to perform a greater variety of experiments on binocular vision than can be carried out easily with the more common form.

Wheatstone also invented a form of stereoscope in which the pic­tures were brought on corresponding points of the retina by refrac­tion instead of by reflexion. This had a form very like the ordinary stereoscope, but, instead of lenses in the apertures to which the eyes are directed, it had “a pair of glass prisms having their faces inclined 15° and their refractive angles turned towards each other. . . . A pair of plate-glass prisms, their faces making with each other an angle of 12°, will bring two pictures, the corresponding points of which are 21/2 inches apart, to coincide at a distance of 12 inches, and a pair with an angle of 15° will occasion coincidence at 8 inches.”@@1

The form of stereoscope generally used is that invented by Sir David Brewster, and is known as the refracting stereoscope. The arrangement is shown

diagrammatically in

fig. 4. Let the left eye

be at A and the right

at B ; let *a* and *b* be

the corresponding pic­

tures for each eye, and

*p*1, *p*2, two prisms of

glass. A prism refracts

rays of light so that

the object seen through

the prism appears to be

nearer to the refracting

edge ; the prism *p*1

therefore refracts the

ray *ap*1 in the direction

*p*1A, as if it proceeded

from *c.* The prism *p*2

refracts the ray *bp*2 so

that to the eye at B it

also appears to proceed

from *c.* The effect of

this is that the object

really appears to be at *c.* And as the points *a* and *b* combine to form the point *c*, so *d* and *e* unite to form the point *f,* and *g* and *h* to form the point

*i* (Weinhold). This

stereoscope consists

of a pyramidal box

blackened inside and

having a lid for the

admission of light (fig.

5). At the narrow

end of the box are

two tubes carrying

the lenses. The tubes

move up and down to

suit eyes of different

focal lengths, and

sometimes convex or

concave lenses are in­

serted over the prisms

to meet the wants of

long-sighted or short­

sighted persons. Fig. 6

shows the upper end of

the stereoscope, with

the lenses in position.

A. Stroh (without knowing that H. Grubb

had described the essentials of the apparatus in 1879) has recently invented a new form of stereoscope based on the well-known effects

of the persistence of vision. Two stereoscopic pictures are simul­taneously projected by two lanterns on a screen so as to overlap, and disks having suitable slits

are rotated in front of the lan­

terns and also in front of the

eyes of the observer, in such a

way that only one picture is

thrown on the screen at a time,

and also that the view of the

picture is seen with the right and left eyes alternately. Further, the connexion between the disks is so arranged that the time of obscuring the view of the observer’s right eye or left eye coincides with the time when the light is shut off from the right or left lantern, and thus the left eye sees the picture of the left lantern and the right eye that of the right lantern. The two eyes never see at the same time, and each eye views its picture after the other, but the impressions come so fast as to be fused in consciousness, and the result is, the image stands out “in solid relief” (*Proc. Roy. Soc.,* No. 244, vol. xl., April 1, 1886).

During his researches into the physiology of vision, Wheatstone was led to study what he termed conversions of relief. Sometimes when we look at a geometrical figure such as a cube or rhom­boid it may be imagined to represent one of two dissimilar figures. In fig. 7 the rhomboid AX is drawn so

that the solid angle A should be seen nearest, and

solid angle X farthest, and face ABCD foremost,

while XDC is behind. Look steadily and the posi­

tion will change : X will appear nearest, solid angle

A farthest ; face ACDB will recede behind XDC.@@2

The effects are most obvious when seen with one

eye, and “no illusion of this kind can take place

when an object of three dimensions is seen with

both eyes while the optic axes make a sensible angle

with each other, because the appearance of two dissimilar figures, one to each eye, prevents the possibility of mistake ” (Wheat­stone). The conversion of a cameo into an intaglio and of an in­taglio into a cameo is a well-known instance of this illusion. Wheatstone observed the conversion of relief exhibited by binocular pictures in the stereoscope when they are transposed, reflected, or inverted, and this led him to the invention of the *Pseudoscope,* an instrιιment which conveys to the mind false perceptions of all ex­ternal objects. “ Two rectangular prisms of flint glass, the faces of which are 1·2 inch square, are placed in a frame with their hypo- thenuses parallel and 2·1 inches from each other ; each prism has a motion on an axis corresponding with the angle nearest the eyes, that they may be adjusted so that their bases may have any inclination towards each other” (Wheatstone’s *Scientific Papers,* p. 275). In fig. 8 there is a diagram of the

instrument. If a spherical surface be exa­

mined with this instrument, it will appear

hollow ; whilst a hollow surface will appear

convex. It is remarkable, however, that

the converting powers of this instrument

are greatest where the new forms can be

conceived without effort. Thus a cameo

and an intaglio, a plaster cast in relief and

its mould, or any object similar in its op­

posite reliefs is at once changed by the

pseudoscope into the converse form. As

pointed out by Dr Carpenter, by gazing we

can reverse the interior of a mask so as to

see the countenance stand out in relief; it

is more difficult to throw the features of a

bust into the shape of a mould ; whilst it

is impossible to effect any conversion upon

the features of the living face. “ The op­

tical change is identically the same in its

nature in every one of these cases; and

there is nothing in the form of the features

which refuses to present a converse, this

converted shape being presented by the

mask ; but the mind, which will admit the

conception of the converted form when suggested by the inanimate mask or bust, is steeled by its previous experience against the notion that actual flesh and

blood can undergo such

a metamorphosis’’(Car­

penter, *Edinburgh Re­*

*view,* 1858, p. 460).

A little consideration will show that the pic­tures of objects placed at a great distance from the eye are practically if not wholly identical. Here there is scarcely any stereoscopic

@@@1 Wheatstone’s *Scientific Papers,* p. 2C7.

@@@2 Necker, *Phil. Mag.,* 3d series, vol. i. p. 357.