

Realidade Virtual e Interfaces Modernas

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IEC-ITA

Julho/2005

Modelagem para Realidade Virtual

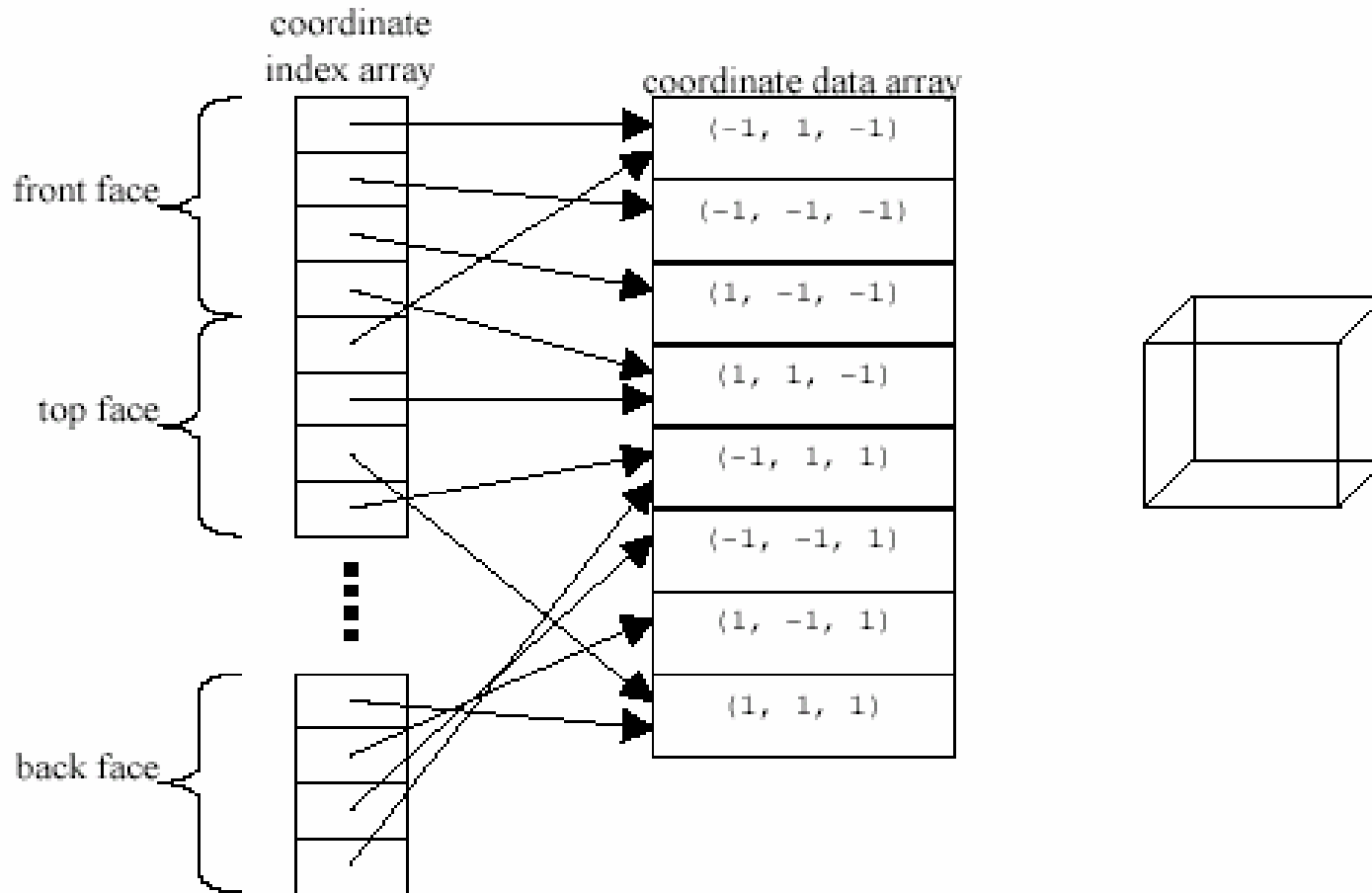
Tópicos

- Malhas triangulares
- Modelagem procedural
- Superfícies paramétricas
- Superfícies implícitas
- Volume e campos de luz
- Aquisição de modelos

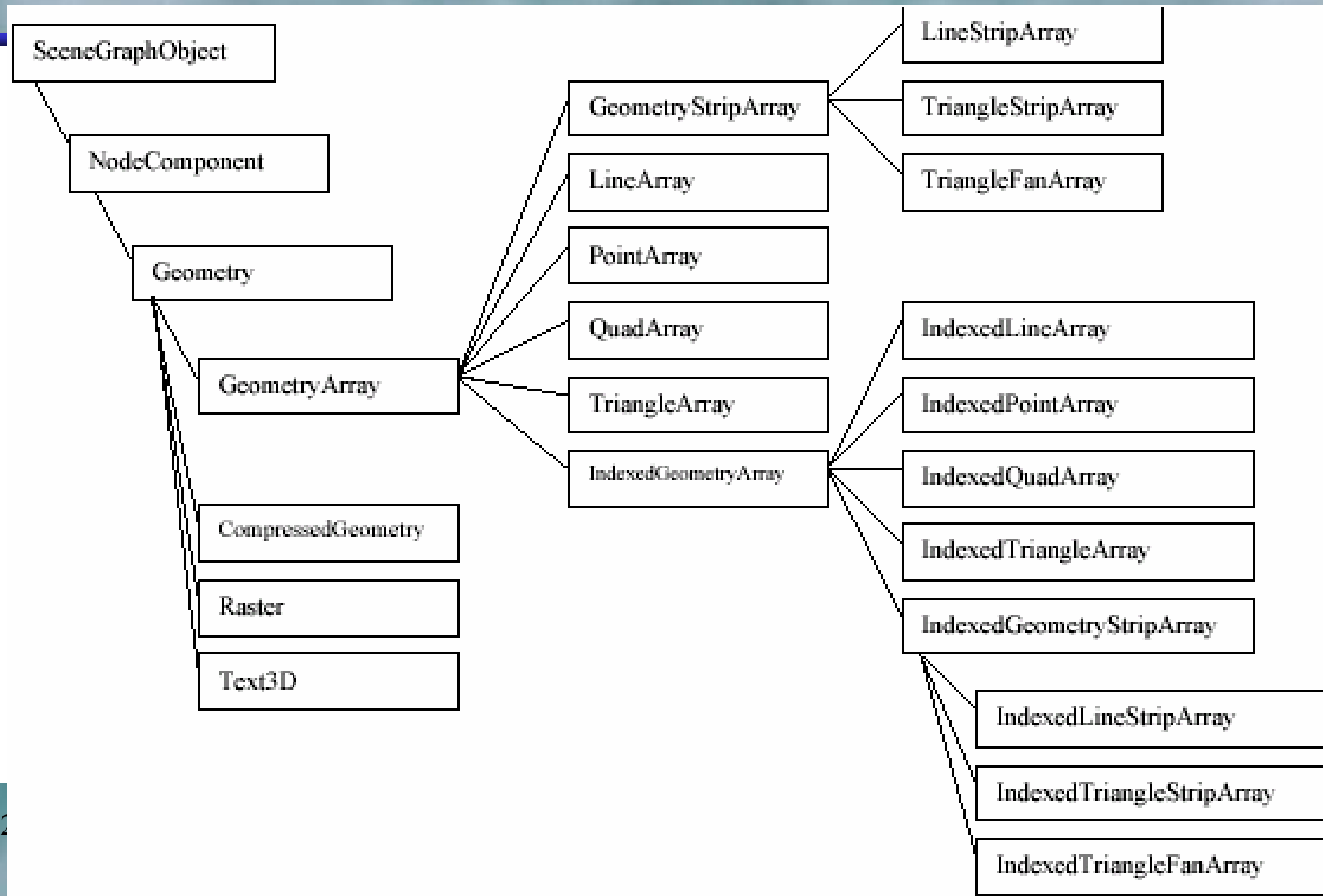
Malhas triangulares

- Por que triângulos?
- Fans
- Strips
- Cor de vértices (vértices pré-iluminados)
- Normais
- Normais e shading
- Índices de vértices

