PRIMITIVE RELIGIOUS ART.[1]

WE have on several occasions directed attention to works by American ethnologists dealing with investigations on the meanings of the designs and patterns of aboriginal decorative art. This fruitful and interesting field of inquiry is by no means exhausted, and two papers on the subject have recently been published by the American Museum of Natural History which merit the careful attention of students. Dr. Clark Wissler has made a valuable study of the decorative art of the Sioux Indians which is a model of clear and concise expression and of adequate illustration. As he truly states, the investigation becomes psychological, because it is necessary to know what ideas the artists have of their designs, and what motives lead to their execution. The assumption that all primitive decorative designs are executed with consciousness that they symbolise some definite object or relation in nature is fairly supported by the facts so far accessible, but does it follow that these symbolic designs were produced by a gradual transition from the realistic representation? That some of them were so produced has been satisfactorily demonstrated; but is this the law of growth for decorative art? It appears, among the American Indians, that the more abstract the idea, the simpler and more geometric the design. On the other hand, it is obvious that a vigorous conventionalisation of representative forms must tend to reduce them all to a few simple geometric designs. In such an event, confusion as to the symbolic aspect of similar designs must arise in the minds of the artists, necessitating re-interpretation or creation of new symbols. Thus any given interpretation need have no certain relation to the origin of the design itself; indeed, the association of the symbol and the idea can be shown in some cases to be quite secondary. Amongst the Sioux there are two main kinds of decorative art—realistic painting and conventional bead- or quill-work; the former is done by the men and the latter by the women, and there is every reason for assuming that the pictographic mode is on the whole the older. One sex has often appropriated the designs used by the other to express divergent ideas, and thus we see how even within the same tribe two or more modes of expressing symbolic motives may make simultaneous use of the same graphic designs.

In a short paper of fifty pages on the decorative art of the Huichol Indians of Mexico, Dr. C. Lumholtz has managed to crowd some 350 figures, so that we have abundant material for study. All these designs, he says, are expressions of religious ideas that pervade the entire existence of these people; in other words, they are permanent prayers. Girdles and ribbons, inasmuch as they are considered as rain serpents, are in themselves prayers for rain and for the results of rain, namely, good crops, health, and life. All the designs on pouches, shirts, skirts, and so forth express prayers for some material benefit, or for protection against evil, or adoration of some deity. Thus the magic double water-gourd, even in its most conventionalised form, means a prayer for water, the source of all life and health. Animals like the puma, jaguar, eagle, &c., express prayers for protection, as well as adoration for the deity to which the creatures belong. The little white flower, *totō*, which grows in the wet, corn-producing season, is at once a symbol and a prayer for corn, and in all sorts of forms it is to be found woven in their costumes. Flowers play, and always have played, an important part in the religion of these Indians; with them flowers, like the plumes of birds, are prayers for rain and life. Dr. Lumholtz doubts if there is such a thing as ornamentation solely for decorative purposes among the Huichol, or, for that matter, among any primitive people. Prof. Boas points out that on the whole the style of decoration of ceremonial objects differs considerably from that of the ornamental parts of garments. The former are crude and pictographic, with slight tendency to conventionalism, while the latter are regular, well executed, and strongly conventionalised, and the general character of these designs much resembles that of similar designs found in other parts of Mexico and in Central and South America. These textile designs, which are of great variety and beauty, acquire much more interest from the suggestive interpretation of their symbolism which Dr. Lumholtz has afforded us.

The American Museum of Natural History is to be congratulated on possessing collections about which so much valuable information has been obtained, and students are to be congratulated on having these riches made accessible to them by means of such beautifully illustrated memoirs.

A. C. H.

[1] "Decorative Art of the Sioux Indians." By Clark Wissler. *Bull. Am. Mus. Nat. Hist.*, vol. xviii., pp. 231–278. (New York, 1904.)
"Decorative Art of the Huichol Indians." By Carl Lumholtz. *Mem. Am. Mus. Nat. Hist.* Whole series, vol. iii. Anthropology, vol. ii. part iii. (New York, 1904.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—An examination for a geographical scholarship will be held on October 12 next. Candidates, who must have taken honours in one of the final schools of the university, should send their names to the reader in geography, Old Ashmolean Museum, by, at latest, October 2. The value of the scholarship is 60*l*.

Dr. J. Ritchie, reader in pathology, has been constituted professor of pathology so long as he holds the readership in question.

