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THE SATURN PERTURBATIONS OF VARIOUS COMETS.—An abstract (No. 3) from the *Archiv der deutschen Seewarte* (vol. xxx., 1907) contains an important mathematical discussion of the perturbations of several comets by Saturn. The first-order perturbations of comets 1889 V., 1896 VI., and 1903 V. (Brooks) are discussed, and the work has been carried out by Dr. Johannes Wendt.

THE GAMES OF NORTH AMERICAN INDIANS.¹

IT has been known that Mr. Stewart Culin, formerly of the Free Museum of Science and Art in Philadelphia, and now of the Brooklyn Institute Museum, has for many years been engaged in a study of the games of the American Indians, and his monograph on the subject has recently been published in the "Twenty-fourth Annual Report of the Bureau of American Ethnology." The value of the memoir can partly be judged by the fact that, with the full index, it extends to 846 pages and contains 1112 figures in the text, in addition to twenty-one plates. The memoir itself is practically an illustrated catalogue of specimens in various museums, combined with extracts from numerous authors. Students of this interesting and suggestive branch of ethnology have now for the first time a mass of data at their disposal, and it is to be hoped that other regions of the world will be treated by equally qualified investigators in a similarly thorough manner. Some material for such studies occurs scattered in various publications and in unpublished museum specimens, but more field-work is necessary before anything so complete as Mr. Culin's monograph can be accomplished.

The collection has been confined to games in which implements are employed, but Indian children have many amusements played without accessories which belong to a different category from those described by Mr. Culin. It is to be hoped that these will eventually be studied, as they are of equal interest with the others.

The indigenous games of the American Indians, excluding purely children's games, may be divided into two groups:—(1) games of chance; (2) games of dexterity. Games of pure skill and calculation, such as chess, are entirely absent. In the first group are:—(1) games in which implements of the nature of dice are thrown at random to determine a number or numbers, and the sum of the count is kept by means of sticks, pebbles, &c., or upon a counting board; (2) games in which one or more of the players guess in which of two or more places an odd or specially marked lot is concealed, success or failure resulting in the gain or loss of counters. In the second group are:—(1) archery in various modifications; (2) a game of sliding javelins or darts upon the hard ground or ice; (3) a game of shooting at a moving target consisting of a netted wheel or a ring; (4) the game of ball in several highly specialised forms; (5) the racing games, more or less related to and complicated with the ball games. In addition, a few other games are described, and allusion is made to introduced games, such as cards and board games.

References to games are of common occurrence in the origin myths of various North American tribes. They

¹ "The Games of the North American Indians." By Stewart Culin. Twenty-fourth Annual Report of the Bureau of American Ethnology, 1902-3. Pp. xl+846. (Washington: Government Printing Office, 1907.)

usually consist of a description of a series of contests, in which the first man or culture hero overcomes some opponent or foe of the human race. The primal gamblers are the Divine Twins, the miraculous offspring of the Sun, who are the principal personages in many Indian mythologies. They, who are the morning and evening stars, live in the east and the west, ruling day and night, summer and winter. Their virgin mother, who also appears as their sister and wife, is constantly spoken of as their grandmother, and is the Moon or the Earth, the Spider Woman, the embodiment of the feminine principle in nature. Always contending, they are the original patrons of play, and their games are the games now played by men. Mr. Cushing thus described the Twins in his account of the Zuñi War Gods:—

"Lo! and of Chance and Fate were they the masters of foredeeming, for they carried the word-painted arrows of destiny, like the regions of men, four in number. And they carried the shuttlecocks of divination, like the regions of men, four in number. And they carried tubes of hidden things . . . and the revealing balls thereof. . . . Yea, and they bore with these other things, the feather bow and plume arrow of far-finding, tipped with the shell of heart-



FIG. 1.—San Carlos Apache Indians playing hoop and pole, Arizona. From a photograph by Mr. S. C. Simms.

searching; and the race sticks of swift journeys and way-winning, two of them, the right and the left, the pursuer and the pursued of men in contention. All these things wherewith to divine men's chance, and play games of hazard, wagering the fate of whole nations on mere pastime, had they with them."

The gaming implements of most North American Indians "are almost exclusively derived from these symbolic weapons." Thus the stick dice are either arrow-shafts or miniature bows, and a similar origin may be asserted for the two or four bones employed in the hand-guessing game or in the four-stick game. Counting sticks in general and the numerous sticks of the widely spread stick game are arrows. The engraved and painted tubes used in the guessing game are arrow shaftments, and this variant probably arose in a country where strong, hollow reeds were used as arrows. In the games of dexterity we also find bows and arrows, often associated with the netted shield. The snow-snake, or game in which missiles are hurled along snow, ice, or frozen ground, appears to be confined to the northern range of tribes within the limit of ice and snow; the projectiles are apparently

derived from clubs, bows or arrows, and may be referred to the weapons of the twin War Gods.

