

The nearer the form and habits of man in his most primitive stage resembled those of the apes, the more in all probability would his habitat or range have been identical with theirs. Therefore an examination of miocene or early pliocene deposits along this line and its diverging branches would scarcely be unattended with success in producing many fossil remains of very primitive or Simian man.

I trust I have said enough to indicate the direction which inquiry ought to take as far as present evidence goes, and I hope that a gigantic combined effort may ere long be made by all naturalists and all lovers of truth to attempt in a downright earnest manner the solution of this great question of the origin of man.

W. S. DUNCAN

The Stone in the Nest of the Swallow

WOULD any of your readers be kind enough to give me some information about the origin of the fable to which Longfellow refers in the following passage of his "Evangeline," Part I., at the end :—

" Oft in the barns they climbed to the populous nests on the rafters,
Seeking with eager eyes that wondrous stone, which the swallow
Brings from the shore of the sea to restore the sight of its fledglings ;
Lucky was he who found that stone in the nest of the swallow ! "

Leiden, March 19

P. P. C. HOEK

Carnivorous Wasps

SIR DAVID WEDDERBURN'S inquiry (NATURE, vol. xxi. p. 417) reminds me of my experience on this subject. Many years ago I was examining an apple-tree, when a wasp alighted on a leaf which formed a caterpillar's nest neatly rolled up. The wasp examined both ends, and finding them closed, it soon clipped a hole in the leaf at one end of the nest about one-eighth of an inch in diameter. It then went to the other end and made a noise which frightened the caterpillar, which came rushing out at the hole. It was immediately seized by the wasp, who, finding it too large to carry off at once, cut it in two and went off with his game. I waited a little, and saw the wasp come back for the other half, with which it also flew away.

After witnessing such evidence of intelligence I have had a great respect for wasps, and gave orders to my gardeners never to destroy one.

I gained some further evidence of their carnivorous taste when I once took my children to Switzerland for a holiday, and on a butterfly hunting expedition. We had spread out the day's find in the evening, and next morning I placed the boards in the sun to dry. On looking at them some hours later I found nearly all the bodies gone, only the thorax and wings left ; and while examining them a wasp alighted on the board, and I soon proved that he was the culprit.

I have no doubt that wasps are most serviceable to gardeners by destroying caterpillars.

R. S. NEWALL

March 21

Intellect in Brutes

SOME time since I observed the following conduct of two spiders, which will show how they sometimes overcome difficulties in the way of capturing their prey. A rather large house-spider had its web in the corner of a room, and during the summer it feasted upon the insects that were unlucky enough to be caught. One evening I noticed a large dipterous insect strike the web ; the spider darted out and succeeded in fastening one foot of the fly. The spider then leapt running back and forth, attaching a thread to a wing, then to a leg, which was soon broken by the violent efforts of the fly to release itself. The spider worked without ceasing for over half an hour to secure its victim ; it then quitted operations, and retired to a distant corner of its web. After seeming to reflect for a while what was best to do, it left the web, went up the wall eight or ten inches distant, and entered a crack in the ceiling. I supposed at the time that the spider had been injured in the scuffle, but what was my surprise after a few moments to see the spider coming back, and close behind another followed ; the two went on the web near the centre, and stopped side by side, apparently consulting as to the best mode of attack. Then at the same instant both spiders darted upon the insect, one towards the head, the other towards the tail. So rapid were their movements I could hardly follow them. In a short time the insect was securely fastened. Both spiders then returned to the centre of the web. Soon after the

friendly spider went to the crack in the ceiling, while the other enjoyed the feast alone.

A. M.

North Manchester, Indiana, U.S., February 25

Diatoms in the London Clay

YOUR correspondent, Mr. W. H. Shrubsole, inquires where sections may be seen in the lower part of the London clay. He will find a good exposure in a brick-yard, half a mile south-west of Roydon Station on the Great Eastern Railway ; in another at Hadham Ford, on the Buntingford branch line, and several in the brick-fields near Bishop Stortford. In all these sections the lowest part of the London clay may be seen, resting upon sands, or loams, of the Reading series. Upon direct application, or otherwise, I shall be happy to supply Mr. Shrubsole with further information.

