7 Legends for design

Contents

7.1 Mapping

7.1.1 Introduction

Outline

The concept of mapping is basic to the visual representation of the earth. Maps used to be dominated by a strategic and military use, nowadays the use of maps has extended to use for quite different types of applications like wayfinding, tourism, travel and also spatial planning.
In urban design and landscape architecture, we see maps as a form of visual representation of the landscape be it urban, rural or infralandscapes. Maps can also be looked at from an artistic point of view. Especially old maps are sometimes pieces of art. Landscape architects and urban designers cannot work without maps; an striking difference with architects. It is not only important to learn how to read and interpret maps; the relation between map image and field image needs special attention and takes time to learn. In the design process it means that abstraction and reduction play an important role in urban design and landscape architecture due to sheer size and scale. So maps and cartographic techniques are basic for the representation of study areas and design interventions alike. Finally you should be able to make use of cartographic information in your drawing of plans at different levels. Problems of reduction and enlargement, of representation of hierarchy and of a 2D-representation of spatial situations should be basic knowledge for a designer.
'Mapping' is not always referring to making maps. It can also be used in a metaphorical way. In this context for instance 'cognitive mapping' (Downs & Stea, 1973) is used but also in expressions like 'mapping the city' that has nothing to do with maps as such but with a way of visualising urbanity.

Cartography and maps

What is a Map? A map is a graphic representation or scale model of spatial concepts, a means for conveying geographic information. Maps are a universal medium for communication, easily understood and appreciated by most people, regardless of language or culture.
Basic to the understanding of the concept of maps is that it is a "snapshot" of an idea, a single picture, a selection of concepts from a constantly changing database of geographic information.

Modern Maps

Maps became increasingly accurate and factual during the 17th, 18th and 19th centuries with the application of scientific methods. Many countries undertook national mapping programs. Nonetheless, much of the world was poorly known until the widespread use of aerial photography following World War II. Modern cartography is based on a combination of ground observations and remote sensing.
Cartography or mapmaking (in Greek chartis = map and graphein = write) is the study and practice of making maps or globes. The cartographic process rests on the premise that there is an objective reality and that we can make reliable representations of that reality by adding levels of abstraction. Maps are basically geographical or topographical models of the land. Maps function as visualisation tools for spatial data. Spatial data is acquired from measurement and can be stored in a database, from which it can be extracted for a variety of purposes. Current trends in this field are moving away from analogue methods of mapmaking and toward the creation of increasingly dynamic, interactive maps that can be manipulated digitally.
Standard features on modern maps are: a scale that is used for precise interpretation of phenomena, conventional signs with legends, a table that contains supplemental information about the specific places on the map, and the practice of orienting maps so that North is at the top and East to the right of the map.

Cartography and communication

Maps are a universal medium for visual communication about the earth. Cartography is related to, but different from other forms of visual communication. Cartographers must pay special attention to coordinate systems, map projections, and issues of scale and direction that are in most cases of relatively little concern to other graphic designers or artists. But, because cartography is a type of graphical communication, some basic insights to the demands of cartography can be learned from the practice of graphical communication and statistical graphics.

7.1.2 Types of maps

Maps are traditionally subdivided into topographic and thematic maps.

Topographic maps

Topographic maps are meant to give the most accurate as possible description of the surface of the earth and the objects that are on that surface like roads, rivers, buildings etc. and their names. Topographic maps are general reference maps showing coastlines, cities, and rivers and use contour lines to show elevation differences. All topographic maps have a military origin; they were first of all made for military use. Nowadays this has changed — military still use topographic maps — many other people make use of topographic maps, realtors, hikers, geographers etc. Nowadays most topographic maps are made on the basis of aerial photographs.
In Holland topographic maps are called 'Topografische kaarten', in Britain 'Ordnance Survey Maps', in France 'Cartes IGN'. Note the difference with a 'topological map'!

A topological map is a very general type of map that show relations but not exact locations, the kind you might sketch on a napkin. The maps of the Metro in Paris, the Underground in London and the railway maps of the Dutch Railways are examples of topological maps.

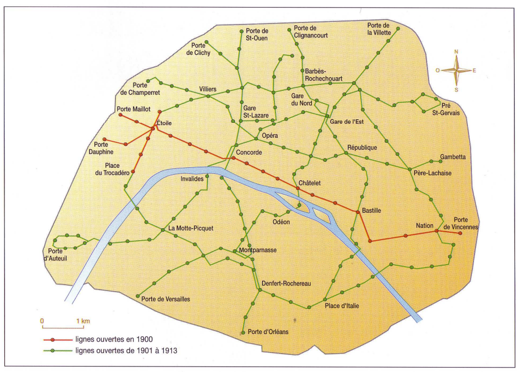


Fig. 1044 The topographic positions of the Metro stations

Fig. 1045 The topological representatin. To see the differences, focus on one line for instance line 1; Porte de Vincennes to Étoile on both maps

Thematic maps

soil maps, geological maps, census maps, historical maps show only a certain aspect like soil types, geology, distribution of population, history of places or events are thematic maps.
Census maps focus on population characteristics of a country. Census maps are thematic maps focusing on population distribution as well as data on such items as age, ethnicity, and income. Census maps help governments provide services to its citizens and plan for the future.
Types of maps being used in urban design and landscape architecture are — besides topographical maps — soil maps, land use maps, historical maps, road maps, hydrological maps etc.

A more modern division can be made between 'map sorts' and 'map types'

Maps sorts

Maps sorts refer to how maps are used; the function of maps. The most important use of maps is orientation. Whether to get across town or across the world, maps are crucial for navigation. They can help us discover the distances between objects and their relative orientation to one another.\

There are:
1. Orientation maps
2. Planning maps
3. Maps for prognosis
4. Management maps
5. Educational maps, atlases

Map types
Map types refer to the different methods of mapmaking. There are nine 'map types':
1. Chorochromatic maps
2. Choropleths
3. Isoline maps
4. Point distribution maps
5. Diagram maps
6. Dot maps
7. Movement maps
8. Spatial models

The types of spatial information on a map
Any map contains different types of spatial information:

1. Topographic; defines the location (where?)
2. Thematic; defines the attribute or quality of the information (what?)
3. Thematic cartography involves maps of specific geographic themes oriented toward specific user groups.
4. Temporal; defines the time (when is topographic and/or thematic information defined?)

Use of maps
The predominant use of maps is for orientation and way finding. Maps can also be used to analyse the land, the topography or any geographical phenomena represented on maps. Designers and planners use maps as basis for their work: to study the form of the land, occupation and land-use, spatial developments and change. This is done by map analysis, for instance by comparing maps from different time periods. A special topic in urban design and landscape architecture is to study the relation between field image and map image. That is part of the visual research of the site. You should always use topographic maps as a basis for your work; no road maps, no city maps (unless you are analysing the road system)!

Geographical information systems (GIS)
Nowadays GIS is an important part of map production, mapping and geographical research. GIS is a digitally based system that adds content to the visual representation on the map. Note that this is different from labeling. For instance the green colour on the map can refer to grassland but in a GIS-system any surface on a map can contain information about that surface. This information can be updated, changed and extended easily. So it offers a possibility for a wide range of applications. The software of ESRI — like ArcInfo, ArcView — is still most used and more or less a standard (www.esri.com).
Learning GIS takes quite some effort and time. There is no way we can teach GIS in the context of this course, this is only a short course on visualisation in urban design and landscape architecture. GIS is a specialist tool that has a different scope and content; it is one of the many research tools for urban designers and landscape architecture. Unfortunately we don't have a structured introductory course in GIS in the department yet, it will definitely come in the future. Steffen Nijhuis (S.Nijhuis@tudelft.nl) is one of the specialists at GIS and its applications in the department of Urbanism.

Types of maps in the Netherlands
The Dutch government is responsible for the production of maps of the country. In former days the Topographic Survey, and nowadays the land registry (*kadaster*), is officially assigned the task of producing topographic maps on the scales 1:10,000 1:25,000 1:50,000 1:100,000 and 1:250,000. Other standard maps include soil maps, geomorphological maps and geological maps. These maps do not cover the whole country. Soil maps, geomorphological maps and geological maps have a

standard scale of 1:50000. These maps are based on 1:50,000 topographic maps, which are printed in grey on these maps.

Other maps

There are several other maps, such as historical maps, older topographic maps (the most important is perhaps the topographic military map dating from around 1850 on a 1:50,000scale), waterway maps, sea charts, water board maps, motorway maps, cycling maps, maps showing administrative boundaries, maps illustrating demographic spread, etc.
All topographic maps are based on a grid of 1:50,000 (see Fig. 1), from map 1 in north-western part of the country to map 62 in the south-eastern part of the country. These 1:50,000 maps are subdivided into Western (W) and Eastern (O) maps, for example : in Amsterdam no 25 O, the O stands for east. The same system is used for larger scales and is further subdivided (see *Fig. 1046*).

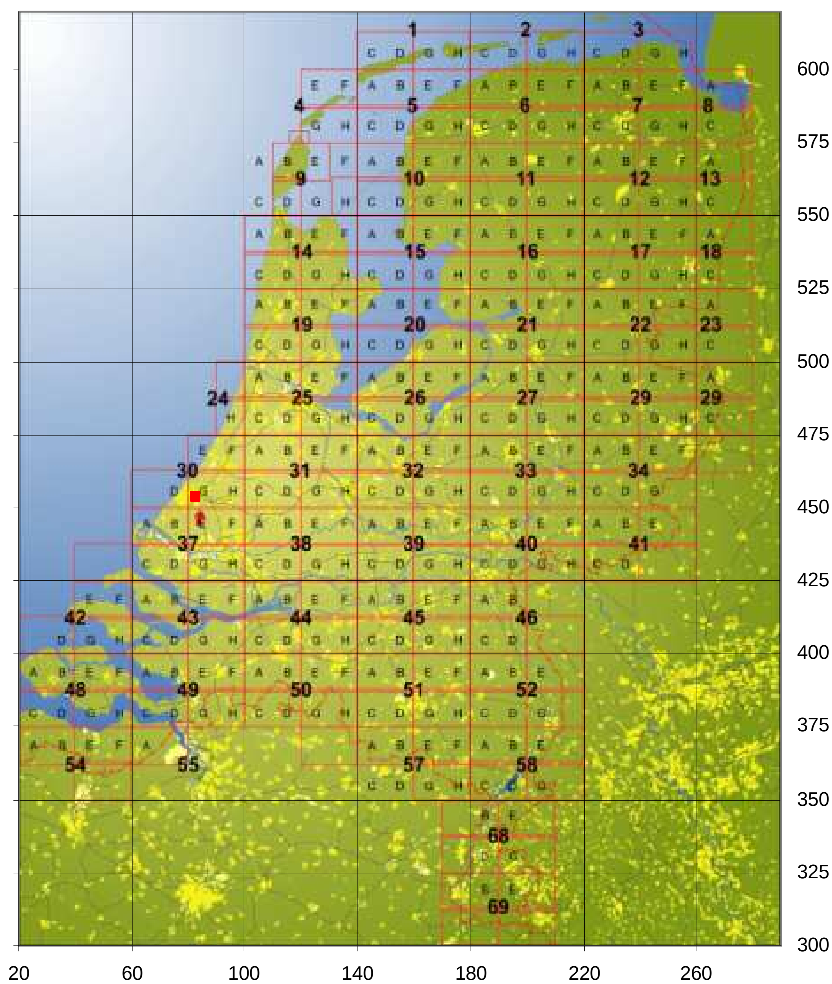


Fig. 1046 Subdivision of topographical maps 1:50,000

25	Original military map nr. 25

25 west	25 oost	Divided in West and East

1:50,000

25 A	25 B	25E	25 F	Divided in 8 maps A-H
25 C	25 D	25 G	25 H	

1:25,000

25 AN 25 AZ	25 BN 25 BZ	25 EN 25 EZ	25 FN 25 FZ	Divided in N=North and Z=South
25 CN 25 CZ	25 DN 25 DZ	25 GN 25 GZ	25 HN 25 HZ	

1:10,000

Fig. 1047 Coding of Dutch topographical maps on different scales

7.1.3 Perception and reading of (topographical) maps

Map reading; from form to content.

Reading maps is for a great deal a matter of pattern recognition and being able to see structure. A map is in some or another way a model of reality that is reduced to the structure of that reality that is represented. Map reading includes the capability to read: longitude and latitude, relief or elevation, land use, hydrological system, administrative boundaries etc. Map reading, therefore, means the interpretation of various symbols, colours or grayscales, type of lines.

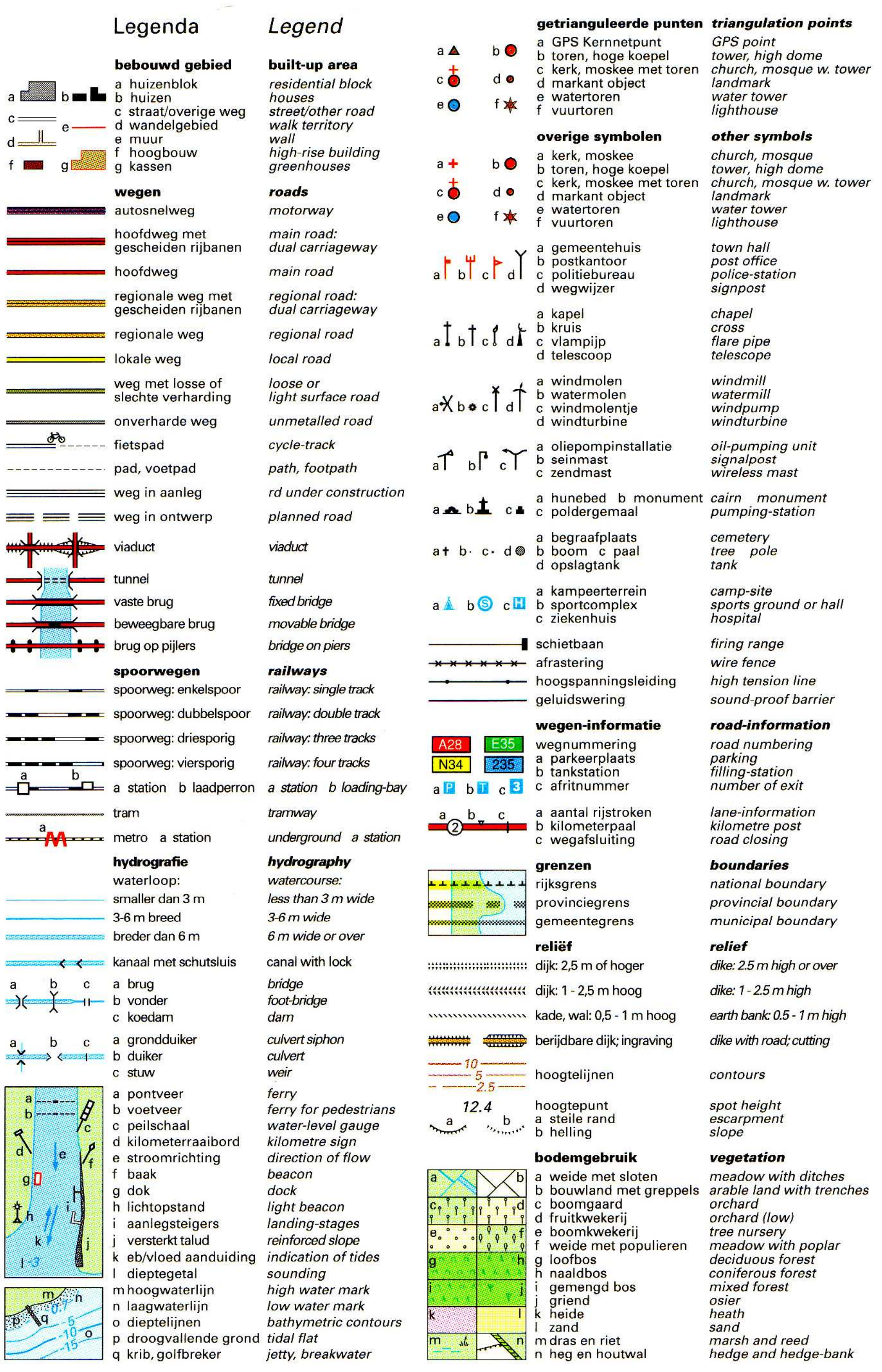


Fig. 1048 Different legend units in a Dutch topographic map

Legends; the reading of maps

You cannot 'read' a map without legend and scale. Sometimes the legend is also called the 'key'. You can distinguish three types of legends on topographic maps:

1. Labels; e.g. a colour green means 'forest'
2. Symbols or icons; e.g. a pumping station is represented by a symbol that is identical anywhere on Dutch topographic maps even though all pumping stations have a different form.
3. Scale representations; e.g. parcels do have the same form as they have in reality, but are scaled down.

Scale; determining size and distance

Scale is relative size. A map or relief model, to be most useful, must accurately show locations, distances and elevations on a given base of convenient size. This means that everything featured on the map or model (land area, distances, rivers, lakes, roads, and so on) must be shown proportionately to its actual size. The proportion chosen for a particular map is its scale.

The scale of a map can be defined simply as the relationship between distance on the map and the distance on the ground, expressed as a proportion, or representative ratio.

Different scales
1:50.000 scale
1:25.000 scale
1:10.000 scale
1:5.000 scale

Scale means relative size; for instance on a 50.000 scale, 1 cm represents 50.000 cm or 500 m.

Different scales of the same area

Fig. 1049 - Fig. 1052 show the Faculty of Architecture building and surroundings. The parcelling and form of the buildings is according to the real form; scale representations.

Fig. 1049 1:50.000 (2x2 cm= 1km2)

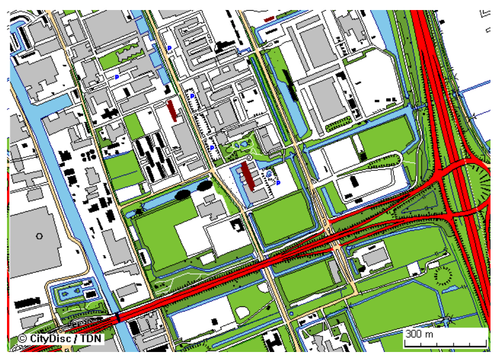


Fig. 1050 1:25.000 (4x4 cm= 1km2)[a]

[a] CDROM 'The Dutch national street guide with maps of the National Topographic Map Service, Emmen' (The Hague) Citydisc

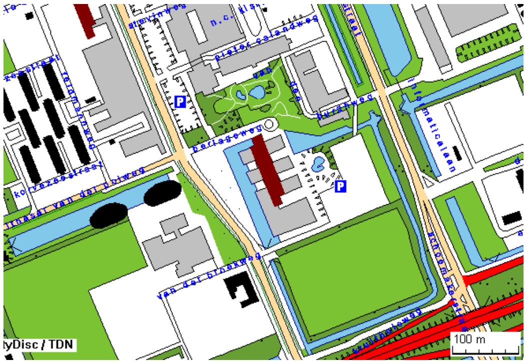


Fig. 1051 1:10.000 (10x10 cm= 1km2)

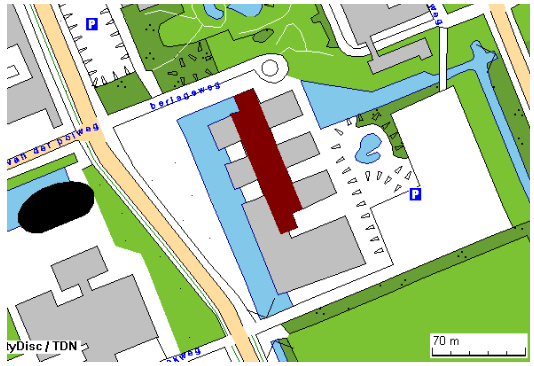
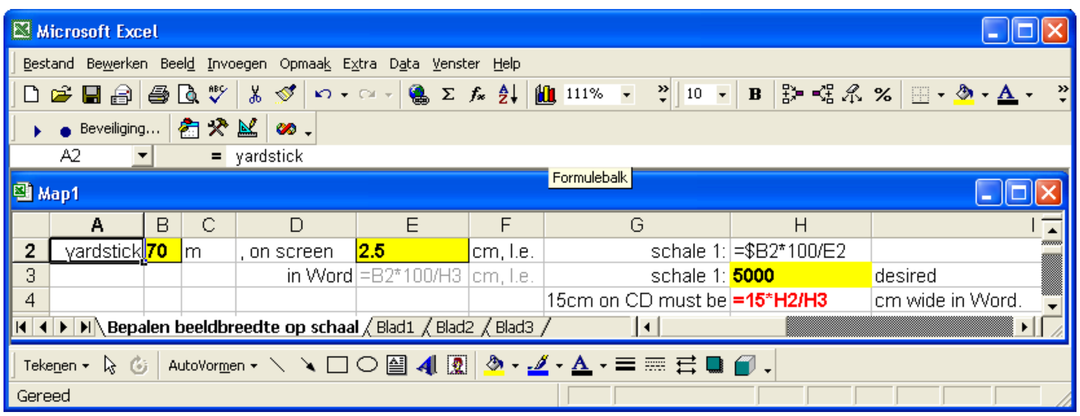


Fig. 1052 1:5000 (20x20 cm= 1 km2)[a]

Importing images from an electronic source at the appropriate scale

Importing the image of an area from an electronic source with a yardstick at the appropriate scale into a word processor similar to Fig. 1049 – *Fig. 1052* could be done as follows. Make the image in the window of the electronic source exactly 15 cm wide (and for example 10 cm high). Copy the map to the clipboard (Ctrl+C). Note the name of the place, district and street. Note the nominal size of the yardstick in m (for example 70m like *Fig. 1052*) and the size on the screen in cm (for example 2.50 cm.) measuring it with a real ruler from screen. Put these measures and the desired scale in an Excelsheet with formulas as given in *Fig. 1053*.



result:

70	m	, on screen	2.50	cm, I.e.	schale 1:	2,800	
		in Word	1.4	cm, I.e.	schale 1:	5,000	desired
				15cm on CD must be		8.40	cm wide in Word.

Fig. 1053 Calculations to import an image at the appropriate scale in a word processor

Put the map in the wordprocessor using Ctrl+V. Keep the image selected. Select 'lay-out', 'image', 'width' and enter at 'width' according to 'cm wide in Word' (8.40 in Fig. 1053). Press ENTER. The figure has the desired scale when you print it. Don't forget to quote the source under each map used because of copy rights. Don't make more than one hard copy and only for personal study purposes.

Screensize and printsize

However, the screen you are looking at right now is often not A4. To check that you can adjust the zoom percentage of the screen until you have an A4 of 21,1cm width (for example 95%, dependent on the type of screen). Click 'Image' and 'Ruler'. Check the number of centimetres above the text on screen with a real ruler. Measure from the centre line of the surrounding streets the size of an urban

[a] CDROM 'The Dutch national street guide with maps of the National Topographic Map Service, Emmen' (The Hague) Citydisc

island. Check with the yardstick in the image whether you have done it properly! Note attributes such as in this example: there is a public space at the rear and a park on the edge of the urban island. Add photographs if you have.

Why do we need to adjust the planimetric scale?

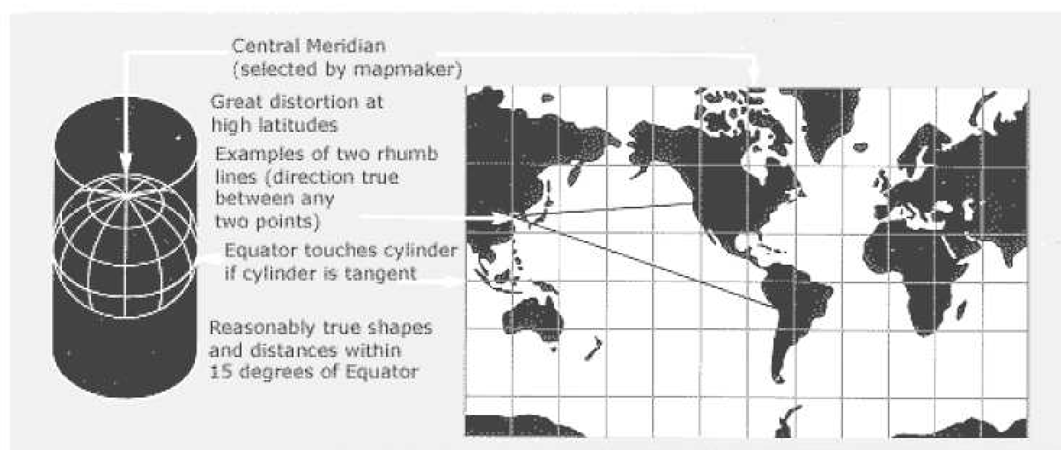
The smaller the scale of a map is, the fewer the features that can be accommodated. Obviously, therefore, the larger the scale the more comprehensive the map.

