



GST 50 – Change and Change of State

Formal Description

Change is the difference in physical reality between two or more points in time. A change of state occurs when one or more of the variables describing an entity or system take different values at different times. Change may be continuous, with values passing through intermediate positions, or discrete, where values change from one distinct state to another. Understanding change is fundamental to the study of behaviour, processes and systems.

Plain English Explanation

The world is constantly changing. Plants grow, rivers flow, buildings age, businesses expand, and societies evolve. Sometimes these changes are gradual and almost imperceptible. At other times they are rapid and dramatic. Understanding change is one of the central objectives of General Systems Theory.

A change occurs whenever reality differs between one moment and another. If a reservoir contains more water today than it did yesterday, its state has changed. If a car accelerates, its speed changes. If a company employs more people than it did last year, one aspect of its state has changed. In every case, change is recognised by comparing the values of relevant variables at different times.

Many changes are continuous. As a tree grows taller, its height passes through many intermediate values rather than jumping instantly from one height to another. Similarly, the temperature of a room usually changes gradually as it warms or cools.

Other changes are discrete. A traffic light changes from red to green through a sequence of distinct states. A computer file may change from closed to open, or a machine from running to stopped. In these cases the variable takes one of a limited number of clearly defined values.

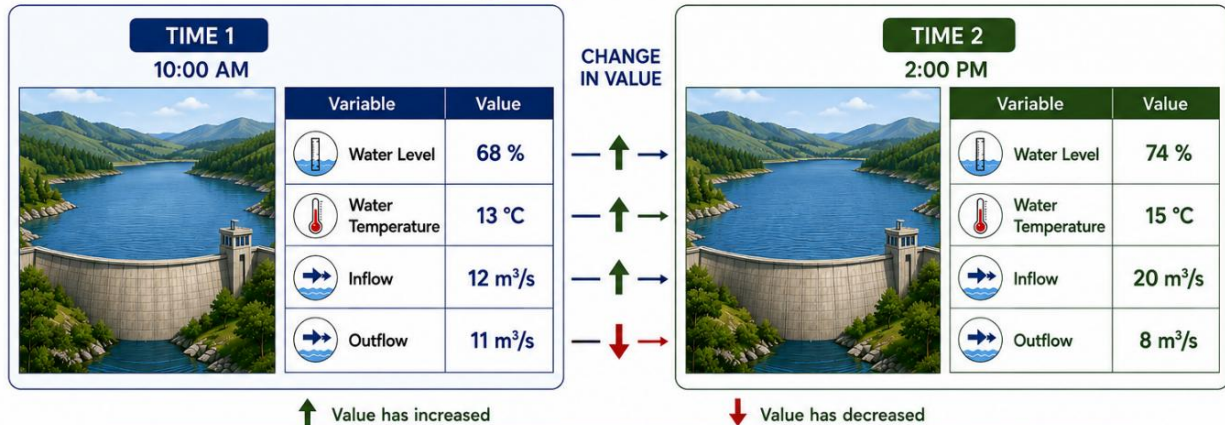
Some variables may remain unchanged while others change. A person's height may remain constant over a single day, while their body temperature, location and heart rate all change. The overall state of an entity or system therefore changes whenever one or more of its relevant variables change value.

Recognising change is the first step towards understanding behaviour. In later modules we shall examine how changes occur, why they occur, and how patterns of change give rise to the behaviour of systems.



CHANGE AND CHANGE OF STATE

Change is recognised by comparing states at different times.
Changes may be continuous or discrete.



KEY POINT

A change is the difference between two states of an entity at different times.
It may be continuous (smooth) or discrete (stepwise).

Examples

The growth of a child provides an example of continuous change. Height, mass and vocabulary gradually increase over many years, passing through countless intermediate values.

By contrast, the status of a passport application changes through a series of discrete states, such as submitted, under review, approved and issued. Although time passes continuously, the application itself moves between a limited number of distinct states.

Provenance and Links

The study of change has occupied philosophers and scientists for thousands of years. Heraclitus famously argued that change is a fundamental characteristic of reality, while Parmenides questioned whether true change exists. Modern science treats change as a measurable aspect of physical reality, and mathematics provides the tools for describing both continuous and discrete variation. Engineering, physics, computer science and dynamical systems theory all rely upon the concepts of state and change to analyse and predict system behaviour. General Systems Theory extends these ideas to all organised systems, whether physical, biological, engineered or social.



Practical Exercise

Choose a familiar entity or system that changes over time, such as a garden, a vehicle, a workplace or a local river.

Identify at least five variables that describe its state. Record their values at one point in time and predict how they might change over the next day, week or month.

For each variable, explain whether you would expect the change to be continuous or discrete, and justify your reasoning.