

Gazette, Special Issue E (2012)

FCL - Future Cities Laboratory

Journal Issue**Publication date:**

2012-08-01

Permanent link:

<https://doi.org/10.3929/ethz-b-000120428>

Rights / license:

In Copyright - Non-Commercial Use Permitted

Originally published in:

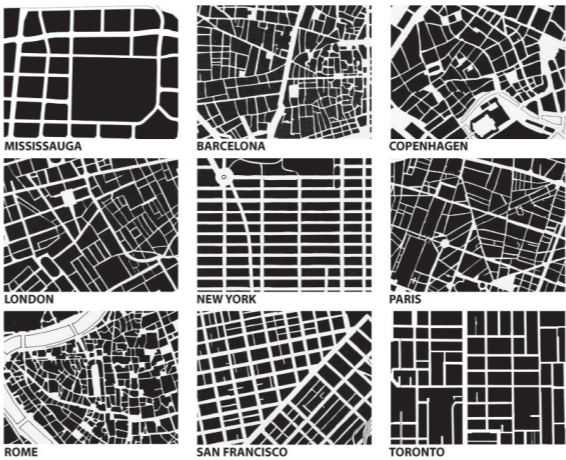
Gazette

Introduction

In this edition of the Gazette, three keywords, namely ‘metabolism’, ‘morphology’, and ‘mapping’ will be explored. The words will be studied individually in terms of their etymology and contextual usage in various fields of study. A Google Ngram of the words will be used to explore their usage in the literature over time. Subsequently, combinations of two words will be explored for potential meanings in various contexts. Finally, combinations of all three keywords will be attempted.

From the *Oxford Advanced Learner’s Dictionary of Current English* (2010), ‘metabolism’ is defined as the chemical processes in living things

that change food, etc. into energy and materials for growth. ‘Morphology’ is defined as the form and structure of animals and plants, studied as a science; the forms of words, studied as a branch of linguistics. ‘Mapping’ is defined as discovering or giving information about something, especially the way it is arranged or organised. It is represented by maps which is a drawing or plan of the earth’s surface or part of it, showing countries, towns, rivers, etc. From these definitions, we have a very basic understanding of the three keywords. We will look at the etymology of the three words in order to explore their potential meanings and nuances further.



‘Urban morphology diagram’, John Hazel 2006, *Studies in Urban Form*, Routledge.

Etymology

The word ‘**METABOLISM**’ is derived from the Greek composite word *μεταβάλλω*, which is composed of the word *βάλλω* and the prefix *μετά-*.

Βάλλω, a verb, means to throw; to cast. Some examples of English words derived from *βάλλω* are ballistics; parable; and parabolic.

The prefix *μέτα-* means over; after; beyond, and is equivalent to the Latin prefix *trans-* which is used in many cases in English. Some examples of English words derived from *μετά-* are metaphor; metaphysics; and metastasis. Thus the verb *μεταβάλλω* means to cast beyond; to throw over (or overthrow), i.e. to alter, to change.

phosis (change of form); morphodynamics (the dynamics of changing forms); and Morpheus (the god of sleep, who gives shape to dreams).

The suffix *-λογία* means branch of knowledge; study of something. Some examples of English words derived from *-λογία* are geology; biology; and sociology. *-λογία* itself is derived from the word *λόγος*, a noun, which means that which is said; that which is thought; account, explanation, narrative; subject matter. Thus the noun *μορφολογία* means the study of forms and shapes.

The word ‘**MAPPING**’ is derived from the English word *map*. Map is a shortened version of the Middle English *mapemounde*, a noun, which means world map and is derived from the Medieval Latin expression *mappa mundi*, which has the same meaning. *Mappa mundi* is derived from the Phoenician word for cloth, *mappa*, as the first maps were drawn on cloth.

The word ‘**MORPHOLOGY**’ is derived from the Greek composite word *μορφολογία*, which is composed of the word *μορφή* and the suffix *-λογία*.

Μορφή, a noun, means shape; form; appearance. Some examples of English words derived from *μορφή* are metamor-

Metabolism / Morphology / Mapping Combination of 3 Keywords

In attempting to combine all three keywords, two combinations were explored. In the first combination, as seen in the Venn diagram of Figure 1, mapping is a subset of morphology, which in turn is a subset of metabolism. What is expressed by the diagram can also be expressed by the phrase ‘metabolism of the morphology of mapping’. This formulation puts the three keywords in a hierarchical relational order. Mapping is the focus of this combination. Hence it is placed at the center of the diagram.