Conversion table

0.001 km =	1 m =	100 cm
0.1 km =	100 m =	10.000 cm
1 km =	1000 m =	100.000 cm
$1\ km^2$ =	100 ha =	$1.000.000\ m^2$
	1 ha =	$10.000\ m^2$

Map projections

A map projection is any of many methods used in cartography (mapmaking) to represent the three-dimensional curved surface of the earth or other body on a plane, a two-dimensional space. The term "projection" here refers to any function defined on the earth's surface and with values on the plane, and not necessarily a geometric projection.



Source:

Fig. 1054 A map projection

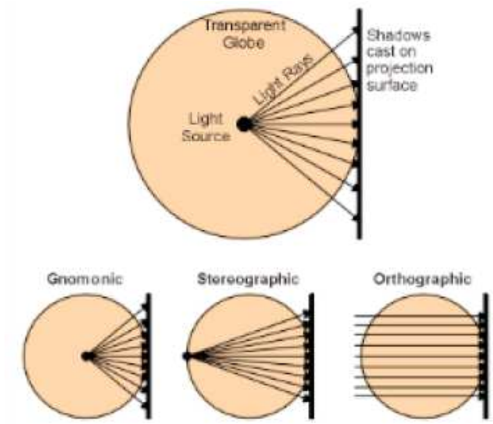
This process always results in distortion to one or more map properties, such as area, scale, shape, or direction. Because of this, hundreds of projections have been developed in order to accurately represent a particular map element or to best suit a particular type of map. Data sources for maps come in various projections depending upon which characteristic the cartographer chooses to represent more accurately (at the expense of other characteristics).

Different types of projections

In the case of the 'Mercator projection', it preserves the right angles of the latitude and longitudinal lines at the expense of area, which is distorted at the poles, showing the land masses there to be larger than they actually are.
Flat maps could not exist without map projections. Flat maps can be more useful than globes in many situations: they are more compact and easier to store; they readily accommodate an enormous range of scales; they are viewed easily on computer displays; they can facilitate measuring properties of the terrain being mapped; they can show larger portions of the earth's surface at once; and they are cheaper to produce and transport. These useful traits of flat maps motivate the development of map projections.

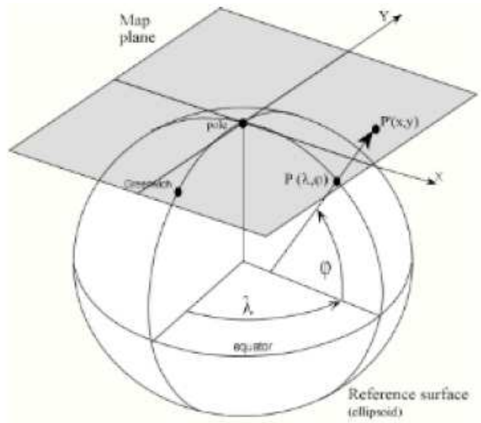
Coordinate system; the defining of location

A coordinate system is just a way of systematically denoting and labeling points in space. Numbered aisles in supermarkets, grids on road maps, and lines of latitude and longitude on the Earth are all coordinate systems which we use every day. Coordinate systems are usually based on two lines, or axes, which are most often perpendicular to one another. In a city, for instance, one building may be "two blocks north and four blocks east", from another, in which case the compass directions of north and east are used as a basis for the grid of the city.



Source:

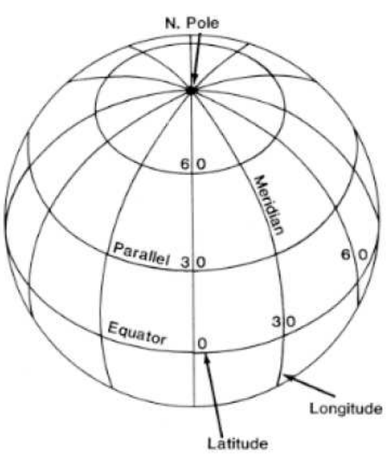
Fig. 1055 Projecting on a plane



Source:

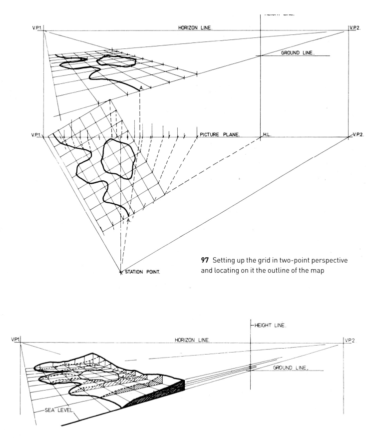
Fig. 1056 Calculations

The dawn of the Great Age of Discovery, some five hundred years ago, greatly increased the demand for accurate maps and charts. The explorers needed maps which covered areas much more vast than those we have yet constructed; they required maps of nothing less than the entire world which they were exploring. Indeed, much of the work of these early explorers involved making newer, more accurate maps of little- or never-traveled regions.



Source:

Fig. 1057 Latitude, longitude



Source:

Fig. 1058 Elevation

Even still, it was not until about a century ago that a standard coordinate system to describe locations on the Earth's surface was adopted. An international convention devised the now-familiar system of latitude and longitude and fixed its reference points. A line of longitude (a meridian) passes through both the North and South Poles. They are labelled according to their angular distance from the prime meridian which passes through Greenwich, England by international agreement. Meridians are labelled between 0° and 180° East or West of the prime meridian. Lines of latitude (often called "parallels") are parallel to the Equator, and are labelled according to angular distance from the Equator- between 0° and 90° North or South. Any point on the surface of the Earth can be uniquely specified by just these two coordinates, latitude and longitude.

The lines of latitude and longitude are not straight, since they are on the surface of a sphere. Nevertheless, if one looks at a small enough region, like a city or a town, that region of the Earth is nearly flat, so the lines of longitude and latitude appear straight and seem to form a square grid. Note that close to the Poles, where the meridians converge, the slant of the meridians is quite noticeable, even on small scales, so even if they appear straight, they won't form a square grid.

GPS (Global Positioning System)

What is GPS? The Global Positioning System (GPS) is an American worldwide radio-navigation system formed from a constellation of 24 satellites (space vehicles) and their ground stations. It is built and operated by the US Dept. of Defense for military use.
Europe is working on its own system called 'Galileo'; it will be available in a couple of years and will be more accurate. GPS uses these "man-made stars" as reference points to calculate positions accurate to a matter of meters. In fact, with advanced forms of GPS you can make measurements to better than a centimeter!
GPS receivers have been miniaturized to just a few integrated circuits and so are becoming very economical. And that makes the technology accessible to virtually everyone. These days GPS is finding its way into cars, boats, planes, construction equipment, movie making gear, farm machinery, even laptop computers. Soon GPS will become almost as basic as the telephone; part of 'ubiquitous computing'.

The GPS User Segment consists of the GPS receivers and the user community. GPS receivers convert satellites' signals into position, velocity, and time estimates. Four satellites are required to compute the four dimensions of X, Y, Z (position) and Time. GPS receivers are used for navigation, positioning, time dissemination, and other research.
> Navigation in three dimensions is the primary function of GPS. Navigation receivers are made for aircraft, ships, ground vehicles, and for hand carrying by individuals. All navigation systems in cars are based on GPS. In sports like sailing GPS is used to determine positions and navigation.
> Precise positioning is possible using GPS receivers at reference locations providing corrections and relative positioning data for remote receivers. Surveying, geodetic control, and plate tectonic studies are examples.

Elevation

In geography, the elevation of a geographic location is its height above mean sea level (or some other fixed point). Elevation is mainly used when referring to points on the earth itself, while altitude is used for points in the air, such as an aircraft. Difference in elevation is also called 'relief'. Relief is in general the showing of a three-dimensional surface on a map; the showing of hills and valleys is not substantially different from that of representing a statistical surface such as the rainfall distribution. People are notoriously poor at reasoning in three dimensions and so it is no surprise that many people find relief harder to interpret than most other information on a map. There are more than a dozen distinct methods for showing relief and so the map designer has a wide choice.
It is more or less a convention in cartography to use darker tones/colours for higher elevations and lighter for lower.

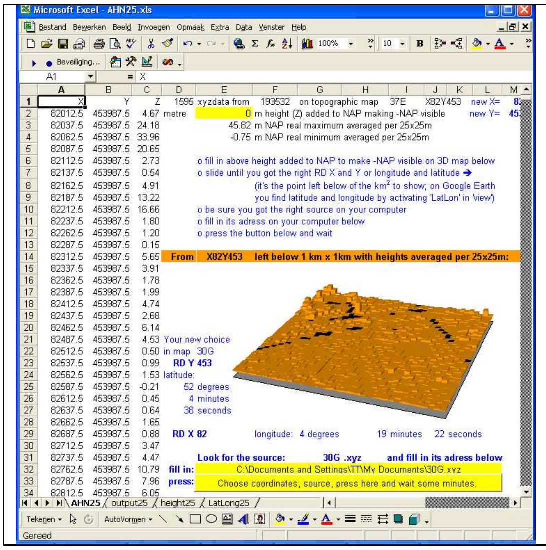
Making 3-D models of topographic maps

Still a comprehensive work, making a 3-D map on the basis of a topographic map.
Haaften (2001) gives a short outline how to do this. Gill (2006) is more extensive in that sense.

The 'Meetkundige Dienst' RWS[a] measured the elevation of The Netherlands every 5 metre. It resulted in a database called 'Algemeen Hoogte Bestand' (AHN) with X, Y and Z coordinates for every measure point to be imported in a CAD or GIS application[b]. The database is divided in smaller parts than *Fig. 1046* because of its enormous size (>50Gb). To get grip on this incomprehensible multitude of figures you can get some of the databases and load them one by one in Excel using an application developed for that purpose (*Fig. 1059*).

[a] http://www.neonet.nl/browse/dcn.waterland.net/neonet/Organisation/AGKYQJSWOPUBOTRJVEEXOQTVO.html

[b] available in the map library of the Faculty of Architecture TUD



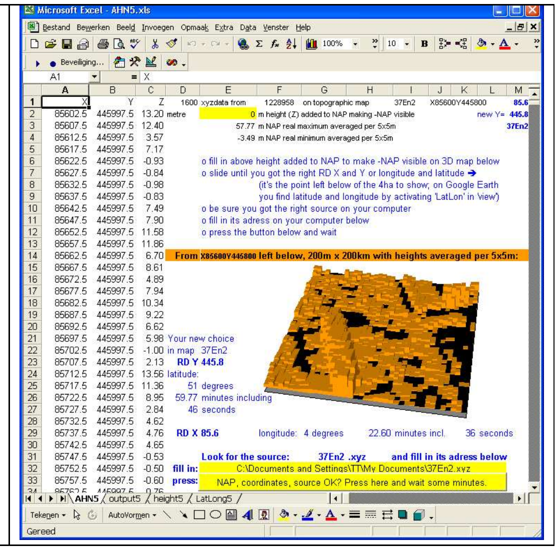


Fig. 1059 AHN 5x5m *Fig. 1060 AHN 25x25m*[a]

However, it is still difficult to recognise the topographic features, because incidental vegetation disturbes the image. So, the database is aggregated into another database with 25x25m cells (see *Fig. 1060*). But even then it is difficult to recognise the Mekelweg in Delft.

Learning to read maps by combination of sources

The more you know about the background of an area in terms of soils, geology the better you will be able to understand the form of the landscape and what you see on the map. Nonetheless all urban designers and landscape architects should be able to read and interpret maps of areas, even though you have never been there or you are not familiar with.

Learning to read maps is a matter of doing; only by experience you gain more insight. The legends and scales as such are not very difficult to understand but the interpretation is the tricky thing. Reading and interpreting contour lines is even for experienced map readers difficult. In Holland we have the disadvantage of not having any mountainous region so there is less possibility to practice that aspect of map reading.

7.1.4 Map analysis and interpretation

Reduction and analysis

Analysis of maps always needs reduction. Reduction of maps (Leupen et al., 1997) is a basic technique in map analysis. Reduction is based on abstraction but is not the same. When you reduce information on a map, it might be one aspect. For instance when you want to analyse the water system, you could leave out the road system in order to focus. Depending on the purpose you leave out information in order to emphasise other information. In case of abstraction you generalise, that is you lower the scale and depending on the size you leave out detailed information. For instance on the map 1:400.000 of Holland, the city of Delft is represented by a small point or circle whereas on the scale 1:25.000 you can distinguish the street patteren, main plaza's etc.

Working with layers

The working with layers is very well known technique in map analysis. Formerly with (transparent) paper, now with digital layers like they can by used in Illustrator. Say you want to research the relation between occupation pattern and elevation of a certain area. You then first make one layer with only the dwellings of that area. Then you do the same for the elevation. By comparing the two you might find a relation; for instance at Walcheren, in the province of Zeeland, you will find that the occupation pattern is related to the higher areas; the ridges of the former creeks. Like in statistics; finding relations

[a] *http://team.bk.tudelft.nl/* > Publications > 2006

is one, secondly you will have to research whether these relations have also causal relations or are haphazard. These research by means of layers can be done in an analogue way (mostly with transparant paper) or digitally like the layers in Illustrator.
The principle here is that you research vertical relations in the landscape.
Still one step further is to make use of GIS. Nowadays analysis of maps is more and more done with GIS. The digital analysis of geographical information and cartographic information is not only cheaper as soon as information is available in digital form, it gives also opportunities for larger scale research with almost infinite amount of data.

Comparing maps in time

Analysis of maps by comparing maps of the same area from different time periods. Historical development can be analysed by comparing maps from different time periods of the same site. For the city of Delft, Geurtsen (1988) did such a study for the urban development of the city.

Fig. 1061: The development of the city of Delft according to Geurtsen[a]

Source:

Fig. 1062 Compare this historical analysis with the present situation!

It can also be shown in one map, like Ven (2004) did for the polders around the Dollard, up in the north in the eastern part of the Province of Groningen.

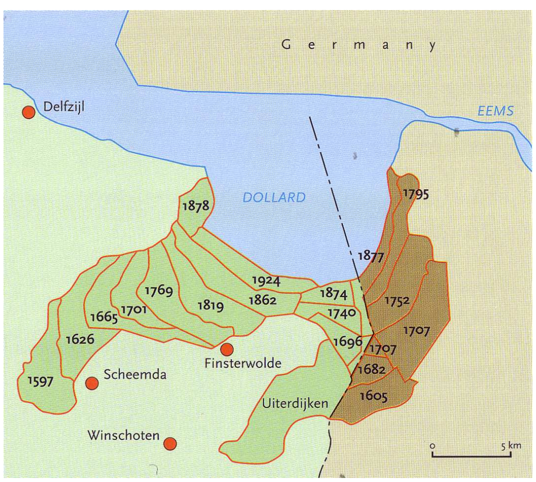


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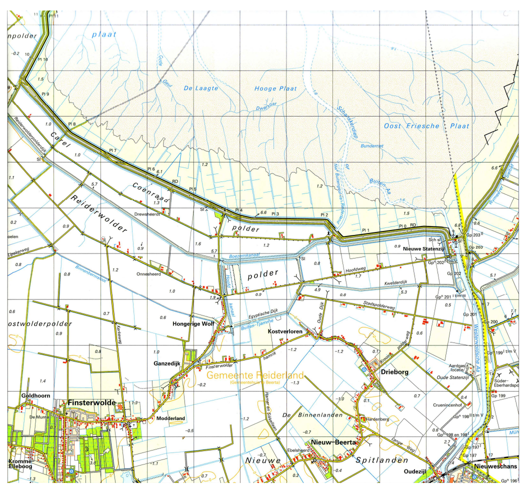
Fig. 1063 Showing the process of landscape development; the making of polders in the Dollard area in the northeastern part of Holland, the process of the subsequent polders in time[b]



Source:

Fig. 1064 The topographic map of the area.

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[a] *Geurtsen ()*
[b] *Ven, 2004*

Analysing of places by means of maps

Analysis of maps by comparing different aspects of the map. Maps represent spaces, places by horizontal and vertical elements. Horizontal elements are: roads, roadsystems, watersystems, parcelling. Vertical elements are: built structures, differences in elevation, plantation. This we call a spatial and/or visual analysis.
By adding the flows of people, material, energy and information you can get an idea how a place works and functions.

In most countries the relief is much more outspoken than in Holland. Formally Holland does not have 'hills' and 'mountains'; the highest point in the South (Vaals) is less than 400 m above sea level. Even though the differences in elevation are not outspoken, in Holland small differences in elevation can make great differences in occupation and land-use.
The only way to analyse the basic topography is to make an analysis on the basis of contour-lines.

7.1.5 Making of maps and communication

Cartographic drawing

Maps can be seen as a form of visual communication — a special-purpose language for describing spatial relationships. Although it is perhaps unwise to draw a direct analogy between cartography and language, concepts such as "grammar" and "syntax" help to explain, at least metaphorically, the sorts of decisions cartographers make as they compose maps. Cartographers seek to make use of visual resources such as colour, shape and pattern to communicate information about spatial relationships. The analogy with language also helps explain why training in principles of effective cartography is so important — it allows us to communicate more effectively.
Drawing maps — cartographic drawing — is a specialist activity. Urban designers and landscape architects should have a basic understanding and insight in cartographic principles.
Keep in mind that cartography in whatever form is a way of communication. What you want to communicate defines the way you are going to work on maps.

Making maps; from content to form

1. Classification and typology. You start out with a classification and typology of the geographical information you have. It is clear that this distinction forms a direct relation with the legend.
2. Generalisation and reduction of maps. Sometimes information is too detailed and needs to be generalised into more global classes or types. Any change in this sense refers at the same time to scale and legend. Every scale has its own legend.
3. Abstraction and diagrams. Any cartographic representation as a map can be considered as a form of abstraction. Sometimes it helps to add diagrams to give additional information next to the map.

Upscaling and downscaling

Re-scaling; upscaling and downscaling. In general downscaling is easier than upscaling. If you compare in an atlas the same area at different scales, you can see the effect of downscaling and upscaling. A different scale shows a completely different image, not just diminishing in size. So every scale has its own image and its own legend.
Technically, downscaling is always always possible as long as you adapt the legend and reduce information, whereas upscaling is only possible if you add new information. In practice you can always 'diminish the size' of maps but not 'enlarge' them. You cannot enlarge or reduce maps without changing the legend! A number of factors influence the options for re-scaling. First you have to identify and measure the area you want to reproduce. For your ease, you will select a rectangular shape including the core area (e.g. protected area, watershed, ancestral domain, or other) and its environs of ecological, cultural and economic significance. If the core of a protected area is a mountain, the rectangle will include the downhill catchments and possibly the settlement areas where most dependent communities reside.

Making cartographic models

The choice of the scale and hence the size of the model should take into account the need for accuracy as well as the need for enough space in which physically to construct and store the model.

Maps and mapping in Holland

Holland has a long cartographic tradition. From the 16th century on Dutch cartographers made maps, not only of Holland but also of other parts of the world. In many cased there were military uses for maps; sea maps, maps of fortifications and topographic maps of an early stage. At the end of the 18th century the first ‘Topographic office’ was established based on French ideas and models. The main goal was a military cartography of the whole country. In 1932 the ‘Topographic service’ was formally established still under military rule. Between 1876 and 1953, a series of 25.000 maps was produced of the whole country; the so-called ‘Bonne-sheets’.
Gradually this series was replaced by a series on 25.000 based on the stereographic projection. In 2004, a new organisation was set up; the ‘Topographic service Kadaster’. This organisation is a formal part of the government service that has independent tasks of producing basic maps, of registration of real estate. It is a public service open to everybody. Nowadays most topographic information is digitally-based information.

In Holland we now have basically three scales in topographic maps; 50.000, 25.000 and 10.000.
The TOP10vector is the basis for all Dutch topographic maps. From this TOP 10vector, the 25.000 and the 10.000 scales can be directly derived. The 50.000 scale needs to be generalised otherwise it will be unreadable. This digital information forms the basis for the production of paper maps, for GIS information, maps for special purposes.
All topographic maps can be ordered at the website of the topographic service; www.tdn.nl

GoogleEarth and Web-mapping

Maps have traditionally been made using pen and paper, but the advent and spread of computers has revolutionised cartography. Most commercial quality maps are now made with map making software that falls into one of three main types; CAD, GIS, and specialised map illustration software.
'Web-GIS' is the culmination of what is regarded as a 'Geospatial Data Infrastructure' or 'GDI.' A GDI is a set of institutional, technical, and economical arrangements used to enhance the availability of correct, up-to-date, to-the-point and integrated geospatial data with regard to timeliness and price affordability, all of which combine to support efficient decision making processes. A GDI is composed technically of geographic information systems, networks, computers, and a plethora of software applications (Plewe, 1997).
Web-GIS consists of a sequence of geo-processing tasks that are distributed over server-side and client-side computer systems. A client is a Web browser. A server consists of a Web server and a Web-GIS software system. A client requests a map or makes a geo-processing request over the Web to a remote server. The Web server translates client requests into internal codes and invokes GIS functions by passing formatted requests to Web-GIS software. The later software returns results that are reformatted for interpretation by the client browser or with additional functionality from a plug-in or Java applet.
Maps generated by a Web-GIS are often called 'Web maps (Plewe, 1997).' They are an interface between a client and the GDI. The design of Web maps is critical for the correct communication of geospatial databases. Conventional and historical GIS analyses have traditionally evolved around constructions using paper maps. With the advent of the Internet, the practices of GIS had to be migrated into the Web environment.

GoogleEarth

GoogleEarth has really revolutionised web-mapping in every sense of the word. For the first time in history, maps of the entire world are available for all those who have internet. For urban design and landscape architecture the possibilities are hard to oversee; we still discover new types of use beyond the already existing of getting maps freely at almost every conceivable scale. Especially in the field of interpretation the possibilities are still to be further discovered. The development of GoogleEarth goes so fast, both in getting more detailed information and in the applications that you can use it for, that you have to keep track frequently to keep up to date. Do regularly download the user manual; it is also free and excellent.

At present, there are few formal standards for the design of Web maps. The visual perception of Web maps is decidedly different from paper maps. This perception is a fundamental consideration during a design phase for Web-GIS. Digital map authoring (i.e. cartography) tends to be more constrained in its available toolset than that used for paper map design. Subsequently, Web-GIS strive to 'emulate' paper map productions and presumably this weighs considerably in any Web-GIS selection. Web-GIS does offer an acceptable differentiation from conventional GIS through the use of animation, rotation functions, three-dimensional viewing, user interaction, and other multimedia presentations (Beddoe, 1997).

Representing objects, their environment and development

Specific problems associated with urban development within rural areas require knowledge of the city itself and of the surrounding countryside. This task needs up-to-date and reliable planning information, including development strategies, processes that take place in and around the city and the spatial spread of characteristic elements. Maps are a good method to lay down information and processes. For the town planner, analyses and interpretations are essential methods to identify and understand processes, and the possibilities and limitations of a region. Regional analyses and interpretations constitute the most important arguments and motives for a design.
Knowledge of the city and surrounding countryside can be derived from maps. When maps are not available or out-dated, aerial photographs and satellite images can be used.
Maps of the Netherlands are numbered according to grids.

INSPIRE is coming

The European Commission and the European Parliament have reached agreement about Guidelines for the set up of a foundation of infrastructure for Spatial Information in the European Community or Infrastructure for Spatial Information in Europe or INSPIRE. For the moment INSPIRE is targeting on the development and execution of environmental management. But the list of information belonging to INSPIRE is more extensive and will give information all kind of subjects belonging to the Spatial Sciences.

The more abstract language of the guideline should be translated into a more practical one for interpretation and definition of a number of specific standards and the description of a limited list of spatial data.

INSPIRE has five basic principles (INSPIRE 2007):

1. Data are once gathered and maintained where it is most efficient.
2. The possibility should be given to combine data of different sources and that these data can be consulted by many users for different purposes.
3. Spatial data should be gathered on one level of the government and it should be possible to use these data on all levels of the government.
4. Spatial data that are necessary for a good public policy should be available without any restriction.
5. It should be easy to discover what spatial data are available, the suitability of these to evaluate and what kind of conditions are committed to it.

There are no specific guidelines or techniques to translate the information to the practice. Accessibility should be guaranteed by internet and by an EU-internet portal for all publicly available information of the EU-member states and the guarantee of the interchangeability of the information.
Spatial data belonging to INSPIRE:

Since 2010

- Geographical names
- Administrative units
- Traffic networks
- Hydrographic data
- Protection zones
- Altitudes
- Identification of ownership
- Cadastral register of land plots
- Groundcover
- Ortho photographs

Since 2013

- Spatial definitions of statistic units
- Buildings

- Soil
- Geology
- Land use
- Human health and safety
- Public services
- Environmental security services
- Production and industrial facilities
- Facilities for agriculture and aquaculture
- Demography
- Registered regions for waste, groundwater, zones of nuisance, mining etc.)
- Regions with natural risks
- Atmospheric circumstances
- Meteorological characteristics
- Oceanography
- Sea regions
- Habitats and biotopes
- Distribution of species.