AT the recent congregation of the University of Leeds a fellowship of the value of 100*l*. was awarded to Mr. Joseph Marshall, of the Victoria University School of Chemistry.

PROF. STEPHEN M. DIXON, holder of the chair of civil engineering in the Dalhousie University, Nova Scotia, has been appointed to the new professorship of civil engineering in the University of Birmingham.

IT was mentioned by the principal of King's College, London, at the recent distribution of prizes and certificates to the successful students that Prof. W. G. Adams, F.R.S., is about to resign his chair after forty-two years' work in the college.

THE Rogers prize of 100*l*. of the University of London has this year been awarded to Dr. B. J. Collingwood for his essay on "Anæsthetics, their Physiological and Clinical Action." The essay submitted by Dr. A. G. Levy was highly commended, and an honorarium of 50*l*. was awarded him.

A MOVEMENT is now in progress for providing the North Wales University College with new buildings at an estimated cost of 175,000*l*., of which 30,000*l*. has been already promised. The site has been given by the corporation, which has presented the deed of gift to Lord Kenyon, president of the college. The president has expressed the hope that the rest of Wales will follow the liberality shown at Bangor, and that there will be no more need for the best professors of the college to leave Bangor for more lucrative positions in other parts of the United Kingdom.

ACCORDING to the *Electrician*, a committee of the Liverpool City Council, instructed by the Finance Committee to report as to how far the educational methods employed at the Liverpool University were in the interests of the city and met its requirements, have reported that they are satisfied that the University is doing its best to ensure that its students shall enter into the business of life with their intellectual powers fully developed by providing the students with a wide range of duty and sound methods of instruction, and they have therefore recommended that the sum of 10,000*l*. should be granted during the present year upon the same conditions under which a similar grant was made for the first time last year. The report of the finance committee has come before the City Council and has been approved. Of the amount in question, 1000*l*. is devoted to scholarships for Liverpool men.

COPIES have been received of the *Johns Hopkins University Circular* containing the programme of courses for the session 1905–06, and of the Yearbook of the Armour Institute of Technology, Chicago, for 1905–06. The Johns Hopkins University will begin its thirtieth year of instruction next October. The work will be carried on

in three divisions:—The graduate department, in which arrangements are made for the instruction of advanced students in the higher branches of science and literature; the medical department, in which students (men and women) who have already received a liberal education are received as candidates for the degree of M.D., and in which doctors of medicine may attend special courses; the collegiate department, in which students receive a liberal education leading to a degree. The Armour Institute of Technology was founded in 1892, and the work of instruction was begun in September, 1893. Courses are now offered in mechanical engineering, electrical engineering, civil engineering, chemical engineering, fire protection engineering, general science, and architecture, and all lead to the degree of Bachelor of Science.

IN the course of an address on degree day, July 8, at the University of Liverpool, Lord Derby, the chancellor, said that since they last met they had several new laboratories, some complete and some in progress. Another building, to be opened in November, will be for the study of natural history. They had also an extension to record of the chemical laboratories, to provide accommodation for the department of physical chemistry, and an addition to the existing department. This had been provided at an estimated cost of 10,500*l*., which the president of the council, Mr. E. K. Muspratt, had promised to contribute. Since they last met 10,000*l*. had been given by Mrs. Barrow, the borough of Birkenhead had given an annual grant of 500*l*., and a grant of 10,000*l*. had been received from the Liverpool City Council, 1000*l*. from the county of Lancaster, from Cheshire 300*l*., and from the borough of Bootle 500*l*. The sum of 1500*l*. had been given to endow a lectureship in memory of Sir William Mitchell Banks. Mr. E. Whitley had promised 1000*l*., and under the will of the late Mr. J. L. Bowes the University would receive a legacy of 8000*l*. for the benefit of the department of chemistry and other purposes. The company subsequently proceeded to the new electrotechnical laboratory, and Sir Joseph Swan formally opened the building, which he described as eminently suited for the purpose for which it was intended. The cost of the laboratory has been defrayed by a sum of 12,000*l*., drawn from the university fund, and the Lancashire County Council has contributed 1000*l*. towards meeting the more pressing demands for equipment.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 18.—"On the Chemical Mechanism of Gastric Secretion." By J. S. **Edkins.**

June 8.—"On the Application of Statistical Mechanics to the General Dynamics of Matter and Ether." By J. H. **Jeans.** Communicated by Prof. J. Larmor, Sec.R.S.

