
Statements by Isaac Newton

In a letter to *Robert Hooke*, February 5, 1675.

“If I have seen further it is by standing on ye sholders of Giants.”

This famous aphorism is usually attributed to Newton but in fact, as articulated in the witty and learned book “On the Shoulders of Giants” by Robert K. Merton, it has a much older lineage.

From the *Philosophiae Naturalis Principia Mathematica*

1. Definitions

- I. **Mass** - “Quantity of matter is a measure of matter that arises from its density and volume jointly.”
- II. **Momentum** - “Quantity of motion is a measure of motion that arises from the velocity and the quantity of matter jointly”
- III. **Inertia** - “Inherent force of matter (*vis insita*) is the power of resisting by which every body, so far as is able, perseveres in its state either of resting or of moving uniformly straight forward.”
- IV. **Force** - “Impressed force is the action exerted on a body to change its state of resting or of uniformly moving straight forward.”

• Annotation

- I. Absolute, true, and mathematical **time**, in and of itself, and of its own nature, without relation of anything external, flows uniformly ...
- II. Absolute **space**, of its own nature without relation to anything external, always remains homogeneous and immovable.

2. Laws

- I. Every body perseveres in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by forces impressed.
- II. A change in motion is proportional to the motive force impressed and takes place along the straight line in which that force is impressed.
- III. To any action there is always an opposite and equal reaction; in other words, the actions of two bodies upon each other are always equal, and always opposite in direction.

“I do not know what I appear to the world; but to myself I seem to have been only like a boy playing on a seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.”

“Queries” from *Optics*, 4th Edition, 1718

“Are not gross bodies and light convertible into one another?”

“Are not the rays of Light very small Bodies emitted from shining Substances?”

“All these things being consider’d, it seems probable to me, that God in the Beginning form’d Matter in solid, massy, hard, impenetrable Particles, of such Sizes and Figures, and with such other Properties, and in such Proportion to Space, as most conduced to the End for which he form’d them;”

“That gravity should be innate, inherent, and essential to matter, so that one body can act on another at a distance, through a vacuum, without mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it.”

“Now the smallest particles of matter may cohere by the strongest attractions, and compose bigger particles of weaker virtue; and many of these may cohere and compose bigger particles whose virtue is still weaker, and so on for diverse successions, until the progression ends in the biggest particles on which the operations in chemistry, and the colours of natural bodies depend, and which by cohering compose bodies of a sensible magnitude.”

“For we must learn from the phenomena of nature what bodies attract one another, and what are the laws and properties of the attraction, before we inquire the cause by which the attraction is perform’d. The attractions of gravity, magnetism, and electricity, reach to very sensible distances, and so have been observed by vulgar eyes, and there may be others which reach to so small distances as to escape observation.”

Some Poems and Prose about Isaac Newton

*When Newton saw an apple fall, he found
In that slight startle from his contemplation –
'T is said (for I'll not answer above ground
Far any sage's creed or calculation) –
A mode of proving that the earth turn'd round
In a most natural whirl, called 'gravitation;'
And this is the sole mortal who could grapple,
Since Adam, with a fall or with an apple.*

– From *Don Juan* by **Byron**, 1819

*Nature and Nature's Laws lay hid in night:
God said, Let Newton be! And all was light.*

– Epitaph for Isaac Newton by **Alexander Pope**, 1727.

Enough of this. Newton, forgive me; you found the only way which, in your age, was just about possible for a man of highest thought and creative power. The concepts, which you created, are even today still guiding our thinking in physics, although we now know that they will have to be replaced by others farther removed from the sphere of immediate experience, if we aim at a profounder understanding of relationships.

– **Albert Einstein**