the quantity of researches annually published about it, and far superior to geometry in its intellectual rank, is the subject of the theory of functions. For the last twenty years and more there has been a perfect freshet of original work in this line. Every year its tide is rising; every year increases the force and value of the new discoveries, which sweep on faster than they can be taken account of. In early days, enthusiasts would sacrifice hecatombs to celebrate the solutions of problems. Later, problems appeared less sublime; theorems were requisite to excite admiration. Now, theorems are as the sands of the sea; original methods alone can command mathematical dithyrambs.

At a not remote period in the history of mathematical thought, a Mystery (with a big M and in the darkest of black-letter) hung over the imaginary unit. It used to be written $\sqrt{-1}$; and what was the square root of a negative? But when it was found that the imaginary unit of algebra was only one of a class of units which, operating upon themselves, in a generalized sense of multiplication, produce -1, the mystery lost its capital; and after the philosophy of ordinary quantity had become better comprehended, the mysteriousness of the imaginary had vanished. The numbers, *one*, *two*, *three*, *four*, etc., are sounds which we have learned to pronounce in a certain order of succession, and which we do pronounce in telling over the individuals of collections. If such a collection is finite, we reach a last individual; and the number pronounced on coming to this last one affords the means of determining whether the individuals of two collections can be made to correspond, one to one, or, if not, in what manner they fail of that. Sometimes the things counted are really in succession like the numbers. Such are trees in a row, degrees of temperature, and years. In other cases, the succession of counting is purely artificial, as in enumerating the population, or the pounds of flour in a barrel. But the counting does not, on that account, cease to be useful, because, in whatever order the individuals are counted, the final number will, in counts of any one collection, always be the same. Even the separation into discrete units (as the gallons of water in a lake) may be artificial, provided that, if it were effected in various ways, it would always lead to the same resulting number. It will be noticed that this is not a nominalistic account of numbers—it does not make them *flatus vocis*, only—but it makes their existence *in re* consist in an experiential constancy; that is, it assigns to reality three elements, (1) sensuous quality, (2) compulsiveness, (3) generality. Besides the system of whole numbers, we often make use of a scheme of quantity connected together like the points on a line. This is useful even when there is no perfect continuity in the things to which it is applied. The scheme of imaginary quantity is simply one that is connected like the points of a plane. Certain natural phenomena, especially in hydrodynamics, correspond exactly, in theory at least, with such a scheme. But since any line upon such a plane is connected like ordinary real, continuous quantity, the usefulness of imaginary quantities extends to almost all cases in which real quantity is used.

The questions to which the theory of functions, so far as yet developed, chiefly addresses itself arise out of the supposition that a correspondence between the points of two different planes of quantity has been established by an equation. It considers the nature of the resulting continuity (so far as this is not resolved in the theory of plane curves), and, more especially, the modes of representing the relation, both geometrical and analytical. The main object of the whole study is to find out how to make use of differential equations, especially such as are the immediate dicta of mechanical laws.

The disciplinary value of the theory of functions is superior to that of any other branch of mathematics. For many minds elementary geometry serves, directly or indirectly, as their model of reasoning. But elementary geometry is so artificial, and is so permeated with fallacies and caprices, that it must be and ought to be difficult to a healthy and ingenuous young mind; and much of the perverse logic that is current in the world is to be laid at its door. Algebra has done much for every educated man; it has given him an exemplar of perfectly accurate abstraction. It would put a mighty weapon in his hands if the application of it, in the elementary books, were not pretty much restricted to two problems, elimination between linear equations and the solution of the quadratic. The theory of probabilities is most instructive and useful, but that is only applied algebra. The theory of numbers is an admirable school of reasoning, as far as it goes, and it goes so far that reflection upon it will counteract much of the poison that the text-books of logic inject into the current of thought. Projective geometry imparts the most precious secrets in generalization while making no fundamental analyses. As for analytical geometry and the calculus, all *that* ought to be taught (as in Prof. Benjamin Peirce's 'Curves and Functions' it *was* taught nearly fifty years ago) as part of the general theory of functions. The theory of functions is, in the first place, intrinsically, quite easy—we mean to follow, not to invent. Of course, it is capable of being obscurely stated. Its logic is the most fundamental conceivable, and, at the same time, is the very subtlest that can anywhere be found; so that no man is too eminent never to have made a slip in it. The outlines of the theory ought to be known to every educated person.

