

Types of Models

Physical models

These are models of *how things look or work in the real world*. When you build a model of what a plant cell looks like or draw a picture of an apple, you are using a physical model. Physical models can be objects, videos, animations, drawings, and diagrams. Sometimes things are shown to scale and sometimes they are not.

Conceptual models

These are mental models that *represent relationships and describe how things work or fit together*. For example, thinking about organisms as biological systems and traits as properties that emerge from the interactions of a biological system are conceptual models. Conceptual models are often shared verbally, but they can also be represented in videos, animations, drawings, and diagrams.

Mathematical models

These models *use mathematical equations, theories, formulas, and proofs* to explain the behavior of a system. For example, Isaac Newton observed the effects of the force of gravity and created a mathematical model to explain its effects (e.g., objects accelerate at 9.8 m/s^2 toward Earth).

Simulations

These models allow scientists to *control variables and mimic real-world processes*. For example, a space-simulator allows untrained astronauts to safely practice moving about in space, and an ecosystem simulator might allow scientists to vary the number of prey and see what the effect is on the plants and predators in the area. Simulations may be physical or computer-based. They often rely on underlying mathematical models. Simulations are especially useful for understanding complex systems.