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VISUALISED NUMERALS

SINCE I addressed a preliminary memoir to you on this subject,¹ so much curious matter has reached me that I trust you will permit me to state my views afresh, and to deduce some inferences. Many of my readers do not and cannot visualise, and few have the habit in a pronounced degree. I must, however, beg them not to consider their own minds as identical with those of every other sane and healthy person. Psychologists ought to inquire into the mental habits of other men with as little prejudice as if they were inquiring into those of animals of different species to their own, and should be prepared to find much in many cases that is quite unlike their own personal experience.

Persons who have the tendency to use mental pictures as the symbols with which they carry on their processes of thought, do so especially in the case of numerals. Thus, when they think of "six," the figure "6" arises before the mind's eye more readily and vividly than the sound "six" echoes in their mind's ear, or than any other perception of that numeral manifests itself. Now the peculiarity that I accidentally found out is this, that about one out of every thirty males, or fifteen females, not only visualise their numerals in this way, but also invariably assign to each of them a definite place in their mental field of view, where it seems to have a home. Thus 6 may always lie low down to the left, 7 may be found a little higher and more to the front, and so on. It follows that whenever these persons think of a series of numbers, as 1, 2, 3, 4, 5, &c., they always appear to the mind's eye as ranged in a definite pattern or "form." This form is stated in all cases to have been in existence at the farthest period to which recollection goes back, though in many cases it has insensibly grown until it included the higher numbers and even negative values. It is usually of a rambling irregular shape, and though constant for the same person, it differs very greatly in different persons. It may consist of a row or rows of faintly marked figures, suspended in the air or lying on a hazy ground, and when the mental eye travels along the row, each as it is looked at in succession becomes for the moment vivid. Or it may consist of a faint line with nothing on it, along which the eye is wont to travel until it reaches the place where the figure it wants is known to reside, and then the figure starts into sight. Or it may be a haze penetrated by faint lines. Or there may be no figures at all in the line, but only dots denoting position. The planes on which the forms lie slope in some cases up to the heavens, in others down to an immeasurable abyss. They often start a little below the level of the eye and rise gently upwards, reminding one of what the appearance of objects on a table would be to a child whose head hardly overtopped it. All these forms can be drawn in a way more or less satisfactory to those who see them, and I have now received nearly eighty drawings, in about

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equal proportions from either sex. I exhibited copies of fifty-four of them (made by a camera lucida) at the Anthropological Institute on Tuesday, March 9, when I read a paper on the subject. The meeting was attended by several of my correspondents, who are well known in the scientific world, and who explained to the meeting their respective forms. They were Mr. George Bidder, O.C., the Rev. G. Henslow, Mr. Roget, Mr. Schuster, F.R.S., Mr. B. Woodd Smith, and Col. Yule, C.B. Two of these, namely, Mr. Henslow and Mr. Schuster, see the forms objectively; they can point to the direction in which at any moment any particular figure appears to them to lie, and when they move their eyes the form moves too. In the other four cases the close co-ordination between brain and eye does not exist, and their images appear in a sort of dreamland having no strict relation with external space. The form of each observer is quite unserviceable to the rest, having no meaning except to himself.

The language employed by persons in respect to some of the features of these forms is apt to be very similar. Phrases are frequently met with, such as "Ever since childhood I have always seen . . ." "I cannot account for their origin in any way;" "It is perfectly independent of the will." I have verbally questioned a great many acquaintances whether they see numerals in any particular way. They usually say No; they ask what I mean, then profess inability to understand my object, and evidently think it some nonsensical fancy. But I get my reward in the proportion of cases I have mentioned. I have already become familiar with the quick look of intelligence on these occasions, and with the reply in words denoting that the right chord had been struck. Then the details are poured forth. I am frequently told how the habit used to be mentioned to relatives, but was ridiculed, and had ceased to be spoken about; or again, how some particular brother or sister had the same habit, but that one only, and so forth. The more I follow up the inquiries, the more the accuracy of the first replies becomes evident; thus, I ask for fresh sketches, and they correspond to the first. The general result is, that these statements bear all the marks one could expect of being the reports of what is clearly seen and what the writer is anxious to describe exactly. Among my foreign correspondents whose names are well known to the scientific world, and whom I am permitted to quote, are M. Antoine d'Abbadie, the traveller, and Member of the Institute, and Baron von Osten Sacken, the Russian entomologist.

