

Modelagem Geométrica

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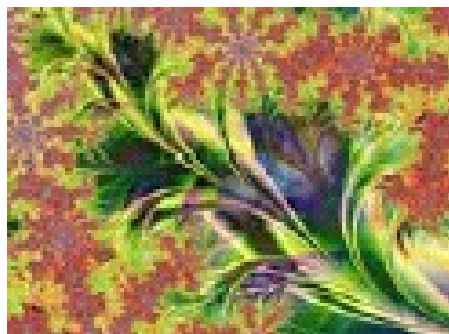
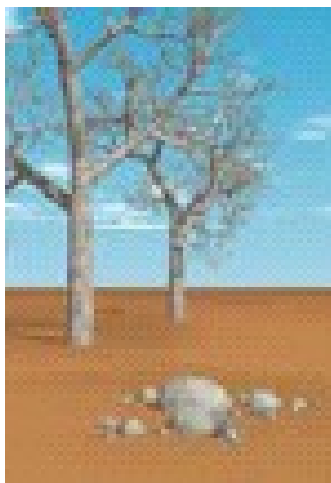
andre.silva@udesc.br

Capítulo 7 do “Foley”

Capítulo 4 de Azevedo e Conci

Mortenson (Geometric Modeling)

Objetos Naturais



Introdução

- São os objetos mais difíceis de modelar porque são amorfos, contínuos e definidos por complexas interações física e/ou químicas
- Definidos
 - Plantas
 - Apresentam superfícies definidas mas tem processo de crescimento associado
- Indefinidos
 - Fogo, fumaça, explosões, nuvens, neblina, etc ...
 - Apresentam limites indefinidos e variáveis
 - Água, rios, córregos, mar, piscina, cachoeiras, fontes d'água, ondas etc...
 - É uma superfície deformável ? Grande dificuldade de representar fielmente turbulências

Fogo



Fogo

(A&C, 2003: Cap 4.12)

- Mapas de texturas 2D animados são normalmente utilizados mas só são convenientes para câmeras estáticas (superposição em vários planos melhora mas não resolve)

Nuvens



Sistemas de Partículas



Sistema de Partículas simulando água em colisão com as pedras.

Simulações

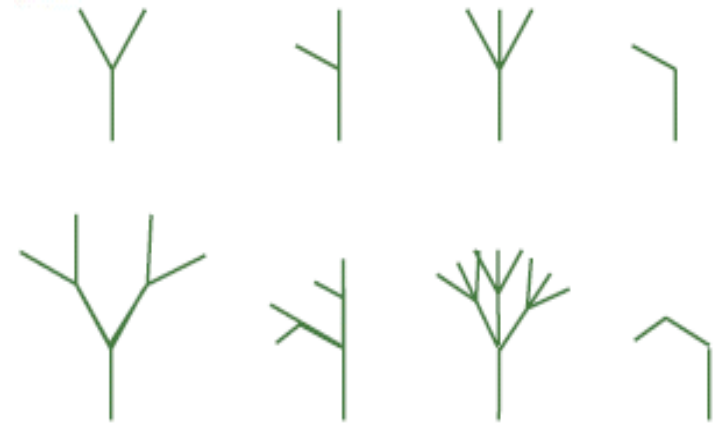
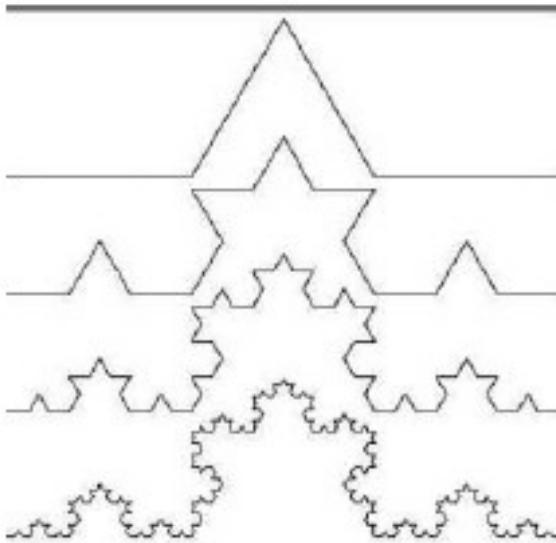
- Água
 - <http://physxinfo.com/news/11109/introduction-to-position-based-fluids/>
- Objetos Deformáveis
 - http://www.youtube.com/watch?feature=player_embedded&v=KppTmsNFneg

Modelagem Procedural

Plantas

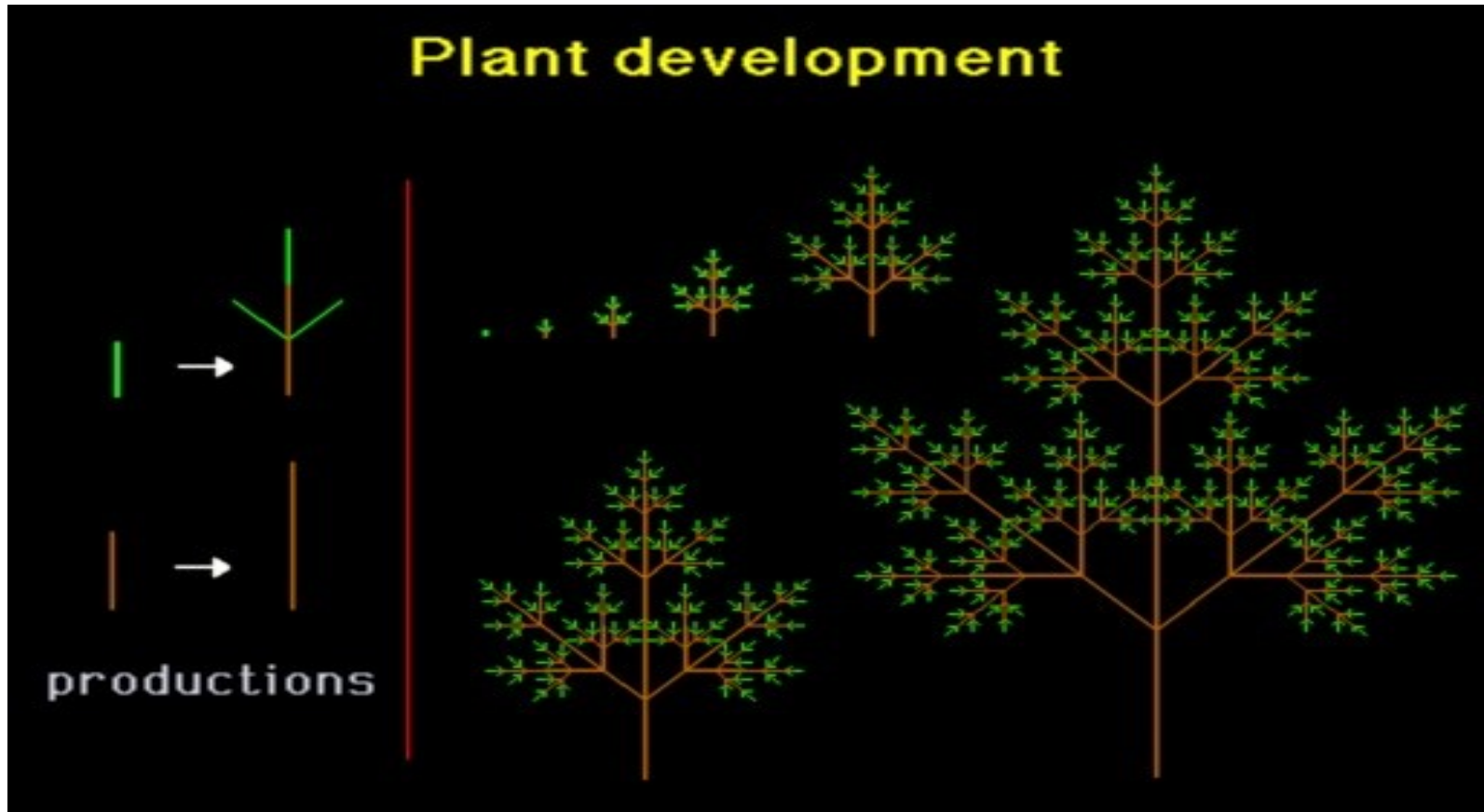
- Desenvolvem-se a partir de um único ponto obedecendo estrutura restrita e pré-definida
 - A topologia de uma planta é definida pela estrutura recursiva de galhos
 - Auto-similaridade em escala
- Vários esquemas de modelagem
 - Fractais
 - L-systems

Plantas



Os fractais têm sempre cópias aproximadas de si.

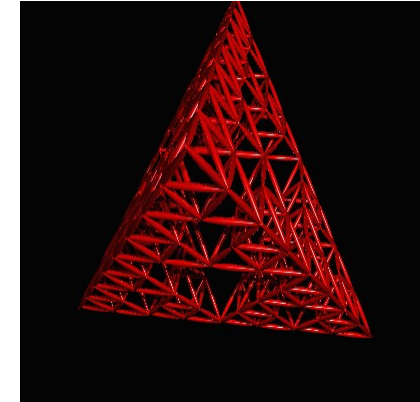
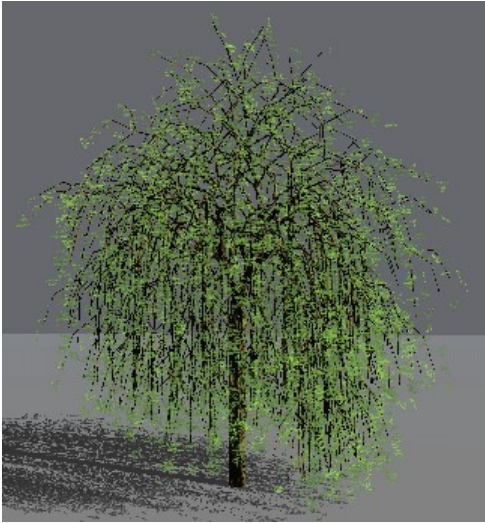
Plantas



Plantas



Procedurais



L-Systems (Przemyslaw Prusinkiewicz)

Modelagem Procedural

Procedural Modeling of Buildings

Pascal Muller et al. Siggraph 2006.





