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Charles Sanders Peirce: Published Works I. Electronic Edition.

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CHARLES SANDERS PEIRCE: CONTRIBUTIONS TO THE NATION: 1894

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58 (29 March 1894) 234-236: LOCKYER'S DAWN OF ASTRONOMY

The Dawn of Astronomy: A Study of the Temple-Worship and Mythology of the Ancient Egyptians.
By J. Norman **Lockyer** . Macmillan & Co. 1894.

CSP, identification: Haskell, *Index to The Nation*. See also: Burks, *Bibliography*; Fisch and Haskell, *Additions to Cohen's Bibliography*; MSS L 159.52-53, L 159.55-56, L 159.58; MS 1392 (draft).

Sir Joseph Norman **Lockyer** (1836-1920) was for many years director of the Solar Physics Observatory and professor of astronomical physics at Royal College of Science. In 1866, he made pioneer observations of the spectrum of sun ; and, in 1868, of solar prominences. **Lockyer** coined the terms "chromosphere" and "helium."

Mr. **Lockyer's** power over the enginery of hypothetical reasoning--that which searches out the explanations of observed facts--is, with reference to astronomy, acknowledged by all Europe. When he first entered the field of astronomy, it was as an amateur, and he now audaciously leaps into another arena where there was no thought of his apparition. The principal object of his book is to advance the hypothesis that Egyptian temples were generally oriented to the risings and settings of stars, so that a few priests, standing in the windowless cell which is the holy of holies of every such structure, and looking out along the narrow aisle of pillars, would be looking in the right direction to catch sight of the temple's star at its rising or its setting.

Let us see how much there is to make this a reasonable suggestion. Certainly an intimate connection subsisted between theology and the astronomy of Egypt. Thus, one of the hieroglyphic determinatives for a god is a star. That is to say, a scribe had to suggest the idea of a god by means of a simple picture, draws a star as likely to effect his purpose. What could better betray the Egyptian way of thinking? The very name of the god of earth, Seb, coincides with the usual word for a star (*sha*, written *sb*); at so that god's name has usually been read--Brugsch thinks it should be *Geb*, which would destroy this argument. But though Seb is god of earth, there is no doubt the planet Saturn was appropriated to him. It is needless to dwell upon such points, because the idea of the gods having stellar affinities is commonly entertained by Egyptologists.

A certain importance was attached to the orientation of temples. The notion that a man ought to face some particular object when he prays belongs to most

religions, if not to all. Everybody knows that our churches look the oldest ones to the east, later ones to the west. We learn from Mr. **Lockyer** that the tradition is, they should be directed toward the sunrise of the patron saint's day. Many temples in Egypt are known to be oriented with precision. In particular, the pyramids of Gizeh, which have been accurately surveyed, are out of position to the east 4', 5', and 14', and we remember that 1' is the *minimum visibile*, 31' the mean diameter of the full moon on the horizon. We know, too, from the inscriptions, that the determination of the azimuth for a temple was a matter of ceremony quite as much as our layings of corner stones, the king being sometimes called upon to perform it; and in this ceremony a star was observed.

We know that the risings and settings of stars were carefully observed by ancient astronomers. The poem of Aratus, which though itself relatively late, reproduces archaic observations, is in evidence. The last 200 lines are entirely devoted to describing the stars on the horizon simultaneously at different times. When the eastward movement of the sun among the fixed stars has brought a given star far enough to the west of the sun for its rising to be observed before sunrise, the star is said to "rise heliac" and it was by the heliac risings chiefly that the progress of the seasons, the times for planting, etc., were ascertained. In Egypt this was particularly necessary; and it was by the heliac risings of Sirius, and later by the cosmical risings, or risings at the same moment as that of the sun, that the date of the inundation was predicted. It would be natural to build temples so that they might serve as observatories in which such risings could, owing to the exclusion of stray light and the direction of vision to the right of the horizon, be conveniently observed.

Thus it would seem that the hypothesis is antecedently quite probable. That which gives it importance is the fact that the point of every star oscillates north and south owing to the precession of the equinoxes. In the course of 130 centuries the shift amounts to from 54° to 73° for different stars, or about half a degree per century; and in special cases it may become indefinitely rapid. Consequently, if we knew that a hundred temples of the old kingdom of known orientation had been oriented to the rising of known stars with a probable error of 1° each, we could astronomically determine their average age with a probable error of only a few years. Now there is a good 500 years of doubt at present affecting the dates of the old kingdom; and our general conception of the course of civilization and of the nature of man depends quite considerably upon the manner in which this doubt is to be resolved.

