

pursuit of symmetry and rule, and which thus produced the theory of Copernicus, as they produce all theories, perpetually show their vigor by overshooting their mark. They obtain something by aiming at much more. They detect the order and connection which exist, by imagining relations of order and connection which have no existence. Real discoveries are thus mixed with baseless assumptions; profound sagacity is combined with fanciful conjecture; not rarely, or in peculiar instances, but commonly, and in most cases; probably in all, if we could read the thoughts of the discoverers as we read the books of Kepler. To try wrong guesses is apparently the only way to hit upon right ones. The character of the true philosopher is, not that he never conjectures hazardously, but that his conjectures are clearly conceived and brought into rigid contact with facts. He sees and compares distinctly the ideas and the things,—the relations of his notions to each other and to phenomena. Under these conditions it is not only excusable, but necessary for him, to snatch at every semblance of general rule;—to try all promising forms of simplicity and symmetry.

Copernicus is not exempt from giving us, in his work, an example of this character of the inventive spirit. The axiom that the celestial motions must be *circular* and *uniform*, appeared to him to have strong claims to acceptance; and his theory of the inequalities of the planetary motions is fashioned upon it. His great desire was to apply it more rigidly than Ptolemy had done. The time did not come for rejecting this axiom, till the observations of Tycho Brahe and the calculations of Kepler had been made.

I shall not attempt to explain, in detail, Copernicus's system of the planetary inequalities. He retained epicycles and eccentrics, altering their centres of motion; that is, he retained what was *true* in the old system, *translating* it into his own. The peculiarities of his method consisted in making such a combination of epicycles as to supply the place of the *equant*,⁴ and to make all the motions equable about the centres of motion. This device was admired for a time, till Kepler's elliptic theory expelled it, with all other forms of the theory of epicycles: but we must observe that Copernicus was aware of some of the discrepancies which belonged to that theory as it had, up to that time, been propounded. In the case of Mercury's orbit, which is more eccentric than that of the other planets, he makes suppositions which are complex indeed, but which show his perception of the imperfection of

⁴ See B. iii. Chap. iii. Sect. 7.