

of the third law of motion, when the action is direct. This error was retained even in the later editions of the *Principia*.⁵

The question of the centre of oscillation had been proposed by Mersenne somewhat earlier,⁶ in 1646. And though the problem was out of the reach of any principles at that time known and understood, some of the mathematicians of the day had rightly solved some cases of it, by proceeding as if the question had been to find the *Centre of Percussion*. The Centre of Percussion is the point about which the momenta of all the parts of a body balance each other, when it is in motion about any axis, and is stopped by striking against an obstacle placed at that centre. Roberval found this point in some easy cases; Descartes also attempted the problem; their rival labors led to an angry controversy: and Descartes was, as in his physical speculations he often was, very presumptuous, though not more than half right.

Huyghens was hardly advanced beyond boyhood when Mersenne first proposed this problem; and, as he says,⁷ could see no principle which even offered an opening to the solution, and had thus been repelled at the threshold. When, however, he published his *Horologium Oscillatorium* in 1673, the fourth part of that work was on the Centre of Oscillation or Agitation; and the principle which he then assumed, though not so simple and self-evident as those to which such problems were afterwards referred, was perfectly correct and general, and led to exact solutions in all cases. The reader has already seen repeatedly in the course of this history, complex and derivative principles presenting themselves to men's minds, before simple and elementary ones. The "hypothesis" assumed by Huyghens was this; "that if any weights are put in motion by the force of gravity, they *cannot* move so that the centre of gravity of them all shall rise *higher* than the place from which it descended." This being assumed, it is easy to show that the centre of gravity will, under all circumstances, rise *as high* as its original position; and this consideration leads to a determination of the oscillation of a compound pendulum. We may observe, in the principle thus selected, a conviction that, in all mechanical action, the centre of gravity may be taken as the representative of the whole system. This conviction, as we have seen, may be traced in the axioms of Archimedes and Stevinus; and Huyghens, when he proceeds upon it, undertakes to show,⁸ that he assumes only this, that a heavy body cannot, of itself, move upwards.

⁵ B. iii. Lemma iii. to Prop. xxxix.

⁷ *Hor. Osc.* Pref.

⁶ Mont. ii. 423.

⁸ *Hor. Osc.* p. 121.