Newton’s 3rd Law

To every force there is an equal but opposite reaction force.

\[ F_{\text{hand on wall}} = -F_{\text{wall on hand}} \]
Newton’s 3rd Law

\[ F_{\text{hand on wall}} = -F_{\text{wall on hand}} \]

You can’t TOUCH without being TOUCHED back!!
An interaction requires a pair of forces acting on two objects.
Action-Reaction Pairs

If ACTION is A acting on B, then REACTION is B acting on A.

- Action: tire pushes on road, Reaction: road pushes on tire
- Action: rocket pushes on gas, Reaction: gas pushes on rocket
- Action: man pulls on spring, Reaction: spring pulls on man
- Action: earth pulls on ball, Reaction: ball pulls on earth
Bug Splat

A bug and bus have a head on collision. Compared to the **FORCE** that acts on the bug, how much force acts on the bus?

More  Same  Less

Newton’s 3rd Law:

\[ F_{bus\texttt{-}bug} = -F_{bug\texttt{-}bus} \]
Bug Splat

Which undergoes the greater acceleration?

\[ a = \frac{F}{m} \]

Which suffers the greatest damage?

Bug     Same     Bus

Bug     Same     Bus
Action-Reaction Pairs
Action-Reaction

You push a heavy car by hand. The car, in turn, pushes back with an opposite but equal force on you. Doesn’t this mean the forces cancel one another, making acceleration impossible? Why or Why not?

Action-Reaction pairs act on different objects. For F = ma, all the forces act on the same object.
Action Reaction Pairs

Gun Pushes Bullet out.
Bullet Pushes back on Gun (& Man)
Rocket Thrust

Newton’s 3rd Law

\[ F_{\text{hand on wall}} = -F_{\text{wall on hand}} \]

This is an INTERACTIVE Universe.