Mensagens

- Muitos dos Objetos Naturais **não** são efetivamente modelados
- Modelagem Geométrica tem muito a ver com sistemas CAD/CAE
- Modelagem Geométrica não é só objetos rígidos manufaturados

Métodos de Modelagem de Objetos (Recursos de **Interface**)

Modificadores/Operadores

A&C, Cap 4.6

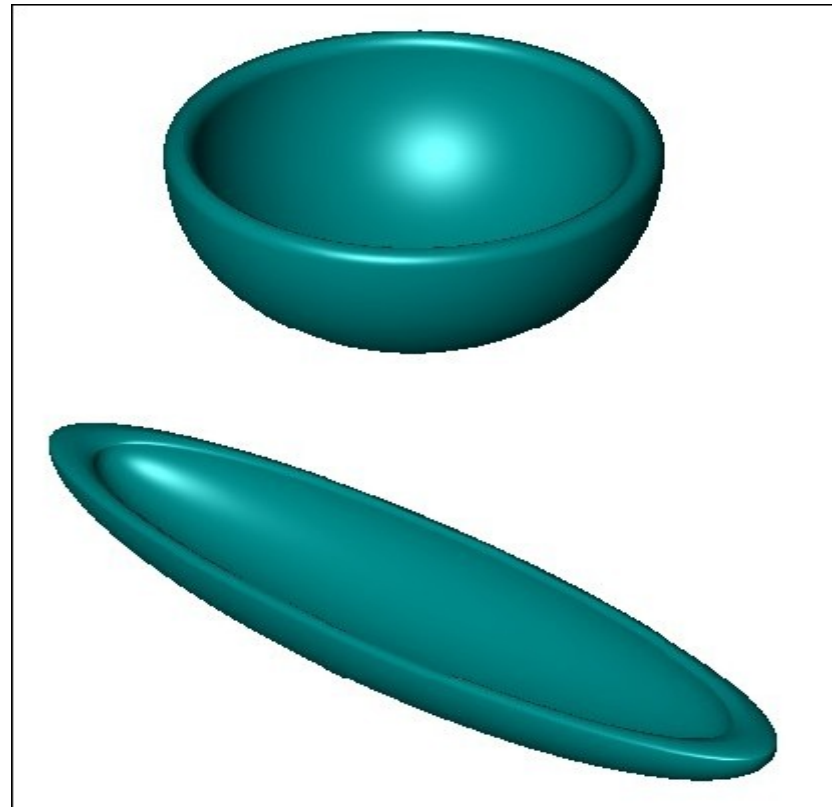
Tipos de Métodos

- Operações **Globais**
 - Transformações/Deformações
 - Considera um **objeto como um todo**
 - Altera todo um objeto existente
 - Gera objeto(s) novo(s) com base em um existente
- Operações **Locais**
 - Detalhamentos
 - Altera **partes geométricas/topológicas** de objeto existente
 - Em nível de pontos/vértices
 - Em nível de faces/superfícies

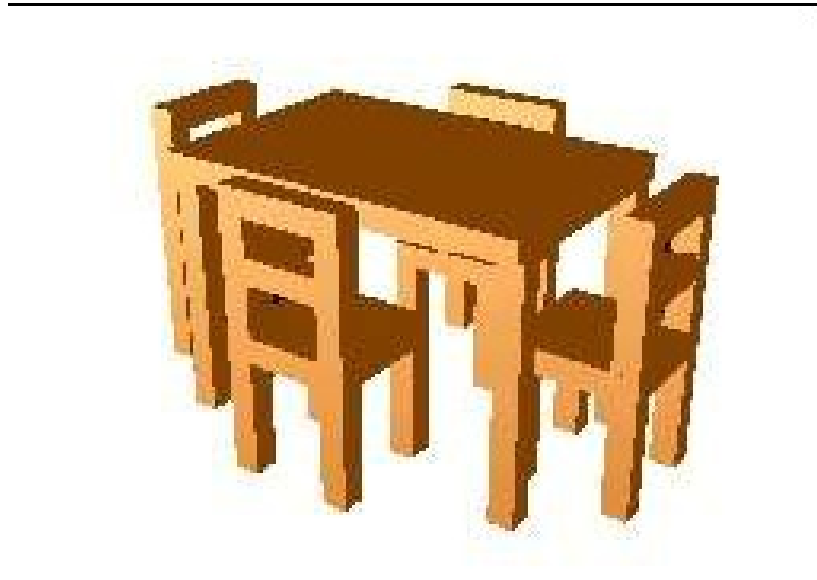
Operações Globais

Refinamento da Malha, Inchaço, Torção,
Dobra, Esticamento, Entortamento,
Afunilamento, Escalemanto, Replicação,
Leis

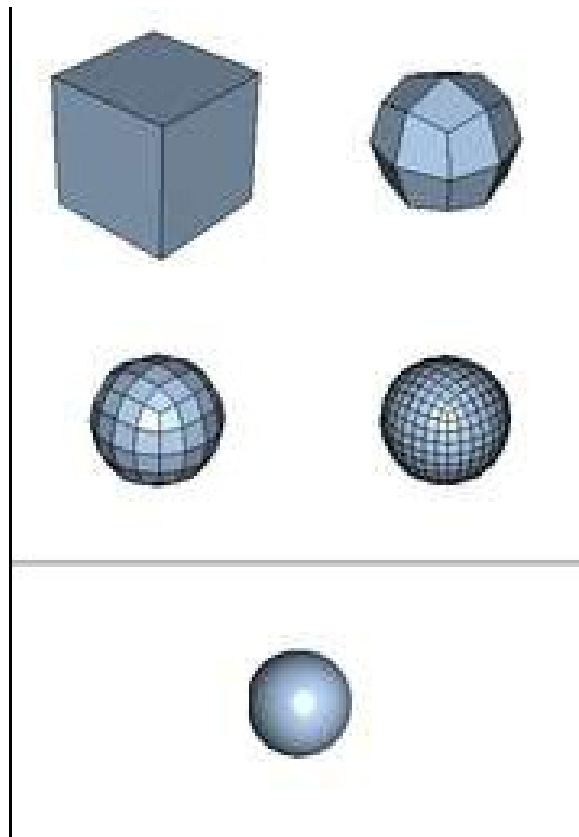
Operação Global: Escala Não Uniforme



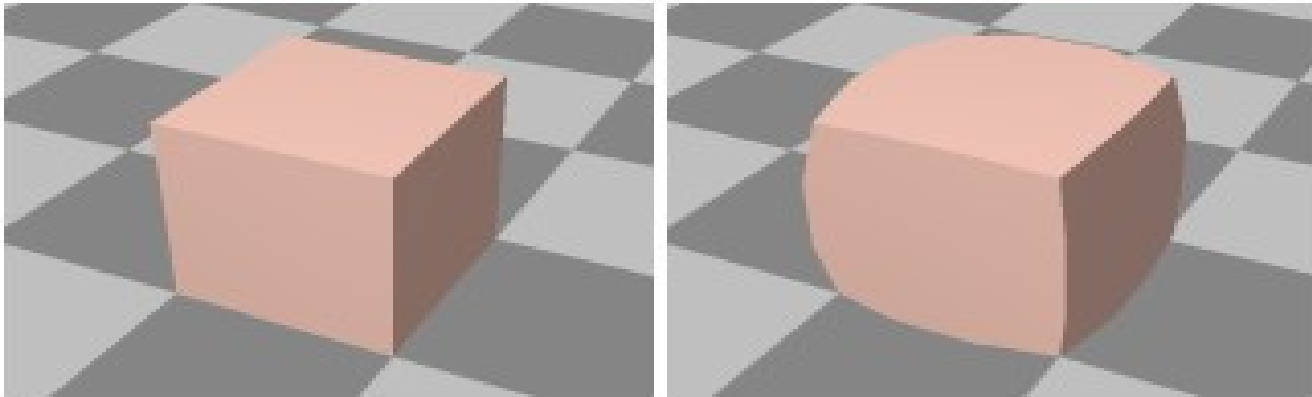
Operação Global: Replicar/Array



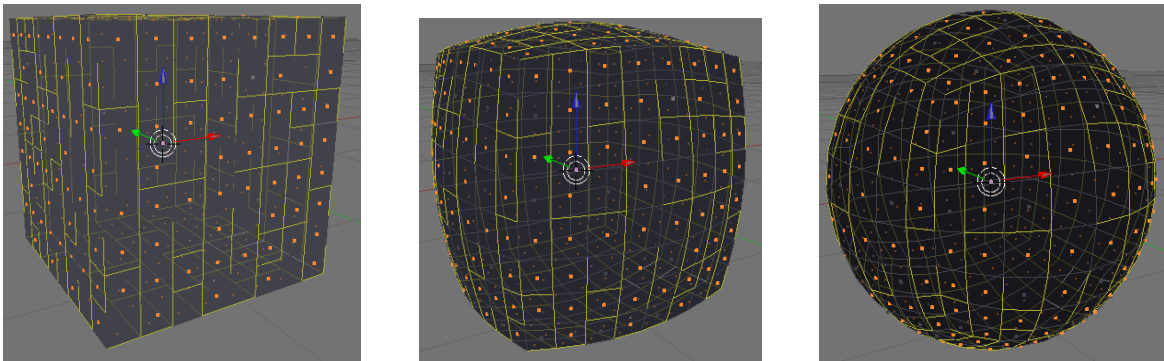
Operação Global: Refinamento/Simplificação



Operação Global: *Bulge* (3D Canvas)

