CHARACTERISTICS OF PROOF-READING.

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I. Introduction.

It has been abundantly proved in the past that when we read we do not perceive separately and individually every letter of every word of the text. Our speed of reading is such that we cannot gain more than a vague general impression of the word, and possibly of some of its more prominent letters. The proof-reader, on the other hand, must perceive every letter of every word with sufficient clearness to detect even minute errors and misprints. What is it, then, which differentiates the reading of the proof-reader from normal reading? And are any special abilities or characteristics necessary for the efficient proof-reader? It seems probable that the proof-reader's perception of the words and letters is of the subliminal type which does not reach consciousness as long as it does not vary from the normal and habitual, but only when it is of an unusual nature. Thus it would be similar to the awareness of the cessation of a long-continued noise which had previously ceased to reach consciousness. But the normal reader is not incapable of this type of perception. Anyone who has attempted to read proofs will have been conscious of adopting an attitude of alertness and special receptiveness to any unusual feature of the printed material, that is to say, to any misprints. It seems possible, then, that the proof-reader may be able habitually to adopt a perfected form of this attitude when reading proofs. But we do not know what if any innate mental or physiological capacities are necessary, or at least favourable, to its inception. Nor can we assume that the proof-reader does not possess some specialized faculty or mode of procedure which enables him to detect misprints with an accuracy impossible to the ordinary reader.

Crossland (1) concluded from his work on proof-reading that some form of innate ability did exist. He compared the rate of reading of

proof-readers and their ability to detect misprints with those of readers untrained in proof-reading. He found that the trained readers as a group read more slowly than the untrained, and deduced that training had probably lengthened the fixation pauses during reading. But although on the average the trained proof-readers showed more accuracy in detecting misprints than the other readers, several of the latter were quite as accurate as the former, and some were more accurate. Thus the longer fixation pauses and slower reading times did not necessarily lead to more accurate perception. Also, when the frequency of the misprints in the proof was varied, on the whole the accuracy of the trained proof-readers varied less than that of the untrained; but it was found that, taking all the readers together, the most accurate ones were the least variable, rather than the trained ones. Thus Crossland concluded that some underlying ability for keen perceptual discrimination determined both the accuracy in detecting misprints, and the variability of that accuracy with the frequency of errors. Clearly some trait or mental 'set' enabled the accurate reader to detect errors with skill; but it is not easy to determine the nature of this trait. It appeared that the aim or object of the reader was a factor of some importance, since accuracy was much greater when special instructions for attention to misprints were given. Again, absorption in the meaning of the content seemed to decrease accuracy considerably. Since this occurred both with the trained and the untrained readers, Crossland considered that ability to ignore this meaning was not acquired with practice, and was probably innate when it did exist. It was found by Downey (2) that when sentences containing misprints were exposed tachistoscopically, the most intelligent subjects at first ignored the misprints, and read entirely for the meaning of the sentences, but when they realized the presence of the misprints, they quickly corrected themselves, and afterwards detected more misprints than the less intelligent subjects. From this Crossland deduced that general intelligence is correlated with proof-reading ability, and that the common factor may be innate ability for accurate perceptual discrimination, since this plays a considerable part in general intelligence as usually estimated. But the work of Whipple (6) and Gates (3) has shown that there is no such thing as general perceptual ability; the ability varies according to the nature of the stimulus object. And we may infer that the detection of misprints in ordinary proofs does not involve the same attitude or the same ability as does their tachistoscopic perception. The part played by the assimilation of the meaning and the general contextual setting is quite different in the two cases. Thus we may be led

to suppose that proof-reading ability may be to some extent connected with the temperamental basis which must underlie the attitudes or aims that enable the proof-reader to concentrate upon the perception of misprints.