To dissect this relational order, *maps*, the product of mapping in its classic sense, are considered. Maps can be small or big; they can be folded, rolled or bound in a book format; they can be orientated towards the north, the south or not at all; they can be made of cloth, thus assuming a form that literally fits the term map, of paper, or not at all if they have an electronic form; they can use sophisticated geometrical transforma-

tions to allow the projection of earth’s curved surface on a flat material or be highly conceptual, resembling more a sketch than a map. There exists a whole *morphology* of maps. Certainly the education of cartographers, the people who make maps, involves lengthy study of this morphology, allowing them to learn the various forms maps may have. If the concept of time and the change (*metabolism*) of map morphologies are considered, then the phrase ‘metabolism of the morphology of mapping’ is easily understood.

In the second combination, as seen in the Venn diagram of Figure 2, morphology is a subset of metabolism, which in turn is a subset of mapping. What is expressed by the diagram can also be expressed by the phrase ‘mapping of the metabolism of morphology’. This formulation puts the three keywords in a hierarchical relational order. Morphology is the focus of this combination. Hence it is placed at the center of the diagram.

Figure 3 shows a schematic which explains this relational order. A *morphology* is an expression of internal dynamics, it arises from a content. The morphology of a beach for example expresses the relation between sediment, waves, currents and wind. The morphology of a city expresses the relation between pre-existing landscapes, societies that inhabit it, including their culture, prevailing ideologies and the economy. The relation of the internal dynamics is not constant, it changes, it is *metabolised*. Therefore the morphology itself is also metabolised. Mapping once would result in a mapping of morphology. *Mapping* many times as changes occur would result in ‘mapping of the metabolism of morphology’. With imagination many examples can be thought of. Furthermore one can just use an online search engine to query the phrase ‘building construction time-lapse movie’ to see a mapping of the metabolism of morphology.

A final word on the combination of the three words Metabolism + Morphology + Mapping. In the great literary work by H. G. Wells, *The Time Machine*, the interaction of the three words is evident in a sequence of events which is made very clear in the movie of the same name. by Dreamwords, Warner Brothers. The protagonist is a scientist who invented a time machine. After the death of his wife, he went fast forward into the future whilst sitting at the same precise location in the machine. As time travels, we see metabolism taking place as plants, cities and geological features change over time. The visuals capture the morphological changes whilst the geoposition of the time machine gave a sense of location on a map as the surroundings change.

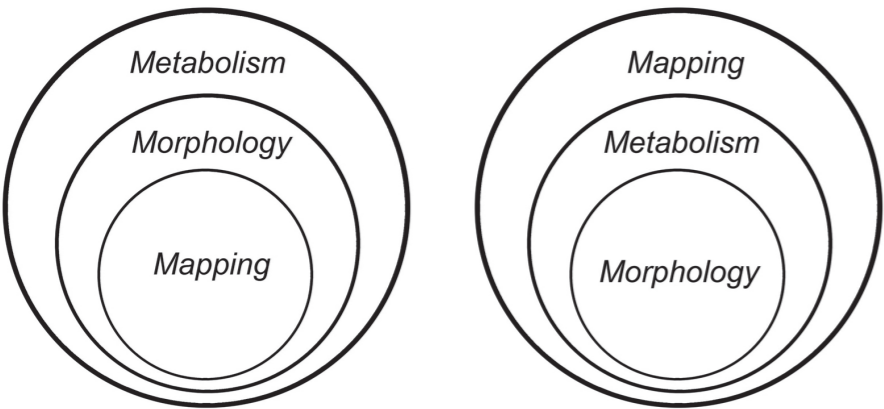


Fig. 1: Mapping as a subset of Morphology which is in turn a subset of Metabolism.