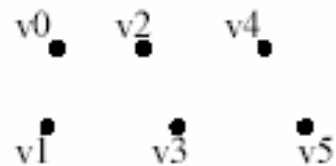
Malhas Triangulares



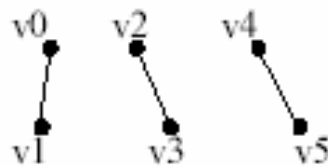
Classes J3D de Geometria



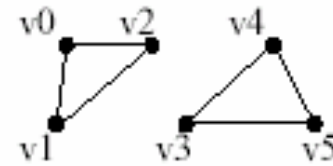
Classes J3D de Geometria



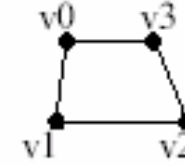
PointArray



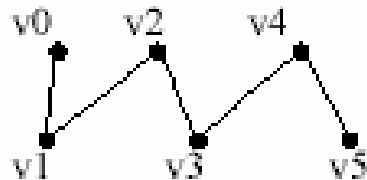
LineArray



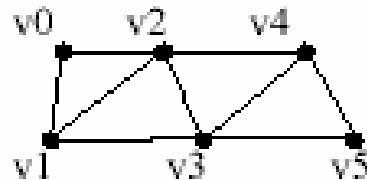
TriangleArray



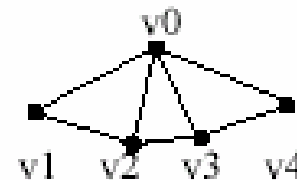
QuadArray



LineStripArray



TriangleStripArray



TriangleFanArray

Modelagem procedural

- Primitivas e instanciação
- Repetição
- Recursão e gramáticas
 - Fractais

Superfícies paramétricas

- Equações

$$x(s, t) = f_1(s, t)$$

$$y(s, t) = f_2(s, t)$$

$$z(s, t) = f_3(s, t)$$

$$\mathbf{N} = \left\langle \frac{\partial}{\partial s} x, \frac{\partial}{\partial s} y, \frac{\partial}{\partial s} z \right\rangle \times \left\langle \frac{\partial}{\partial t} x, \frac{\partial}{\partial t} y, \frac{\partial}{\partial t} z \right\rangle$$

$$\mathbf{n} = \frac{\mathbf{N}}{|\mathbf{N}|}$$

- Curva de Bézier
- Superfície de Bézier
- NURBS

Superfícies implícitas

- Traçado de raios
- Marching cubes: algoritmo clássico para gerar triangulações de superfícies definidas de forma implícita (patenteado).
- Blobs

Volume

- Rendering de volume
- Marching cubes (também utilizado para gerar uma triangulação)

Aquisição

- Mapa de profundidade
 - Light-stripe
 - Range-finder
 - Estéreo
 - Stylus acoplado mecanicamente
- Reconstrução a partir de pontos
- Mapa de ambiente
- Lumigraph / Light Fields

Campos de luz

- Image based rendering

Box Modeling

- Operações sobre poliedros ou malhas triangulares
 - Extrusão
 - Bevel
 - Inset
- Superfícies de revolução

Exemplo Box-Modelling





Object: object01



File Edit Mode Object Options View Build Settings Window About

New

Open ...

Close ...

Save

Save As ...

Save All

Browse ...

Configure ...

Configure GUI ...

Render Preview...

Page Setup ...

Print Preview...

Print ...

Exit

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Object editor

Object: object01



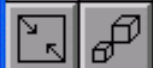
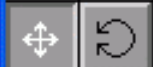
File Edit Mode Object Options View Build Settings Window About



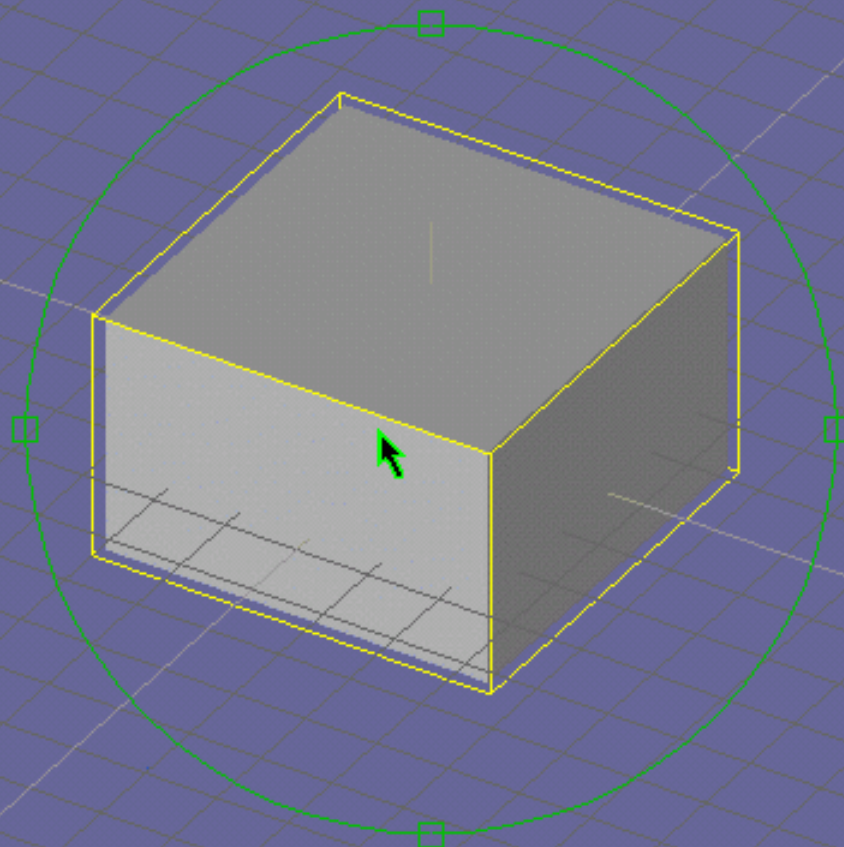
User1



X Y Z



UV



cube01

Position: (-2.01, 4.58, 0)

Object: object01



File Edit Mode Object Options View Build Settings Window About



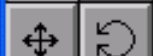
User1



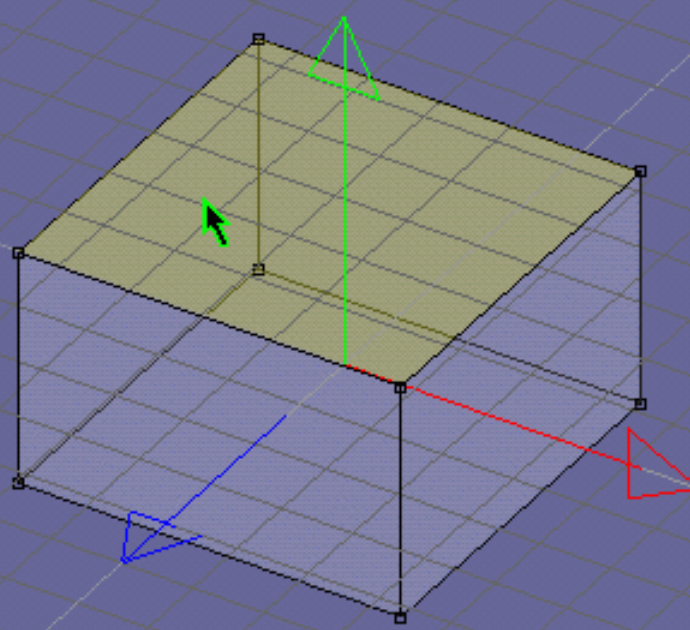
X Y Z



Front Back



UV



cube01

Position: (-2.01, 4.58, 0)

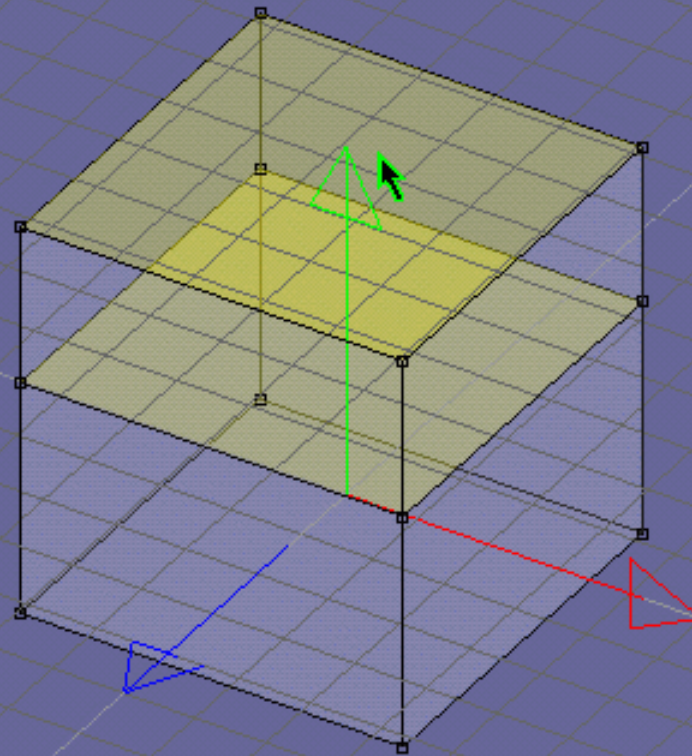
Object: object01



File Edit Mode Object Options View Build Settings Window About



User1



Front Back



cube01

Position: (-2.01, 4.58, 0)