But the results of Crossland may equally show that certain individuals are able when called upon to assume an attitude or mental 'set' such that the general meaning of the content is ignored, while the recognition of misprints occupies the centre of consciousness. And it seems quite possible that only long training will enable the reader to maintain this attitude indefinitely, without undue effort and strain, though the untrained reader can do so for a short period, perhaps with considerable effort. A study of the underlying mental processes concomitant with reading should throw some light upon these attitudes. It has been shown by the writer (4) that the variations in the eye movements and fixation pauses which occur in normal reading are in general closely related to the underlying mental processes. It was thus thought that some information as to the nature of the methods and abilities of professional proof-readers might be obtained by studying their eye movements in reading normal material and material containing misprints, and comparing them with the eye movements of other individuals who were not professional proof-readers. Moreover, Crossland's theory as to the unusual length of the fixation pauses of proof-readers could be tested, and also the importance to the accurate proof-reader of natural accuracy of eye movement and fixation.

II. Method of experiment.

The method by which the eye movements were recorded has already been described in detail in this *Journal* (5). In brief, a beam of light is directed on to the cornea of the right eye, reflected by it and focussed to form a magnified image upon a photographic film which travels vertically at a steady rate. Fixation pauses appear as a series of fine vertical black lines upon the film. A time record is also photographed upon the film, so that the duration as well as the number of the fixations can be measured[1]. Eight passages, each ten lines in length, of normal printed reading matter, dealing with various topics, were read by each subject. In addition were read eight passages, each twenty lines in length, of reading

[1] In practice it was found more convenient to arrive at the average duration of the fixations in the reading of each line of print by dividing the time taken to read the line by the number of fixations. The time taken by the inter-fixation movements was neglected, since it is small and regular.

matter of similar content and style; the second, third, sixth and seventh of these contained a number of misprints varying from nine to nineteen. The third passage is appended, as a specimen.

It was shown in a former series of experiments (4) that the number and duration of the fixation pauses made in normal reading appeared to be related to the accuracy of voluntary eye movement from point to point, and the steadiness of voluntary fixation upon a point. Thus in this series also records were taken of the movements of the eyes to and fro between points situated at visual angles of 5°, 10° and 20° to the left and right of the central point; and also of long fixations for periods of twenty seconds of points situated at these angular distances from the central point.

The subjects of these experiments were (1) four proof-readers, called *W*, *X*, *Y* and *Z*, from the Cambridge University Press, (2) five of the subjects, here called *A*, *B*, *C*, *D* and *E*, who had taken part in the previous series of experiments (4). Three of the proof-readers were 'press' readers; that is to say, they read the final proof before it was printed for publication, and read it more or less straight through without a word-by-word comparison with the original MS. They had been proof-readers for thirty, sixteen and ten years respectively. The fourth was a young man who had been proof-reading for two or three years only; he was a 'first-proof reader'—that is, he read the first rough proof from the printer, comparing it continually with the author's MS. Thus he had not only had much less experience than the other three, but was also less accustomed to rely upon his own acumen and judgment in detecting and correcting misprints. One qualification must be attached to the results obtained from the first three subjects; their eyesight was not normal, and two of them were so short-sighted that it was necessary to place the smaller printed material closer to their eyes than the normal reading distance.

Of the other five subjects, four were graduates and research workers in psychology. The fifth had a considerable knowledge of psychology, but less general education and less practice in reading than the others.

III. RESULTS OF THE EXPERIMENTS.

In Table I are shown the average results for the nine subjects reading the twelve passages of normal reading material. It appears that the average time taken to read a line of print was slightly greater for the proof-readers as a group than for the other subjects; but the overlap was much too large to allow any conclusions to be based upon the difference. The standard deviations (S.D.), which measure the variation of the reading time from line to line, are, however, less for the proof-readers

