

a line falling across the moon, perpendicular to a line extending from horn to horn is always directed towards the sun; a rule that artists would do well to commit to memory.

The phenomena are very simple. A few days after new moon, the moon which had been close to the sun is now visible at some distance to the left and east; and as the daily motion of the moon is about 13° from west to east relatively to the sun, it follows that it rises nearly an hour later every day. The illuminated side of the moon must be turned towards the sun, for it derives its light entirely from that source. A few days after new moon a section of the illumined side is presented to the earth as a clear crescent, with the convex side towards the sun—that is, to the right. The moon now rises some hours after the sun, and sets some hours later. When the moon has entered its first quarter—that is, $7\frac{1}{2}$ days after new moon—half of its illuminated side is turned towards us, and being now at a distance of 90° from the sun, it rises at midday and sets at midnight, presenting the appearance of half a round disc, with the convex side to the right.

Pursuing its course for another $7\frac{1}{2}$ days the satellite is in opposition to the sun, rising as full moon when the latter sets, and shining in the meridian at midnight. From this point the right edge of the disc contracts, while the left remains convex; and, at the period of the second quadrature, or last quarter, the the east edge is circular, the western edge a straight line. At this period the moon rises about 6 A.M. The western, or right, edge, continues to contract until the moon again assumes the form of a sickle, but with the hollow side to the right, when it finally disappears in the sun, to reappear a few days later as the new moon, with its convexity reversed.

THE CALCULATOR, GIACOMO INAUDI.

ALFRED BINET.

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THE mathematicians, physicians, and philosophers have had the invaluable opportunity of studying a new calculating prodigy, in a young man twenty-four years old, named Giacomo Inaudi, whom Mr. Darboux, in February last, presented at a session of the Academy of Sciences. This young man executes mentally, with surprising rapidity, arithmetical operations, involving a great number of figures.

Inaudi, born the 13th of October, 1867, at Onorato, in Piedmont, is of a poor family, and his relatives are to-day in humble positions. One of his brothers is a waiter at a café, another is a shoemaker. Giacomo passed his early years in watching sheep. Towards the age of six he was seized with a passion for figures. While watching his flock, he combined numbers mentally. Unlike most known calculators, he did not try to give his calculations a material form by counting on his fingers or with pebbles, like Mondeux and Ampère. All Inaudi's operations were mental, and he made them with words representing the numbers which he had heard from his eldest brother. At that time neither he nor his brother knew how to read. Thus he learned by ear the names of the series of numbers up to a hundred and he set to work to calculate with those he knew. When he had exhausted the figures with which he was acquainted, he asked to be taught the numbers beyond a hundred, so as to extend the sphere of his calculations. He does not remember that his brother ever taught him the multiplication table. By continual practice the young calculator made rapid progress. When he was seven years old, he could make in his head multiplications of five figures.

Soon Inaudi left his native country and made with his brother a vagabond tour in Provence. The brother played an organ and Giacomo exhibited a marmot and held out his hand for pennies. To increase their small gains, the lad proposed to persons whom he met to execute for them mental calculations. He aided the country people in making up their accounts. He exhibited himself in cafés, and solved with great rapidity all the arithmetical questions proposed to him.

Inaudi came to Paris for the first time in 1880, and was presented by Broca to the Society of Anthropology. At that time he could neither read or write. Since 1880, Giacomo has made great progress. He learned reading and writing, and then the sphere of his operations enlarged. His education began so late, that it is but rudimentary in very many respects; but he is intelligent, talks agreeably, with good sense, sometimes with irony. He is very skillful at cards and billiards. He has a good head, with an immense square forehead, as high as it is broad. At the Salpêtrière, under the direction of Dr. Charcot, he has been subjected to a long anthropometrical examination.

