



GST 31 – Compression and Human Understanding

Formal Description

Compression is the cognitive process by which complex information is represented in simplified forms that preserve features relevant to understanding, communication, reasoning, and action. Compression enables finite cognitive systems to comprehend realities that would otherwise exceed their capacity for direct representation.

Plain English Explanation

The world contains vastly more information than any individual can process directly. Every object, event, and system consists of enormous numbers of interacting components and processes. If we attempted to consider all this detail simultaneously, effective thought would become impossible.

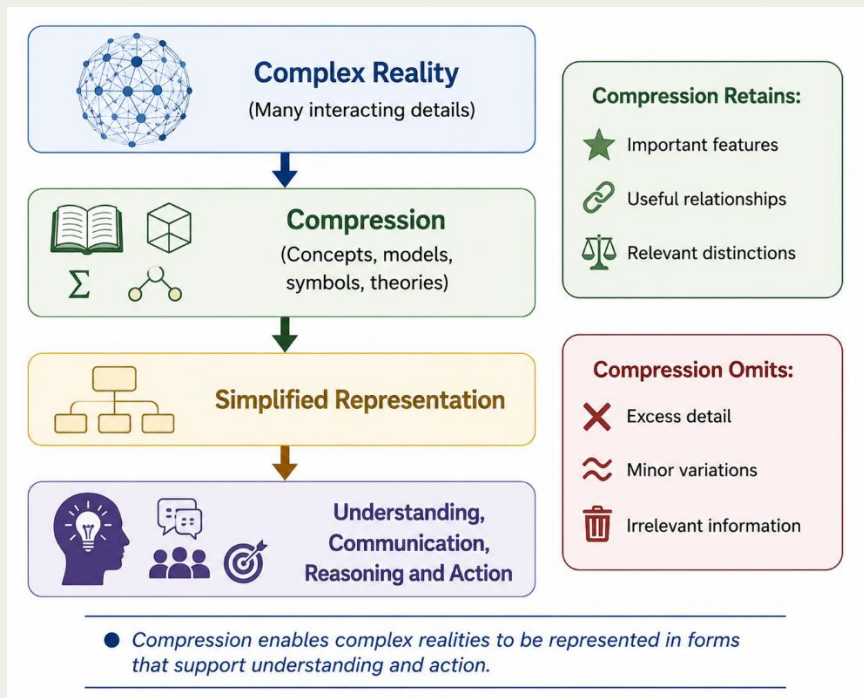
To overcome this problem, humans compress information.

Compression occurs whenever complex realities are represented using simpler concepts, models, symbols, diagrams, or explanations. Rather than retaining every detail, compression preserves information that is relevant to a particular purpose while ignoring information that is less important. For example, a map compresses a landscape. It omits most of the detail while retaining information useful for navigation. Similarly, a concept such as "forest" compresses countless trees, plants, animals, soils, and ecological interactions into a single idea.

Human understanding depends heavily upon compression. Words, concepts, theories, diagrams, statistics, and models are all forms of compression. They allow people to reason about complex realities without having to represent every underlying detail.

Compression is therefore not a weakness of cognition. It is one of its greatest strengths. Without compression, learning, communication, planning, science, and decision-making would be impossible.

At the same time, all compression involves trade-offs. Useful detail is inevitably omitted. Different observers may therefore develop different compressions of the same reality depending upon their goals, experiences, and interests.



Example 1 – Maps

A road map omits most features of the landscape while retaining information useful for navigation.

Example 2 – Scientific Concepts

The concept of gravity compresses an enormous number of observations into a simple explanatory framework.

Example 3 – Organisations

When people refer to a company, they compress thousands of employees, technologies, processes, contracts, and interactions into a single concept.

Example 4 – Everyday Communication

A weather forecast compresses vast quantities of atmospheric data into a brief description that people can easily understand and use.

Provenance and Links

The importance of compression has been recognised across information theory, psychology, artificial intelligence, complexity science, and systems theory.

Relevant contributors include:

- Claude Shannon – information and communication.
- Herbert Simon – complexity and bounded rationality.
- George Miller – limits of human information processing.
- Daniel Kahneman – cognitive efficiency and judgement.
- Gregory Bateson – information, pattern, and understanding.

Related topics include information theory, cognition, abstraction, modelling, complexity, communication, and knowledge representation.



Practical Exercise

Choose a complex system that you are familiar with.

Examples might include:

- a business,
- a school,
- a sports team,
- a transport network,
- a family.

1. Describe the system reasonably thoroughly, listing some of the details that could be included in a complete description.
2. Create a short summary of the system using no more than three sentences.
3. Identify what information was retained and what information was omitted.
4. Note, the words and phrases used to create the summary and the detail that they have replaced.
5. Reflect on how the compression changed your understanding of the system.

How much complexity can be removed before the description becomes unhelpful?