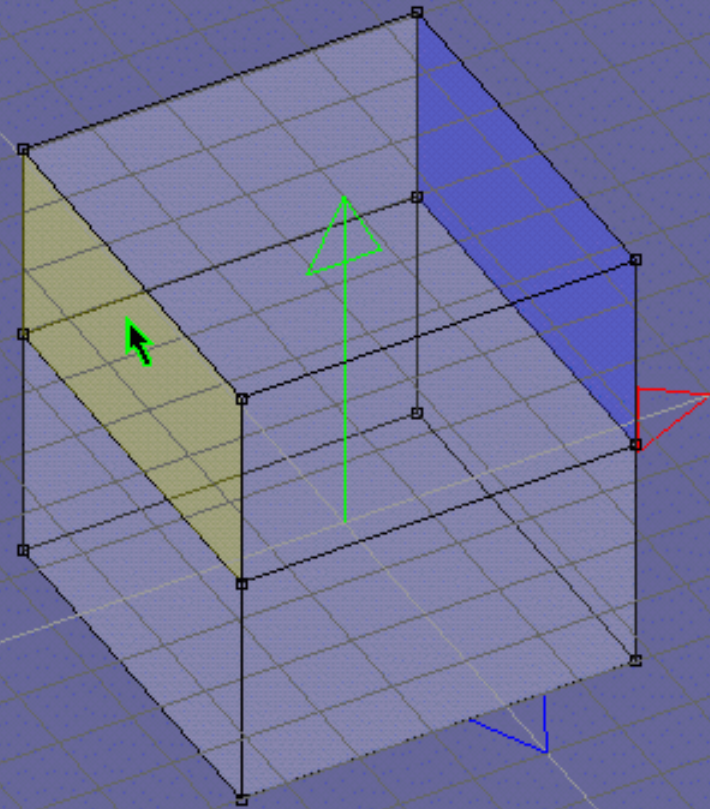
Object: object01



File Edit Mode Object Options View Build Settings Window About



User1



Undo extrude faces

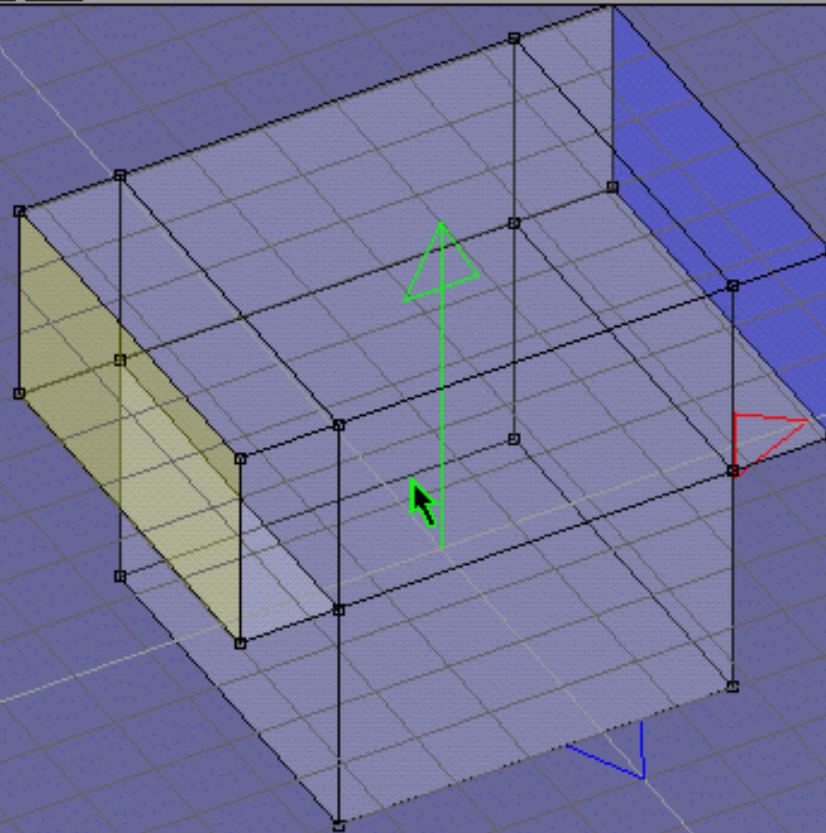
Object: object01



File Edit Mode Object Options View Build Settings Window About



User1



Front Back



Undo extrude faces

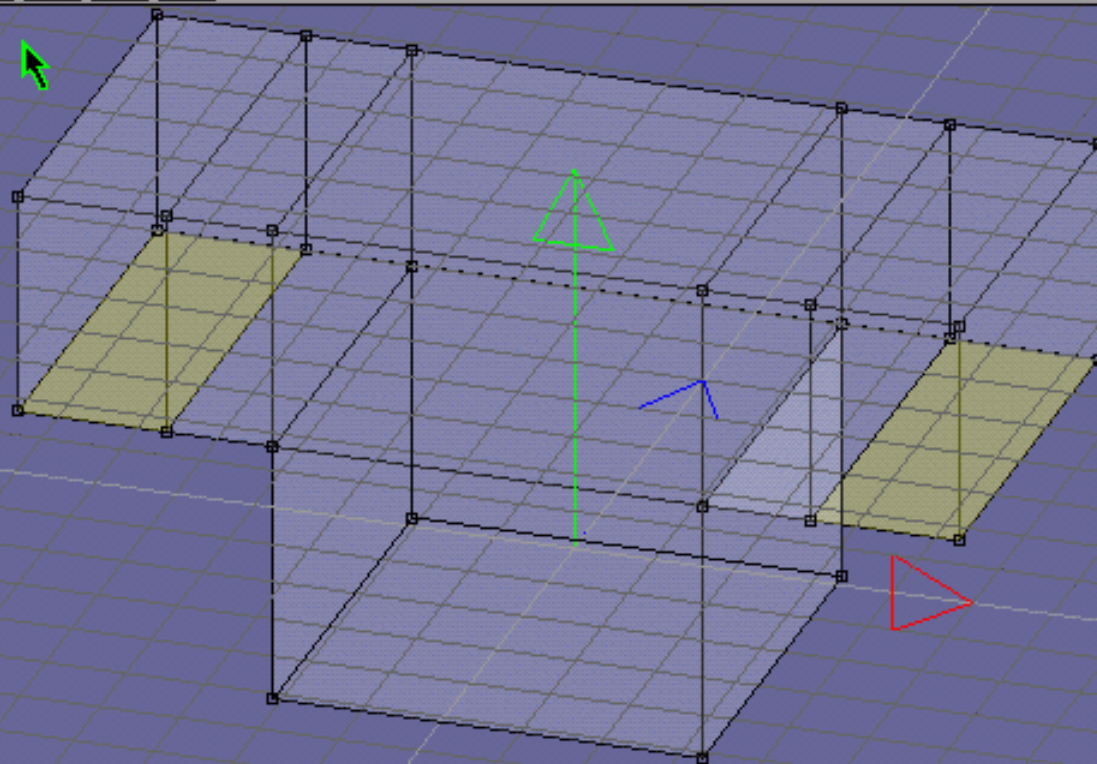
Object: object01



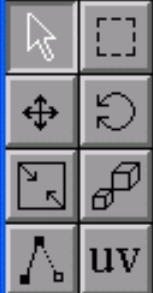
File Edit Mode Object Options View Build Settings Window About



User1



Front Back



Undo extrude faces

Object: object01



File Edit Mode Object Options View Build Settings Window About

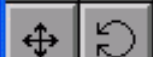


User1

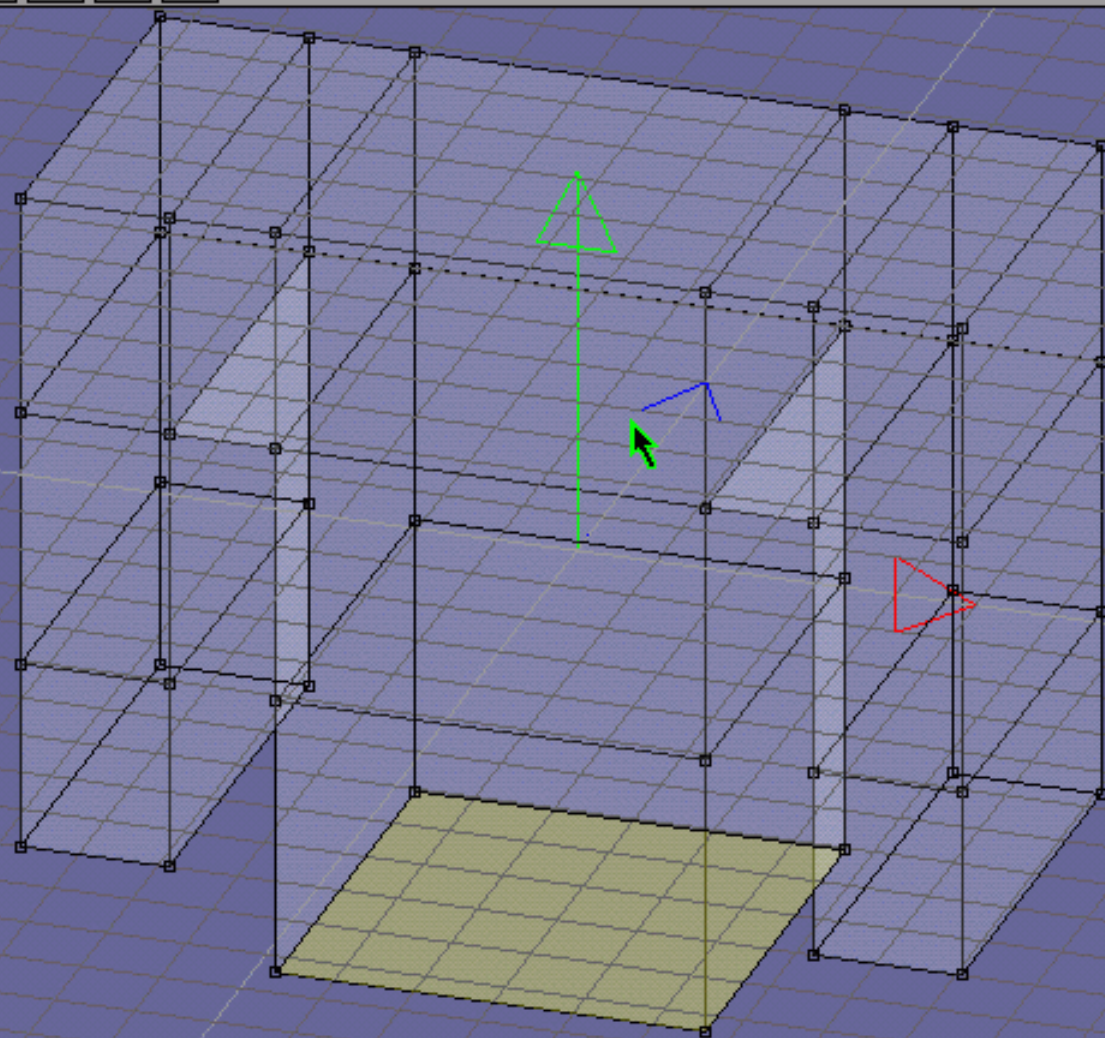
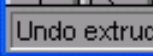
X Y Z



