

IllustraVis 2009

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# Calligraphic Approaches to Illustration

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Viz+Intelligent MultiModal Interfaces

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Interfaces Group

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Institute for Computer and Systems  
Engineering, Lisboa

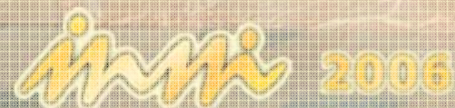


# Some Projects

- Large-Scale Displays (MAXIMUS)
- Haptics, Sound & Sketching (SATIN)
- Out-of-Core Visualization (Visir)
- Sketching + Retrieval for CAD (Eurotooling)

## PAST

- SmartSketches (2000-2004)
- Interaction Immersive VR+AR (IMPROVE)

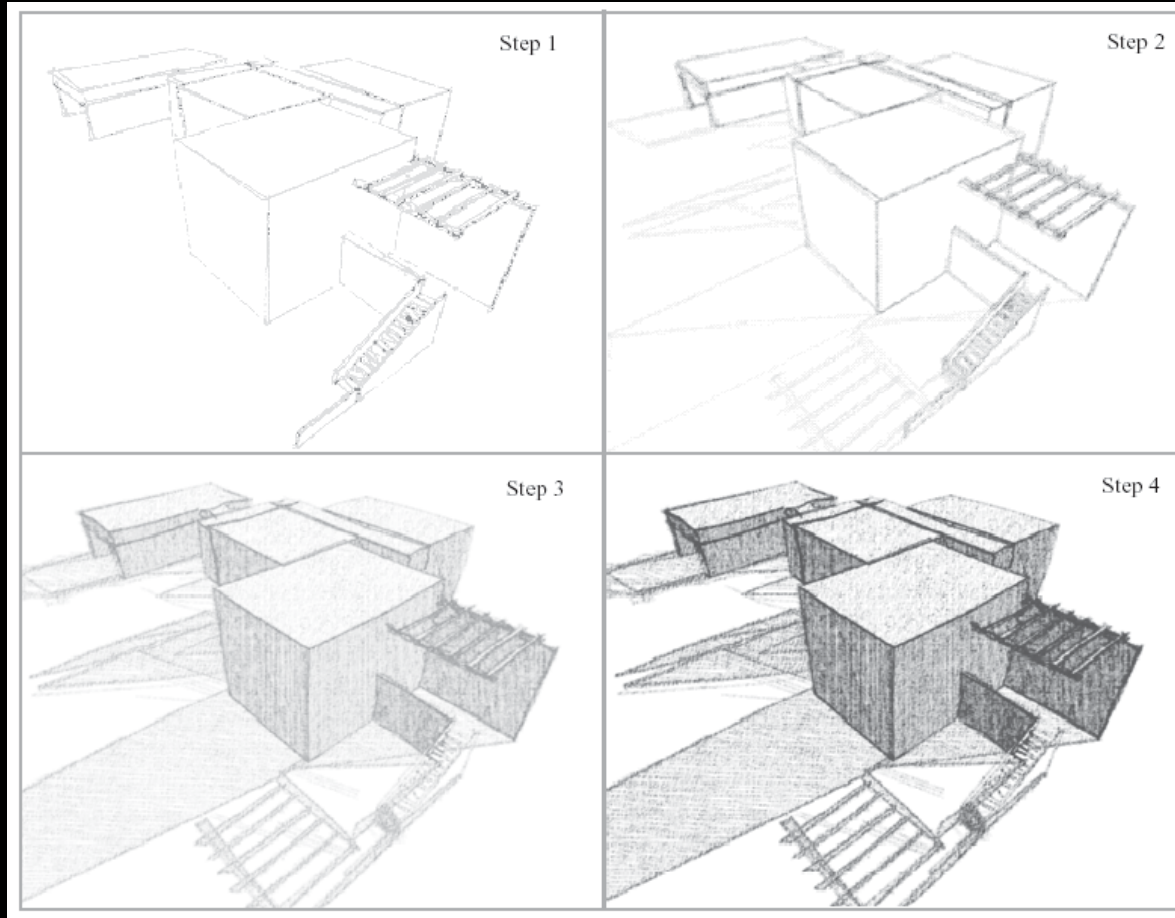




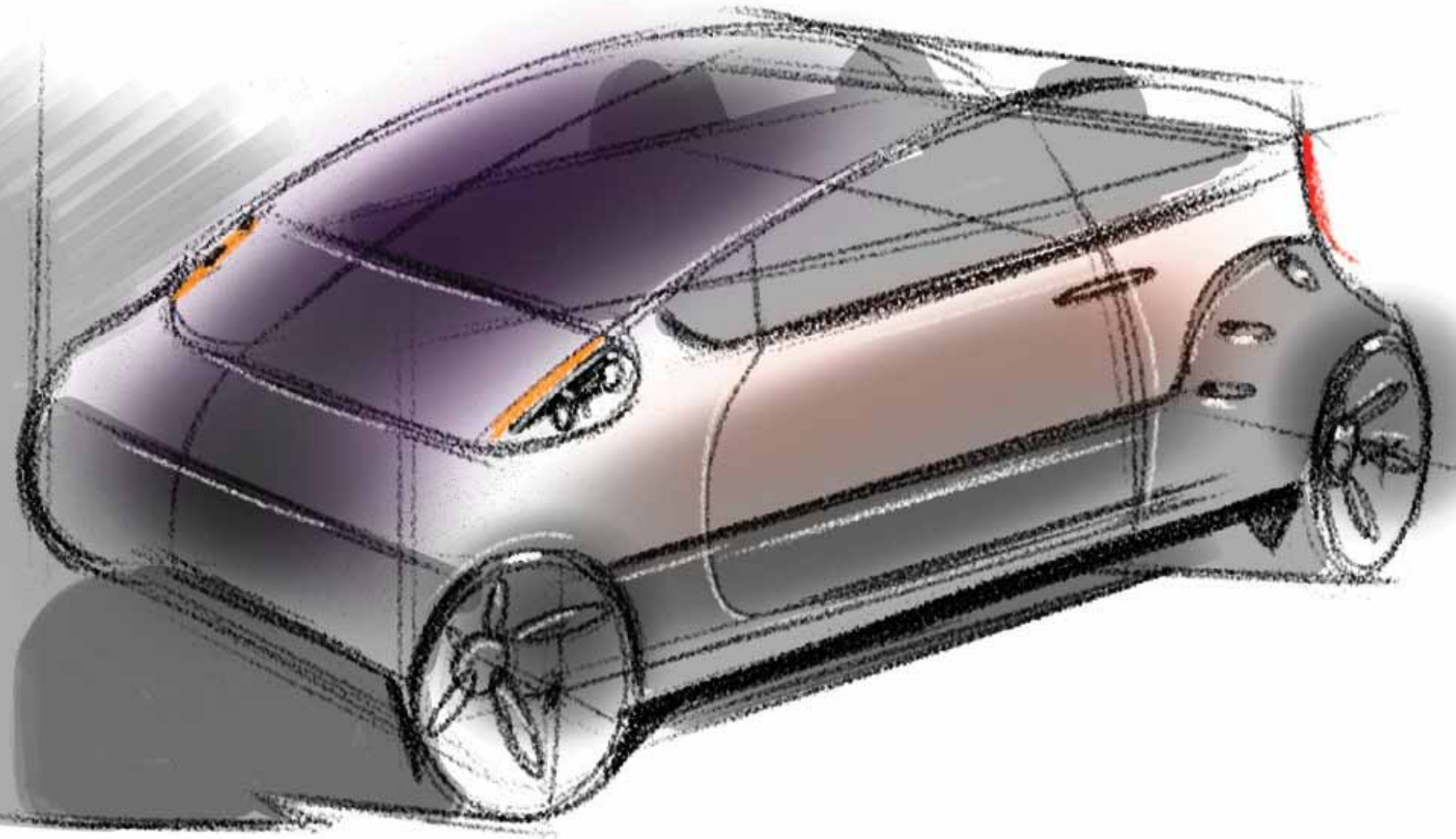
# Outline

- Calligraphic Interfaces
- Visual Languages
- Illustration
- Modeling with few strokes
- Sketching VR + AR
- Conclusions

# *Sketching early design stages*



**Sketches convey lots of information**



# ***Modeling: Disadvantages of WIMP***

- | Non-linear complexity (notice CAD) with number of commands**
- | 90/10 rule: 10% of the commands provide 90% of the functionality**
- | Increasingly complex applications => no more upgrades**
- | Expert users frustrated by too many layers of commands**

# ***M otivation***

- | **CAD Systems less usable than paper + pencil**
- | **Interactions “too structured”**
- | **Large GAPS from :**
  - | **mental model to functions available**
  - | **Articulation from user goals to system operations**
- | **W YGILTW YW**



# ***Calligraphic Interfaces***

- | **Combination Tablet + Stylus**
- | **From the greek Kalos (beautiful) + Graphein (to write or draw)**
- | **Applications organized around sketches and drawings**
- | **Explicitly address imprecision and ambiguity**
- | **Goal : make CAD systems more usable**

# *Not a new idea (See Sketchpad)*

## | Ivan Sutherland's Sketchpad (1963)



# ***Some Related Work***

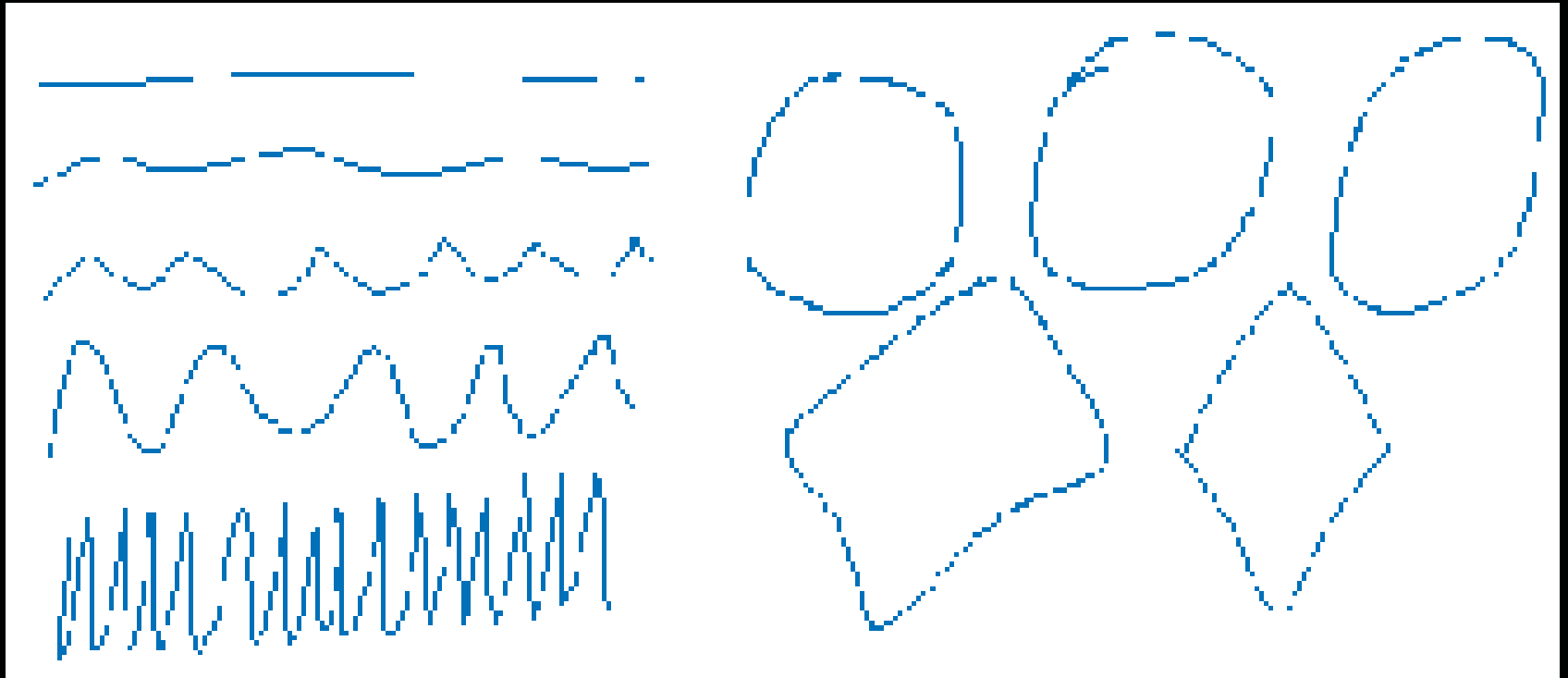
- | **Sketch (Zelevnik, 96) – mouse based**
- | **Cocktail Napkin (Gross + Do, 95-97)**
- | **Jim Landay (SILK+ DENIM, 97)**
- | **Sketch'N Make (Bloomenthal et al, 98)**
- | **Igarashi's Teddy system (99)**
- | **Virtual Table (Bimber et al 2000)**
- | **Randall Davis Mech Assist. (MIT'02)**

# *Paper and Pencil metaphor*

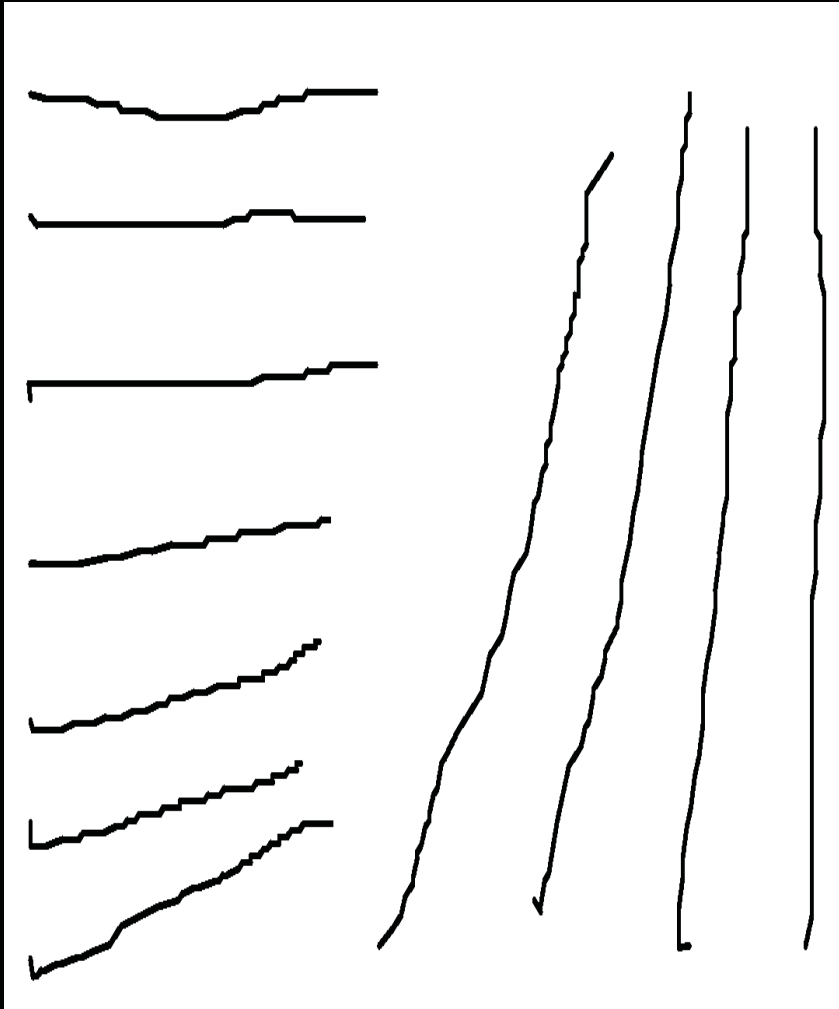
- | **Copy workflow from draftspeople, animators, artists**
- | **Use construction lines**
- | **Reduce command set**



# *Ambiguous shapes*

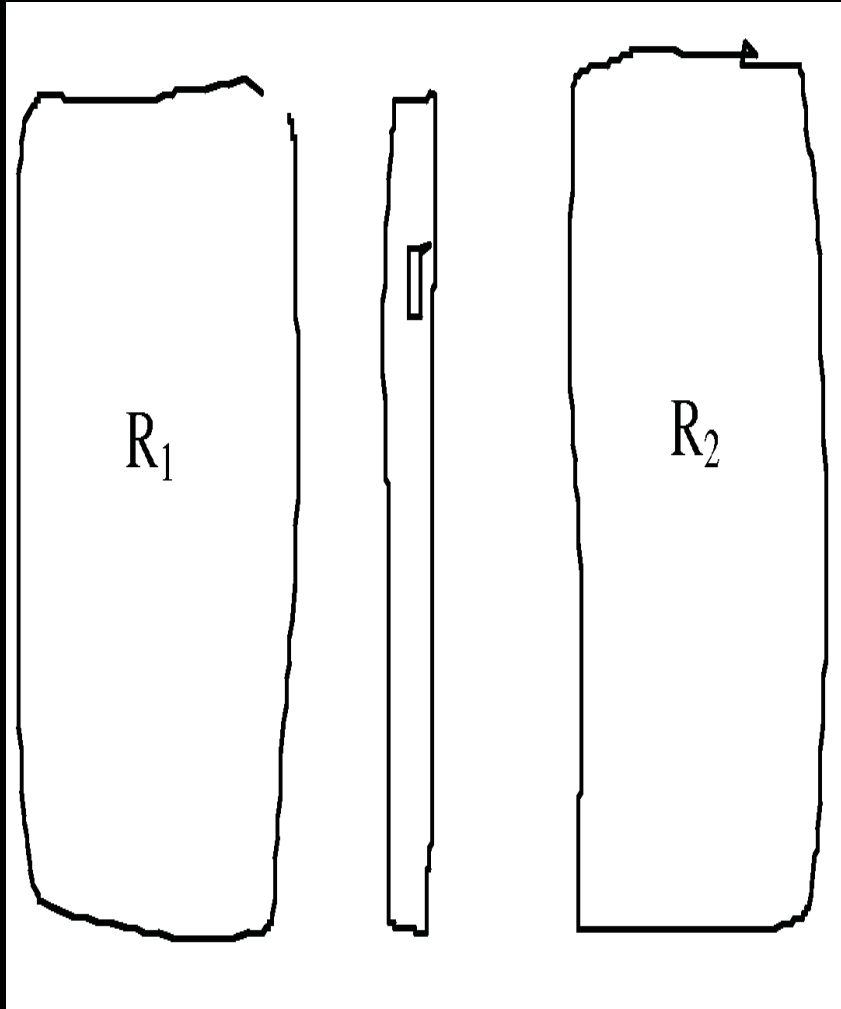


# Sketched lines can be ambiguous



- | Which are strictly
- | horizontal
- | and
- | strictly
- | vertical ?
- | In between ?

# Ambiguous Spatial Relations



- | Which window to associate scrollbar to?
- | Usually leftmost
- | what if our language also accepts rightmost ?

