

CREATION OF 3D CITY SYMBOLS

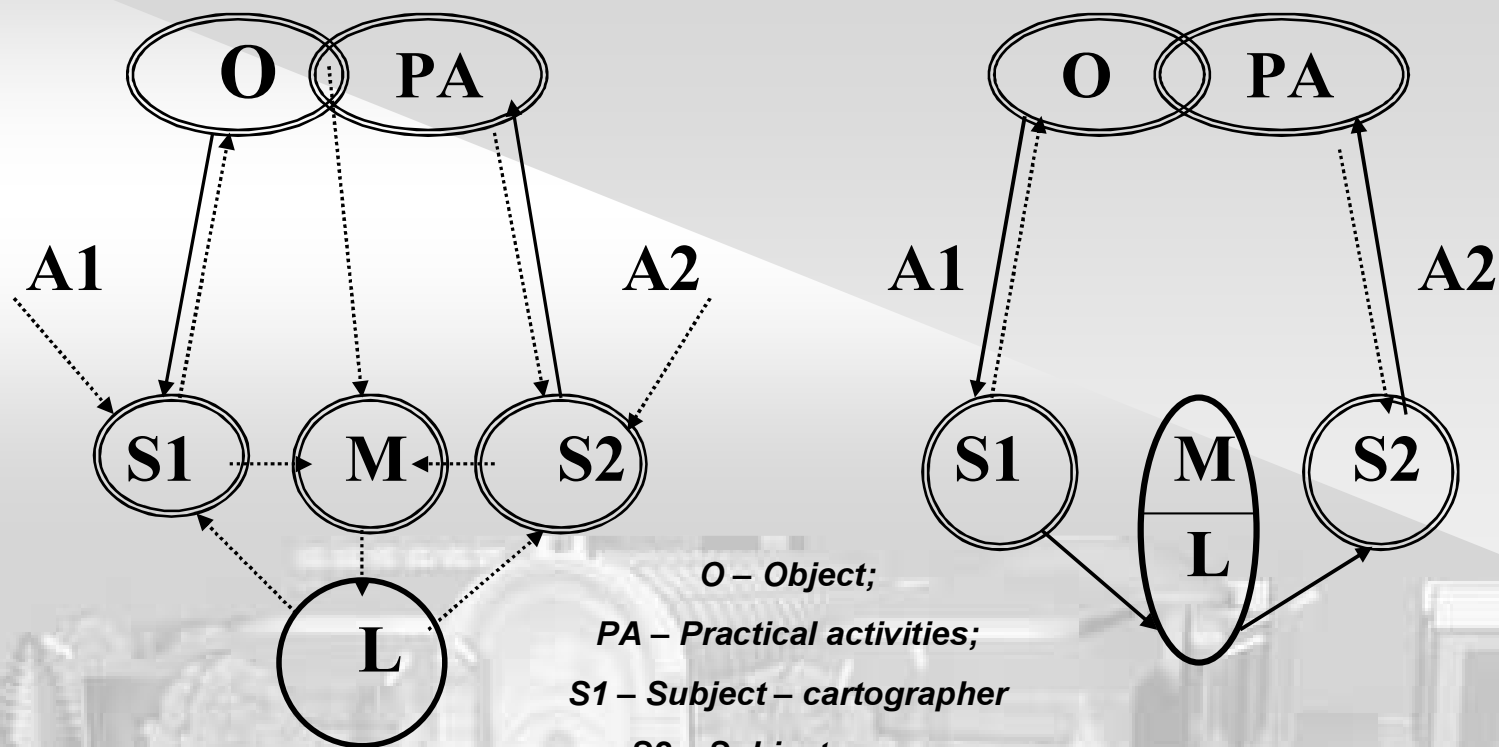
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Creation – Usage of the map



O – Object;
PA – Practical activities;
S1 – Subject – cartographer
S2 – Subject – user;
A1 u A2 – activators;
M – map;
L – language (symbols)

2D or 3D modeling in cartography?

- Recently cartographers used different graphical methods for representation of 3D spatial objects and phenomena
- The 2D maps are very comfortable for communication, distribution and usage.
- The problem in 3D map is their perspective view, which changes from the position of the viewer. Furthermore the perspective projection cannot be use for measure analyses. This means that they cannot be used in paper version or other plane representation.

Purpose of 3D symbols' research

Formalization of the logic for cartographic representation of information in 3D maps applying a symbol system

- **rules for creation of a quality symbol system;**
- **economically effective norms for working with 3D maps by various users.**

Investigation among 15 Bulgarian firms, working in the field of GIS, geodesy and cartography

- **6% - there is no need of symbols**
- **94% - cartographic symbols are an important issue:**
 - **geodetic network;**
 - **thematic contents;**
 - **pipe lines;**
 - **traffic and public signs and marks;**
 - **information signs and marks and others.**

3D MAP - DEFINITION

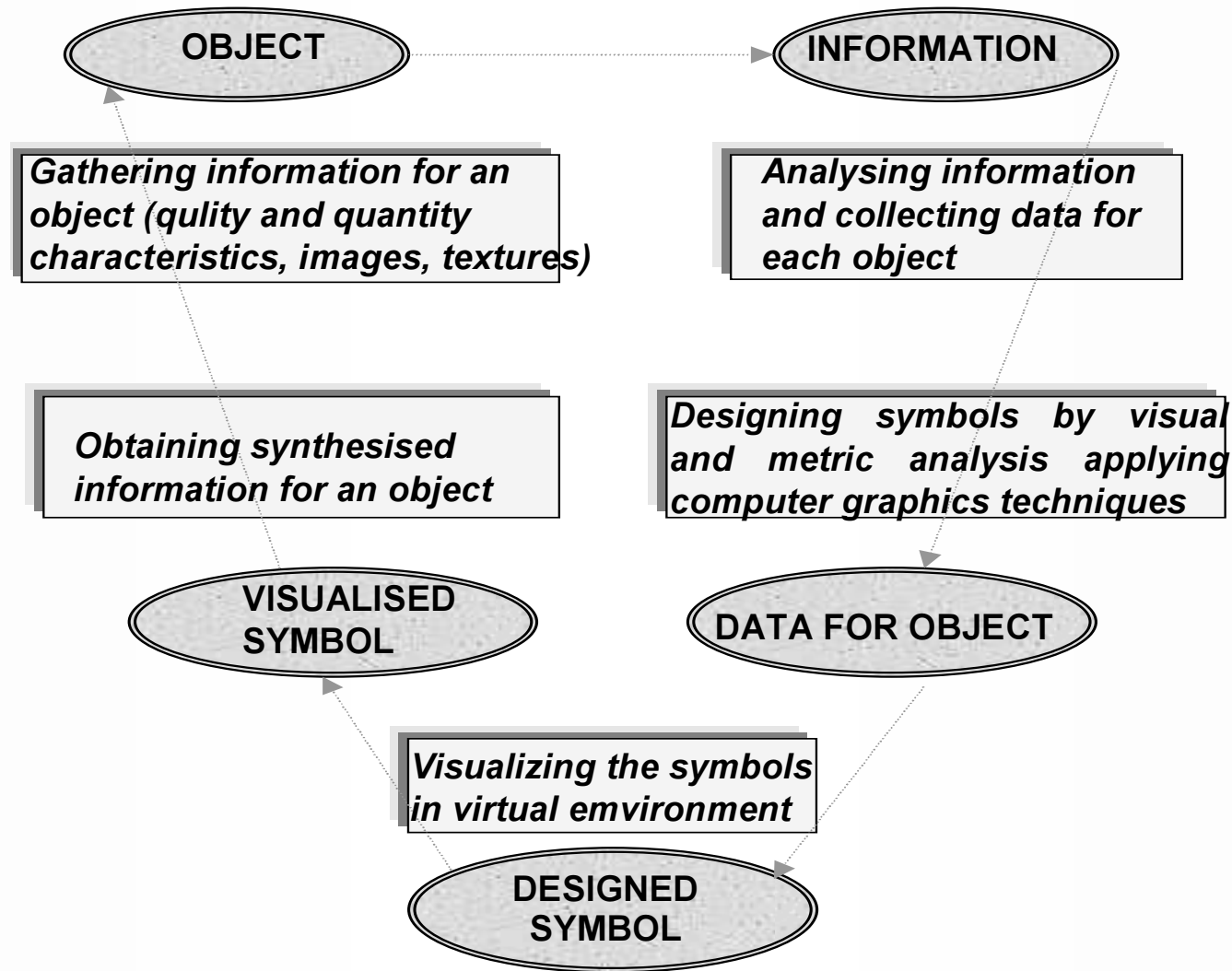
Digital, mathematical defined, three-dimensional virtual representation of the Earth surface, objects and phenomena in nature and society.

Represented objects and phenomena are classified, designed and visualised according to a particular purpose.

Shortcomings of 3D Maps

- The requirements of different hardware parts of computer are still high.
- A lot of additional preparation is necessary when different objects, phenomena and symbols should be designed.
- A strict control should be done in mutually situation of symbols and objects in animation 3D maps.
- There is not formally defined 3D symbol system.

