Can count in the sense of naming figures up to twenty or so, but only up to six does he apply the symbols to things and use them. Up to six knows the combinations two and two, two and three, etc. Is learning to read voluntarily. Learns by printing words. The other day he recognized his own name "James" on a cab.

Odo, October, 1887.—Compared with James at same age I have only again to repeat that he is more advanced, but that there is little to note, the process of learning not being visible, *i.e.*, he picks up things from his brother without effort, unconsciously. His acts and deeds are all acquired by imitation, not by thinking them out. His vocabulary is fuller than James' was at his age, because he learns from him. In the same way he climbs, jumps, etc., better than his brother at the same age, although he does not promise to be nearly so athletic a man. As the gap between a child and a senior is too great in everything for a child to learn by direct complete copying, so where James does a thing Odo recognizes as utterly beyond him he gives no attention to it, *e.g.*, riding a tricycle, writing words, climbing *over* a fence.

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*An Improved Reaction-Time Instrument.** By Dr. Bevan Lewis, Medical Superintendent of the West Riding Asylum, Wakefield.

I thought it might prove of some interest to demonstrate at the psychological section the instrument I have hitherto used at the West Riding Asylum for the purpose of registering the reaction time to a sight and sound signal. The instrument in its original form, as made by the Cambridge Scientific Instrument Company, may be familiar to you, but lately I have so far modified it and extended its utility that I think it will be well to indicate the changes introduced in detail. The original, with minor alterations, has been described so fully in Dr. Hack Tuke's new "Dictionary of Psychological Medicine" that I shall only briefly refer here to the general scheme of its construction, referring those who seek more minute particulars to this article.

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You observe, then, gentlemen, we have here a square standard of pitch pine supported on a tripod, with levelling screws adapted. A rectangular piece of teak or mahogany is screwed into the standard about three feet from the floor, at a convenient height for reading off upon it the registry of the falling rods.

At its farther end is a horizontal table, upon which rests the hand of the party operated upon, whilst along the centre of the cross-piece you observe a horseshoe or stirrup secured by an electro magnet, which, released on interrupting the current, is drawn back by a powerful spiral spring, and so clamps the registry rod in falling.

At the summit of the vertical standard you see an arrangement whereby the rod was formerly suspended on a steel bar, which being released by turning a screw, swung round and started the rod.

The rod itself, made of box or lance-wood, was accurately graduated along its edge into hundredths of a second—the complete fall of the rod occupying $\frac{30}{100}$ths, or $\frac{3}{10}$ths, of a second. After falling through a short distance, a brass plate which rides astride the top of the rod encounters a diaphragm, and so gives a sound signal by its impact. To this diaphragm, however, there is adapted an arrangement for the make and break of an electric current, so that an electric bell conveniently gives the sound signal.

For a sight signal you observe the rod has a vertical slit which corresponds, when the rod hangs suspended in a state of rest, to a small window in the ledge projecting from the standard. After the usual distance the further fall of the rod suddenly shuts off the light seen through the slit, at the same moment at which the sound signal would have been given had we not removed the brass weight above.

This, gentlemen, is the instrument as first constructed, and its application is described in a few words:—For a *sound signal* the subject sits with his right hand resting on the horizontal table, his forefinger upon the interrupting button of the clamp-magnet. An attendant standing behind released the rod, which, falling a short distance, gave the sound signal, whereupon the finger is instantly depressed, the stirrup released, and the rod firmly clamped. The observer, sitting in front, reads off the figure at which the clamp secures the rod.

For a *sight signal* the brass weight giving the sound signal

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is removed, and the subject, sitting as before, keeps his eye fixed at the light seen through the slit of the rod. The instant this disappears he again clamps the rod in like manner.

And now as to the novel features introduced. The release of the rod frequently caused a very perceptible click, which, with a *strained attention*, was most likely to be taken for the subsequent sound signal. Observe the fallacy. The initial slow fall of the rod to the level at which the sound signal was given was computed to occupy 0·1 second, or $\frac{10}{100}$ths; it was therefore of considerable moment that the release should be a perfectly *silent* one. This was effected by introducing an electro-magnet, to which the graduated rod swung, attached by a short cylinder of soft iron.

Then arose a further desideratum. The fall of the rod occupied but $\frac{3}{10}$ths of a second, whereas several of my subjects required a far longer interval for their reaction. You see how this end has been secured. Four electro-magnets suspend as many rods by means of soft iron keepers attached to each of the latter. The rods are exactly alike in graduation.

Below, on the footboard, you observe a series of four keys which are introduced into the circuit of the respective electro-magnets above. When the first rod falls it strikes the first key, breaks the circuit of the second electro-magnet, and so starts the second rod; it, in its turn, strikes the second key, breaks the circuit of the third electro-magnet, and starts the third rod, and so on through any number it may be desired to utilize.

I find four rods all that is requisite for practical purposes. For securing these rods a much more powerful spiral spring was requisite, and a lengthened clamp of four stirrup divisions.

The fall of the rods in succession on the disconnecting keys introduced, as you may suppose, a most undesirable clatter; and here you see the method adopted to minimize this disturbing element—an ingenious contrivance, which I owe exclusively to my friend Dr. Bedford Pierce. Each rod, you will note, has a short horizontal arm at its lower end, to which is suspended a soft light weight, which, with the gentlest touch upon the key, breaks contact and releases the next rod, whilst each rod in turn falls, not on the key, but upon a pad stuffed with sand, which notably deadens the thud

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and diminishes the rebound of the rod. Dr. Bedford Pierce has thus provided an almost silent fall for the rods, whilst the arrangement above secures an absolutely silent release.

You will also observe the first rod is so suspended as to fall through a distance of 4·875 cm. ere the signals for sound or sight are given. The object of this is that the rod should acquire such a degree of velocity as to afford convenient divisions for time registry; otherwise, when starting from a position of rest the initial movement is so slow that divisions of hundredths of a second would require too fine a graduation for practical purposes. This initial fall of the three last rods is accounted for exactly by the distance of the suspended pads below the rod itself—in other words, the pad touches the key and breaks contact before the rod has completed its fall, so that by the time the rod has reached the baseboard, the second rod has just fallen through the initial space alluded to and has acquired the desired momentum.

This feature adds immensely to the value of the contrivance suggested by Dr. Pierce, as it eliminates the period of fall which would be registered with difficulty if not uncertainty.

One further change I have introduced. The brass weight astride the first rod has been dispensed with for the sound signal, and in lieu thereof a fixed weight is placed upon the diaphragm, just sufficient to make circuit with a single-stroke electric bell. The weight is kept up by a small cork wedge, which is secured to the rod by a thread. When the rod has fallen through the initial distance it pulls out the wedge, releases the weight, and a signal is instantly given. I find this a great improvement upon the older method adopted.

Those who are familiar with psychometric methods will recognize the importance of having both a single-stroke and an ordinary continuous electric bell in circuit as a sound signal.

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