Front Back



UV



Undo extrude faces

Object: object01



File Edit Mode Object Options View Build Settings Window About

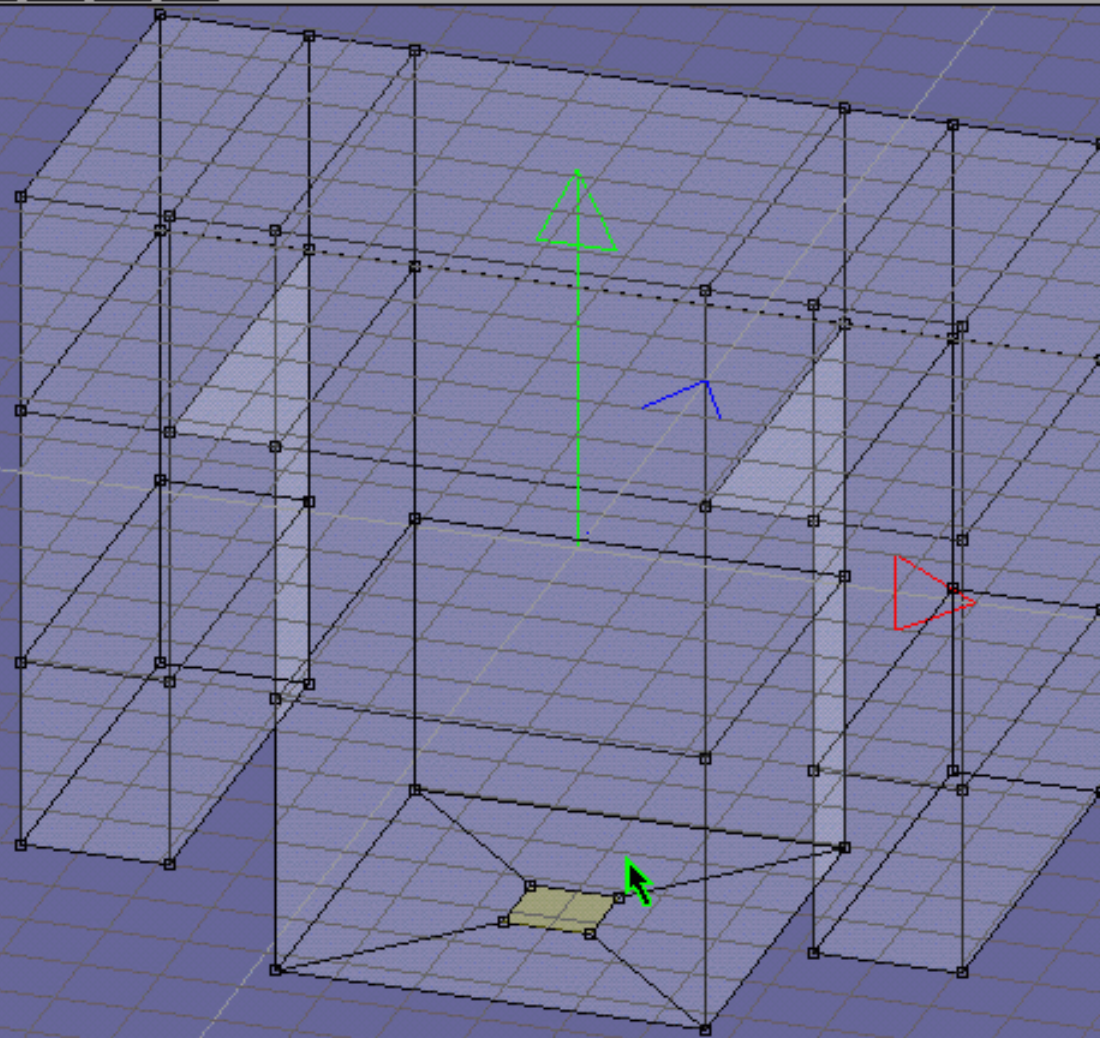
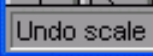
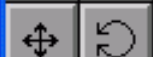


User1

X Y Z



Front Back



Undo scale faces

Object: object01



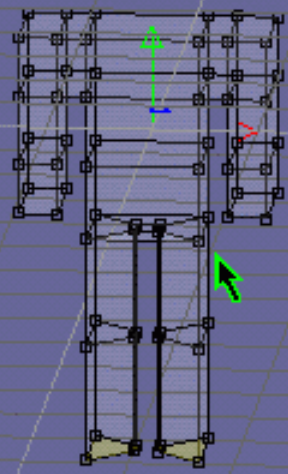
File Edit Mode Object Options View Build Settings Window About



User1



Front Back

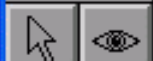


Undo inset faces

Object: object01



File Edit Mode Object Options View Build Settings Window About



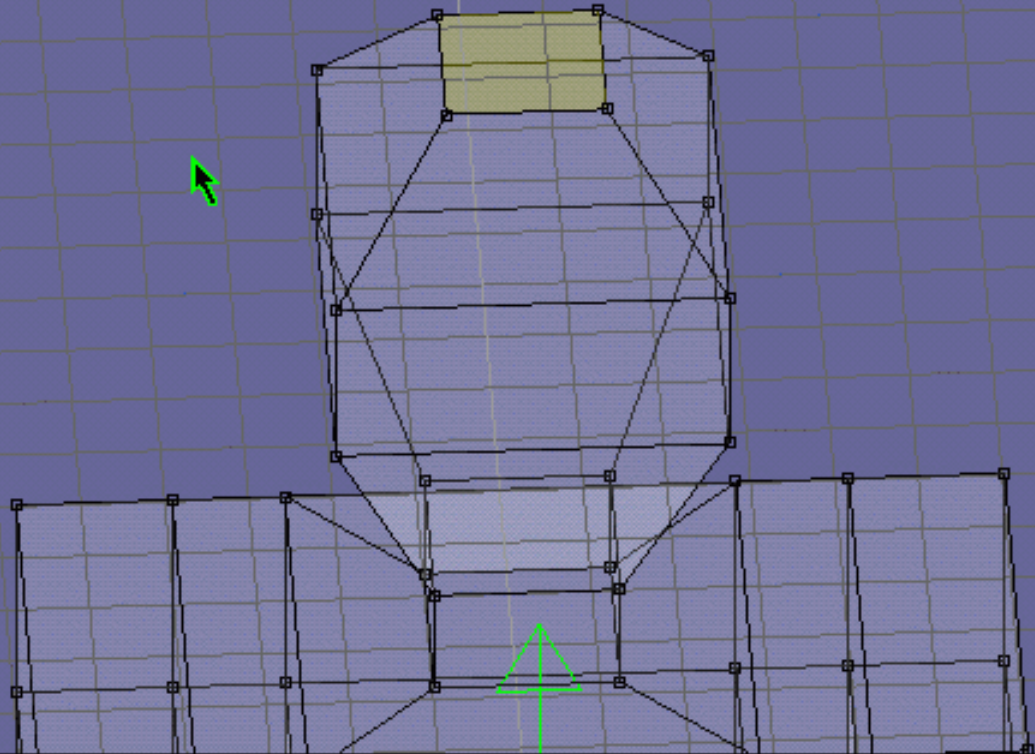
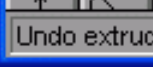
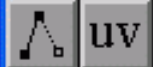
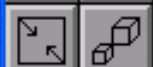
User1



X Y Z



Front Back



Undo extrude faces

Object: object01



File Edit Mode Object Options View Build Settings Window About



File Object

Apply

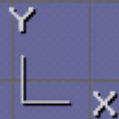
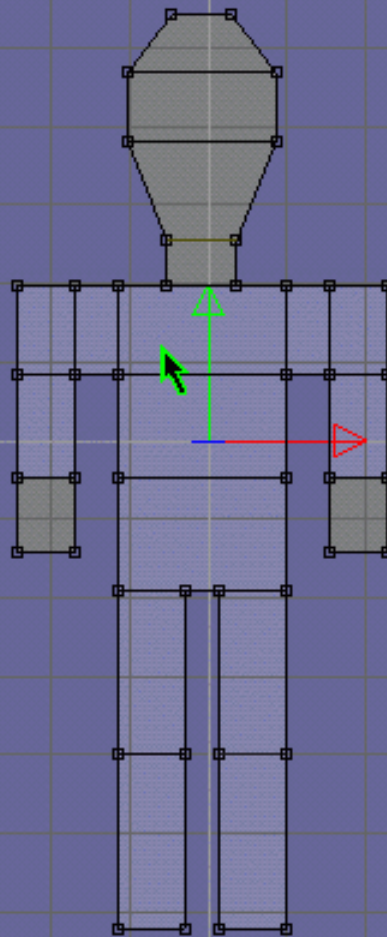
New