The opposing players are frequently the representatives of the two War Gods, and gaming implements are among the objects sacrificed upon the altar of the Twins Zuñi. In general, games appear to be played ceremonially, as pleasing to the gods, with the object of securing fertility, causing rain, giving and prolonging life, expelling demons, or curing sickness. There is no direct evidence of the employment of games in divination, apart from an observation by Cushing.

The game of hoop and pole, like the dice game, was played throughout the entire continent north of Mexico. It consists essentially in throwing a spear or shooting an arrow at a hoop or ring, the counts being determined by the way in which the darts fall with reference to the target. The game is remarkable for the wide diversity in the form of the implements employed, as well as in the method of play. A common and most widely distributed form of the hoop is twined with a network resembling



FIG. 2.—Altar of War God, Zuñi, New Mexico, with corn-cob darts used in the ring (or hoop) game. From a photograph of the reproduction in the United States National Museum.

a spider's web, the counts being determined by the particular holes which are penetrated by the darts. The author regards the plain hoop as a modification of the netted hoop, which represents the net shield of the twin War Gods. This object, which the Twins derived from the Spider Woman, is a feminine symbol, and may be used as an amulet. The dart or arrows are masculine. Dr. G. A. Dorsey, who has studied the symbolism of the ring employed in the Sun dance of the Arapaho, says it is symbolic of the creation of the world, for it represents the sun, earth, sky, water, and wind. Although Mr. Culin states "there is no record of women participating" in this game, it is played, as he himself notes, by Hopi maidens as a part of the prolonged Oraibi Oáqōl ceremonies (H. R. Voth, Field Columbian Museum, Anth. Series, vi. [1903], p. 42). Though this cult is largely concerned with producing rain, it seems to be essentially a germination ceremony, and probably has reference to the maturation of the maidens. Mr. Culin adduces other

evidence in support of a fertility significance for this game, but he does not make any special allusion to it. Amongst some tribes the game is mythologically connected with the increase of buffalo; indeed, the Cheyenne and other Plains Indians call it the "buffalo game." The game had a religious character among the Apache, and probably this held good everywhere.

Probably connected with the foregoing is the widely spread game played by one person which consists of catching a ring, perforated object, or a ball on a peg. Dr. G. A. Dorsey says the Klamath always play it in winter; it is called "splitting or punching out the moon," and in this way the winter months are shortened and the advent of spring is hastened.

Ball games are well developed in North America, and Mr. Culin deals with them as fully as possible. The game of cat's cradle receives some attention, and various figures are illustrated, but as no instructions are given as to how they are made, much of the information is of little value. Mrs. Jayne's remarkable book on the subject is not referred to, neither is the magical aspect of the game among certain Eskimo as recorded by Boas on the authority of Captain Comer. The holy spiders taught the game to the Navaho, but calamity would befall if it were played at any other time than winter. The Zuñi explain cat's cradle as the netted shield of the War Gods, the game having been taught to them when little boys by the Spider Woman for their amusement. Owing to the ubiquitous nature of this pastime, it is evident that the Zuñi explanation of its origin is purely secondary, and was invented to bring it into their mythological system. We may suspect that the same may have happened for the hoop and pole game, in spite of Mr. Culin's belief that the oldest forms of existing games occur in the southwestern United States. Lack of space precludes due mention of the numerous minor amusements described by the author, though they are of considerable interest.

In introducing the memoir, Prof. W. H. Holmes, Chief of the Bureau, states that "the paper practically creates the science of games, and for the first time gives this branch its proper place in the science of man." This eulogy is somewhat exaggerated, as others on this side of the Atlantic have directed attention to the ethnological value of the study of games, and while Mr. Culin has produced a memorable monograph of lasting value, he can hardly be said to have introduced therein any general principles that had not previously been enunciated.

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NERVE AS A MASTER OF MUSCLE.¹

WE have on the table before us two muscles. The animal was dead when they were taken from it a short while ago. But the animal was, as we are ourselves, an assemblage of organs, and many of these organs go on living for a certain time after the animal, as an animal, is dead. Hence these muscles, carefully removed, are still alive. We notice a marked difference between their behaviour now. To understand the behaviour of organisms we have to think of them as processes rather than as structures. An animal is something happening. The function of muscles is to contract. Of the two muscles now before us, one still goes on contracting, although quite isolated from the body of which it formed a part; but the other does not contract, although that is its function in the body. The muscle which still goes on contracting is the heart; the other is a muscle like the biceps of our own arm. We might think that, as it rests there motionless, it is not alive. It is, however, fully alive. We can satisfy ourselves of that. If I apply to it a faint electric current, it answers by exhibiting its functional activity—it contracts. Yet it does not contract of itself, nor will it, however long we may preserve it; it will die without of itself even contracting once. What is the significance of this difference between the two?

The secret of this difference is largely an affair of the nervous system. The tie between muscular activity and nervous activity is always close; but it is very different in

¹ A discourse delivered at the Royal Institution by Prof. C. S. Sherrington, F.R.S.