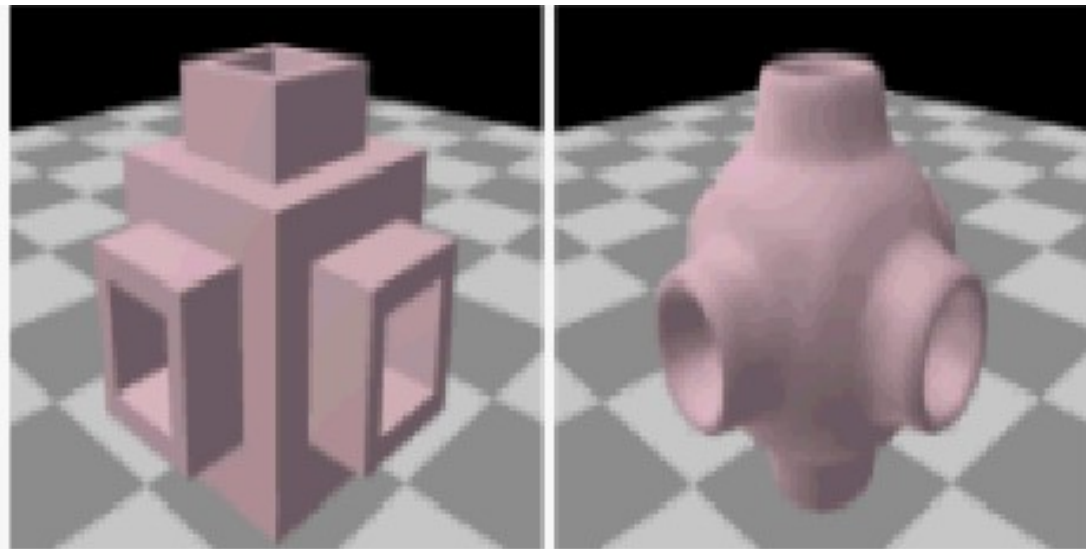


To Sphere (Blender)



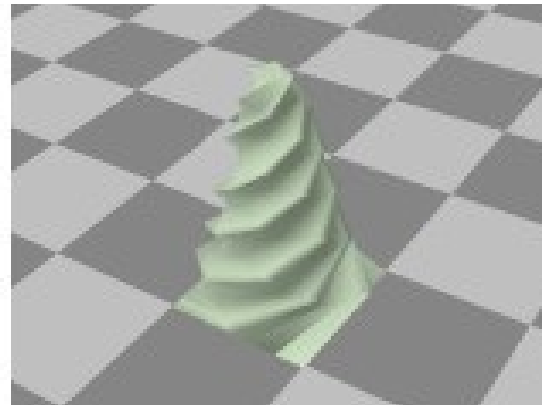
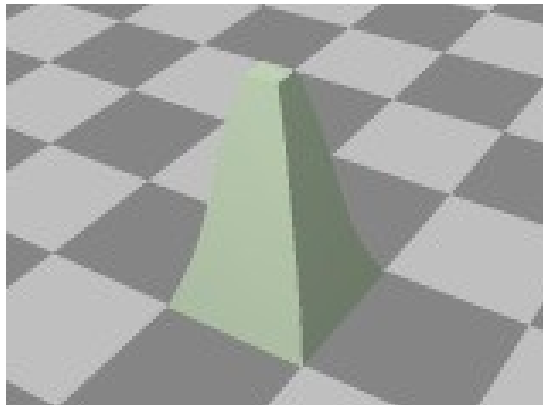
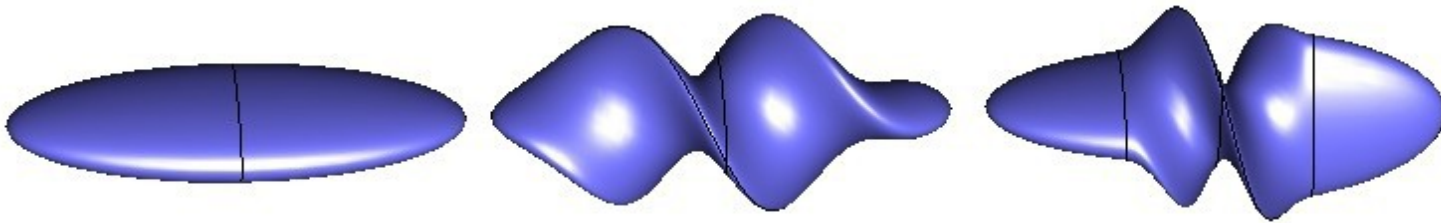
Operação Global: *Smooth* (Canvas 3D)

Smooth Operation



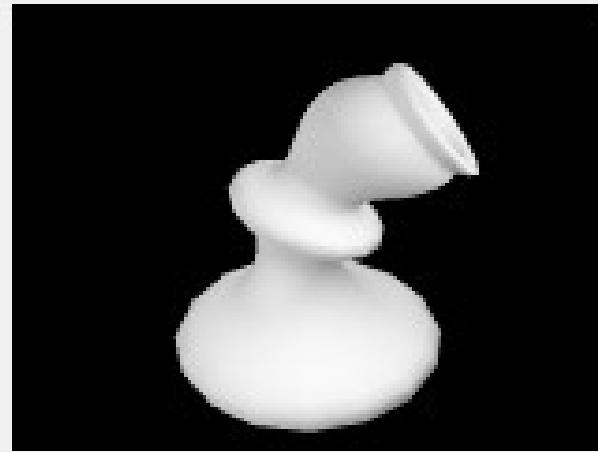
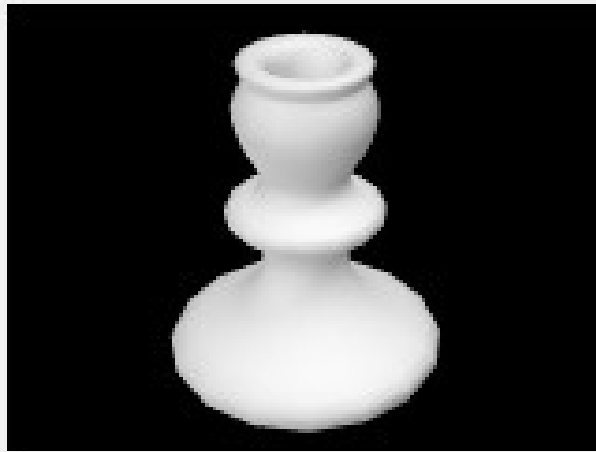
Operação Global:

Warping: Twist



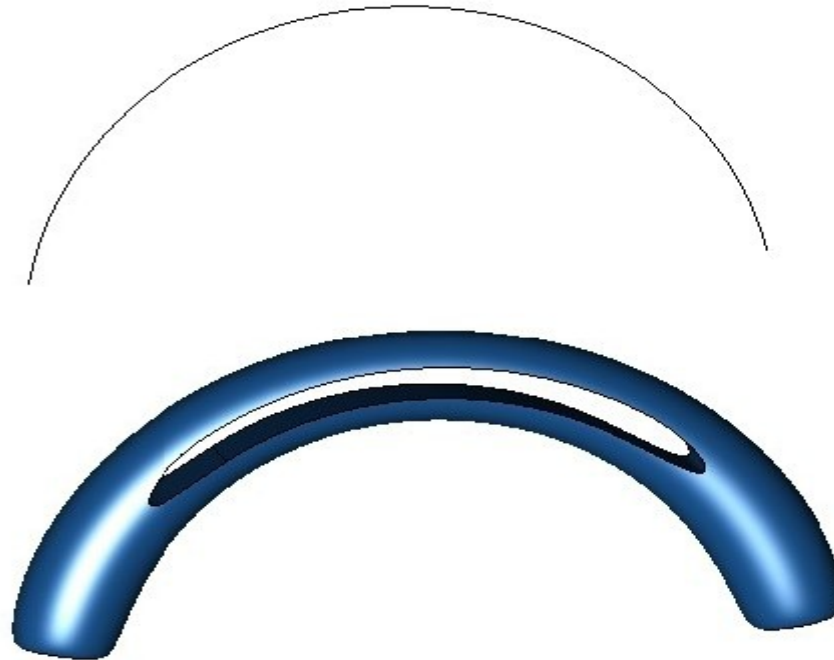
Canvas3D

Operação Global: *Bend or Shear* (3D Canvas)



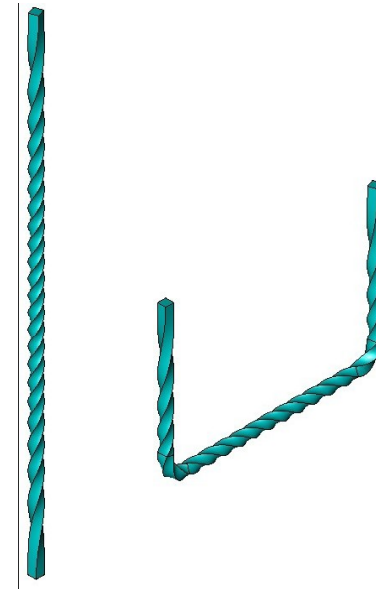
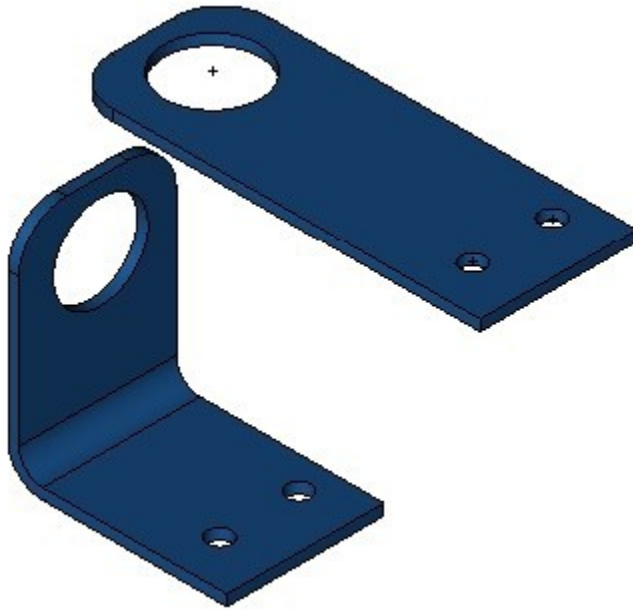
Operação Global:

Warping: Bend Along Curve



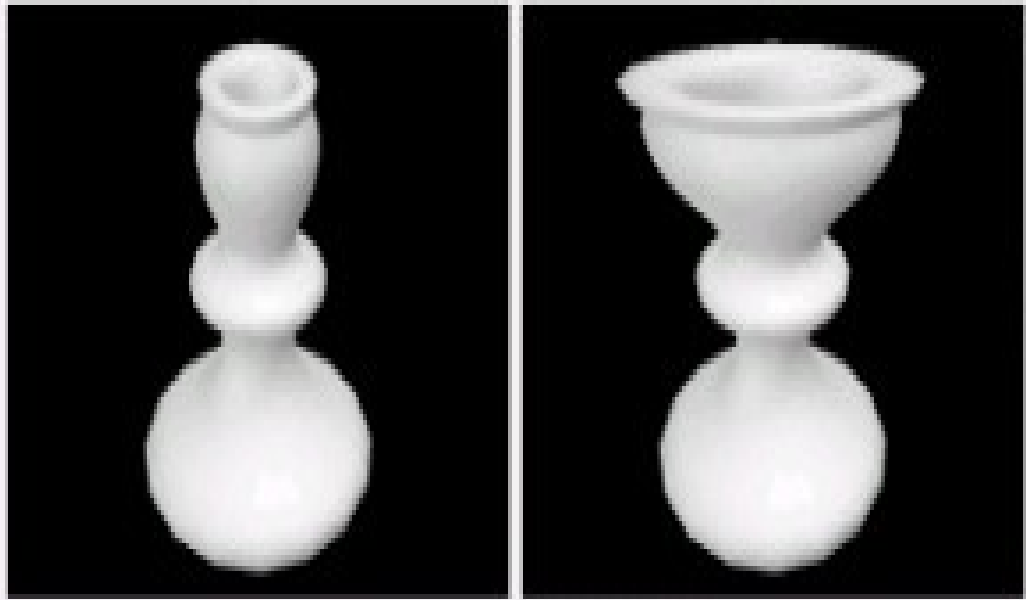
Operação Global:

Warping: Bend Axis

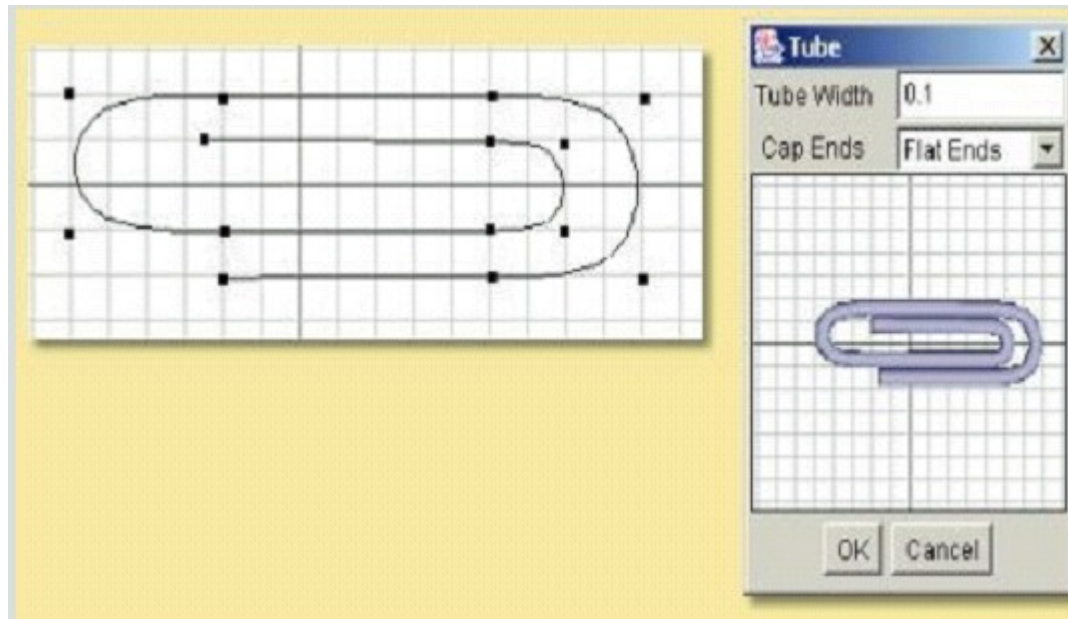


Operação Global: *Taper* (Canvas 3D)

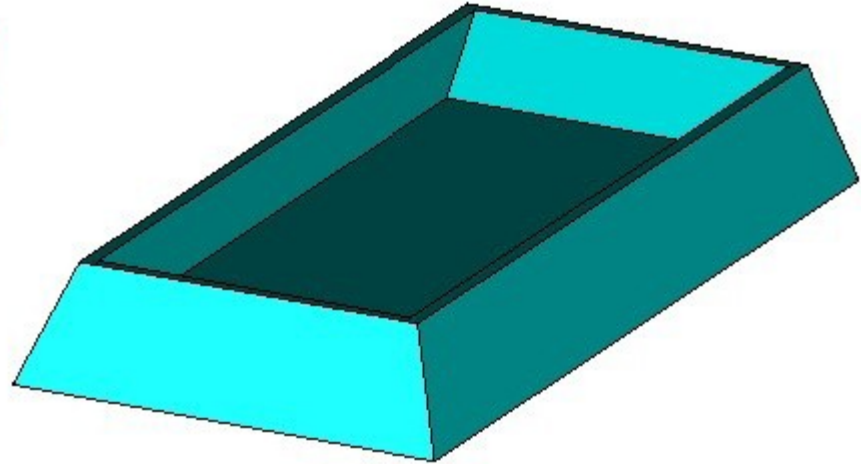
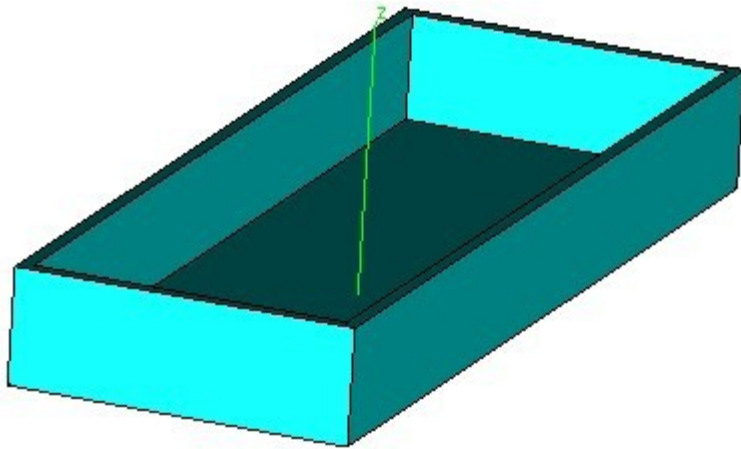
Taper Operation



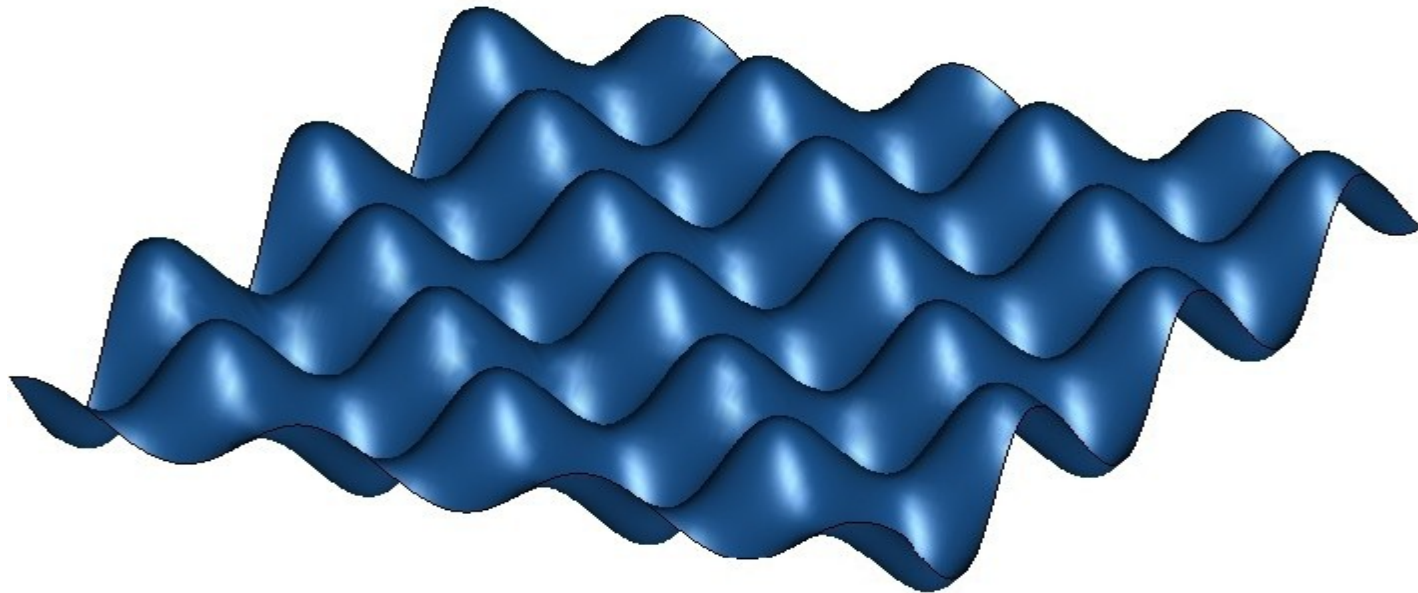
Operação Global: *Tube* (Art of Illusion)