Material Name

Front Back

UV

Front



Undo extrude faces

Material Editor

Surface Properties

Name:

Ambient: =

Diffuse: =

Specular: =

Emissive: =

Rough: Trans:

Brilliance:

Two Sided

R H

G S

B L

Material Editor

Surface Properties

Name:

Ambient: =

Diffuse: =

Specular: =

Emissive: =

Rough: Trans:

Brilliance:

Two Sided

R H

G S

B L

Object: object01

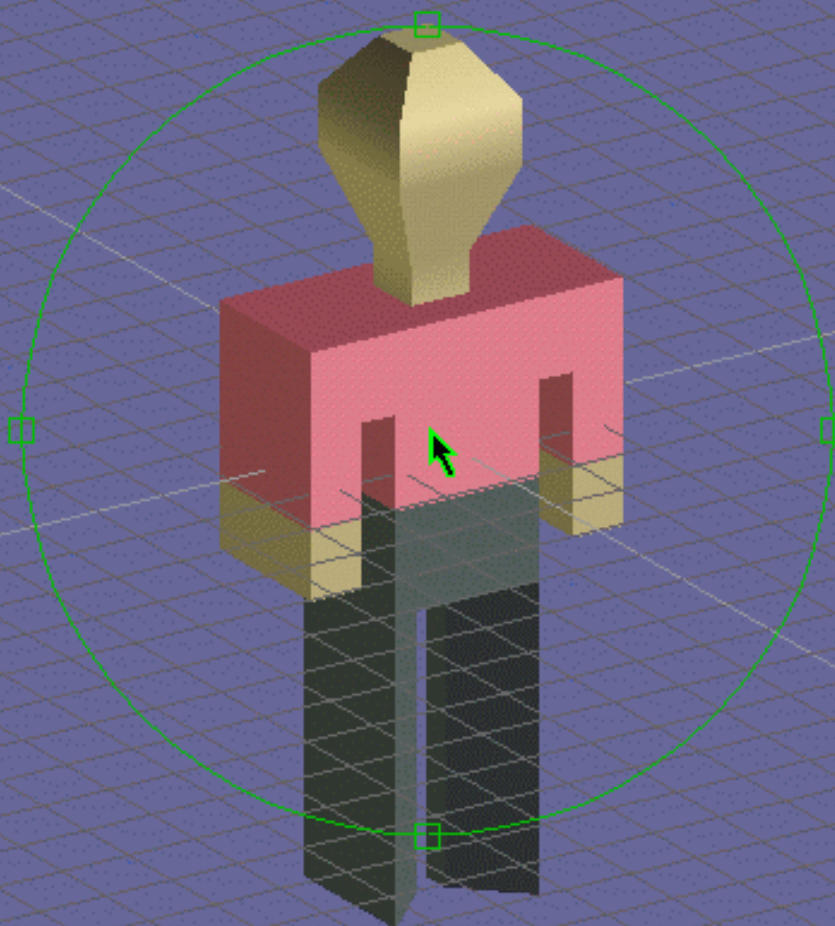


File Edit Mode Object Options View Build Settings Window About



		File	Object
Apply			
material01			
		material02	
UV			
		material03	
		New	
		Material Name	