There has hitherto been no treatise in our language on the modern development of the theory. At length the same year presents us with two. Though the first has 700 pages of royal octavo, and the other 500 of common octavo, yet the subject is so vast that a considerable part of the contents of either is excluded from the other, and much that we might desire to see is absent from both. Dr. Forsyth has been well known for some years less than half a generation as an indefatigable investigator of functions, and he has already produced two profound treatises on differential equations. The present work contains many not unimportant contributions of his own Messrs. Harkness and Morley are younger men, but, as this volume shows, thoroughly versed in their subject. Dr. Forsyth keeps as much as he can to the general theory, treating such a special subject as elliptic integrals, for instance, with the greatest brevity possible, and at the same time in such a way as to afford a bird's-eye view of it. Messrs. Harkness and Morley, on the other hand, seem to have been of the opinion that it was better to go somewhat deeply into a smaller selection of topics. Many things are crowded out to make room for long chapters on Elliptic and Abelian Functions, while, at the same time, these very subjects are not treated with all the fulness which is requisite for the practical applications of them. This, at least, is certainly true of elliptics. Practical applications of Abelian functions ought, perhaps, in the present state of things, not to be thought of. Certain preliminary branches, absolutely indispensable to the comprehension of the theory of functions, such as the logic of infinity, continuity, etc., and the doctrine of the convergency of series, are entirely omitted by Forsyth, while he inserts matter about substitutions which the reader will be glad to find thus at his hand, but which really belongs in a treatise on algebra. The other writers have followed the opposite course in these respects, though we cannot quite content ourselves with their attempted reproduction of Cantor's logical ideas. Dr. Forsyth imitates, in a general way, the French lucid style of exposition, though the French accuracy of statement and neatness of demonstration are often wanting in his book. Messrs. Harkness and Morley express themselves in the German manner, which makes the exposition as easy as possible for the writer—and never mind the reader. For an illustration of what we mean it is sufficient to open the book at random. At the top of p. 352, we read (with a slight modification of notation for our printer's sake):

"The symbol MN equals 1 or 0, according as M and N do or do not contain a common letter."

Now, it is inaccurate to speak of a *symbol* being equal to a number; and since M and N are single letters, there can be no question of their containing a common letter. But the authors mean that when they are replaced by the duadic symbols which form one of four or five different ways of expressing the same thing, *those symbols* have or have not a common letter, according as the corresponding quantities equal 1 or 0. The opposite page, 353, presents several singular instances of saying one thing while meaning another; and it is stated that a certain notation "will be" used, which notation is incontinently dropped without another word, and another one, not defined, is constantly used for many pages. So, on p. 355, a notation is defined, in no apparent connection with anything in the vicinity, and is never used for many pages, until it suddenly springs up after we have forgotten all about it. These examples are not culled.

It would be unfair to convey the idea that Forsyth is quite impeccable in his expressions. This is far from being true. Thus, at the beginning of chapter iii., in enunciating Cauchy's fundamental theorem on the expansion of a holomorphic function, the important words "unconditionally and uniformly," as describing the mode of convergence, are omitted, as they are overlooked in the proof given. The first page of chapter vii. has but sixteen lines of text, yet they contain no less than three faults of expression, if not of logic. Indeed, Forsyth is really too negligent in regard to terminology. Thus, that category of surfaces, curves, etc., which the Germans call *Geschlecht*, the French *genre*, and which we should do well to term *genus*, instead of the usual word "deficiency," Forsyth most confusingly designates as the *class*. Both books will be found serviceable to students, alike to those of higher and of lower grades. We may mention, by the way, that Forsyth is rich in illustrative examples, Harkness and Morley pretty poor. But we cannot sincerely pronounce either of them quite satisfactory, whether as a handbook or as a textbook, and both handbook and textbook are certainly needed. The latter ought to be so clear of all pedantical details as to be fit for the use of every young person who seeks a broad intellectual education.

Picard's very admirable work is not proper-

is supposed to be lost on the mountains, an ancient servitor, being questioned about what Sir Andrew says, answers, "Nothing worth hearing; a wife more or less ain't much matter to him." Then a sister of the monster remarks to his son by the first wife:

"It is most unthinking of your father to go on marrying these silly women one after another; I can't think where he finds them. How did the last one die?—tumbled down stairs, or sat in a draught, didn't she? They really must be a great trouble to Patty."