than for any of the other subjects except *B*. Again, although on the whole the proof-readers made fewer fixation pauses per line than the other subjects, there was an overlap; but the standard deviation of number of pauses was less for the proof-readers than for any other subject except *B*. The average duration of the pauses was much the same for proof-readers and others, and so also were the standard deviations of duration[1]. But the regressions[2] were much fewer for the proof-readers, except Subject *Z*, than for the others, except Subject *B*. Now it is clear that frequent regressions prevent a methodical and regular type of reading. Hence we may deduce that the proof-readers, in reading normal material, are not much slower than the ordinary reader, but are on the whole considerably more regular and methodical, and less variable. This conclusion is immediately apparent on viewing the photographic records of the fixations; the almost machine-like regularity of the succession of pauses shown by the proof-readers may be contrasted with the irregularity of the other subjects. Subject *Z* provides an instructive exception. His tendency to regress was very similar to that of the

Table I.

	Reading time per line in sec.		No. of pauses per line		Duration of pauses in sec.		No. of regressions per line
Subject	Av.	S.D. from Av.	Av.	S.D. from Av.	Av.	S.D. from Av.	
A	2·61	0·528	10·4	2·05	0·255	0·0375	1·23
B	1·76	0·332	7·4	1·33	0·242	0·0330	0·16
C	2·68	0·677	9·1	2·03	0·302	0·0400	1·08
D	2·23	0·498	9·6	2·02	0·231	0·0261	1·27
E	2·41	0·500	11·2	2·20	0·218	0·0258	2·04
Av.	2·34	0·507	9·5	1·93	0·250	0·0325	1·16
W	2·93	0·343	8·8	1·09	0·342	0·0452	0·49
X	1·95	0·272	8·9	1·21	0·216	0·0239	0·31
Y	3·11	0·459	11·1	1·68	0·281	0·0293	0·48
Z	1·98	0·317	8·6	1·37	0·228	0·0307	1·39
Av.	2·49	0·348	9·4	1·34	0·267	0·0323	0·67

ordinary reader, and it is tempting to assume that it had not yet been eliminated by years of training.

But it was also pointed out that Subject *B* showed as little variation and as few regressions as did the proof-readers. This extreme regularity seems to have been due to the total lack of interest with which this subject read the material. In a former series of experiments (4) it was

[1] Had it been possible to measure the duration of each fixation pause individually, group differences between the standard deviations might have been more apparent.

[2] A regression occurs when the eye moves backwards from the word fixated to another before it in the line, or in the previous line.

found that when he was interested in the content of what he was reading, and was attending closely to the meaning of the content, his variability and number of regressions were considerably increased, although they were still less than those of Subjects *A*, *C*, *D* and *E*. Thus it appeared that a reader with a natural tendency to regularity of reading might be even more regular when scarcely paying any attention to the meaning of the content. This connection between lack of attention and regularity of the reading processes was manifested fairly generally by all the non-proof-readers. This supports Crossland's conclusion, that one qualification for a proof-reader is to pay little attention to the general meaning of the content. The introspections given by one or two of the proof-readers lead to the same conclusion. They stated that it was necessary to assimilate to some extent the meaning of the words and phrases, in order to correct grammatical errors and also contradictions and disparities of statement. But there was little or no comprehension of the ultimate direction of the argument, or the general conclusions of the reasoning, and, in all probability, none of the associated thought and imagery which constitute the ultimate significance of words and phrases. Similarly the proof-readers knew the correct spelling and even the correct use of technical terms and phrases without understanding in the least what they meant. Hence it seems probable that the most accurate correction of a proof is made by a reader who is not personally interested in the topic under discussion; or by one who by long practice has learnt to inhibit any such interest.

