continued unchanged. It is of course nothing new to Egyptologists; but to the ethnographer and the historian of the arts it is a noteworthy instance of retrogression in one of the most useful and highly prized inventions ever made by man, and that in a country of continuous and unbroken culture.

The Native Written Language of Easter Island.

In the last published report of the United States National Museum, Washington, is a very interesting description of a visit to Easter Island in 1886 by Paymaster W. J. Thomson of the ship Mohican, U.S.N. He describes the platforms, stone images, arts, and language of the natives, aiding the reader by numerous photogravures. In these points his report is full, but not especially new. Where he does go ahead of all previous voyagers is in his information about the remarkable written language which it has long been known the natives of this island had invented, and in which they were accustomed to record their legends. The inscriptions were usually upon slabs or paddles of toromiro wood, a tree indigenous to the island. The figures are of equal height and extend in regular lines along the sides and edges of the piece of wood.

With great difficulty, and finally only by recalling the ancient adage, *in vino veritas*, did Mr. Thomson succeed in persuading an old islander to read some of the inscriptions. He is able, therefore, to show us five of them, the originals in photogravure, with translations into the native tongue of the islanders, and this text rendered into English. It is a most praiseworthy piece of ethnographic study, and should put an end to the nonsense which has long periodically appeared about this island and its inhabitants.

The figures are shown to be "pictorial symbols, carrying their signification in the image they represent." Many objects are treated conventionally, and all are depicted about the same size, thus imparting the aspect of linear uniformity. The subjects treated are family histories, traditions, and lists of the gods, the figures merely serving as pictorial reminders of the names and facts.

In all these respects the inscriptions are in no wise different and not a whit superior to those found on the "meday sticks" of the Algonquin Indians. Neither indicates a high degree of culture, and the line of their evolution is clear enough. As we might expect, the full vocabulary printed by Mr. Thomson shows the natives of the island to speak a well-marked Polynesian dialect, and they seem to have differed from the other Pelynesians in nothing but a somewhat higher developed taste for graphic and glyptic design.

The Thegiha and Klamath Languages.

Two publications have recently been issued by the Bureau of Ethnology, Washington, which should attract the attention of students of the American aborigines. Both are in the series called "Contributions to North American Ethnology."

One is entitled "The Thegiha Language," by James Owen Dorsey. The Thegiha is a member of the Siouan or Dakota stock, and is spoken by the Ponkas and Omahas. The portly volume of 794 quarto pages is filled with a large number of myths, stories, and letters in the language, accompanied by interlinear and free translations, grammatic notes and explanations. A second volume is promised containing a detailed grammar and dictionary.

The work on the Klamath language, which is nearly the same as the Modoc, is by A. S. Gatschet. It is in two quarto volumes of 711 pages each. The first contains an ethnographic sketch of the tribe especially interesting for its mythology, 200 pages of text and 500 pages of grammar; the second volume is the dictionary. The Klamath is described as a synthetic language, inclining to polysyntheticism in the inflection of nouns and the derivation of verbs. Its tendency to incorporation is well marked.

Both these laborious works are exceedingly well done, and reflect great credit on their authors. One must regret, however, that different phonetic alphabets have been adopted. Dorsey employs that of the Bureau of Ethnology, Gatschet that which he calls "my scientific alphabet, based on the original pronunciation of the letters;" not always very scientific, as may be judged from the fact that he gives as identical the *u* sound in English *nude*, German *uhr*, French *cour*. Mr. Gatschet must have learned his English where they call dukes "dooks."

THE GROWTH OF CHILDREN.

In his recent paper on the growth of children in the Twenty-Second Annual Report of the State Board of Health of Massachusetts, page 479 ff, Dr. H. P. Bowditch has called attention to the fact that the curves representing the distribution of cases in those years during which growth continues is asymmetrical, so that the average and median values, (the one corresponding to the point above and below which one-half the total number of cases are found) do not coincide. An examination of the original tables on which this statement is based (The Growth of Children, Eighth Annual Report of the State Board of Health of Massachusetts, 1877, Table 4 ff.), brings out the asymmetry of the curves represented by these figures very clearly, and proves that the difference between the average and median values is not accidental. Dr. Bowditch calls also attention to the fact that the variability of the series first increases and later on decreases.