Fortunately for Patty, they were no trouble to her. Her levity increased with her number of stepmothers. Quite young, she perceived that her father killed off his wives by unceasing worrying and nagging, and the hope of her life was for the advent of a wife who should turn on him and beat him with his own weapons. The only person whom the situation plunged in gloom was the son, Alan Wyke, and it is to his horror of the Face of Death and struggle to get away from it that the author's serious effort is directed. What interest there may be in this struggle is seriously impaired by a devouring curiosity to know whether the fifth wife is taking it out of Sir Andrew, and an avidity for details of the process. Moreover, it is evident that the author has determined upon a belief in the immortality of the soul as the only cure of that fear of death which, as Dr. Johnson said, if any man says he never felt, he lies; and an argument of which the conclusion is foreseen from the beginning is dull. Then confidence in the author's fitness for the exposition of faiths is shaken by reference to the Stoics and Cicero as examples of a universal thirst for immortality, even as belief in his practical seamanship trembles when, meaning aft, or for'ard, he speaks of the "other end of the little boat." On the whole, the book presents the strange spectacle of a writer with rather a nice talent for comedy gravely and ineffectually striving after tragedy.

The title 'Rose, Shamrock, and Thistle,' though not exactly intriguing, has the merit of descriptive accuracy. The nationality of the characters may be detected by the chosen button-hole flower, and the scene of action is the old debatable land on both sides of the Tweed. Contrary to custom and expectation, the shamrock thrusts itself where it has no right to be, not for the purpose of causing division and strife, but to plead for union and personify smiling peace. When it, or she, Miss Rhoda Carysfort, arrives at the home of her English uncle, Mr. Mayne, relations between him and the Scotch Farquhars are strained. There is a dispute about land, and an unhappy love-affair, besides many minor grievances, all waiting for adjustment by a person of tact. Miss Carysfort's tact is equal to every call, and the result she achieves is consummate happiness for everybody. Besides having tact, she was very precipitate. Crossing to England, she rushes on deck in the dark and into the arms of a stranger, who throws over her "shuddering form a Scottish shepherd's plaid," and to whom "in the gloom she clung as to a pillar of refuge." Within five minutes she confides to the stranger details of her worldly condition and several precious reflections. It is by this impulsive method that her subsequent mediations are conducted and successes achieved.

Yet, in spite of all, she is not an interesting person. Nobody in the book is interesting, nor is anything that is done or said. The stranger (of course the Scottish foe of the Maynes) is a dreary bore. To know that he referred to the people dwelling about his Scottish tower as "poor hinds," is conclusive. Of the English Maynes, the daughter is worthy and colorless, and the eldest son a ridiculous prig, who "pours out treasures of knowledge" to his little brothers at their play, and only when thus agreeably occupied, permits his "grave features to relax from their classic dignity." This is the sort of book that causes the disinterested reader aimlessly to wonder on what system of selection the business of publishing is conducted; it is also the sort of book that bitterly exasperates the writer of oft-rejected MSS and causes him to cry aloud against "rings" and inscrutable Fate. "May I be lost," he shouts, "if my novel is half so bad as that!" For his comfort be it said that his novel, unless he is afflicted with a mania for discussing "burning questions," could not possibly be worse.

In the 'Memoirs of Sherlock Holmes,' Mr. Doyle's pearl of detectives probably makes his last appearance. In the 'Final Problem,' where the game is changed and the most desperate and dangerous of criminals is hot on Sherlock's trail, they meet, grapple, tumble over a precipice and perish together. Of their bodies no trace was found, and probably none ever will be unless the spirit of the all-seeing Sherlock should personally conduct an investigation. In that case his enthusiastic biographer, Watson, will doubtless be on hand zealous to record, and perfect as ever in the rare art of self-obliteration. Except in Edgar Allan Poe's hands, the narration of the detection of crime has never been distinguished by literary quality, and he divided the interest between the horror of the crime and the mystery surrounding its perpetration. Mr. Doyle has adopted and extended Poe's method of deduction from minute observation, but has not been particular to select crimes of extraordinary atrocity or startling novelty for the display of Sherlock's acuteness. He appears to have chosen incidents at haphazard from police records and then applied a rule which may be formulated—Keep your eyes open and you must find out. His style is correspondingly matter-of-fact and succinct, and his work leaves no impression after the curiosity momentarily excited has been gratified. But he always excites curiosity, and he never falls into that vulgarity of sentiment and phrase which usually characterizes fiction worked up from police news. Considering the Sherlock Holmes stories, with such novels as 'Micah Clarke' and 'The Refugees,' we are struck by the author's uncommon versatility and his ability to provide entertainment for many tastes and moods.