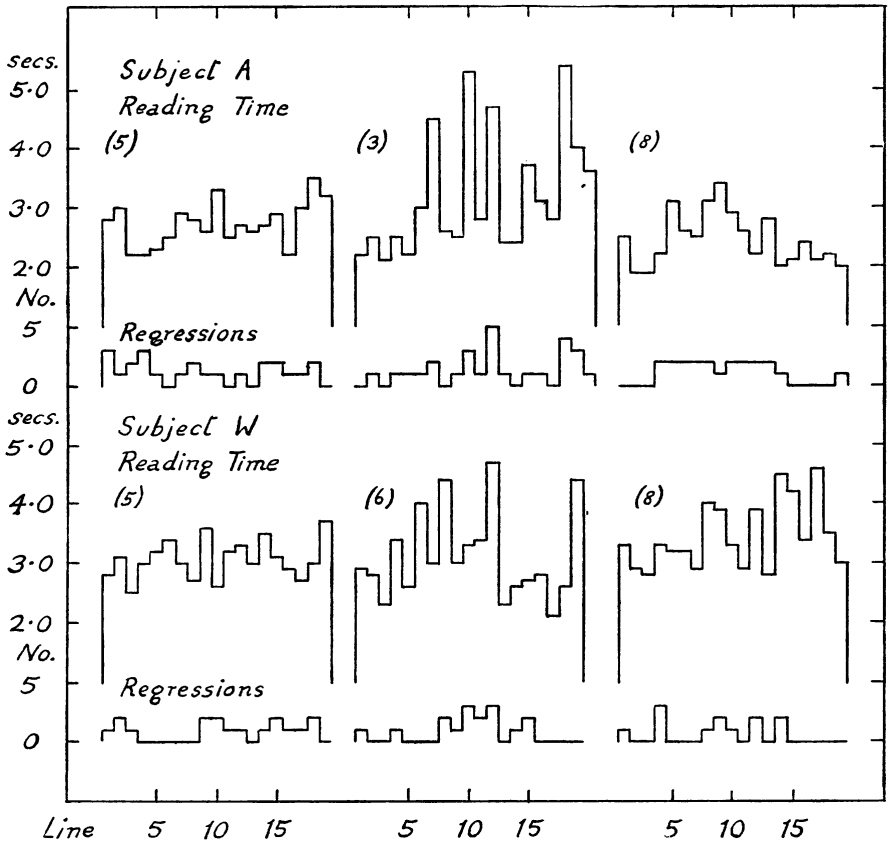
The same regularity of procedure appeared among the proof-readers when reading material containing errors. This procedure was not altogether comparable with actual proof-reading, because the readers were not able to stop and correct the errors. They often experienced a feeling of struggle and effort as a result of this, but stated that they were able to continue straightforward reading, without regression and without any difficulty in understanding the meaning of the content. The non-proof-readers, who experienced no habitual tendency to correct the misprints, were far more affected by them. After having noticed one or two obvious misprints, they usually adopted an alert, searching attitude—on the look-out for more misprints. This was frequently accompanied by pronounced affect—with feelings of irritation or amusement, or with heightened interest in the pursuit of 'spotting' the misprints. In consequence, interest in the meaning of the content usually diminished; and in one passage where there was a misprint in nearly every line, comprehension of the meaning was generally very vague, and sometimes com-

pletely absent. These attitudes were not infrequently carried over into the reading of the subsequent passages containing no misprints; but they usually disappeared during the latter half of the reading, once it had become clear that there were few if any misprints. Thus it appears that in the naïve subject anything unusual in the perceptual situation—the proof—arouses an attitude of scrutiny, often affectively toned, towards its minute details. But in the proof-reader this attitude has probably become habitual, and is only accompanied by affect when the normal processes are inhibited, that is to say, when the error is not immediately corrected.

These conclusions are supported by the variations in the eye movement processes which appeared in the reading of the material containing misprints. Thus in Table II it is shown that in general the difference of average reading time per line between the passages (1) and (5), containing no misprints, and passages (2), (3), (6) and (7), containing misprints, is considerably less for the proof-readers than for the other subjects; the same is true on the whole for the standard deviations of average reading time, and for the number of regressions. Thus the proof-readers were more regular in their normal reading than the other subjects, and much more regular in their reading of material containing misprints. This must not be attributed to the fact that the proof-readers were less quick and accurate in detecting the misprints than were the other subjects; the reverse was the case.

