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EXHIBITION *of* INSTRUMENTS (1) *for* TESTING PERCEPTION *of* DIFFERENCES *of* TINT, *and* (2) *for* DETERMINING REACTION-TIME.

By FRANCIS GALTON, ESQ., F.R.S.

1. *Instrument for testing the perception of differences of Tint.*

Mr. F. Galton exhibited a new instrument designed by himself. It was a long box blackened inside, that had a horizontal slot at one end, A, to look in at, and two square windows B_1 B_2 at the other end, B to look out at. The box is directed towards a screen of white paper easily illuminated, so that the observer looking through A sees two bright windows in front of him, all the rest being dark. His eyes are well shaded by three wings attached to the box at A, one above, and one at either side.

The upper part of the end of the box towards B is hinged and can be turned back; then two graduated wheels D_1 and D_2 are disclosed. They turn independently on the same axis which is fixed through the horizontal partition that divides the wheels. Each wheel carries a light frame set across its diameter at right angles to its face. Similar gratings G_1 G_2 of fine wire (or else slips of coloured glass) can be inserted into these frames. Thus the piece consisting of D_1 and G_1 is exactly similar to that consisting of D_2 and G_2, but the two pieces are placed in opposite aspects, D_1 and D_2 being on different sides of the partition, and G_1 and G_2 standing outwards from them respectively. The wheel D_2 can be set by the experimenter in any desired position, and D_1 can be rotated by the person who is being tested, whenever he pleases to turn a stud S, with which D_1 is connected by a string.

Now when the grating (or the glass) is inclined to the line of sight, less of the light from the screen that passes through the

corresponding window reaches his eye than when it is set more squarely. Therefore the brightness of the two windows cannot be the same unless the graduations on D_1 and D_2 correspond in position.

To perform the test:—Open the hinged end at B; set D_2 to any desired angle; close the hinged end. The person to be tested now looks through A, and turns the stud S until he has to the best of his judgment matched the tint of the window B_1 with that of B_2. Then the operator opens the hinged end and reads off the difference, if any, in the position of D_1 and D_2.

(The precise value to be assigned to each degree of difference of graduation under the most suitable test conditions, has not yet been calculated, the instrument being still in an experimental stage).

2. *Instrument for determining Reaction-time.*

This instrument, also designed by Mr. F. Galton, measures the interval between a Signal and the Response to it, by the space traversed by an oscillating pendulum when measured along a chord. The pendulum is always released at the same angle of 18° from the vertical, and the graduations are made on a chord of the arc through which it swings, situated at a vertical distance of 800 millimetres from the point of suspension. In this case, the length of the half-chord, or of $800 \times \tan 18°$, is equal to 259·9 millimetres. The graduations show the space travelled across from the starting point, at the close of each hundredth of the time required to perform a single oscillation. The places for the alternate graduations are given in the subjoined table, which has been calculated for the purpose, and may be useful in other ways, but the times to which the entries there refer are counted from the vertical position of the pendulum, and are reckoned up to $-$ 50 on the one side, and to $\times$ 50 on the other. The value of the decimal is only approximate; it had, in many cases, to be obtained by graphical interpollation. The pendulum is made to beat seconds, so the graduations are for hundredths of a second.

A pendulum must have considerable inertia in order to keep good time; on the other hand it is impossible to give a sudden check to the motion of a body that has considerable inertia without a serious jar. Therefore it is not the pendulum that has to be suddenly checked in this apparatus, but a thread that is stretched parallel to it, by an elastic band both above and below. As the pendulum oscillates the thread swings with it, and the thread passes between a pair of light bars that lie just below the graduated chord and are parallel to it. On pressing a key these bars revolve

round an axis common to both, through a little more than a quarter of a circle. They thus nip the thread and hold it tight, while no jar is communicated to the pendulum. The signal either for sight or for sound is mechanically effected by the detent at the moment when it is pushed down to release the pendulum. The pendulum may also be released, without giving any signal. In this case a sight signal has afterwards to be produced by causing the pendulum in its course to brush against and slightly to turn a very light and small mirror, so as to throw on or off the reflection of a window. A sound signal is similarly made by causing the pendulum to carry a light weight against a hollow box, which strikes the weight off. Neither of these acts produce any sensible alteration in the swing of a heavy pendulum.

TABLE.

T=the time of a single oscillation. Angle of oscillation 18° on either side of the vertical. The distances are measured upon a chord that lies 800 millimetres vertically below the point of suspension. The decimals are only approximately correct.

$\frac{T}{100}$	Distances from vertical.	$\frac{T}{100}$	Distances from vertical.	$\frac{T}{100}$	Distances from vertical.
0	0	20	148·5	40	246·4
2	15·7	22	161·5	42	251·2
4	31·3	24	174·0	44	255·1
6	46·8	26	185·9	46	257·9
8	62·2	28	197·0	48	259·5
10	77·6	30	207·4	50	259·9
12	92·3	32	216·2		
14	107·0	34	224·8		
16	121·5	36	232·7		
18	135·2	38	239·8		

The following Paper was read by the Author:—