

wise have thought of, and which, at all events, *if* verified in practice, are real additions to our stock of knowledge and to the arts of life.

(209.) In framing a theory which shall render a rational account of any natural phenomenon, we have *first* to consider the agents on which it depends, or the causes to which we regard it as ultimately referable. These agents are not to be arbitrarily assumed; they must be such as we have good inductive grounds to believe do exist in nature, and do perform a part in phenomena analogous to those we would render an account of; or such, whose presence in the actual case can be demonstrated by unequivocal signs. They must be *veræ causæ*, in short, which we can not only show to exist and to act, but the laws of whose action we can derive independently, by direct induction, from experiments purposely instituted; or at least make such suppositions respecting them as shall not be contrary to our experience, and which will remain to be verified by the coincidence of the conclusions we shall deduce from them, with facts. For example, in the theory of gravitation, we suppose an agent—*viz.* force, or mechanical power—to act on *any* material body which is placed in the presence of *any* other, and to urge the two mutually towards each other. This is a *vera causa*; for heavy bodies (that is, all bodies, but some more, some less) tend to, or endeavor to reach, the earth, and require the exertion of force to counteract this endeavor, or to keep them up. Now, that which opposes and neutralizes force *is* force. And again, a plumb-line, which, when allowed to hang freely, always hangs perpendicularly, is found to hang observably aside from the perpendicular when in the neighborhood of a considerable mountain, thereby proving that a force is exerted upon it, which draws it towards the mountain. Moreover, since it is a fact that the moon does circulate about the earth, it must be drawn towards the earth by a force; for if there were no force acting upon it, it would go on in a straight line without turning aside to circulate in an orbit, and would, therefore, soon