Chapter 10
Glossary of Terms

Please note: Most of these terms are not specific to General Morphological Analysis. Many of them have been borrowed from other areas of study and employed for the purpose of explaining and understanding the morphological modelling of complex societal problems. Their "meanings" may have shifted in emphasis. They are employed as "aids in understanding", not as dogma.

Audit trail

A sequence of records, each of which contains evidence or other forms of knowledge pertaining to and resulting from the execution of a process or system function. In the *morphological modelling* process it is the definitions of the *parameters* and *parameter values*, and the recording of the reasoning behind each of the *Cross-consistency assessments*.

Cross Consistency Assessment – CCA

Pertains to the process by which the *parameter values* (or parameter *conditions*) in the *morphological field* are compared with one another, pair-wise, in the manner of a cross-impact matrix. As each pair of conditions is examined, a judgement is made as to whether – or to what extent – the pair can coexist, i.e. represent a consistent relationship. This process reduces the total *problem space* to a smaller (internally consistent) *solution space*.

CARMA

***Computer Aided Resource for Morphological Analysis*:** A proprietary software system used for carrying out morphological modelling and creating non-quantified inference models.

Cognitive Feedback

We use this term here to denote *causative action* on society (and the physical world) *as a result* of human cognitive processes and conscious self-reflection. CFB is essentially the opposite of *epiphenomenalism* – the doctrine that "mind" (or human consciousness) is only a by-product and has no influence or causal effect on the physical world. (Note: In psychology – especially in the area of decision making – *Cognitive Feedback* denotes a process that gives decision makers information about their own, and others, cognitive processes).

Complexity (in self-referential systems)

The term *complexity* is used here to denote a self-referencing system – e.g. a person, a social organisation, a community or society. This involves a level or domain of causality that goes beyond the notions of linear (mechanical) cause-effect. Such complex (self-referential) systems are *causal*, but not *determinant*. See Hofstadter (1979), Luhmann (1995) and Rittel (1972). A purely formal-mathematical model of self-reference is exemplified in Gödel's Incompleteness Theorems.

Complex Adaptive System (CAS)

In social science, a dynamic (dispersed and decentralized) network of agents (e.g. individuals, organisations, institutions, nations) acting concurrently and reacting to each other. Coherent behaviour in the system can arise from competition and cooperation among the agents themselves. However, order is emergent as opposed to predetermined the system's development is non-linear and irreversible and the system's future is generally unpredictable (see e.g. Holland 1994).

Coherence

Degree of interconnection and consistency between parts – in this case between the *parameter values* in a morphological field.

Conditions

(see also "Parameter Values"): The different states or values a parameter can take the parameter's value range (see Fig. 10.1).
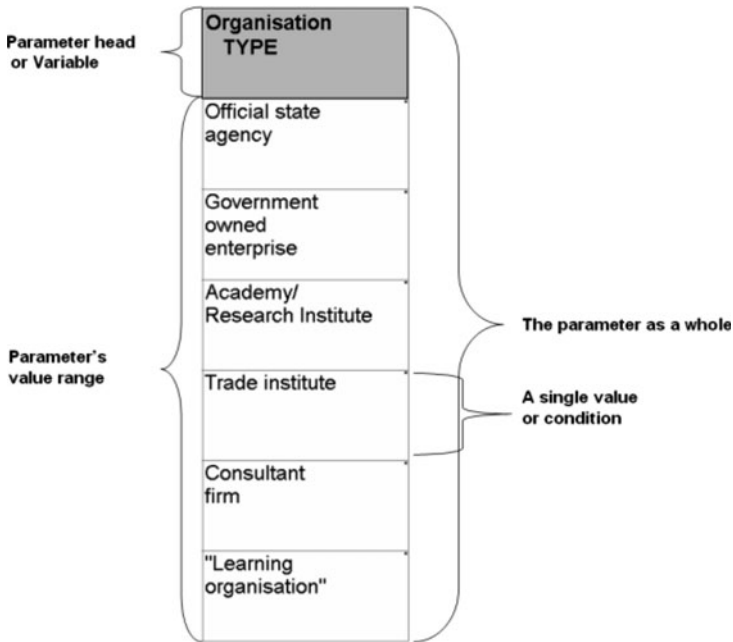
Fig. 10.1 Parameter terms

Consensus

Consensus usually means "general agreement or concord" within a group. Facilitators usually differentiate between *first-order* and *second-order* consensus. The normal, *first-order* form is that of gaining a common standpoint or agreeing upon a common solution. So-called *second order consensus* is when stakeholders in a group learn to accept each other's specific stakeholder positions – on the basis of understanding the *reasons* for these positions.