Now for the results. These forms (as distinguished from the figures now seen upon them) are survivals of a very early mental stage, and must have originated before the child learnt his letters. There is no nursery book or diagram that could suggest their fantastic shapes. Their very variety shows them to be derived from no common origin. They frequently turn with a left-handed twist, which written and printed things do not. They are more archaic than the alphabetical and historical forms used by the same persons, for these bear evident marks of their origin. The clock face has little or nothing to do with them, for its influence can only be traced in three cases. I believe the forms to have been mnemonic diagrams, invented by the children when they were learning to count *verbally*, the *sounds* of the successive numerals being associated with the successive points of the form. Also, that when the children began to read, the visual symbols of the numerals quickly supplanted the verbal ones, and established themselves permanently in their place. On this supposition we possess in these numerical forms a representation of the route along which the attention naturally travels in the mental field of view of the child. It is entirely the child's own way of working, and therefore true to his nature; and being natural, it persists through life and offers itself in the adult for our examination.

The characteristic run of the lines in each form has

some general similarity to that of the correspondent's hand-writing, but it must testify more directly to his mental peculiarities than the latter. The form shows the ways that the mind most likes to travel by, but the hand-writing is a compromise between what the writer desires to produce under the joint guidance of a natural fancy, of education and of fashion, with what the muscles of the hand can most easily effect. These forms or natural lines of thought are, I presume, analogous to those that instinctively prompt each species of animal to make his lair, burrow, nest, or other piece of domestic architecture, on an identical plan, with trifling individual variations, and that prompts gregarious animals to group themselves always in the same sort of array. In these numerical forms we find real "psychograms."

One of the most obvious facts common to them is the curious proof they afford of the perplexity caused by our barbarous nomenclature of the numerals. We say "ten," "eleven," "fifteen," &c., when we see "one-nought," "one-one," "one-five," &c., and other civilised nations are as bad or worse than ourselves, as the French with their "soixante quinze." The way in which the perplexity is shown is by the wriggles and twists in the forms at 10 and 12 and by the exceptional length of the 'teens. It is not easy to describe in a few words what is so variously portrayed, but the general effect on looking at my collection is most striking. It is really painful to think of the vast amount of petty difficulty to the existence of which this indisputable testimony is given. The difficulty does not cease with childhood, else the twists would have been smoothed away, and I am sure from trials on myself that I for my part still feel it much. I can dictate more easily by saying on-one, on-two, &c., and I can write and sum from dictation much more quickly when some such plan is used. It should be adopted by those who want to remove as much friction as possible from their brain-work. I have little doubt that the conflict between our language and our notation is a serious though unsuspected hindrance to the ready establishment of decimal weights and measures.

I find from inquiries made for me at schools that young people see forms more commonly than adults, but that their forms are less developed and sure. I conclude that where they are vivid and serviceable they are much used, and insensibly grow in vividness, in definition, and in automatic character. Otherwise they decay from disuse and become forgotten. Hence arises the rather sharp division between the seers and non-seers in adult life.

I am still desirous of more information on this subject, especially concerning children, and on colour associations with figures, letters, and words.

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FRANCIS GALTON

THE TELEPHONIC EXCHANGE IN THE UNITED STATES

THE telephone has already become firmly established in America as a medium of daily communication. Eighty-five towns are thus connected, and to the various telephonic companies there are 70,000 subscribers, and the number is rapidly increasing. For some details as to the working of this method of intercommunication we are indebted to our French contemporary *La Nature*. If we enter the great hall of the central office of the Merchants' Telephone Exchange at 198, Broadway, New York (Fig. 1), we see a series of "Switchmen" engaged in establishing communications among the subscribers. There is a switchman corresponding with one of the subscribers who has called (Fig. 2); further on is another *employe* engaged in raising the notice signal. In the city, in the subscriber's house or office, is the office telephone, which is set up in a great number of houses; this model is very convenient for business, for it permits of speaking into the mouth-piece placed on the left, of