More information is to be found on website *http://inspire.jrc.it/*

7.1.6 Legends for municipal zoning plans

The Law on spatial Planning 2008 prescribed colours symbols and codes for municipal zoning plans summarised in the tables below[a].

code	Dutch	English	R	G	B	C	M	Y	Pantone
	Grens	boundary	255	255	255	100	100	100	
A	Agrarisch	agricultural	235	240	210	10	5	20	7485U
AW	Agrarisch met waarden	agricultural with values	210	225	165	20	15	35	580U
B	Bedrijf	business	180	095	210	35	60	00	258U
BT	Bedrijventerrein	industrial estate	200	160	215	20	30	00	522U
BO	Bos	forest	100	170	045	55	10	100	369U
C	Centrum	center	255	200	190	00	20	15	706U
CO	Cultuur en ontspanning	culture and entertainment	255	060	130	00	90	35	Rubine Red U
DH	Detailhandel	retail	255	160	150	00	40	30	1625U
DV	Dienstverlening	provision of services	240	145	190	05	40	05	701U
G	Groen	greenery	040	200	070	50	00	80	360U
GD	Gemengd	mixed	255	190	135	00	25	45	156U
H	Horeca	hotel and catering industry	255	105	035	00	70	90	Orange 021U
K	Kantoor	office	235	195	215	05	20	05	250U
M	Maatschappelijk	social	220	155	120	05	35	50	157U
N	Natuur	nature	130	165	145	40	15	40	557U
R	Recreatie	recreation	185	215	070	20	05	85	380U
S	Sport	sports	130	200	070	45	05	90	3B2U
T	Tuin	garden	200	215	110	15	05	65	584U
V	Verkeer	traffic	205	205	205	20	20	20	427U
W	Wonen	living	256	255	000	06	00	97	102C
WA	Water	water	175	205	225	25	05	10	290U
WG	Woongebied	residential area	255	255	180	00	00	30	600U
	Overig	remaining	235	225	235	05	10	10	663U

Fig. 1065 Legally prescribed colours for main uses in Dutch zoning plans

[a] *http://www.helpdeskdurp.nl/infotype/webpage/view.asp?objectID=129*

code		Dutch	English
L		**Leidingen**	**cables and pipes**
L-B		Brandstof	fuel
L-G		Gas	gas
L-H		Hoogspanning	high tension
L-HV		Hoogspanningsverbinding	high tension connection
L-L		Leidingstrook	strip for cables and pipes
L-O		Olie	oil
L-R		Riool	sewer
L-W		Water	water

WR		**Waarden**	**values**
WR-A		Archeologie	archaeology
WR-C		Cultuurhistorie	history of civilisation
WR-E		Ecologie	ecology
WR-G		Geomorfologie	geomorphologie
WR-L		Landschap	landscape

WS		**Waterstaat**	**water management**
WS-WB		Waterbergingsgebied	water store area
WS-WK		Waterkering	dam
WS-WL		Waterlopen	watercourse
WS-WS		Waterstaatkundige functie	water management function

Fig. 1066 Legally prescribed patterns for main double uses in Dutch zoning plans

	Dutch and analogue representation		English and digital representation	transp
	geluidzone (R255 G155 B0)		noise zone (R255 G155 B0)	60%
	industrie			
	spoor			
	weg			
	luchtvaartverkeerzone (R155 G50 B205)		air connection zone (R155 G50 B205)	60%
	milieuzone (R0 G155 BO)		environmental zone (R0 G155 B0)	60%
	bodembeschermingsgebied			
	geluidsgevoelige functie			
	geurzone			
	grondwaterbeschermingsgebied			
	stiltegebied			
	waterwingebied			
	zones Wet Milieubeheer			
	reconstructiewetzone (R56 G133 B94)		Reconstruction law zones (R56 G133 B94)	60%
	extensiveringsgebied			
	landbouwontwikkelingsgebied			
	verwevingsgebied			
	veiligheidszone (R0 G0 B255)		safety zone (RO GO B255)	60%
	bevl			
	leiding			
	lpg			
	munitie			
	vervoer gevaarlijke stoffen			
	vuurwerk			
	windturbine			

	Dutch and analogue representation		English and digital representation	transp
	vrijwaringszone (RO G255 B255)		protection zone (R55 G205 B0)	60%
	buisleidingenstraat			
	dijk			
	duin			
	molenbiotoop			
	radar			
	spoor			
	straalpad			
	vaarweg			
	weg			
	Wro-zone (R255 GO BO)		Law of spatial planning zone (R255 G0 B0)	60%
	moderniseringsgebied			
	ontheffingsgebied			
	verwerkelijking in naaste toekomst			
	wijzigingsgebied			
	overig (R100 G100 B100)		remaining (R100 G100 B100)	60%

Fig. 1067 Legal and environmental zones

(bah)	(bah)	bedrijf aan huls	
(cw)	(cw)	cultuurhistorische waarde	
(iv)	(iv)	intensieve veehouderij	
(rw)	(rw)	recreatiewoning	
(-rw)	(-rw)	recreatiewoning uitgesloten	
(sdh-..)	(sdh-..)	specifieke vorm van detailhandel	
(-sdh-..)	(-sdh-..)	specifieke vorm van detailhandel uitgesloten	
		digitale grens	

Fig. 1068 Examples of functional indications

code	Functieaanduidingen SVBP2008	Functional indications
(as)	aanlegsteiger	jetty
(a)	agrarisch	agricultural
(ab)	agrarisch bedrijf	agricultural business
(al)	agrarisch loonbedrijf	agricultural wage labour business
(agw)	agrarisch met waarden	agricultural with values
(ak)	akkerbouw	farming
(abp)	ambachtelijke be- en verwerking agrarische producten	
(aqc)	aquacultuur	
(aq)	aquaduct	
(aw)	archeologische waarden	
(az)	asielzoekerscentrum	
(atl)	atelier	
(at)	attractiepark	
(ac)	autocircuit	
(bsd)	baggerspeciedepot	
(bb)	bed & breakfast	
(b)	bedrijf	
(bah)	bedrijf aan huis	
(b≤)	bedrijf tot en met categorie..	
(b=)	bedrijf van categorie ..	
(bw)	bedrijfswoning	
(bt)	bedrijventerrein	
(beb)	beeldbepalende boom	
(bp)	begraafplaats	

code	**Functieaanduidingen SVBP2008**	**Functional indications**
(be)	belwinkel	
(bh)	beroep aan huis	
(bi)	bibliotheek	
(bs)	bioscoop	
(bot)	bollenteelt	
(bm)	bomenteelt	
(bd)	bordeel	
(bo)	bos	
(bow)	bowlingbaan	
(brk)	brandweerkazerne	
(br)	brug	
(cs)	caravanstalling	
(ca)	casino	
(c	centrum	
(coc)	congrescentrum	
(cc)	creativiteitscentum	
(cr)	crematorium	
(co)	cultuur en ontspanning	
(cw)	cultuurhistorische waarden	
(dr)	dagrecreatie	
(da)	dansschool	
(dh)	detailhandel	
(dhg)	detailhandel grootschalig	
(dhe)	detailhandel in brand en explosiegevaarlijke goederen	
(dhp)	detailhandel perifeer	
(dhv)	detailhandel volumineus	
(dv)	dienstverlening	
(ds)	dierenasiel	
(dt)	dierentuin	
(di)	discotheek	
(db)	drafbaan	
(do)	drugsopvang	
(evz)	ecologische verbindingszone	
(ew)	ecologische waarde	
(ek)	eendenkooi	
(e)	erf	
(ev)	evenemententerrein	
(fz)	feestzaal	
(ft)	fruitteelt	
(ga)	garage	
(gs)	geluidscherm	
(gw)	geluidwal	
(gm)	gemaal	
(gd)	gemengd	
(gmw)	geomorfologische waarde	
(gz)	gezondheidszorg	
(gt)	glastuinbouw	
(go)	golfbaan	
(g)	groen	
(gr)	gronddepot	
(gv)	grondgebonden veehouderij	
(gh)	groothandel	
(ha)	haven	

code	**Functieaanduidingen SVBP2008**	**Functional indications**
(h)	horeca	
(h≤)	horeca tot en met horecacategorie	
(h=)	horeca van categorie..	
(hs)	houtsingel	
(hw)	houtwal	
(hv)	hovenier	
(ijs)	ijsbaan	
(i)	infrastructuur	
(ik)	intensieve kwekerij	
(iv)	intensieve veehouderij	
(ic)	internetcafé	
(iw)	internetwinkel	
(jh)	jachthaven	
(jo)	jeugdopvang	
(jop)	jongeren ontmoetingsplek	
(ji)	justitiële inrichting	
(kv)	kamerverhuur	
(kp)	kampeerboerderij	
(kt)	kampeerterrein	
(k)	kantoor	
(kab)	kartbaan	
(ks)	kas	
(kz)	kazerne	
(kb)	kinderboerderij	
(kijs)	kunstijsbaan	
(ll)	laad- en losplaats	
(lb)	landingsbaan	
(lw)	landschapswaarden	
(lbr)	leiding brandstof	
(lg)	leiding gas	
(lhs)	leiding hoogspanning	
(lhv)	leiding hoogspanningsverbinding	
(lo)	leiding olie	
(lr)	leiding riool	
(lwa)	leiding water	
(ls)	leidingstrook	
(lp)	ligplaats	
(lh)	luchthaven	
(lv)	luchtverkeer	
(m)	maatschappelijk	
(ma)	manege	
(mrk)	markt	
(me)	meer	
(mo)	militair oefenterrein	
(mz)	militaire zaken	
(mb)	modelvliegtuigbaan	
(mob)	monumentale boom	
(mc)	motorcrossterrein	
(md)	munitiedepot	
(mu)	museum	
(ms)	muziekschool	
(mt)	muziektheater	
(nso)	naschoolse opvang	

code	Functieaanduidingen SVBP2008	Functional indications
(n)	natuur	
(nlw)	natuur- en landschapswaarden	
(nw)	natuurwaarden	
(nb)	nutsbedrijf	
(nv)	nutsvoorziening	
(oe)	oever	
(on)	onderwijs	
(os)	ontsluiting	
(ov)	openbaar vervoer	
(ovs)	openbaar vervoerstation	
(od)	openbare dienstverlening	
(op)	opslag	
(pf)	paardenfokkerij	
(ph)	paardenhouderij	
(pd)	pad	
(pa)	park	
(pg)	parkeergarage	
(p)	parkeerterrein	
(pb)	partyboerderij	
(pah	passantenhaven	
(pp)	pitch & putt	
(ps)	plantsoen	
(pl)	plein	
(prr)	praktijkruimte	
(pr)	prostitutie	
(raamexploitatie)	raamprostitutie	
(rv)	railverkeer	
(r)	recreatie	
(rw)	recreatiewoning	
(re)	religie	
(ri)	risicovolle inrichting	
(rr)	rivier	
(sau)	sauna	
(shu)	schiphuis	
(si)	seksinrichting	
(sit)	sierteelt	
(sil)	silo	
(ske)	skeelerbaan	
(skb)	skibaan	
(sl)	sluis	
(sa-..)	specifieke vorm van agrarisch	
(saw-..)	specifieke vorm van agrarisch met waarden	
(sb-..)	specifieke vorm van bedrijf	
(sbt-..)	specifieke vorm van bedrijventerrein	
(sbo-..)	specifieke vorm van bos	
(sc-..)	specifieke vorm van centrum	
(sco-..)	specifieke vorm van cultuur en ontspanning	
(sdh-..)	specifieke vorm van detailhandel	
(sdv-..)	specifieke vorm van dienstverlening	
(sgd-..)	specifieke vorm van gemengd	
(sg-..)	specifieke vorm van groen	
(sh-..)	specifieke vorm van horeca	

code	**Functieaanduidingen SVBP2008**	**Functional indications**
(sk-..)	specifieke vorm van kantoor	
(sle-..)	specifieke vorm van leiding	
(sm-..)	specifieke vorm van maatschappelijk	
(sn-..)	specifieke vorm van natuur	
(sr-..)	specifieke vorm van recreatie	
(ss-..)	specifieke vorm van sport	
(st-..)	specifieke vorm van tuin	
(sv-..)	specifieke vorm van verkeer	
(swr-..)	specifieke vorm van waarde	
(swa-..)	specifieke vorm van water	
(sws-..)	specifieke vorm van waterstaat	
(sw-..)	specifieke vorm van wonen	
(swg-..)	specifieke vorm van woongebied	
(spt)	speeltuin	
(sz)	speelvoorziening	
(sp)	spoorweg	
(s)	sport	
(spc)	sportcentrum	
(sph)	sporthal	
(spv)	sportveld	
(spz)	sportzaal	
(sq)	squashcentrum	
(sd)	stadion	
(ste)	steiger	
(str)	strand	
(shs)	strandhuis	
(sth)	studentenhuisvesting	
(stw)	stuw	
(su)	supermarkt	
(tn)	tennisbaan	
(tr)	terras	
(th)	theater	
(t)	tuin	
(tb)	tuinbouw	
(tc)	tuincentrum	
(tu)	tunnel	
(uv)	uitvaartcentrum	
(vw)	vaarweg	
(vh)	veerhaven	
(ve)	ven	
(vb)	verblijfsgebied	
(vr)	verblijfsrecreatie	
(vl)	verenigingsleven	
(v)	verkeer	
(vep)	verkoop eigen producten	
(vml)	verkooppunt motorbrandstoffen met lpg	
(vm)	verkooppunt motorbrandstoffen zonder lpg	
(va)	vertrek- en aankomsthal	
(vij)	vijver	
(vk)	viskwekerij	
(vt)	volkstuin	
(vu)	vulpunt lpg	
(wm)	waardevolle boom	

code	**Functieaanduidingen SVBP2008**	**Functional indications**
(wa)	water	
(wb)	waterberging	
(wk)	waterkering	
(ws)	waterstaat	
(ww)	waterweg	
(wz)	waterzuiveringsinstallatie	
(we)	weg	
(wel)	wellness	
(wei)	welzijnsinstelling	
(wn)	wielerbaan	
(wt)	windturbine	
(wtp)	windturbinepark	
(w)	wonen	
(wg)	woongebied	
(wl)	woonschepenligplaats	
(wp)	woonwagenstandplaats	
(zee)	zee	
(zo)	zend-/ontvangstinstallatie	
(zbo)	zorgboerderij	
(zoi)	zorginstelling	
(zw)	zorgwoning	
(zb)	zwembad	

Fig. 1069 Functional indications

code	**Bouwaanduidingen SVBP2008**
[aeg]	aaneengebouwd
[am]	antennemast
[bg]	bijgebouwen
[gs]	gestapeld
[kap]	kap
[ka]	karakteristiek
[nr]	nokrichting
[ond]	onderdoorgang
[pd]	plat dak
[tae]	twee-aaneen
[vrij]	vrijstaand
[sba-..]	specifieke bouwaanduiding

Fig. 1070 Building indications

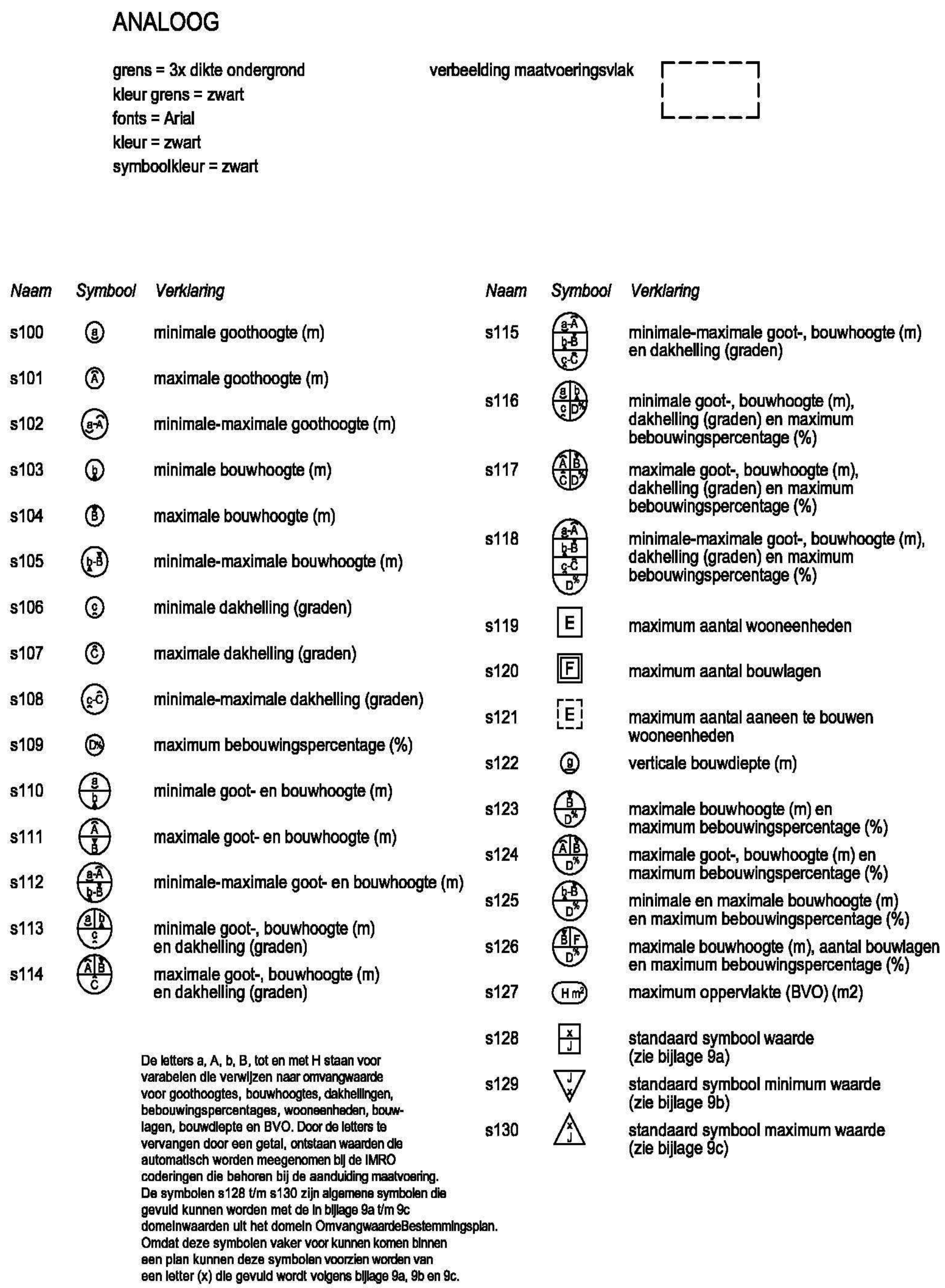
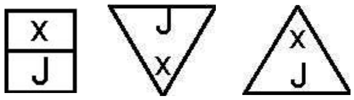


Fig. 1071 Indicating measures in Dutch zoning plans



waarde **minimum** **maximum**

s128	**x**	**s129**	**x**	**s130**	**x**	**J**	**betekenis x**
s128a	a					aantal	aantal
s128b	b	s129a	a	s130a	a	aantal	bedrijven
s128c	c	s129b	b	s130b	b	aantal	bezoekers
s128d	d	s129c	c			aantal	bouwlagen
s128e	e	s129d	d	s130c	c	aantal	gebouwen
s128f	f	s129e	e	s130d	d	aantal	parkeerplaatsen
s128g	g	s129f	f	s130e	e	aantal	rijstroken
s128h	h	s129g	g	s130f	f	aantal	sporen
s128i	i	s129h	h	s130g	g	aantal	winkels
s128j	j	s129i	i			aantal	wooneenheden
s128k	k						maatvoering
s128l	l	s129j	j	s130h	h	m^2	bebouwd oppervlak
s128m	m	s129k	k			%	bebouwingspercentage terrein
s128n	n	s129l	l	s130i	i	m	breedte
s128o	o					graden	dakhelling
s128p	p	s129m	m			m	diepte
s128q	q	s129n	n	s130j	j	m	hoogte
s128r	r					m	bouwhoogte
s128s	s					m	goothoogte
s128t	t	s129o	o	s130k	k	m	hoogteligging vlak
s128u	u	s129p	p	s130l	l	m	lengte
s128v	v	s129q	q	s130m	m	m^2	oppervlakte
		s129r	r	s130n	n	m^2	vloeroppervlakte
s128w	w	s129s	s	s130o	o	m^2	bruto vloeroppervlakte;
s128x	x	s129t	t			m^2	bvo vloeroppervlakte;
s128y	y	s129u	u	s130p	p	m^2	netto vloeroppervlakte;
s128z	z	s129v	v	s130q	q	m^2	woning vloeroppervlakte;
s128aa	aa	s129w	w	s130r	r	m^3	volume
s128ab	ab	s129x	x	s130s	s		vrije tekst
s128ac	ac	s129y	y	s130t	t		vrije tekst
s128ad	ad	s129z	z	s130u	u		vrije tekst

Fig. 1072 Meaning of standard symbol values

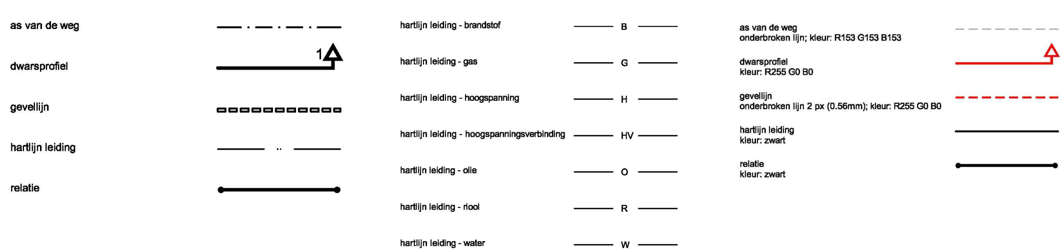


Fig. 1073 Examples of lines

7.2 Child perception

7.2.1 Introduction

Combining different sensory impressions

Experiments with babies, reported by Piaget and Inhelder (1947), keep me fascinated from the first time I read about them until now, because of the practical and design implications of the idea. Firstly, they gave the children an object to feel by touching behind a screen making sure they could not see it. Then they showed the same object, making sure they could not touch it. Piaget and Inhelder questioned at what age the children would combine these two totally different sensory impressions into one concept. On the average it appeared to be on the age of one and a half years old. These conclusions were criticized later (it happens earlier) but the idea has remained the same.

Concept formation

Combining different sensory impressions **synaesthetically** into a concept of any object involved, means more than a conditional Pavlov-reflex. Starting up your digestive system when a bell rings does not yet mean that you can imagine them as a concept, and they are not the same after all. It means that if you feel the object without seeing it, you can make a visual imagination of the object without seeing it. It is the very start of logical operations like ‘not’, ‘or’, ‘if … then’. It explains the fascination of young children for the game of peek-a-boo or hide-and-seek: mother hides herself and calls you. You can hear her voice, but you do not see her. You now are looking for her, because you have the visual imagination you like to check completing your concept.

Moving experience

In later investigations Piaget and Inhelder emphasized the importance of the **motoric ability** for imagination capabilities and learning. You can change your visual impression by moving physically. This possibility causes continuous experiments by children. I remember my niece celebrating her first birthday. Grandma held her on her lap saying ‘Quiet my darling, quiet!’. But she stayed crying all the time kicking her legs. I had been reading Piaget recently and said: ‘Give her to me’. Grandma handed me the child and I helped her kicking legs to move her body up and down to see my face alternating with the background. She started laughing! Grandma, somewhat embarrassed, thought she loved me more then her, but I explained her the baby was experimenting parallax: changing object and context by moving up and down. She did not see me as a person, she tried to understand the difference between my face and my background first. That is why moving on a seesaw is so fascinating for children.

Object constancy

She should have experienced **object constancy** earlier: mother is not there; she appears in the door and walks into your direction. Her face enlarges until it fills your total scope of vision: is that large object the same object appearing as a small face peeping around the door? You throw toys out of your box, they bring them back. Repeating experiences like that show constancy of changing objects: different, gradually enlarging impressions link up to one imaginable object. That is why swings and merry-go-rounds are important. Later on you run away from your mother and look back. She became very small and to regain your safety you run back to enlarge her. Your mother is not yet a person, but ‘something large and warm’, like my three years old daughters described their concept of ‘mother’ when I asked them ‘What is a mother?’. The other way round dangerous things are ‘large and cold’. A car is not dangerous when it is far away, because it is small.

Pain

There we are. The dangerous things at home are well known when you are three years old, because they are nearby and large, cold, solid and hard. They can hurt when you run too fast. You learn by collision. But once you are in the street you have to run faster to discern objects further away than at home and it takes years to learn that there are objects running faster than you, becoming large, cold, hard and painful very quickly. That is why playing tag is so important. Young animals are short-sighted to learn discerning objects nearby first by little movements causing parallax. The vision, radius of awareness and speed grow with the years of childhood. I think the radius of awareness grows exponentially, but it is a hypothesis.

