is better for text because lower case words have a distinctive word shape. If one draws around the perimeter of a word in capitals the shape always resembles a rectangle, but with a lower case word the ascenders and descenders make the shape more characteristic. Although Rayner and Kaiser (1975) have demonstrated that word shape is of some importance in reading, there are other explanations for the lower case advantage when reading text. Poulton (1969) points out that capital letters are used to signal the start of a sentence or a proper name but this is not possible when all letters are capitals. The last few words of a sentence are read relatively slowly (Mitchell and Green, 1978) and it may be important for readers to have a clear visual clue that the end of a sentence is approaching.

This second explanation could not apply when searching for a name on a map, but with this task there are other reasons why the emphasis given to an initial capital letter could be an advantage; for example, it might help the searcher place his eye fixations accurately in relation to the beginning of a name.

This experiment investigates the speed of searching for a name on a map-like display with four typographical conditions: capitals, small capitals with a large initial capital, lower case, and lower case with an initial capital (see Fig. 1). If the lower case advantage results from the more distinctive word shape of lower case letters we would expect the two conditions using lower case letters to be faster than the two with capitals. But if it is the emphasis given to the initial letter which is important, the two conditions which emphasise the initial letter should be faster than the two which do not. The experiment should indicate which explanation is of greater importance in explaining the lower case advantage when searching for a name on a map.

Method

Subjects

The subjects were 89 men and 138 women aged between 17 and 22. They were drawn from two sources: 70 were university undergraduates acting as paid volunteers who were tested in five groups and the others were candidates for admission into the Psychology Department participating in optional experiments on the same day as their interview. They were tested in ten separate groups.

Material

Sixty place names were selected at random from the gazetteer of a world atlas. All were single word names between five and ten letters long and none was exceptionally difficult to pronounce. All four versions of the search page had the same arrangement of these names which resembled the haphazard distribution of names on a map. The search pages were A4 size with the names occupying an area of 210 mm square and the remainder of the page left blank for attaching a search list. The names were printed in black and, unlike a map, no other symbols were present. They were set in Baskerville with an x-height of about 0.11 mm (about 8.5 point). The four conditions, illustrated in Fig. 1, were capitals, lower case, lower case with an initial capital, and small capitals with a large initial capital. In this last condition the small capitals were about 70% of the size of the initial capital.