M. Augustin Filon is better known in France as a historian and critic of literature than as a writer of fiction; he is, therefore, not among the French authors already popular in America. The little historical romance entitled 'Garrick's Pupil' is, indeed, the first translation of his work that we have seen. It makes a very pleasant introduction, noticeable, coming from a Frenchman, for a delicate appreciation of some authors, artists, and statesmen of the eighteenth century to whom their own countrymen are particularly bound by esteem and love. The drama has properly the flavor of its century. There is a wicked lord pursuing innocence for its undoing; a difficult complication unravelled by the declaration of the remorseful villain that he had caused two infants to be exchanged at birth; and, finally, young and tender lovers united, made happy and powerful by the immolation of the wicked lord and his wickeder mentor each on the other's rapier. This antique legend is so well set that we feel some irritation against memory insisting that we have heard it several times before. Some incidents of the Gordon riots are vividly told, though more "bookish" than the scenes that cannot be found in serious history. The dainty and wilful young actress is nicely contrasted with the rakish Lady Vereker, and it is again noticeable, coming from a Frenchman, that the young person is as good as she is beautiful, and that her most serious escapades are no more than frolics. The translation might easily have been better, yet is not vexatiously bad, and, after all, even indifferent English seems a more natural and fitting garment for such a tale than the best of French.

The fund of cheerfulness with which Nature endows the average mortal is not warranted to endure through a prolonged spinsterhood passed in the monotony of a small village. Especially when the spinster plunges for relief into autobiography is she prone to become lachrymose. Nothing except a sense of humor and a very warm heart can save her from perpetrating a book of lamentations. The "I" of 'A Spinster's Leaflets' is possessed of both saving graces, conspicuously the latter. She took an interest in her neighbors; she loved their children; she had a dream of a door-step baby—all of which kept her from contemplating herself as a rare exotic among common garden plants, unkindly left to wither on the stem. Her reminiscences are interesting and pleasantly written, though there is sometimes a strain for unusual expression, a confusion between the value of an idea and mere sound, which detracts from naturalness and desirable simplicity. One gets a little tired of the dream of the door-step baby, and welcomes the conversion of the vision into a fact. Like most realized dreams, this one does not give unadulterated joy. In spite of the old maid's tact and reasonableness and generosity and love, the boy goes wrong—wrong as if he had been her own son—and the tragedy of his wrongdoing is perhaps more bitter for her than for an actual mother. The scene where Philip confesses his transgressions indicates deep emotion, heroically restrained, and is altogether genuine. His repentance takes a form which hardly seems to be a natural development of his character, but, since it filled the spinster with contentment, there is no reason for less interested persons to cavil.

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.

MR. LOCKYER'S power over the engines 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 axal 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 the theology and the astronomy of Egypt. Thus, one of the hieroglyphic determinatives for a god is a star. That is to say, a scribe having 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 (*sba*, written *sb*); at least, so that god's name has usually been read—Brugsch thinks it should be *Geb*, which would destroy this argument. But though Seb, or Geb, 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 Egyptologers.

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 by only 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 what stars are 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 heliacally"; and it was by the heliacal 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 heliacal 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 point 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 rising point of every star oscillates north and south owing to the precession of the equinoxes. In the course of 180 centuries the shifting will amount 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 risings of known stars with a probable error of 1° each, we could astronomically determine their average age with a probable error of only 20 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, 3 to 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 forty 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 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 small 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 data 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 that zodiac is accurately enough followed to allow no doubt about t[illegible] 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 must, 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 north, and their risings and settings consequently so very oblique, as to be indeterminate and unattractive phenomena, which it seems very 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 without 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 place 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, 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. Very 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 that 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 to be 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 an eternal 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. Soon it was found out that the year was 365¼ 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 forever. So they kept on with the old year. In like manner it may be that when the king had once oriented a temple and had sworn to Ptah that that orientation never should be changed, the Egyptians may have conceived that it had got to stay so. They 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; and 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. Claudius Ptolemy, if he is to be considered an Egyptian, is the only one of the race who ever showed scientific genius. Their weakness is put into a strong light when they are compared with the Chaldees, who, even when magic was their only lore, pursued that study with all the 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 they 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 early 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 Egyptologers become so seized with admiration for them that they are generally blinded to their scientific weakness. Erman alone, in his excellent popular work, 'Ægypten 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 persisted 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 (what 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 is this 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 to the latitude of Denderah would look, and find it quite unlike the celebrated planisphere. Most likely, then, the original was executed at Nineveh (latitude 36½°) 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 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, we must confess, does indeed speak volumes in respect to the degree of assiduity with which they had been prosecuting the work of astronomical observation. It is as if we had no star-catalogues better than those of Sûfi 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.