Which programme of requirements we can conclude per level of scale?

7.2.2 The growing scale of perception

The radius of awareness

If the radius of awareness grows exponentially it could happen like *Fig. 1074* shows. The radius R should be interpreted elastically between its neighbors (R=10m means 'between 3 and 30m'). If psychologists would study that relation and name the values children observe in every stage of their growth, it would be a great help for designers to determine their legend units and composition.

years old	m radius R	area of awareness
0	1	Action space
1	3	Room
3	10	House
5	30	Yard
7	100	Neighbours
9	300	Neighbourhood
11	1000	District
13	3000	Town

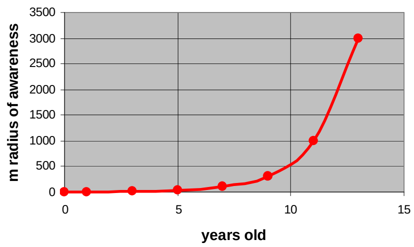
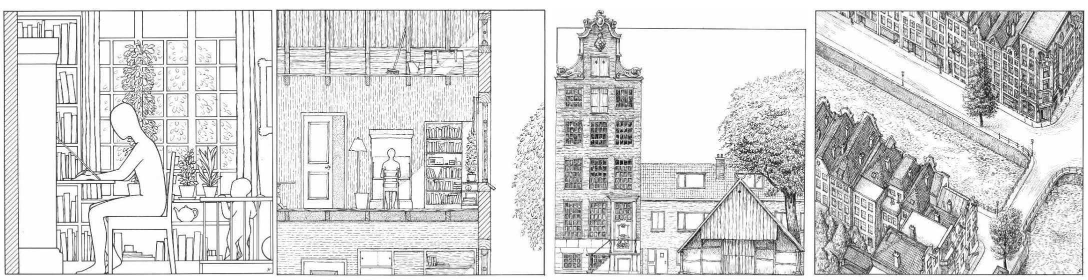


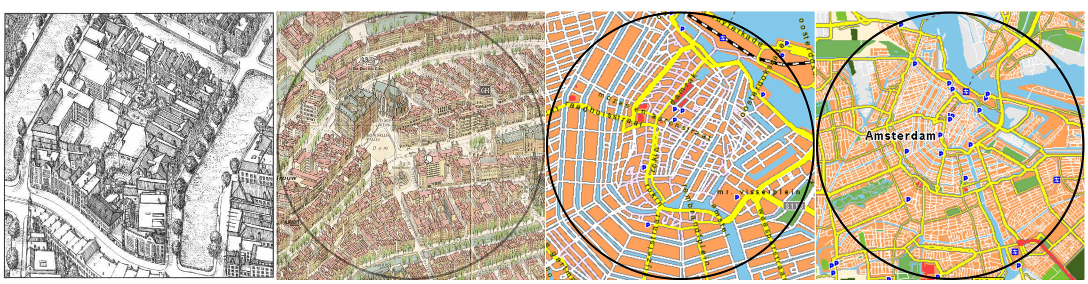
Fig. 1074 Hypothetical scales of awareness by age

Observable variables

To get an idea of the realities these measures indicate, see *Fig. 1075*. The question is: 'Which observable variables vary on every level of scale?'.



0 year: R = 1m *1 year: R = 3m* *3 years: R = 10m* *5 years: R = 30m*



7 years: R = 100m *9 years: R = 300m* *11 years: R = 1000m* *13 years: R = 3000m*

Fig. 1075 Growing awareness by scale[a]

Let us first try to look as a child on different ages.

[a] Jong, T. M. de; 5 drawings by Jan Huffener (1978)

I am sorry in this text it's a boy like I was, rewrite it yourself for a girl if you think it's relevant.

A baby street like a room (3m)

You are one year old. The front door opens and they put you in a buggy. Suddenly at one side, all kind of unknown objects whiz by. Some objects on the far side stay longer. You don't have any influence, because *they* drive your car. You cannot stay to experiment parallax properly. So, you look forward. There, all kinds of objects enlarge, become dangerous, but they pass aside and disappear. Suddenly your driver turns. You shake in your buggy. The scene changes dramatically. They drive you in a dark hole. Slowly in becomes lighter. You hear voices, but you see dresses, trousers, legs, shoes and tiles as different colour surfaces. Looking upward you see bodies towering above you, faces and hands. Suddenly they shake you and drive you in a white hole with cars whizzing by. Another shake makes your scene well-known until they take you out of the buggy. They hold you before a wall that opens after some jingle with a turning hand. You smell something you are used to. You are 'home'.

A toddler street like a house (10m)

You are three years old. You can walk! That means, you can change the world around you by walking through a black hole. Sometimes the hole is gone, but in the mean time you learned to open the wall, standing on your toes and stepping back, pulling a handle down. There are several worlds, but there is one you can open by pulling a handle aside. In that room there is noise, wind, movement and very much space. You may run. They often call you back. If you fall, it's hard. Between the tiles there are blades and ants. Sometimes there is a drain cover with holes aside somewhat lower. But if you want to look inside they call you back: "dangerous!". You find pieces of soft brown clay, but they hold you back: "dirty!". You may not even step on it. They take you into another room by turning a corner. Suddenly you are standing in the sun. Here plants are huge and not standing on a windowsill, but in the ground. So, they can not fall down if you run through them. But they call you back: "dirty!". Some have prickles, so you stay walking on the pavement. There are several pavements: stepping down they are darker with smaller stones. But if you step down they call you back: "dangerous! We said that earlier!". Stupid: that was the drain cover.

A young child street like a yard (30m)

You are five years old. Your father takes you to school in the morning, your mother from school in the afternoon turning 5 corners. They moved into a house with a garden and a gate to a path, going to a playground and to a street with cars and large trees. You may not play in the sand around that trees, it is dirty. You've got marbles, but there are not much groves to play marbles. You like to go to the far side, but it is too dangerous. You've got a bike, but you may not leave the pavement with the large tiles. If you stay riding on that pavement, going around the corner three times, you come back from the other side! Your friend has no bike, so together you play on the playground. But it is too childish, your little sister plays there with your mother on the wipperchicken and the slide. My friend had a secret hut there, but they cut off plantation. So, it is not very secret anymore. But he has a *real* Play station on his computer!

A child street like a school (100m)

You are seven years old. You may cross the street in front of your house. Your new friend lives there. His neighbour has a motorbike. He is repairing it in front of his house. Round the corner lives an ugly man. You ring his bell, run away and look around the corner how angry he is. Your mother takes you to her work. You never knew she has a room there as well. Your portrait is on her desk, but you cannot play there. You get a chocolate in a café with strange people. Your father showed you how to go to Grandma by bus and you got a ticket to try yourself. The driver tells you where to go out. You see large buildings where people work, but they don't live there and there are no children.

A child street like a village or neighbourhood (300m)

You are nine years old. You may cross all the streets until the district way. You can go to school, the sports field, the hairdresser and to Grandma by bike. You've got roller skates on your birthday, but you only may skate on the skate ground at five minutes cycling. There are shops where you can buy stickers, but your new friend makes them on his computer. He takes you to the computer shop, but you like the car models you can buy next door. Your pocket money has doubled last year, but it is still not sufficient. If you help Grandma cleaning her house three times you can buy a Ferrari.

A child street to explore (1000m)
You are eleven years old. You climb the old church-tower and see your house from above, your school, your swimming pool and the fields outside the city where you cycled with your friends. You see your own daily life like a bird. Apparently there are many more districts in town. The city ends somewhere. Next year you will go to high school in another district. You will loose friends of your neighbourhood and find new ones from elsewhere.

A teen-ager street to meet (3000m)
There are students from other cities and countries in your class. In the geography class you learn countries and cities by heart. You visit them on holiday. You are not a child anymore. You have seen your city by night. There are right and wrong disco's. You have got a newspaper round to be able to pay for your girlfriend next time. You look at her lighted room from behind a tree in the street where she lives. Where could you make an appointment next week? She often goes to a volleyball ground hidden behind a large office building in her neighborhood. There you can sit, beyond neon lights, unnoticed by others, pretending to look at the games together.

7.2.3 Field of vision

Growth
From the second year on, children grow linear with their age to the adult stature of their nationality (see *Fig. 1077*). After 10 years old they outgrow a car (*Fig. 1076*). So, children have less overview than adults.

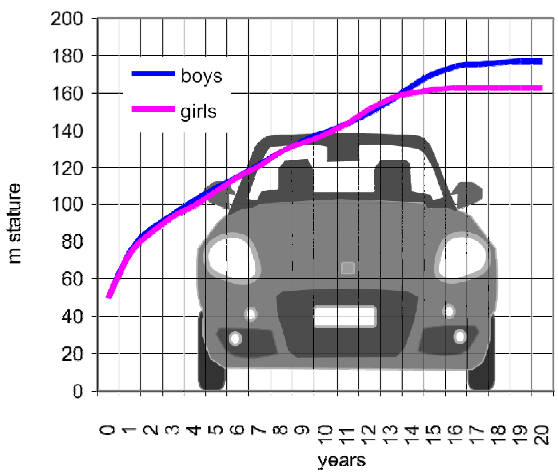


Fig. 1076 Growth of an average child in the USA[a]

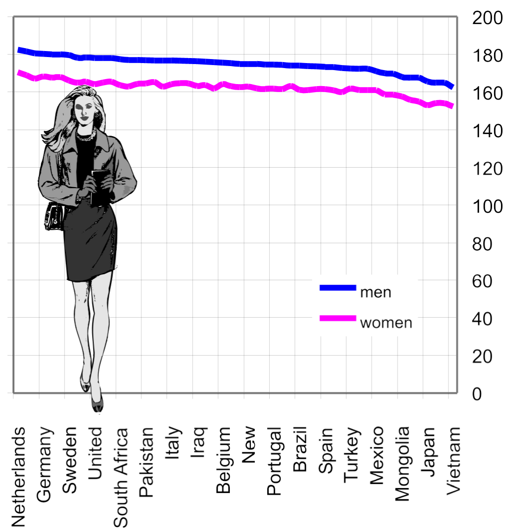


Fig. 1077 Adult length variation by nationality[b]

The growing eye
Moreover, their field of vision is smaller. So, their vision is closer to the fixation center with less attention to context. Context sensibility seems to be primarily the task of hearing. But, to determine the direction of noise is more difficult for children than for adults. Deaf people compensate their failing sense by developing a larger field of vision earlier.[c]

[a] *http://kidshealth.org/parent/growth/growth/growth_charts.htm* l
[b] *http://en.wikipedia.org/wiki/Human_height*
[c] *http://www.shef.ac.uk/personal/l/lgf/visiondeaf/*

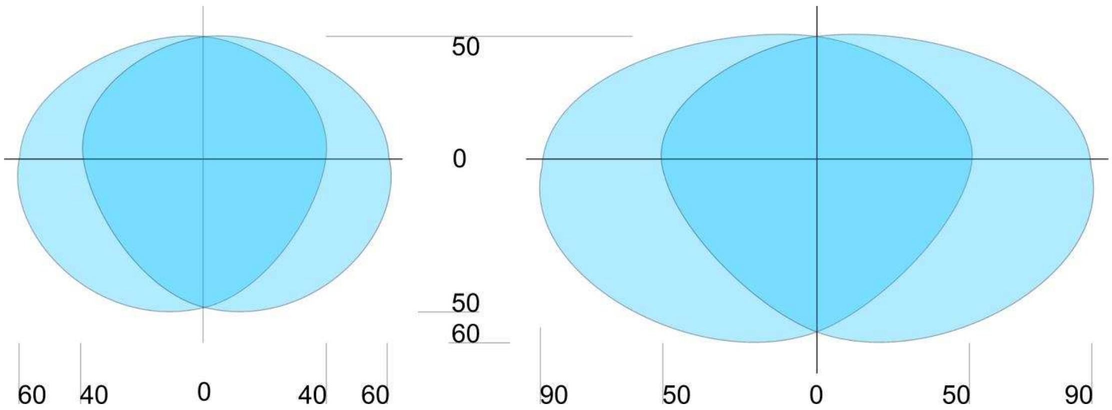


Fig. 1078 A child's average field of vision, and an adult's average field of vision in degrees from center[a]

Fixation point

Visibility is highest in the central fixation point, declining into the boundaries of the field of vision (see *Fig. 1079*).

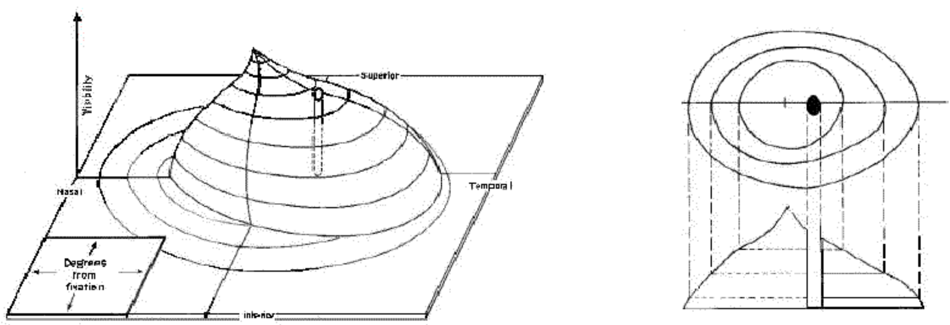


Fig. 1079 Visibility represented by Anderson (1984) as a third dimension in the field of vision[b]

Because of their limited field of vision children have to move their head more often than adults to build up a concept of context. Adults complain wrongly about lack of concentration then. They have to change focus themselves to understand the composition of a scene as well. Design helps to balance recognition and surprise. Too much recognition causes boredom, too much surprise chaos (see *Fig. 1081*).

7.2.4 The composition of a scene

Components and details

A scene comprises components and details. To design a quickly understandable scene we have to make larger components externally *different* from each other, but internally filled with characteristic details recognizably *equal* to distinguish the particular component from the other components with other characteristic details. That art is called composition.

[a] *http://www.shef.ac.uk/personal/l/lgf/visiondeaf/*; *http://home.zonnet.nl/jcamps/gezichts.htm*
[b] *http://www.msac.gov.au/pdfs/reports/msacref13.pdf*; *http://www.msac.gov.au/pdfs/reports/msacref13.pdf*

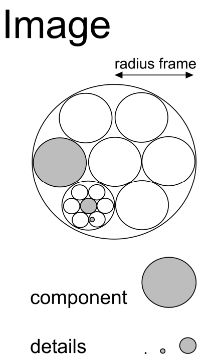


Fig. 1080 Components

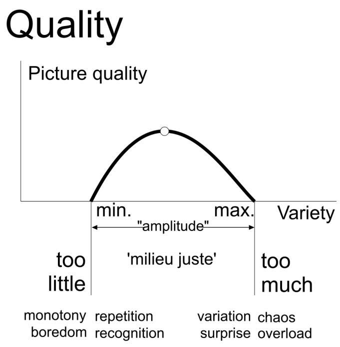


Fig. 1081 Quality as a working of variety

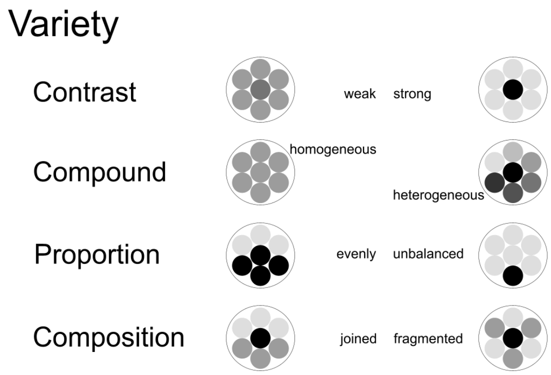


Fig. 1082 Design means of variety[a]

Any level of scale mentioned in *Fig. 1075* needs its own composition. On any level of scale components and details have new characteristics of categorization and orientation.

Observable differences

Your action space (R=1m) has hard and soft, movable and non-movable components in different colors. Your room (R=3m) has a door, corners to play, eat and store, different in light, material and visibility. These are the legends for designing a child street like a room.

Your house (R=10m) has differences of accessibility, control, light, noise, temperature, wetness, differently suitable for playing, personal care and rest. What could we use to distinguish the components of a child street like a house? Your yard (R=30m) is differently covered, planted and lighted by the sun. There are components of the house extending in the garden or the street (in-between realm). You behave differently at the back or front side. There are formal and informal places, hard and soft places, places of recognition and surprise. What is the difference between lawn and pavement, terrace and walk? Are there in-betweens to hesitate where to go?

Your school (R=100m) has spaces to sit and to run, compete, watch, play and learn. Your village or neighborhood (R=300m) has spaces to buy, walk and ride a bike. Your district (R=1km) has spaces of living, business, traffic and parks. Your city (R=3km) has spaces to meet and retire, atmospheres and cultures to explore.

7.2.5 Conclusions for urban design

Resolution

A field of vision comprises a largest measure in reality (frame, expressed as R) and a smallest visible detail (grain, expressed as r). Both change the observed composition if you approach an object or a scene. The distance from the observed composition is approximately equal to its frame.
If the frame of a picture represents a reality of radius R = 10m and the grain a radius r = 10cm, the resolution r / R is 1%. You will call the result a ‘drawing’. If frame and grain differ less (say 3%), it is a rougher sketch, stressing the concept. If they differ more, it could be a more precise blue print (0.1%). Object and details of a blue print lay too far apart to understand the composition or concept immediately, they get their use primarily for realization.

Legends for design

On every level of scale the map you draw may have a different legend. For example, in a drawing with a frame R=10m, you can draw tiles in the pavement (10cm), the kind of plantation, the furniture of the street and the entries of homes. These are adult categories. Make a sketch to group them more roughly into less components, comprising child categories. But what do you choose as components and their legend units in other frames? You have to dissect or group them into components suitable for child perception on different ages. *Fig. 1083* gives an overview of variety per level of scale named in

[a] Jong (2004)

this article. You could interpret it as guiding principle for design: try to change softness every meter, light every 3m and so on. However, for example light and shadow could be changed very successfully on other levels of scale as well. The table is only a starting point to be extended.

years old	**0**	**1**	**3**	**5**	**7**	**9**	**11**	**13**	
m Radius of frame	**1**	**3**	**10**	**30**	**100**	**300**	**1000**	**3000**	**learning**
differences to experience:									
hard-soft	x								danger
movable|non-movable	x								operational abilities
color	x								recognition
windows|doors		x							orientation
light|dark		x							imagination
shelter|corners		x							to escape adult movements
function|time		x							every time having its own place
visibility		x							hide-and-seek
accessibility			x						rules
control			x						other people
noise			x						context
temperature			x						kinds of clothes
wetness				x					hygiene
ceiling|shelter				x					in-betweens to hesitate, to decide
plantation				x					nature
sun				x					nature
formal-informal				x					different behavior
recognition|suprise				x					initiative
run|compete					x				ambition
watch, learn					x				to learn
possibility to buy						x			expensiveness
possibility to walk						x			interest
possibility to ride a bike						x			ride
urban functions							x		exploration
meet|retire								x	projection|identification
atmosphers|cultures								x	identity

Fig. 1083 Legends for design

A composition is not only determined by components, but also by details directing your fixation. We only mentioned characteristic details, determining components. But there are also marking details, determining boundaries, connecting details determining in-betweens and striking details labelling the whole scene.

7.3 Composition analysis

Establishing a legend by composition

Composition analysis is not only a research method for analysing the balance between repetition and diversity in existing urban architectural units, but also a design method to achieve this sort of balance and to explore its possibilities. In composition analysis, there appears to be an infinite number of possible types of balance. These extend artistic freedom by challenging the possibilities to their limits. Within this are boundaries of survival value, future value, practical value, and experiential value. Composition analysis is a systematic form of establishing a legend in the research and design process. Establishing a legend is an unexpressed supposition in every structure- and function analysis.
The composition analysis discussed here has been developed for the image-quality plan of the Amsterdam district '*De Baarsjes*'. by Jong and Ravesloot (1995). The following pages are an literal quotation taken from this document.

7.3.1 Variation

The starting point is that image quality is an outcome of variation in surroundings. Too little variation (monotony) results in boredom, and too much variation (chaos) in overloading (see *Fig. 1081*). For every individual, there are boundaries and optima of recognition by repetition and of surprise by change. This relationship says nothing about the importance of built-up surroundings, but rather about its potential to accommodate different sorts of meanings.

Scale

That this simple relationship has not been utilised earlier, even though much psychological research has a bearing on it, can be ascribed to scale problems at the time of implementation. For this reason, we will consider images on different scale levels separately (district image, neighbourhood image, block image, etc.).

Components and details

Within each image, we will make a scale differentiation between components and details (see *Fig. 1080*). We consider parts larger than one tenth of the image as components that define the composition. We will call everything smaller than one tenth a 'detail', for the time being.

Different components

The components of an image can be more or less alike (see *Fig. 1082*). If they are rather different, then the contrast is strong, otherwise it is weak. Between the most and the least similar components within an image, one can distinguish a smallest discernable and a largest discernable contrast. If all the components are similar (non-contrasting), then we call the composition homogenous, and if they differ, heterogeneous. One can observe a relationship between compositions of similar components, a relationship that can be either balanced or unbalanced. For the same contrast, the same composition and the same relationship, it is still possible to discern variation in composition. Similar components in a composition can be grouped in a more or less compact form.

Diversity and repetition on different levels of scale

Variation on one scale level (e.g. between the components) does not obstruct the occurrence of monotony on the other scale level (e.g. between the details within a component). In particular, it is the application of different principles on different scale levels that adds 'tension' to the image. One can now arrange the design strategies into scale levels in 'accords' between diversity (V) and repetition (R), for example:

ACCORDS	A	B
between buildings	Repetition	Diversity
between components:	Diversity	Repetition
between details:	Repetition	Diversity

Fig. 1084 *Variation accords*

Traditional and industrial accords
The traditional architectonic accord A (Repetition at the building and detail levels, but Diversity on the levels in between, 'RDR') differs from the modern accord B ('DRD'). After all, present architecture is mostly valued for the unique contour (D) of the building as a whole and for the originality (D) of the details, while between both these scale levels, repetition (R) is valued as 'architectonic clarity'.

7.3.2 Scale levels

Three examples of style and scale
In Fig. 1085, three periods of architectural style, and, for the sake of brevity, the three scale levels linked to them are shown. A *tholos* for Asklepios in Epidauros, with a radius of 10 metres; Palladio's Villa Rotonda, with a radius of 30 metres; and Berlage's Mercatorplein in the district De Baarsjes, with a radius of 100 metres. In each period, and on each scale, components and details can be seen which indicate to what extent one can talk about diversity or repetition. [6]

Perceiving different compositions approaching a building
When we approach a façade, we first look at the composition of the different components and then at the details. By doing this, in each case, we have a different frame, depending on our distance away from that object. So, at a distance of 10 metres from our façade , when we turn our heads, the whole façade is within our vision (10-metre radius). Using a wide-angle lens, we can see our appartment (3-metre radius), and using a standard lens, a window or a door (1-metre radius).
To assimilate the total image of the street, we need to view it from a distance of about 30 metres. In each case, we position what we see within a larger frame. We see an image in a radius that is approximately the same as our distance away from that image.

Fading details by increasing distance
The more we extend that distance away from the image, the fewer details we see: the elements of façade are rougher than those of our house when we stand near to it. We only have an image of our block of houses thanks to the fact that we have walk around it at some stage. It is a conceptual image, but it is thereby no less important, because it helps us to find our way. This is also the case with our neighbourhood, district and urban images.