Fig. 2: Morphology as a subset of Metabolism which is turn a subset of Mapping

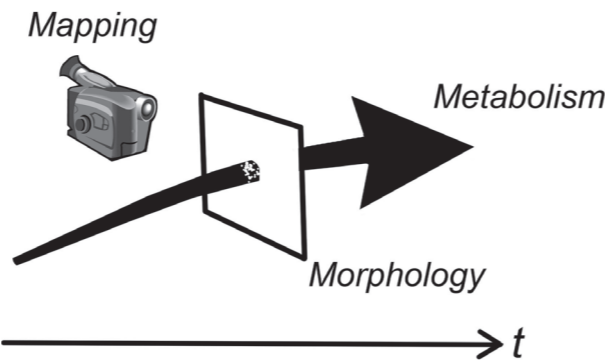


Fig. 3: A diagrammatic illustration of Fig. 2 whereby Metabolism is a process of internal change and growth. A cross-section of Metabolism captures the Morphology at any particular time. The machine or media which is used to capture the Morphology is the act of Mapping

(FCL) FUTURE CITIES LABORATORY未来城市实验室

GAZETTE

Special Issue	Tags
E	Metabolism, Morphology, Mapping
Date	Editors
01 / 08 / 2012	Abdul Rahim and Nikos Theodoratos
Fold, Punch, File	Published by
	FCL – Future Cities Laboratory Singapore ETH Centre for Global Environmental Sustainability (SEC) 1 Create Way, #06–01 CREATE Tower, Singapore 138602 chan.lishan@arch.ethz.ch
	ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich
	(SEC) SINGAPORE-ETH CENTRE新加坡–ETH 研究中心

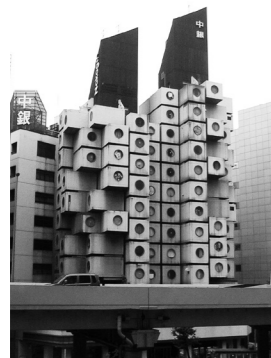
Metabolism

Biochemical metabolism has been studied and described since the sixteenth century by Sanctorius (1561–1636) who introduced the concept of insensible perspiration. Theodor Schwann (1810–1882) suggested three words, anabolism (ana- means ‘up’ in Greek), catabolism (cata- means ‘down’ in Greek) and metabolism to describe the whole process.

The concept of *social metabolism* has been used by the Marxist school and the Left as a means to critique the relation of Capitalism to nature. According to Padovan (2000), social metabolism is the form in which societies establish and maintain their material input from and output to nature; the mode in which they organise the exchange of matter and energy with their natural environment.

Agro-chemist J. von Liebig studied how urbanisation affected the cycle of nutrients. He showed that cities imported matter in the form of food, building materials, textiles, etc. , which eventually polluted water bodies instead of returning into the soil as it does in the countryside. Karl Marx explained how the development of industry by capitalism and the formation of the world market greatly increased and accelerated this process.

The Metabolist Architectural Movement was developed by architects in Japan in the 1950s. Its members had a vision for future cities inhabited by mass societies. The buildings and structures that would accommodate such societies should be modular, flexible and expandable. Their evolution would resemble the process of organic growth, hence the term ‘metabolist’.



The Nakagin Capsule Tower by Kisho Kurokawa

Metabolism + Mapping

A combination of the word ‘metabolism’ and ‘mapping’ is usually found in the metabolic pathway diagrams in biology. The metabolic processes carried out by the living cell, tissue or organ are specific biochemical processes that take place at a particular location; whereas mapping is the act of pinning down and communicating these processes and their locations, usually through a two-dimensional drawing or a three-dimensional representation of the particular cell, tissue or organ. For example, in aerobic respiration, biochemical equations for the process of pyruvate decarboxylation can be placed accurately on a drawing of an animal cell by locating it where the reaction takes place which is within the mitochondria. The biochemical equations for the electron transport chain can be mapped onto the mitochondrial membrane where it takes place.

Morphology

The morphology of flora and fauna have been studied since the nineteenth century and the common form of communicating such studies were detailed coloured drawings. This coincided with the Victorian penchant for collecting specimens from colonised countries.

Morphology is also used in geology to study features such as mountains, rivers and valleys. Figure 4 shows the morphology of different rivers.

Urban planners and designers use the term urban morphology. to describe the growth of towns and cities such as the one found in the *Journal of Design Research*, issue 4–1, by Salingaros, N (2004) in figure 5.

In linguistics, morphology is the branch that studies how words are put together. A morpheme is the smallest conceptual meaningful component of a word, or other linguistic unit, that has semantic meaning. A morpheme is physically represented by morph(s) in sentences.