Steps for Creating of Symbol for 3D Map



Comparative indications

Symbols for 2D Maps

Symbols for 3D Maps

1. Objectiveness

Point, Line and Area Symbols

Point and Texture Symbols

2. Dimensionality in situatuin

2 Dimensions

2 or 3 Dimensions

3. Scalability

Scaleability of Symbols

**Real dimensions of symbol
(average for representation object)**

**4. Representation of dynamics
of phenomena and objects**

**Symbols for dynamics, map-
diagrams and locality of diagrams**

**Unlimited usage of all symbols in
animated environment**

5. Colors in representation

**CMYK - for published maps
RGB – for screen maps**

RGB vizualization

**6. Classification according the
shape**

Art, geometric and letters symbols

Volume and plane symbols

**7. Classification according the
orientation**

North and according the terrain

Real orientation

**8. Qualified and quantified
analyses**

Usage of 2D GIS

Usage of 3D GIS

9. Information capacity

Limited by the scale

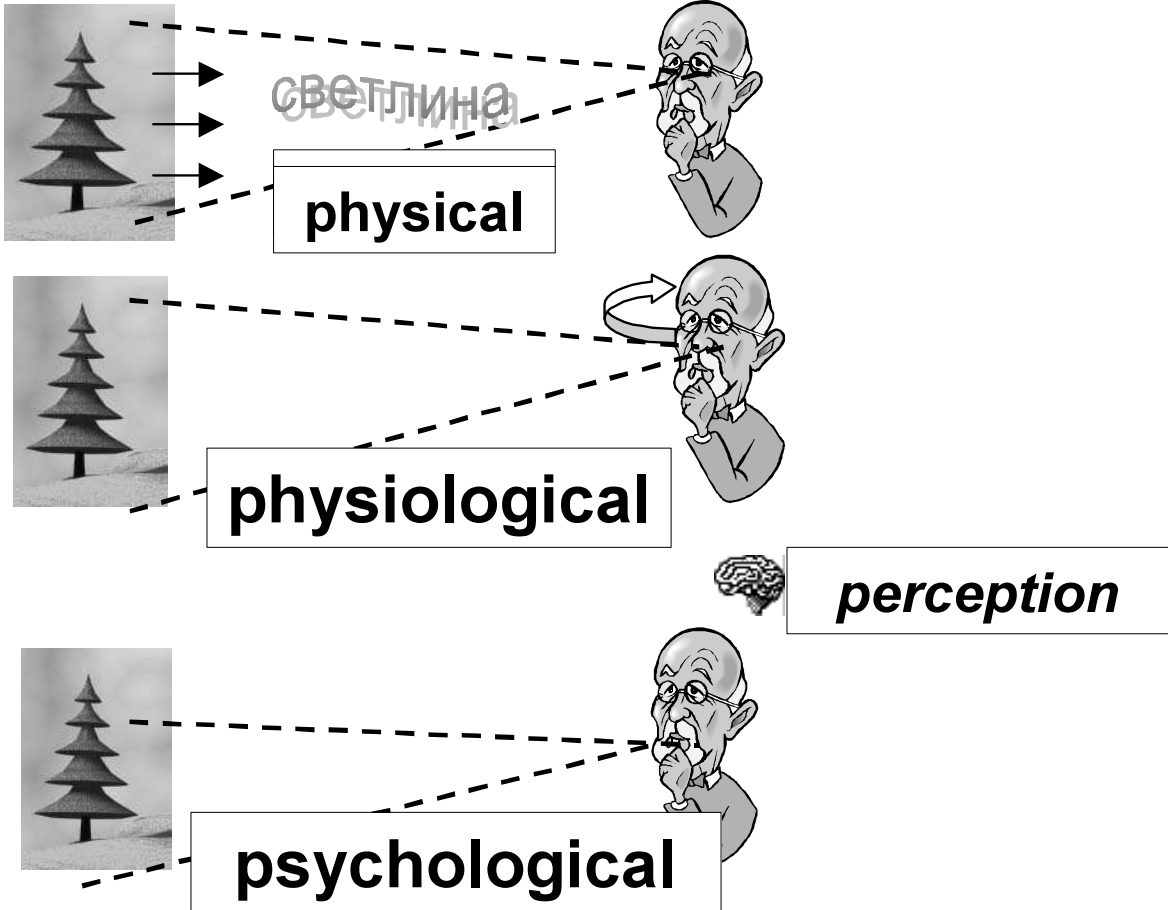
Limited by hardware systems

10. Standartization

In state level

No solved

3 Steps of symbol's perception

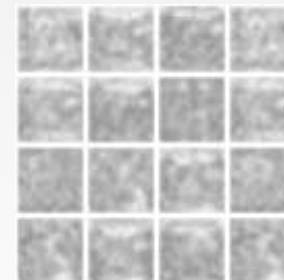
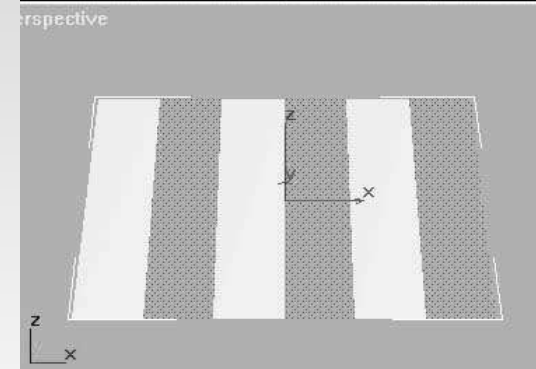
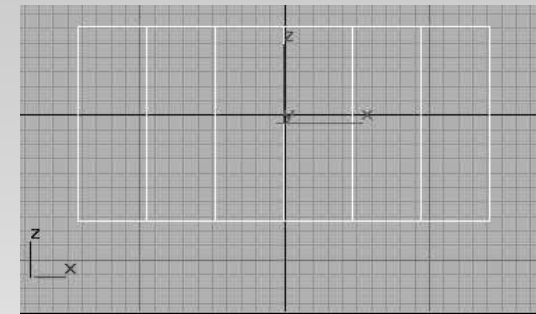
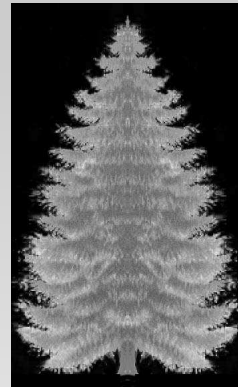


2D Symbols in 3D Maps

- *Designed by function “builbord”*

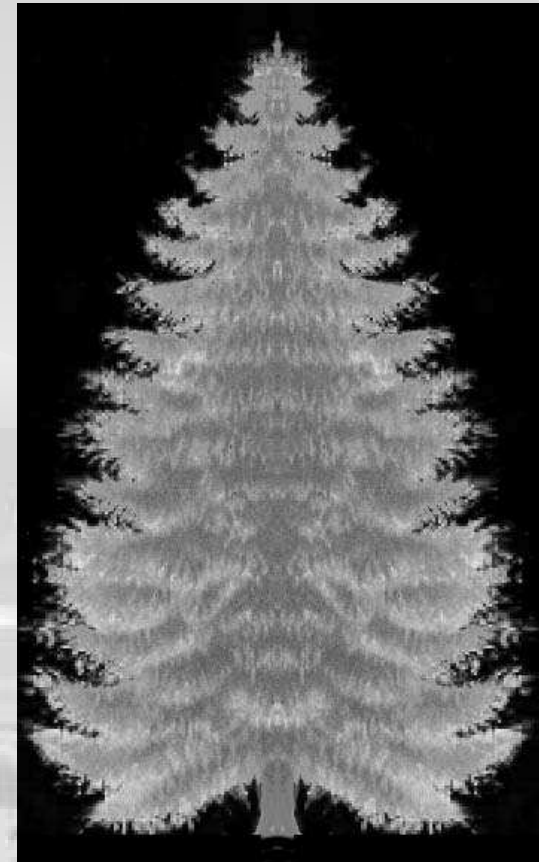
- *Subobjects in a symbol*

- *Using of necessary textures*



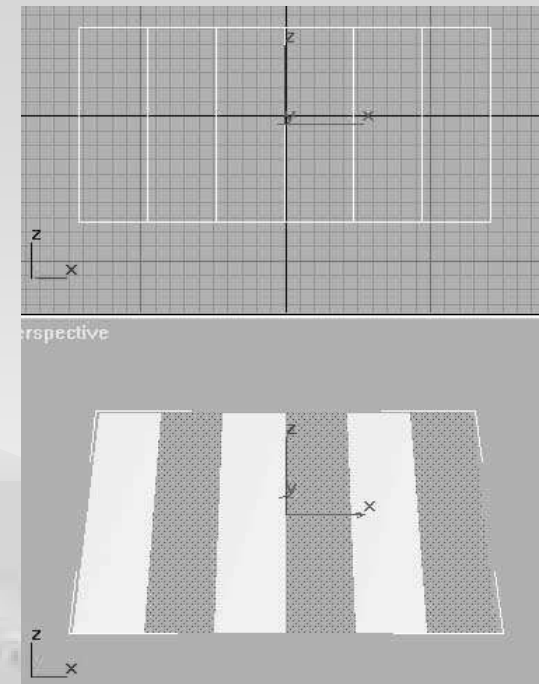
billboard

- Easy way for symbol creation
- Geometry of rectangle + photo-texture of typical object
- It is visible from many viewer positions excluding “top” and “bottom”
- High photo-realism, fast and cheap way for symbol’s creation of complex objects