It also appeared that the slight increase of reading time and its standard deviation which did occur was more or less maintained by Subjects *W*, *X* and *Y* during the reading of passages (4) and (8), containing no misprints, showing that the attitude of alertness and scrutiny, once adopted in response to the occurrence of misprints, persisted to a greater degree with these subjects than with Subjects *A*, *B*, *D*, *E* or *Z*. This is also illustrated in the Figure, which shows the reading time for each line and the number of regressions for Subjects *A* and *W* reading passages (5), (3) and (8), and (5), (6) and (8) respectively. In the reading of passage (3) Subject *A*'s reading time and regressions suddenly increased and became irregular on his realizing the presence of the misprints; and decreased and became more regular in the latter half of passage (8), when he found that there were no misprints in this passage. Contrasted with this, the increase of reading time and regressions for Subject *W* reading passage (6) is slighter and more regular; but the irregularity persists all through the reading of passage (8). The number of regressions made by Subjects *W*, *X* and *Y* in reading passages (4) and (8) was not much greater

than that made in reading passages (1) and (5), which perhaps shows that the regressions in passages (2), (3), (6) and (7) resulted from the inability to correct the misprints in the accustomed manner. That is to say, they were an artifact of the experimental situation, and were not natural to the habitual procedure adopted in proof-reading; they did not occur in passages (4) and (8), where there were no misprints, because there was no habitual tendency to perpetuate them.



It was suggested by Crossland (1) that in proof-reading the duration of the pauses might be considerably lengthened, but this is not shown in these results. It is true that there was a slight increase of average duration for both groups of subjects between passages (1) and (5), and passages (2), (3), (6) and (7), and that the proof-readers remained at the higher level while reading passages (4) and (8), while the other subjects returned to the previous average duration. This is shown in Table III.

Table II.

Subject	Av. reading time per line in sec.					Standard deviation of reading time					Av. number of regressions per line				
	Av. for passages			Differences between passages		Av. for passages			Differences between passages		Av. for passages			Differences between passages	
	(1), (5)	(2), (3), (6), (7)	(4), (8)	[(2), (3), (6), (7)] − [(1), (5)]	[(2), (3), (6), (7)] − [(4), (8)]	(1), (5)	(2), (3), (6), (7)	(4), (8)	[(2), (3), (6), (7)] − [(1), (5)]	[(2), (3), (6), (7)] − [(4), (8)]	(1), (5)	(2), (3), (6), (7)	(4), (8)	[(2), (3), (6), (7)] − [(1), (5)]	[(2), (3), (6), (7)] − [(4), (8)]
A	2·67	3·06	2·94	0·39	0·12	0·460	0·836	0·553	0·376	0·283	1·08	1·59	1·60	0·51	− 0·01
B	1·78	2·19	1·83	0·41	0·36	0·234	0·744	0·406	0·510	0·338	0·13	0·62	0·26	0·49	0·36
C	2·58	3·34	3·28	0·76	0·06	0·619	0·837	0·944	0·218	− 0·107	0·95	1·57	1·47	0·62	0·10
D	2·26	3·05	2·66	0·79	0·39	0·604	1·205	0·617	0·601	0·588	1·47	2·31	1·76	0·84	0·55
E	2·56	3·03	2·78	0·47	0·25	0·499	0·793	0·514	0·294	0·279	2·35	3·32	2·99	0·97	0·33
			Av.	0·56	0·24			Av.	0·400	0·276			Av.	0·69	0·27
W	3·07	3·23	3·45	0·16	− 0·22	0·325	0·679	0·554	0·354	0·125	0·89	1·04	0·63	0·15	0·41
X	2·03	2·43	2·39	0·40	0·04	0·192	0·506	0·367	0·314	0·139	0·26	0·56	0·34	0·30	0·22
Y	2·89	3·46	3·64	0·57	− 0·18	0·431	0·558	0·539	0·127	0·019	0·40	0·55	0·44	0·15	0·11
Z	1·99	2·13	2·18	0·14	− 0·05	0·327	0·324	0·263	− 0·003	0·061	1·70	1·45	1·37	− 0·25	0·08
			Av.	0·32	− 0·10			Av.	0·198	0·086			Av.	0·09	0·21

Table III.

