

blows were struck by a hammer which struck with a known force, appended to an accurate recording apparatus. The extent of the jerk proved to be an index of the state of the nerves. The first series of experiments showed that the jerk obtained upon rising in the morning was small; that that given after breakfast was, on the average, higher than those at subsequent hours, and that it rose after each meal; also, that the effect of muscular exercise was always to largely diminish its extent. Slight mental fatigue does not seem to affect the knee-jerk, while unusual mental fatigue produced an irritability which reinforced it. Irritation of the skin, voluntary movements, attention to unusual sounds, exciting mental work (such as the recitation of a stirring poem), music (especially of an emotional character), exciting dreams, all increased the extent of the knee-jerk. Violent respiratory movements also increased it, while a rise of temperature or a fall of the barometer diminished it, opposite meteorological conditions producing opposite results. A second series of experiments confirmed the results obtained by the first.

ARCHÆOLOGY AND ANTHROPOLOGY.

THE MAGIC MIRROR OF CHINA AND JAPAN.—The magic mirror is the common toilet mirror or *kagami* in everyday use in Japan. It is a thin disk of cast bronze about eight inches in diameter, or of various sizes, and has a short handle cast with the piece. The plane side is amalgamated; on the back are representations in relief of bamboos, ships, storks, trees, etc., and generally two large characters.

The performance of this mirror has long excited great curiosity and interest, and there have been many ingenious conjectures as to the reason of the strange way of its reflection. The magic is that, when it is properly prepared and the sun's rays caught upon it and reflected on a screen, the outlines of the characters and figures on the back show in the reflection. The figures appear lighter than the rest of the field, and not frequently with a sharp outline. Better results will be obtained if the mirror is slightly warmed, laid on its back on a perfectly flat surface, and briskly polished with a cloth. Then, if the sun's rays are caught upon it, at first in the reflection the figures cannot be seen, but they gradually appear and are permanent. In China its peculiarity has been long and well known, for it was spoken of with great admiration in the eleventh century by Tchih-Kouo, and the poet Kin-ma, celebrated it in verse. It is probably used as one of the very numerous agents of divination practiced there; and in passing, we note that a mirror, the symbol of purity, is found in every Shinto temple and shrine in Japan. The Chinese mirror has no handle; it is held by cords passed through lugs at the back.

They are called in China *theou-kouang-kien*, or mirrors that are penetrated by light, an expression which portrays a popular error. Ou-tsin-hing, who lived between 1260 and 1341, wrote on the subject as follows: "Here is the cause of that phenomenon which proves the employment separately of fine and coarse copper. If they have produced in the founding in a mould a dragon arranged in a circle, on the face of the mirror they engrave deeply an exactly similar dragon. Then, with copper a little denser, they fill up the deep cuts of the chisel, submit the mirror to the action of fire, after which they level and dress the face and give it a light coating of tin. When its image is reflected on the wall, it presents the clear tints and dark tints which proves that the one is of the portions of purer copper and the other of the coarser parts."¹ He claims to have seen a broken mirror which was so constructed. Aside from physical reasons, the cheapness of the *kagami* refutes the idea of this extremely difficult process to make a common toilet article.

An amusing interpretation of the riddle was brought out on questioning several Japanese. They said that magic mirrors are caused by earthquake shocks occurring just when the metal is being poured into the mould; the shock rearranges the particles and alters the reflecting powers. Workmen sometimes jar the flasks to produce the effect during the rare absence of an earth tremor in that land of seismic disturbances. Just how much magic comes from the great fish whose uneasy slumber causes earthquakes, according to Japanese folk-lore, has not been found out.

However, in the course of these inquiries a fact was elicited of some importance. All mirrors are not "magic," and they cannot be "made to order." This may have some bearing on the theory or explanation of Messrs. Ayrton and Perry, English electricians, who have accidentally observed that on amalgamation, or coating with mercury, brass expands. They think this will explain the workings of the mirror, or is a primary cause. Amalgamation would affect the thinner parts made by the pattern more than the rest of the plate, giving it the imperceptible unevenness that becomes plainly apparent in the reflected image.² This is the most scientific explanation that has yet been given, and may be tentatively accepted as the best yet offered. Yet it is not improbable that artificial heat, or the heat of the sun, increases the unevenness of the plate by irregular tension relative to the pattern, and is a sufficient cause. That the figures do not come out at once indicates this, and I believe it is not the least factor in the problem. It is given, at any rate, with the hope that it will throw some light on a curious and perplexing catoptric phenomenon.

Since writing this, I notice an article on this subject in the *Journal of the Franklin Institute* for January, 1888. The author, Mr. Ives, gives much valuable information, and thinks that the

¹ *L'Univers*, vol. vi. : *Chine Moderne*, vol. ii. p. 637.

² *Science*, July 2, 1886.

cause is to be found in the elasticity of the plate, making it slightly irregular on grinding.—*Walter Hough*, U. S. National Museum.

ANTHROPOLOGICAL NEWS.—Ensign A. P. Niblack, U. S. N., has just returned to Washington from a three years' voyage to southern Alaska, where he was engaged on Coast Survey duty, in the steamer Carlisle P. Patterson. Lieut. Niblack is an enthusiastic archæologist and has done good service to that science as the records of the Smithsonian Institution will abundantly show.

He pushes his researches among natives whenever and wherever his duties permit. He returns loaded with ethnologic material, which he will now have the opportunity to classify and describe. He has perfected himself in photography, and returns with full series of Indian villages, houses, totems, burial posts and glaciers, which, jutting into the sea and breaking off, are caught in the act of transforming themselves into icebergs. Lieut. Niblack's interest and studies have been directed to the Totem posts with which that country is so prolific. He says that winter is the only season when studies can be successfully made in the ethnology of Alaska.

The natives are then at their homes prepared to give or receive pleasure or information. In the summer they are engaged sometimes far inland on the mountains and inaccessible.

Mr. E. A. Douglas, of New York, has returned to the United States after two years' absence in Europe.

Mr. Douglas possessess one of the finest private Ethnographic collections in the United States. It was stored for safe keeping during his absence at the New York Museum, Central Park.

Mr. Douglas has now gone to Florida, where he will continue his studies until his return in May. His address is Saint Augustine.

SCIENTIFIC NEWS.

—The Middlesex Institute proposes to publish a Flora of Middlesex County (Mass.), giving a complete list of the Phanerogams and Vascular Cryptogams. In the lower Cryptogams, lists prepared by specialists will be given, as complete as the present state of knowledge permits. The work is based upon botanical researches for many years by members of the Institute, with this publication in view; supplemented by a careful examination of all works bearing upon the subject, and all public and private collections accessible. No plants have been admitted to the list except on evidence of the actual specimen or of competent botanists; and all doubtful questions with regard to identification have been referred to eminent specialists. The publication will be an octavo volume of more than 200 pages.