The object of the paper is to apply the methods of statistical mechanics to questions connected with radiation and the energy of the ether. An attempt is made to examine whether or not the modern theory of thermodynamics of radiation can be regarded as resting on sound dynamical principles. The result arrived at is that the use made of the second law of thermodynamics in this theory, in particular in the proof of Stefan's law, is one which cannot be justified, and hence that those parts of the theory of thermodynamics of radiation which are based upon the use of the second law must be regarded as unsound.

The problem is obtained in its simplest form by considering either a finite universe, or else a finite portion of an infinite universe, enclosed within a perfectly reflecting boundary. Let the number of degrees of freedom of the matter inside this boundary, neglecting the interaction with the ether, be N, so that there are 2N coordinates of the aggregate system which very nearly represent motion of matter only. The number N is known to be actually finite, although it may be supposed to be so large that the error involved in treating it as infinite will be negligible. Let the number of degrees of the ether be M, giving 2M coordinates to the aggregate system. If we suppose the ether to have an absolutely continuous structure, the number M will be absolutely infinite.

The energy of the 2M coordinates of the ether is expressible as a sum of 2M squares. The energy of the 2N material coordinates may, again neglecting small terms, be divided into kinetic and potential energy. The kinetic energy is expressible as a sum of N squares, namely, the sum of the three components of energy of each electron of which the matter is composed. Thus the total energy is expressible as the sum of 2M+N squares, plus an unknown potential energy of electrons. It now follows, as in the proof of the well known theorem of equipartition of energy, that after an infinite time the sum of any p of these squares stands to the sum of the remaining q squares in a ratio which is equal to p/q, subject only to the condition that p and q are large enough to be treated as infinite without appreciable error. Since 2M and N satisfy these conditions, it follows that the system tends towards a state in which the energy of the ether is infinite in comparison with the kinetic energy of the matter. In other words, there is a general tendency for the ether to gain energy at the expense of matter.

It is, however, obvious that our own universe is at present far removed from its final state, so that the study of this final state is of less interest than the study of the stages through which the final state is being reached.

In discussing the transition to the final state, a principle proved elsewhere ("The Dynamical Theory of Gases," chapter ix.) is of service. Suppose that a vibration of any dynamical system is influenced by an external agency. Then the principle in question asserts that the ultimate effect of this influence is infinitesimal, except when the external agency changes to a considerable extent in a time comparable with the period of the vibration. If the time of change in the external agency is n times the period of the vibration, where n is large, then the ultimate change in the energy of the vibration vanishes to the same order as e^{-n}, a quantity which soon becomes negligible as n increases.

Thus, if θ is some small interval of time, so small that the material system may be regarded as perceptibly unaltered through a time θ, then the change produced in the energy of ether vibrations of which the period is less than θ will be very slight. The energy of such vibrations may therefore be treated as though it were incapable of change, so long as our consideration of the system does not extend over a very long period.

The total number of modes of vibration of any enclosed or unenclosed piece of ether is, as has been said, either very great or infinite, but the number of vibrations of an enclosed piece of ether *of which the frequencies are below an assigned value* is finite. Thus, we can now suppose M replaced by some small number M′, and the value of M′ will be finite. So long as we limit our consideration of the system to a finite time, say a million years, we may regard the energies of the remaining modes of vibration as constant and very small. The ratio of ethereal to material kinetic energy is now $2M'/N$, a quantity which cannot be infinite and may be very small.

If θ is a small time satisfying the conditions specified, then the rate at which an ether vibration of high frequency p gains energy will involve a factor $e^{-p\theta}$, so that the time required for the vibration to acquire a perceptible amount of energy will involve a factor $e^{p\theta}$. This is, of course, only true when $p\theta$ is large. The energy of those vibrations for which $p\theta$ is not large is rapidly adjusted, and a state will soon be reached in which these vibrations have the share of energy allotted to them by the theorem of equipartition of energy. With the progress of time the energy of the remaining vibrations gradually becomes perceptible, until ultimately the final state is reached.

We cannot, however, realise in nature the boundary impervious to all forms of energy, so that it is important to consider whether these predictions have to be modified if the boundary, instead of being perfect, is simply as perfect as we can make it.

It is found that there is no longer any tendency for the energy of the matter, even after infinite time, to vanish in comparison with that of the ether inside the enclosure; the two tend to assume a finite ratio, although neither of the actual energies can be permanent, as the system