Subject	Av. duration of pauses in sec.					Av. number of pauses per line				
	Av. for passages			Differences between passages		Av. for passages			Differences between passages	
	(1), (5)	(2), (3), (6), (7)	(4), (8)	[(2), (3), (6), (7)] − [(1), (5)]	[(2), (3), (6), (7)] − [(4), (8)]	(1), (5)	(2), (3), (6), (7)	(4), (8)	[(2), (3), (6), (7)] − [(1), (5)]	[(2), (3), (6), (7)] − [(4), (8)]
A	0·243	0·260	0·251	0·017	0·009	11·1	11·8	11·7	0·7	0·1
B	0·225	0·246	0·224	0·021	0·022	7·9	9·4	8·3	1·5	1·1
C	0·310	0·325	0·293	0·015	0·032	9·4	10·5	11·3	1·1	− 0·8
D	0·229	0·235	0·239	0·006	− 0·004	9·8	12·8	11·3	3·0	1·5
E	0·216	0·217	0·217	0·001	0·000	11·9	14·2	13·1	2·3	1·1
				Av. 0·012	0·012				Av. 1·7	0·6
W	0·304	0·304	0·338	0·000	− 0·034	10·2	10·7	10·4	0·5	0·3
X	0·232	0·237	0·215	0·005	0·022	8·9	10·3	10·4	1·4	− 0·1
Y	0·276	0·293	0·277	0·017	0·016	10·5	11·9	13·1	1·4	− 1·2
Z	0·233	0·236	0·237	0·003	− 0·001	8·9	9·1	9·1	0·2	0
				Av. 0·006	0·001				Av. 0·9	− 0·3

The same applied, however, to the average number of fixation pauses per line. Thus it appears that the presence of misprints caused an increase both of number and duration of fixation pauses, which was slightly though not significantly greater among the non-proof-readers than among the proof-readers, but which persisted for the proof-readers during the subsequent reading of material without misprints. The misprints did not set up any differentiating effect between number and duration of fixation pauses, but merely produced a general increase of reading time per line. Nor had the fixation pauses of the proof-readers become permanently lengthened by long practice in proof-reading; the range of pause duration was very similar for all the subjects in reading all kinds of material.

Thus we may conclude that there is little obvious difference in objective procedure between the trained proof-reader and the ordinary practised reader. But clearly the proof-reader is more regular in reading normal material and still more in reading material containing misprints; his reading time and number of fixations are less variable, and he makes very many fewer regressions. He is able to deal with material riddled with misprints, even when these are unexpected, in a systematic and methodical fashion, without getting confused or allowing his eyes to wander wildly backwards and forwards.

If the only characteristic of the proof-reader's eye movements which differentiates them from those of the non-proof-reader is their much greater regularity, it is interesting to discover whether there are any characteristics of voluntary eye movement which differentiate the proof-reader. It was found that all readers tended to let their eyes fluctuate and wander away from the fixation point both during the long fixation periods of twenty seconds, and also during the short fixation periods between voluntary movements. It was difficult to measure the degree of fluctuation in these cases. But a rough estimate is provided by counting the number of fluctuations which could be detected. In Table IV these numbers are given for each subject as a percentage of the average for all subjects. It will be seen that on the whole the proof-readers made fewer fluctuations than the other subjects. The difference was more clearly marked in the short fixation periods than in the long ones; and in the latter, Subject *W*'s fixations were quite exceptionally fluctuating. This inability to fixate may have been due to ocular defect, since it was most pronounced. Table IV also shows that the proof-readers were among the more accurate in moving their eyes from one point to another—that is to say, they did not show so strong a tendency to stop

short of or go beyond the correct point, and then make corrective movements. If the subjects are ranked in order from the steadiest and most accurate to the least steady and most inaccurate in voluntary fixation and movements, it appears that the average ranks of the proof-readers were higher than the average ranks of all the other subjects except *C*

Table IV.