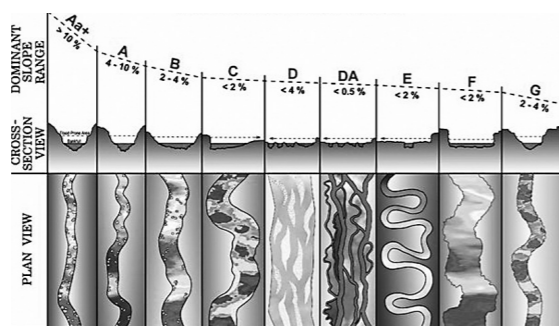


Fig. 4: Morphological differences in stream types

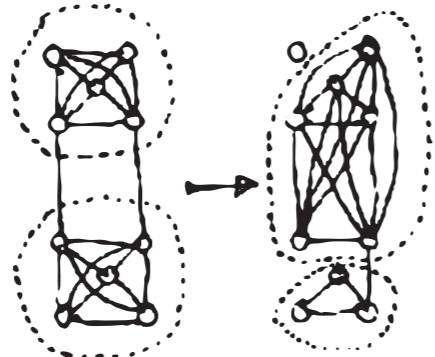


Fig. 5: Urban morphology

Morphology + Mapping

A combination of the words ‘mapping’ and ‘morphology’ would be a representation of the form and structure of physical and biological structures such as plants, animals, mountains and rivers. The geomorphology of a region can be represented on a three-dimensional terrain model derived from an accurate map in a GIS platform.

In linguistics, morphemes are like maps that explains the working of the language. In biology, phylogenetic trees or maps classifies flora and fauna according to their morphology.

Mapping

The word ‘mapping’ has its use in a variety of contexts. Its versatility comes from its generic definition which is about giving information, particularly to the way the information is arranged. Its representation can also be two- and three-dimensional. In physical geography, cartography and surveying are acts of mapping terrain and landforms, resulting in cartographic maps. The mapping of people into kingdoms, tribes or nations is done under the study of human geography. In biology, metabolic processes can be mapped onto a diagram or cross-section of a particular organ or tissue. In psychology, the act of mind-mapping mimics how the brain functions in terms of thought processes and the digestion of information. Gene-mapping is the act of elucidating the location of particular DNA sequences on a chromosome. In mathematics, mapping is thought of as a function that changes a variable into another. In this case, the function acts as the map because the resulting variable is specific for each starting variable.

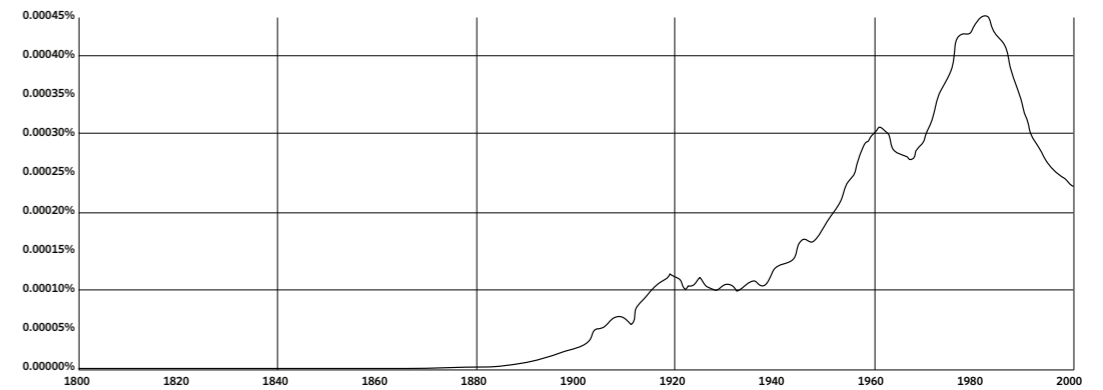
One may at first think of maps as precise, logical constructs. However, maps are neither neutral nor absolute. The accuracy and quality of representation on a map is dependent on the equipment, skills and knowledge at the time. Furthermore, each map tells a story of the one who maps and the environment in which that person is in. Some maps may tell a story of power struggles over a period of time, while others may tell a story of economy and trade.

‘Ever since John Harrison’s 1761 invention of the chronometer, which made possible the precise calculation of longitudes, the entire planet’s curved surface had been subjected to a geometrical grid which squared off empty seas and unexplored regions in measured boxes. The task of, as it were, ‘filling in’ the boxes was to be accomplished by explorers, surveyors, and military forces. Triangulation by triangulation, war by war, treaty by treaty, the alignment of map and power proceeded.’