Mr. **Lockyer** reports that there are but a few temples whose azimuths are sufficiently known for the purpose of testing his theory. Still, he instances 7 which he supposes directed to the rising of Sirius, 12 to that of Phact, 9 to that of Hadar that of Dubhe, 7 to that of Etamin, 4 to the setting of Canopus, 5 to that of Capella, and 2 to that of Spica. For each of these he calculated the date of orientation; and upon comparison with history he finds that in every case his calculated date either agrees with that of history or antecedes it. But he well remarks that it is quite possible that many temples were erected upon the foundations of previous structures whose orientation they followed, so that the

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cases in which his date antecedes the recorded date are not to be counted as against his hypothesis. We add, however, that neither are they to be counted in its favor; so that the result thus far is that Mr. **Lockyer's** theory is unrefuted by facts, and is even in some measure supported by observation. Considering its great importance, if true, the verdict should be that Mr. **Lockyer** has done enough to warrant the expenditure of the time of some of the foremen of the world's work and of sufficient money to obtain sufficient evidence to put the question at rest.

But while we are quite in earnest as to this, we cannot blind our eyes to certain serious difficulties in the way of the theory. For example, Mr. **Lockyer** finds five temples oriented to the setting of Capella. One of these is the temple of Ptah at Karnak. Another is a temple believed to be dedicated to Ptah at Memphis. Concerning the cult at the others there is little evidence. But why should a temple of Ptah be directed to the setting of Capella? The so-called circular zodiac of Denderah, now in the Louvre, shows us in the place of Capella a mummified cat held out in the hand of a man wearing ostrich feathers. The projection of the zodiac is accurately enough followed to allow no doubt about this. The cat we know was the emanation of the goddess Bast, who was called the beloved of Ptah. Accordingly, if the temples of Ptah had been directed to the rising of Capella, we should see no difficulty. But Mr. **Lockyer** is positive that a star must be either male or female; that if female only its rising is to be worshipped, if male only its setting. It may be said that the figure on the Denderah planisphere that holds the cat represents Ptah. But is that likely? The scarab was Ptah's emblem; and there is said to have been an Egyptian constellation of the scarab. If so, it has been confounded by the Denderah artist with Cancer, which is misplaced where we put Leo minor. In fact, the stars of Leo minor, with a few from the feet of Ursa major, make a very good scarab, as anybody can see these evenings in the sky. This, then, have been the part of the heavens sacred to Ptah, and it is unlikely there was any other.

Again, Mr. **Lockyer** makes no less than twelve temples directed to the rising of Phact and seven to that of Etamin. The former is a star of two and three-quarter magnitude, the latter fainter than two and one-third. The risings of such stars cannot be observed, we believe, even in Egypt. Only very bright stars can be seen to rise. Moreover, Etamin and Dubhe were so near the horizon and their risings and settings consequently so very oblique, as to be indeterminate and unattractive phenomena, which it seems unlikely persons would be led to observe.

But our objections do not stop here. As long as astronomers busied themselves with the times of rising of stars chiefly with much attention to their amplitudes, or directions on the horizon, we can readily understand how the precession of the equinoxes could escape detection. But when they had built a few costly temples on purpose to have stars appear at their risings in the exact axes of long corridors, which temples after a few years (in the case of Dubhe after twenty years only) were found to be out of alignment by a whole degree, the king who had paid for them and who had, perhaps, devoted his personal attention to their orientation, would be likely to grumble and to appoint an investigating committee. Nor could the fact by any possibility be kept quiet. The precession of the equinoxes ought,

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then, one would think, to have been discovered and published. Mr. **Lockyer** supposes that it was indeed discovered, but that "the priests"—which can here only mean the whole body of the priests, say perhaps a tenth of the population—kept the matter secret. Well, this is pretty violent, but let us suppose that it was so. Did they, then, still go on orienting their temples to the rising of Dubhe, knowing the star would not stay in that place for one generation?

Mr. **Lockyer** supposes that rival sects used to scheme to build their temples in each other's way, so as to prevent those others from seeing the worshipped star at its rising: and he thinks temples were abandoned and their cult put an end to in this way. At the same time he thinks that when temples were rebuilt at vast expense, the builders simply followed old lines of orientation without taking the trouble to change them, although they could see the risings would not occur in the directions of the new temples, and even knew the principle by virtue of which there was sure to be such failure. These parts of the theory, we think, will have been modified in some measure, even if any part of it stands. Whether, after such modification shall have been made, it will retain any great value as an arbiter of chronology is a question not to be hastily answered.