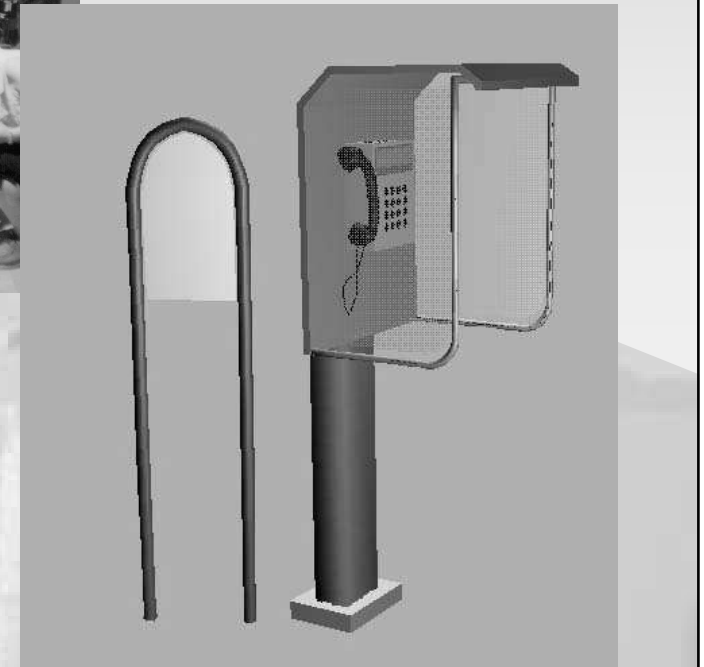
Subobjects in a symbol

- ***Objects and subobjects in symbol creation***
- ***Subobjects – 3D or 2D shapes***
- ***2D example: pedestrian path is a subobject in road***



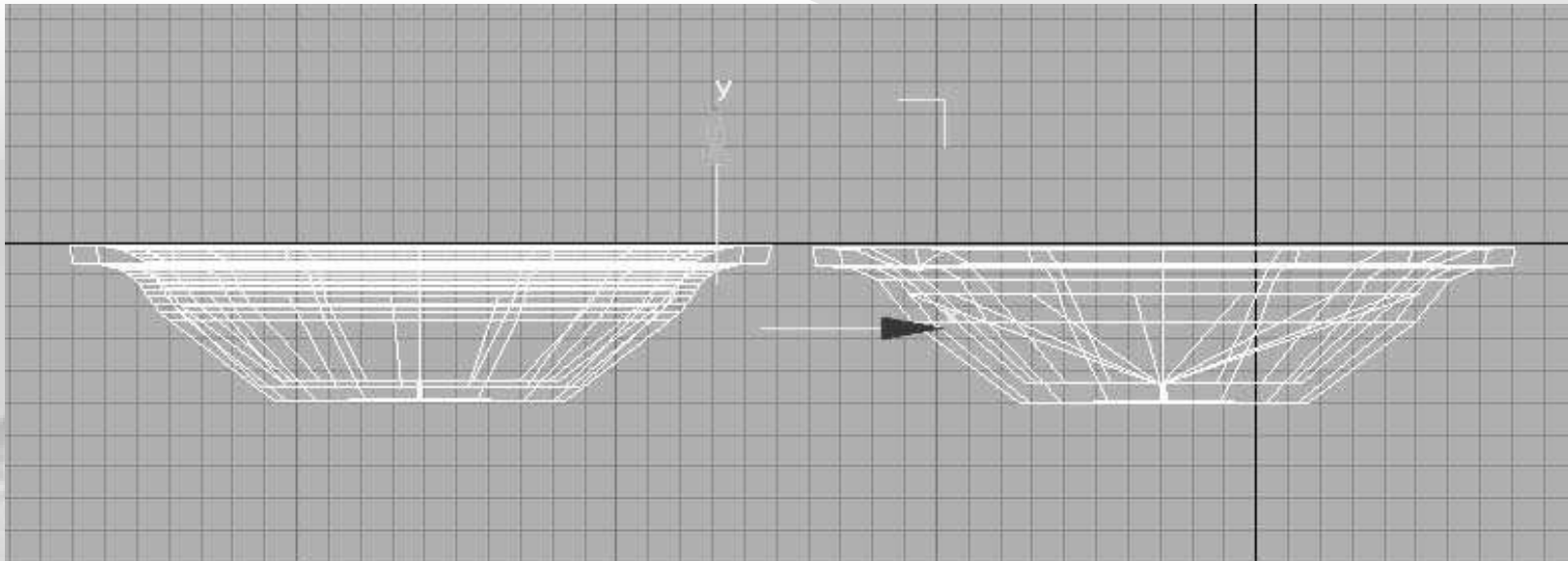
Basic Requirements for Creating 3D Symbols

- The symbols should be similar to the real objects, which are represented in 3D map.



Basic Requirements for Creating 3D Symbols

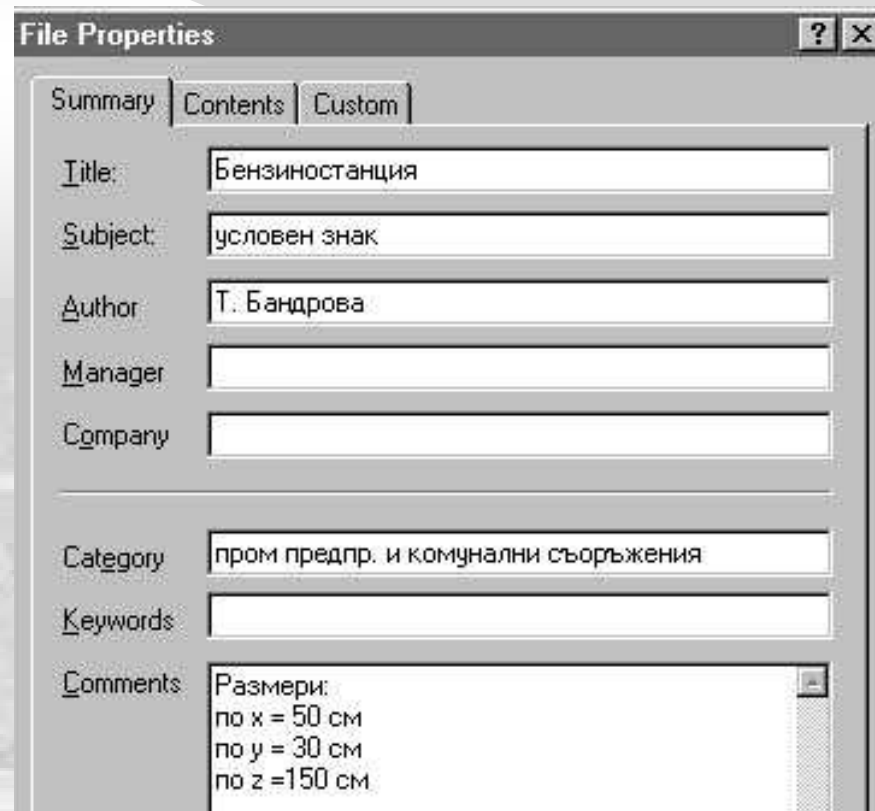
- **Minimum polygons should be used when a new symbol is built**



fountain

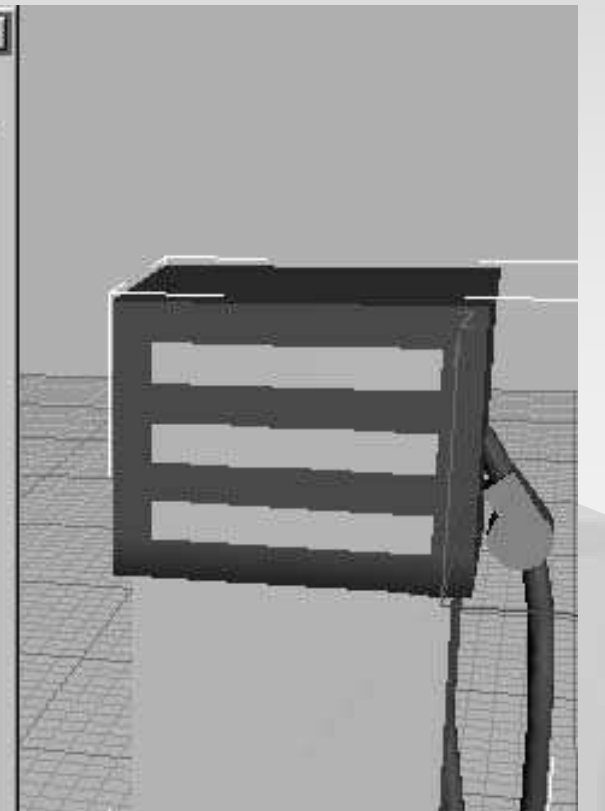
Basic Requirements for Creating 3D Symbols

- The symbols should be created in their real dimensions.