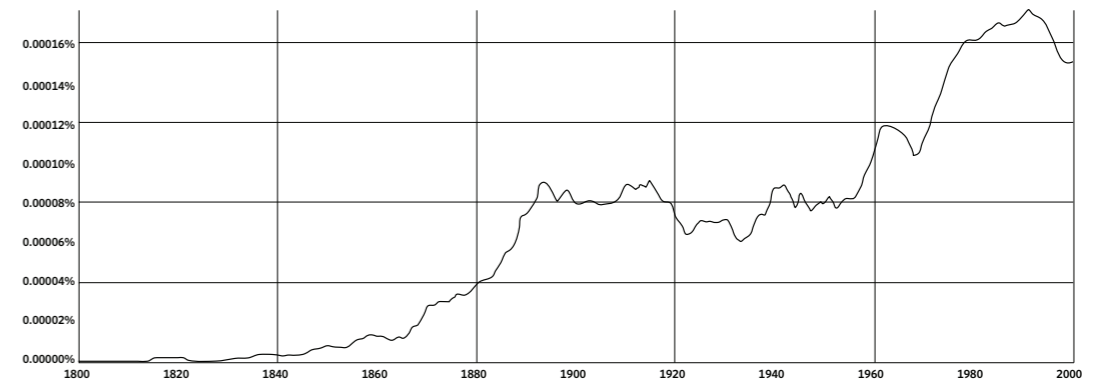
(David S. Landes, *Revolution in Time: Clocks and the Making of the Modern World*, chapter 9. In Anderson, B. (1991). *Imagined Communities: Reflections on the origin and spread of nationalism*. London: Verso, pp 163–185.)

Metabolism + Morphology

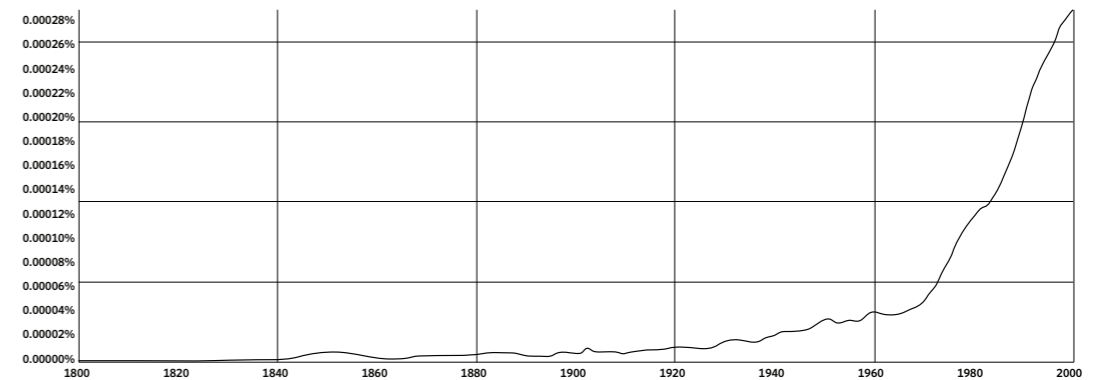
A combination of the words ‘metabolism’ and ‘morphology’ would have the connotation of a process of change of growth and the ‘morph’ that is the form and structure of a physical phenomenon. There is a time component to the study of form and this is usually communicated in time-lapse photography or a three-dimensional visualisation software that shows change of plant, building or city forms over time. Another way of looking at the combination of these two key words is to study the metabolism or change of linguistic ‘morphology’ over time, that is how the ‘morpheme’ of the language of a certain culture has evolved from the past to the present. For example, the Nini Talk website features a diagram showing the evolution of the languages of China from the Zhou Dynasty to the present.



Metabolism



Morphology



Mapping

From the Google Ngram, the word ‘morphology’ has the earliest use in 1820, followed by ‘mapping’ in 1845 and finally ‘metabolism’ in the 1870s. However, the usage for ‘metabolism’ took off exponentially in the 1900s after which it climbed linearly, peaking in about 1985. The usage of the word ‘morphology’ climbed steadily in the early part of the twentieth century but then took off almost exponentially in the 1980s, peaking in about 1995. The usage of the word ‘mapping’ was very gradual at the start but it took off exponentially around the late 1970s until the 1990s and just about to peak in the year 2000. This is presumably due in part to the advent of Geographic Information Systems (GIS) which saw great advances in geography and environmental visualisation but also the birth of a new concept of gene-mapping and the Human Genome Project.