	No. of fluctuations as per cent. of av. no. of		No. of inaccurate fixations per ten movements	Av. inaccuracy of movement in minutes of angle	Rank of subject in: No. of fluctuations in		No. of inaccurate fixations	Av. inaccuracy of movement	Av. rank of subject
Subject	Long fixations	Short fixations			Long fixations	Short fixations			
A	125	138	8·2	53·3	7	9	7	6	7·3
B	91	110	8·1	55·7	5	6	4	8	5·8
C	58	94	6·9	40·7	3	5	1	3	3·0
D	107	136	8·8	54·6	6	8	8	7	7·3
E	163	125	8·9	55·7	8	7	9	8	8·0
Av.	108·8	120·6	8·2	52·0	5·8	7·0	5·8	6·4	6·3
W	198	78	7·5	32·1	9	3	3	1	4·0
X	25	85	8·1	47·1	1	4	4	4	3·3
Y	82	62	8·1	52·5	4	1	4	5	3·5
Z	47	67	7·0	38·6	2	2	2	2	2·0
Av.	88·0	73·0	7·7	42·6	4·0	2·5	3·3	3·0	3·2

(see Table IV). That is to say, there was nothing phenomenal or unusual about the accuracy and steadiness of the proof-readers' voluntary movement and fixation; but they did tend on the whole to be among the steadiest and most accurate.

IV. Conclusions.

The general conclusions seem, then, to be that good proof-readers possess a fair amount of accuracy and steadiness of eye movement, which is presumably innate because they had had no practice in making voluntary eye movements and fixations such as those just mentioned. This is coupled with considerable regularity of eye movement in reading; but it is not possible to say exactly how far this is natural or acquired. It is not acquired from much practice in normal reading; this is shown particularly by Subjects *C*, *D* and *E*, who had all had a great deal of practice in reading, but showed very variable reading times and many regressions. On the other hand, it does seem possible that regularity is acquired by much practice in proof-reading; since Subject *Z*, who had only been proof-reading a short time, made a good many more regressions than Subjects *W*, *X* and *Y*. It is probable that the regularity was only in part a habitual motor tendency. Both with the normal reading material, and the material containing misprints, it resulted to some

extent from lack of interest in, or apprehension of, the general meaning of the content, as did Subject *B*'s regularity in reading the normal material. This brings us back to the theory originally propounded, that ability in proof-reading is largely a matter of attitude or mental 'set' towards the material read; and that, while other readers can assume it to some extent, the professional proof-reader has perfected it by long practice, and can assume and maintain it automatically. Thus one proof-reader stated that in ordinary reading for pleasure he might or might not notice any misprints in the text. But when proof-reading he felt quite different; he "got down to it," and was confident that he did not pass over any misprint. The proof-readers had not, of course, had any practice in introspection, and were unable to describe this mental 'set' at all clearly. It seems probable that it involved a species of 'side-tracking' of assimilation of the general meaning of the content, coupled with alertness and scrutiny of typographical detail. That is to say, the words and letters were perceived more as a series of designs (just as, in glancing at a book of Euclid, one might perceive and name 'triangle, circle, right-angle,' and so on); but the symbolic associations of the words were of secondary importance in consciousness, while the whole complex of associated thought and imagery which usually follows word perception was almost entirely inhibited. This method of reacting to the printed words had become almost as habitual to the proof-reader as had the converse method to the mature and practised normal reader.

