

clusive by all the examiners, it is most desirable that some method should be used about which there could be no doubt whatever. Such a method, I believe, is one founded on the exact measurement of the persistence of vision of colours throughout the spectrum, when the frequency of flicker is at its critical value. The only thing the person under examination has to do is to adjust the speed of a sectored disc so that the flickering of the part of the spectrum under observation just ceases. The speed of the disc may be automatically registered on a chronograph by electrical means. A series of measurements throughout the spectrum when plotted gives a "persistence curve," which can readily be compared with a similar curve for a normal eye. The great advantage of this test is that it is purely mechanical, and does not involve the handling of coloured materials or the judging of colours in any way by the candidate.

A careful study by this method of twenty-six cases of colour-blindness which I made some years ago ("Persistence of Vision in Colour-blind Subjects," *Phys. Rev.*, vol. xv., 1902) showed such systematic differences between eyes with normal and those with abnormal colour-vision that I am convinced it is the most exact method yet used for the study, not only of colour-blindness, but also of normal colour-perception. I can the more readily express such an opinion inasmuch as this method, though used very extensively by myself, was originally devised by Prof. E. L. Nichols.

In the article in NATURE there is the statement that in the study of colour-blindness "there is none of that accuracy of definition in the scientific picture which rejoices the heart of the physicist." To some extent this may, perhaps, be true, especially for very strong or weak intensities of stimulus. On the basis of the cases I have referred to above, I venture to assert that, for ordinary daylight, there is far more "accuracy of definition" than is usually supposed to exist. I do not know how many cases of colour-blindness must be studied to render the conclusions drawn therefrom reasonably sure, but those to which I refer can readily be divided into distinct classes on the basis of three fundamental colour-sensations, red, green, and violet.

Holmgren, I believe, first pointed out the possibility of the following varieties of colour-blindness:—

| | |
|-----------------------------------|--|
| Red-blindness | } Defective in <i>one</i> colour sensation. |
| Green-blindness | |
| Violet-blindness | } Defective in <i>two</i> colour sensations. |
| Red-green blindness | |
| Red-violet blindness | |
| Green-violet blindness | |
| Red-green-violet blindness | } Defective in <i>three</i> colour sensations. |
| or total colour-blindness | |

In the paper on colour-blindness referred to above, there is, I believe, a demonstration of the existence of each of the above types with the single exception of violet-blindness. This classification, which was arrived at by means of persistency curves, seems to me to be as definite as could almost be desired.

I would therefore suggest this method for the examination of at least doubtful cases of defective colour-vision. The only objection is that the measurements, while simple and easily performed, are somewhat tedious if the spectrum is to be thoroughly examined.

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Practice and Knowledge.

MR. AND MRS. HOWARD in NATURE of February 17 show that "the past history of agricultural science furnishes several examples of belated explanations of the utility of practices the value of which has long been a tradition among practical men." In other departments of life practice in advance of knowledge is frequent, and there is one which struck me recently, and may have been observed by others, which is the practice of blowing hot and cold with the mouth which Æsop makes use of in his fable of the "Satyr and the Traveller," and has given rise to the common disparaging saying of "blowing hot and cold."

Some may suppose that the whole explanation of blow-

ing hot and cold may be in the difference in temperature of the two bodies blown on; the Traveller's hands in Æsop's fable were colder than his breath, while the heated mulled wine was warmer. This, however, is only a partial explanation. We have unconsciously acquired the practice of blowing at different temperatures. If we wish to warm our hands we open the mouth wide and direct a slow moving current of air to them, or, more properly expressed, we breathe on our hands. This current has nearly the body temperature; but when we wish to blow cold we purse in the lips until there is only a small opening, as in whistling, and discharge a fine jet of air under pressure. This jet entangles a large amount of air with it, and when it arrives at the hot surface its temperature is much lower than that of the breath. Should the hot surface be also moist, the current of air quickens the evaporation, and so hastens the cooling.

In passing, it may be noticed here that Æsop and the modern use of the expression "blowing hot and cold" seem to have missed the mark. The objects blown on are not the same, but different, and require and receive different treatment. It is no disparagement to say of a man that he blew hot on a scheme which seemed to him to require encouragement, while he blew cold on another he thought ought to be suppressed. Æsop putting the words into the mouth of a being of the type of a Satyr seems to suggest he was not quite sure he had given the highest interpretation of the incident recorded in the fable.

JOHN AITKEN.

Accelerated Velocity of Jupiter's Red Spot Hollow.

THE longitude of the middle of the Hollow has shown a comparatively rapid diminution since the beginning of the present apparition, as the figures below clearly indicate:—

| Month | Mean longitude | Diminution | Month | Mean longitude | Diminution |
|------------------|----------------|------------|-------------------|----------------|------------|
| 1909 October ... | 15°3' | 0 | 1910 January ... | 8°8' | 3°0' |
| 1909 November... | 13°3' | 2°0' | 1910 February ... | 7°4' | 1°4' |
| 1909 December... | 11°8' | 1°5' | | | |

From its estimated position on October 25 and February 25 (the first and last dates of observation in the above table), a rotation period of 9h. 55m. 37.9s. (287 rotations) has been deduced. This is 2.7 seconds shorter than the adopted period.

If the present accelerated rate of motion continues until June next, the centre of the Hollow will arrive at λ 0°, or, rather, its longitude will coincide with the zero meridian of system ii.

Now this quicker velocity became evident towards the end of the last apparition. An examination of my transit-chart of the Red Spot region for that epoch shows that, up to the beginning of May, 1909, the Hollow exhibited a normal monthly increase in longitude of 1.0°. Subsequently it began to move decidedly quicker, and this acceleration has been well maintained up to the present, as will thus be seen:—

| Date | λ | Elapsed rotation period | Remarks |
|------------------|-----------|-------------------------|---|
| | | h. m. s. | |
| 1908 Dec. 20 ... | 13°6' | | |
| 1909 May 2 ... | 18°1' | 321 ... 9 55 42.1 | {May 2 chosen as approximate date of change in velocity |
| 1909 May 2 ... | 18°1' | | {The last transit of the apparition |
| 1909 June 12 ... | 18°4' | 99 ... 9 55 40.9 | {was taken on June 12 |
| 1909 June 12 ... | 18°4' | | {Planet invisible for greater part of |
| 1909 Oct. 25 ... | 15°3' | 327 ... 9 55 40.5 | {time between the two dates |
| 1909 Oct. 25 ... | 15°3' | | {Hollow in conjunction with S. |
| 1910 Feb. 25 ... | 7°0' | 287 ... 9 55 37.9 | {Tropical Dark Area, since January |

The approximate date when the present accelerated velocity first commenced may be regarded as May 2, 1909.

The recent behaviour of the Hollow, or the Red Spot, is attributed to one well-known phenomenon. Once about every twenty-three months the Great South Tropical Dark Area passes rapidly by the Spot, and on each occasion the latter temporarily participates in its movements. As it is now two years since we witnessed the last of these periodical occurrences, the dark matter, having swept round the planet, is once again involving the region of the Red Spot. The recent accelerated motion of the Hollow, therefore, was fully anticipated.

March 4.

SCRIVEN BOLTON.