User1



Undo extrude faces

Object: object01

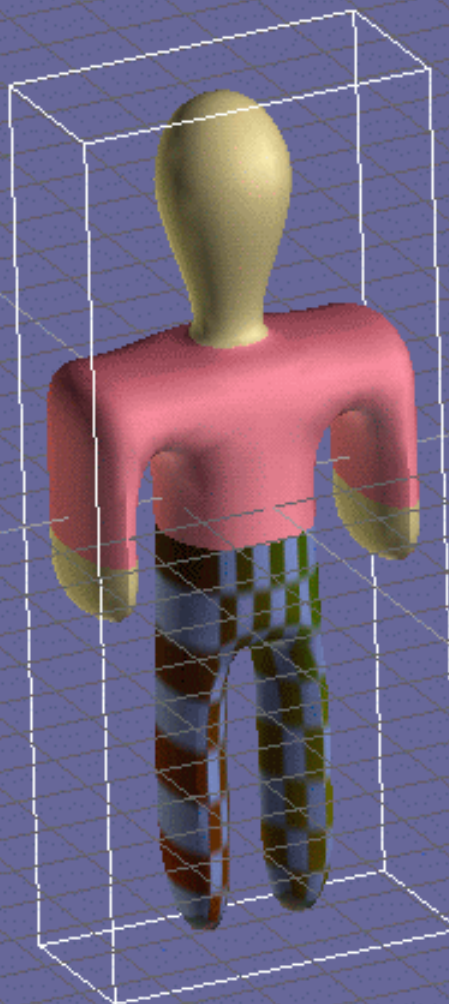


File Edit Mode Object Options View Build Settings Window About

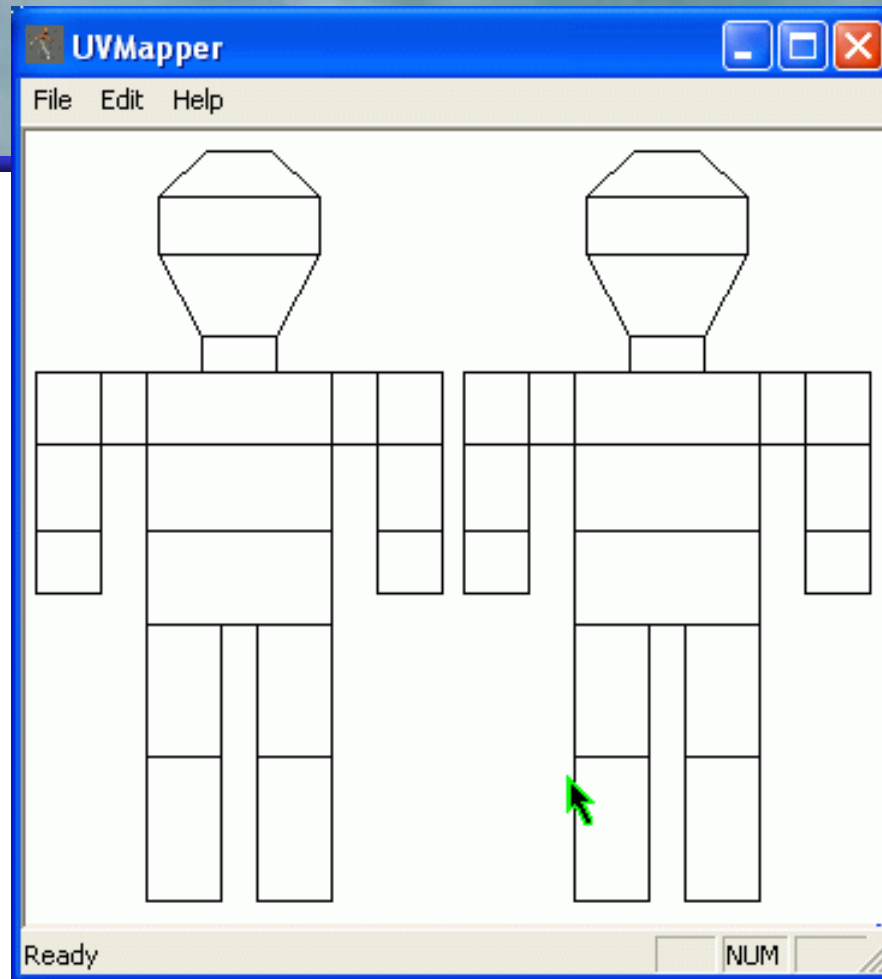


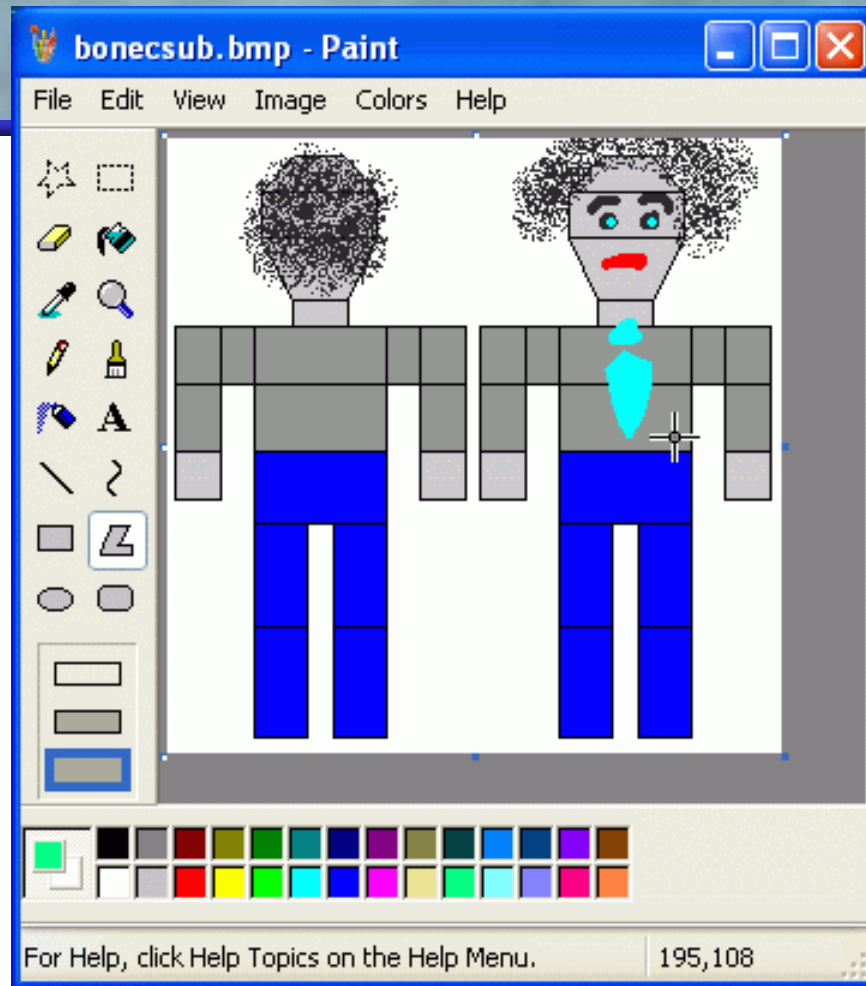
		File	Object
Apply			
material01			
		material02	
UV			
		material03	
		New	
		Material Name	

User1



mesh: mesh01





Object: object01



File Edit Mode Object Options View Build Settings Window About



File Object

Apply

material01

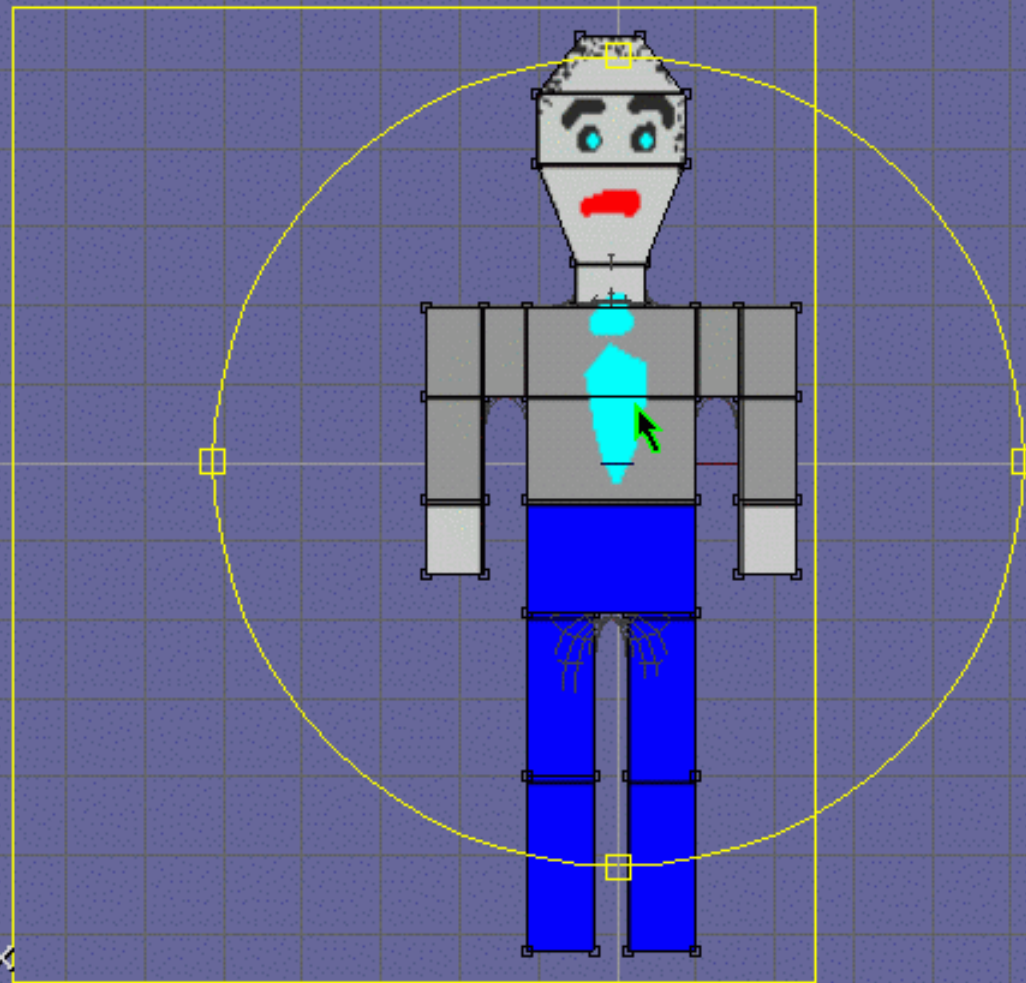
material02

material03

material04

New

Front



subdivision: subdivision01

Object: object01



File Edit Mode Object Options View Build Settings Window About



File Object

User1

Apply

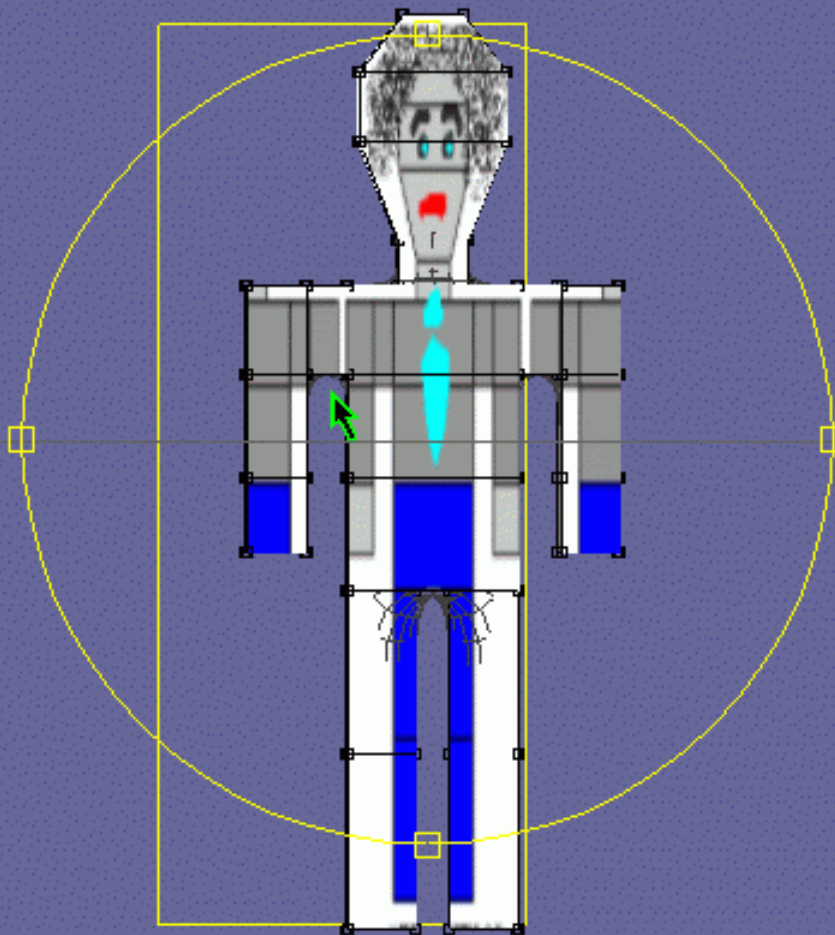
material01

material02

material03

material04

New





File Object

Apply



material01

New

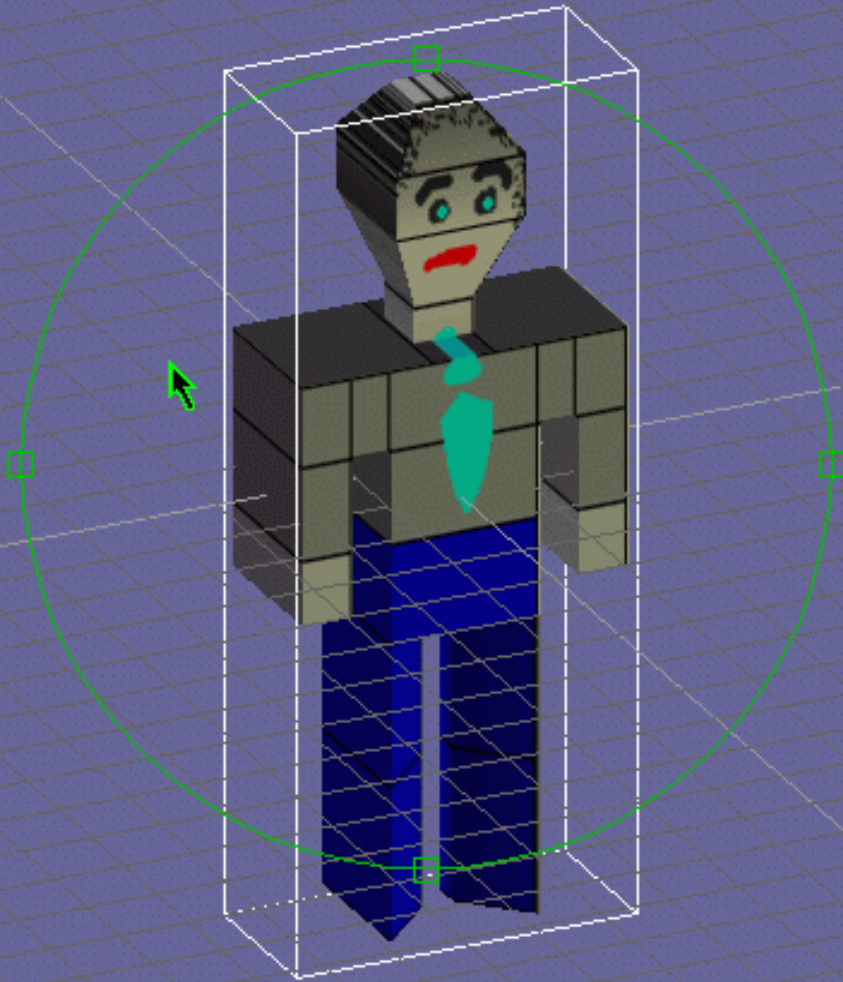
Material Name

UV



A vertical sidebar containing various tool icons and controls. It includes a 'File' and 'Object' menu, an 'Apply' button, a material preview sphere labeled 'material01', a 'New' button, a 'Material Name' input field, and a 'UV' section with several icons for UV mapping and texture editing.