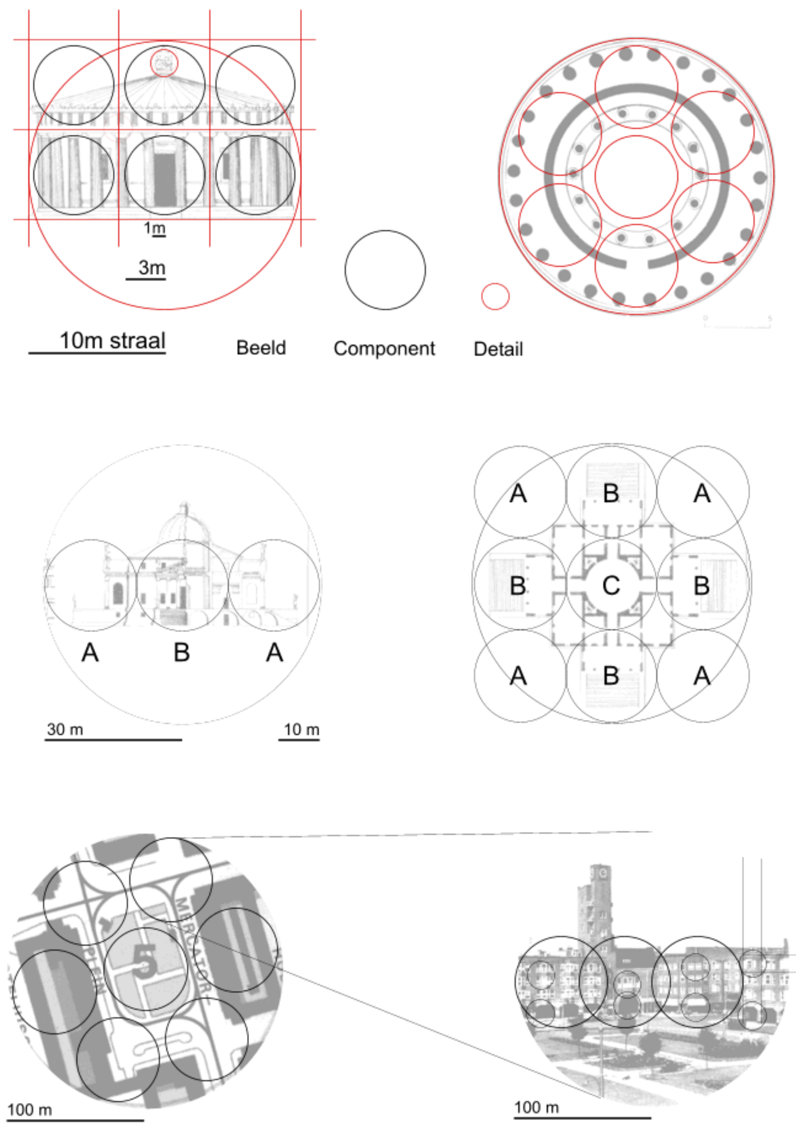


Fig. 1085 *Components and details of images in a radius of 10, 30 and 100 metres*.

By chance, the *tholos* has a diameter of 20 metres and thus a radius of 10 metres. The components of a radius of about 3 metres appear in the image of the map as the central *cella*and the components of the *peristyllum.*

Distinguishing components

When one looks at them, they appear to be an entrance section and the flanking parts of the pillared gallery, and the roof section and foreground laid out in a similar way. The division of the components of the same order of size is, of course, free and is not linked to an orthogonal or hexagonal grid. The capitals, triglyphs and other ornaments are contained as details in a frame of 1m radius.

The components of the Villa Rotonda differ more. The middle section is dominant. The special (B) according to Tzonis, Lefaivre et al. (1989) is flanked by the common (A) , repeating components following the classical scheme ABA.[7] On the map, a large central section C appears, flanked by similar ABA schemes, in which, this time, the peripheral area can be included as the most common component. In the image of Mercatorplein, the area *is* the central component (30m in radius), flanked by an approximately equally large groups of house façades in the corners and along the lengthy sides. The details consist here of façade (10 m) window and entrance sections (3 m). The image of a block (of buildings) can also be described within a radius of 100 m.

Details, components and frame
For our analysis, we differentiate the following images by their details, components and frame (with radius expressed in metres):

	detail		component	frame	ACCORD
	<		>		BAARSJES
district image		100		1000	R
neighbourhood image		30		300	V
ensemble		10		100	R
street image		3		30	V
façade image		1		10	R
house image		0,3		3	V
finished image		0,1		1	R

Fig. 1086 Variation accord for *De Baarsjes*

Variation and repetition per level of scale
In *De Baarsjes* all the neighbourhoods within the district image look alike (R), but within each neighbourhood, the squares, and the block and street groups (‘ensembles’) vary greatly (V). Within each separate ensemble, the blocks and streets are again very similar (R), but within each block and street, the façades vary (V). Within the façades, appartments are repeated (R),[29] but within each house image, the finished image varies (V).

7.3.3 Focus

The primary difference in an image determines the dominant component
In the first instance, the variation in the district image is read against the variation among its components. As large units as possible are chosen as components within the image, wherein a maximal repetition of characteristic details can be found. It is as if one scans the image with a searchlight the size of a component, until one has caught the most repetitive part of the bundle. When, by doing this, one connects the definable diversity (between the components) and the repitition (within the components) so closely to the scale level of the district and its components, it becomes very important where one chooses to place (focus) the boundaries of the district components (and thus the boundaries of the formulated homogeneity).

Looking for internal homogeneity of components
To establish the remaining image-defining variations within each district component, a neighbourhood image can be formulated by looking for relatively homogeneous neighbourhood components that differ maximally among themselves at that level.

Symmetry of roads
If, for example, a road lies between two district components, then this road accentuates the difference between the district components, or, alternatively, the similarity within a district component. In the one case, that can lead to the establishment of an asymmetric street profile, and, in the other case, to a symmetric one. For instance, in the case of De Baarsjes, the focus determines the symmetry of the Hoofdweg. When one reaches the Postjes neighbourhood, we can distinguish, for various reasons, two different district components on both sides of the Hoofdweg. For this reason, the walls of the streets on the opposite side do not need to be the same (<>). Once past the Postjesweg, a striking symmetry between the street walls becomes evident (><). This gives the impression that one is entering a homogeneous neighbourhood.

7.3.4 Morphological reconstruction

Dividing and articulating

How, now, do we determine the focus? Following Van der Hoeven and Louwe's example, Hoeven and Louwe (1985) the urban area is 'morphologically reconstructed' (see the Fig. *1087*) First, the area covered by the district is divided as equally as possible in the two main directions, using the most characteristic repetitive detail: a building block of 72 by 360 metres. In this way, the present district image has been reconstructed with an accuracy of approx. 100 metres. This conceptual design intervention is called 'dividing'. Globally speaking, the second intervention, 'segmenting' or 'articulating', means connecting main roads and waterways to the surroundings and taking the consequences for the primary zoning. Thus, a more differentiated topological scheme arises that, in turn, is more closely aligned to present actuality.

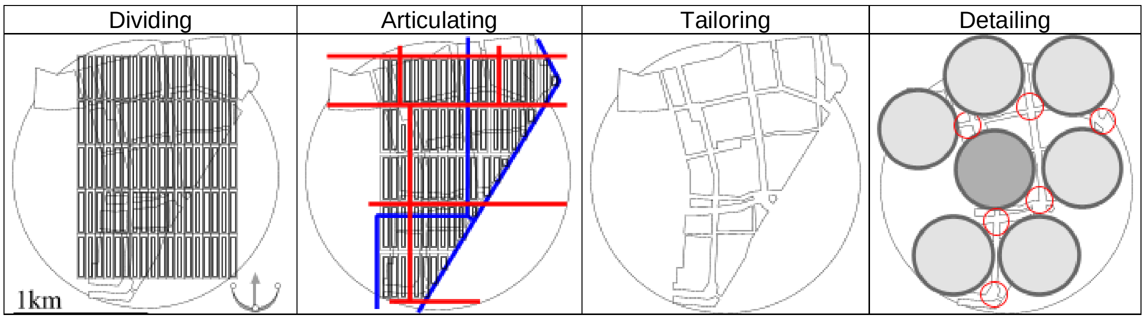


Fig. *1087 Morphological reconstruction of the urban area De Baarsjes*

Tailoring and de-tailing

A third intervention cuts the otherwise homogeneous parts apart and 'adds' them to the existing topography. An analogy to the work of the tailor, the cutter, the couturier or dressmaker, this intervention is known as 'tailoring'. The next intervention, 'detailing', temporarily divides the area internally into components that are considered to be homogeneous, identified by characteristic internally repeating details. The connecting details can be found between the components, just where their differences culminate. These can be points or lines, which either represent the surrounding components or are in contrast to them.

7.3.5 Structure in terms of openness and closedness.

Divisions and connections

Structure (coherence) is the way in which grouped parts form a whole or the sum of divisions and connections. The concept forms a separate category between form and function, because the same structure can take on different forms and can have different functions, and *vice versa*. Coherence always arises between different parts; in the drawing, these are the legend units.

Cohesion and adhesion

One can refer to the coherence between one kind of legend unit as cohesion. The coherence between different kinds of legend units then has to be called adhesion.[8] Coherence can be stimulated by nearness in space and realised by separating or connecting infrastructure.

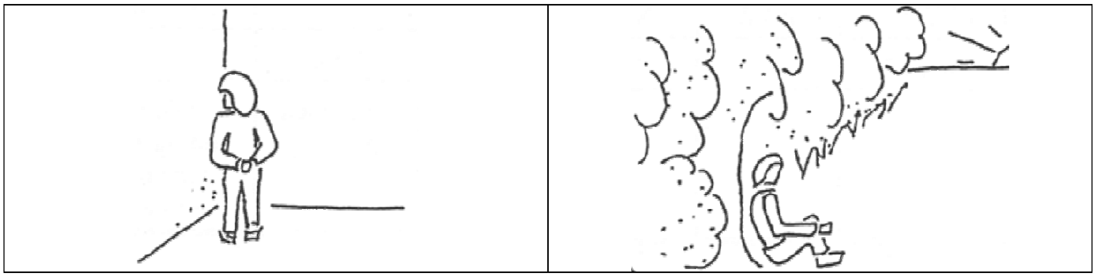


Fig. 1088 *Polarities 3m*[a]

Polarisation between open (α) and closed (β) sides

Spatial elements such as a neighbourhood, a house, a chair, a cupbourd, a television set, a person are often polarised, on the one hand, towards an open 'front' where the connections are concentrated and the communication with other elements takes place, and, on the other hand, to a closed 'back' in which the 'functions characteristic of the system' are concentrated where they can operate sheltered from the outside world. One cannot reverse this polarity with impunity without jeapodising the function. For example, it is pointless placing a TV set, a cupboard or a chair with their fronts against a wall. One only puts a person in a corner (with their front against a wall) if one wants to 'gag' them (Fig. 1088).

Scales of polarisation

One can recognise polarity between openness and closedness on different levels of scale and can give them meaning as 'structure' in design and research. The polarities at different scale levels influence each other. The polarity of a wall of a small room (3m radius) or of a forest edge (100m radius), interfers with human polarity (1m radius) by causing hinderance or back-coverage.[393]

Motoric and sensoric polarisation of rooms and houses

In the left hand Fig. 1089, a study has an 'open' window-side and an 'walled-in' door-side. This sensoric polarity is realised within a radius of 3m. If one considers accessibility as 'the distance to the front door" (radius 10m), then on a greater scale and in a motorical sense, the door-side is the most 'open' side of the room and the window-side is the most 'closed'. The polarities change meaning according to the scale and are directed antipodally ('contrapolar').

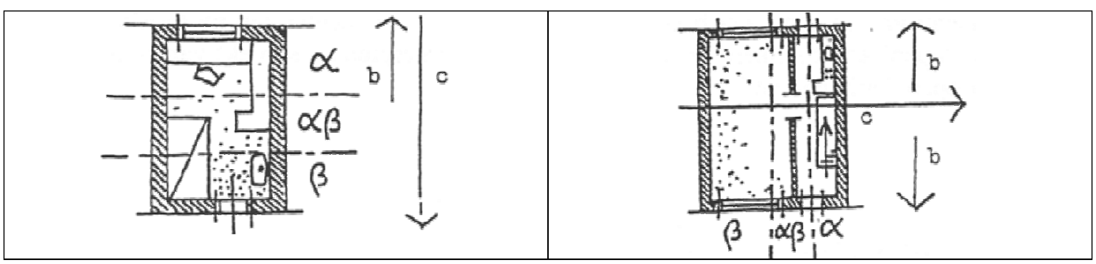


Fig. 1089 *Polarities of 3 and 10m*[b]

The right-hand Fig. 1089 is a sketch of a house with a through lounge in which the front door, back door, corridor, staircase, hall, cables, piping and wiring, in short the communication functions, are concentrated in the small aisle on one side, and the 'system characteristic' living functions on the other side , in the large aisle. This is the motoric polarity (c) from the left-hand drawing that extends for a distance of 10m. The sensoric 3m polarity that divides the house on two sides into a window side and a walled-in zone is here perpendicular ('orthopolar').

[a] Jong (1978)
[b] Jong (1978)

Breaking boring polarisation by design
The three standard hobbies of 'creative' architects: 'the front door in the living room', 'the staircase in the living room', or 'the kitchen in the living room' all breach the 10m motoric polarity, so that the objections to them (draught, smells, people walking through) have to be solved mechanically.

Ensemble and urban island polarisation
The ensemble is polarised within a radius of 30m towards the open, communicative, public front and a more closed, protected 'private' back.

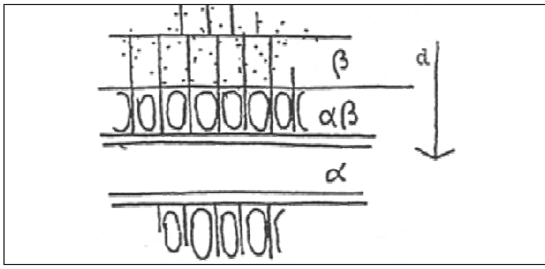


Fig. 1090 *Polarity 30m*

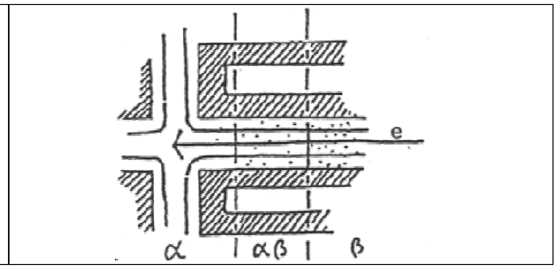


Fig. 1091 *Polarity 100m*[a]

Its most 'open' side is where the street crosses with another street or enters a more important street or square; its middle is the most 'closed' part.

Polarisation on higher levels of scale
This polarity can be spread over more than 100m. Within the radius of 300m, one can be polarised towards 'neighbourhood centre' and 'neighbourhood green'; within a radius of 1000 metres towards 'district centre' and 'district green'. In a similar manner, within a radius of 3 km, the town has an open 'town centre' and a more closed 'periphery'. However, this is a motoric interpretation of 'open' and 'closed'. A more sensoric interpretation talks about closed 'inner city' and open 'outside areas'[394].

7.3.6 Functional differentiation

Function as values of use on different terms
The built-up and unbuilt upon surroundings have different values, such as short-term experiencial value, medium-term practical value, long-term future value and extremely long-term survival value. By definition, this has to do with the value for people, including the value for plants and animals, in sofar as we, as people, recognise that value.[395]
For experiencial value 'shape' is enough; one doesn't need much structure for this. For the other values, increasing amounts of structure are needed. These have to be designed in that way, because structure is the 'condition' for these values.

Practical values
Practical values can be subdivided into economy, culture and administration. [9] These can be recognised in the medieval town (see the market square of Delft) as the following:

[a] Jong (1978)

Social differentiation	Urban differentiation
administration (aristocracy)	castle, palace
culture (spirituality)	church, cloister
economic basis (citizens, serfs)	market, shops, dwellings, small traditional trade businesses

Fig. 1092 *Trias urbanica in the Middle Ages*

Trias urbanica

Pierre George's definition George (1961can be called '*trias urbanica'*. By subdividing further, as a result of social differentiation, it is possible using Jakubowski's (1936) [10] and Parsons(1966 and 1977) systematique to imagine a '*trias politica'* from Montesquieu and Derathé (1973), a '*trias cultura'* and a '*trias economica'*.

Social differentiation	**Urban differentiation**
Politics	
legislative power	town hall
legal/administrative	law court/government services
executive power	police station, prison, barracks, military training ground
Culture	
religion/ ideology	churches, monuments, signs
art/science	museums, institutes, libraries
up-bringing/education	socio-cultural facilities, schools
Economy	
production	firms, banks, offices
exchange	distribution points, infrastructure
consumption	living, health service, recreation

Fig. 1093 *Social and urban differentiation in modern times*

Concentration and centralisation

Functions can be concentrated or deconcentrated spatially, but apart from that, each function can also be centralised or decentralised in a hierarchical order.[396]
So, there are 4 possibilities of form related to function:

FORM

		concentration	deconcentration
FUNCTION	centralisation	Concentration of centralised functions	Deconcentration of centralised functions
	decentralisation	Concentration of decentralised functions	Deconcentration of decentralised functions

Fig. 1094 *The difference between concentration and centralisation demonstrated*

In the concept of 'centre' a morphological and a functional meaning have to be discerned.

7.3.7 Intention

Desirable possibilities
Intentions can range from tradition-oriented to opportunity-oriented. They are proportioned as are probability and possibility within what is desirable.[397]

More than a programme of requirements
A design is traditionally preceded by a programme of requirements, compiled according to the wishes of the commissioning body. In order to meet these requirements, the designer has to create the conditions in his proposals that will lead to the fulfilment of these requirements. In doing this, he himself sets additional requirements based on past experience and on his expectations regarding future use and perception.

Robustness
The finished design will be used and perceived in a different way than the commissioning body and designer had envisaged. A design to be used in different ways and contexts we call 'robust' That quality often leads to a plea for flexibility, 'leave possibilities open'. This means making fewer design efforts.
However, from that point of view, one can also defend an environmental diversity that offers freedom of choice and with which one not only makes allowance for the unsuspected, but also facilitates it. This means putting more effort into design.

Art and kitch
A painting such as 'the child with a tear' that prescribes emotions in us, emotions that we have to feel every time we look at it, is no more art than sentimentality (kitch). A true piece of art enables one to feel different emotions every time we look at it.[398]

Unexpected use
Nature has no wishes. Nevertheless, we try, as people, to make a programme of requirements for nature development.[23]. That is as paradoxical as the order 'Be spontaneous'. We do that based on a primitive and often inaccurate picture of how plants, animals and human beings will use the environment that we design. We are repeatedly surprised by the way in which the surroundings that we have designed are put to use by nature.

Unintended possibilities
We cannot make a programme of requirements for nature: each species has its own programme of requirements, about which we have little understanding and there are at least 1,500,000 species in addition to *homo sapiens*. All we can do is to create environmental diversity and wait to see what use nature will make of it. While ever one is unable to base the programme of requirements on prognoses, diversity remains a form of risk coverage for perceptive-, practical-, future- and survival values. This design intention seems to me to be important, not only for nature, but also for human beings, as long as we believe in their freedom of choice. Image quality can be related directly and in a design-oriented way to variation in surroundings.[399]

7.4 Legends

7.4.1 Resolution and tolerance

The vocabulary of design

The legend is the vocabulary of design. A legend unit is a type and any legend is a result of (sometimes hidden) typology (for example living, working, recreating, travelling in CIAM's functional typology). According to Jong and Engel (2002) typology in design study is not the same as top-down categorizing in empirical research. A type is not a category, a model or a concept but the raw material for design. A type combines incomparable categories. For example form and colour are incomparable: you can not speak about redder than round. A type has to be designed to become a model, a design that can be realised. Types are chosen because of their potential for design. They seldom lack aspects of form. So, a design legend often can not be explained by words.

Resolution, the distance between frame and grain

That is why design sometimes begins with a collage assembling reference images into a larger composition (collage, montage). In that case the reference images are the legend, sometimes even summarised and explained apart from the composition. The reference images should not be taken litterally then, but interpreted as general types. In a later stage the composition becomes a realisable design and the legend transforms in homogeneous lines or surfaces indicated by form or colour. Their external form in the drawing is its smallest detail, its 'grain', supposed to be homogeneous inside. Compared with the measure of the composition as a whole ('frame') the grain determines the resolution of the drawing. The measure in reality of frame and grain could be expressed in their rough radius R={…1,3,10,30,100m….} and r={…1,3,10,30,100mm….}. So, a resolution r/R=0.1 may concern a sketch, r/R=0.01 a drawing, r/R=0.001 a very precise blue print.

Tolerance, the preciseness of the drawing

Apart from the concept of *resolution* you have to consider the *tolerance* of a drawing. For example, if in an early stage of design you sketch a line indicating a road your intention is an approximate location, though it may be drawn in high resolution. Discussing the drawing with parties concerned a tolerance of 10m from the core of the line may be supposed. A drawing entails often different tolerances. The existing objects you want to keep in the design could be drawn with a small tolerance. Their exact location is determined. However, the designed lines start with a large tolerance and in the course of the design process their location is more and more precise; the tolerance decreases. If you draw the existing objects by narrow lines and the designed objects by thick lines your most important message comes to the fore best, while the objects everybody knows already shift to the background.

7.4.2 Scale-sensitivity

Frame and grain

Your legend is scale sensitive. For example, using the CIAM typology of living, working, recreating and travelling for a regional sketch (R=30km and r=3km) tacitly supposes design decisions like dividing living, working and recreational areas concentrated within a radius of 3km. However, using it for a district sketch (R=1km, r=100m) hides other design suppositions[400]. So, frame and grain (scale) determine the meaning of your design vocabulary (legend).

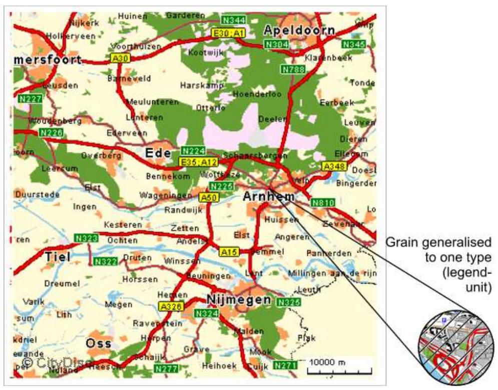


Fig. 1095 *The region Veluwe-Arnhem-Nijmegen 60x60km*
The radius of its grain is R=300m in reality; on scale 1:25 000 it is r=1.2cm

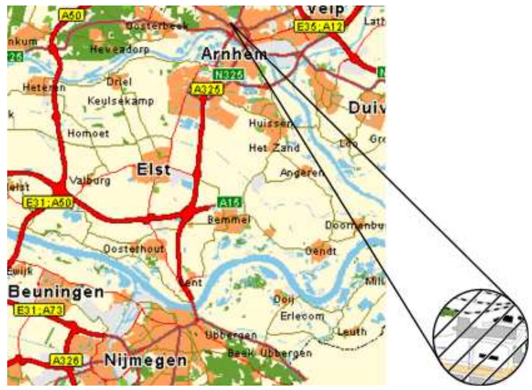


Fig. 1096 *The sub-region Arnhem-Nijmegen 20x20km*
The radius of its grain is R=100m in reality: on scale 1:10 000 it is r=1cm[a]

From sketch into blue print

In Fig. 1095 the radius of the smallest legend unit (grain) covers 1% of the radius of the whole map (300m) and a surface of approximately 30ha. So, it is not a rough sketch or precise blue print, but a drawing. Fig. 1096 is a drawing as well, but with a smaller frame and grain. In both representations the legend distinguishes built-up area, forest, heathland, agriculture, water and highways. What kind of legends you would choose planning the area? There are infinitly more possibilities than the CIAM legend, topographical and density stereotypes. They all introduce hidden design decisions.
A legend in grain spots of the same surface makes the produced map countable as a surface programme. Such quantity and surface sensible spots can be grouped together into larger surfaces or subdivided into 10 smaller spots each, increasing resolution eventually into that of a photograph at last. However increasing resolution makes the map less accessible for analysis.

[a] *CDRom 'de nationale Stratengids van Nederland met kaarten van de Topografische Dienst te Emmen' (Den Haag) Citydisc*

7.4.3 Unconventional true scale legend units

Design principles as a legend

Steenbergen and Zeeuw (1995); Steenbergen and Reh (1996); Steenbergen (1999) and Reh discerned principles of landscape design as legend units (types) for the national planning agency of the rural area: urban nodes, rural estates and castles, plantations, landscape theatres and streamlands. In 2003 students tried to find them on a large 1:10 000 map of Fig. 1095 (Fig. 1098) and glued them as spots of two sizes (300m and 1000m) from Fig. 1097.

Grain				Legend				
Radius real	surface real	radius on scale	diameter on scale	Red	Orange	Yellow	Green	Blue
m	ha	cm	cm	meaning				
300	30	1,2	2,4	urban node	rural estate	plantation	landscape theatre	streamland
1000	300	4,0	8,0					

Fig. 1097 *Legend-units landscaping r={300m,1000m} in a frame R=30km 1:25 000*

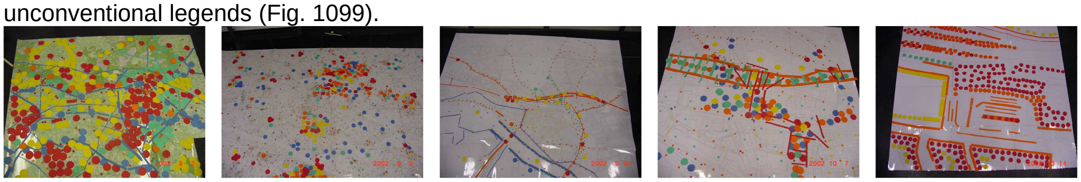
Existing urban nodes, rural estates and castles, plantations, landscape theatres and streamlands in the region of Fig. 1095 were glued in grey shade first, planned ones in clear colour later.