Operação Global: *Taper*



Operação Global: Warp Law
 $\text{vec}(u, -30+v, 2\sin(u)*\cos(v))$

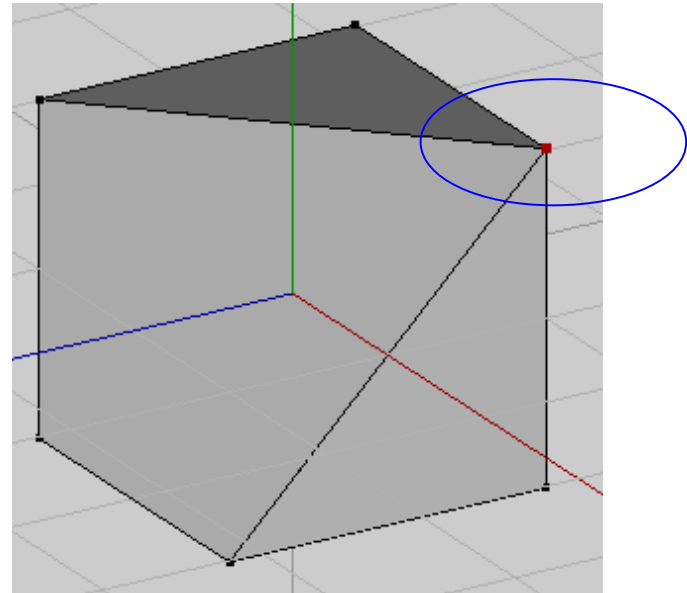
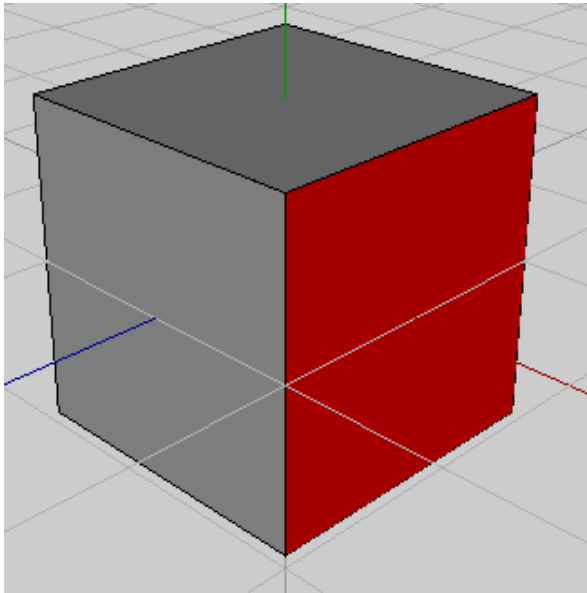


Operações Locais

Nível de **Ponto**/Vértice ou **Aresta**

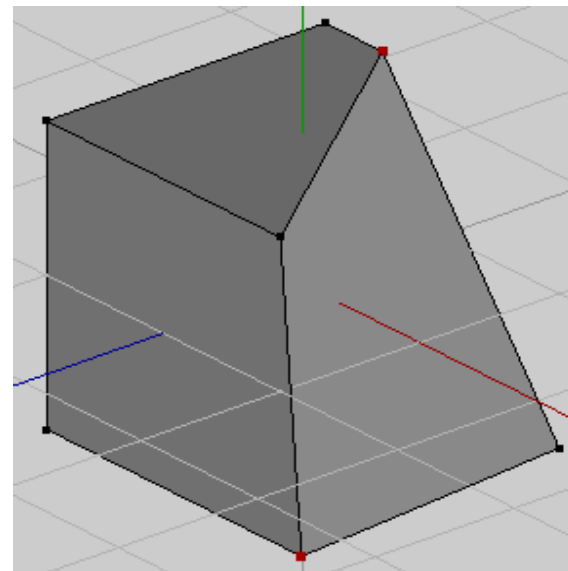
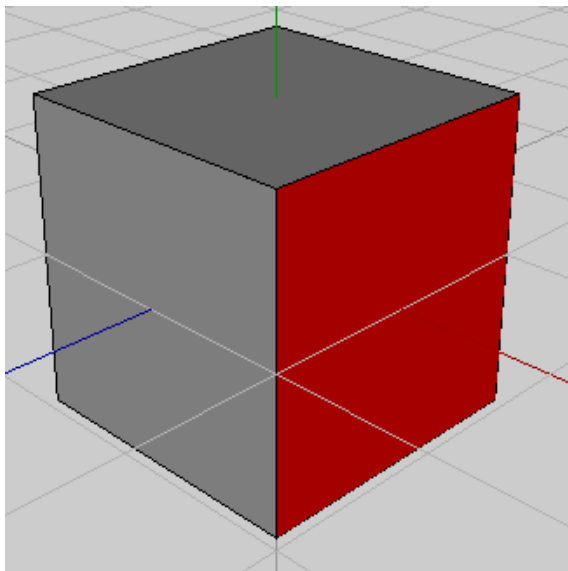
Une Ponto, Move Ponto,
Arredonda/Corta Aresta

Operação Local: *Weld* (Wings3D)

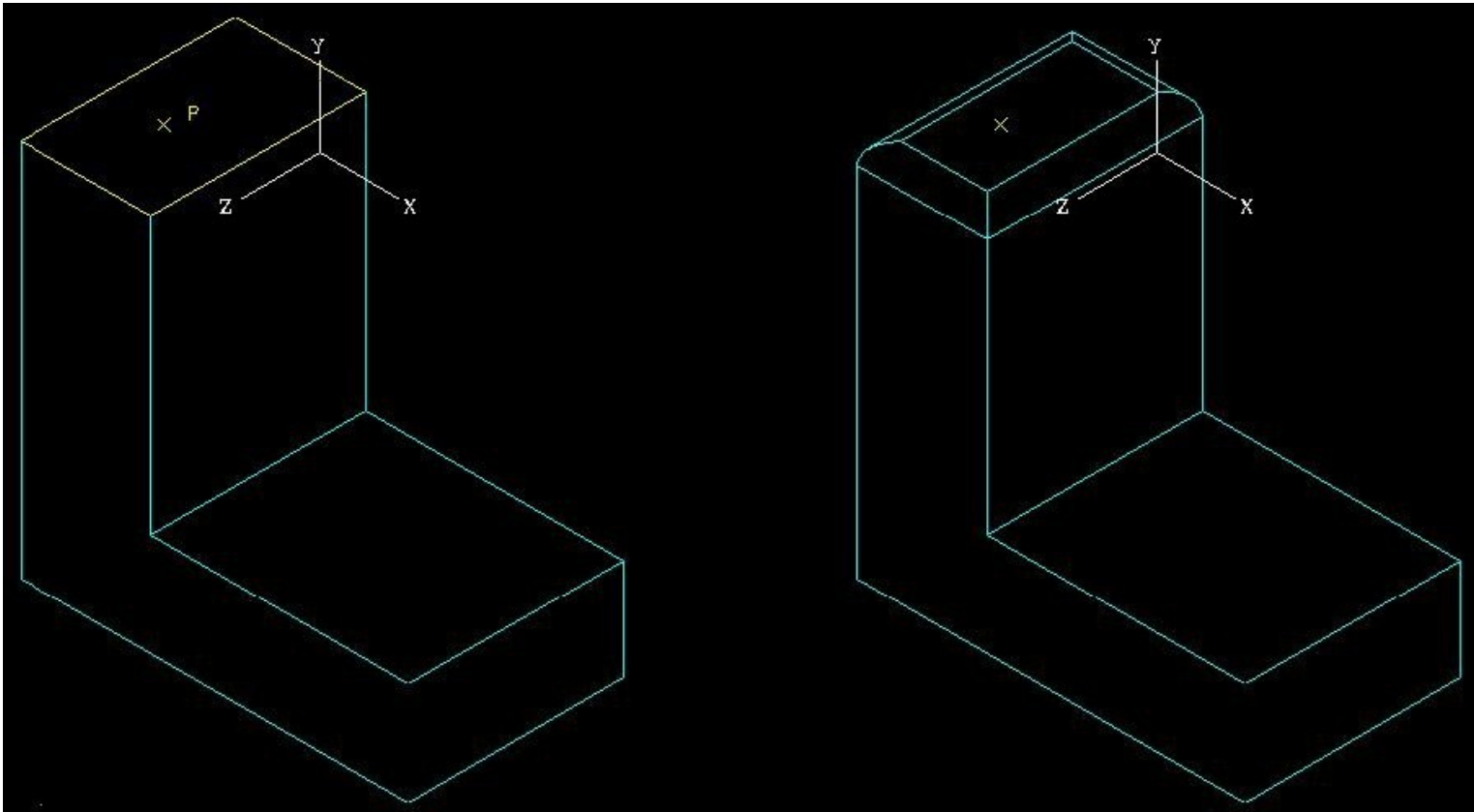


Wings 3D

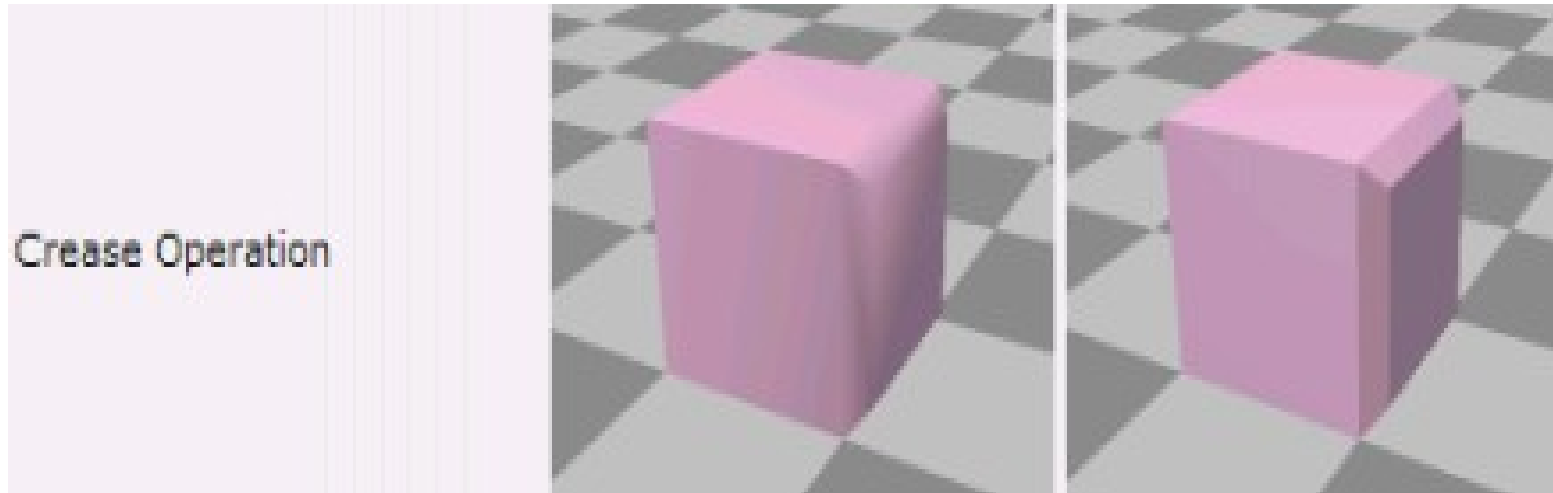
Operação Local: *Deform Crumple (Wings 3D)*