User1



Object: bonectex



File Edit Mode Object Options View Build Settings Window About



File Object

User1

Apply

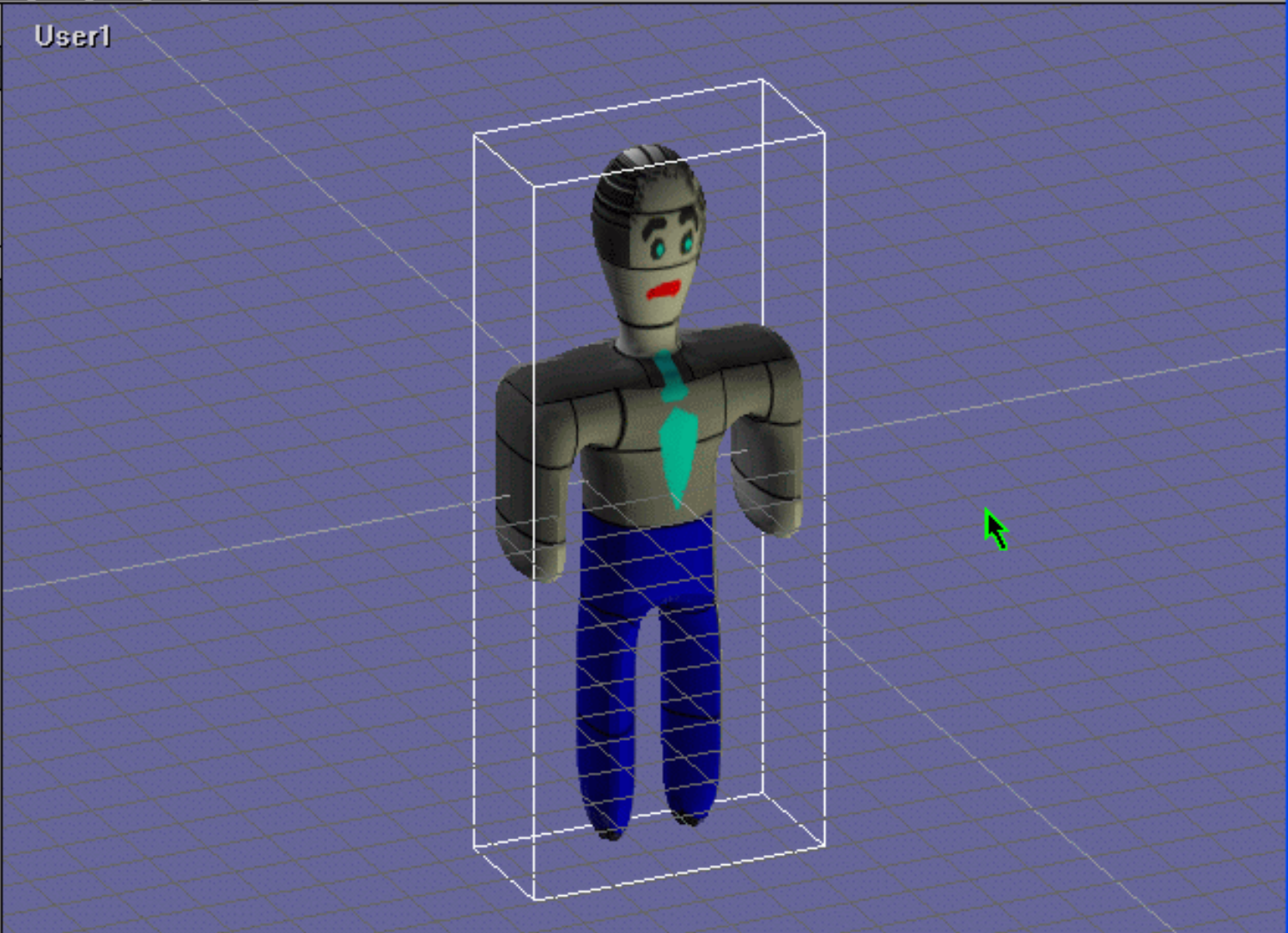


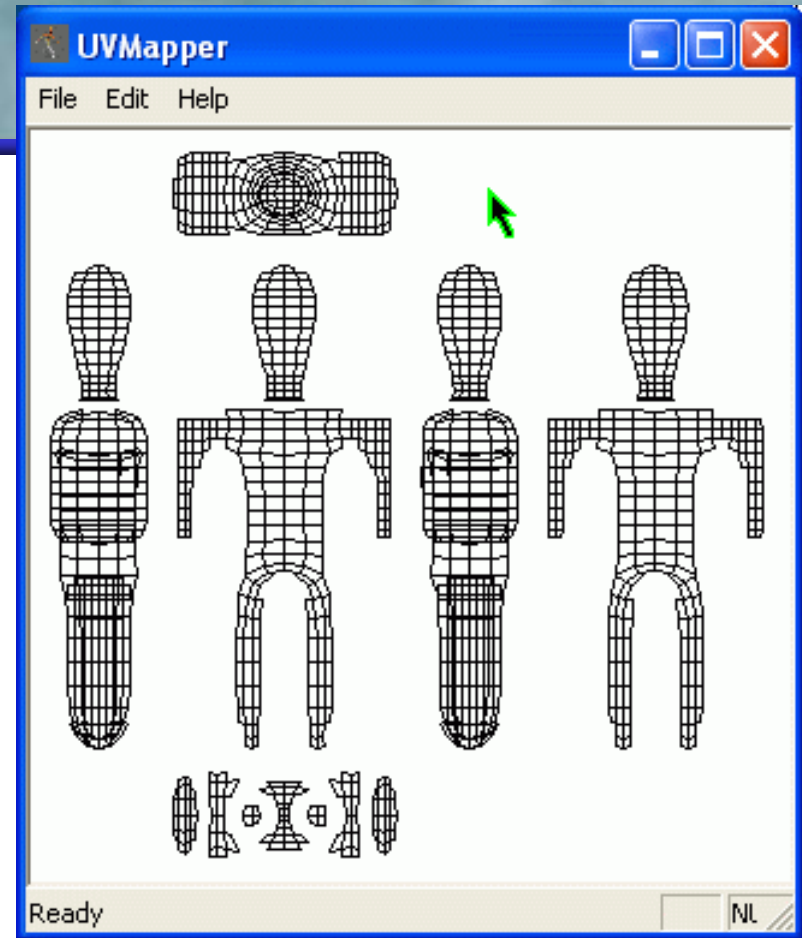
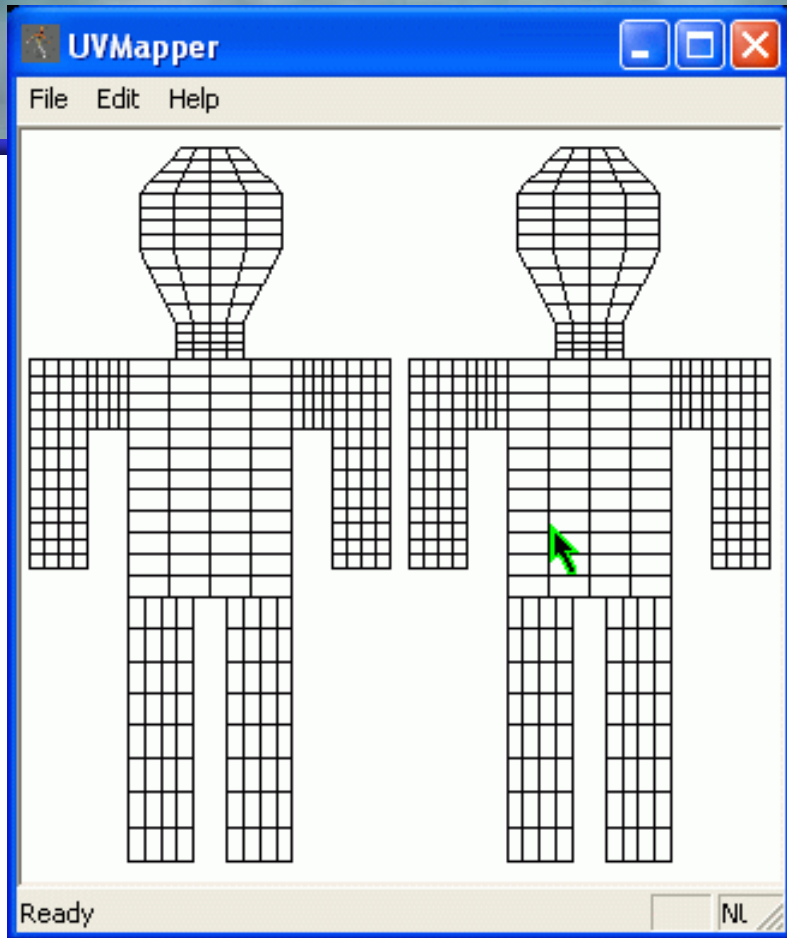
material01