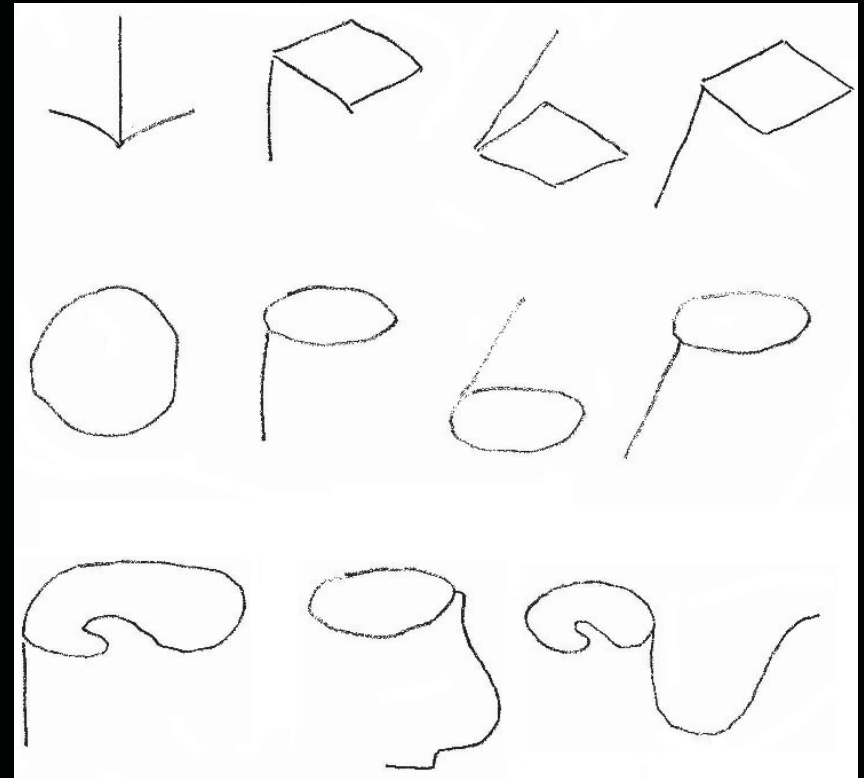
# ***How to Reduce Command Set ?***

- | **Use gesture recognizer**
- | **Gestures create geometry (3D shapes)**
- | **2D Shapes recognized + projected against background planes**
- | ***or other objects***
- | ***Context provides meaning***
- | ***When in doubt, ask the user***

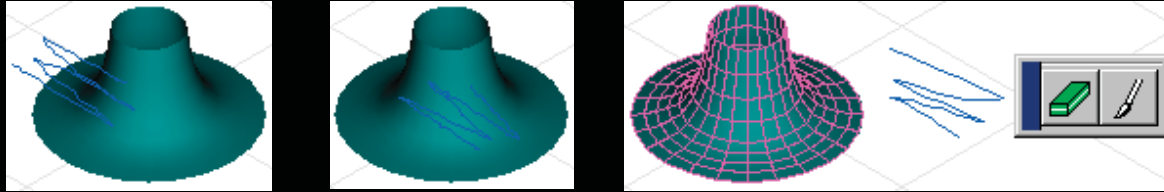


# ***RISC Interfaces : GiDES***

- | **Iconic Input**
- | **Primitive creation similar to Sketch (Zelevnik, Bimber)**
- | **Simple solids, surfaces, ducts**
- | **Contributions:**
  - | **Context**
  - | **Ambiguity**
  - | **Incremental construction**

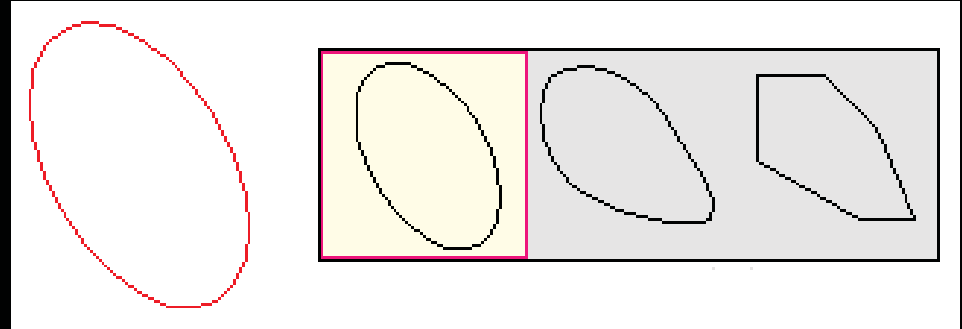
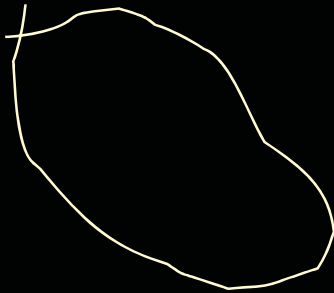


# RISC Interfaces. Context



- | **Ambiguity == Operator overloading**
- | **Three different meanings for the same input:**
- | **Crosses border == Delete shape**
- | **Inside == Texture / Color**
- | **Outside == Ambiguous: Expectation List**

# *Expectation lists: User control*



- | **Different (Ambiguous) Interpretations for Same Input**
- | **Default is “most likely”**
  - | Geometrical shape Ellipse
  - | Spline
  - | Filtered Polyline
- | **Cycle interpretations**
- | **Intelligent / Adaptive Behavior**

# 3D Expectation lists

Handle perceptual ambiguity too

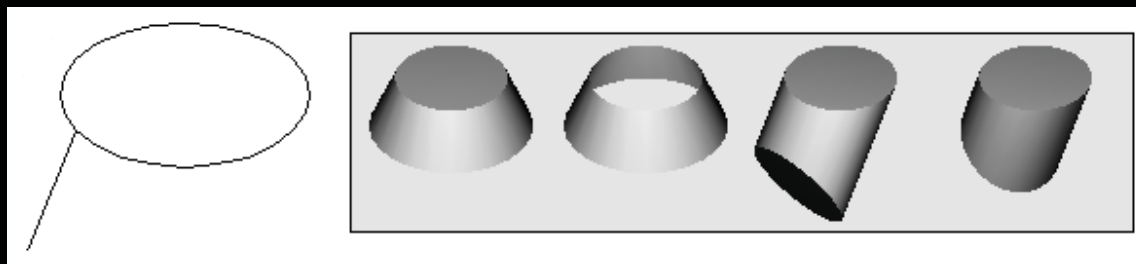
Also work for constructors:

Solid (Cone Trunk)

Hollow (Surface)

Perspective “cylinder”

(two possible interpretations - Necker)





# Sketch-Based Modeling

GiDES++  
ShapeShop

# ***Gides++***

- | **See demo VIDEO**
- | **Expectation Lists**
- | **2D+3D Recognition**
- | **NPR**
- | **Constraints**
- | **Editable Holes**
- | **Integration with SBR**

# ***ShapeShop: Sketch-Based Solid Modeling with BlobTrees***

***SBM 05 + SG05 Sketch***

**Ryan Schmidt**

**Brian Wyvill**

**Mario Costa Sousa**

# ShapeShop

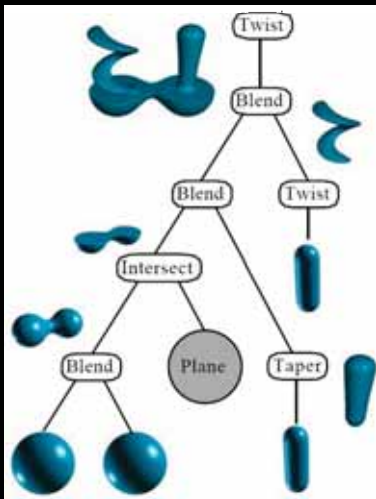
- | Build on ideas from SKETCH [Zelevnik et al 96], Teddy [Igarashi et al 99], GiDES++ [Jorge et al 03]
- | Use Hierarchical Implicit Volume Modeling (BlobTrees [Wyvill et al 99]) as underlying shape representation



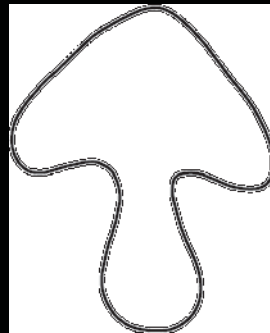


# ShapeShop

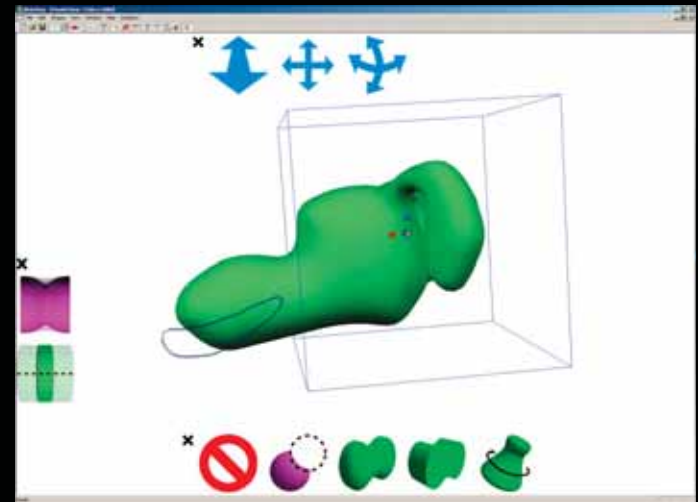
- | ShapeShop is a tool for creating BlobTree models using sketches



+



=



BlobTree

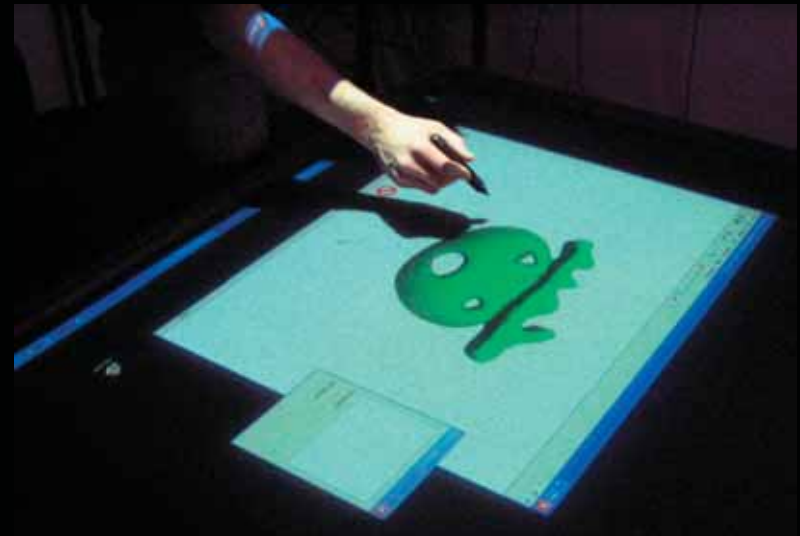
Sketching

ShapeShop

# Interaction Design

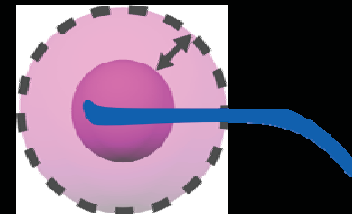
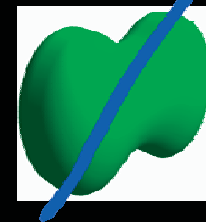


- | **Sketching interface is Non-Modal**
  - | **No Mouse Buttons or Keyboards**
- | **Pencils have no buttons**
- | **Large display input systems are often non-modal (SmartBoard, etc)**



# Non-Modal Widgets

- | Pure gesture interface is challenging
  - | Complex gestures, sketch/gesture collision
- | Adapt ideas from CrossY [Apitz et al, UIST 04]
- | Crossing for button selection
- | Capture-Drag for changing continuous values



*Interface Demo*

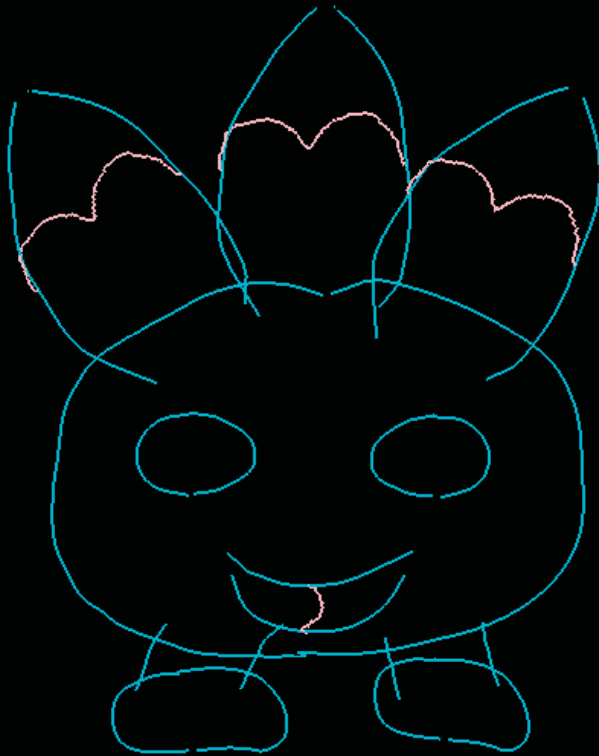
videos

***A Few Good Strokes:  
Sketch-Based Modeling  
Parametric Surfaces***

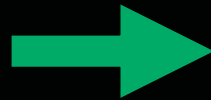
**Joseph Charlin  
Mario C Sousa  
Faramarz Samavati  
Joaquim Jorge**

# Sketch-Based Modeling

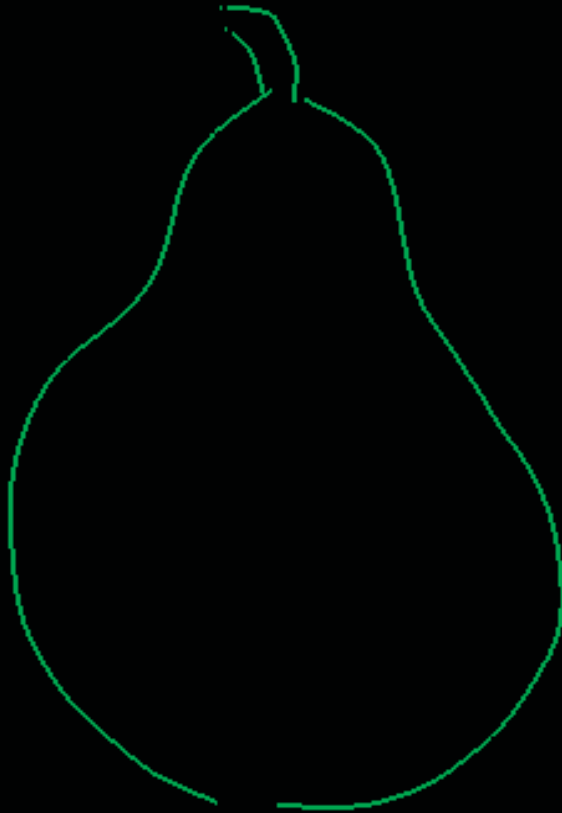
- Uses 2D operations to define 3D shapes



**2D Sketch Input**



**3D Model**



**2D**  
**Strokes**



**3D**  
**Model**



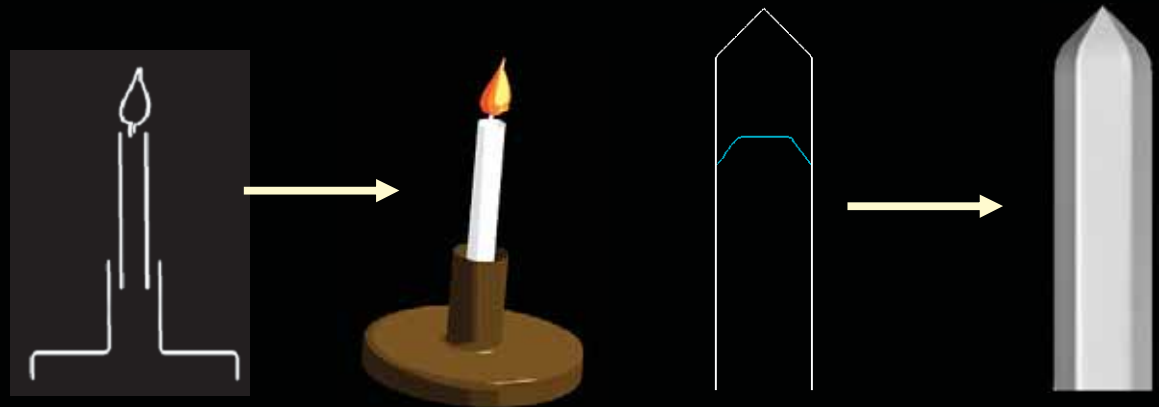
# VIDEO

# Contributions

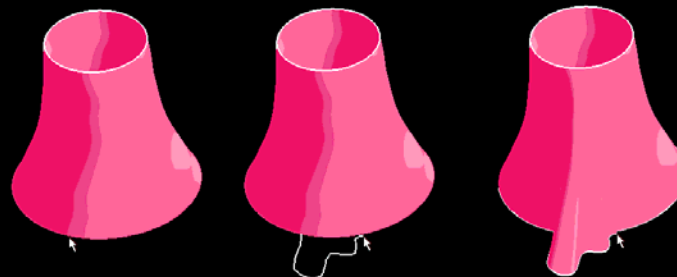
- Stroke Capture:
- new method for parametric surfaces


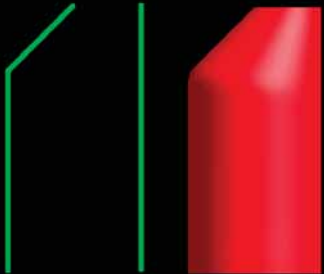
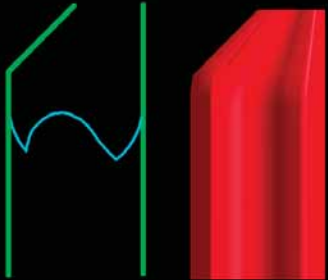
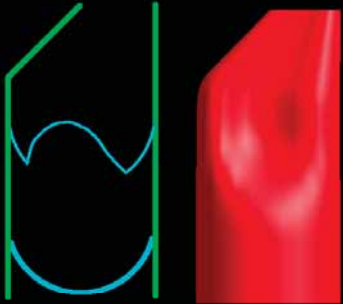


- Creation Phase:
- two new surfaces
- B-Spline modeling

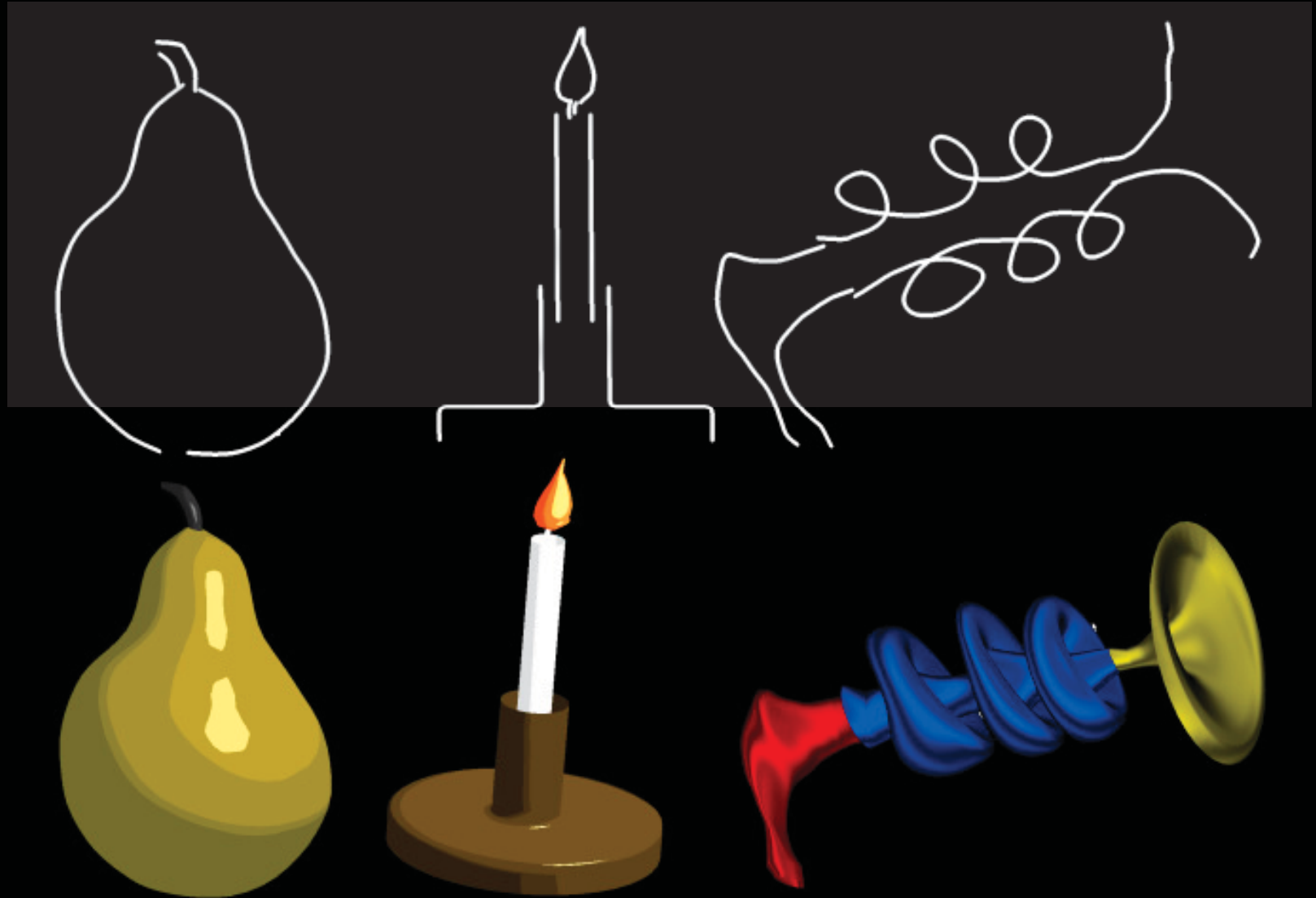


- Editing Phase:
- two new operations

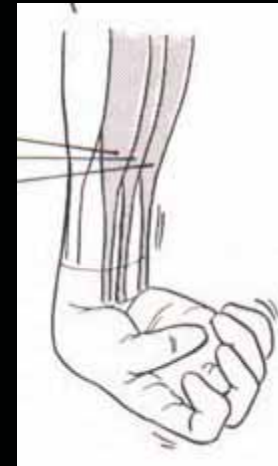


1 stroke	2 strokes	3 strokes	4+ strokes
			
<p><b>Tube Surface</b></p>	<p><b>Rotational Blending Surface</b></p>	<p><b>Cross-Sectional Blending Surface</b></p>	<p><b>B-Spline Patch</b></p>

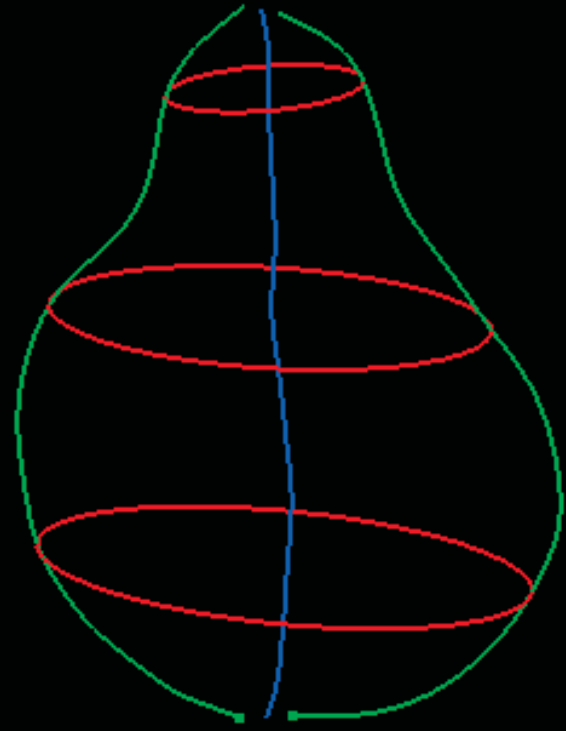
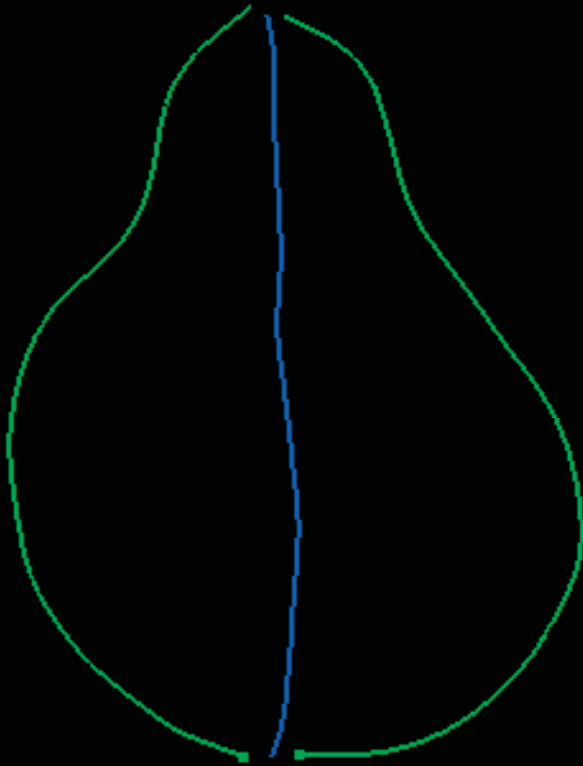
# Rotational Blending Surface



