stereoscopic instruments for measuring distance, proved that as a rule persons with normal eyes have a power of perception of depth of 10*"* and still less in unrestricted vision. This is explained as follows (Hering, Heine) :—

It is unimportant for perception where the filament mentioned above is illuminated. In order to see two objects lying close to one another it is not essential that the two image-points should be separated from one another by the distance of the two nerve fila­ments of the eyes. This happens whenever the line separating two objects passes through the two points (see fig. 4). It is natural that the perception of depth has no fixed limits, for the position of the images shown in fig. 4 changes with the movement of the eyeball, and the closer the two points are to one another, the more rarely it occurs. If the angle of convergence of the optic axes = ∆, the (average) distance between the eyes B=65 mm., *δ =* 1/2*'* relatively = 1:7000 (the perception of depth easily attained by normal sight) and E=the normal distance of the point P from B in fig. 2, then from E = B/Δ, the change of depth *d*E gives:—

*d*E = B.δ/Δ2 = E.δ/Δ = E2.δ/B.

If the angle Δ has the value δ then all perception of depth ceases. At this distance objects are only still distinguishable from those lying behind them, which together form a surface but cannot always be seen as a surface because our representations of the depths of distant objects are not conclusively controlled by stereoscopic sight. This dis­tance is called the radius of the stereoscopic field, and is calculated by the formula R = B/δ, whence R = 450 metres. From the above formulae it can be directly seen that the variation dE increases with E2, and the proportional variation dE/E increases with E. The numerical values can be easily calculated when either Δ or E is given thus:

dE/E = δ/∆ or dE/E = E/R.

The limits of stereoscopic vision defined above can be extended and under the name of "stereoscope ” every binocular in­strument is included which serves this end. Those instruments should first be mentioned which have restored the more or less lost power of stereoscopic vision. It is necessary for those with normal sight to wear spectacles when the eyes cease to accommodate themselves to objects near at hand. Spectacles which only cover the lower half of the eye and leave the upper half free to look out into space are the best. For those who have been operated on for cataract, and for excessively short-sighted persons, the “ telescope-spectacles ” devised by Μ. v. Rohr (of Zeiss, Jena) are a great assistance. There are two methods of extending the limits of stereoscopic vision and of increasing the accuracy of the perception of depth. (1) by augmenting the keenness of sight by the aid of a telescope or microscope, and (2) by increasing the interpupillary distance by several reflections after the plan shown by Helmholtz in his mirror stereoscope (1857) (see fig 5). When binocular tele­scopes and microscopes are used, erect images are formed when the two instruments arc contiguous. If this is not the case, the order of depth is reversed and the same false or pseudo­images are formed as when the pictures in a stereoscopic view are interchanged or a correctly combined stereoscopic picture is observed in a so-called pseudo-stereoscope. If, however, in this case the axes of both instruments intersect in front of the eyes, then reversed pictures are obtained, but the correct order of depth is recovered.

Telescope magnification (*m* times) and base magnification *(n* times) bring the radius R of the stereoscopic field to *m* or *n* times respectively the value above given, and if both are simultaneously active to *mn* times. The errors for a certain distance E are accord­ingly reduced to 1/*mn*. Of course these expedients do not increase the capability of the observer, but the values of the convergence angle Δ and δ in the object-space are different. It is therefore quite natural that the three-dimensional images, which appear in the binocular vision-space of the observer, vary with reference to their dimensions and the distance of the separate parts from each other. In this respect the action of the base magnification is funda­mentally different from that of the telescope magnification. Both bring the objects *m* or *n* times respectively nearer to the observer, but in the first case the areal dimensions are diminished in the same proportion as the distances are lessened, whilst in the other case the real dimensions remain unchanged. In the first case the three- dimensional image is a model proportionately diminished in all its dimensions and brought nearer to the observer: in the other case the objects appear pushed together to the front like the wings of a theatre. The remark made in Helmholtz’s *Physiological Optics* that when *m = n* the three-dimensional image would look like the object seen without any instrument at a distance of 1/*n* is conse­quently not correct. What is remarkable is that this observation, to which as a so-called “ Helmholtz rule ” great importance was for a long while attached, and to a certain extent still is, does not correctly express the views of Helmholtz, which he states very clearly in his earlier essay on the tele-stereoscope, and which agree with the explanation here given.

Spectacles and binocular telescopes were the first binocular instruments (see Binocular Instruments). The latter with chromatic lenses had already been constructed in the 17th and 18th centuries. The Dutch double-telescope (opera.glasses), which were almost exclusively used up to the ’nineties of the 19th century, were introduced in the ’thirties by Fr. Voigt- länder. The binocular microscope appeared in the early ’fifties. The introduction of the Porro prism (four reflections with reversion of the picture and lateral transposition of the rays) by Abbe in 1893 was of great importance for the binocular telescope and micro-scope. It led to the construction of the prism field-glasses and other telescopes which, in comparison with the Galileo binocular telescopes till then in use, not only had a considerably increased per­ception of depth but also a substantially larger field of vision. ■' Similarly by inserting the Porro inverting system between the eyepiece and the objective, the binocular microscope constructed by H. S. Greenough and S. Czapski was produced. Recently binocular glasses (after Fritsch and Zeiss) have come into use for slight magnifications, in which, following the example given by Wenham (1853), the interpupillary distance and the angle of convergence are diminished by four reflections (the course of the rays reversed as in fig. 5).

All of the instruments mentioned above are used exclusively for the observation of three-dimensional objects with two eyes. Wheatstone (1838) first show,cd that the same spatial impression could be produced by two views of the object taken