The causes of these phenomena will be considered in the following lines. When considering statures and weights of adults of a certain region, we find them generally arranged symmetrically around the average which has the maximum frequency. The tables showing the values of these measurements from year to year prove that growth is irregular, being more rapid in the beginning and becoming slower as the adult stage is nearly reached. When we consider children of a certain age, we may say that they will not all be in the same state of development. Some will have reached a point just corresponding to their age, while others will be a little backward, and others still a little in advance of their age. Consequently the values of their measurements will not exactly correspond to those of their age. We may assume that the difference between their stage of development and that belonging to their exact age is due to accidental causes, so that just as many will be less developed as farther developed than the average child of a particular age. Or : there will be as many children on a stage of development corresponding to that of their age plus a certain length of time as corresponding to that of their age minus a certain length of time.

The number of children who have a certain amount of deviation may be assumed to be arranged in a probability curve, so that the average of all the children will be exactly on the stage of development belonging to their age.

At a period when the rate of growth is decreasing rapidly, those children whose growth is retarded will be farther remote from the value belonging to their age than those whose growth is accelerated. As the numbers above and below the average are equal, those with retarded growth will have a greater influence upon the average than those whose growth is accelerated, therefore the average value of the measurement of all the children of a certain age will be too low when the rate of growth is decreasing, and too high when it is increasing.

These considerations may be expressed in mathematical form as follows: —

In the adult, the relative frequency of the deviation x from the average value of the measurement, s, may be expressed by the formula —

$$p_{s+x} = \frac{1}{\mu_1 \sqrt{2\pi}} e^{-\frac{x^2}{2\mu_1^2}}$$

μ_1 is the measure of variability of the series and is called the mean variation, or the mean variability. A series is the more variable the larger μ_1.

The value of the measurement belonging to the average of all those individuals who will finally reach the value s is, at any given period, a function of this period and may be called st. The average of all those individuals who will finally reach the stature $s + x$ may be expressed as a function of st and x, $f\left(^st\ ; x\right)$.

The individuals constituting the adult series will not develop quite regularly, but some will be in advance of others. We assume that at any given time these variations in period will be distributed according to the law of probabilities. The relative frequency of the variation y from the period under consideration, t, will be

$$p_{t+y} = \frac{1}{\mu_2 \sqrt{2\pi}} e^{-\frac{y^2}{2\mu_2^2}}$$

The value of the measurement belonging to a child which will finally reach the value $s + x$, at the period $t + y$, will be $f\left(^st + y ; x\right)$. p_{t+y} expresses therefore also the relative frequency of the individuals measuring $f\left(^st + y ; x\right)$ at the period t among that class which will finally reach the value $s + x$. The relative frequency of the latter among all individuals is p_{s+x}. Therefore, the relative frequency of the value $f\left(^st + y ; x\right)$ among the whole series will be

$$P_{f\left(^st + y ; x\right)} = p_{s+x}\, p_{t+y} = \frac{1}{\mu \mu_1 2\pi} e^{-\frac{x^2}{2\mu_1^2} - \frac{y^2}{2\mu_2^2}}$$

It remains to determine $f\left(^st + y ; x\right)$. The function $f\left(^st\ ; x\right)$ may be obtained by observations on the same individuals taken in annual intervals. The form of the function will be

$$\left.\begin{array}{l} f\left(^st\ ; x\right) = {}^st + f_1\left(^st\right)x + f_2\left(^st\right)x^2 + \ldots \\ \text{and} \\ f\left(^st+y ; x\right) = {}^st+y + f_1\left(^st+y\right)x + f_2\left(^st+y\right)x^2 + \ldots \end{array}\right\} x_0 < x < x_1$$

By means of observations we find also

$$\left.\begin{array}{l} ^st + y = {}^st + a_1 y + a_2 y^2 + \ldots . \\ f_n\left(^st + y\right) = \overset{(n)}{b_0} + \overset{(n)}{b_1} y + \overset{(n)}{b_2} y^2 + \ldots \end{array}\right\} y_0 < y < y_1$$