It may, perhaps, be objected that there is little experimental basis for such a theory. It was shown, however, that the proof-reader reacted to material containing misprints with a type of objective behaviour which was much more systematic and methodical than that of the ordinary reader; and that this type of behaviour, once initiated, persisted over a period when no misprints were encountered—that is to say, it was relatively permanent, and not quickly abandoned. Moreover, the subsequent introspective reports seemed to show that the proof-readers were much less muddled and upset by unexpectedly meeting with the misprints. They were able to carry out the rudimentary assimilation of the meaning which, it was noted above, was necessary for the detection of errors of grammar, contradictory statements and so on; whereas the ordinary readers had very little idea of any meaning at all when the number of misprints was large. Thus it is clear that the proof-reader possessed a well-adjusted habitual mode of response to the presence of misprints; and this mode did not show any objective characteristics markedly different from those of normal reading. It is also reasonable to

suppose that this mode of response involved a withdrawal of interest and attention from the meaning of the content. This was shown both by the fragmentary introspections of the proof-readers themselves, and by deduction from the fuller introspections of Subject *B*, whose procedure in reading normal material was so very similar to that of the proof-readers. Thus we may conclude that the mode of response to the mis-printed proof consisted of some such attitude or mental 'set' as that described above. It is still impossible to determine the extent to which this attitude is based upon underlying general intelligence or temperamental disposition. It seems fairly clear that there is no specific proof-reading ability, but that this aptitude must be related to a number of broad general traits of character. It also seems probable that natural accuracy of voluntary eye movement may be of assistance to the regular movement processes characteristic of the proof-reader.

V. Summary.

1. The eye movements made by four proof-readers in reading normal material and material containing misprints were compared with those of five other readers who had had no training in proof-reading.

2. The average reading time per line and the number and duration of the fixation pauses of the proof-readers were much the same as those of the other subjects in normal reading; but the standard deviations of reading time and number of pauses and the number of regressions of the former were considerably less than those of the latter.

3. In reading material containing misprints, the reading time per line and the number of regressions increased much less for the proof-readers than for the other subjects, but this increase was maintained by the proof-readers, and not by the other subjects, during the subsequent reading of material containing no misprints.

4. It was concluded that the proof-readers were able to adopt and maintain indefinitely an attitude or mental 'set' towards reading material containing misprints such that the recognition of small details of the structure of letters and words occupied the centre of consciousness, while assimilation of the general meaning of the content was relegated to the background. This accounted for the regularity of their eye movements. Non-proof-readers could not adopt this attitude with the same efficiency and permanency.

5. The proof-readers were naturally fairly accurate and steady in the execution of voluntary movements and fixations.

In conclusion I wish to express my thanks to the Cambridge University Press for its great kindness in allowing four proof-readers to act as the subjects of these experiments. My acknowledgments are due to the Medical Research Council, by whose auspices this work was made possible.

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APPENDIX.

The whole descent is like a dream to me, so rapidly was it accomplished. I had scarcely left the summit ere the valley had closed round my path, and the sun beat upon me, walking in stagnant lowland atmosphere. I was in different country from the day before; The stony skeleton of the world was here vigorously displayed to sun and air. The slopes were steep and changeful. Oak-trees clung along the hills, well grown, weathy in leaf, and touched by autumn with strong and luminous colours. Here and there another stream would fall in from the right or the left, down a gorgeof snow-white and tumultuary boulders. The river in the bottom (for it was rapidly growing a river, collecting on all hands as it trotted on its way) here foamed a white in desperate rapids, and there lay in pools of the most enchanting sea-green shot with watery browns. As far as I have gone, I have never seen a river of so delicate and change ful a hue; crystal was not more clear, the meadows were not by half so green; and at every pool I saw I felt a longing to be out of these hot, dusty, and material garments, and bathe my naked body in the mountain air and water. all the time as I went on I never forgot it was the Sabbath; the stillness was a perpetual reminder; and I heard in spirit the churchbells clamouring all over Europe, and the psalms of a thousand churches.

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