ECONOMIC DISCORDS.

The Distribution of Wealth. By John R. Commons. Macmillan. 1893.

Labor and the Popular Welfare. By W. H. Mallock. London: Adam & Charles Black; New York: Macmillan. 1893.

THERE was never a time when so great a number were crying out, "What shall we do to be [socially] saved?" as at present, nor ever one when the cries of "Lo, here!" and "Lo, there!" were more conflicting. That any one should have within a generation written of the harmonies of economics must seem to modern students well-nigh incredible. We have selected almost at random these two books as illustrating the bewildering diversity of the views which the public desiring to be educated is asked to accept. If the two authors were to read each other's works, it is clear that each would express a very derogatory opinion of the other; and some might be found to agree with both judgments.

Prof. Commons is a follower of the Austrian economists, and of course makes much of the theory of marginal utility. This theory, it is perhaps well to explain, owes its significance to the fact that when the satisfaction of a want is begun, the pleasure is more intense than that experienced as satiety approaches. Hence, as he that is full craves no food, food then offered has for him no value. Or, to take an illustration of our own, when the theory of marginal utility has been expounded until every one is tired of it, no further exposition affords any pleasurable sensation. For our own part, we think the new political economists have neglected a most important suggestion of Aristotle's, for they base their theory upon the proposition that an excess of useful things is useless, but Aristotle points out that it may be positively hurtful. Why should we not have an economics constructed upon this principle, just as the mathematicians elaborate a universe turned inside out through negative dimensions of space? We believe that several very pretty reputations might be won by young professors if they would expound political economy from this standpoint.

In justice to Prof. Commons we should say that in another connection he does present certain theories that are preposterous enough to give him claim to originality. He informs us that the right enjoyed by those now engaged in a certain trade to prevent other people from engaging in it is an extension of freedom of contract, "the essential right of freedom in industry." As the result of freedom of this kind is lack of employment for the outsiders, Prof. Commons very logically infers that they must have a right to be employed, and that a proper view of freedom requires that employers should be required to retain their workmen permanently, at such wages and upon such conditions as "the State" prescribes. But if by reason of dishonesty and inefficiency workmen are discharged by private employers, then the State will take them up. Public works shall be undertaken, and if such a thing as a deficit should occur, it is only necessary to squeeze the owners of "unearned increments" by taxation. As in Prof. Commons's view nearly all industry is subjected to monopoly, the possibilities of revenue here are beyond the dreams of Henry George. But there would be no deficit, for Prof. Commons assures us that not only would the wages of the lowest laborers be increased by 30 to 50 per cent., but the wages of all laborers would be increased by raising "the marginal utility of the marginal laborers."

While Prof. Commons finds monopoly and rent everywhere, Mr. Mallock eloquently demonstrates that the rent charge in England is a mere trifle. "In 1814 the incomes of the landlord and farmer were 56 per cent. of the total assessed to income tax, in 1851 they were 37 per cent., and in 1880 only 24 per cent." They are now only 16 per cent. If these incomes were divided among the people, it would give each man about two pence a day and each woman about three half-pence. Moreover, the holders of more than a thousand acres were in receipt of only £29,000,000 of rent in 1878, which must be now less than £20,000,000, while the million small holders whose rentals average but £76 received in the aggregate £70,000,000. Thus it appears, upon Mr. Mallock's showing, that the great landlords are scarcely worth plundering—and, indeed, when we consider the rate at which their property has lately depreciated, it looks as if it might presently vanish without the aid of the socialists.

Having shown that the proletariat would make little by confiscating the rents, Mr. Mallock then imagines a mob dividing the contents of a palatial house in London, and points out that rare pottery and pictures would not be susceptible of division without loss of value, and that in general a division of wealth would occasion great shrinkage. The net result would be that every one would find himself possessed of some kind of lodging, of £8 worth of furniture and clothes, the same value of provisions and miscellaneous goods, and somewhat less than £4 worth of jewelry. From this he justly infers that no equal division of capital is practicable, and that the efforts of the radicals must be directed to the redistribution of income.

But when the source of the national income is examined, Mr. Mallock finds that the socialists of what may now perhaps be called the orthodox or classical school labor under a grave misapprehension. They consider that all wealth is produced by the workers for wages; but Mr. Mallock contends that of the national income of £1,300,000,000, Labor produces about five hundred, while Ability and Capital produce about eight hundred millions

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