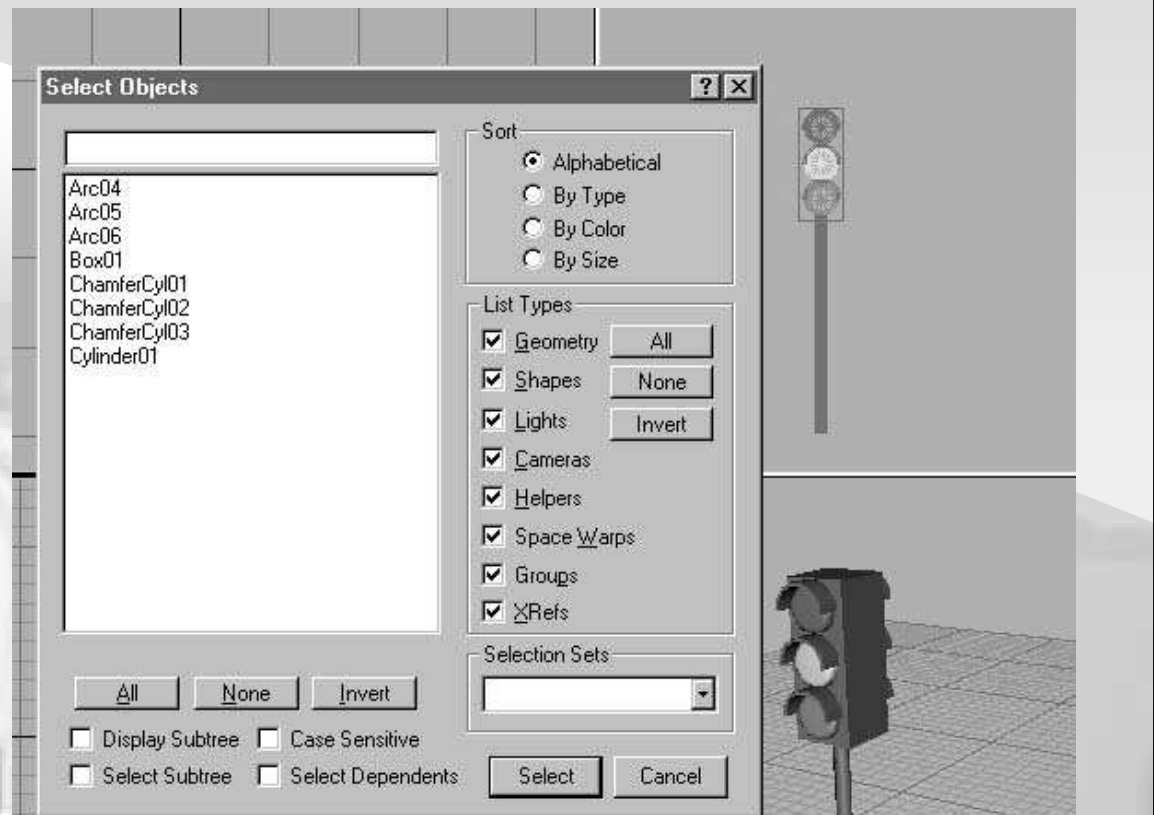
The screenshot shows a 'File Properties' dialog box with the following fields:

Field	Value
Title	Бензиностанция
Subject	условен знак
Author	Т. Бандрова
Manager	
Company	
Category	пром предпр. и комунални съоръжения
Keywords	
Comments	Размери: по x = 50 см по y = 30 см по z = 150 см



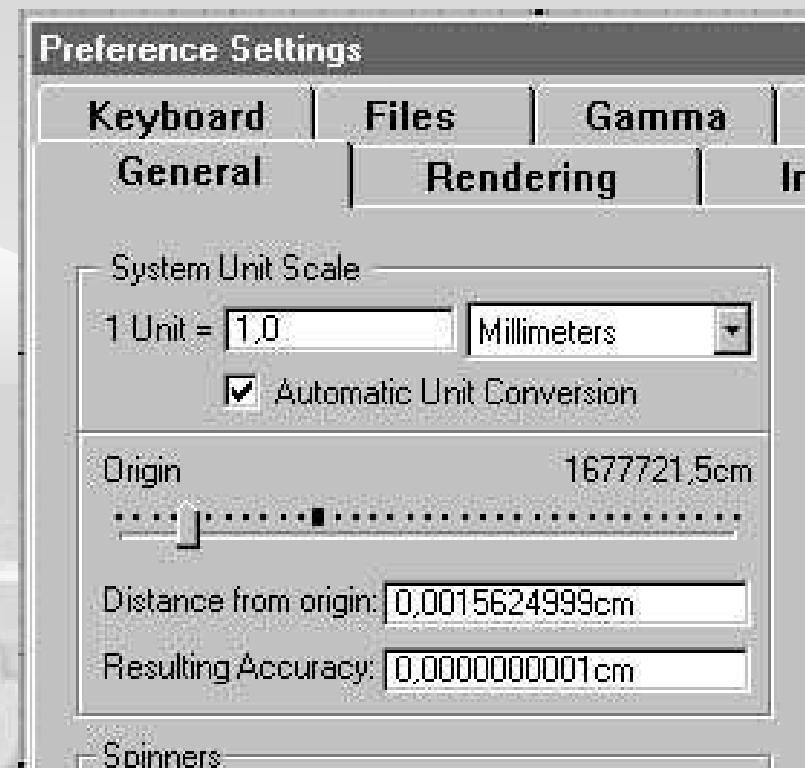
Basic Requirements for Creating 3D Symbols

- The symbols are designed for different purposes depending on user's needs.