Operação Local: *Fillet*

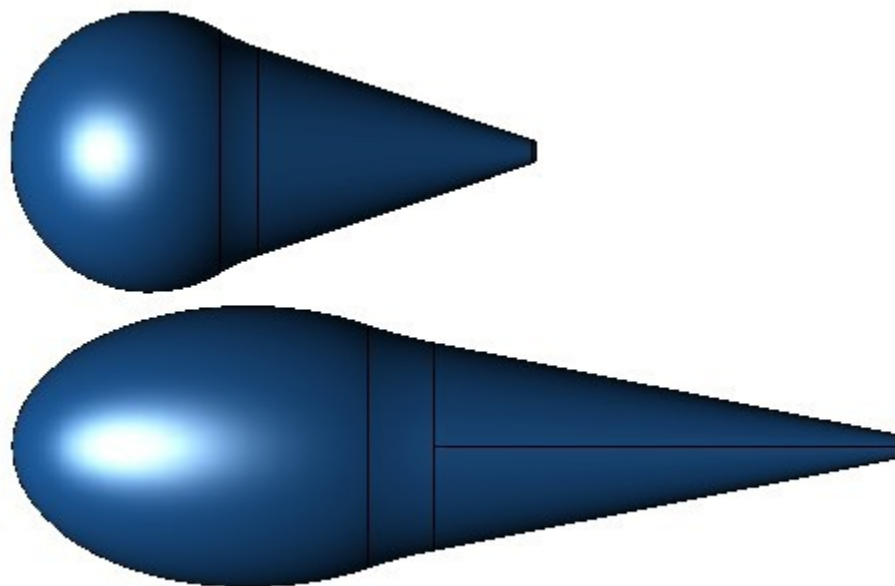


Operação Local: *Crease* (Canvas 3D)

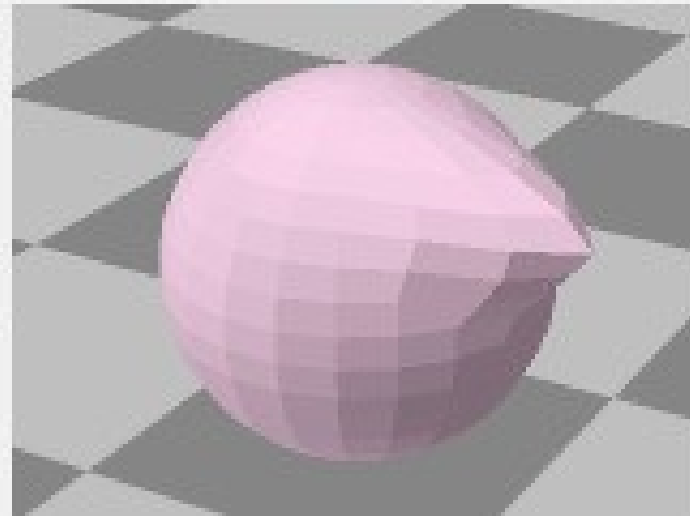
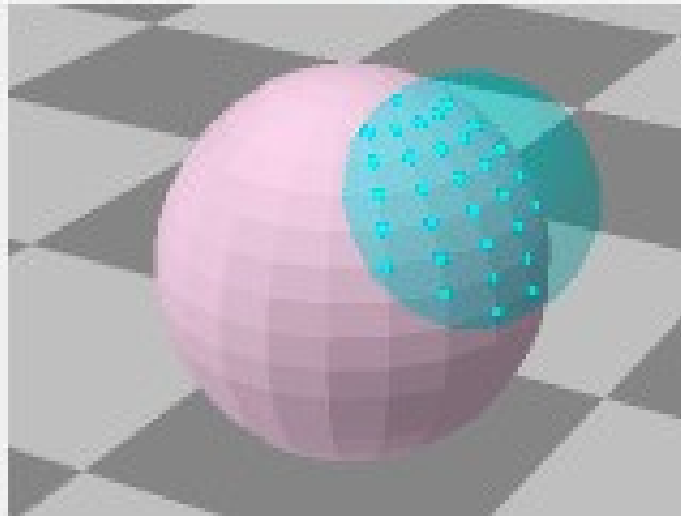


Operação Local:

Warping: Stretch



Operação Local: Deformação (3D Canvas)



Operações Locais

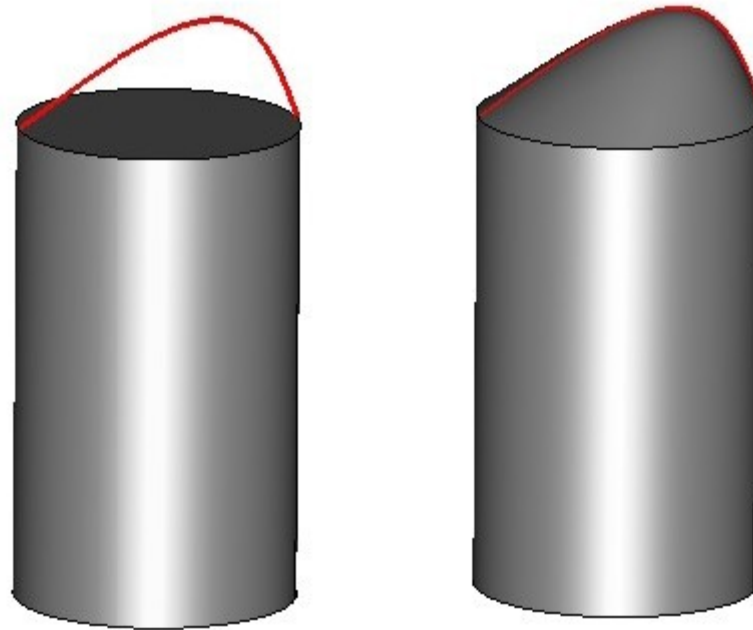
Nível de **Face/Superfície**

Deforma Face, Suaviza Face, Estica,
Alinha Faces, Afunda por Pressão,
Estende Face

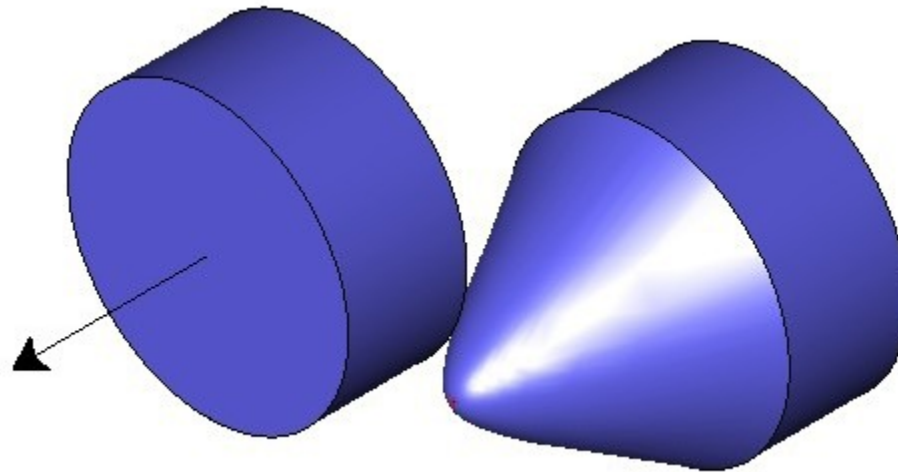


Deform by Point/Curve

Deforma Face

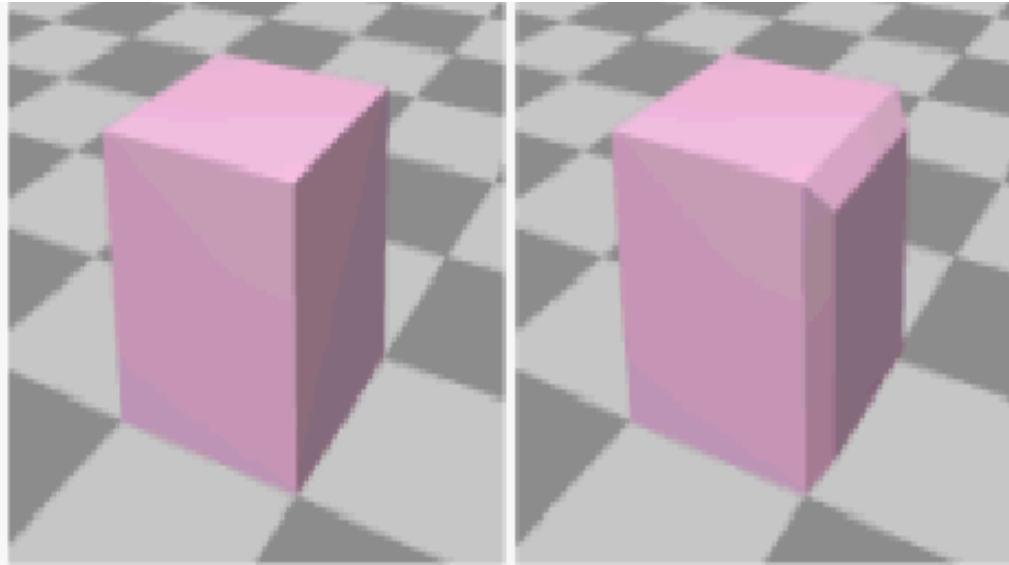


Operação Local: *Deform by Location*

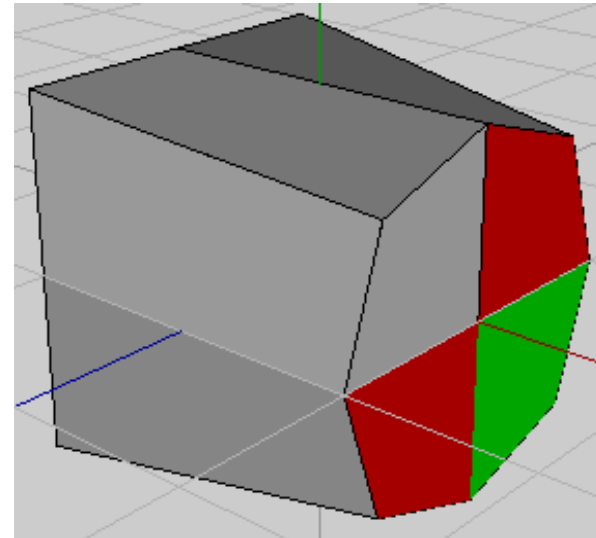
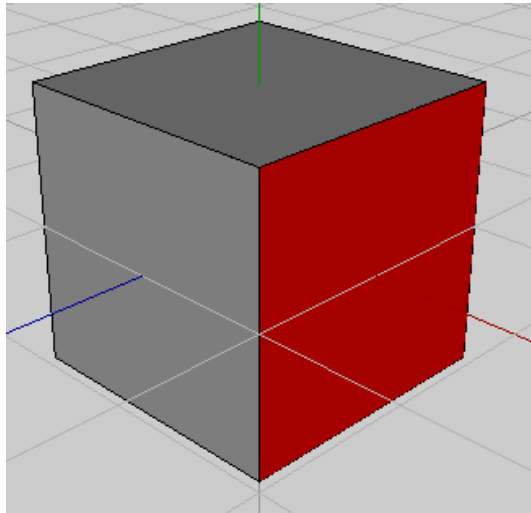


