

Yet, as we understand Kant, the "thing" is not perceived; the form does not reduce "the manifoldness to order," and the "pure forms" do not "take up the matter and give it unity," nor do they lie in the mind. The chapter on Hegel is also unsatisfactory, and is a new illustration of the fact that it is well-nigh impossible to make Hegelianism speak English. Moreover, in the brief account given of recent British ethics, the author fails to bring out clearly the distinction between the various systems of Utilitarianism, as for example that between the "greatest happiness" principle as interpreted by Bentham and Mill respectively.

The book is well-printed, has a full bibliography, a good table of contents, and an excellent index.

Science.

The Collected Mathematical Works of George William Hill. Vol. IV. Washington: Carnegie Institution.

This is a quarto of solid mathematics of 460 pages, which differs from the other three volumes in that about a quarter of its matter here appears for the first time in print. The thirty-three memoirs are of various degrees of importance. All but two or three relate to planetary and lunar theory.

This science, which in Ptolemy's time, in Kepler's, in Newton's, represented the very highest climbs of scientific intelligence, to-day, by force of its own perfectionment, and by the growth of other sciences that began by being its pupils, is reduced to an art of performing excessively intricate calculations. It must be a peculiar mind that can devote a lifetime to it; and with less devotion there is no chance of being able to improve it. Tradition (along with something else) influences the scientific world greatly to honor any exceptional mastery of it; and yet it has now come to offer the barest minimum of interest from the point of view of philosophy or that of positive science, and scarcely more from that of logic; not even very much from a purely mathematical standpoint. Its difficulty consists in its extreme intricacy and in the extraordinary exactitude of the observational data with which its results must be confronted. As to the complexity of the facts themselves, it is as nothing compared with that of almost the simplest terrestrial phenomena; for the single dynamical law involved—that of gravitation—is all but the simplest conceivable, and has already been most thoroughly studied.

In another five or ten centuries we may hope that such calculations as Mr. Hill's will bring some discovery of vital moment, just as Lord Rayleigh's fastidiousness about the specific gravity of nitrogen did. But our hope is subject to two perilous conditions: first, that the Greenwich Observatory will keep up its work during all that time; and, secondly, that men will continue to be produced with faith, like Mr. Hill's, sufficient to induce them to spend their lives in computations which can have no useful results in their time, and for which none will thank them but those in whose breasts their enthusiasm can kindle a sympathetic spark. It is that spark, hot and lasting, which is the second reason of the

honor that all true men of science pay them.

Among the papers in this volume which do not relate to planetary or lunar theory, there is none that compares in interest with that infinite determinant by which Mr. Hill succeeded in solving for the first time an important class of differential equations. A useful method is developed for deducing the coefficients of a power series from special values of the series. There is an extremely interesting memoir of forty pages on the distribution of gravity over the earth's surface, in which the author introduces an idea which he has repeatedly introduced into his astronomical work.

There is also a paper upon the proper choice of a projection for a map whose "chief end is to present to the eye a picture of what appears on the surface of the earth." The paper occupies but eleven pages, and we should not have taken notice of it here, but for the fact that it furnishes some data for the study of a question in a branch of science whose students would little dream of seeking light in anybody's "collected mathematical works." The question relates to psychology: namely, how much justification is there for two imputations ordinarily made upon the wisdom of mathematicians in general, especially theoretical astronomers, and above all others Laplace?

One of these imputed characters is a readiness to assume superior competence to deal with some matters that are altogether outside their horizons. The other is a disposition to take short cuts to the solution of problems, mostly practical, that properly demand examination of the results of extended experience; and to take these short cuts by setting up hastily adopted principles as entitled to overrule every other consideration. This is substantially what Napoleon said of Laplace, although the real fault was Napoleon's own for supposing that great capacity in one narrow direction was any reason for expecting marked talent in a totally different line.

The particular problem of the map-projection which Mr. Hill treats, plainly calls for a thorough acquaintance with three extensive classes of facts. In the first place, the problem is a psychological one; and a large mass of psychological observations bearing upon the question are on record; and they can readily be supplemented by experiment. In the second place, a knowledge of the methods of the cartographical draughtsman is called for. In the third place, the problem, far from being at all novel, has been many times luminously treated by men well-versed in all three classes of facts.

Mr. Hill's memoir, however, shows insufficient consideration of each of these three classes of facts. He bases his conclusion upon principles which seem to be, considering the high rank of the author as a scientist, astoundingly arbitrary, and certainly not universally true. Two of these principles were first put forward by great mathematicians; but one of them is, none the less, obtrusively absurd to anybody acquainted with the art of cartographical draughting, while the other, apparently based upon a consideration of small consequence, conflicts with the defined purpose of the maps under consideration. In short, the memoir is a remarkable instance of a

publication which, beginning by clearly defining its purpose as a practical one, neglects all the practical aspects of the problem, and busies itself exclusively with matters of curiosity which are practical trivialities. The map of Asia that is given at the end is certainly better than the frightful deformities which, until recently, were given in our atlases. But it does not present as good a picture of the continent as some others. If, instead of Asia, what was to be pictured had been the entire United States and all its possessions, a very different projection would show the relations between the parts very satisfactorily.

Handbook of the Trees of the Northern States and Canada. By Romeyn B. Hough. Lowville, N. Y. Published by the author.

This volume may well be styled photo-descriptive. Opened at any page, its scope and value are instantly apparent. The unique wood sections, which comprise Mr. Hough's "American Woods," are widely known; and it was during trips in search of them that he obtained the series of nearly seven hundred negatives which practically constitute the present work. For the nature-lover, the lumberman, and especially for the student of the evolution of our arboreal flora, this mode of graphic presentation will prove of great help. Indeed, it is difficult to see how such a method can be surpassed. The volume treats of all the trees of the northern United States and Canada, two pages facing each other being devoted to each species.

For example, pages 228 and 229 are devoted to the sycamore. The names button-wood and button-ball-tree are given as synonyms, followed by the scientific title. On the first page are photographs, of a branchlet bearing the mature leaves and fruit; a fruiting head separating, with scattered akenes and hairs; a branchlet from a vigorous shoot showing stipules; a branchlet in winter, and an example of the cup-shaped base of the petiole. These are all photographed on a background ruled into inch squares, giving at once the relative size. The winter branchlet of natural size is of especial value, as presenting clearly the winter characters of the tree. On the opposite page is a photograph of a large isolated trunk showing the general character of bark and branches, while a foot-rule laid against the tree shows proportions. The distribution of the sycamore is indicated by the shaded area on a two by two and a half-inch map. Another cut of about the same size shows the photographic appearance of a thin section of the wood magnified fifteen diameters. The rest of the page is filled with some three hundred words of text descriptive of the color, size, and abundance of the tree, and especially of its adaptability to commercial use. A few lines of fine print give technical characters of leaves, flowers, and fruit. A foot-note refers to page 437, where we find a synopsis of the family and genus. Following this synopsis is a well-compiled glossary and an index of both common and botanical names.

The photographs are excellent, and there is nothing but praise for the work as a whole. From the point of view of evolution its value is apparent when we review the char-

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