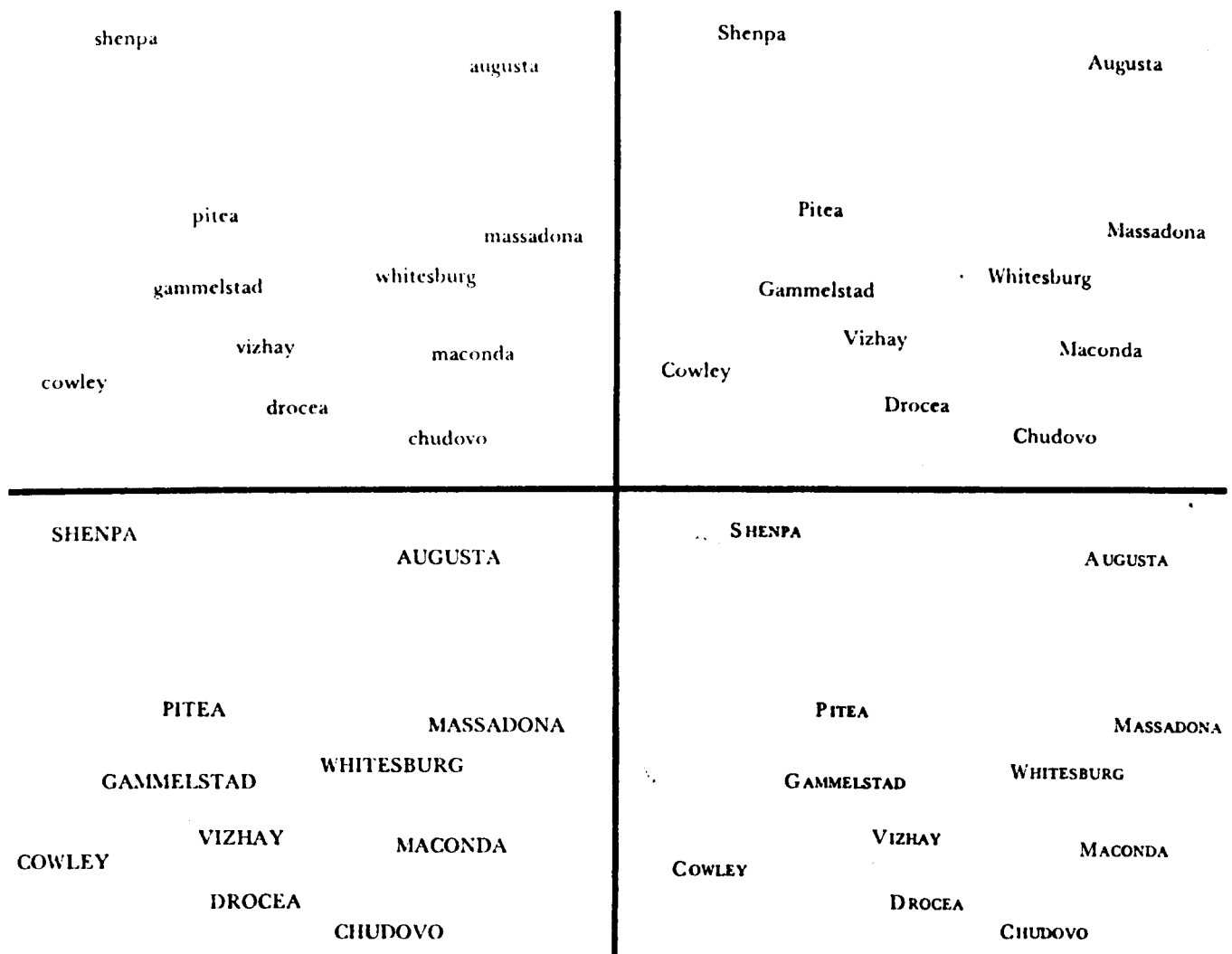


Fig. 1 Sample areas from the four kinds of search page: lower case (top left), lower case with an initial capital (top right), large capitals (bottom left), and small capitals with a large initial capital (bottom right).

Table 1: The mean number of names found on the first and second halves of the test for the different search page and search list conditions

	First 3 searches	Second 3 searches
Search page		
Capital and small capitals	17.1	19.5
Capital and lower case	16.6	19.1
All capitals	17.0	19.0
All lower case	16.0	16.9
Search list		
All capitals	16.2	18.7
Capital and lower case	17.1	18.4

Six search lists were prepared, each consisting of 20 names selected randomly from the search page. These were typewritten in either capitals or lower case with an initial capital. Each subject received a booklet containing six search pages with a different search list attached to the left side of each. Blank pages were interleaved between the search pages.

Design

The experiment used an independent groups design. Search lists appeared in two conditions: capitals or lower case with an initial capital. Search pages were in one of four conditions: capitals, lower case, lower case with an initial capital or small capitals with an initial large capital. There were six orders for the search lists which was varied cyclically: 123456, 234561, 345612, etc. With these three variables there are 48 conditions to which approximately equal numbers of subjects were assigned.

Procedure

The search procedure was explained with the aid of a blackboard illustration. Subjects were told to search for one name at a time in the order of the search list. When they found a name they were instructed to circle it and join it with a line to the previous name. The importance of working fast was emphasised. Subjects started a search by turning a page in the booklet, and turned again at the end

of the time limit so that they were looking at a blank page between searches. They made six searches for 1 min with 1 min unfilled intervals between searches.

Results

The mean number of names found on the six searches was 5.0, 5.7, 5.9, 6.3, 6.2 and 6.1. An examination of the means suggested that differences between the search page conditions increased with practice. Therefore the first three and second three searches were analysed separately. The means are shown in Table 1.

Two analyses of variance were carried out with the type of subject (undergraduates or admission candidates) as a covariate. There are no statistically significant effects from the first three searches (all $p > 0.1$). For the second three searches there is a significant effect of the search page ($F(3,218) = 3.11, p < 0.05$) and of the covariate ($F(1,218) = 5.21, p < 0.05$), but the effect of the search list and its interaction are not significant ($F(1,218) = 0.24, F(3,218) = 0.27$). A Duncan's multiple range test adopting the $p < 0.05$ level shows that, for the search page, the all lower case condition differs significantly from all the other conditions, but no other differences are significant.

On average, subjects found one name every 10.2 s. If it takes about 2 s to start and finish a search, names are being processed at the approximate rate of one every 270 ms. This figure is consistent with Phillips, Noyes and Audley's (1978) suggestion that in this type of search task each name must be fixated individually in order to eliminate it.