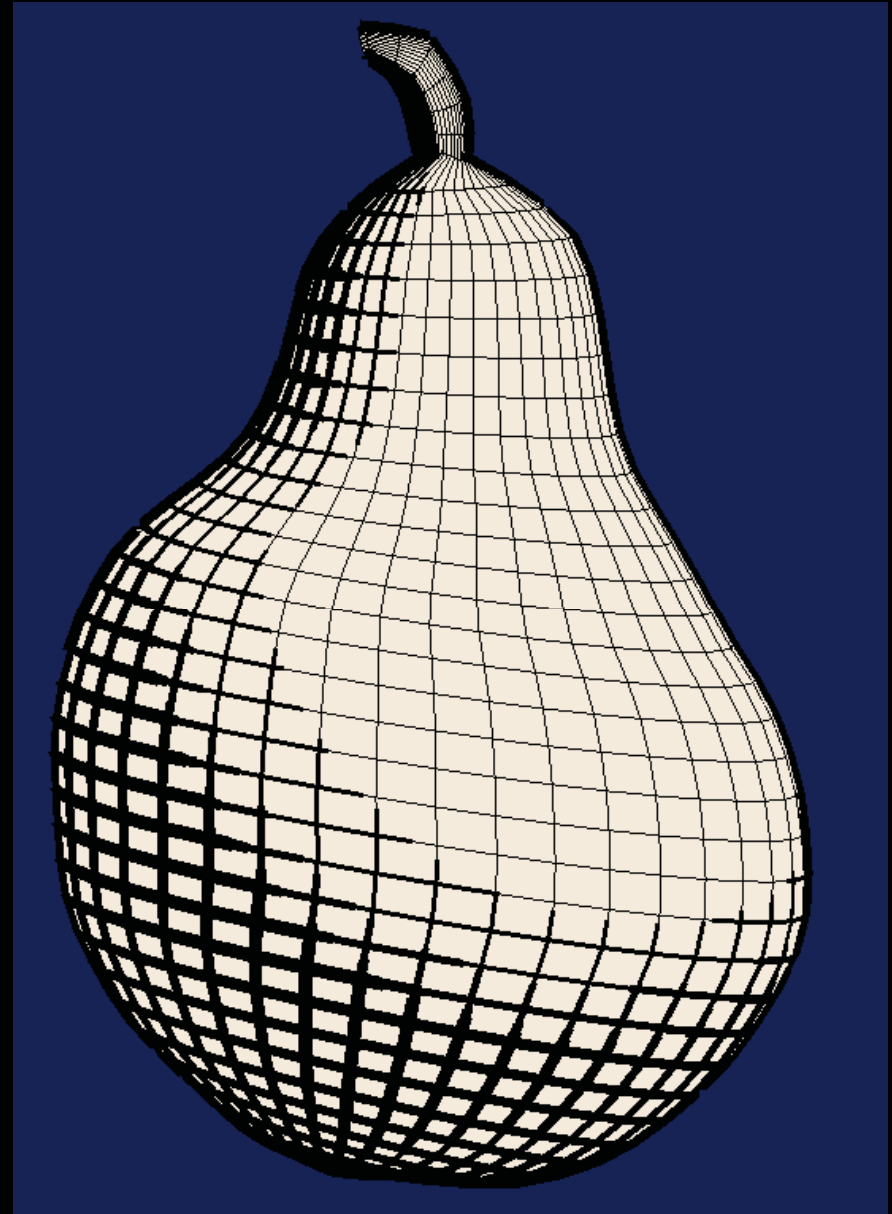
# Default Interpretation: Round



# *Similar to inflation*

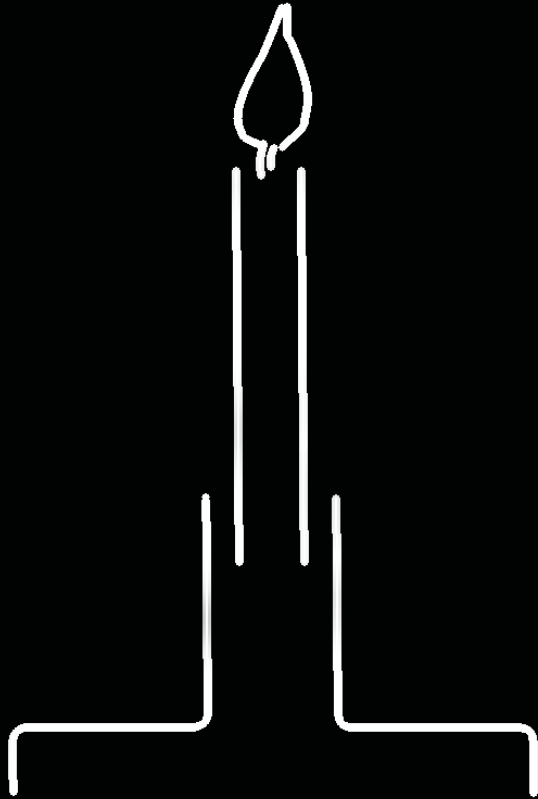


- Each pair of strokes creates a **Rotational Blending Surface**





# *Sharp Features possible*



# *Cross Sectional Blending: Motivation*



pretty good

# *Cross Sectional Blending: Motivation*

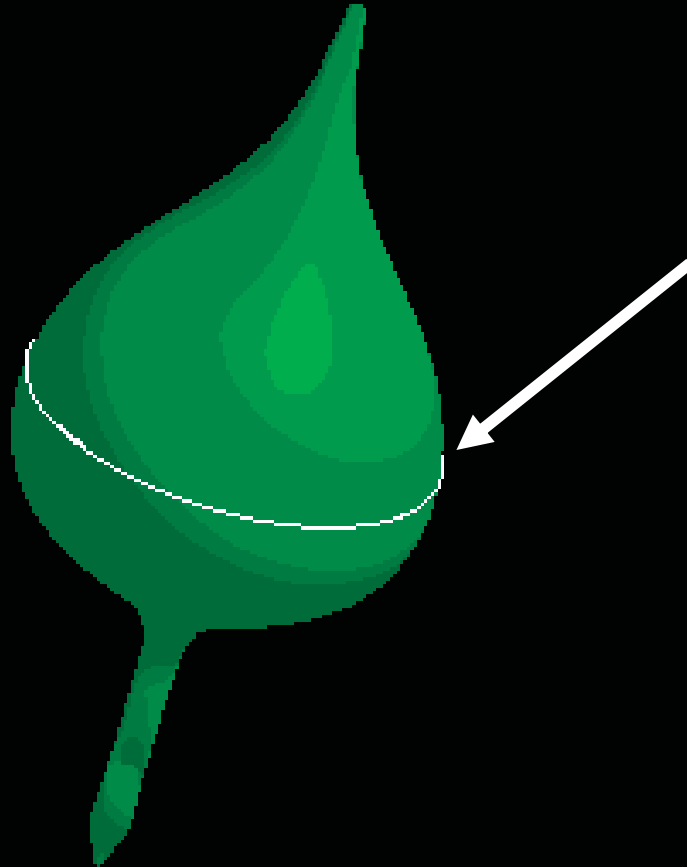


pretty good

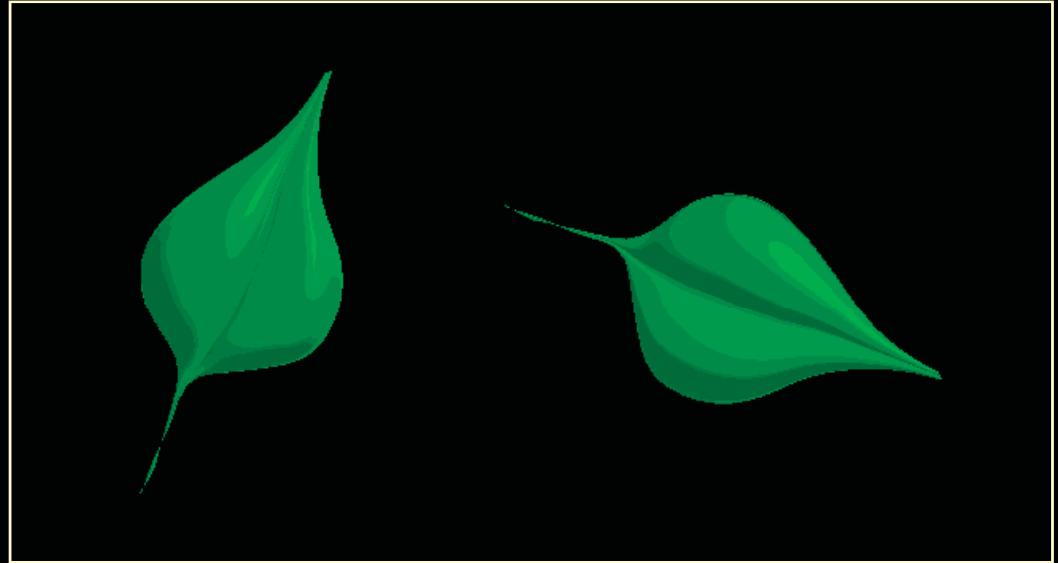
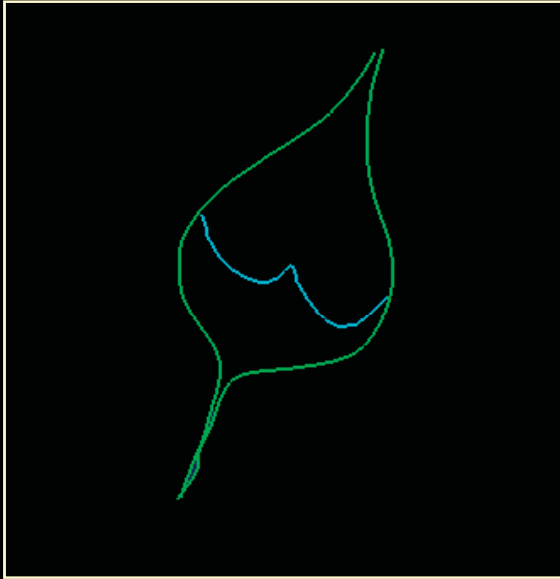


doesn't look like a leaf

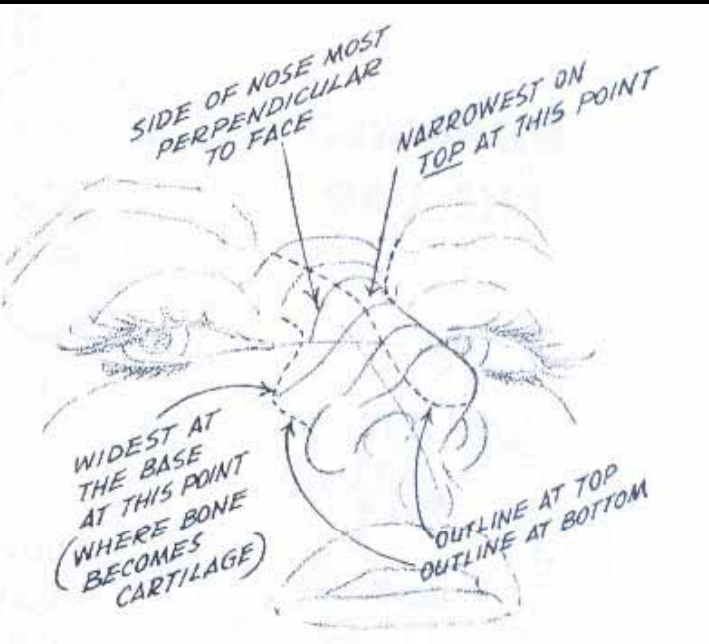
# *Why doesn't it look like a leaf?*



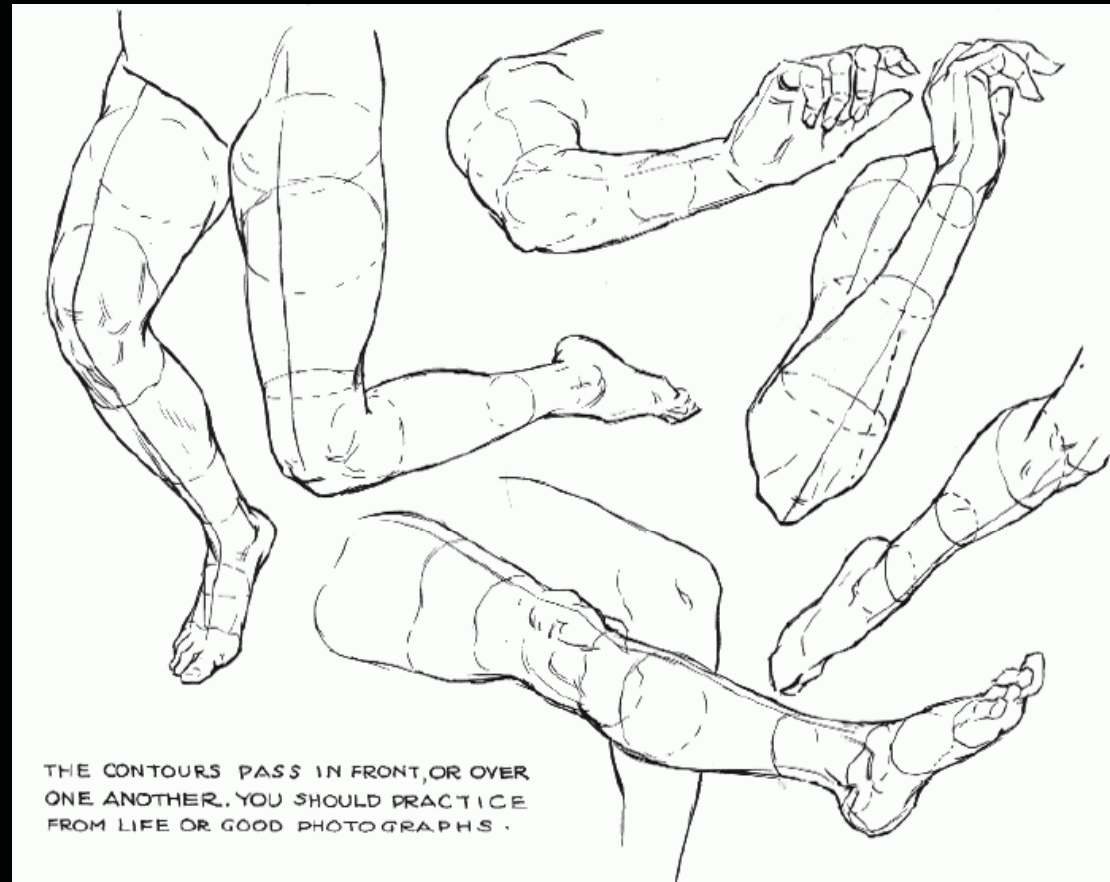
# *Replace circle to get Non Circular Cross Sections*



# Motivation



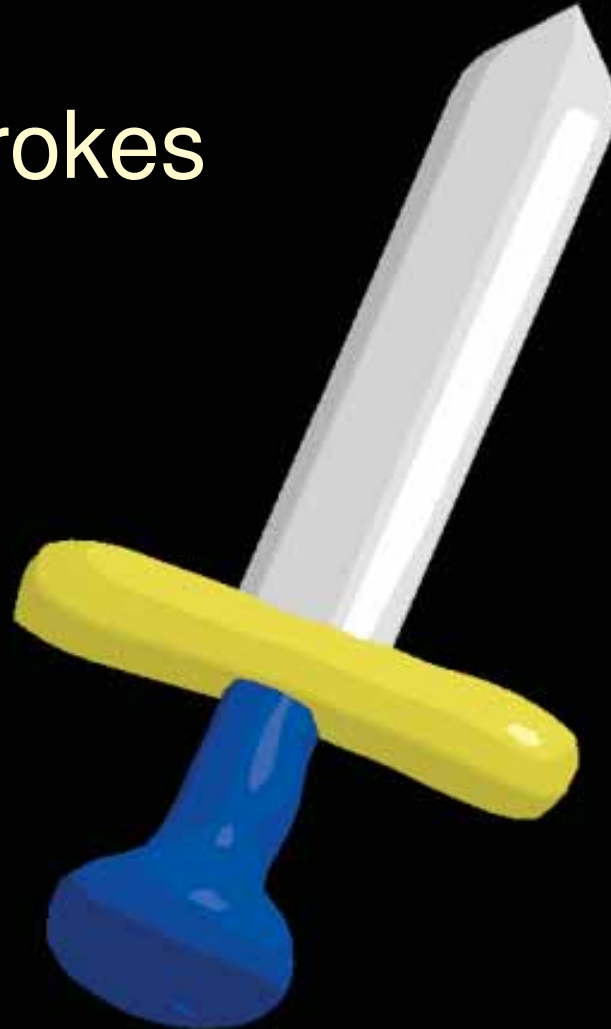
Jack Hamm: Drawing the Head and Figure (1963)



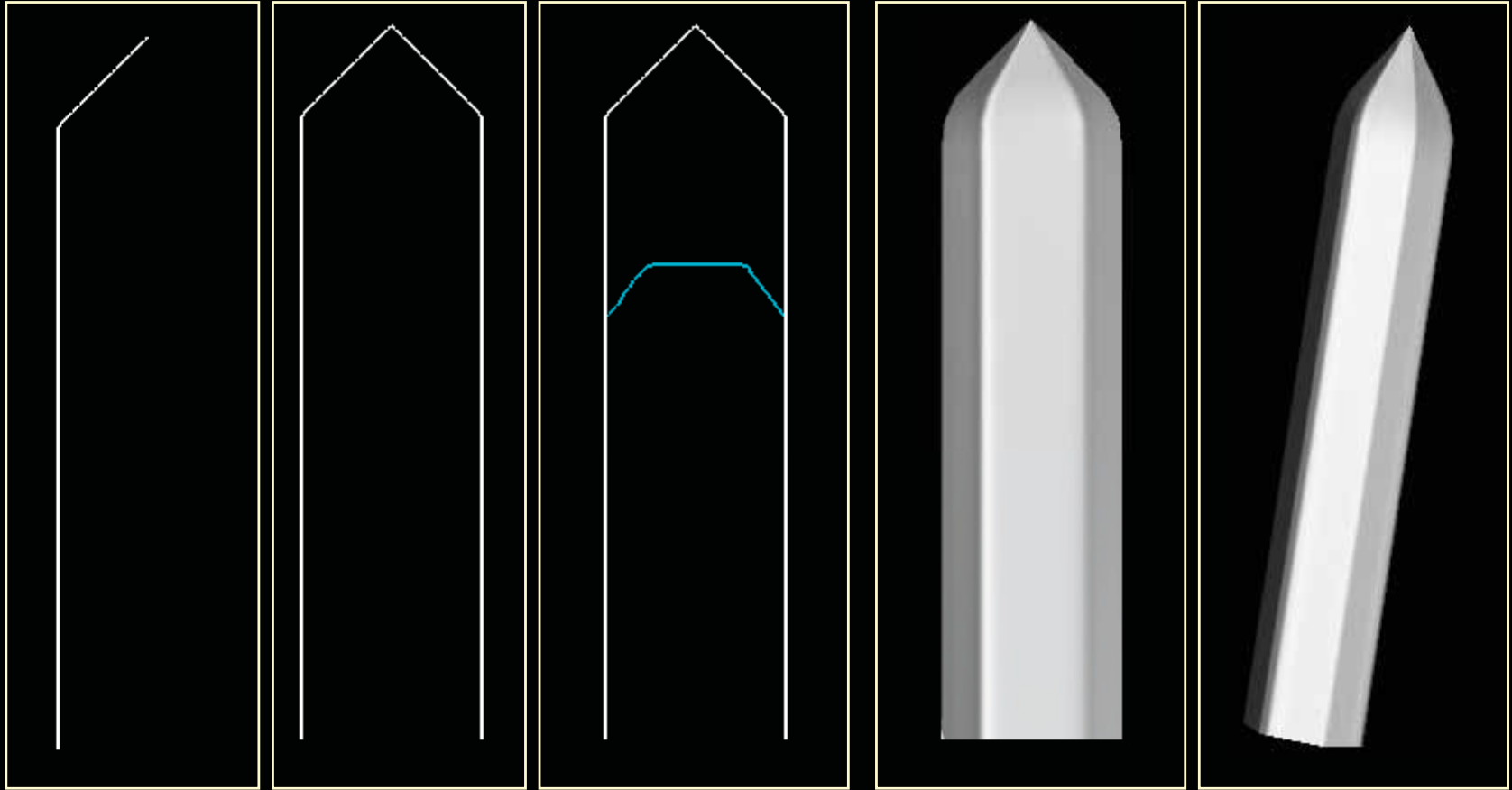
Andrew Loomis: Figure Drawing for All It's Worth (1943)

