A Note on Daylight Requirement

Wm. Kunerth
Iowa State College
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Two years ago the author read a short paper in which he gave the intensity of illumination required when direct lighting is used as compared with what is required when indirect lighting is employed. Experimental results were given based on the average obtained from 26 college seniors. The data showed that 2.8 ft. candles were desirable for reading by direct lighting and 4.0 ft. candles by indirect lighting, both being median value. Only artificial light was used.

Since then it has seemed desirable also to determine what the necessary intensity would be when daylight is used. Accordingly the same text book and the same tablet arm chairs were employed, in order to make the results as nearly comparable as possible. The following instructions were given.

"Using Barrow's 'Light, Photometry and Illumination,' choose a location in Room 15 such that when seated on the tablet arm chair in a natural position facing the north, and with book on the arm rest, the natural lighting is just sufficient to read comfortably, i.e. just enough light to read by for hours with comfort but less light would subject the eyes to a strain.

"Before deciding that the place chosen is correct, you should read there for at least 10 minutes."

In Room 15 daylight came only from the west and the amount could be regulated by means of dark curtains opening vertically along the center of the window. These curtains could be pulled back allowing much light to enter or they could be partly or entirely closed up making the room dark. The light that fell on the printed page should be thought of as fairly well diffused daylight but was incident mainly from one side. After a person had found the place which met the conditions set, the intensity of illumination at that point was measured always by one and the same man with a Macbeth Illuminometer.

Another part of this experiment was conducted on a cloudy day in a room having a great deal of window space so that the light

was very thoroughly diffused. Almost all persons taking part in these experiments were college seniors.

The experimental work was such as to be affected by great fluctuations in judgment as to the proper intensity required for comfortable reading. The influences of poor vision, and of eye fatigue are perhaps the chief factors causing fluctuations. It was therefore, thought desirable to take the median value rather than the average of all results obtained for any one part. The results obtained are given herewith.

<table>
<thead>
<tr>
<th>Diffusion Type</th>
<th>Median Intensity Required in Ft. Candles</th>
<th>Individuals Taking Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair diffusion........</td>
<td>5.2</td>
<td>41</td>
</tr>
<tr>
<td>Thorough diffusion....</td>
<td>8.5</td>
<td>25</td>
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</table>

This shows that a decidedly greater intensity is required when the lighting is thoroughly diffuse than when it is directed. This difference could not have been due to the difference in spectral character of the light for in both cases we used the same quality of light,—namely daylight. It is then the degree of diffusion which determines the amount of light required—the greater the diffusion the greater the intensity required.

It should also be noted that natural lighting in buildings is likely to be deficient if it falls below 0.2 per cent of what it is outdoors, i.e. the daylight factor should not be less than 0.2 per cent.

In conclusion it may be stated that this result could have been predicted qualitatively from the results and theory advanced in the paper above referred to where we read that “under the indirect lighting system everything in the field of vision is about equally illuminated, the pupil contracts much more than it does under the direct system, where much of the field is dark. In the latter case the pupil will enlarge to allow more light to enter and will soon come to a state where a person can read print comfortably even though the actual intensity is small. It seems then that the illumination intensity required depends quite largely upon the brightness of the objects in the field of vision. If they are as bright as the objects on which we wish to focus our attention, then a high intensity is required; if, on the other hand, they are dark, the pupil will enlarge to take in a big flood of light and a smaller intensity will suffice.”

DEPARTMENT OF PHYSICS,
IOWA STATE COLLEGE.

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