The operations executed by Inaudi are additions, subtractions, multiplications, divisions, extractions of roots. Besides, he resolves, by arithmetic, problems corresponding to equations of the first degree. All these operations are effected by mental calculation. This phrase I use to signify a calculation which is done in the head, without employing a reading of the figures, or writing, or any material means whatever to aid the memory. In general, Inaudi proceeds in this fashion: When you give him a problem by word of mouth, he listens attentively and repeats what has been told him, articulating clearly, in order to fasten it in his mind. If he has not understood what has been said to him, he makes you say it again. You may give him the problem in writing, but he prefers to receive it through his ear; and if you insist on his reading it, he utters it in a low voice. When he has thoroughly comprehended the question put to him, he says: "I begin," and he proceeds to whisper very rapidly, with an indistinct murmur, in which you can distinguish, now and then, some names of figures. While this is going on, nothing can move or distract him; he performs the most complicated calculations in the midst of the noise of public representations. Still further, he can talk while he is working mentally. He answers questions appropriately, even sustains a regular conversation, without his arithmetical calculations being interrupted. Only in that case the calculation takes a little longer. After a time, which is always very short, he says: "I have done," and he announces the solution, proving it for his personal satisfaction.

Inaudi adds in a few seconds seven sums of from eight to ten figures. He makes a subtraction of two sums of twenty-one figures each in a few minutes. He finds as rapidly the square root, the cube root of a sum of eight or ten figures, if the sum is a perfect square. It takes him a trifle longer when, after the extraction of the square or cube root, there is a remainder. With incredible quickness he finds the sixth or seventh root of a sum of several figures. He makes a division or a multiplication in less time than it takes to enunciate the problem. To give a particular example, Inaudi was asked how many seconds there are in 18 years, 7 months, 21 days, 3 hours. He gave the answer in thirteen seconds.

Observation of this wonderful calculator furnishes a new proof of the theory, now widely accepted, of partial memories. It is customary to use the word memory in a general sense to express the faculty, which all thinking beings possess, of preserving and reproducing impressions received. Psychological analysis, however, and a great number of facts of mental pathology, have shown that memory cannot be considered a single faculty, having a distinct locality. In the last analysis, memory is a combination of operations. There exists, as was well said in the Report of the Academic Committee on Inaudi, naught but partial, special, local memories, each of which has its own proper field, and which are so independent of each other, that one of them can become weakened or disappear, or, on the contrary, be developed in excess, without the other memories undergoing a corresponding modification. This is shown in the case of calculating prodigies. With them no memory is destroyed; but one of their memories, that of figures, is abnormally developed, exciting astonishment and admiration, while their other memories, considered together,

have no particular feature, and sometimes are even below the average.

The Academic Committee which studied Inaudi ascertained that his processes of action are contrary to the opinions current about calculating prodigies. These last, according to their own testimony, appear, like chess-players who possess the singular faculty of playing without seeing the board, to take for the principal base of their mental operations the visual memory. At the moment when there is uttered before them the data of the problem to be solved, they have an internal vision of the numbers uttered, and, during all the time necessary for the operation of solving the problem, these numbers remain before their imagination as though they were written on a tablet placed before their eyes. This being so, nothing is easier than to explain the faculty of mental calculation, that is, the faculty of being able to calculate, without knowing how to read or write.

The experiments have proved that Inaudi is not a visual calculator. What is he then? It would not be absolutely just to say that he employs auditive images. Auditive images and sensations of words are associated with the movements of the larynx and mouth necessary to pronounce them, and when a person represents to himself a word under the form of the sound, he must have at the same time particular sensations in the organs of phonation, as though the word was going to be pronounced. In other words, for what concerns language, the auditive type has the closest connection with the motive type; the two things are necessarily very often combined. This is probably what occurs with Inaudi, who, while making his calculations, moves his lips a little, and keeps up a sort of whisper, in which can be distinguished now and then, some names of figures.

The study of Inaudi has thus been fruitful for psychology. It has confirmed in a remarkable manner the theory of partial memories, and has familiarized us with a new form of mental calculation, the auditive form.

THE CAVE MEN OF THE ROCHERS ROUGES.

CLARE SOREL STRONG.

The Lyceum, Dublin, June.