Fig. 1098 *Students making a map*

There are many existing rural estates and castles in that region. Vista's and other forms of accompanying landscapes were generalised in the glued spot. Plantations are colonised surfaces by which the programme is put on stage by intended or unintended grid like landscape architecture. They could be found not only in the rural, but also in the urban area, going beyond the stereotypic town-landscape dichotomy. Landscape theatres are recognisable natural, agricultural or urban systems of views and routes by which the physical, biological or cultural origin of the landscape could be experienced. Streamlands are locations where the dynamics of natural or urban life can be experienced.

Physical quantities as a legend

On every level of scale (R={30km, 10km, 3km, 1km, 300m, 100m}) such maps were made with shifting unconventional legends (Fig. 1099).



week 1 30km Landscape | *week 2 10km Town and traffic* | *week 5 1km Infrastructure* | *week 6 300m Physics and soil* | *week 7 100m Materialisation*

Fig. 1099 *Exercises BkM1U 06 2002*

Quantified human activities as a legend

To indicate traffic in a frame R=10km (Fig. 1096) spots of Fig. 1100 were used.

Grain				Legend for a regular Monday				
Radius real	surface real	radius on scale	diameter on scale	Red: people average per hour using a station or motorway exit	Orange: people living at home	Yellow: people working	Green: people recreating	Blue: people caring or studying nature
m	ha	cm	cm					
100	3	1,0	2,0	100	1000	500	<100	<10
300	30	3,0	6,0	1000	10 000	5000	<1000	<100

Fig. 1100 *Legend-units town and traffic r={100m, 300m} in a frame R=10km, 1:10 000*

Different legends on different scales

Infrastructure was studied in a frame of R=1km, physics and soil in a frame of 300m.

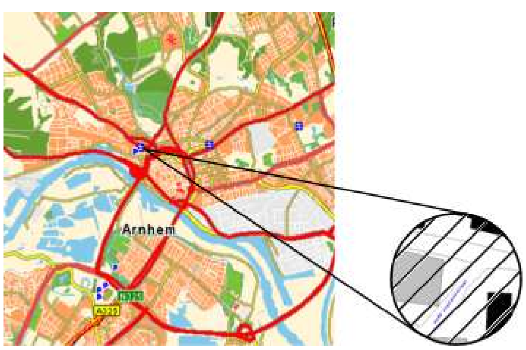


Fig. 1101 *The town of Arnhem 6x6km. The radius of its grain meets R=30m in reality; r=1.2cm on scale 1:2 500*

Fig. 1102 *The railway station neighbourhood 600x600m of Arnhem The grain is R=3m in reality, 1,2cm on scale 1:250*[a]

Money as a legend

Existing and planned infrastructure was studied in spots of investment according to Fig. 1103.

Grain				Legend				
Radius real	surface real	radius on scale	diameter on scale	Red investment crossing	Orange investment trace	Yellow investment multiple land use	Green investment milieu	Blue investment waterworks
m	m^2	cm	cm	meaning				
10	300	1.0	2.0	€ 10 mln	€ 10 mln	€ 10 mln	€ 10 mln	€ 10 mln
30	3000	3.0	6.0	€ 100 mln	€ 100 mln	€ 100 mln	€ 100 mln	€ 100 mln

Fig. 1103 *Legend-units infrastructure r={10m, 30m} in a frame R=1km, 1:1000*

Problems and opportunities as a legend

Physics and soil was studied by problem and opportunity spotting according to Fig. 1104.

Grain				Legend				
Radius real	surface real	radius on scale	diameter on scale	Red	Orange	Yellow	Green	Blue
m	m^2	cm	cm	meaning				
3	30	1.2	2,4					
first: problems **then: opportunities**				Safety	Noise	Light (sun/ artificial)	Ecotope	Wind
10	300	4.0	8,0					

Fig. 1104 *Legend-units physics and soil R={3m, 10m} in a frame R=300m, 1:250*

Creative design starts with doubting its most self evident supposition: its vocabulary.

[a] *CDRom 'de nationale Stratengids van Nederland met kaarten van de Topografische Dienst te Emmen' (Den Haag) Citydisc*

7.5 Scales of separation

7.5.1 Potentials rather than functions

An important starting point for designing, forming policy on, and researching into legend units is the level at which one wants to separate or mix them. I deal with the scale-segmented approach here. However, the terms employed in this are only used here to indicate the extent of an area and thus have no functional meaning other than 'potentials' for functions.

Scale falsification

This approach is based on the discovery that 'scale falsification' (see Fig. 697) can occur in most urban architectural argumentations when one derives the argumentation from another scale level than that on which the inference is implemented. For example, this has been the case with the division between living and working. The radius within which the hinderance was determined was much smaller than the radius within which living was separated from working. In addition, the scale-segmented approach renders designers' paradoxical concepts, such as 'bundled deconcentration', understandable and acceptable. The same applies to the separation and mixing of red, green, blue and black.

The paradox of a homogeneous mixture

The concept of 'mixing', for example, of mixing built-up and vacant areas, is scale-dependent. What in a large radius is called mixing, can be segregation in a small radius. These conceptual confusions cannot arise any more in the legend proposed. Different principles for arranging can be recognised immediately on the map, according to scale.

Accords of distribution

The distribution of the urban area within a radius of 10 km has hardly any influence on the landscape around, if this is concentrated within a radius of 30 km. (see Fig. 702, the two upper variants CC and CD). However, the distribution within a radius of 30 km breaks the landscape around into landscape parks. Under that condition, the distribution within a radius of 10 km again becomes important: the landscape parks are further divided into urban landscapes. Until 1983,[13] the national strategy was DC (Bundled Deconcentration, see *Fig. 848*). After thatRPD (1983), the policy was changed to CC (Compact City/Town), but, in practice, the strategy was CD and even DD.

Shape, size and adjacent legend units

Shape and size do not in themelves give an indication of the probable function, but rather of possible functions; of functions such as nature and recreation (see Fig. 772 and Fig. 773).
Due to technical developments, some traditional urban functions (such as certain types of distribution) have become less dependent on the size of the built-up area around (the 'area capacity': the number of residents within a certain radius). Others (such as commuter traffic, public transport, urban nature and recreation) are still, or have become even more, dependent on that size. A table of potential functions could also be set up for each radius of the built-up area, even though it would have a more temporary character.

Value and adjacent legend units

The internet is used a lot by estate agents. This is one of their messages:

'... project developments of houses, appartments and detached villas will also be situated at the water's edge. In Almere, houses have been built at the edge of the lake, with a mooring place for a boat, so that one gets the idea of being on holiday in one's own house, whatever the season. Rotterdam makes use of its water-rich environment and Amsterdam is planning a new development at a location still occupied by water. Nieuwegein has its river bungalows along the banks of the Lek and there are many other locations where one can live at the water's edge. Who would not want to live at the side of the largest expanse of water in the Netherlands, the North Sea, and watch the sun sink into the sea every cloudless evening?
But, of course, we cannot all live at the water's edge, so some people go and live on it. Houseboats and boat conversions decorate the sides of the water in all shapes and forms, irrespective of municipal

and ministerial policies to discourage them. Hardly any new moorings become available, and permits are hardly ever issued for them any more. A boat conversion without a mooring permit is like a house without a building permit.
The remaining alternative is to live far away from the large areas of water and to buy a pleasure (!) yacht in which one spends as much of one's free time as possible. The yacht harbours on the Veluwemeer and the IJmeer, the Veersemeer and the Biesbosch, Nieuwkoop and Vinkeveen, Loosdrecht and the Sneekermeer offer these floating cabins, tired of tramping through the waterways all summer, places where they can hibernate through the winter en masse. Because another fact is that: it is nice on the water as long as it doesn't rain (too wet) and as long as it is not frozen over (too dry). But now let's return ... to the shore.
Because so many people are charmed by the restful effects and wide expanses of water, with the many additional recreational possibilities close at hand, these locations are more expensive than other spots.
If living at the water's edge is restricted to the narrow ditch at the bottom of a back garden, then there are hardly any financial consequences. But if that narrow ditch becomes a stream, then the price of the plot is already higher. And should that stream broaden out into an often depicted slow-moving lowland river, flanked by summer and winter dykes, then the situation becomes very attractive for many people. Consequently, ... the more cubic metres of water that move along the banks of the waterway, the higher the square-metre price of the land becomes.

Maas van Vliet
Estate agent/ surveyor, Nieuwegein

Here, the economic function of the transition between buildings and water is defined. However, there are other functions and other transitions that must be valued and considered.

Boundaries between legend units

Apart from the colour combinations red and blue, one can distinguish on different scale levels the following margins between red, green, blue and black:

straal in m	RG	RB	RZ	GZ	BZ	GB
30 000	nationale spreiding?	bouwen in de duinen?				Nederland Waterland
10 000	Groene Hart?		mainports	groene inpassing van snelwegen	Afsluitdijk	Casco-concept
3 000	bufferzones?				Tjeukemeer	3 netwerken
1 000	stadsgroen?	Makelaars-droom	geluidhinder		havens	
300	wijkgroen?				boulevards	oever-recreatie
100	buurtgroen?					
30	vlekgroen?		ontsluiting	bermbeheer		
10	hof of tuin?	ontwatering			kaden	taluds
3						
1	snippergroen	Venetië	rooilijnmarge			beschoeiing

Fig. 1105 *Urban architectural agendas with respect to legend and scale*

Drawing creates boundaries. The decision as to where one draws a boundary, and why there, in particular, depends on the agenda.[401]

7.5.2 Conditional considerations

Each cell in Fig. 1105 has values and dilemmas that must be weighed up, not only economic, but also spatially, ecologically, technically, culturally and managerially. These considerations become simpler when one places those values in a conditional context (Fig. 1106).

Fig. 1106 *Urban operations arranged conditionally*

This figure shows, for example, that one cannot imagine management without culturally based collective concepts and shared presuppositions, but reversely, one can.
As a result, one cannot imagine culture without an economy that makes a decent existence possible, but reversely, one can. One cannot imagine economy without technical infrastructure: because, if the dykes break, the economy in the above-mentioned sense, does not exist any more. One cannot imagine technique without raw materials and raw materials cannot be imagined unless there is a time–space connection.

Weighting the uncomparable

Fig. 1107 gives an example of considerations using the above values, and summarized conditionally.

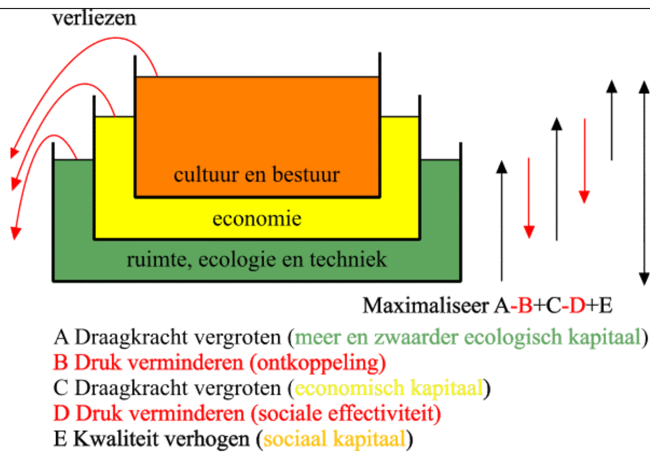


Fig. 1107 *Conditional assessments*

7.5.3 The context and perspective of consideration

Futures

Anybody has an implicit idea about the probable future. It directs your decisions. When somebody else judges your design (evaluation), (s)he can reject your design from another idea about the future.
So, it is important to make explicit your idea about the future for an honest judgement of your study.
Try *http://team.bk.tudelft.nl*, publications 2003, FutureImpact.exe (Fig. 1108) to make your ideas about the future explicit in a design relevant way.

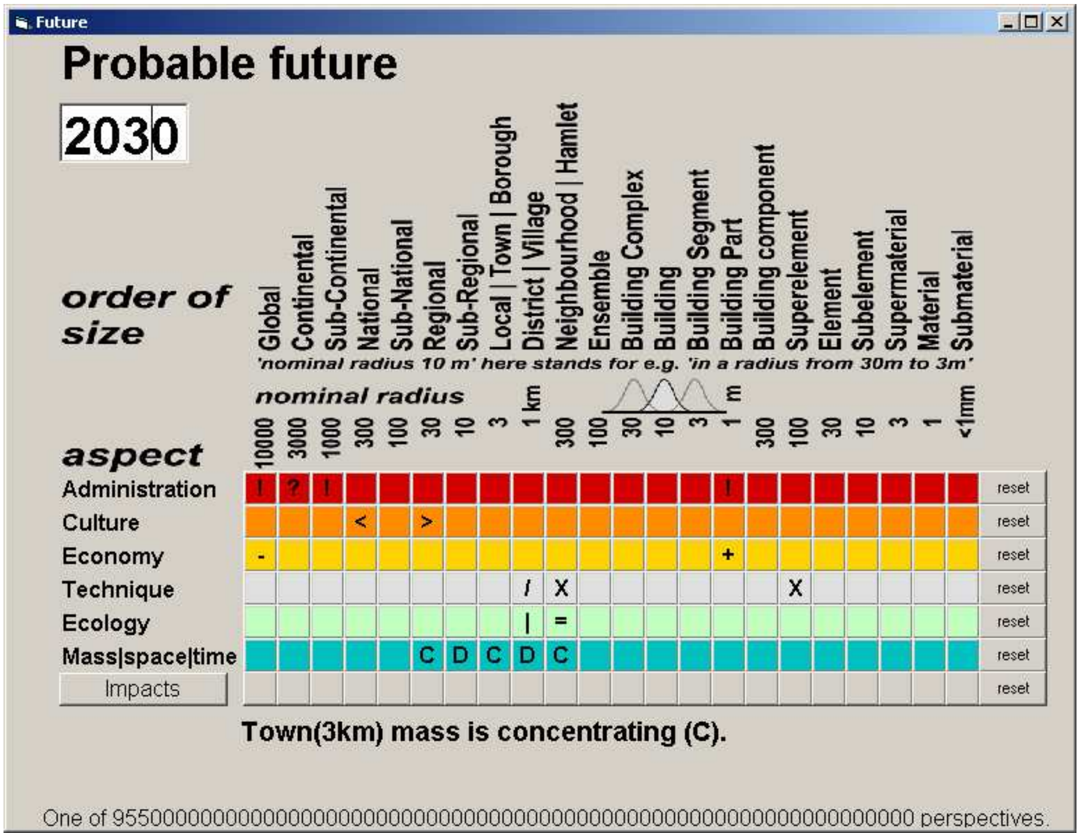


Fig. 1108 *Determining your probable future*[a]

In what kind of management, culture, economy you will have to operate?

The aspects 'management', 'culture' and so forth, are deliberately operationalised in an abstract way in extreme values (initiative(!) versus executing(?), traditional(<) versus innovative(>) and so forth), so that they mean something at each order of magnitude. Then they gain another working on each scale level, whereby their meaning shifts according to scale context.

Frame and grain of your object determine your context

Deciding among incomparable spatial, ecological, technical, economic, cultural and managerial values (evaluation) is dependent on the size of the project, the context within which the programme or intention is determined and the probable future in which the impacts of the intervention are anticipated within the term of a given planning horizon. In a second sheet of the computer programme you can fill in the frame(O) and grain(o) (size and resolution) of the object you have in mind. By doing so, the rest is context (see Fig. 1109).

[a] Jong (2003) http://team.bk.tudelft.nl , publications 2003

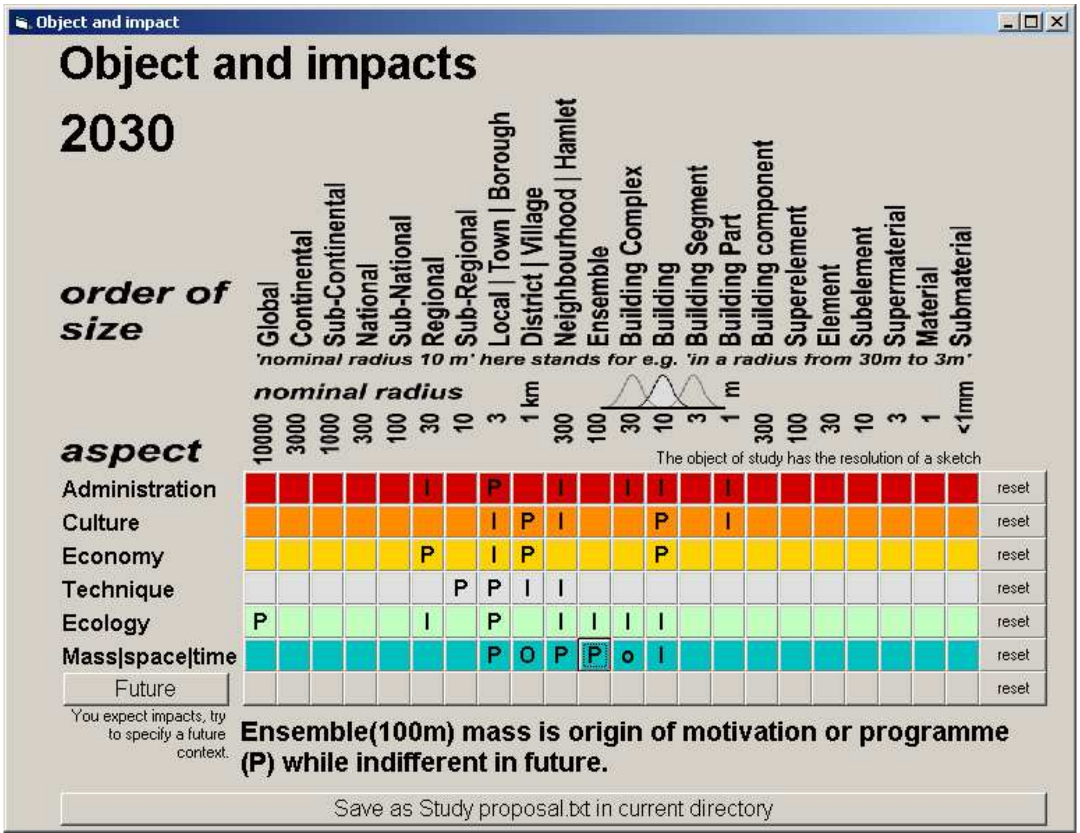


Fig. 1109 *Determining object, local context and impacts*

What targeted (P) and non targeted (I) impacts you expect from the object you have in mind in that context? Once you have made explicit *where* you expect the object to have its impacts (not even specifying them), you can ask the computer programme to make the framework of a priliminary study proposal by pushing the button below (see Fig. 1109).

Planning horizon and changing perspective

The perspective determines the manner in which one guesses effects, and this perspective changes in a rather unpredictable way, for example, at national level, as follows,:

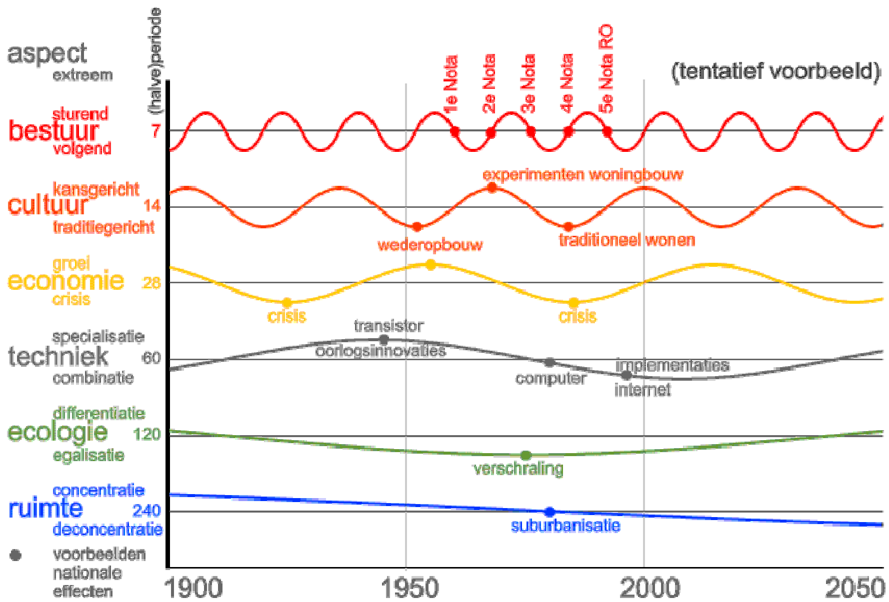


Fig. 1110 *Changing perspective*

The predictability decreases with increasing periodicity (in an upward direction).

Geographical and historical variation in context.

Fig. 1111 represent the same sorts of outside spaces in Venice, and are on the same scale as a ArchitectenCie's design for the harbour island in IJburg Amsterdam. The extent to which the geographical and historical context can determine the outcome is obvious from this. From these images, the potential of exposure of stone to water also becomes evident, and the significance of the margin between built-up and vacant areas.

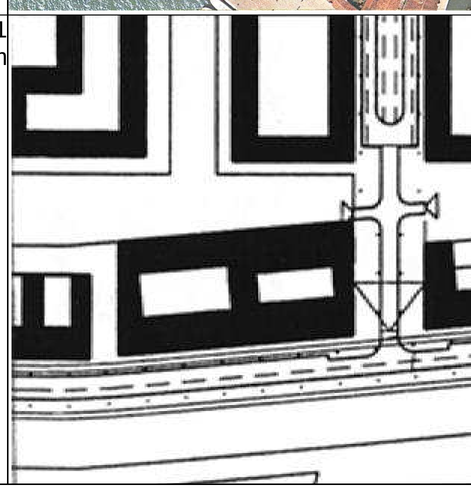
	Venice 1 x 2 km		Venice 200 x 200m radius 100m < canals every 100m < ⊥ streets every 30m < opened up internally by inner streets < occasionally with front to the water
Novelli (1989)			Venice 200 x 200m < interior < line of sight over the water < concave avenue
	IJburg 1 x 2 km		IJburg early design Harbour island 200 x 200m the same scale < interior < line of sight < more room to see < greater margin < convex avenue

Fig. 1111 *Geographical variation of conceptions*

7.5.4 Relief between built-up and vacant areas

A primary separation of legends

The examples of Fig. 1111 illustrate how important the margin is between built-up and vacant areas, and how much potential this margin has for a coherent urban image. Vertical segmentation on the façade surface gives motives for placing greenery, lighting, street furniture, pedestrian crossings and possibilities for interaction with adjoining water. In this way, public space is segmented by the façade in a manner that everyone understands. A number of examples are given below of this type of margin and the possibility for differentiating the outside space in relation to this with green and blue.

Inward and outward view

An urban architectural plan can be given shape starting from either the inside or the outside space. At the buildings level, the first principle starting with the outside is geared towards large, detached constructions that are expressive on all sides. Within this, as many external functions as possible (parking, traffic, light, air, greenery) are internalised. This leads to a relatively large outside area and so to large façades. Walled-in feelings are compensated by windows overlooking vacant and empty spaces, courtyards or inner squares within 10 metres from each room.

Outward extensions

Reasoned from inside outwards, a possible break in the building line is made in the form of 'cold extensions' such as platforms, balconies, galleries and oriels ('external margin' extensions) that leave the façade surface with a sudden jump in temperature (the skin) as undisturbed as possible. This is in turn, in itself, favourable for restricting the outside surface, although every extension also causes cold transition areas.

Inward extensions

In contrast, the second principle in the same scale tends towards the externalisation of functions, towards buildings that are less independent within themselves and with internal breaks in the building line (building backwards into an 'internal margin'). By doing this, the outside space gains more protected and covered external spaces such as inner corners, porches, arcades and walled-in balconies.

Recessing and extending parts of a façade

A systematic combination of both gives the façade a horizontal and/or vertical relief:

Horizontal relief	small space	large space	*vertical relief*	traffic space	lodging space
top floor	recessing	extending			
intermediate floors	extending	recessing	corner	recessing	extending
ground floor	recessing	extending	flank	extending	recessing

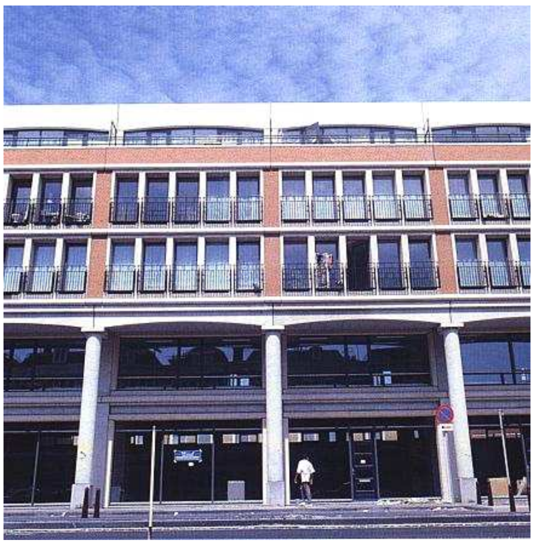
Fig. 1112 *Horizontal and vertical relief*

Systematically building recesses, setting the building back in an internal margin in a horizontal relief is appropriate mainly for the ground floor, at the level of public use, and – because of exposure to the sun – on the top floor. Building outwards can easily take place where there is unused space, so on the intermediate floors. Put the opposite way: platforms, ramps and extensions on the ground floor, recessed floors and overhangs on the top floor or roof (Wright effect), lends itself more to special locations and to large outside spaces. These accentuate the contours of the building.

