# Characteristics of technological outcomes

Technological outcomes are products and systems developed by means of technological practice for a specific purpose.

A technological outcome:

* is evaluated in terms of its fitness for purpose
* can be described in terms of its physical and functional natures
* must be interpreted in relation to the social and historical context in which it was developed and used

An outcome’s proper function is its intended and/or socially accepted purpose. Alternative functions are successful functions that have been discovered or developed by users. Outcomes that do not successfully fulfil their intended functions are malfunctions.

## Key ideas

### Realisation

A technological outcome is by definition a fully realised product and/or system created by people for a particular purpose using technological practice. Once it has been placed in situ, no further design input is required for it to function.

“Fully realised” means the outcome has moved beyond concept, plan, or model and now exists and functions as designed in the made world – it is fit for purpose in every respect, including aesthetic.

This definition enables technological outcomes to be distinguished from natural objects such as trees and rocks and from other outcomes of human activity such as art works, language, knowledge, social structures, and organisational systems.

### Products vs systems

Technological outcomes can be categorised as products and systems but distinguishing between the two is not always straightforward. In fact it often depends on how you look at the outcome concerned. For example, you could describe a cell phone as a technological system, comprising interconnected components that work together to achieve a purpose. But you could also describe the same phone as a technological product, focusing on the materials used in its manufacture and not on the many interconnected components inside it.

### Socio-technological environments

A key feature of technological products and systems is that they are intimately connected to other entities including natural objects and people, and systems (political, social, cultural, and so on). When technological outcomes combine with the natural and social world, the result can be described as a socio-technological environment.

Socio-technological environments include communication networks, hospitals, transport systems, waste disposal, recreational parks, factories, power plants, and so on. For example, the cellular network comprises a range of technological products and systems (such as cell phones, towers, data-logging computers, transmitting circuits, and receiver circuits) alongside non-technological systems (legal, political, financial, energy, and so on) and entities (such as people and geographical features).

### One outcome, two natures

All technological outcomes have a dual nature: physical and functional. An outcome’s physical nature is what it is made of and looks like; its functional nature is what it can do. Understanding the relationship between the two is a good starting point for understanding a technological outcome as a whole, and it is crucial when developing a product or system for a specific purpose.

Technologists recognise that, whatever the technological outcome they are seeking to develop, a number of different physical natures may be possible. For example, if the aim is to design an outcome that will function as a drinking vessel, they might explore a range of shapes (for example, a mug versus a stem glass) and/or materials (for example, ceramic versus glass). The technologist will determine the vessel’s physical nature by making a series of decisions designed to provide the most fit-for-purpose outcome. These will take account of the drink to be held, the wants and needs of target users, the context in which the vessel will be used, and the materials and equipment available to manufacture it. But if the aim is to design a technological outcome that uses particular materials or components, technologists might begin by exploring their performance possibilities to identify possible functions.

It can be seen therefore that requirements for the functional nature of a technological outcome will always limit options for the physical nature, and vice versa.

The relationship between the two natures of a proposed technological outcome can be a useful tool when making fitness-for-purpose decisions – and when analysing existing outcomes and the influences on their development (for example, available knowledge, skills, equipment and materials).

Exploration of the physical and functional natures of a proposed technological outcome can suggest possible long-term implications and future adaptations or innovations. In the case of an existing technological outcome whose purpose is unknown, its physical nature may provide clues to its function.

### Design elements

Design elements provide another useful tool for analysing and interpreting an existing technological outcome.

* Elements such as colour, movement, pattern and rhythm, proportion, balance, harmony, contrast, and style relate to the outcome’s physical nature (its “form”).
* Elements such strength and durability, safety and stability, efficiency, reliability, nutritional value, user-friendliness, and ergonomic fit relate to the outcome’s functional nature.

By looking at these elements as a whole, the technologist can see how physical and functional elements have been prioritised to give an outcome that can be considered fit for purpose. Almost certainly they could have been prioritised differently depending on the intent of the designer, their knowledge of materials, their professional and personal beliefs, the sociocultural context, and so on.

### Intended and alternative functions

Technological outcomes can also be described in terms of intended and alternative functions.

An outcome’s intended or proper function is the use for which it was designed, its socially accepted, normal use. This is the use that drove its development, gave it its physical and functional natures, and allowed it to be evaluated as fit for purpose.

Alternative functions evolve when people find that an outcome can be successfully used in a way or ways that the technologist did not intend. Not only do people find new uses for technological outcomes, they often modify their physical natures to make them even more suitable for the alternative function. They may also pressure the technologist to redesign the original outcome to better perform the alternative function. When an alternative function becomes accepted as normal, it usurps the proper function label. This process demonstrates one way in which end users, technological outcomes, and technologists interact.

### Malfunction

The term malfunction is used to describe a technological outcome that fails to successfully fulfil its intended function.

Malfunction is single-event failure and to be distinguished from gradual loss of function over time due to general wear and tear.

Malfunction is also very different from “designed failure”, where a product or system component is deliberately engineered to stop working after so many uses. The ethics of this practice are influenced by such factors as market forces, maintaining employment, material developments, changing fashions, social norms, and public opinion.

When looking at examples of malfunction, gradual loss of functioning due to wear and tear, and designed failure, the complexity of the interface between design, materials, end users, instructions, operational parameters, and environments becomes apparent.

Operational parameters are the boundaries and/or conditions within which an outcome is designed to function (see Technological Systems).