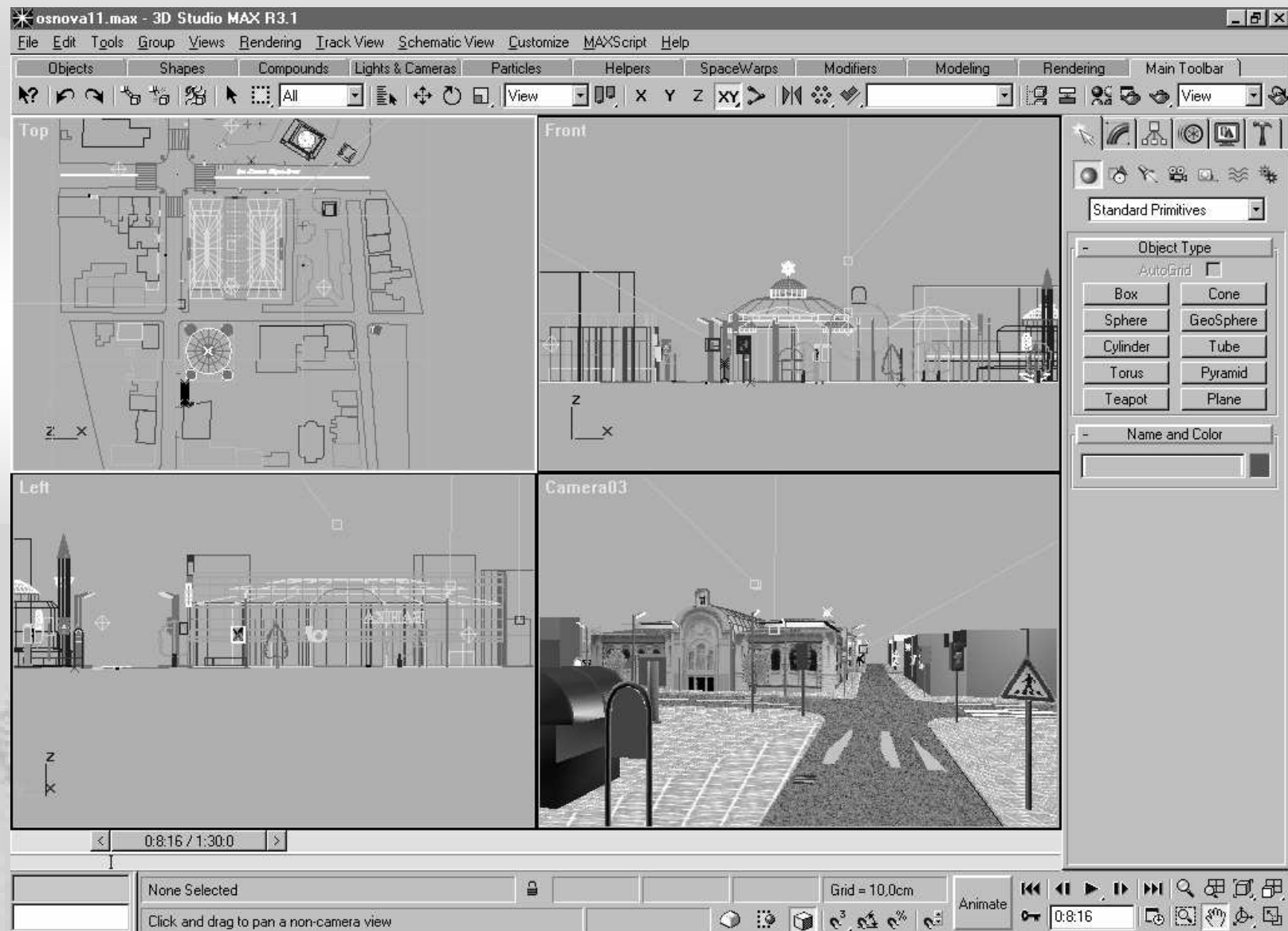


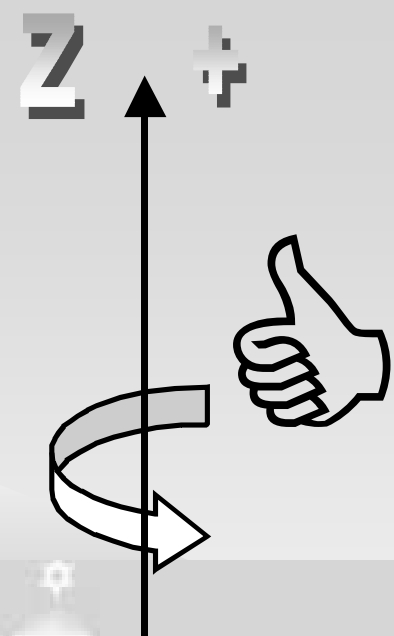
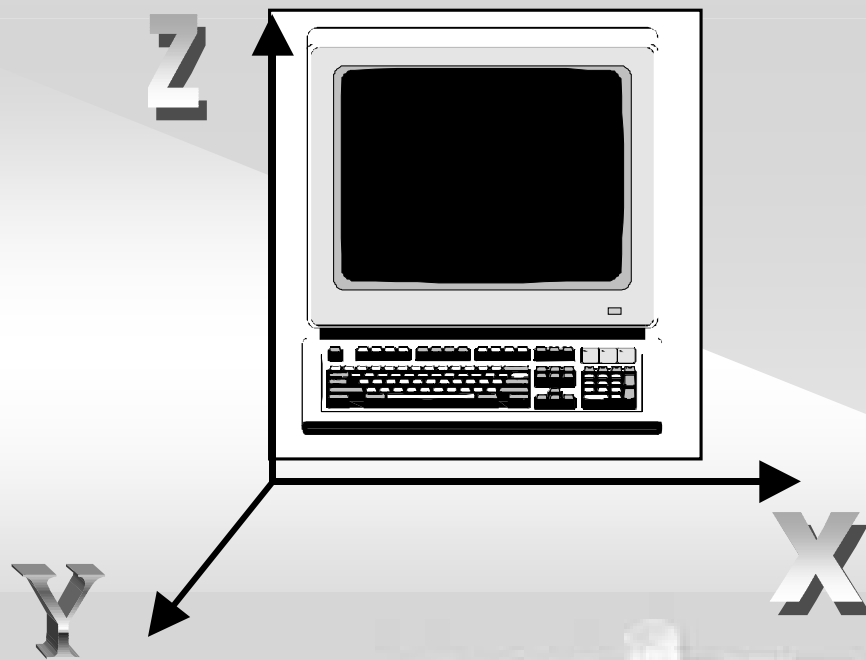
Accuracy in symbol location

- accuracy of measurements and data capture
- scale of 2D map
- method of sources processing



Characteristic of project windows





**Space coordinate system XYZ and
+axes rotation on the right hand rules**

Creating of Symbol System for 3D City Maps



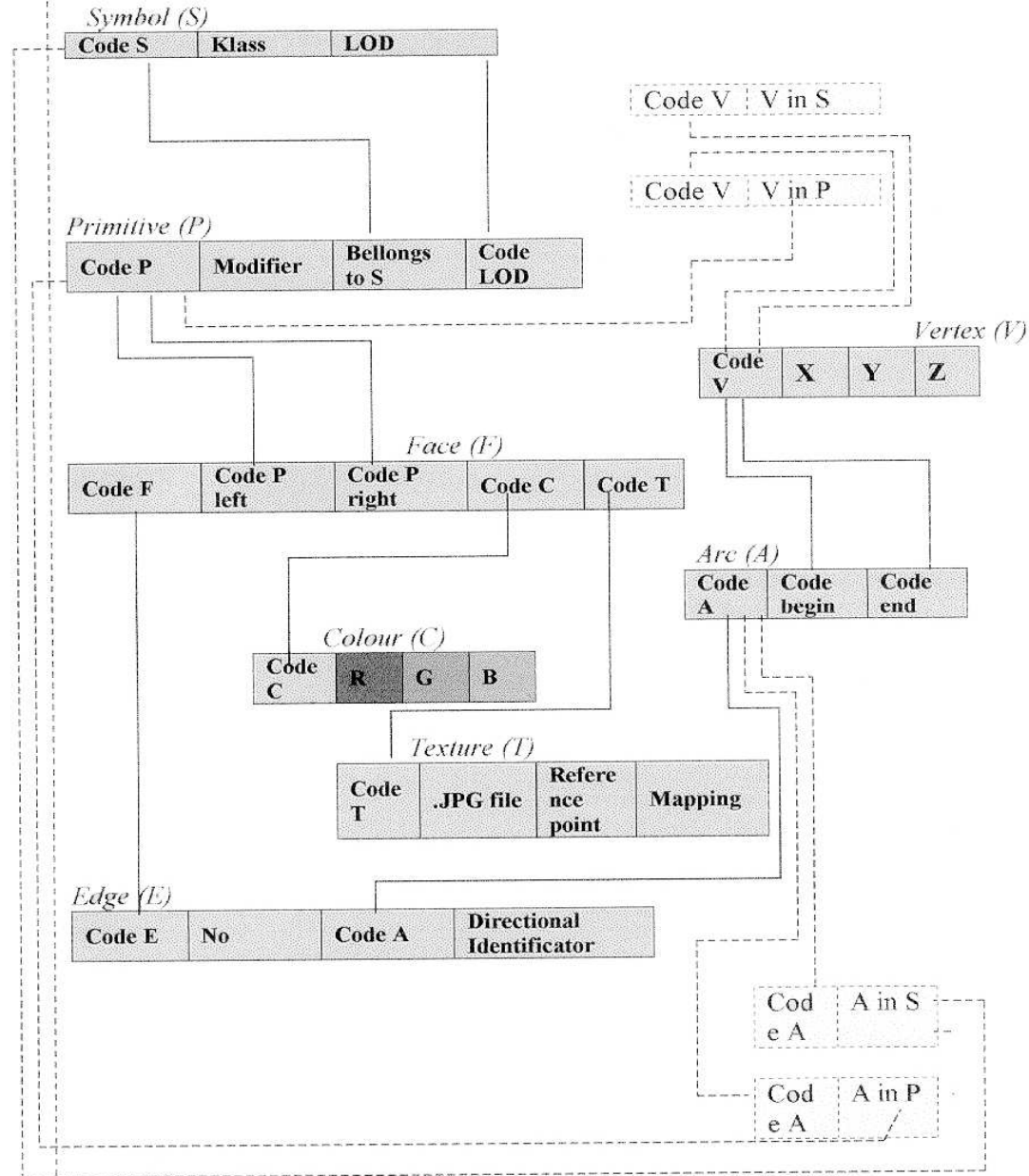
The Proposed 3D Symbols Contribute to:

- *Quickness, simplicity and economy in the building up of 3D maps*

- *Ability for representation of “small” objects in city environment*

- *Representation of quantity and quality differences between objects of different dimensions*

Appendix 1: Organisation of vector and raster data representation of symbols for 3D maps