Discussion

Names set entirely in lower case letters take longer to find than names in the other typographical conditions. Although the difference is statistically significant for only the second three searches, it is supported by the means from the first three. The result suggests that in a search task of this kind the distinctive word shape of lower case letters is of little importance, whereas emphasis given to the initial letter of a name leads to faster search.

However, the results do not fit the prediction entirely and it is surprising that even with 227 subjects this experiment has failed to demonstrate the usual lower case advantage, namely that lower case with an initial capital is faster than capitals of the same point size. To demonstrate the effect, any advantage from capitals being physically larger must be more than offset by the advantages of lower case. The typeface used in this experiment was Baskerville for which the difference in size between lower case and capital letters is especially large. In the study by Phillips *et al* (1977), which demonstrated a lower case advantage on maps, the typefaces were Times and Univers where the height of the lower case x is about 70% of the capital X, but with Baskerville the difference is about 60%. Therefore, it is possible that the failure to show the usual effect is due to the use of Baskerville: any advantage in lower case is being cancelled out by the larger physical size of the capital letters.

An inspection of Fig. 1 confirms that names in the all capitals condition are considerably longer than the others. If the average length of a word in this condition is 1.0, the averages for lower case, lower case with an initial

capital and small capitals with a large initial are about 0.72, 0.73 and 0.78 respectively. If we choose to compare the typographical conditions, matched not by point size but by word length (as suggested by Spencer, 1969), we must disregard the score from the all-capitals condition as it is almost certainly larger than it should be. From this standpoint, the results provide a clear picture: emphasising the initial letter helps search but distinctive word shape does not.

In the search task most names on the display will have a different initial letter from the target name and so, in theory, it is only necessary to process the initial letter of these to eliminate them. It might be thought that this elimination could be carried out in peripheral vision, with eye fixations being made only on names with the same initial as the target. But eye movement records contradict this, although it is true that eye fixations are significantly longer on names which have the same initial letter as the target (Phillips, Noyes and Audley, 1978). Emphasis on the initial letter could help to reduce search time in several ways. For example, it might help people place eye fixations more accurately in relation to the beginning of a name, or if an eye fixation is placed inaccurately, a large initial letter may make a small correcting movement of the eyes unnecessary.

Conclusions

The experiment reported here is of direct relevance only to the task of searching for a name on a map, but it calls into question the word shape explanation in other contexts, particularly for search tasks.

Case has been the focus of a number of typographical innovations, for example, the poet E.E. Cummings frequently omitted capitals from his work, whereas the typographer van den Bergh argued that text should be set in nothing but capitals. However, for normal usage there is little to divert us from the usual practice: whatever the context use lower case except at the start of sentences, for proper names and for abbreviations.

However, when type is being designed to help the reader search quickly, two suggestions emerge from this study. Firstly, if a designer wishes to avoid lower case in order to make a typographical distinction, for example, to distinguish on a map country names from city names, he might consider the use of small capitals with a large initial capital, because this retains the emphasis on the capital letter. Secondly, when setting proper names with more than one word, it is perhaps only necessary to use a capital on the first word (eg, Dollis hill, Nelson road) as normally it is only this first initial which is processed in a search task.

Note

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References

Mitchell, D.C., and Green, D.W.
1978 *Quarterly Journal of Experimental Psychology*,

30, 609–636. The effects of context and content on immediate processing in reading.

Paterson, D.G., and Tinker, M.A.

1940 How to make type readable. New York: Harper.

Phillips, R.J., Noyes, L., and Audley, R.J.

1977 *Ergonomics*, 20, 671–682. The legibility of type on maps.

Phillips, R.J., and Noyes, L.

1977 *Applied Ergonomics*, 8, 73–77. Searching for names in two city street maps.

Phillips, R.J., Noyes, E.J., and Audley, R.J.

1978 *Cartographic Journal*, 15, 72–77. Searching for names on maps.

Poulton, E.C.

1967 *Journal of Applied Psychology*, 51, 417–425.

Searching for newspaper headlines printed in capitals or lower-case letters.

Poulton, E.C.

1969 *New Society*, 13, 869–871 (5 June). How efficient is print?

Rayner, K., and Kaiser, J.S.

1975 *Journal of Educational Psychology*, 67, 301–306. Reading mutilated text.

Spencer, H.

1969 *The visible word*. London: Lund Humphreys.

Tinker, M.A., and Paterson, D.G.

1928 *Journal of Applied Psychology*, 12, 359–368. Influence of type form on speed of reading.

Tinker, M.A.

1955 *Journal of Applied Psychology*, 39, 444–446. Prolonged reading tasks in visual research.