By substitution we find

$$\left.\begin{array}{l} f\left(^st + y ; x\right) = {}^st + a_1 y + a_2 y^2 + \ldots . \\ \quad + x\,(b_0' + b_1' y + b_2' y^2 + \ldots) \\ \quad + x^2\,(b_0'' + b_1'' y + b_2'' y^2 + \ldots) \end{array}\right\} \begin{array}{l} x_0 < x < x_1 \\ y_0 < y < y_1 \end{array}$$

For a certain series of combinations of x and y this function will remain constant. Then the function may be considered a new variable u —

$$f\left(^st + y ; x\right) = {}^st + u.$$

The probability of finding the value $^st + u$ is

$$T_{^st + u} = \int_{-lim}^{+lim}\!\!\int P_{f\left(^st + y ; x\right)}\, dy\, dx + R$$ where the limits depend upon x_0, x_1, y_0, and y_1, and where R is a certain rest which is determined by the same values.

By assuming the limits x_0, x_1, y_0, y_1 sufficiently narrow and neglecting terms of higher degrees, which may be done on account of the smallness of their factors, the equation assumes the form

$$T_{^st + u} = \frac{(1 + c\,u)}{M \sqrt{2\pi}} e^{-\frac{u^2}{2M^2}}$$

$$M = \sqrt{a_1^{\,2}\mu_2^{\,2} + b_0^{\,2}\mu_1^{\,2}}$$

This function is asymmetrical. It is, therefore, shown that the asymmetry of the curves is an effect of the irregularity of growth.

Only for $a_2, a_3, \ldots = 0$

and $\overset{(n)}{b_1}, \overset{(n)}{b_2} \ldots . = 0$, the curve will be an ordinary probability curve, c being zero in that case. When $a_2, a_3, \ldots$ are zero, growth is regular.

We may also draw certain conclusions in regard to the value M. μ_2 is the variability of period. According to the laws of probability this variability must be proportional to the square-root of time elapsed —

$$\mu_2 = \mu \sqrt{t}.$$

It is also probable that

$$f\left(^st\ ; x\right) = {}^st + x\sqrt{\frac{^st}{s}}$$

$$b_0 = \sqrt{\frac{^st}{s}}$$

$$M^2 = a_1^{\,2}\mu^2 t + \frac{^st}{t}\mu_1^2$$

We will investigate for which points

$$M > \mu_1,$$

$$a_1^{\,2}\mu^2 t + \frac{^st}{s}\mu_1^2 > \mu_1^2$$

$$a_1^{\,2}\mu^2 t > \frac{s - {}^st}{s}\mu_1^2$$

For small values of t, $\frac{s - {}^st}{s}$ is large, but at a certain period, when a_1 is still large the product on the left-hand side will rapidly increase over that on the right-hand side until a_1 begins to decrease. It may be expected that in all cases when a_1 is sufficiently large, i.e., the growth rapid, there must be a time when the variability of the growing series is greater than that of the adult series.

M and μ_1 are known by observation. Therefore μ_2 may be computed according to the formula

$$M^2 = a_1^{\,2}\mu_2^{\,2} + b_0^{\,2}\mu_1^{\,2},$$

and we have, therefore, a means of determining the variability of period of the growing individuals. By means of this value we can also determine how many individuals of any given age will have reached the adult stage.

This theory holds good for statistics of all kinds of development, whatever the cause of the development may be: for physical measurements as well as for psychical; for growth as well as for the effects of practice.

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G. P. PUTNAM'S SONS will publish immediately "New Chapters in Greek History," based upon the latest archæological discoveries, by Professor Percy Gardner of Oxford, and "The Test Pronouncer," by W. H. P. Phyfe, a companion to the author's "7,000 Words Often Mispronounced," containing the same list of words, differently arranged, for convenience in recitations. They also announce new supplies of Phyfe's books on pronunciation: "7,000 Words Often Mispronounced," "How Should I Pronounce," and "The School Pronouncer."