Horizontal relief

Oud
Boven, Freijser et al. (1997)

15% horizontal extension
on the 1st floor



Coenen

Mecanoo

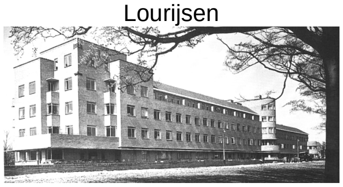
Fig. 1113 *Examples of horizontal relief*[a]

[a] Freijser et al. (1997)

Vertical relief

To achieve a vertical relief in the façade, one can choose to recess the corners and extend on the sides of the building (for example, at the entrances to the building), extending both over the floors, or one can choose for the reverse: fortress-like extensions at the corners and recesses in the sides of the ground plan. The latter is less suitable because of traffic considerations and lends itself to special situations such as car-free streets.

Lourijsen



Brandes

De Bazel

Greiner

Brandes

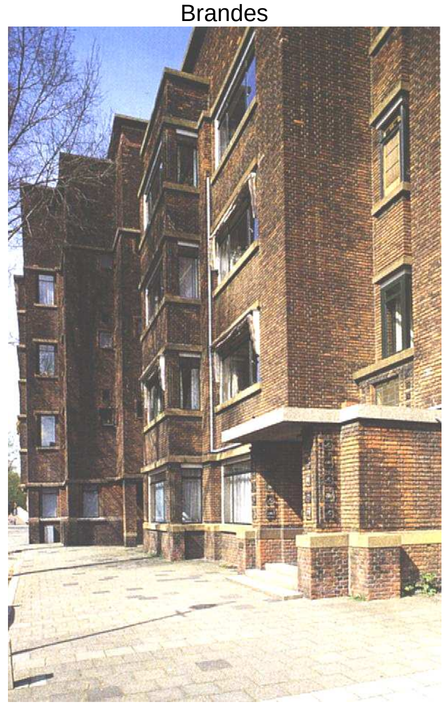
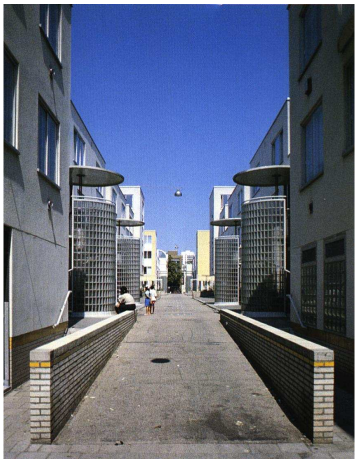


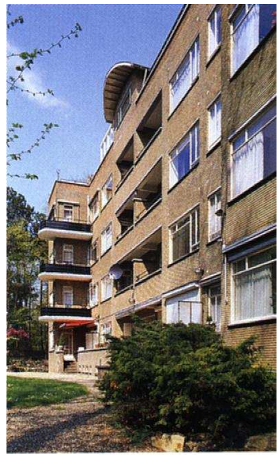
Fig. 1114 recessed corner

Fig. 1115 extended flank



< Atelier PRO

extension on the corner and flank



< Wils

extension on the corner, recess in the flank

< Wils
Boven, Freijser et al. (1997) page 65

30% horizontal recess on the first floor 1[e]
40% horizontal extension on the ground floor.

Fig. 1116 *Combinations*[a]

Sculptural effect

Where there is increasing non-systematic variation in recessing and extending, the sculptural effect increases at first, but then it decreases again because of fragmentation.

Loerakker

Van Herk

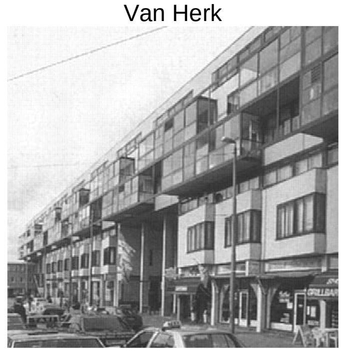


Fig. 1117 *Examples of combinations of horizontal and vertical relief*

[a] Freijser et al. (1997)

Structural effect
By, introducing a pattern on the smallest scale (internal or external balconies), from a distance, the façade gains a structural effect.

Mehrtens | Benthem en Crouwel

Fig. 1118 *Repetition 3m>30m*[a]

The recognisability of the ensemble
One can leave these choices entirely to the architect or, from the beginning, link it to the context in order to 'add lustre' to a special location. By doing this, an urban architectural ensemble (street, square, building complex in a radius of approx. 100 m) becomes more recognisable as an entity, compared with other ensembles. After all, such choices have a greater effect if they are repeated between the buildings themselves. For example, recessed corners of blocks of buildings (see Cerda's Barcelona) only create a broadening urban architectural image if the same principles are used in the next and/or opposite block, also if the symmetry in which this occurs is incomplete.

7.5.5 Interaction with exterior spaces

Differences on higher levels of scale
When one lets such choices depend more on the context at a higher scale level, that requires an urban architectural typology of location variants in a broader context. One can then look for the context on the district level (1km◎) up to the European level (3000km◎).
The larger the context in which the location variants of open spaces and especially open water occur, the more scarce and thus the more precious they are. That applies to the corners of an island such as the south-west corner of the Harbour Island (Haveneiland) in IJburg, but also for IJburg as the inner corner of the IJsselmeer, or for Amsterdam as a corner of Europe, where lines from south and east converge on sea- and airports. One can leave such location factors for what they are, but one can also exploit them urban architecturally, and cash in on their scarcity.

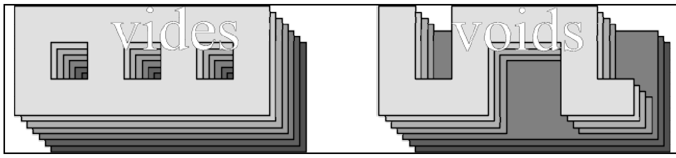
Homogeneity by mixing places
In an age in which residents bring ideas back home with them from holidays spent in all parts of the world, reminders of Venice or St. Petersburg can also play a role, but by careful interpretation,

[a] Freijser et al. (1997)

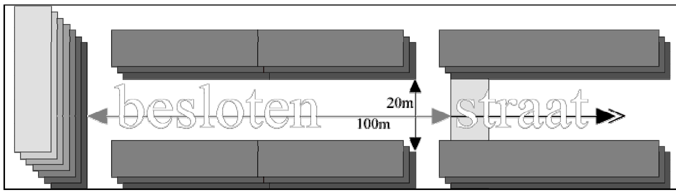
optimalisation, transformation and realisation, these must be adapted in such a way that they become rare in their own right. To what extent can the combinations that have come about in Venice, be used as a model for those in Amsterdam, and to what extent are they divorced from our time or place?

Interaction with sun, wind, water, earth, life, living outside

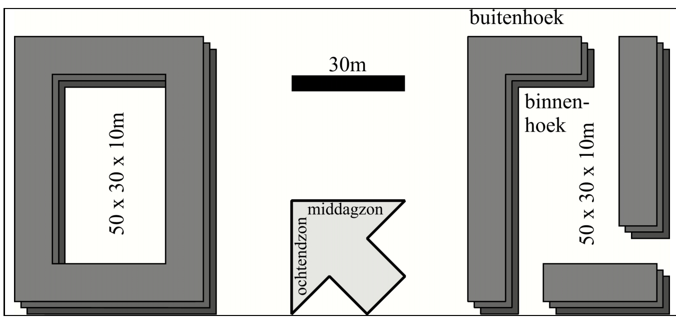
The effect of the outside space on the margin, and *vice versa*, is also connected here with climate (for example, with the amounts of sun and wind) and orientation (their direction), but, in particular, it is connected with the size of the open space along which the margins lie and the extent to which they are enclosed. Spaces that are totally, or for the most part, enclosed horizontally, such as empty spaces and voids (up to a breadth of 20m), courtyards and inner squares (20m or more in breadth) offer, in each case, another context for designing the margin. In the last two, it makes rather a lot of difference whether these are part of the through-traffic structure (outside courtyards and squares) or not (inner courtyards and squares).



incorporated up to 30 metres in a building
empty spaces
voids

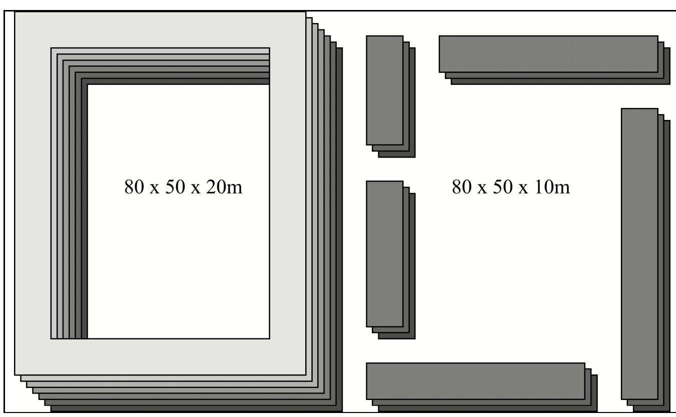


length smaller than 5 times the breadth: enclosed, otherwise through-going spaces: passages, streets, avenues



up to 30m in breadth

interior courtyards, small inner squares
exterior courtyards and small outer squares



more than 30m

courtyards, inner squares
courtyards, outer squares

with less than 50% road surface: courtyard, otherwise a square

Fig. 1119 *Outside spaces*

Squares


market square for animals (Beestenmarkt) in Delft approx. 40 x 50m


Main market square (Grote Markt), Haarlem


Mercator Square (Mercatorplein), Amsterdam approx. 80 x 140m

Fig. 1120 Squares

Margins


Gouda Abken BV, approx. 20m

P.M.
Schiedam by Van de Seyp and Van Dijk, approx. 10m

Fig. 1121 Margins in courtyards and streets

Widths


EDE BRAUWERE
Fig. 1122 Small outside space with continual horizontal relief


Rotterdam Crooswijk Malschaert
Fig. 1123 Large outside space with vertical relief every 80m.

The depth of relief

Relief that has a rather small depth can, nevertheless, greatly influence the appearance of streets, as we know from experience in existing districts where plastic window-frames that have been moved to the façade surface interfere with the recognisability of the street.

The fequency of relief

The frequency of the relief is related to the length and height of the façade. The minimal frequency is 0. A small frequency is once per façade (e.g.once vertically between two side streets or once horizontally between the lowest and highest floors). Each frequency larger than that gives a more unrestful image and, in special cases, may be accepted or even requested.

7.5.6 An academic example of urban architectural rules.

The rules given here only apply to building lines (alignments) and façades. A distinction is made between ground-floor façades (BG), intermediary floors (TV) and the floor directly under the roof (DV).

1. The building lines are the outside boundary of the façade surface, unless it is established in the following rules that at a particular depth, over a certain area, and at a certain frequency, it is permitted to extend and/or recess a building with respect to the building line.
2. The particular characteristic of the planning area within a town is ‘powerful and urban’. This leads to the general rule that deviations from the building line should strengthen the vertical character of the buildings and, with a view to this, must extend above each other over a number of floors.
3. Acceptability and the desirability of having differences between the façade surface and the building line is established by four fixed characteristics of the urban architectural plan. These are:

   a. the position of the building with respect to water;
   b. the position of the building within the urban district;
   c. the position of the façade with respect to the public space that borders it;
   d. the position of the façade with respect to the sun.

Each of these characteristics leads to a series of different public spaces. Each series is divided into a series of types (rules 5-8). For each of the four characteristics in each series a general rule is given (rules 8-12).

5. Water in the planning area is divided into four types on the basis of breadth, as follows:

W1 >100m	: external water
W2 50-100m	: internal water
W3 25-50m	: waterways
W4 <25m	: canals

6. The planning area is divided on the basis of centrality in three types of urban area, as follows:

IJ1	centre, up to 300m from the southernmost point of the harbour
IJ2	central area, 300-1000m around the centre
IJ3	periphery, urban areas around the central area

7. Public space in the planning area is divided into ten types, grouped into streets (S), squares (P) and courtyards (H), as follows:

S1	1>10 b, where b is 24–48m: main street
S2	1>10b, where b is 12–24m: street
S3	1> 5b, where b is 4–12m : lane
S4	1> 5b, where b is <4m : passage
P1	built-up on one side, remaining sides W or S
P2	built-up on two sides, remaining sides W or S
P3	built-up on three sides, remaining sides W or S
P4	built-up on all four sides.
H3	built-up on three sides, remaining side W

H4 built-up on all four sides.

8. The façades are divided according to their position in relation to the sun's orbit (Z), by the hours of the day, as follows:

Z1	0–6 hrs	: night façade (N–E)
Z2	6–12 hrs	: morning façade (S–E)
Z3	12–18 hrs	: afternoon façade (S–W)
Z4	18–24 hrs	: evening façade (N–W)

9. Because of traffic, the corners between S1 and S2 are recessed from the corner to 3m.
All the other corners are built along the building line to at least 5m from the corner.
The rules below only apply then to the remaining surface of the façade.

10. The general rule for recessed building surfaces with respect to the building line in connection with their location with respect to the sun's orbit is that the less exposure to the sun, the smaller the percentage of the façade surface that is allowed to deviate from the alignment of the building. For Z1, the desired deviation from the remaining façade surfaces according to rule 10 is 20%, for Z2 this is 40%, for Z3 60%, and for Z4 80%.

11. The general rule for the depth of the recess with respect to the alignment of the building in connection with location by water and public space is that from at least 1% of the bordering public space in the south-west of the planning area (*luw*) to at least 5% of it in the north-east of the planning area (*ruw*) are recessed inside the building alignment.

12. The general rule for the frequency of recessing with respect to the building alignment is that the nearer one comes to the centre, the 'liveliness' of the façade increases. In the connection with the above sentence, the frequency with which recessing occurs amounts to a maximum of 3 times for each 100m of building alignment on the north-west side to at least 9 times for each 100m of building alignment on the south-east side.

7.6 Boundaries of imagination

7.6.1 Creativity

Creativity means leaving out at least one self evident tacit supposition. We found a systematic way to examine *hidden presuppositions* in science and technology. We provisionally call it '*conditional analysis*' and use it in ecology, design, education and in making computer programs. It has more to do with possibilities than with probabilities or necessities[a]. It gives some insight in the boundaries of imagination and thus design.

Conditional analysis

It is based on the simple comparison[b] of two concepts A and B, putting the question 'could you imagine A without B?' and the reverse question. Temporarily we take in consideration only the pairs of concepts that make possible a different answer on both questions.

As soon as we can imagine A without B but B not without A we call A a (semantic) condition for B. As soon as we find a concept C that we cannot imagine without B but B without C we can, we have semantically a '*conditional range*' of concepts ABC out of which the hypothesis emerges that we cannot imagine C without A, but in the reverse we can. Though introspective, these comparisons turned out to give consensus based on a possibility of falsification[c].

Culture supposes life, life supposes matter

Let us for instance conditionally compare the ecological concepts *Abiotic*, *Biotic* and *Cultural* phenomena (A, B and C). I cannot imagine cultural phenomena without biotic (because culture presupposes at any time living people and functioning brains), but biotic phenomena without cultural I can (for instance plants[d]). I cannot imagine biotic phenomena without abiotic phenomena, but abiotic phenomena without biotic I can (for instance light, air, water, soil). So the hypotheses to be controlled are: 'I cannot imagine cultural phenomena without abiotic phenomena, but abiotic phenomena without cultural I can.'. If we confirm that hypotheses we can draw a conditional scheme like this:

[a]Some presuppositions of normal logic lack that seem to stagnate the development of drawing theory, design theory and ecological theory. Though we, Jong, T. M. d. (2002) Verbal models in: T. M. d. Jong and D. J. H. v. d. Voordt *Ways to research and study architectural, urban and technical design* (Delft) Faculteit Bouwkunde TUD did not examine it thouroughly, semantic conditions may be tacitly presupposed in normal logic. To formulate the function of a logical operator 'o', you first need to test the truth-value of 'PoQ' in four conditions (if P is true and Q is true, if P is true and Q is false, if P is false and Q is true, if P is false and Q is false). That conditional if..than.. test cannot be performed by the conditional operators (⇒, ⇐ and ⇔) to be defined by the truth-table itself. What kind of conditional comparisons are they than if they are tacitly supposed in formulating these well-known conditionals? Conditional analysis may also shed some light on the hidden propositions in the terminology 'true' and 'false' and the hidden propositions concerning restrictions on space and time in logical reasoning. For instance, the expression 'It rains and it rains not' is true on world-scale, but forbidden in formal logic as a contradiction. So the hidden supposition of formal logic must be that only local events could be logically expressed. A drawing containing different locations cannot be logic in this way.

[b.] The expression 'comparison' is used here in an unusually broader sense than in formal logic or mathematics, but until now seemed to be correctly understood without explanation.

[c.] Including the comparisons needed for the hypothesis, we needed 6 comparisons to make a conditional sequence of three concepts. The fourth one will need another 6 comparisons, the fifth another 8. We compared appoximately 200 crucial concepts in science and technology like 'set', 'pattern', 'structure', 'function' and the like (note 6). That required 39800 comparisons and resulted in a samantically conditional sequence of these concepts with one single condition at the beginning.

[d.] This already says something about my preconception about culture: 'a plant has no culture'. Though the concept of culture is not yet defined by this operation, it is in any case 'placed' and the boundaries of many possible definitions are set.

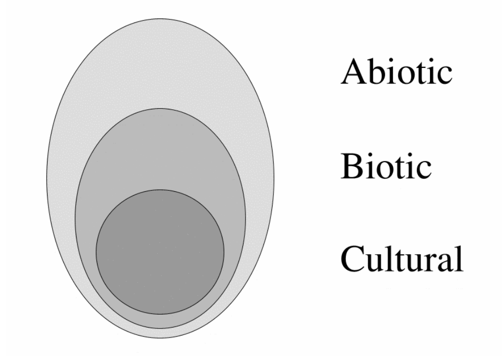


Fig. 1124 *The ABC model*[a]

It seems to be a *Venn diagram* out of set-theory. But it is not, because set-theory presupposes more than the concept of presupposition itself. It presupposes for example the concept of 'element' and any equality of the elements (according to the criterion of the set). Jong (1992) supposes less.

A *semantic Venn diagram* does not yet need these and perhaps other presuppositions. The drawn borders are no inward formulated borders of sets and elements, but outward boundaries of eventually vague and continuous conception.

The *ABC model* represents phenomena outside culture, but is itself a concept and thus culture.

This raises the philosophical question whether there is any difference between '*preconception*' (*presupposition*, *assumption*) and '*precondition*' (*prerequisite*) at all. The environmental crisis taught us however that there appeared preconditions for life we did not preconceive beforehand. We consider '*environment*' in an ecological sense as the set of conditions for life, known or yet unknown.

Nature a human concept or the reverse
In *Fig. 1012* two very different ecological presuppositions that have a direct influence on the way people design a landscape or townscape are drawn: 'Man is part of nature' and 'Nature is only a human concept' *ecocentrism* and *anthropocentrism*).

A paradox of argument
Both suppositions contain a paradox. The anthropocentric way of thinking would imply that physics and biology ('N') cannot find anything new from experiment or observation that is not already included in the existing set of concepts (C) or its combinations[b] (idealistic position). Wittgenstein (1919, 1959; Wittgenstein (1963; Wittgenstein and Hermans (1986) said: 'The boundaries of our world are the boundaries of our language.', and: ‘About which you cannot speak you have to be silent.’ It was a reason to suspect him of mysticism.
The ecocentric view however would imply that we cannot communicate such observations. To take these observations serious, we have to regard them as a not yet cultural part of the natural world N (materialistic position).

Logic as culture
Let us now consider culture (C) as an intermediate between the picture ('N') and the portrayed in the natural world (N). Wittgenstein supposes that the picture and and the portrayed have their 'logical form' in common. Formal logic however cannot cope with expressions like exclamations, questions, proposals (like designs) and orders: they have no logical form. That is what occupied the later *Wittgenstein (1953)*. In my opinion these linguistic expressions are the very solution to the paradox of ecocentric thinking. Questions are the definition of an emptiness at the boundaries of knowledge, proposals and designs are excursions in an unknown, but nevertheless imaginable and perhaps possible future world.

Culture as a set of suppositions
This brings me to a specification of culture, creativity, science and art. *Culture* is the set of suppositions in communication. Suppose we had to explicate all presuppositions of our communication before we could start with it, in that case we would seldom have time to communicate[c]. Fortunately we don't have to explicate every time all these preconceptions, we simply take them for granted and call them culture. That is easy, but it also keeps 'self-evident' concepts out of discussion. *Creativity* just

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[a] Jong (1972)
[b] Synthetic judgements a priori of Kant, I. (1976) *Kritik der reinen Vernunft* (Frankfurt am Main) Suhrkamp Verlag. .
[c] 'Suppose we are human, suppose we use a language, suppose we understand the same things using the same words, suppose this building does not pour down, suppose you don’t kill me for the things I say etceteras etcetera . . . than we could have a conference, shall we have a conference?'

starts with disclaiming these apparently self-evident preconceptions, *science* starts with doubting them.

Art as a ripple at the outside boundary of culture
Art is a ripple at the outside boundary of culture denying conventional and adding unconventional presuppositions by poièsis[a]. We need art or technique to make new concepts outside conventional language. Science on itself does not provide that.

7.6.2 Possible futures

Different futures
Probable ecological, economic and cultural *futures* are gloomy from a viewpoint of inevitable environmental developments. But are the probable futures the only ones that we have to take in consideration? *Empirical research* is limited to the probable futures. Design, or technical research is limited to the broader set of possible ones.
I cannot imagine the probable without the possible. The reverse I can.
What is probable must be by definition possible.

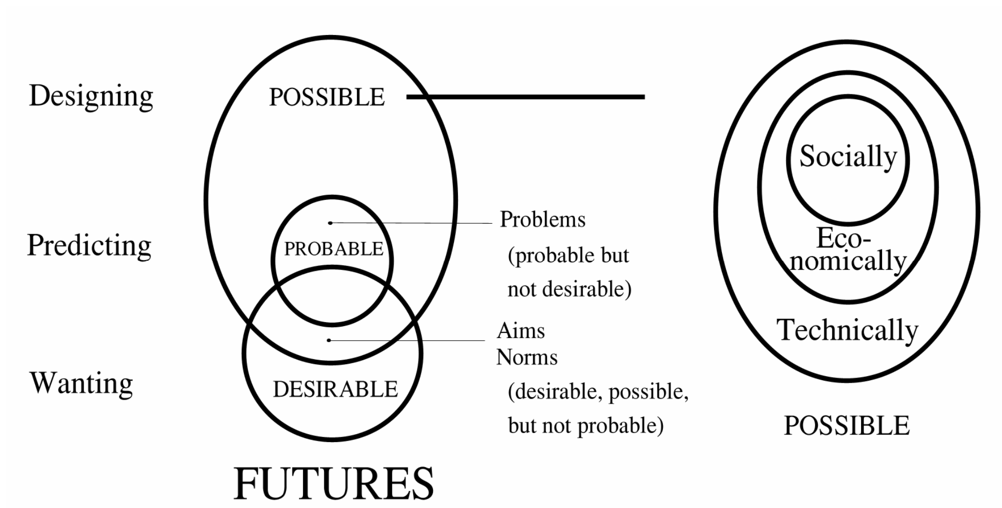

Fig. 1125 The modality of the possible

Boundaries of causal thinking
Predicting probable futures requires causal thinking on an empirical basis. We cannot predict possible futures as far as they are not probable: we have to design them. They are invisible for probability-calculations. They are fundamentally ab-normal, outside the 95%-area of probability. Designs cannot be calculated or predicted. If so, they would no longer be designs. Design produces possibilities, conditions, freedom of choice, difference.

Design does not cause futures, it makes them possible
Every line a designer draws is a precondition for further drawing, but not a cause for the rest of the design process. In the same way the performance of the resulting building, the behaviour of its inhabitants, is not caused or even necessarily aimed by the designer, but only made possible in a universum of possibilities opened by the design. Every line a computerprogrammer writes is a condition for the rest of the program, but not the cause of its performance. On the other hand one single missing line can 'ceteris paribus' be called the 'cause' of its break-down.

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[a] ποιησισ, manufacture, construction

Conditions of life

In the same way global life has no single cause, but many conditions of which lacking one on a single place and moment can indeed cause the death of an individual. Special conditions of sunlight, moist and minerals do not cause special life-forms (let alone that they can be aimed by norms of sunlight, moist and minerals per location), they only make different life-forms possible. The relation conditional <> causal has its analogies in the dualities possible <> probable, designing <> predicting, means-directed <> aim-directed, and probably ecocentric <> antropocentric.
What kind of thinking do we need for design study?