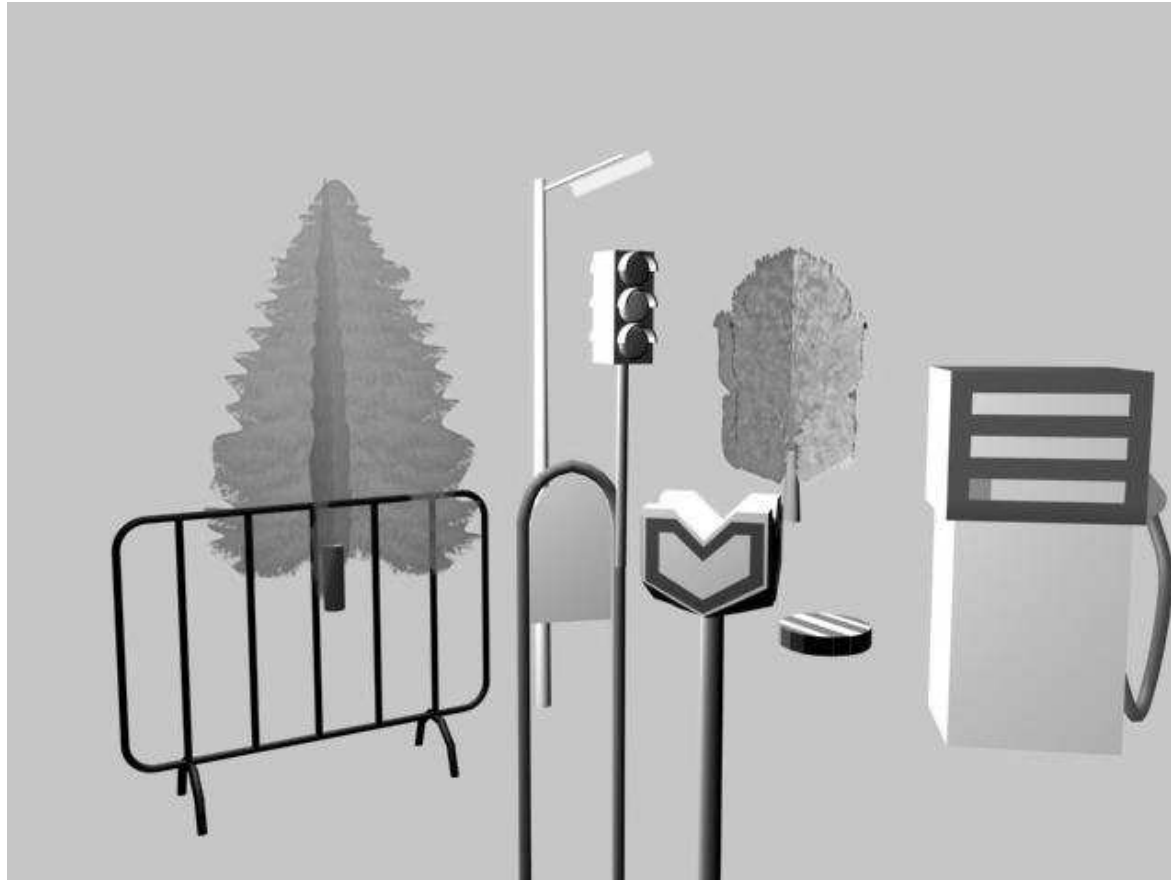




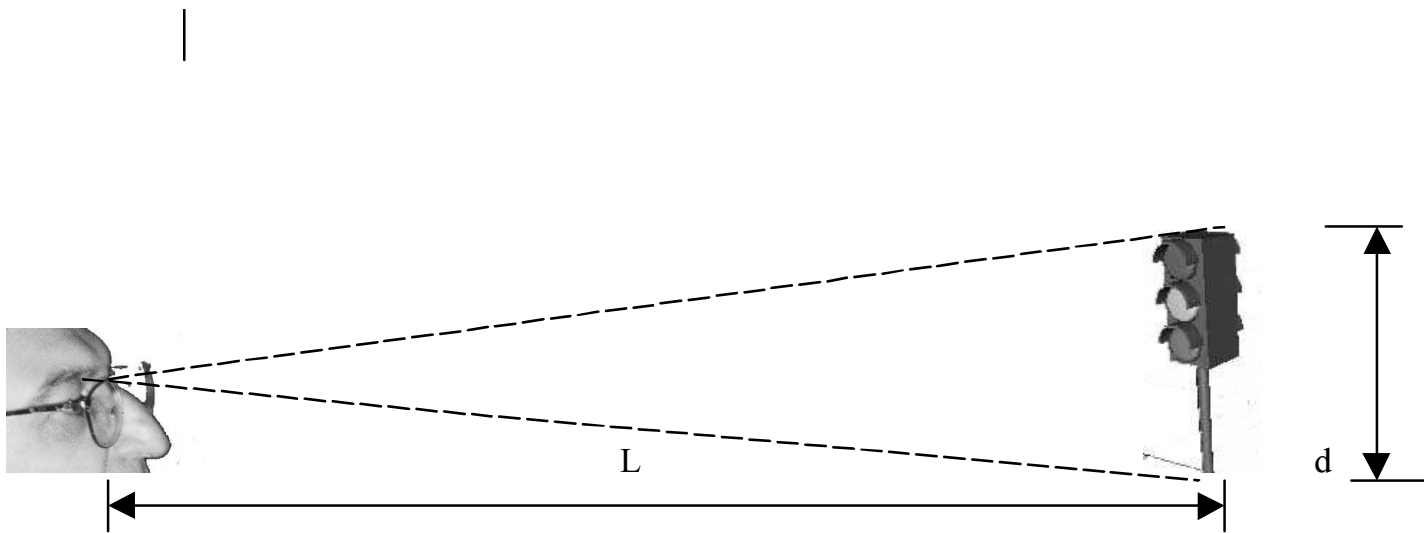
Symbols for objects in settlements and geodetic base

4/27/2006

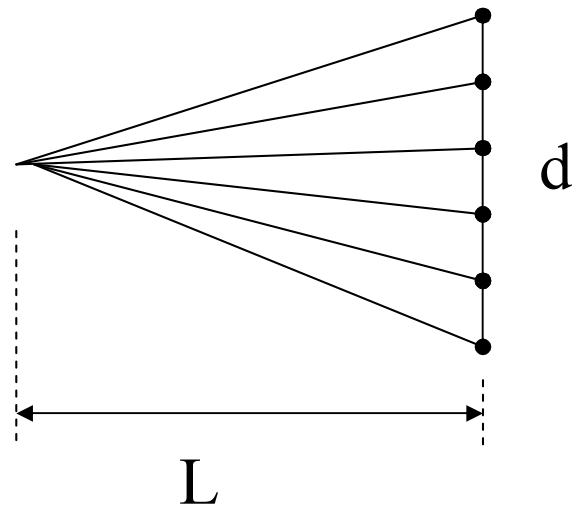
25



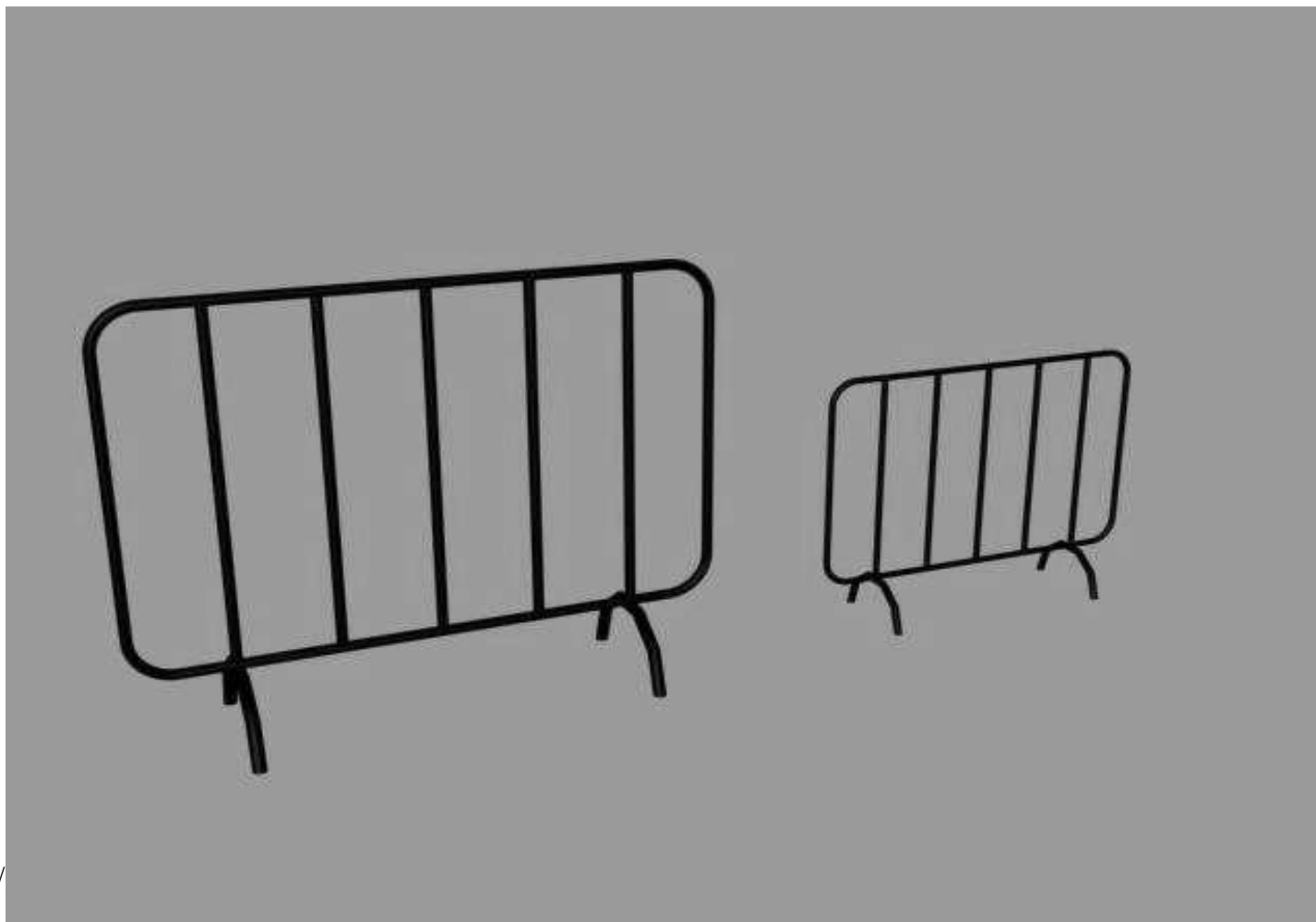
Symbols for industry, transport and plants