# *Faceted Surfaces*

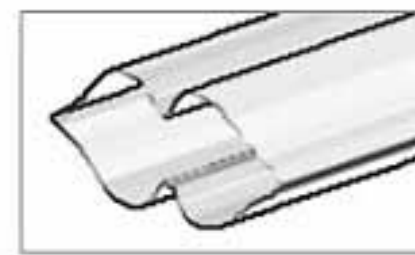
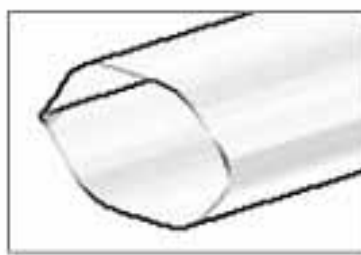
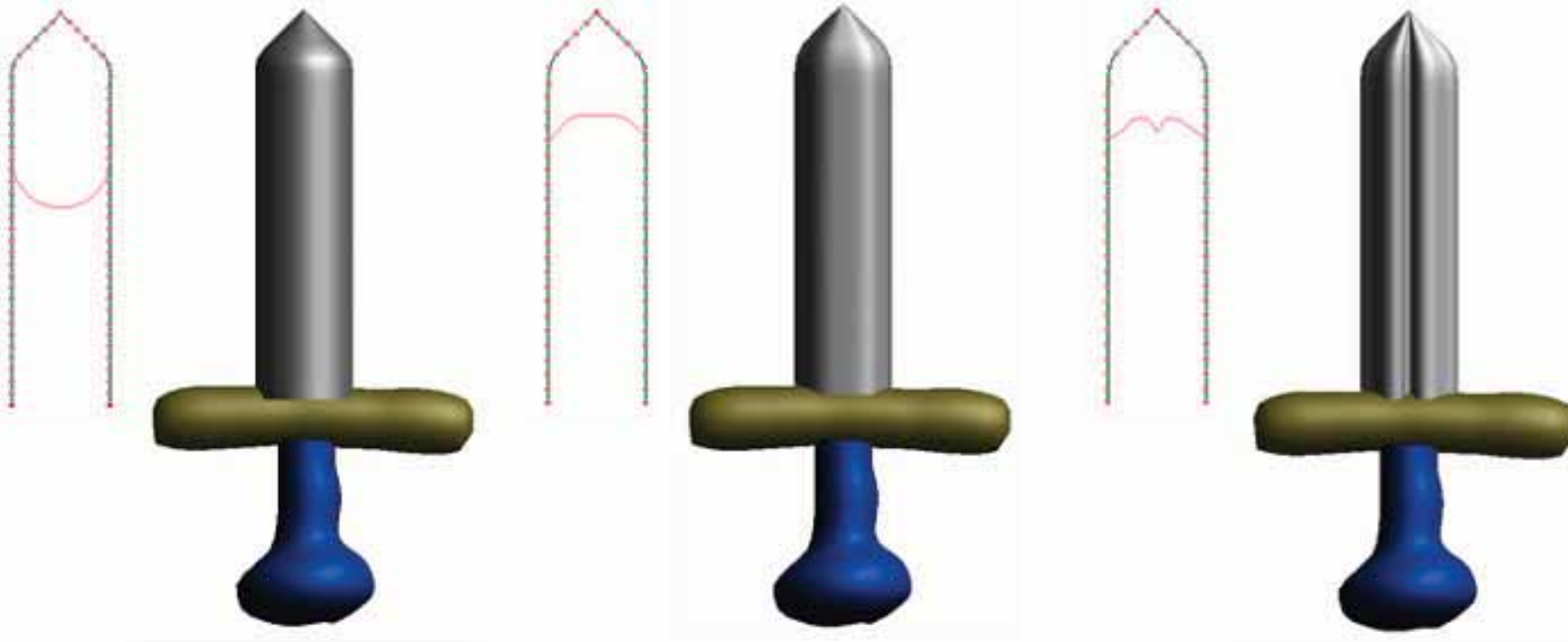
total: seven strokes



# Creating the Sword Blade

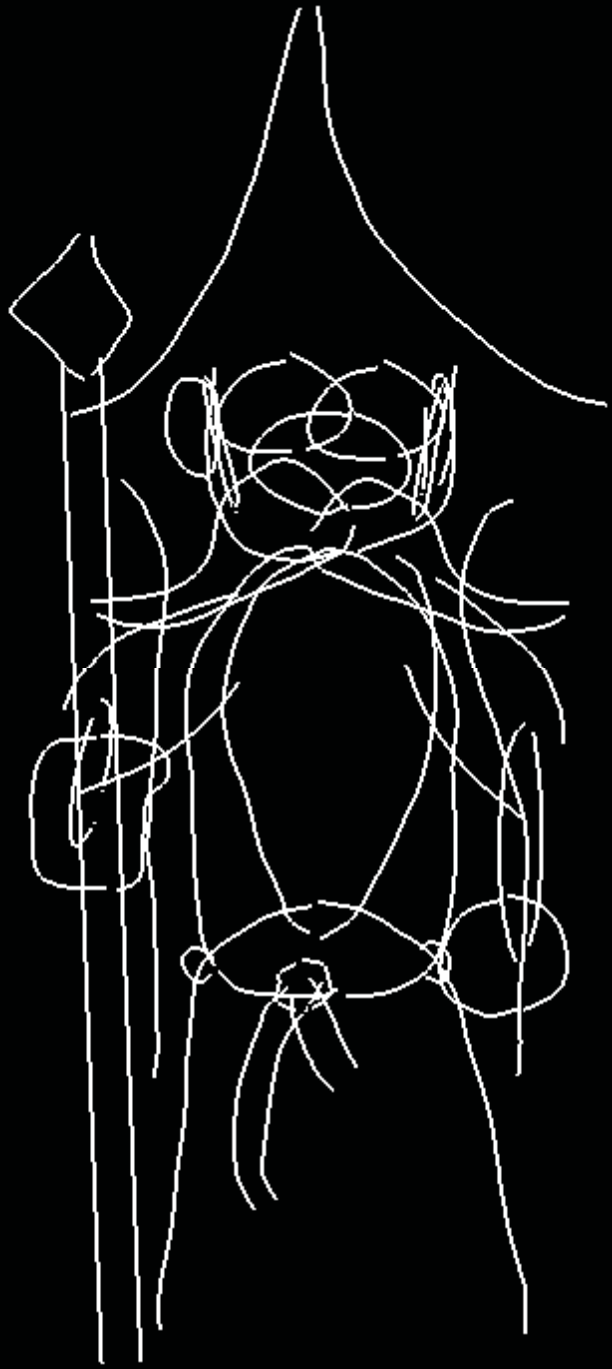






# Wizard





*inni*

# Orthogonal Deformation Stroke



original  
surface

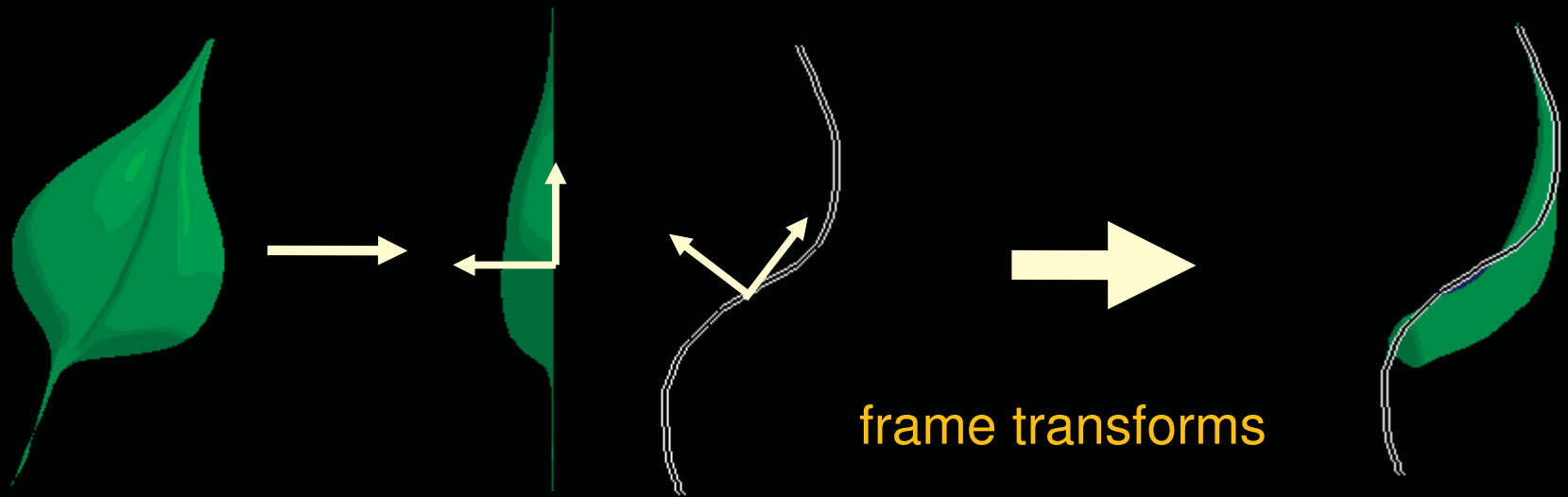


surface from the side  
+ deformation stroke



the surface is  
deformed by the stroke

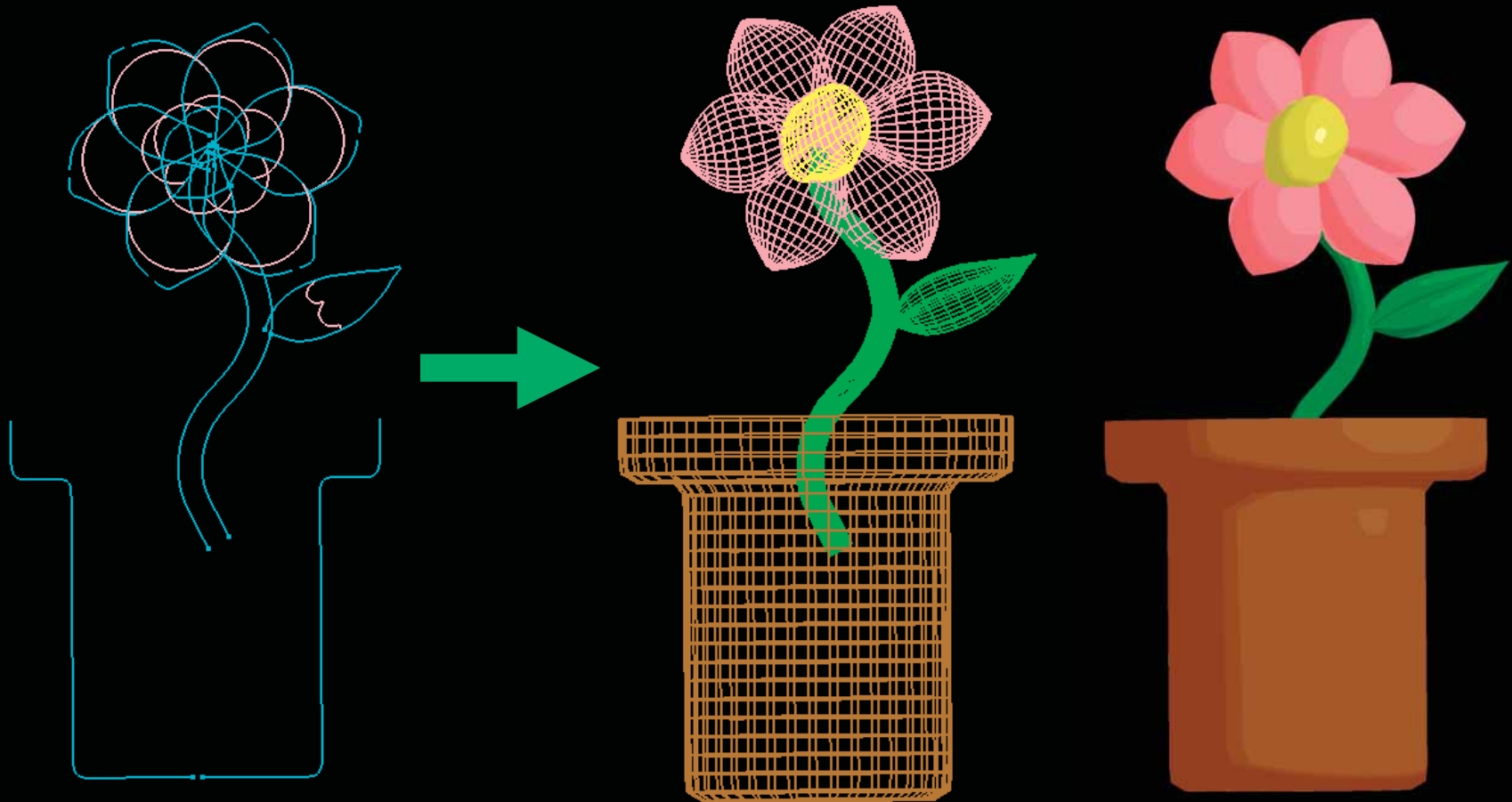
# Orthogonal Deformation Strokes



**VIDEO**



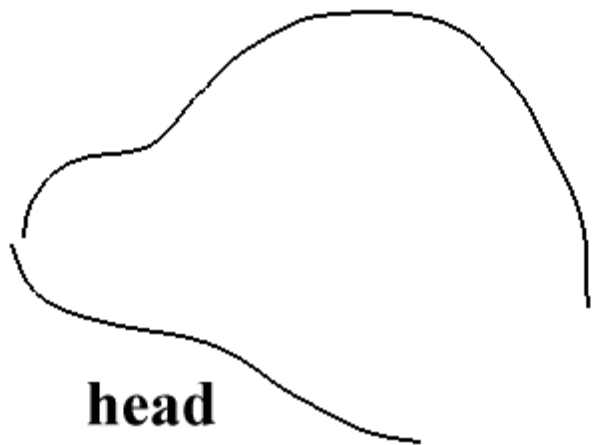
# Results







Vulpix: A cartoon fox with curly hair



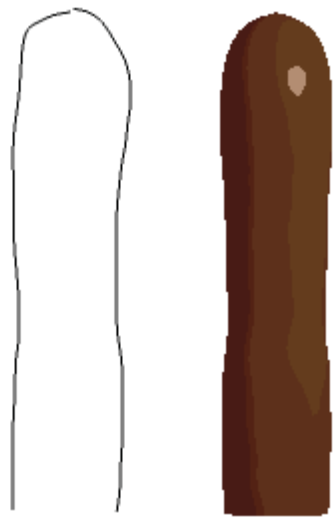
**head**



**nose**



**ear**

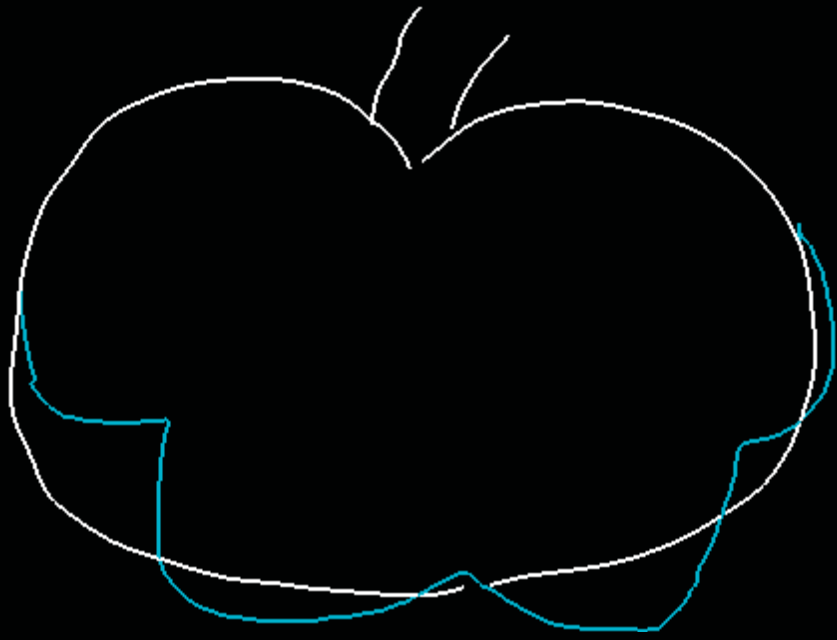


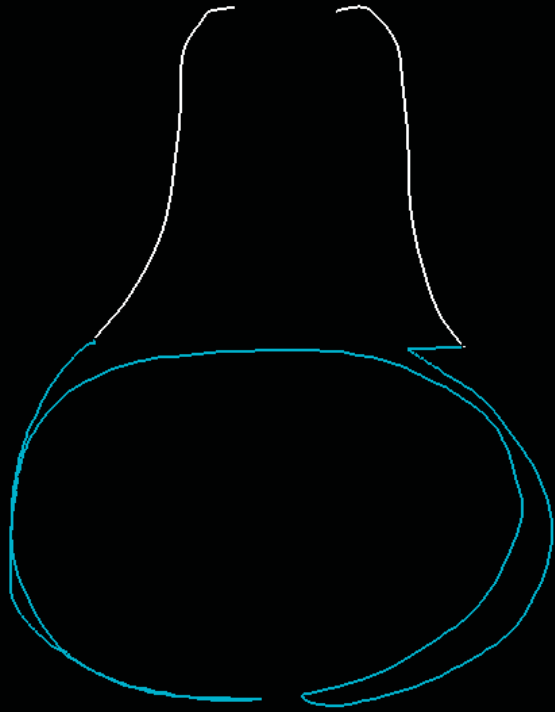
**curly hair**



**eye**



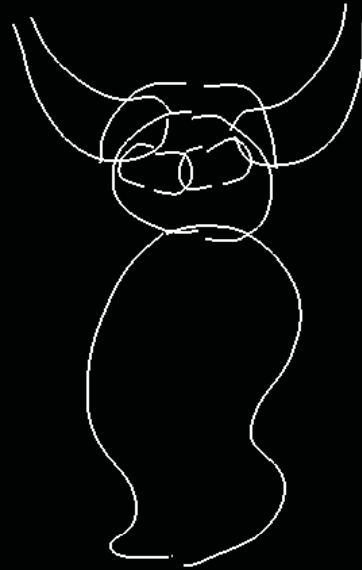




**cape**

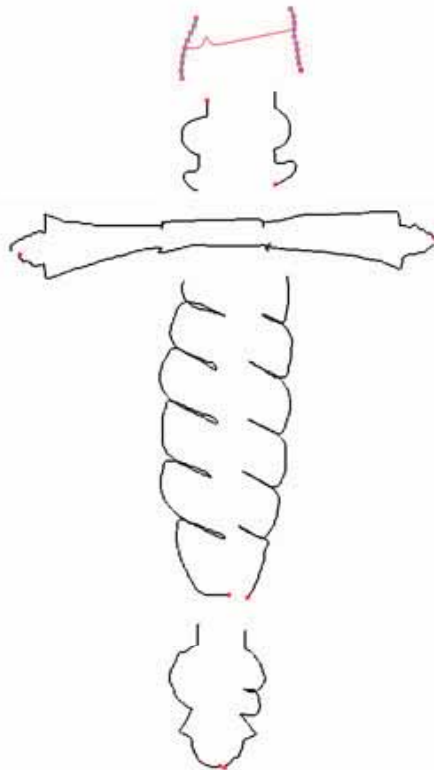
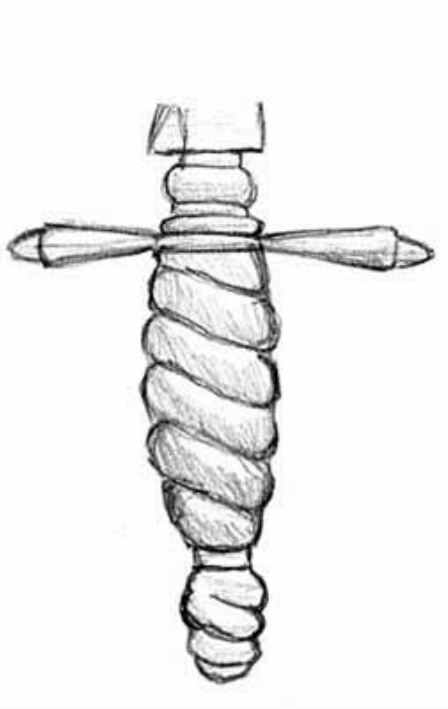