Causal and conditional thinking

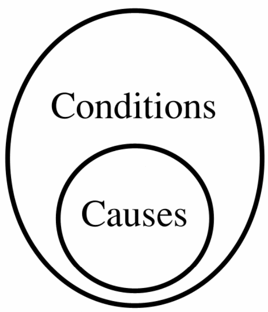

Fig. 1126 *Causes under conditions*

I cannot imagine causes without conditions, the reverse I can. We have to make a step back from *causal thinking* about probabilities into the broader area of *conditional thinking* about possibilities. Every cause is a condition for anything to happen, but not every *condition* is also a *cause*. The foundation of a house may be a precondition but not a cause of its existence. Causal thinking is conditional thinking, but conditional thinking is not always causal.
Suppose we read in the paper: 'The crash of the cars was caused because one of the drivers lost control of his wheel.' That sounds plausible until an extraterrestrial descends, saying: 'Nonsense, the collision was caused by two objects approaching eachother with great speed.'

If he is right, the paper is wrong, because if the cars would not have been approaching eachother and one of the drivers would have lost control there would have been no collision. So it is only a cause under the tacit precondition of approaching cars. Every causal conclusion is based on innumerable tacit conditions called '*ceteris paribus* presuppositions'.

Any cause supposes conditions

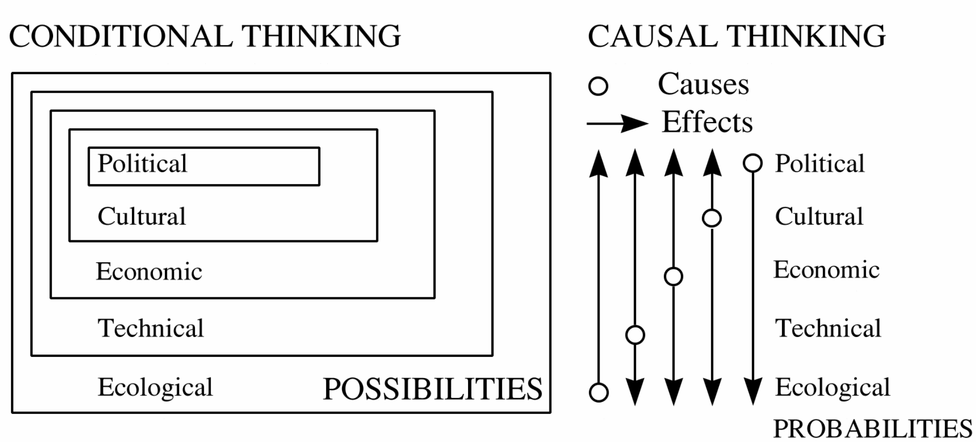

Fig. 1127 *Conditional thinking as a ceteris paribus environment of causal thinking*

I cannot imagine *social possibilities* without any *economic conditions*. The reverse I can.
I cannot imagine *economic possibilities* without *technical conditions*. The reverse I can.
This gives a semantic conditional sequence of possibilities. In stable technical conditions economic initiatives can cause technical or social change. But when the dikes burst the technical 'ceteris paribus' for economic determinism are lacking.

Changing conditions

The ceteris-paribus presuppositions of causal explanations also change on different levels in time. That means changing causal explanantion. They also can be changed by design forcing shifting explanation about the effects. Innovative design implies removing some preconditions and making new ones. Design makes *ceteris* ***non*** *paribus*.

Innovative design implicates always removing suppressed conditions and making new ones. Loose from that conditions change in different wave-lengths:

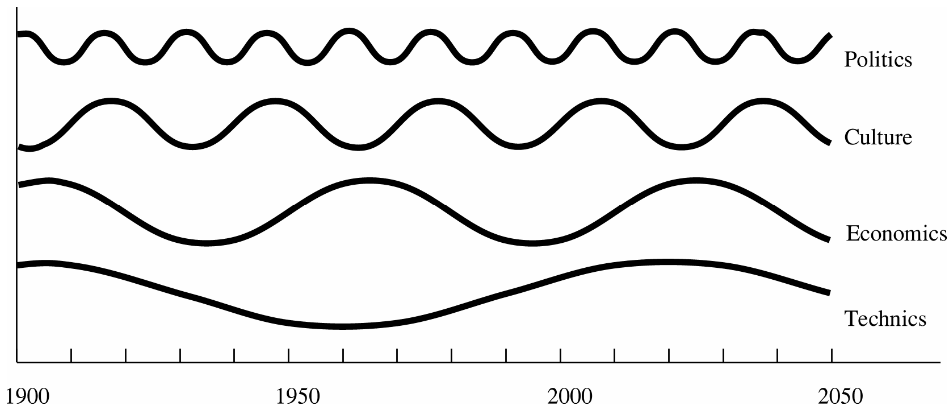

Fig. 1128 *Changing conditions for causal thinking.*

Now we can point out a week component in causal thinking. The ceteris-paribus presuppositions of causal explanations change on different levels and can be changed by design ... by us.

Comforting the causal trapped

Professor Helmar Krupp (1996), former director of the Fraunhofer Institut in Karlsruhe studied physics, pilosophy and sociology. He came to the conclusion that the individual no longer can influence the evolution of society. Society behaves as a system with its own dynamics. Individuals have to submit to this dynamics. In the conference 'The mind of technology', Delft, 27 november 1996, De Jong tried to comfort him by emphasising design. The limitations of research could be broken by design.
Probable ecological, economic and cultural futures are gloomy from a viewpoint of inevitable Schumpeter dynamics or Fukuyama-expectations. But are the probable futures the only ones that we have to take in consideration? Empirical research is limited to the probable futures, design, innovation or technical research to the possible ones. And that creates hope.

Form supposes a legend

I cannot imagine a *representation* or *drawing* without indicated differences, an (eventually tacitly presupposed) vocabulary or *legend* (key to symbols). The legend is the vocabulary of the drawing. Only by drawing differences one can make *forms* and only by making different forms one can make *structures*. *Function* presupposes a structure within which the function operates.

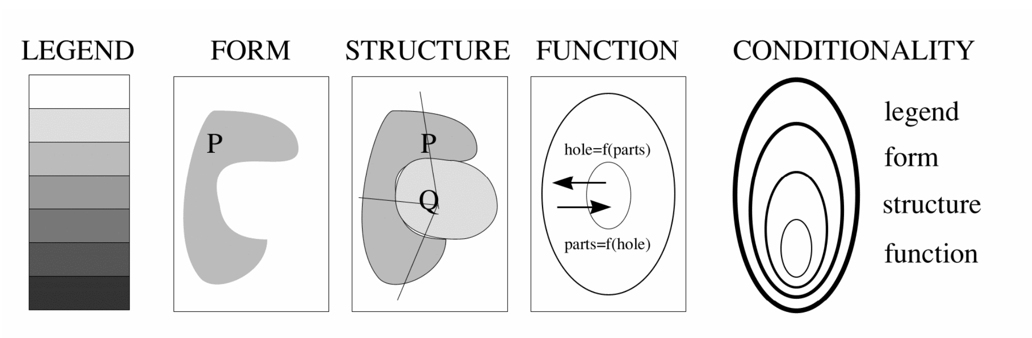

Fig. 1129 *The legend and its relation to form, structure and function*

The same form by different structures

Nevertheless, within one set of forms (for example a box of blocks) you can imagine different ways of connecting them (structures) and within different structures you can imagine different functions. In the reverse the same function often chooses different structures and the same structure is often built in different forms or materials. So where the design process lays the initiative is free. It can be either a causal, *aim-directed* (purposive) process starting with the function (*funcionalist* position) or a conditional, *means-directed* process (*formalist* or *structuralist* position).

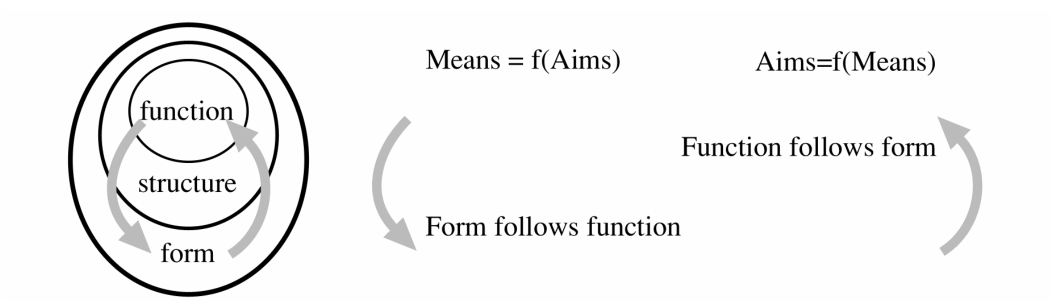

Fig. 1130 *Function, form, aims and means*

The sequence of aims and means

When the number of *aims* is smaller than the number of *means* you better can use aims as *independent variable* with the means as *dependent variable*. In architecture and certainly urban planning the number of means is smaller than the number of aims. In that case you better can variate the means to see what gives the greatest amount of possibilities for future generations.

7.6.3 Environment, the set of conditions for life

Environment in the technical and ecological sense of Hendriks (1993) is the set of conditions for life (see Fig. 1010). In this definition 'conditions' can be interpreted as ecological, technical, economic, cultural or administrative preconditions. These substitutions result in 5 different usual concepts of 'environment': the administrative environment, the cultural environment etc. The concept 'life' can be substituted in the same sense as 'social life, cultural life, life of men, animals, plants etc, multiplicating the meanings of the concept of 'environment'.

Building conditioning life

Building is a prerequisite for human and other life. Building and *urbanization* has ecologically more positive effects on the environment than negative. In contrast with other productive branches it produces more 'environment' than it costs. It produces an environment for humans without which they would not survive at the same rate. But it also could produce a better environment for a variety of plants and animals than many places outside the built-up area (see Fig. 768).

Making th city a source of life

Vos (1993) and Denters, Ruesink et al. (1994) reported that for instance in the Dutch cities Zoetermeer and Amsterdam, you can find 1/3 and 1/2 of the total amount of botanical species in the Netherlands. Within the city of Zoetermeer one square kilometre counts even 350 wild self breeding species outside the gardens. That is 7 times more species than an agricultural square kilometre in the direct surroundings and as much as a square km in the natural environment of natural reserves as the Dutch dunes. Of course we cannot say that the value of an urban ecosystem equals that of the dunes, but we signal a potential that we could improve. To improve the contribution of urban design to the solution of the ecological crisis we have to emphasize more the production of positive effects and its research than the reduction of the smaller negative effects.

The sun as source of the city

Let me give another example of environmentally decisive design. The development of *photovoltaic cells* can destroy many gloomy prophecies. The photovoltaic cell deminished a factor 14 in price since 1975 (see *Fig. 14*); another factor 8 and it outruns the economic efficiency of fossil fuels. The only problem is a cheaper way of slicing sand. The last two centuries technical problems like that never waited longer than 10 years for their solution.

Let's destroy **all** gloomy prophecies by design.

7.6.4 Starting by difference

Design makes a difference

The very beginning of any range of semantic conditions seems to be '*difference*'. Any concept presupposes 'difference'. Difference on itself cannot be defined because the concept of '*definition*' already presupposes making difference with the rest. But also the concepts of 'making', 'with', 'the', and 'rest' presuppose 'difference'. So in the sentence concerned, 'difference' was already at least five times presupposed! Even the concept of *equality* (as necessarily presupposed in the concepts of 'gathering' and 'counting' and therefore in set-theory and mathematics) presupposes difference. As soon as you accept that there are 'different differences', for instance more or less difference ('*variation*'), you have to accept that equality is a special case of difference.

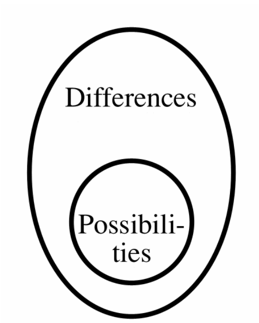

Fig. 1131 *Anything differs*

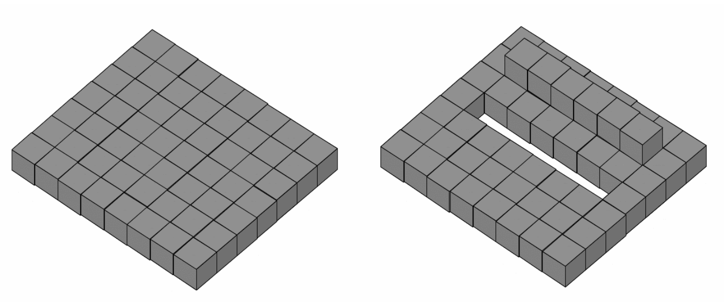

Fig. 1132 *Difference makes possible*

Difference makes possible

According to Fig. 1132 there should be a more specific relation between difference and possibility than the conditional one in Fig. 1131. However, I did not yet find a more convincing consideration than a picture like Fig. 1132.
Yet this question is essential for designers. If after all their profession as producers of possibilities has a specific relation with differentiation, than it has a difficulty with the accepted scientific practice of generalization.

Equality is a special kind of difference

Ashby (1960) and *Leeuwen (1971)* noticed that given a difference you always can imagine more difference, but not always less. The least kind of difference we call equality. Nevertheless, there must be a difference of place or moment left to establish that equality, otherwise the comparison has no sense. So we can draw an important conclusion: equality is a special kind of difference and not the opposite of it.

The search for equality ends somewere

Many scientists feel uncomfortable with that conclusion because their profession is based on equations that conceive regularities in sets of n>1 'comparable' facts. Designers on the contrary do not, because their profession is based on originality in every single n=1 case. Without that originality their design would not be a design, but a prediction. The very concept '*concept*' presupposes any equality in the observations conceived in the concept, but the concept '*conception*' presupposes something different from earlier observations. Conceptualization always needs a reduction of diversity.

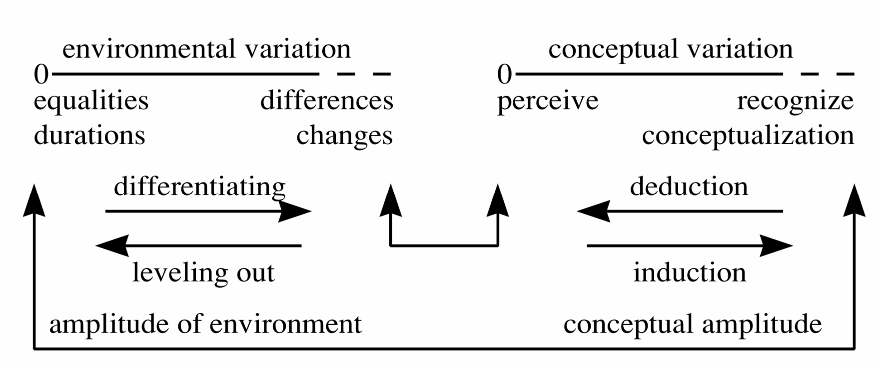

Fig. 1133 *Perceiving differences, recognising equaities*

The sense of difference

Vision, hearing, smelling, touching all need differences or changes in the environment. As soon as there is some repetition within these perceptions, we 'recognize' it, which is the basis of cognition and conceptualization. (Re)cognition however is only based on similarity, it **reduces** the differences that still can be perceived. So conceptualization changes sometimes chaos in surprize, sometimes surprize in recognition, sometimes recognition in boredom.

Deminishng returns of reductive science

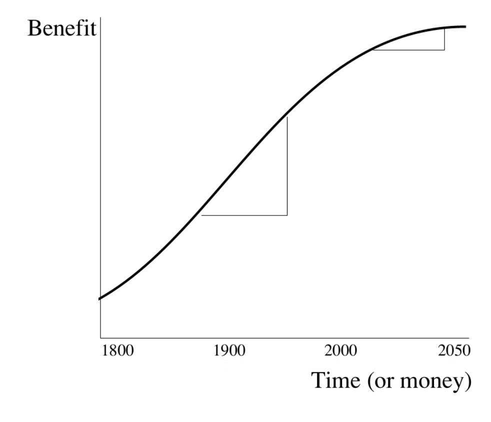

Fig. 1134 *Deminishing returns of monocausal (or paucicausal) research*

Causal thinking is a special way of reducing diversity. It reduces similarities in repeating sequences of phenomena to the more general concepts of cause-effect relationships. Causal explanation has the more value the more reduction of different cases is possible by abstraction.

Alas, nowadays there are not so much phenomena left that can be explained monocausally. They largely have been explained earlier. What is left are context sensitive effects that can be caused by many different 'causes' or causes that can bring about many different effects, dependent on small differences in the environment where the 'cause' is introduced. Striking a match can cause little damage here, and big damage there. So monocausal (or 'paucicausal') research shows deminishing returns, especially on environmental (context sensitive) issues.

Means and aims can only be chosen on the basis of a supposed causal relationship between both. Otherwise thinking about means and aims is senseless. The same means applied here have other effects as applied there. Apart from that they are also scale-dependent and therefore subject of misconceptions.

7.6.5 The importance of diversity in ecology

Ecological tolerance

The curve of *ecological tolerance* (see Fig. 695) relates the chance of survival of a species or ecosystem to any environmental variable, for instance the presence of water. In that special case survival runs between drying out and drowning.

A risk-cover for life

Variety is a risk-cover for life. This is not only true for the variety in the abiotic conditions, but also for the variety of ecosystems, species and of genetic possibilities within each species. Life survived many disasters thanks to biodiversity. In the diversity of life there was always a species to survive or within a species a specimen that survived. Survival of the fittest presupposes diversity from which can be chosen in changed circumstances. Deminishing biodiversity means undermining the resistance against catastrophes. From the 1.5 million species we know, this century we lost approximately 50000. So, we not only introduce ecological disasters, but also undermine the resistance of life against these disasters.

Biodiversity supposed in any quality of life

Biodiversity in mankind is a crucial value in our quality of life. As we are here we are all different and the very last comfort you can give a depressed person is 'But you are unique'. Diversity is also a precondition for trade and communication. If production and consumption would be the same everywhere, there would be no economic life. If we would have all the same perceptions and ideas, there would be no communication. It is an important misconception to believe that communication only helps bridgeing differences. Communication also produces diversity by compensating eachother and coordinating behaviour by specialization.

Freedom of choice supposes diversity

World commission on environment and development (1987, Committee Brundtland, see) summarizes the environmental challenge by stating sustainability as leaving next generations at least as much possibilities as we found ourselves. But what are possibilities? 'Possibilities' is not the same as economic supply. If our parents would have left us the same supplies as they found in their childhood, we would be far from satisfied. 'Possibilities' has to do with freedom of choice and thus variety. Our converging Schumpeter-economy described by Krupp (1996) and Fukuyama (1992)-culture leaves no choice. In our search for the alternative we find everywhere in the world the same hotels, the same dinners, the same language. This century, the last 'primitive' cultures are lost and with them an experience of life that no western language can express.

Trade and communication suppose diversity

The extremest consequence of this levelling out would be a world without economy and even communication. If there are no longer any differences in production factors, exchanging goods and services would no longer be necessary. If total world wide distribution of knowledge and consensus would be the result of our communication age, there would no longer be anything worthwile to communicate. These thought experiments show clearly that 'difference' is also a hidden presupposition in communication and economy.

Diversity and quality

Quality can be measured in terms of possibilities of use, experience and expectation for future generations. The way design can sustain a sustainable development in the sense of Brundtland is to produce more choices for man, animal and plant. If there were one best solution for all problems of architecture and urban planning, it would be the worst in the sense of choices for future generations! This paradox pleads more for diversity than for uniform solutions. Moreover, if there was an uniform solution, the designer would have no task.

Quality is always a function of variation (see Fig. 696). Quality of possible experience moves between diversity and uniformity, surprise and recognition. One step too far into both sides brings us in the area of boredom or confusion. This is a simple conception, already recognized by Birkhoff (1933) and Bense (1954) see also Koutamanis (2002), but why dit it not succeed, why is quality always posed as an unsolvable question?

Different diversities at different scales

Any discussion on variety and thus variables can fall prey to confuson of scale. That means that even logic and science as forms of communication are prey to the scale paradox. The paradox of *Achilles and the turtle* is a beautiful example of the scale-paradox in time. The turtle says: 'Achilles cannot outrun me when I get a headstart, because when he is where I was at the moment he started I'm already further, when he reaches that point I am again further and so on!'. This conclusion is only incorrect by changing the time-scale during the reasoning. Something similar is found by Russell on set-theory. Russell (1919) bans sets containing themselves and reflexive judgements as 'I am a liar'.

Premises of conclusions to be drawn at the same scale

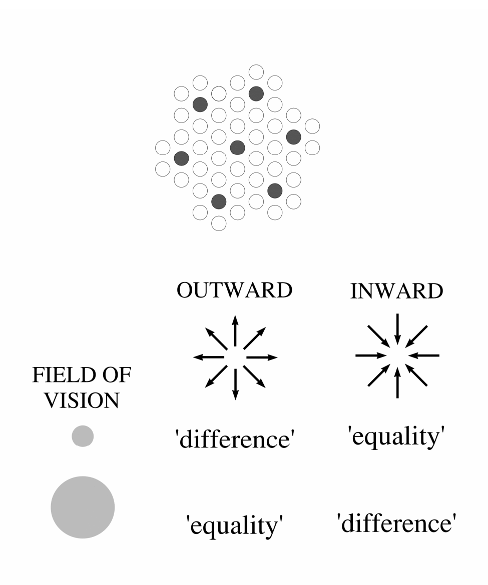

Fig. 1135 *The scale paradox*

The *scale paradox* means an important scientific ban on applying conclusions drawn on one level of scale to another without any concern. The picture shows the possibility of changing conclusions on a change of schale by a factor 3. There are 7 decimals between a grain of sand and the earth. That gives approximately 15 possibilities of turning conclusions. Between a molecule and a grain of sand applies the same. This ban is violated so many times, that this should be an important criterion on the validity of scientific judgements.

The scale-paradox is not limited on concepts of diversity. An important example of turning conceptions into their opposite by scale is the duality of aim and means. For the government subsidizing a municipality the subsidy is a means, for the municipality it is an aim. So the conception of means changes in a conception of aim by crossing levels of scale. The turning of '*Zweckbegriff*' into '*Systemrationalität*' by Luhmann (1973) may be a turning conception of the same character.
In growing organizations *integration* on the level of the organization as a whole means often *desintegration* of the subsystems and perhaps a new form of integration in the sub-sub-systems. This process is often called '*differentiation*'!

7.6.6 Conclusion

Obedience to nature called freedom

The computer sustains the design process and spatial design sustains or even enlarges our freedom of choice. Enlarging the diversity of inside and outside space offers after all new possibilities and thus new freedom of choice. Concerning the possibilities of future generations of world population since Bruntland, we call the maintenance of that freedom '*sustainable development*'. Environmental planning takes into account the simultaneously appearing loss of possibilities and freedom of choice for future generations.

Extending freedom of choice by design

The building process however has in this sense more positive than negative ecological effects. The best way design can sustain a sustainable development in the sense of Brundtland, is to produce more choices (possibilities) for man, animal and plant. If there were one scientificly tested best solution for all causally formulated problems of architecture and urban plaming, it would be the worst in the sense of choices for future generations. This paradox rises when we consider science only as a method of optimizing probable effects. I would like to state that technical science has more to do with possibilities than with probabilities.

Sutaining design by computing

Computerprogramming not only sustains design and freedom of choice, it also forces us to make clear hidden presuppositions and that is the traditional task of art and science.
In that perspective the task of technical science is to make clear the preconditions (or presuppositions) of technical performance, the task of technical ecology that of life performance.
The presuppositions about the design process, as they are differently hidden in a designers' mind and in design sustaining computer programs, have something in common with the preconditions of technical and biological performance. If our theory can cope with both, it will concern a more essential thing about design, building and ecology.

Designing the improbable

The *possibility* (the set of conditions) of an event is something different from a cause (and subsequently the probability) of an event. Every cause is a condition for something to happen, but not every condition is also a cause. The design of a house does not cause the behaviour of a household. It only makes more ways of behaviour possible than there would have been possible without a house. It allows freedom of choice, offers conditions. In the same way the design of a *computerprogamme* is no good when it forces the user into a specific way of thinking, it should give the opportunity for different ways of thinking. Ecology is the science of conditions, prerequisites for different life-forms. Global Iife by its enormeous differentiation is not monocausal and thus not predictable or 'aimable'. Death of individuals on the other hand, is predictable by pointing out any essential condition for life lacking. Man as a part of life is essentially not predictable as long as we believe in freedom of choice.

Sustaining the possible

In ecology, technology, design and computerprogramming conditional thinking is as important as the operational, aim-directed, causal thinking we are used to. The methodology of causal and probability thinking is largely developed. But what methodology do we need when we do not only ask questions about the cause or aim of a phenomenon, but about the conditions under which a phenomenon could possibly appear, its possibility?