when we say that it requires more force to throw a stone one hundred paces than fifty."[4] Reasoning upon this difference, he comes to the conclusion that "the Momentum of percussion is infinite, since there is no resistance, however great, which is not overcome by a force of percussion, however small."[5] He further explains this by observing that the resistance to percussion must occupy some portion of time, although this portion may be insensible. This correct mode of removing the apparent incongruity of continuous and instantaneous force, was a material step in the solution of the problem.

The Laws of the mutual Impact of bodies were erroneously given by Descartes in his *Principia;* and appear to have been first correctly stated by Wren, Wallis, and Huyghens, who about the same time (1669) sent papers to the Royal Society of London on the subject. In these solutions, we perceive that men were gradually coming to apprehend the Third Law of Motion in its most general sense; namely, that the Momentum (which is proportional to the Mass of the body and its Velocity jointly) may be taken for the measure of the effect; so that this Momentum is as much diminished in the striking body by the resistance it experiences, as it is increased in the body struck by the Impact. This was sometimes expressed by saying that "the Quantity of Motion remains unaltered," *Quantity of Motion* being used as synonymous with *Momentum*. Newton expressed it by saying that "Action and Reaction are equal and opposite," which is still one of the most familiar modes of expressing the Third Law of Motion.

In this mode of stating the Law, we see an example of a propensity which has prevailed very generally among mathematicians; namely, a disposition to present the fundamental laws of rest and of motion as if they were equally manifest, and, indeed, identical. The close analogy and connection which exists between the principles of equilibrium and of motion, often led men to confound the evidence of the two; and this confusion introduced an ambiguity in the use of words, as we have seen in the case of Momentum, Force, and others. The same may be said of *Action* and *Reaction*, which have both a statical and a dynamical signification. And by this means, the most general statements of the laws of motion are made to coincide with the most general statical propositions. For instance, Newton deduced from his principles the conclusion, that by the mutual action of bodies, the motion of their centre of gravity cannot be affected. Marriotte, in his *Traité de la*

[4] *Op.* iii. 210. [5] iii. 211.