"L'HOMME DE MENTONE!" This is the title given to a palæolithic skeleton that has been for about a quarter of a century the joy and pride of the French scientific world, or rather of a section of that world. But for some of us there are three men of Mentone. The first of these is M. Bonfils, a living specimen of scientific enthusiasm, curator and founder of the Mentone Museum. The second, which M. Bonfils helped M. Riviere to find, reposes in a Paris collection, but there is a life-size drawing of him in the Mentone Museum, measuring two metres and three centimetres, say six feet five. What a splendid fellow this savage must have been when he wore all his pads of cartilage, his inter-articular gristles—the things that make the middle-aged so much taller than the old folks, who totter along, bone resting (almost) upon bone, because they have worn down the buffers with which a once kind nature fitted their joints. Thirdly, there is the "New Man of Mentone."

Nine years ago, M. Louis Jallien, aided by the counsels of M. Bonfils, began fresh researches in the caverns which had, fifteen years before, yielded the man of Mentone (merely a neolithic man!), and at the depth of eight metres and forty centimetres the new skeleton was discovered. This was a palæolithic man: his instruments were without trace of polish or ornamentation. He lay on his back, with limbs extended; and on his forehead and shoulders he bore pieces of flint—in forehead band and epaulette fashion—each about six inches long by two and a half wide. There cannot be a doubt that this was an interment. As the question of the disposal of the prehistoric dead had been hotly debated—the balance of

opinion being altogether against burial—this discovery caused a great sensation amongst all those busied with questions of the sort. The skeleton lay in a natural vault, formed on one side by the wall of the cavern and on the other by an immense block of stone with an overhanging edge.

There are nine caverns in the *Rochers Rouge*. All are in the same rock, at the same level with the same outlook (toward the South), and the same sort of remains in them.

The skull of the "new man" was broken into sixty fragments by the pickaxe of one of the workmen, before the whole of the excavating was complete, and this was so far lucky that M. Bonfils carried away the pieces, and put them together carefully; but the guard was driven away from the excavation, set upon by three men, on the plea that their employers claimed all treasure-trove, and they carried off or scattered everything that they could lay hands upon.

M. Bonfils points out some striking differences between the bones of modern dead men, and those of prehistoric man. In a Roman leg which was placed beside that of the "new man of Mentone" for comparison, the fibula is flattish, the tibia round, whereas, in the prehistoric specimen, the tibia is flat and the fibula round. Prehistoric man followed his own fashion in the matter of arm bones, too, and his knee-pan would make a tidy little saucer! Moreover, the differences between ancient and modern skulls are very marked. The new man of Mentone was three times as heavy in the jaw as his descendant of to-day. His enormous head ran backward, and was not proportionately very broad at the temple, not very much domed a-top. Scarcely a very high type, our cave man, but no monkey, believe me!

Since I wrote the above, new wonders have come to light at the *Rochers Rouge*. M. Riviere has unearthed three more skeletons. I have seen them, too,—gigantic frames just showing through the red earth of the caves. The heads had been removed. Dr. Verneaux, of the Paris Institute, was piecing them together in a small white house hard by. The cave is a storehouse of treasures in stone and bone. As a proof, I may say a learned German came to see the skeletons the other day, and, turning over the dust of the grotto with his cane, unearthed a jawbone of the little pouched or marsupial rat, allied to the kangaroos of Australia. These recently-discovered prehistoric remains are now the subject of a lawsuit, which is very unfortunate, since, until it shall be decided, these veritable bones of contention must lie where they are, under very imperfect protection.

RELIGIOUS.

THE TRUE IDEA OF CREATION.

THE REVEREND J. H. WYTHE, D.D.

Methodist Review, New York, July-August.

CREATION means that which was caused to exist, and necessarily implies dependence upon the will and power of a Supreme Creator. It is self-evident that no finite being can be self-caused. Whatever is self-existent is eternal; and whatever had a beginning was created or caused to exist. The continuance in being, also, of any created thing, is but the continuance of the same creative power and will by which it began to be.

The Bible ascribes all finite existence to the will and power of a personal self-existent Being; but certain systems of philosophy ascribe existence to a law of development, or an evolution from the preceding conditions of the universe itself. In one form or another these later philosophies maintain the self-existence or eternity of the universe. Either a personal or impersonal cause of existence must be recognized, for no other is conceivable.

The law of parsimony in logic which forbids the multiplying of principles or things when the phenomenon can be explained