We were speaking of Ptah. Ptah was the god of truth. But that characteristic of truth which is particularly emphasized in the myths and symbolism of the god is unchangeability. Now it is unquestionable that absolute truth, if one could attain to it, is as unchangeable as a rock; but attainable truth, the most enlightened opinion, is distinguished from that which is cruder and less truthful by its life and growth and metabolism. When the Egyptians discovered the year had 365 days, they induced the king to enter the temple of Ptah and swear by all that was truthful that he would never change the length of the year nor allow any of his successors to do so. It was found out that the year was 365 ¼ days, and matters of great concern were getting thrown into the utmost confusion. But what was to be done? The king had sworn in the temple of Truth. He had bound his successor and bound that successor to bind his successors for ever. So they kept on with the old year. In like manner it may be that when the king had once oriented a temple had sworn to Ptah that that orientation never should be changed, the Egyptians may have conceived that it had got to stay so. It had a sort of the-boy-stood-on-the-burning-deck idea of truth. But when it had once become quite clear that the changeless orientation was wrong, there would no longer be any stinging incentive to strenuous endeavors for the highest accuracy of orientation.

The Egyptians were priests or engineers or physicians or artisans. They were always pursuing a practical object, without unnecessary generalization. They had a decided distaste for generalization carried beyond practical needs. They hated to see things more regular than there was any use of their being. Right angles bored them. Longfellow said he *hated* science, and so he did so did the Egyptians. The greater their cleverness in solving practical problems, the more it brings into relief their utter incapacity for science. The mathematical papyrus is a marvel of inaptitude. The medical papyrus, recently translated, is beneath contempt. Cleopatra, if he is to be considered an Egyptian, is the only one of the race who ever showed scientific genius. Their weakness is

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into a strong light when they are compared with the Chaldees, who, even when magic was their only lore, pursued that study with a method and industry of modern savants. In particular, the Babylonians were great archæologists; and it is to the diligence with which some of them searched out their own history that the chronological accuracy of our knowledge about it is due. The Egyptians, on the other hand, cared nothing about fact. They covered the walls of their buildings, not with records of the past, but with dreams of what would do in a future life. They loved to boast that their writings had been found in some ancient tomb or under the statue of some emperor; king, because to their minds what was old and what was true were indistinguishable; but to veracious history they were indifferent. Of course, there are aspects--namely, all practical and theoretically ethical aspects--under which the Egyptians appear as a very admirable people; and Egyptologists become so seized with admiration for them that they are generally blinded to their scientific weakness. Erman alone, in his excellent popular work, 'Ägypten und ägyptisches Leben im Alterthum' (Tübingen, 1885), has told the plain truth.

We refer to this side of the Egyptian character here because we infer from it that it is most unlikely that that people persist for ages in such scientific accuracy in the orientation of their buildings as to justify any inferences from it involving nice calculations. [Lockyer](#) adduces the circular zodiac of Denderah as evidence of the scientific accuracy of the Egyptians, saying (which we fully admit) that that zodiac must have been copied from a regular map of the heavens constructed about 700 B. C. That was Biot's discovery. But [Lockyer](#) rather innocently takes it for granted that that map had been made in Egypt. Not only gratuitous, but the nature of the projection proves that it was an importation, for it is a central projection from the vertex of a cone tangent to the sphere on the circle of perpetual occultation for a latitude little less than 40°; so that it cannot show any of those stars that are so far south as to be visible only at lower latitudes. We have been to the trouble of trying how a similar projection suited the latitude of Denderah would look, and find it quite unlike the celebrated planisphere. Most likely, then, the original was executed at Nineveh (latitude 36 ½°) in the reign of Sargon, when the Egyptians, as we otherwise know, after the fashion of defeated nations were eager to acquire that knowledge that had gained them their adversaries the victory of Raphia, 719 B. C. The copy set up at Denderah in the second century after Christ cannot well have been a copy at first or at second hand, and in it Egyptian constellation figures were substituted for the Assyrian ones, except in its most scientific part, the zodiac, all the figures of which are of Chaldean origin, barring the figure in the place of Cancer, and possibly Libra. But when Mr. [Lockyer](#) asks us to judge the astronomy of the Egyptians by this monument, we must in fairness assent to that. That that people, setting up such a costly piece of work in an eminently scientific age, knew no better way than to copy the record made in Assyria eight centuries before, without glancing at the heavens to see what enormous changes the precession of the equinoxes had brought about in the interval--that must confess, does indeed speak volumes in respect to the degree of assiduity with which they had been prosecuting the

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work of astronomical observation. It is as if we had no star-catalogues better than those of Süff and Ulugh Beg; or as if those astronomers had done nothing but make servile transcripts from Ptolemy.

We cannot leave the book without calling attention to the perspicuous and valuable discussion of the Sothic cycle. Some of the chapters upon the religion, on the other hand, seem to us, we must say, to push theorizing further than good sense can go