New

Material Name

UV





Exemplo Teddy



Outros modos de modelagem

- CSG (geometria construtiva de sólidos)
- Varredura (sweep) de formas
- Simulação física
- Sistemas de molas
- Sistemas de restrições

Níveis de detalhes

- Nós do grafo de cenas J3D
- Escolha do nível de detalhes
- Troca do nível de detalhes
 - Abrupta
 - Suave

Definindo malhas com níveis de detalhes

- Troca abrupta
- Morphing
- Malhas progressivas

Mapeamento de textura

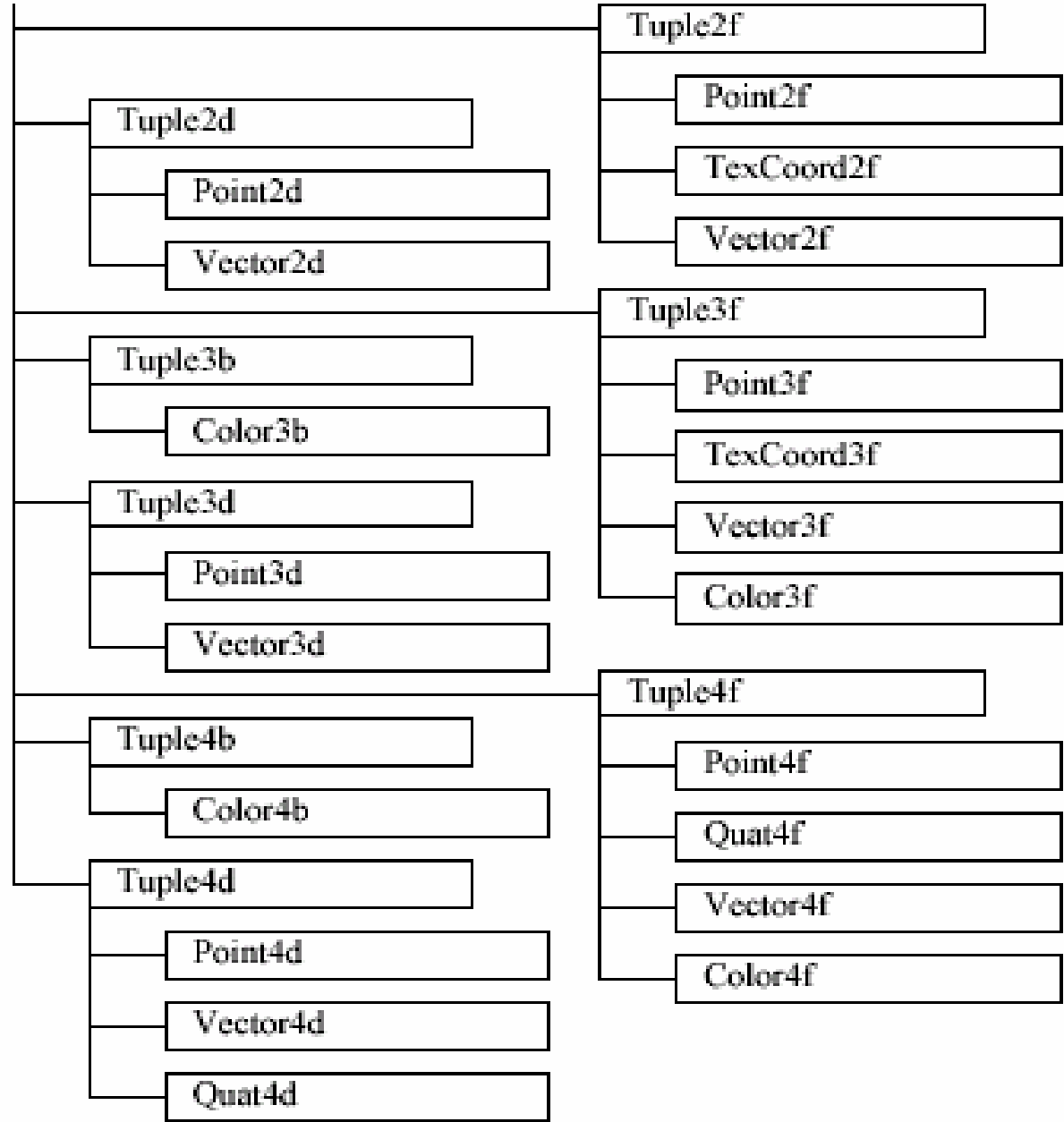
- Aliasing em mapeamento de texturas
- Filtragem em mapeamento de textura
- Técnica de mip-map
- Bump-maps

Multirresolução em imagens

- Imagens do globo terrestre
 - Google maps

Classes matemáticas do Java 3D

javax.vecmath



GeometryArray Constructor

GeometryArray(int vertexCount, int vertexFormat)

Constructs an empty GeometryArray object with the specified number of vertices, and vertex format. One or more individual flags are bitwise "OR"ed together to describe the per-vertex data. The flag constants used for specifying the format are:

COORDINATES: Specifies this vertex array contains coordinates. This bit must be set.

NORMALS: Specifies this vertex array contains surface normals.

COLOR_3: Specifies this vertex array contains colors without transparency.

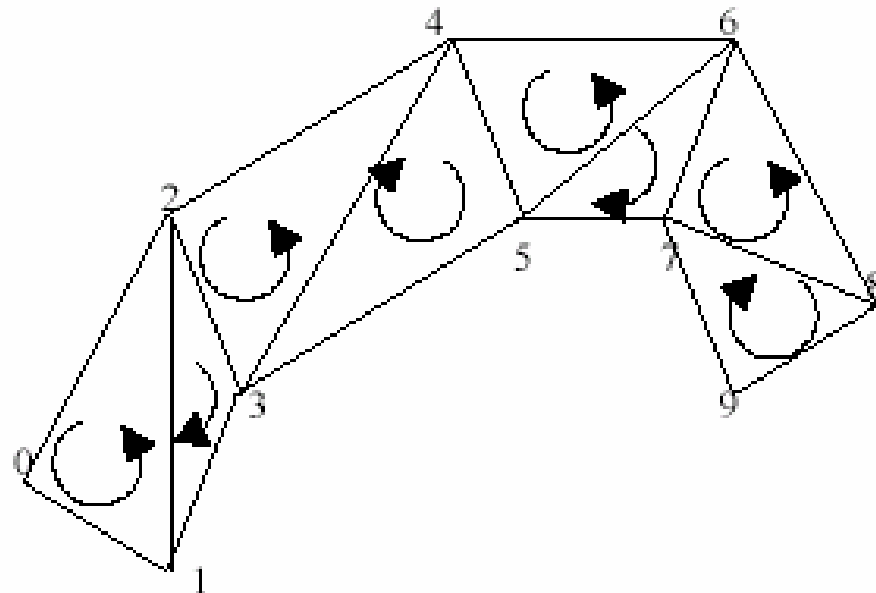
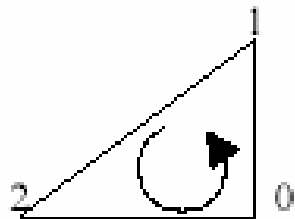
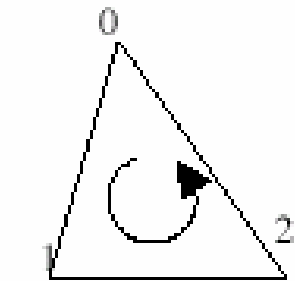
COLOR_4: Specifies this vertex array contains colors with transparency.

TEXTURE_COORDINATE_2: Specifies this vertex array contains 2D texture coordinates.

TEXTURE_COORDINATE_3: Specifies this vertex array contains 3D texture coordinates.

For each vertex format flags set, there is a corresponding array created internal to the GeometryArray object. Each of these arrays is vertexCount in size.

- Classe GeometryInfo
 - Triangulator
 - NormalGenerator
 - Stripifier



Leituras complementares

- Schmalstieg – A Survey of Advanced Interactive 3-D Graphics Techniques
- Igarashi, Matsuoka, Tanaka – Teddy: A Sketching Interface for 3D Freeform Design
- Sato, Wheeler, Ikeuchi – Object Shape and Reflectance Modeling from Observation
- Kutulakos, Seitz – What do N photographs Tell Us About 3D Shape?
- Chen – QuickTime VR – An Image-Based Approach to Virtual Environment Navigation
- Gortler et al. – The Lumigraph
- Levoy, Hanrahan – Light Field Rendering