**shoulder  
plate**



**body, head  
and helmet**





actual drawing

our reconstruction  
in 3D

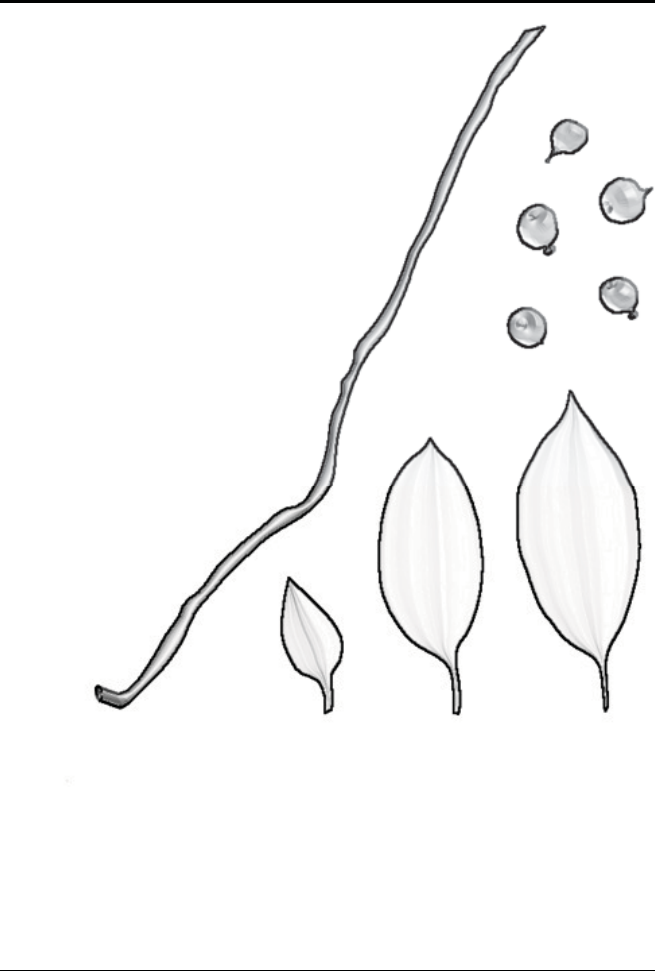




botanical illustration

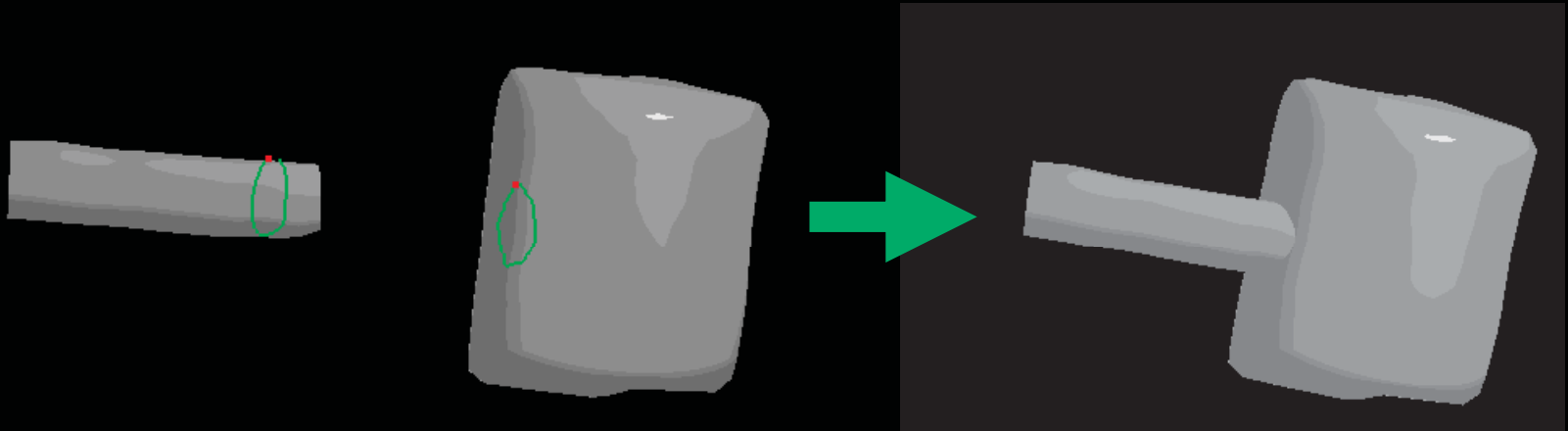


using our system

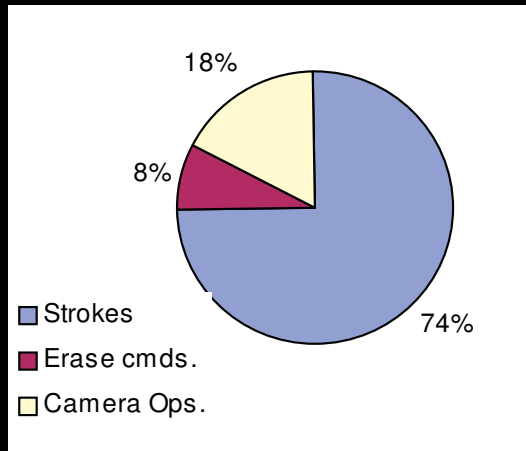




# Targeted Constrained Move

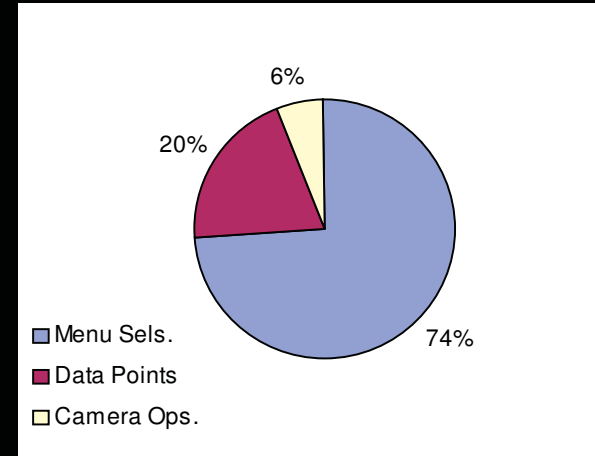


# Complexity Budget



Our System

Strokes  
dominate (75%)



Commercial CAD

Menu Sels  
Dominate 75%

# *Modeling Plant Structures Using Concept Sketches*

*Fabricio Anastacio  
Mario Costa Sousa  
Faramarz Samavati  
Joaquim Jorge*

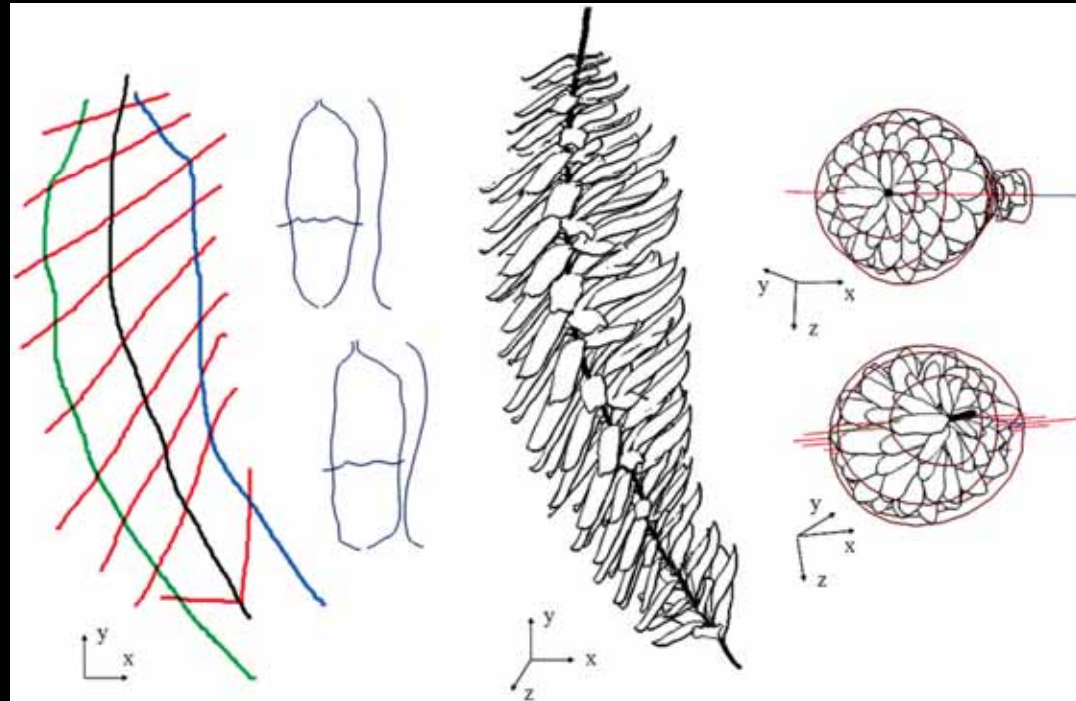
*NPAR*

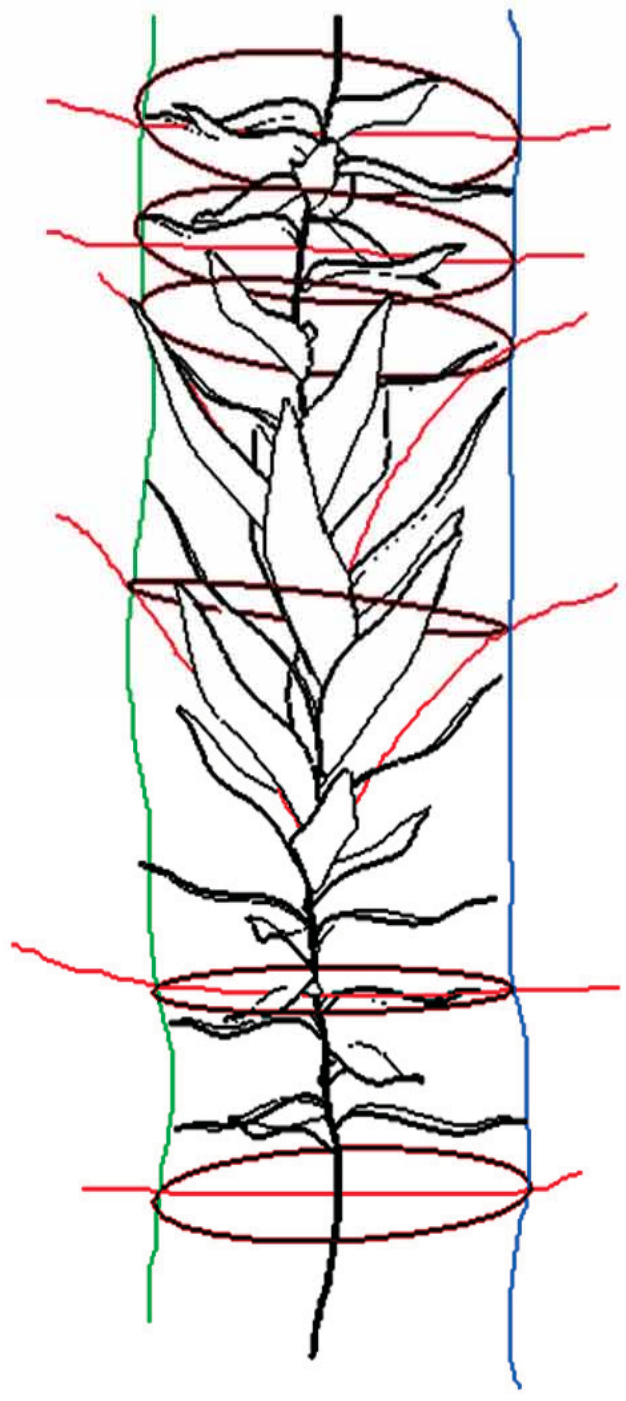
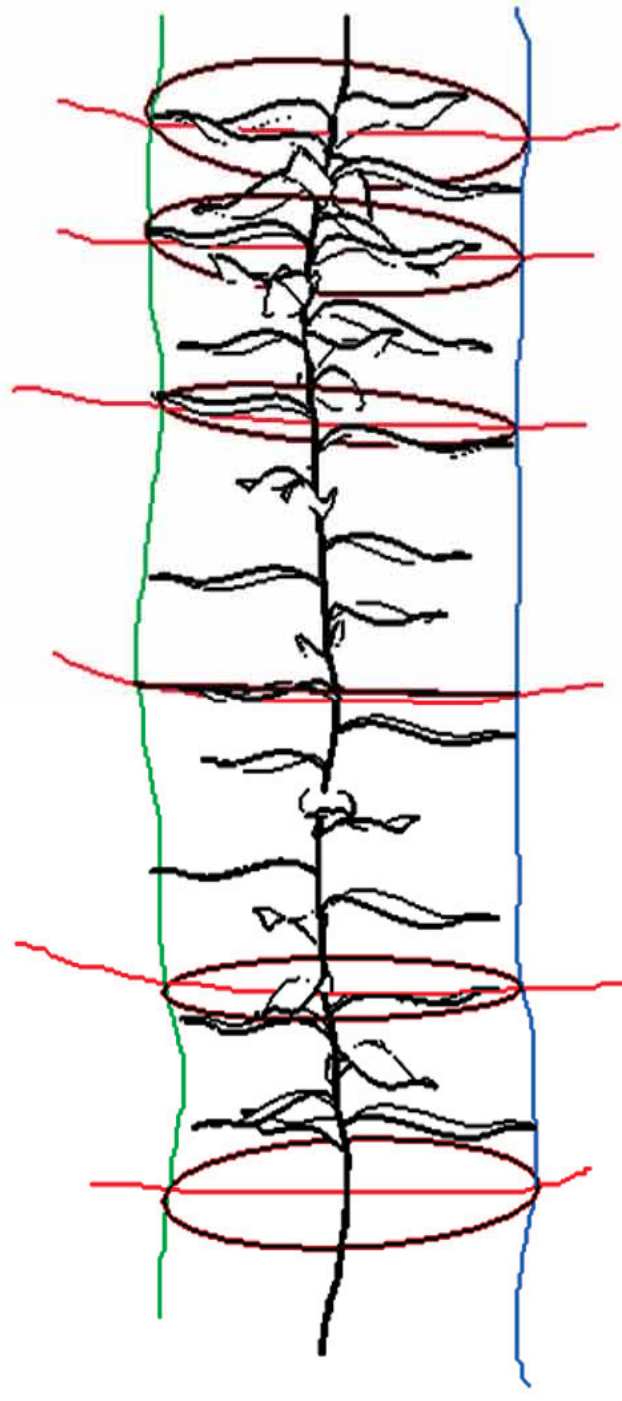
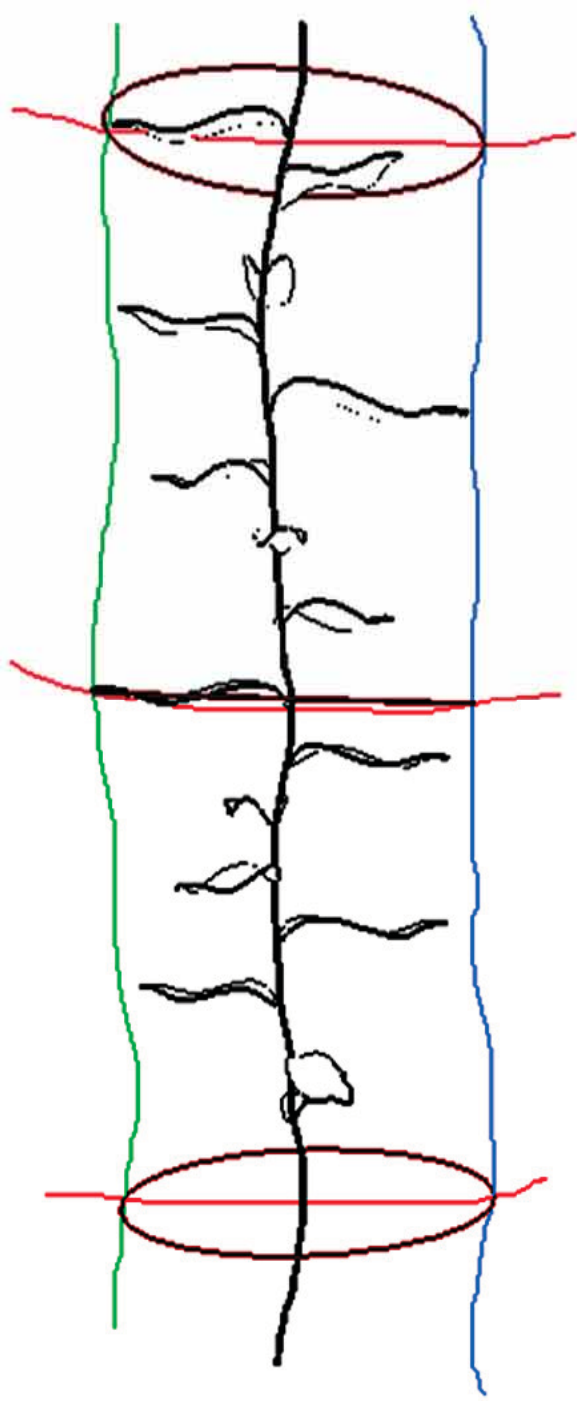
# *Combining Interaction with Modeling and Algorithms*

# Concept Sketches

## Plant Modeling and Rendering

- | 3D single-compound plant structures with phyllotactic arrangements
- | Hand-gestures artistic variations
- | Biologically-correct positioning rules of plant organs.



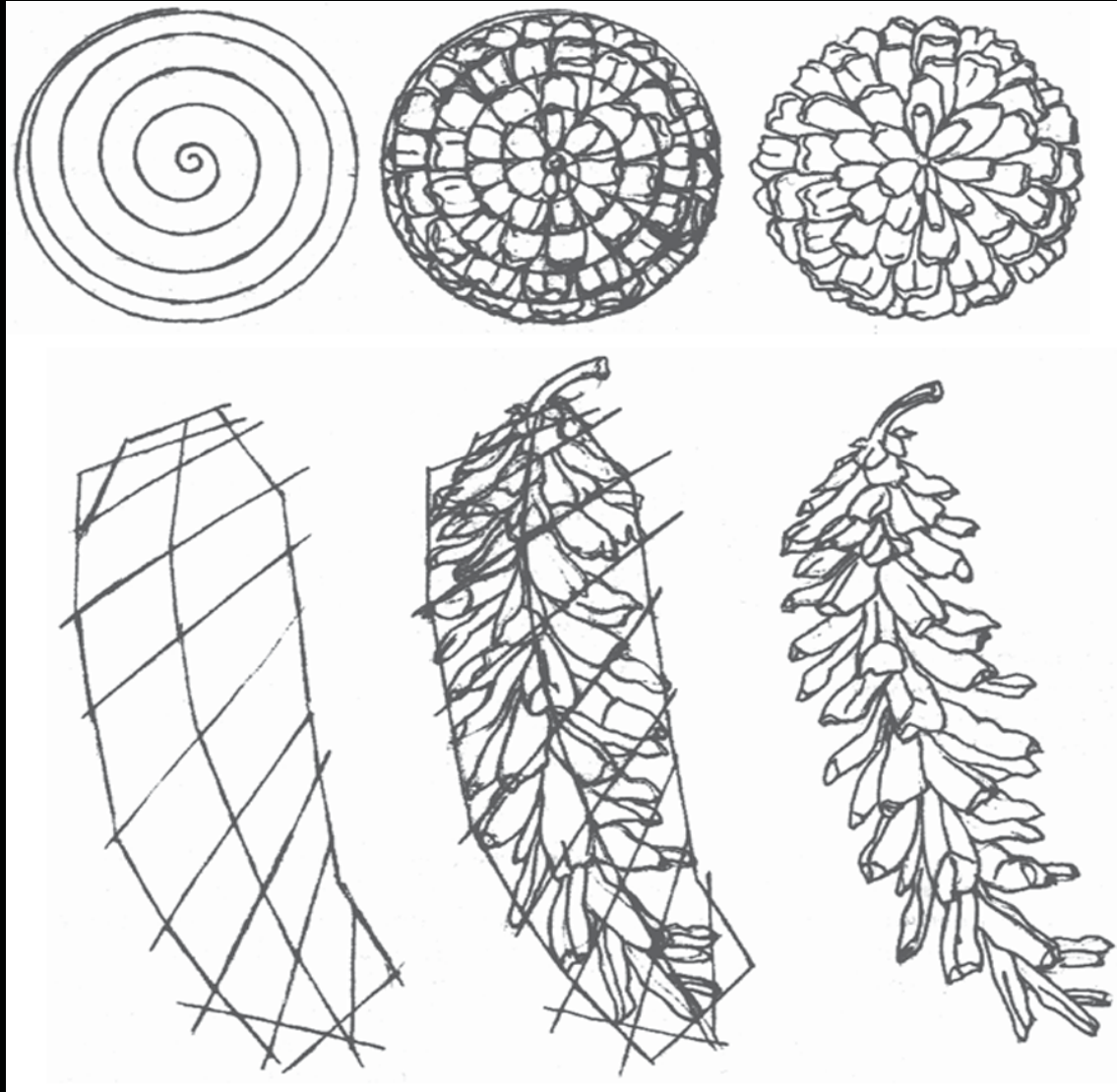


# Concept Sketches

## Botanical Illustrations

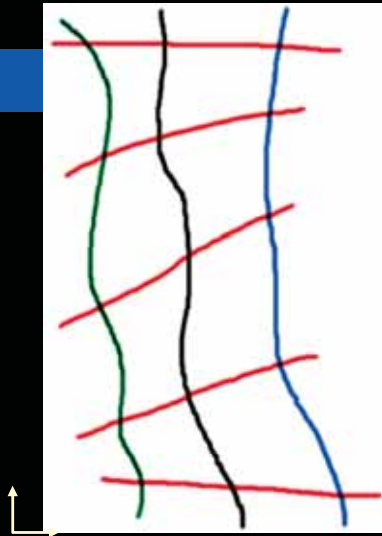
Construction  
lines indicate

Posture  
Proportions  
Constraints

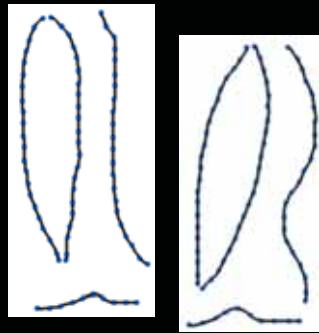




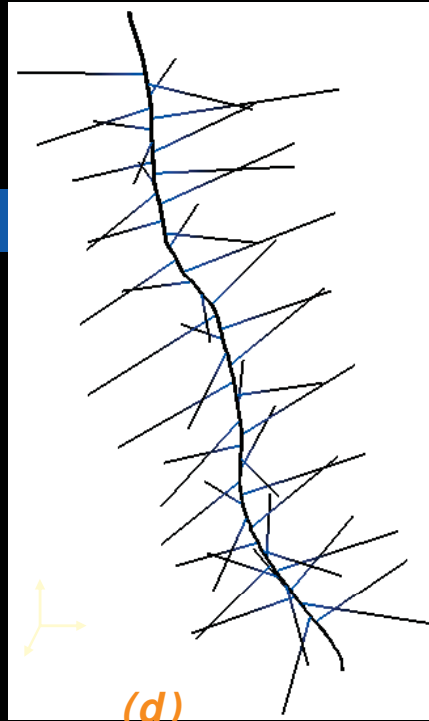
# Approach :