Consistency

Degree of compatibility between statements or conditions; in this case between the *conditions* of different *parameters* in a *morphological field*.

Configuration

At least one parameter value or condition displayed from each of the parameters in a morphological model (see Fig. 10.2).

File Edit View Matrix Options Window Help

Organisation TYPE	Leadership culture	Buyer structure	Dominate product/ service	Co-operation strategies	Employee profile	Main employee incentive
Official state agency	Bureaucratic hierarchy	Ministry dominated	Process + method support	Outside help when needed	Life-long service	Money
Government owned enterprise	Strong scientific leadership	Military and material dominated	Soft studies	Joint ventures	Career researcher	Managerial career
Academy	Marketing division leadership	Defence Industry	Hard studies	Consultant purchasing	Development engineer	Pleasure in one's work
Trade institute	Umbrella management	Civilian agencies	Basic research	Mediator only	"Consultant"	Educational motivation
Consultant firm	Gatekeeping	Private markets (national)	Testing, construction		Entrepreneur	Titles, specialist career
"Learning organisation"	Skunk-works (ad hocrati)	International markets	Second opinion		Elite troops	Organisation gives status

Fig. 10.2 Morphological model with single configuration displayed

File Edit View Matrix Options Window Help

Organisation TYPE	Leadership culture	Buyer structure	Dominate product/ service	Co-operation strategies	Employee profile	Main employee incentive
Official state agency	Bureaucratic hierarchy	Ministry dominated	Process + method support	Outside help when needed	Life-long service	Money
Government owned enterprise	Strong scientific leadership	Military and material dominated	Soft studies	Joint ventures	Career researcher	Managerial career
Academy	Marketing division leadership	Defence Industry	Hard studies	Consultant purchasing	Development engineer	Pleasure in one's work
Trade institute	Umbrella management	Civilian agencies	Basic research	Mediator only	"Consultant"	Educational motivation
Consultant firm	Gatekeeping	Private markets (national)	Testing, construction		Entrepreneur	Titles, specialist career
"Learning organisation"	Skunk-works (ad hocrati)	International markets	Second opinion		Elite troops	Organisation gives status

Fig. 10.3 Morphological model with multi-driver input selected (*grey*) and clustered configuration displayed (*black*)

Configuration cluster

A Collection of configurations, all of which are consistent with a given (selected) condition (see Fig. 10.3).

Contextual Environment

Those processes and conditions in the outside world, which can influence our organisation, but which we cannot influence significantly ("External world factors").

Decision Support

Support for management decision making under uncertainty.

Decision Support System (DSS)

Software and modelling methods used to aid management decision making under uncertainty.

Dimension

A coordinate in any conceptual space, whereby a quantity or quality can be varied along a continuum or a discrete number of states. In conjunction with other such quantities or qualities, it serves to define the variables or degrees of freedom that determine a system's state or behaviour (see "Parameter").

Driver

A parameter that is of central importance to a process or model, and which tends to "drive" other parameters. A factor that influences many other factors, but is itself less influenced.

Empirical Inconsistency

A practical (empirical) incompatibility or discrepancy between two or more conditions or statements about the observed world (comp. Logical Inconsistency).

Field Coverage

Pertains to how much of the Morphological Field is covered by the solution space. One endeavours to have "full field coverage".

General Morphological Analysis (GMA)

A generalised form of Morphological Analysis which is not associated with any specific discipline. Developed by Professor Fritz Zwicky of the California Institute of Technology (CalTech) in the late 1940s. "I have proposed to generalize and systematize the concept of morphological research and include not only the study of the shapes of geometrical, geological, biological, and generally material structures, but also to study the more abstract structural interrelations among phenomena, concepts, and ideas, whatever their character might be." (Fritz Zwicky: Discovery, Invention, Research through the Morphological Approach, p. 34).

General Morphology

Another designation for General Morphological Analysis.

Hyper-Coherent

When the degree of compatibility or internal consistency between parameters in a morphological model is very high, and many possible solutions or outcomes are obtained (opposite of hyper-constrained).

Hyper-Constrained

When the degree of compatibility or internal consistency between parameters in a morphological model is very low, and very few possible solutions or outcomes are obtained (opposite of hyper- coherent).

Inconsistency

When two statements or conditions are logically or empirically incompatible or contradictory.

Influence diagram

In general, a qualitative model of a system, which depicts influence relationships between different elements or aspects of the system, shows the direction of such influences and (usually, but not always) allows for feedback loops or circular

causality. In some cases, influences can be given relative strengths, and flows between nodes can be mapped. In other cases, the diagrams are only pictorial representations of complex nets of interaction.

Linkage (Linkage structure)

Concerns how parameters in a Morphological Field are linked, i.e. which parameters constrain each other, and which do not.