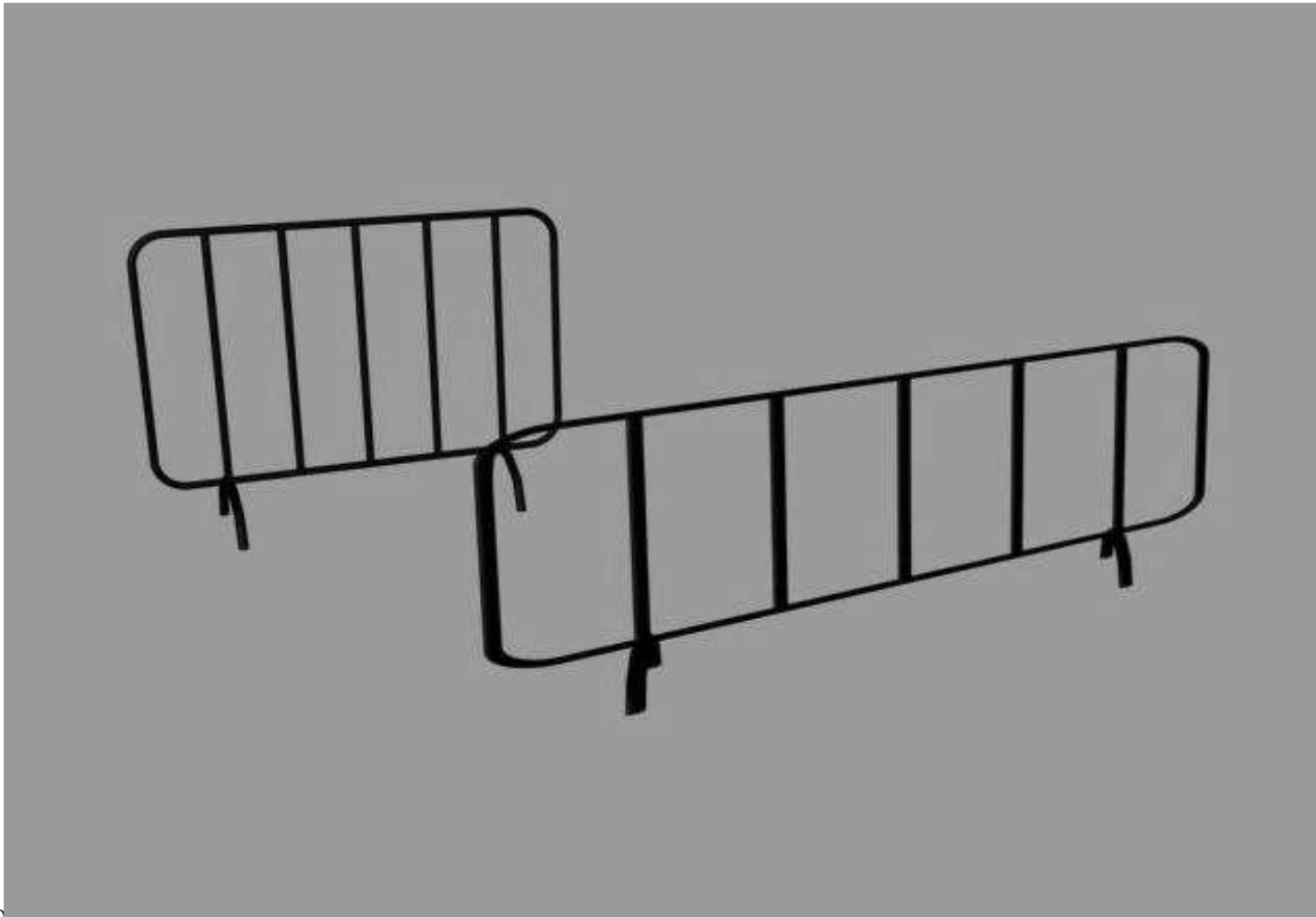
$$d = 2L \cdot \text{tg} \frac{\alpha}{2}$$



Volumetric scale



Plane scale



The Designed and Created Symbols are a Part of Symbol System for 3D Map Because

- They are built and systematized in syntactical aspect, spatial combinations between them are available.**
- The informatic property of symbols is shown by their relation to mapping objects.**
- In pragmatical aspect - The way of representation of objects is clear for every user of map. For this reason, there is not a legend like in 2D map.**

Levels of Details

Symbol	Dimensions (m)	Level of details	Distance of appearing (m)
Gas-station	2,0 / 1,3 / 0,4	Near	50
		Middle	100
		Far	600
Traffic lights	3,0 / 0,9 / 0,6	Near	75
		Middle	200
		Far	500
Electric lamp	8,0 / 2,2 / 0,5	Near	300
		Far	600
Bank	2,0 / 0,8 / 0,1	Near	100
		Far	200
Road sign	3,5 / 0,9 / 0,1	Near	75
		Far	200
Shaft	0,5 / 0,5 / 0,05	Far	75
Tree	3,0 / 3,0 / 0,0	Far	600



4/27/2006

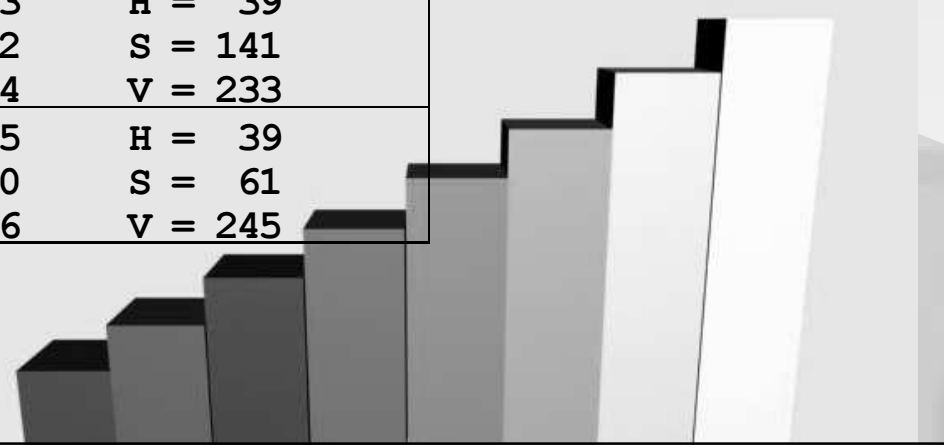
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An usage of VRML as a Standart for Symbol Vizualizing in Internet

VRML is presented as International Standard, used in all modern software products for 3D modeling. All symbols of “Model Sofia” are designed on way to convert them in VRML format.



Building/ number of floors	Color/ Name	Characteristics of colors - RGB и HSV	
1	Dark-brown	R = 130 G = 52 B = 0	H = 17 S = 255 V = 130
2	Brown	R = 170 G = 71 B = 5	H = 17 S = 247 V = 170
3	Dark-Red	R = 176 G = 26 B = 26	H = 255 S = 217 V = 176
4	Red	R = 220 G = 67 B = 67	H = 255 S = 177 V = 220
5	Light-Red	R = 226 G = 96 B = 96	H = 255 S = 147 V = 226
6	Orange	R = 224 G = 143 B = 87	H = 17 S = 156 V = 224
7	Yellow	R = 33 G = 222 B = 104	H = 39 S = 141 V = 233
Above7	Light-Yellow	R = 235 G = 240 B = 186	H = 39 S = 61 V = 245



Textures for visualizing of symbols

Texture – synthesized or scanned image added to object's geometry and it shows object's quality characteristic

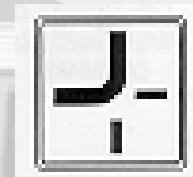
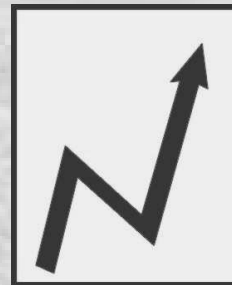
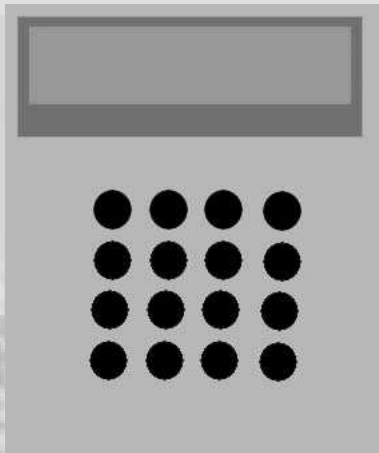
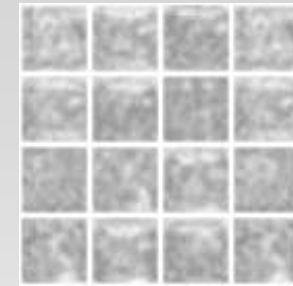
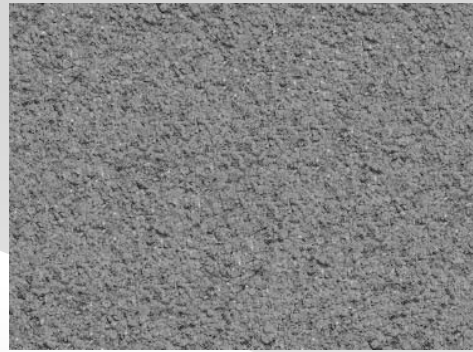
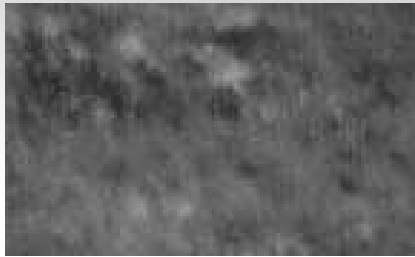
-procedures textures – generating graph effects by modules for filtering of images. They are proposed by PhotoShop and Adobe Premiere