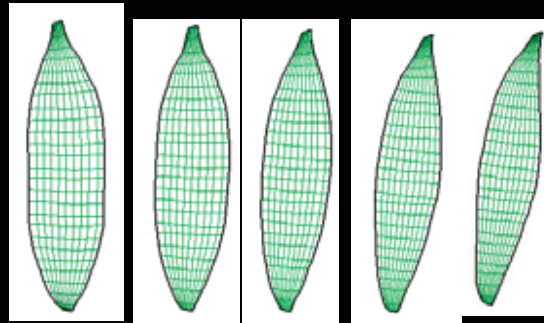
(a)



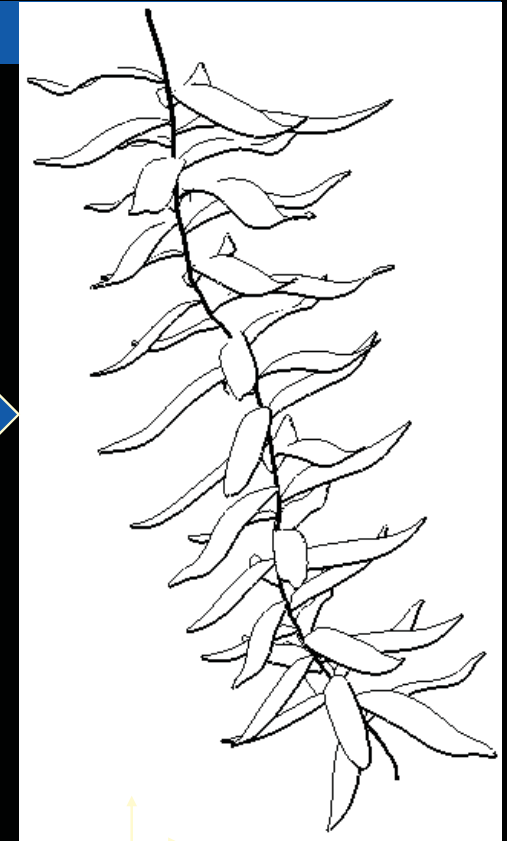
(b)



(d)



(c)



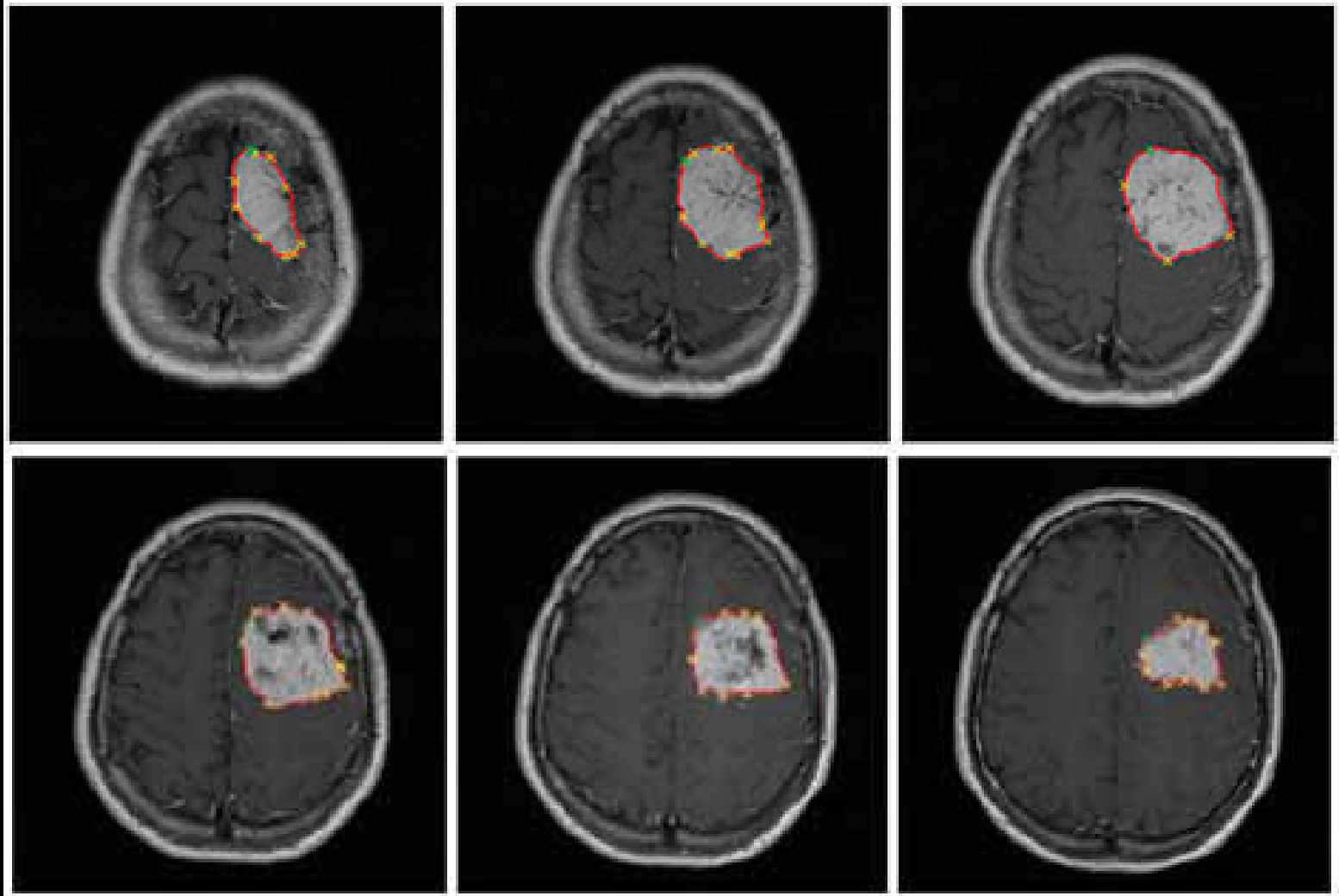
(e)



***Medical Image  
Segmentation with Sketches***

**Vasco Gervásio +  
Joaquim A. Jorge**

# Conventional techniques do not work



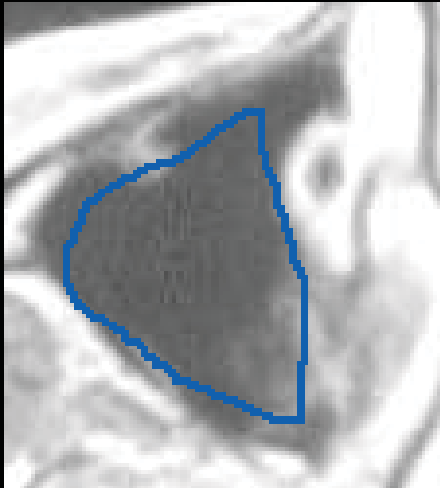
*Snakes are  
good*



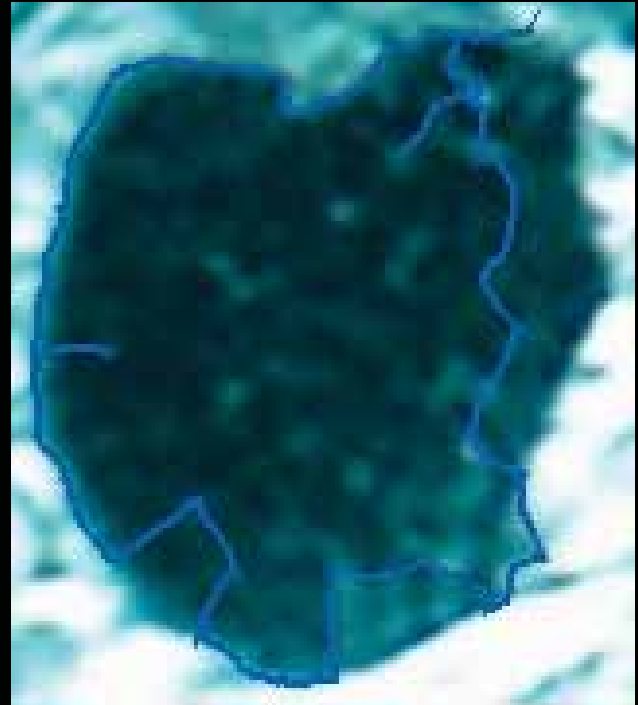
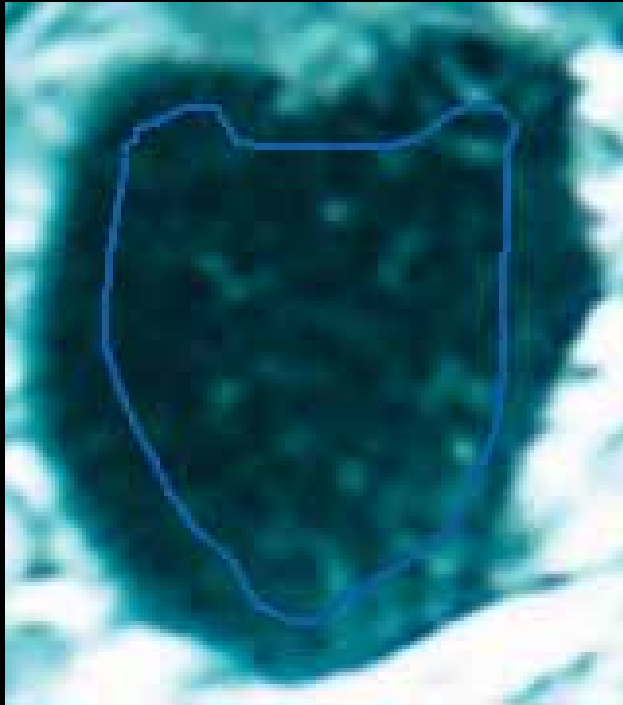
***But not  
excellent!***



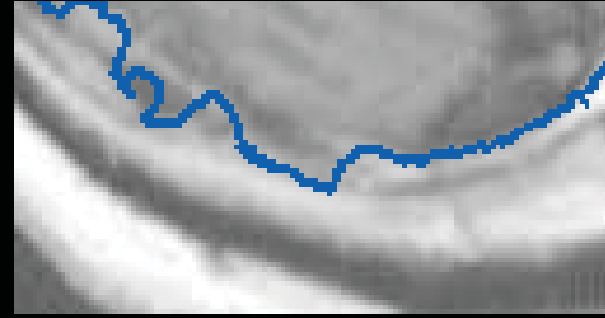
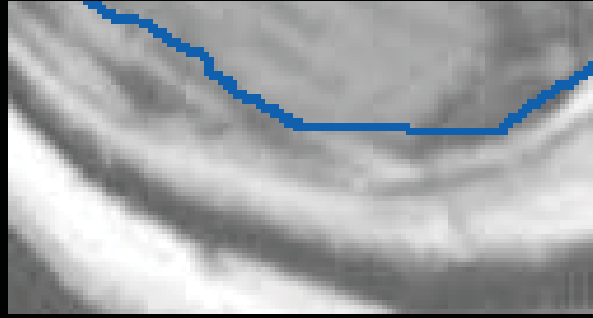
# *Low Gradient difficult*



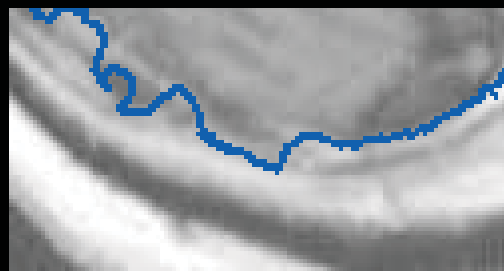
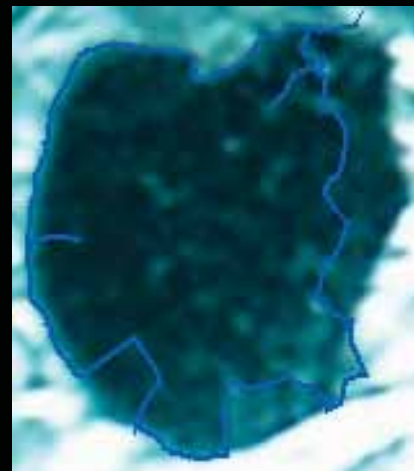
# Noise



# *Different Contours*

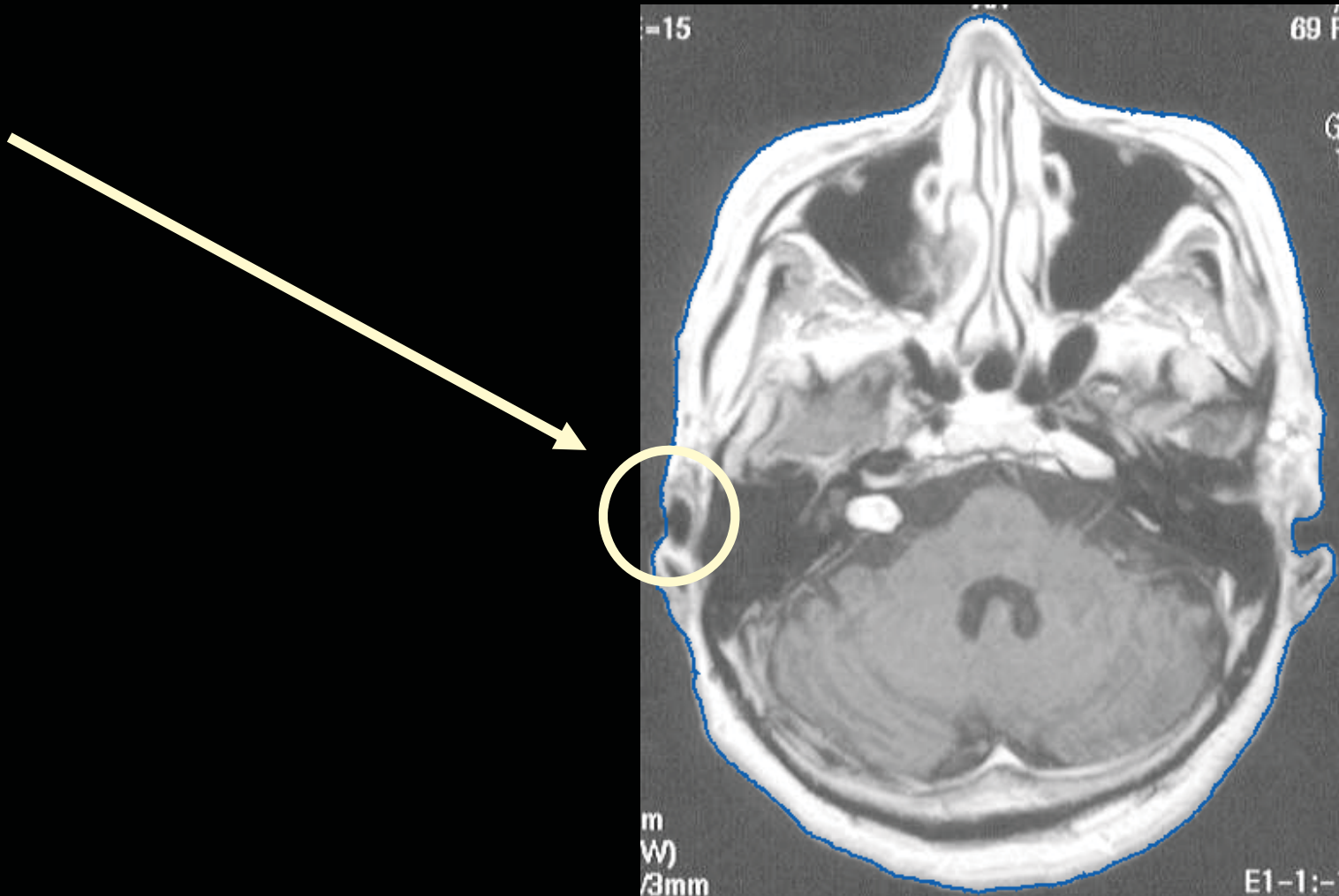


# *Low quality*

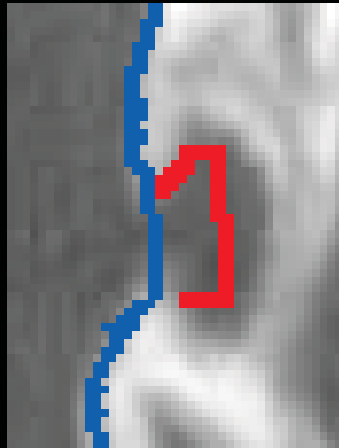




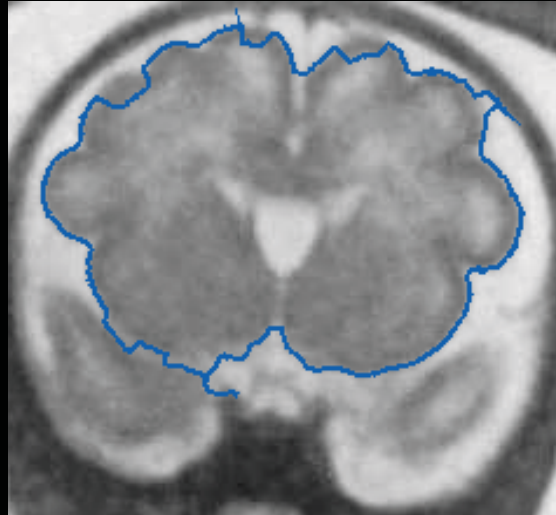
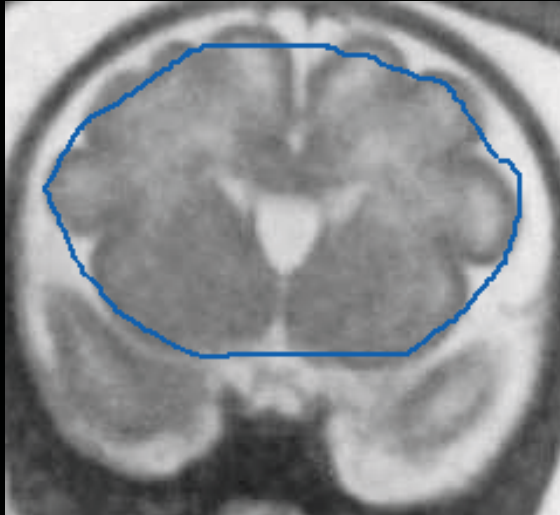
# *Local convergence difficult*



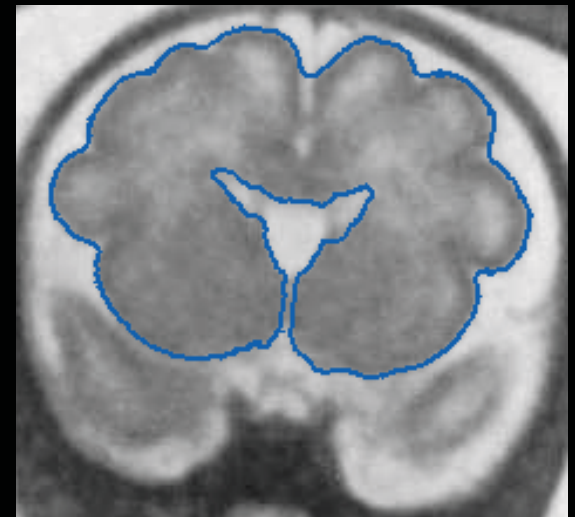
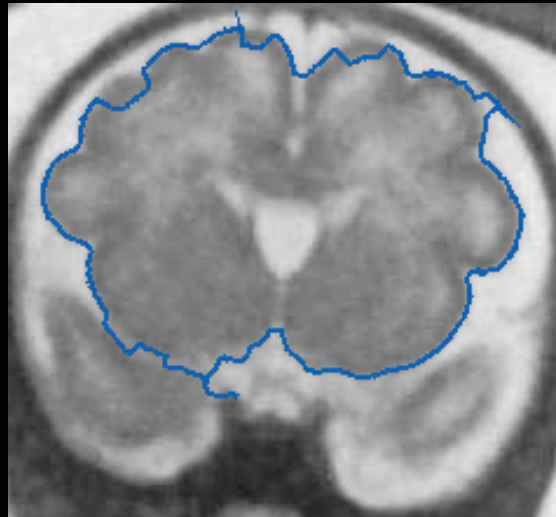
# Details



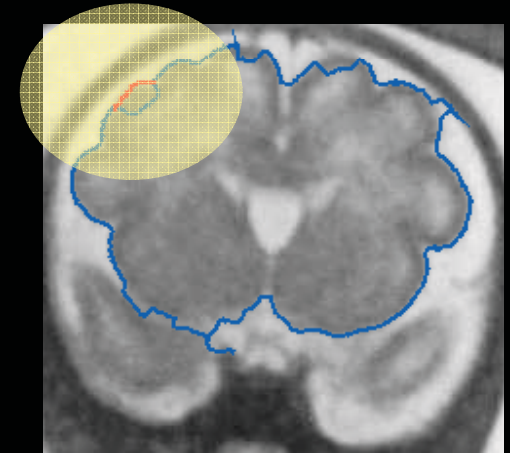
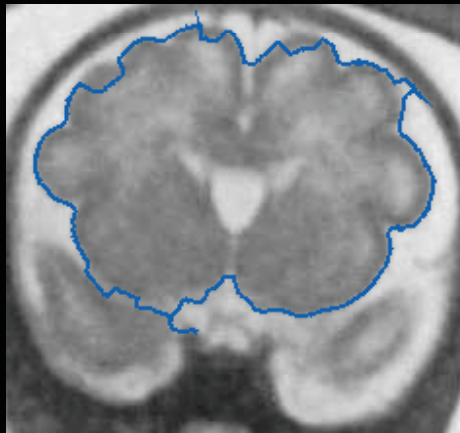
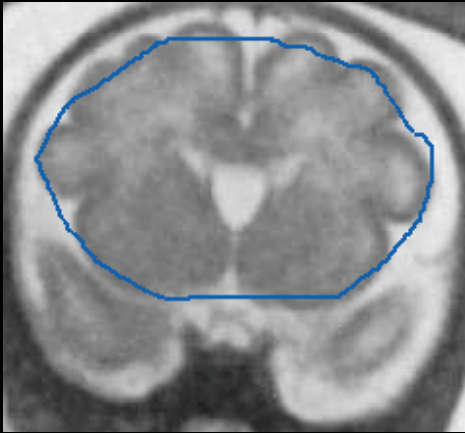
# *Oversketching Contours*