Logical Inconsistency (Analytic Contradiction)

A logical incompatibility or contradiction between two or more statements. A "contradiction in terms" (comp. Empirical Inconsistency).

Mess

(See: "Social Mess").

Model

A simplified, schematic representation of a system or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics. Scientific models usually delineate the system's or phenomenon's variables and relate such variables to one another. In quantitative modelling these relations can be functional (mathematical) or statistical. In non-quantified modelling the relations can be logical (e.g. consistency) or pertain merely to influence (influence diagrams).

Morphology

The study of *form* or *structure* as such.

Morphological Analysis

The study of form or structure by identifying the multiple dimensions comprising any system, e.g. an organism, an organisation, a conceptual system or any entity taken as a whole. Employed in e.g. Zoology, Botany, Geology and Linguistics (See "General Morphological Analysis").

Morphological Field

The field of constructed dimensions or parameters which is the basis for a morphological model.

Morphological Model

A morphological field with its parameters assessed and linked through a Cross-Consistency Assessment (CCA).

Multi-Driver Inputs

Using multiple drivers as input to a morphological model in order to determine numerous possible outputs or results (see "Driver").

Normative Inconsistency (Normative Constraint)

An incompatibility or discrepancy between two or more conditions based on social norms, ethics and standards.

Parameter

One of a set of measurable factors that defines a system and determines its behaviour, and which can be varied in an experiment.

Parameter space

A set of mutually linked parameters making up the Morphological Field.

Parameter Values

(see also "Conditions"): The different states or values a parameter can take on the parameter's value range (see Fig. 10.1).

"Problem"

Use by Ackoff (1974) to denote a well-defined issue where the parameters and the mutual relationships between parameters are known, but where there is no single, unequivocal solution. Instead there are many possible solutions "depending on" how different aspects of the "problem" relate to each other.

Problem space

The totality of the possible configurations obtained in a Morphological Field (see "Solution space").

Problem Structuring Methods

A family of methods that apply modelling approaches to address messy or wicked problems faced by managers of organizations. These methods seek to alleviate or improve situations characterised by uncertainty, conflict and complexity.

"Puzzle"

Use by Ackoff (1974) to denote a well defined issue where the parameters and the mutual relationships between parameters are known, and where there is a single, unambiguous solution.

Risk

A form of uncertainty that has a well-grounded (quantitative) probability. Risk = (probability of something happening) × (consequences if it does happen).

Risk Analysis

Generally, the science of risks, their probability and evaluation. In business, it is a technique to identify and assess factors that may jeopardize the success of a project or achieving a goal. The technique also helps to define preventive measures to reduce the probability of these factors from occurring and to identify appropriate countermeasures.

Risk Mitigation

Long-term measures for reducing or eliminating risk.

Scenario

An outline or model concerning a hypothetical sequence of events (development over time) or a set of circumstances (futures projection). A scenario is usually related to a given time period (usually, but not always, the future); treats a number of defined variables (e.g. economic conditions, demographic conditions, etc.); and allows the variables to be related or linked to each other by way of different types of relationships (e.g. causal relations, probabilities, internal consistency).

Scenario Laboratory

A morphological inference model developed to map and interrelate scenario variables. It allows these variables to be related or linked to each other by way of internal consistency.

Social Mess (see also "Wicked Problems")

Used by Ackoff (1974) to denote a social or organisational planning problem that is vaguely defined, ambiguous and reactive (i.e. it reacts when you try to do something with it). These are primarily long-term social and organisational planning problems with many and varied stakeholders. (See: "Complex Adaptive System (CAS)").

Solution Space

The subset of all of the configurations in a morphological model which fulfil the requirement of being internally consistent, and thus being a possible solution.

Strategy Space

The internal world of an organisation, comprising those factors which the organisation can influence and mould into a strategy for coping with the contextual environment.

Transactional Environment

Factors which are external to an organisation as such, but which the organisation may be able to influence (e.g. through information campaigns, legal actions, lobbying, etc.).

Uncertainty (Genuine Uncertainty)

While risk is a form of uncertainty that has a well-grounded (quantitative) probability, *genuine uncertainty* cannot be ascribed a probability. In many cases, genuine uncertainty cannot be reduced to any significant extent and must be dealt with by, for instance, strategic flexibility (concerning the Contextual Environment) or pro-active measures (concerning the Transactional Environment).

Values

See "Parameter values" or "Conditions".

Variable

A quantity or quality capable of assuming a set of values or conditions.

Wicked Problems: (See also "Social Mess")

Used by Rittel and Webber (1973) to denote a complex, continually developing and mutating social, organisational and policy planning problems.