-raster textures – digital images (scanned images). Using for facades texturing

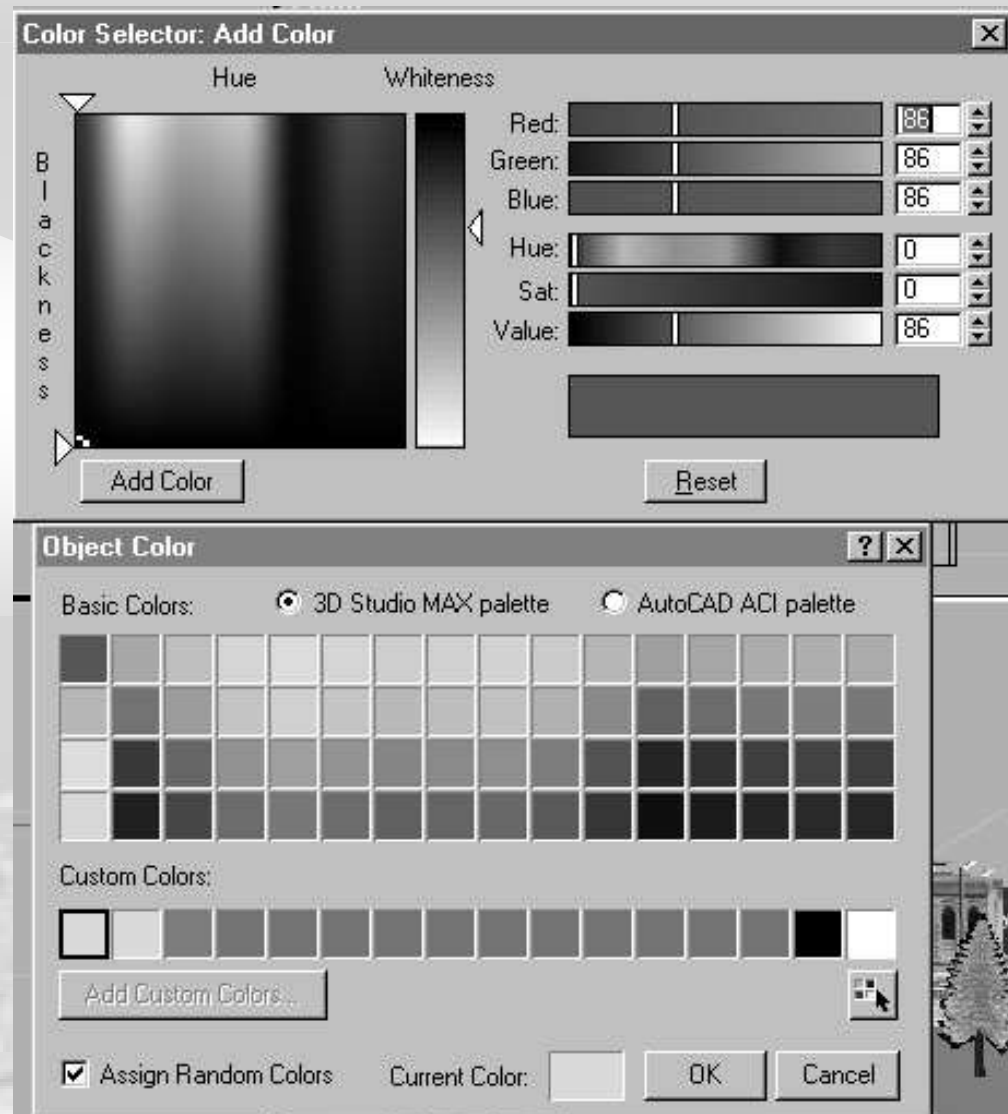
-drawing texturing – preliminary prepared drawings, multiple repeated figures – ex. For brick surfaces, color variants

-three-dimensional textures – imitation of surface roughness – pores, foams, sands, shades, etc.

Textures for visualizing of symbols



Materials used for visualizing of symbols



Illumination - sources

Omni – sporadic light source, emanating in regular and equal capacity, in all direction

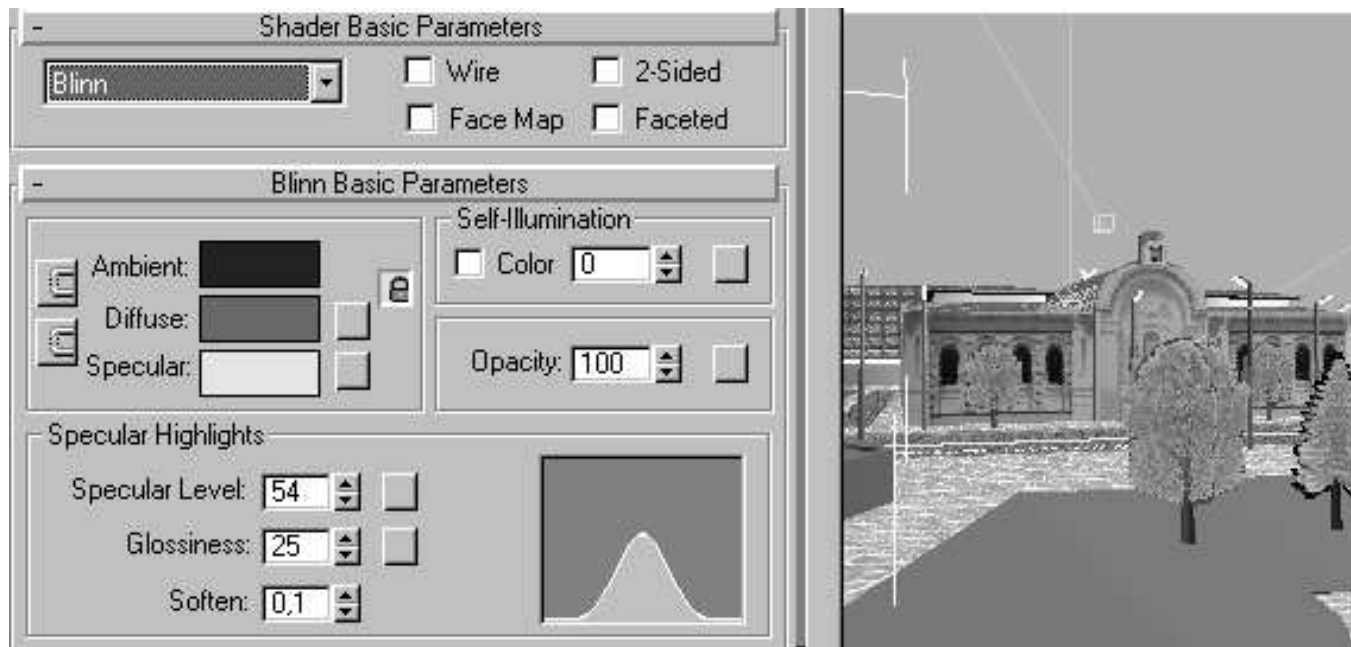
Directional – rays from the infinite distant source and parallel distributions

Spot – The light has conic radiating

Ambient – impression for clear sunny day, gloaming or night

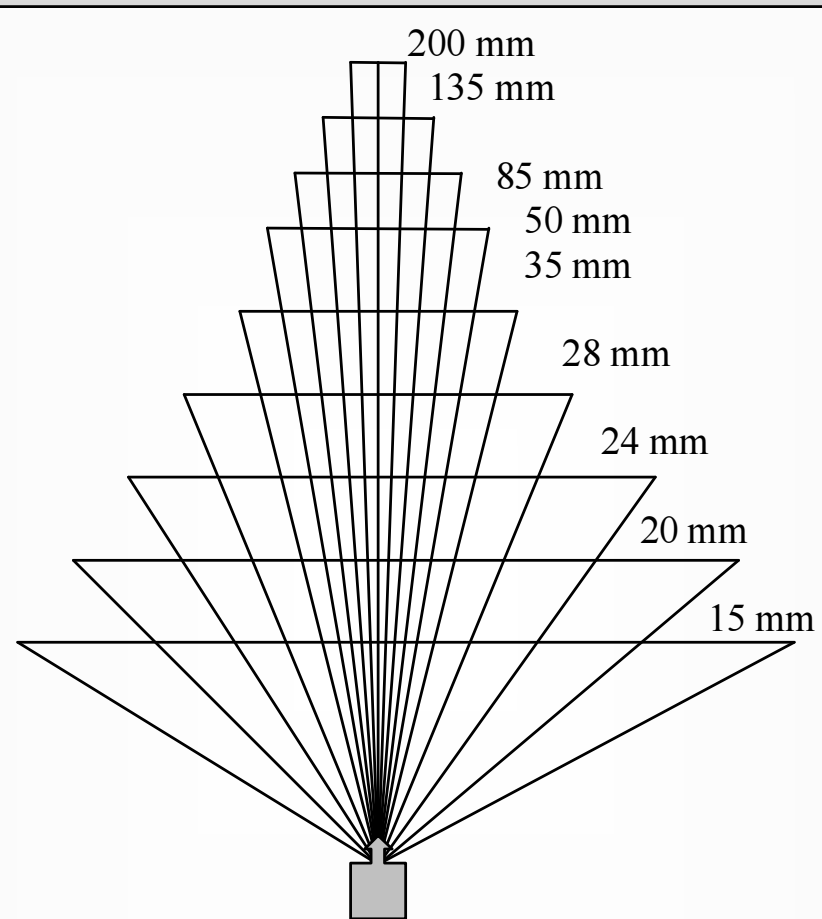


Parameters define optic characteristic of colours



Virtual Camera - an element of 3D map

<i>Focal distance F, mm</i>	<i>Visual angle, degree</i>
200	10,286
135	15,189
85	23,913
50	39,598
35	54,432
28	65,470
24	73,740
20	83,974
15	100,385
9, 867	175,000



*Virtual cameras with
typical focus distances*