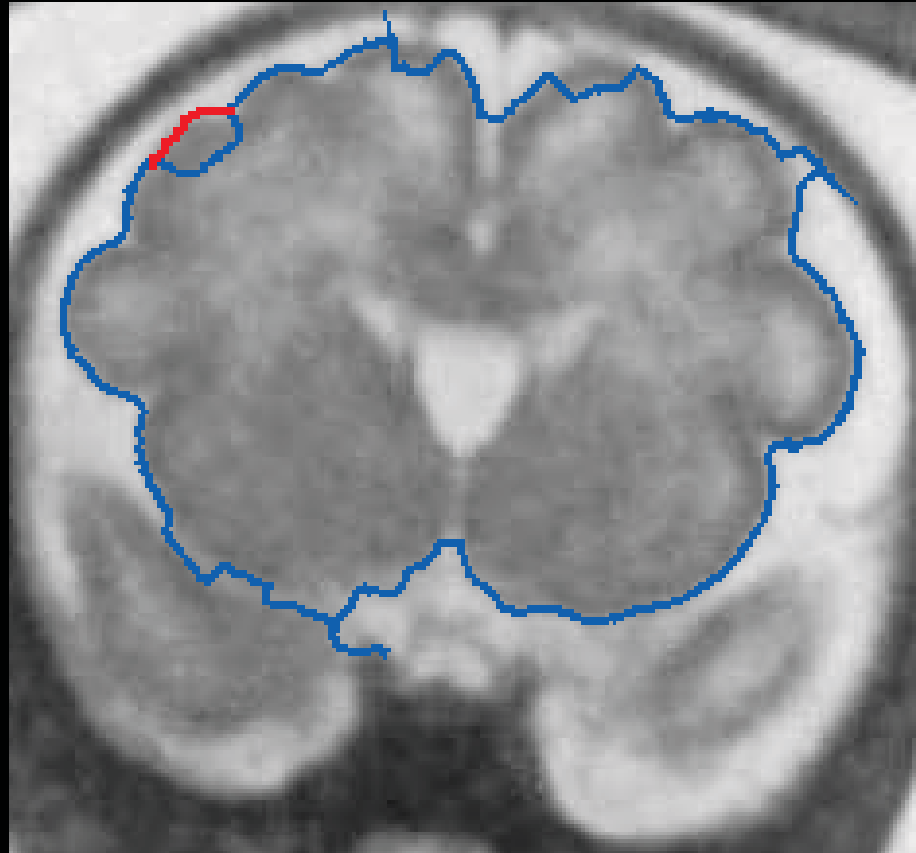
# Oversketching

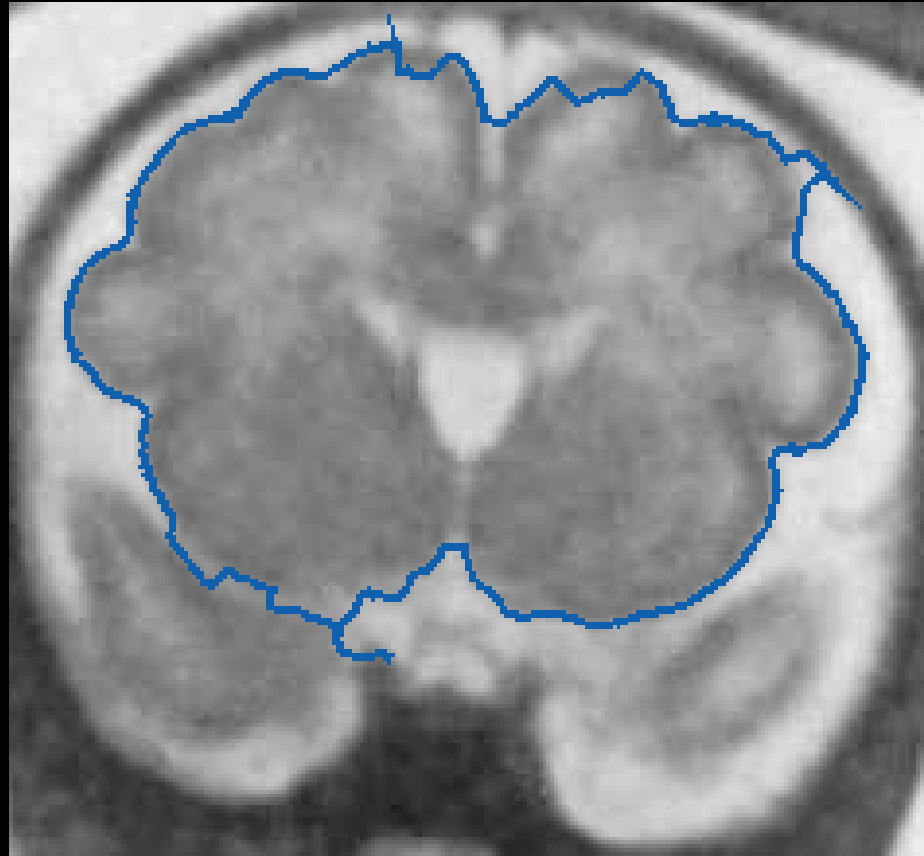


# *Users correct mistakes*

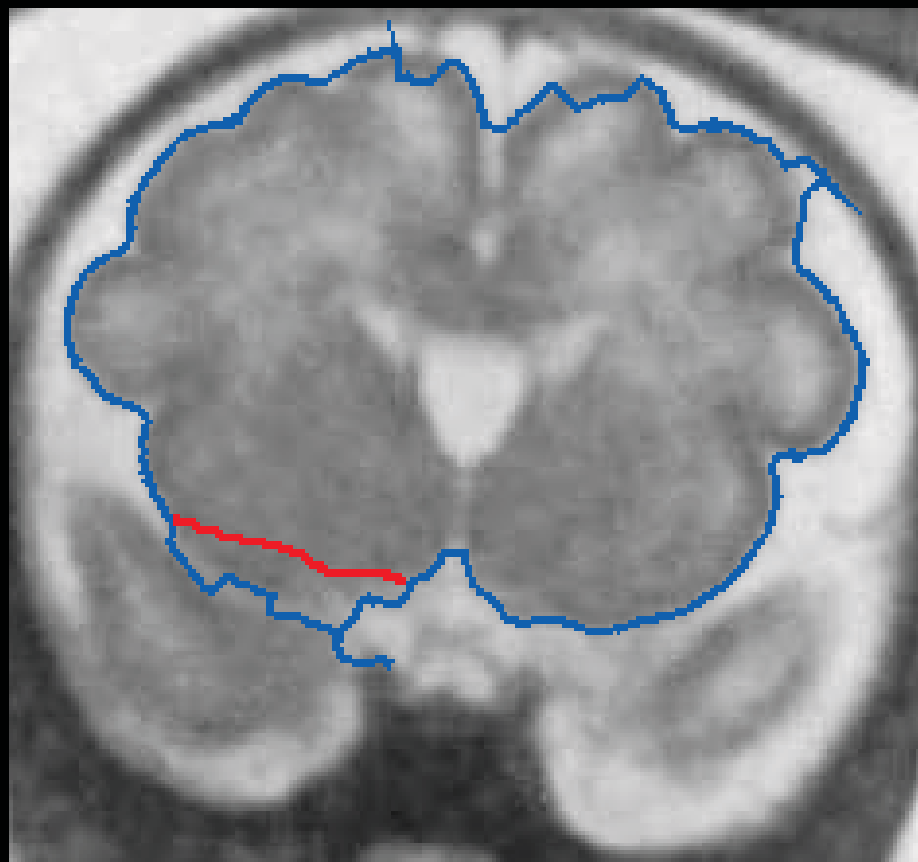


# *Apply snakes to modified contour*



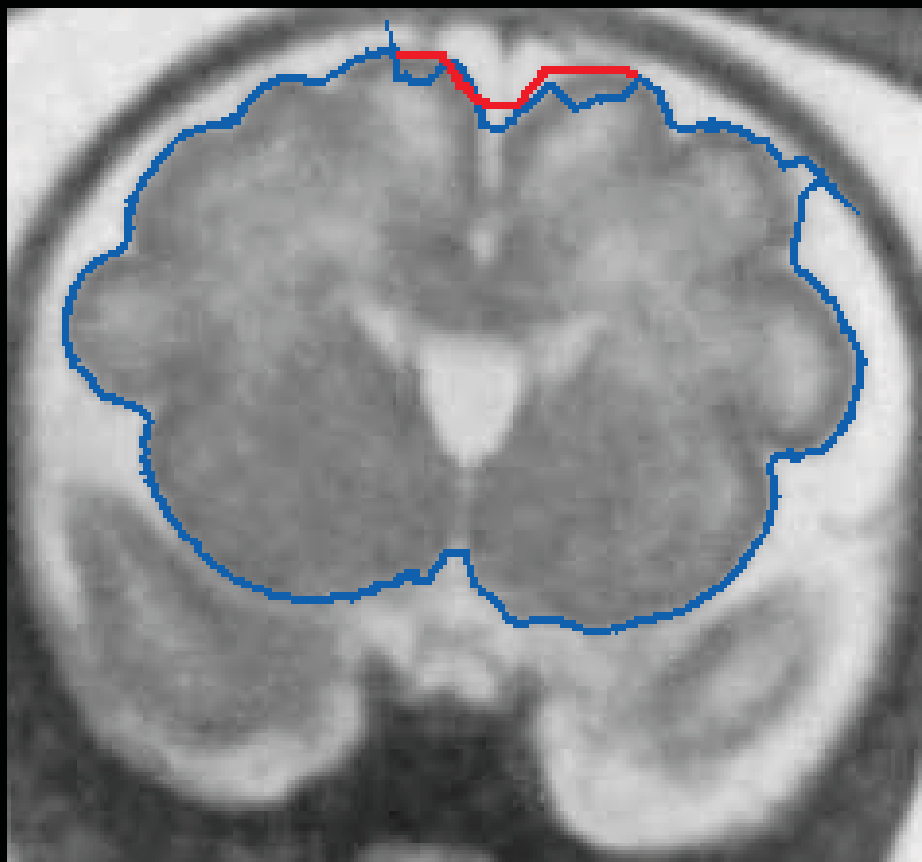


***Iterate till user is satisfied***

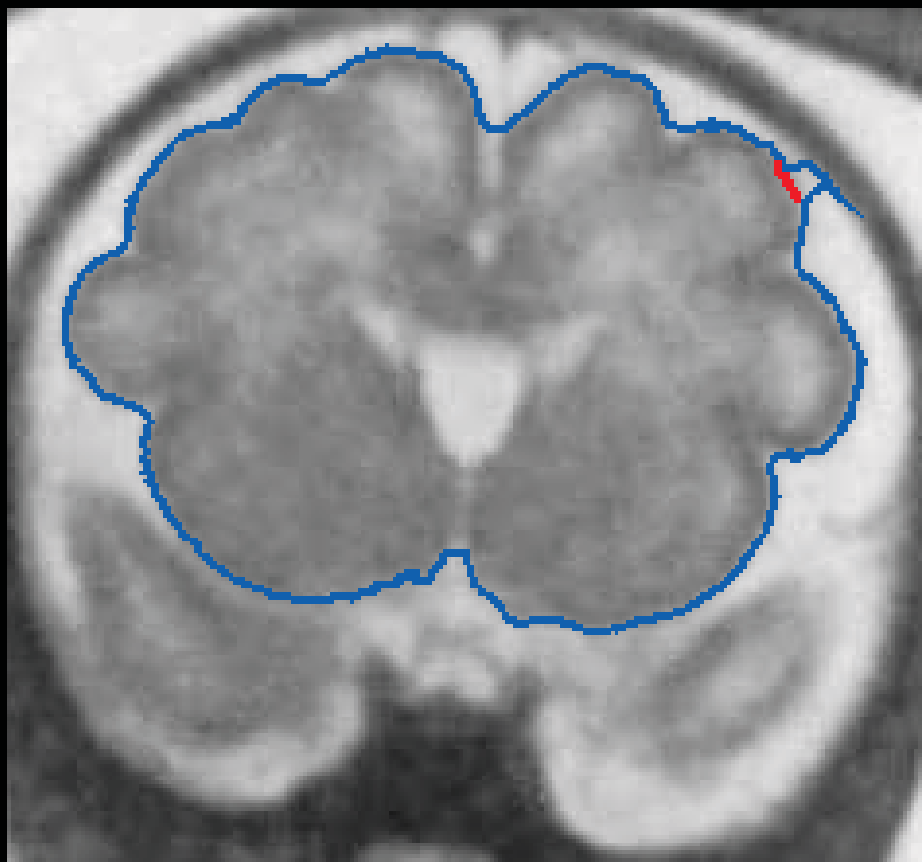




***Iterate till user is satisfied***



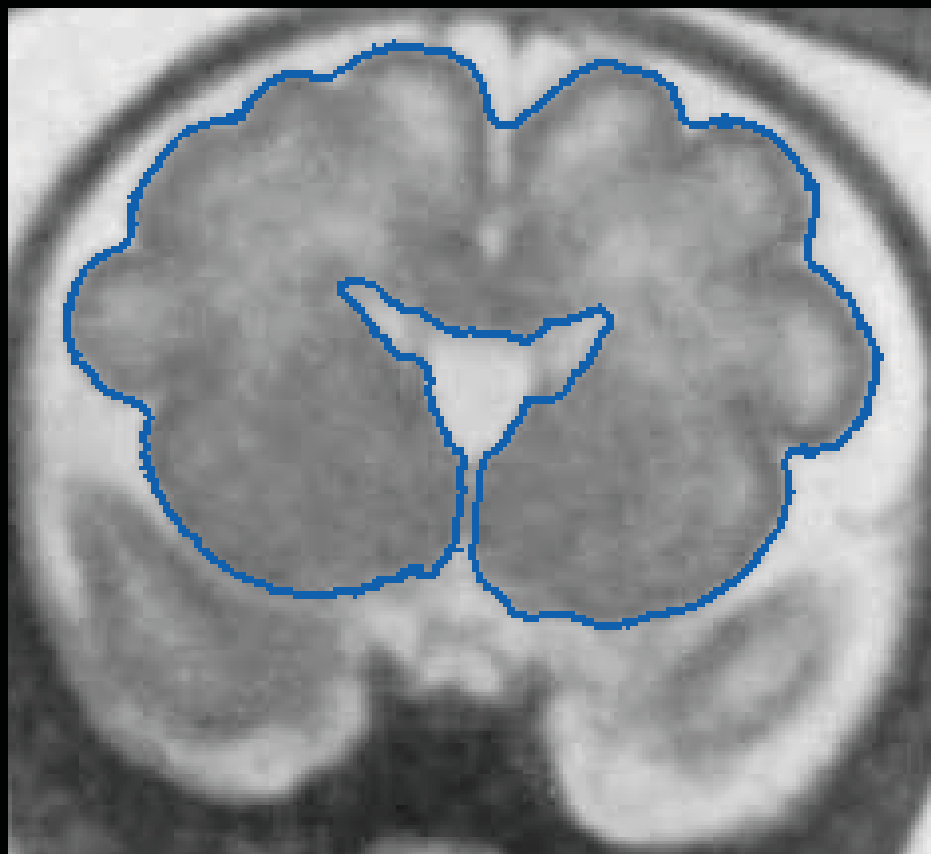
***Iterate till satisfied***



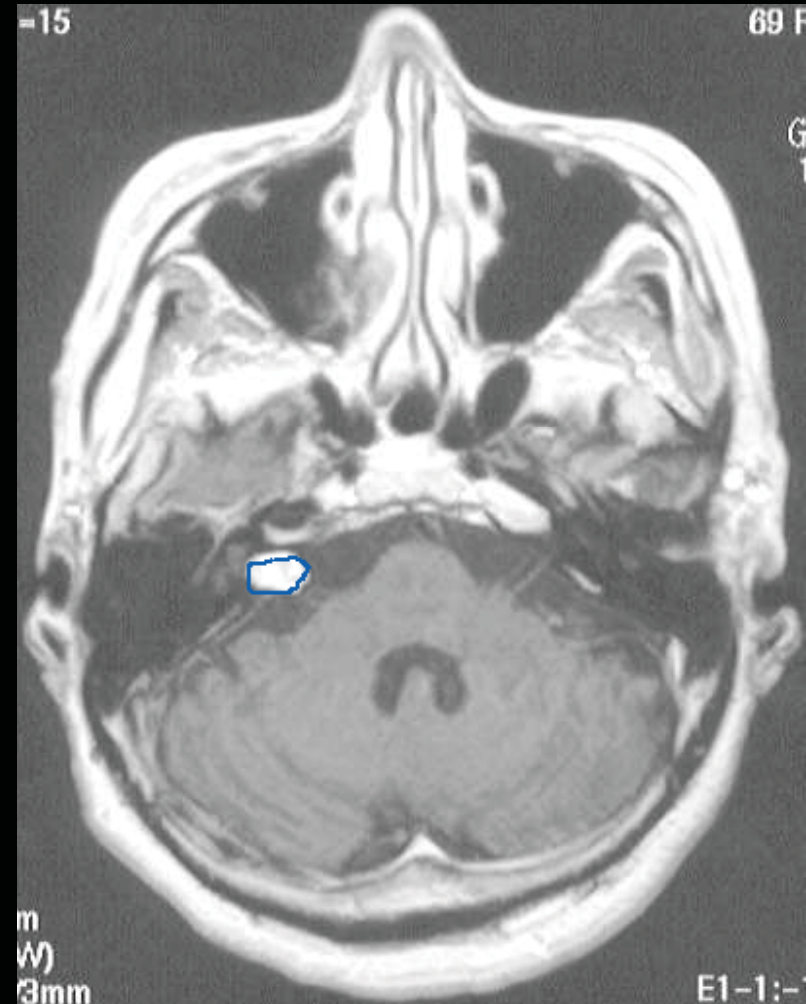
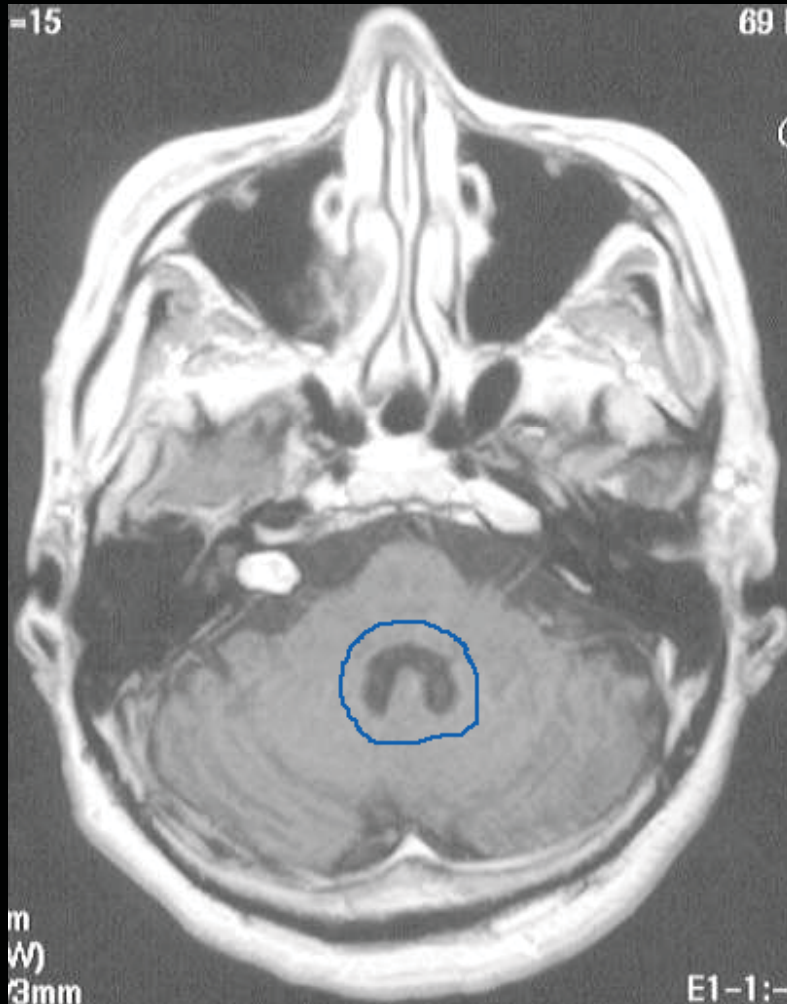
***Iterate till user satisfied***