Operação Local: *Extrude* (Canvas 3D)

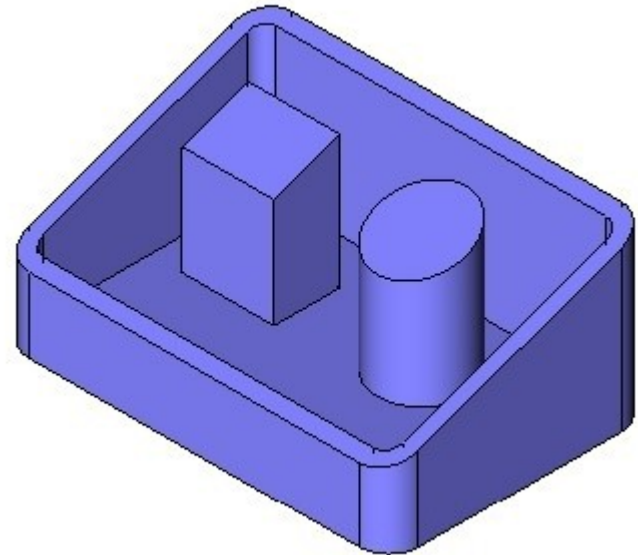
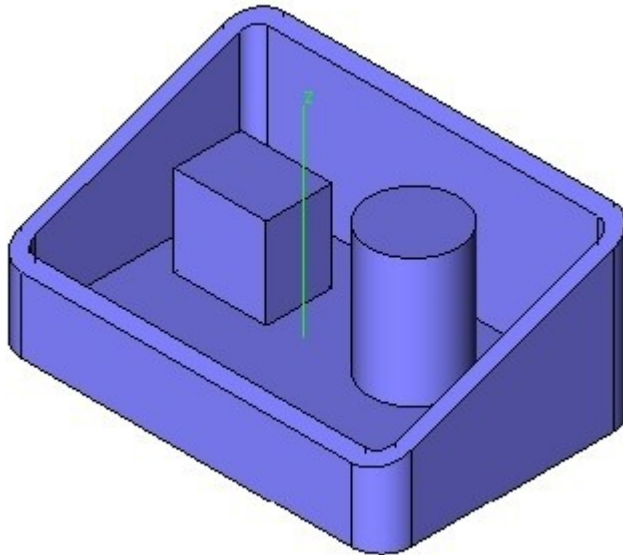
Extrude Operation



Operação Local: *Smooth* (Wings3D)

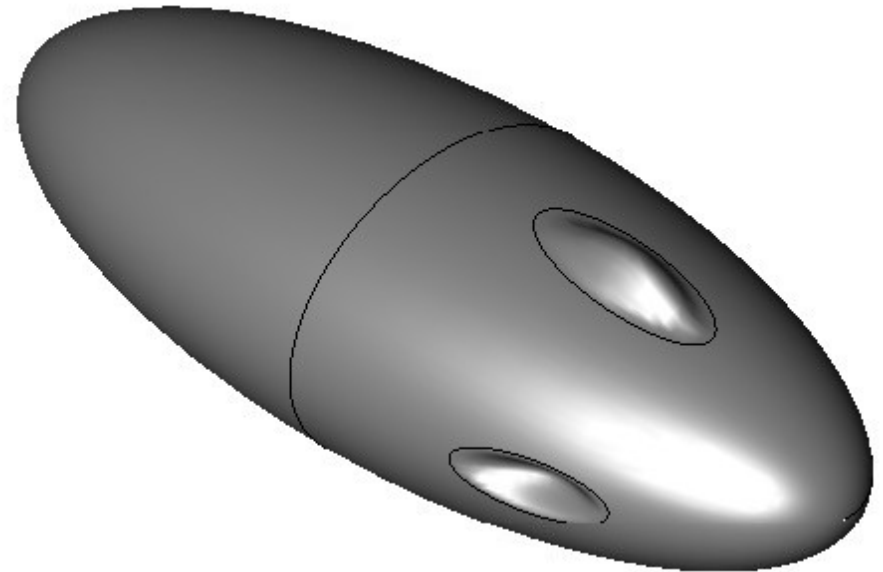
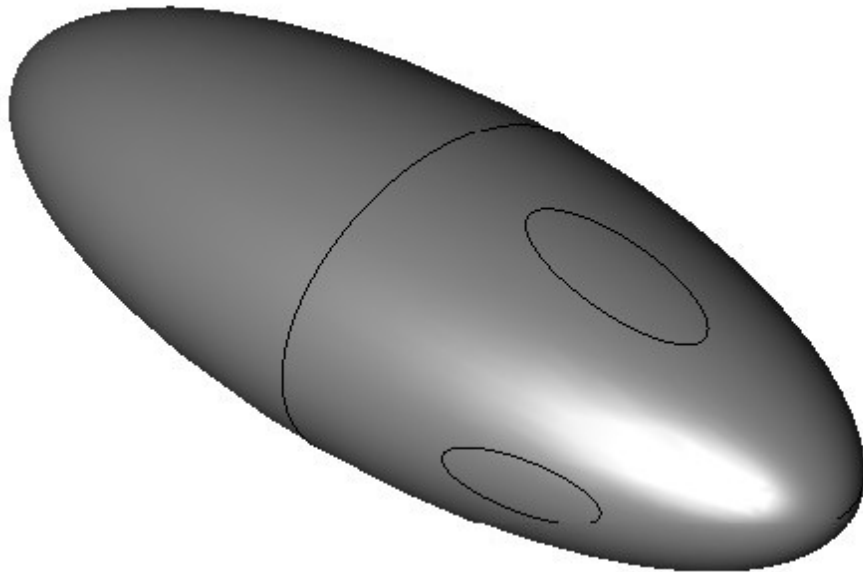


Operação Local: *Match* (Local Operation)

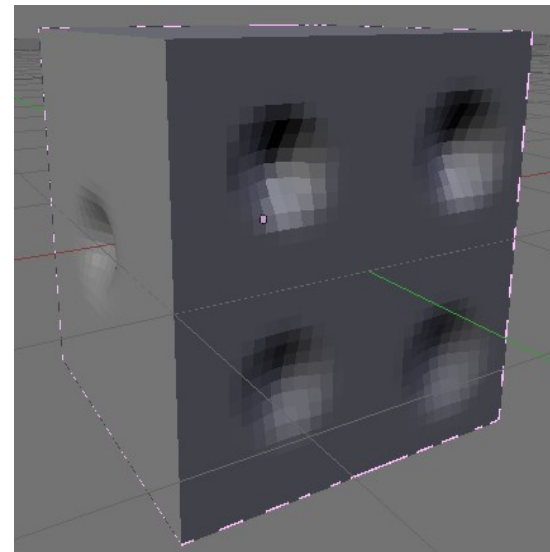
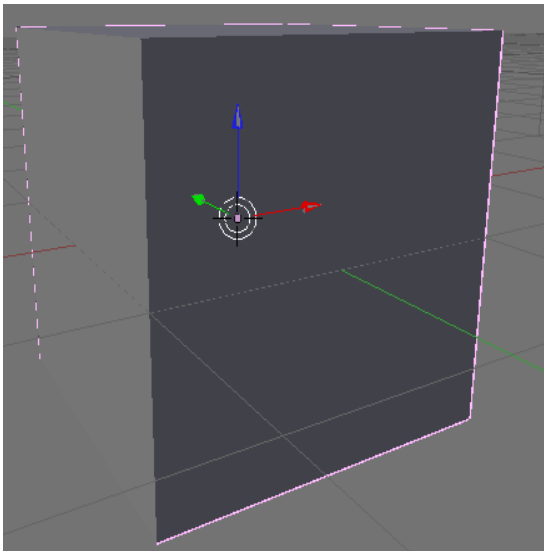


Operação Local:

Deform by Pressure

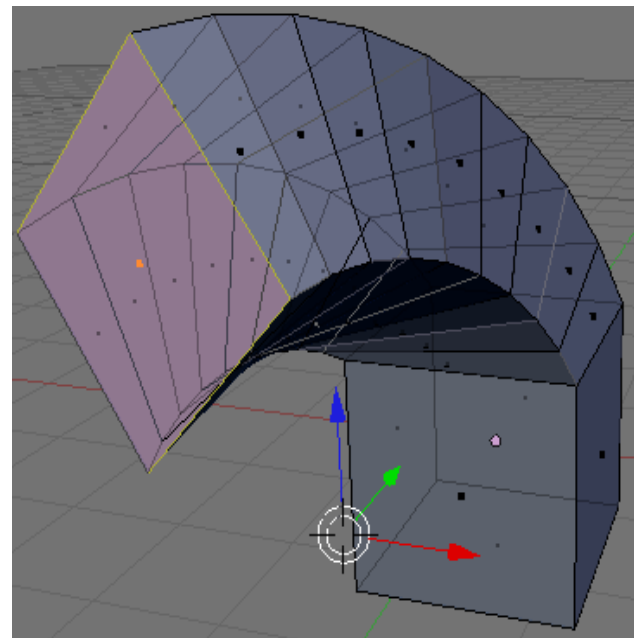
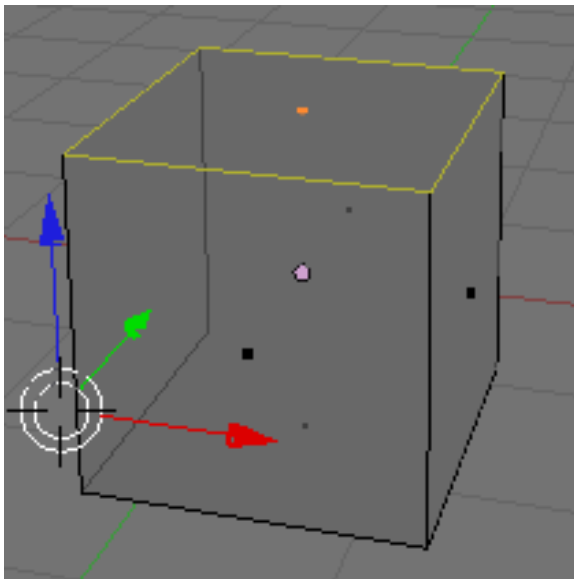


Operação Local: *Sculpt*



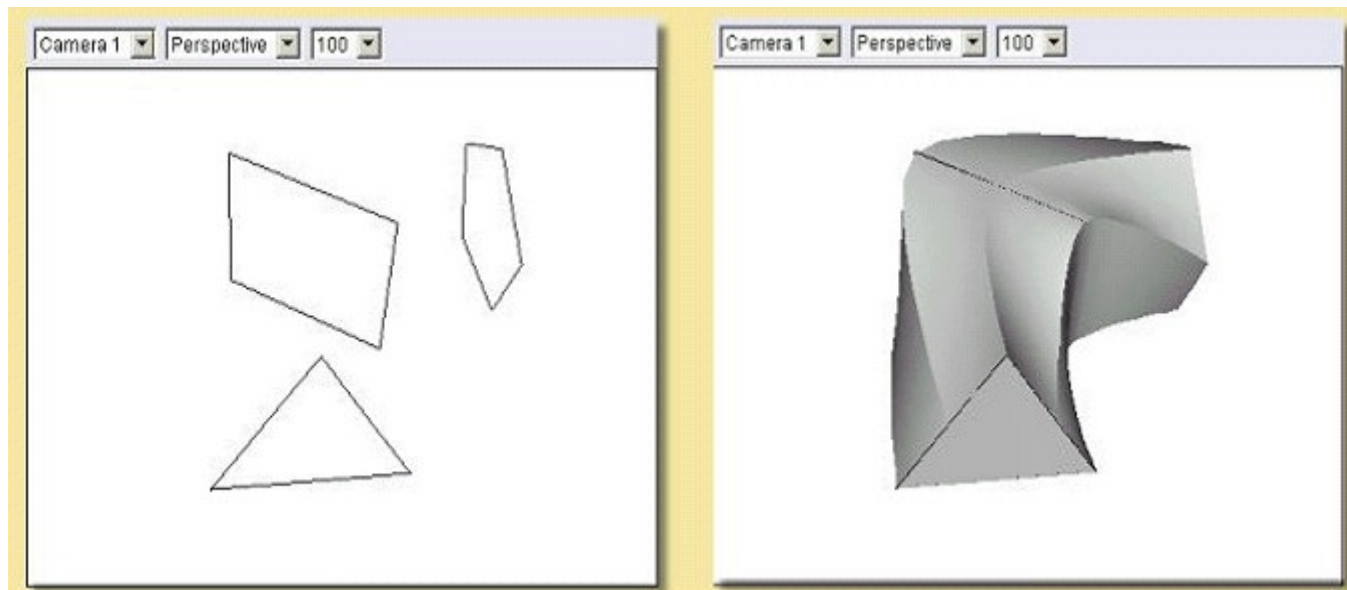
Blender

Operação Local: *Spin* (Estende a Face)



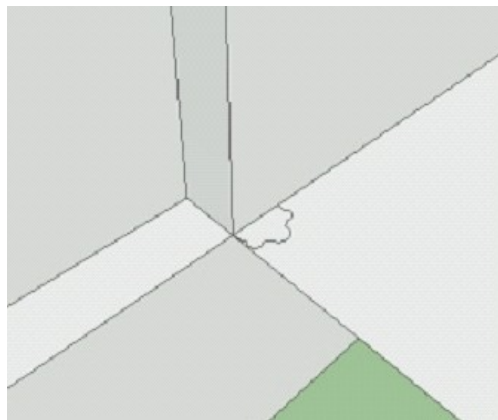
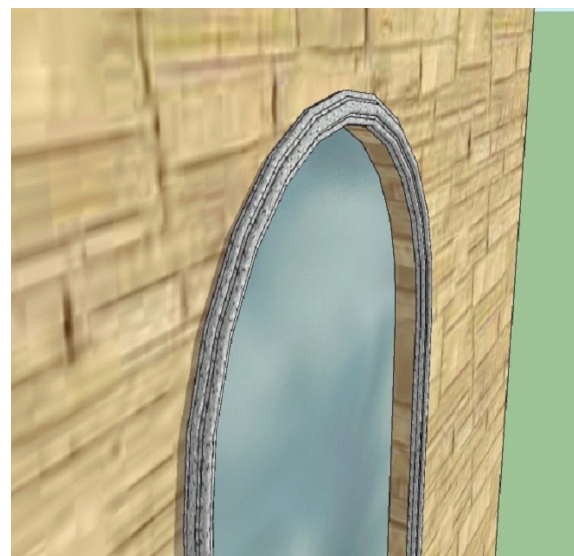
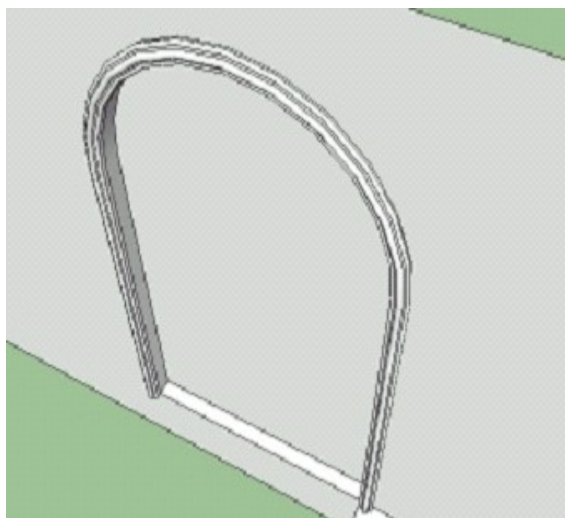
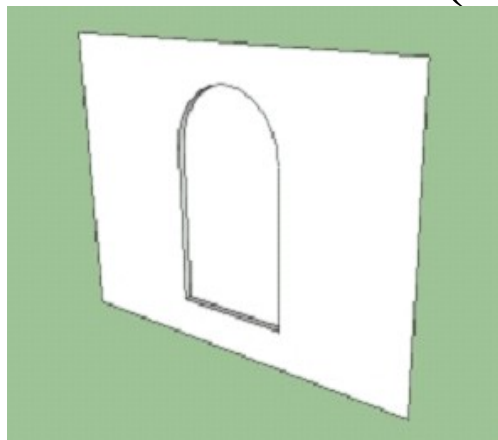
Blender

Operação Local: *Skin* (Art of Illusion)



Follow Me (SketchUp)

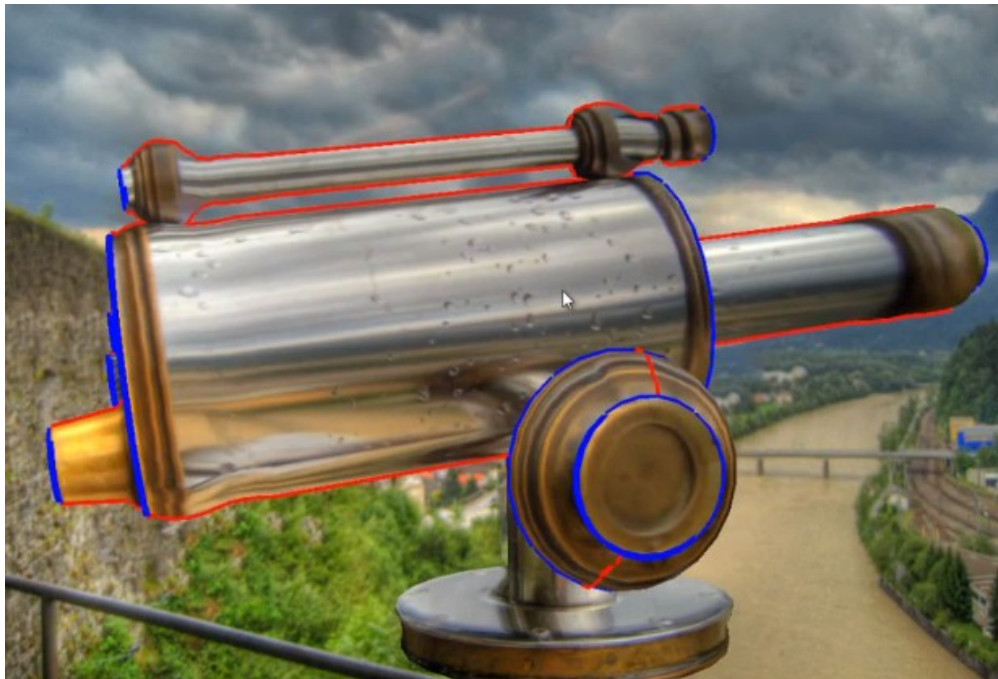
(Diretor é oriundo do modelo)



Super Sweeping

SIGGRAPH 2013

<http://petapixel.com/2013/09/09/type-3d-manipulation-software-future-photo-manipulation/>



Interface

- O objetivo destas metáforas é facilitar o trabalho de **criação** dos objetos
- Por traz de cada uma dessas metáforas de construção de objetos, existem operações de criação **convencionais** em separado ou combinadas.....