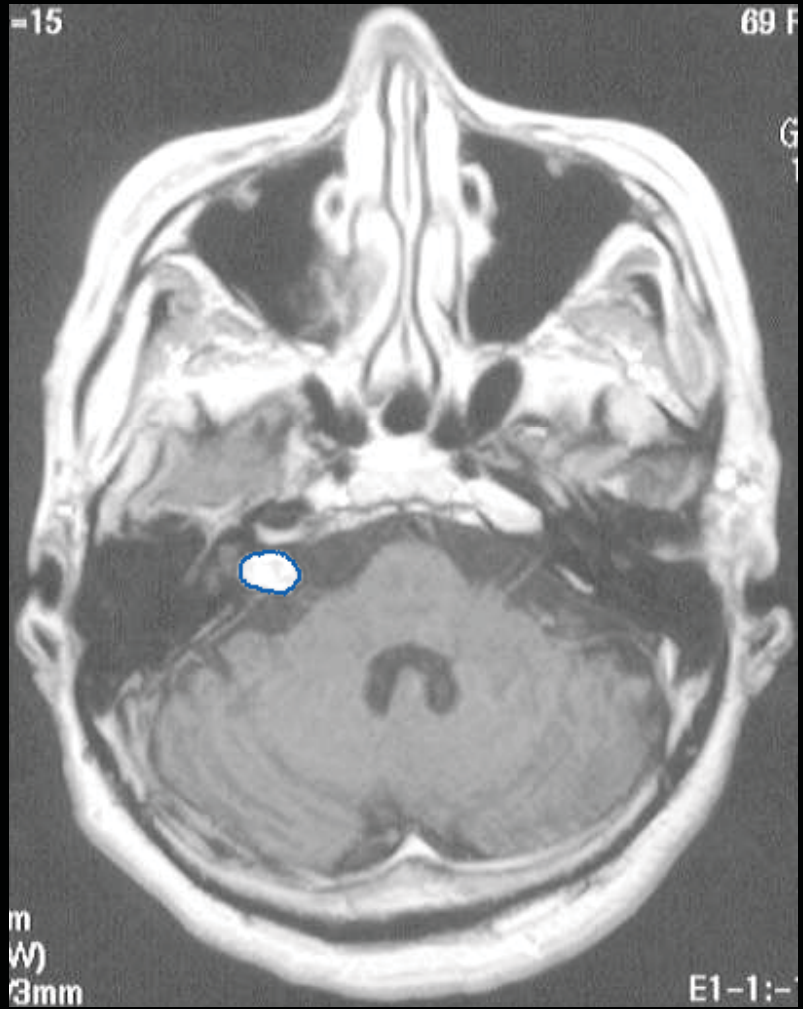
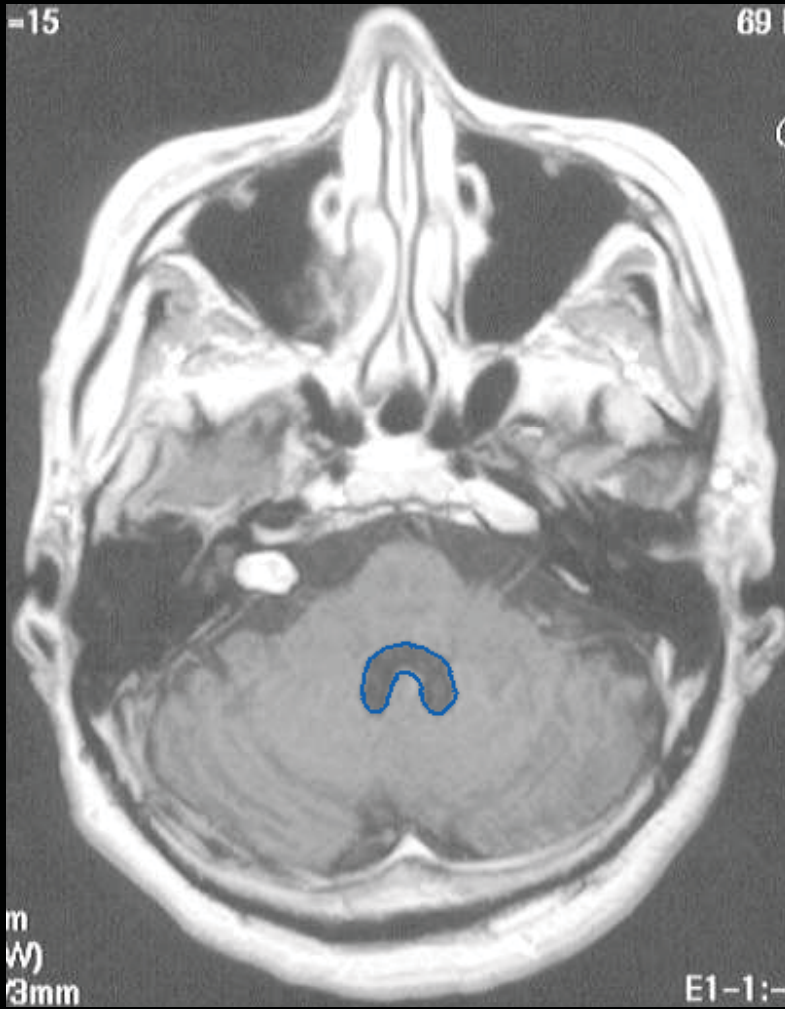
***Iterate till satisfied***



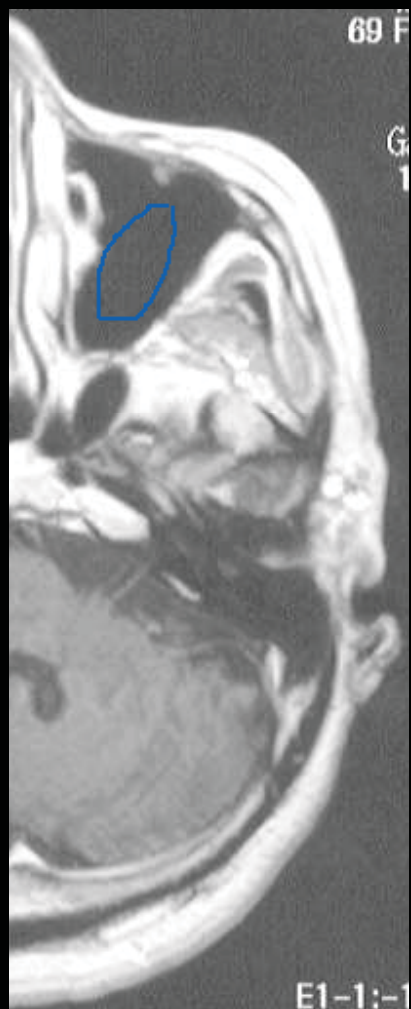
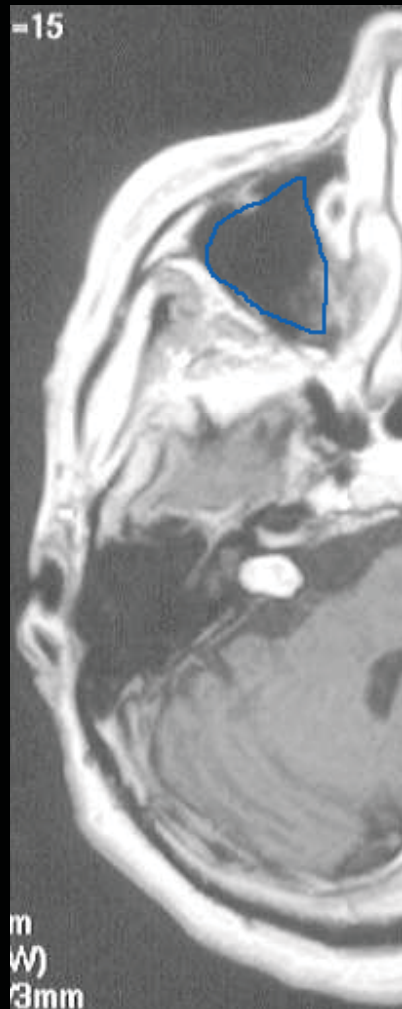
# Results



# Results

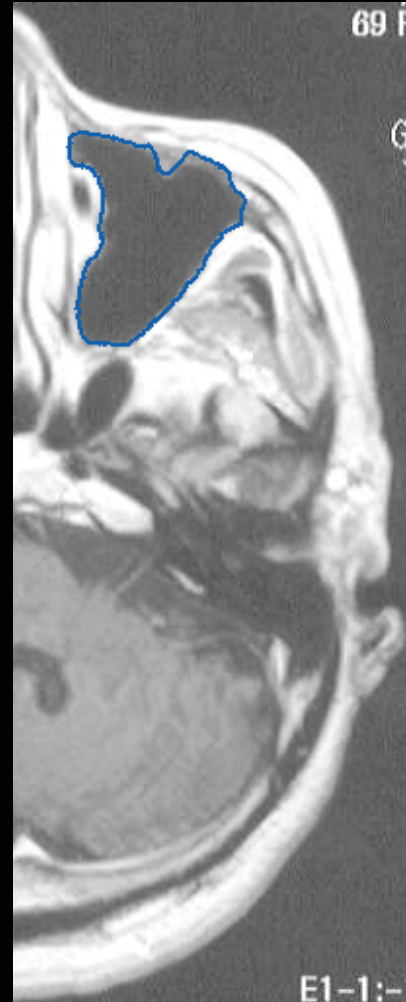


# Results



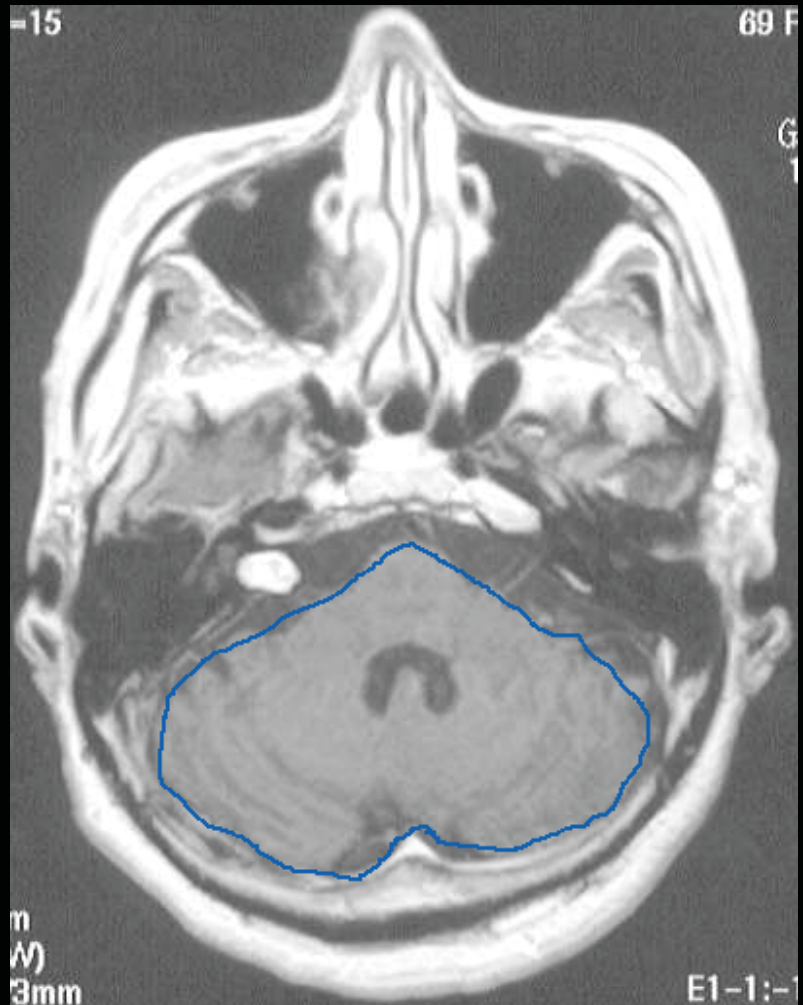


# Results

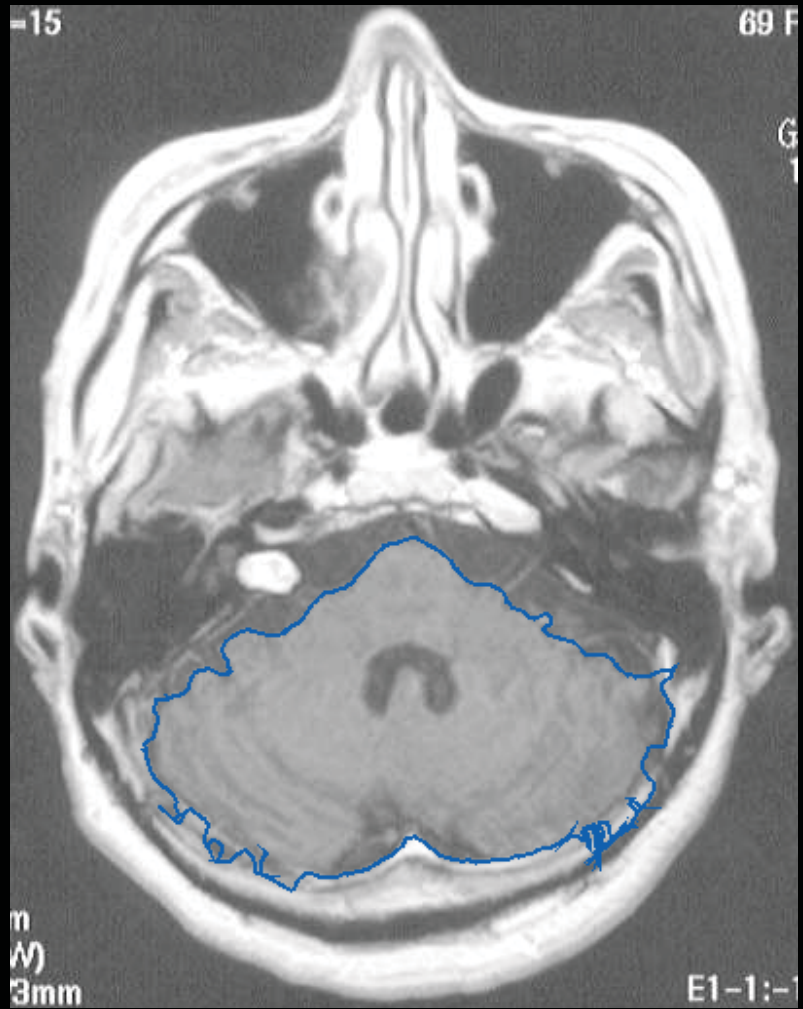




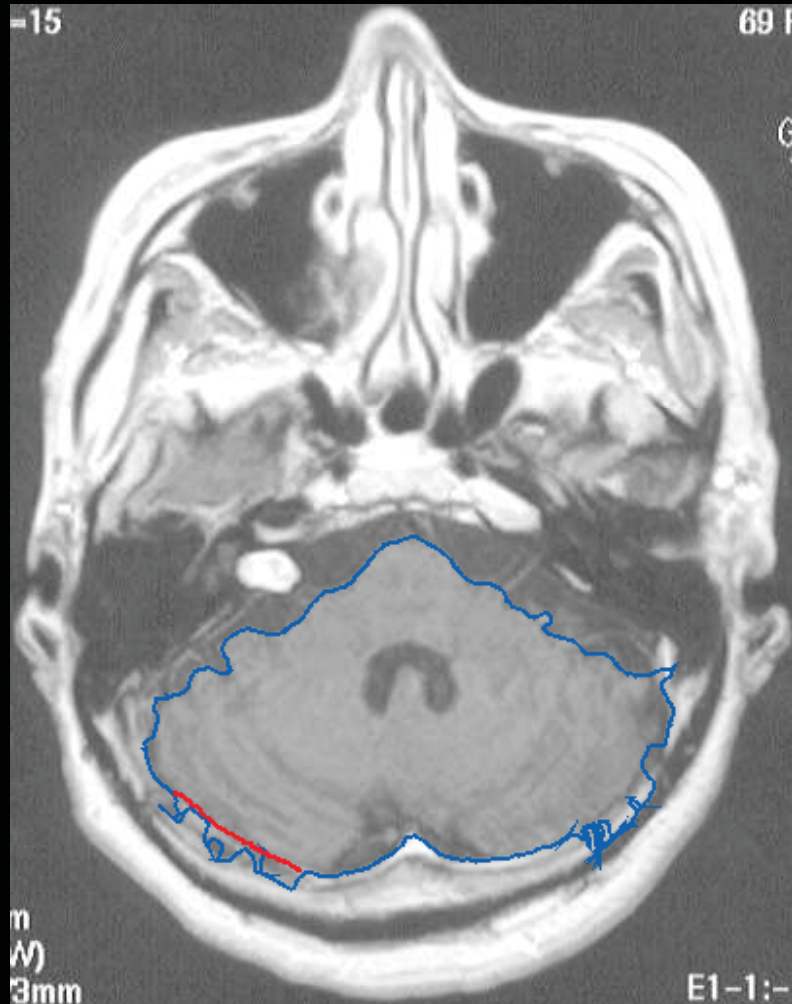
# Results



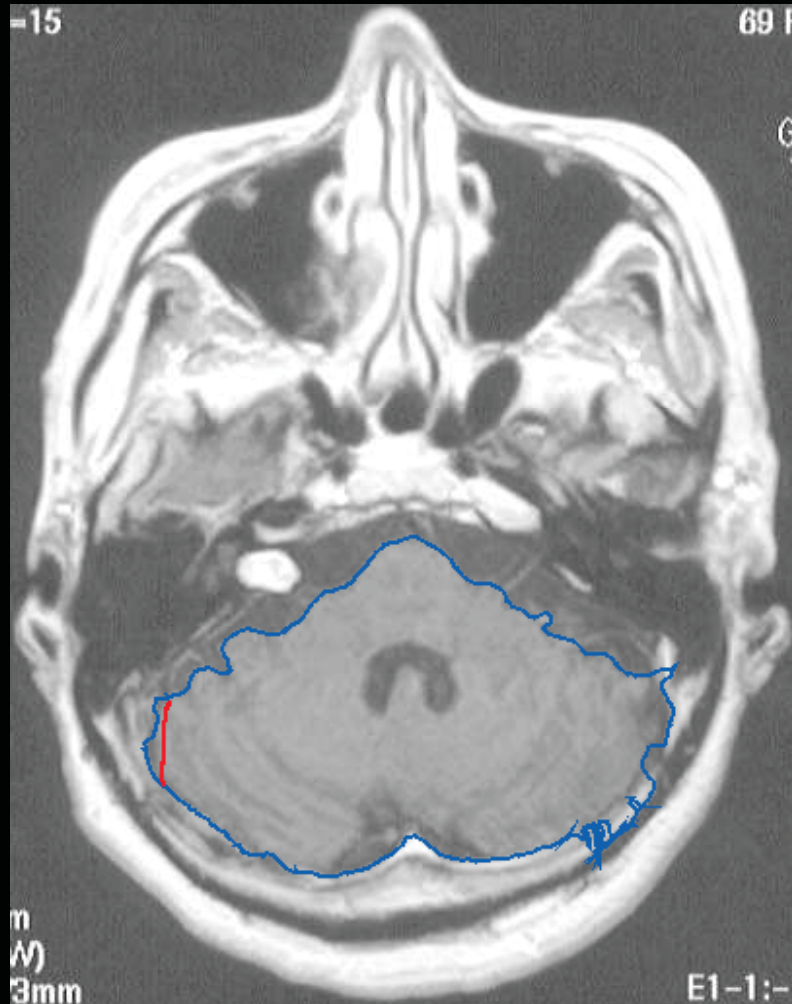
# Results



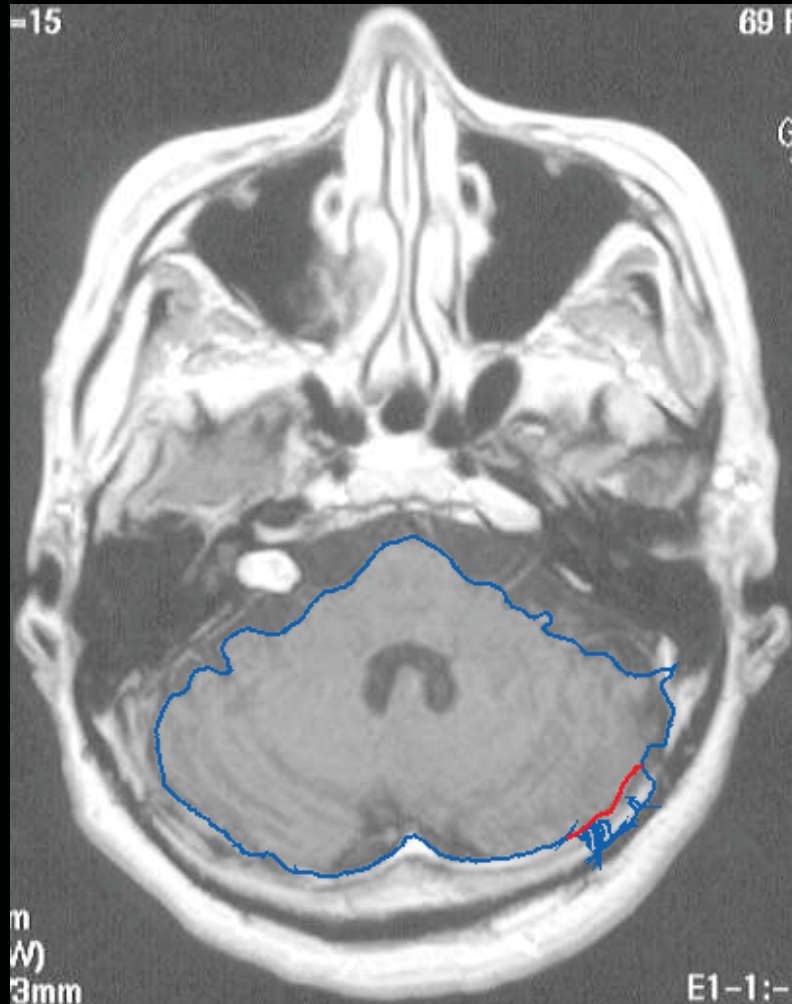
# Resultados



# Resultados

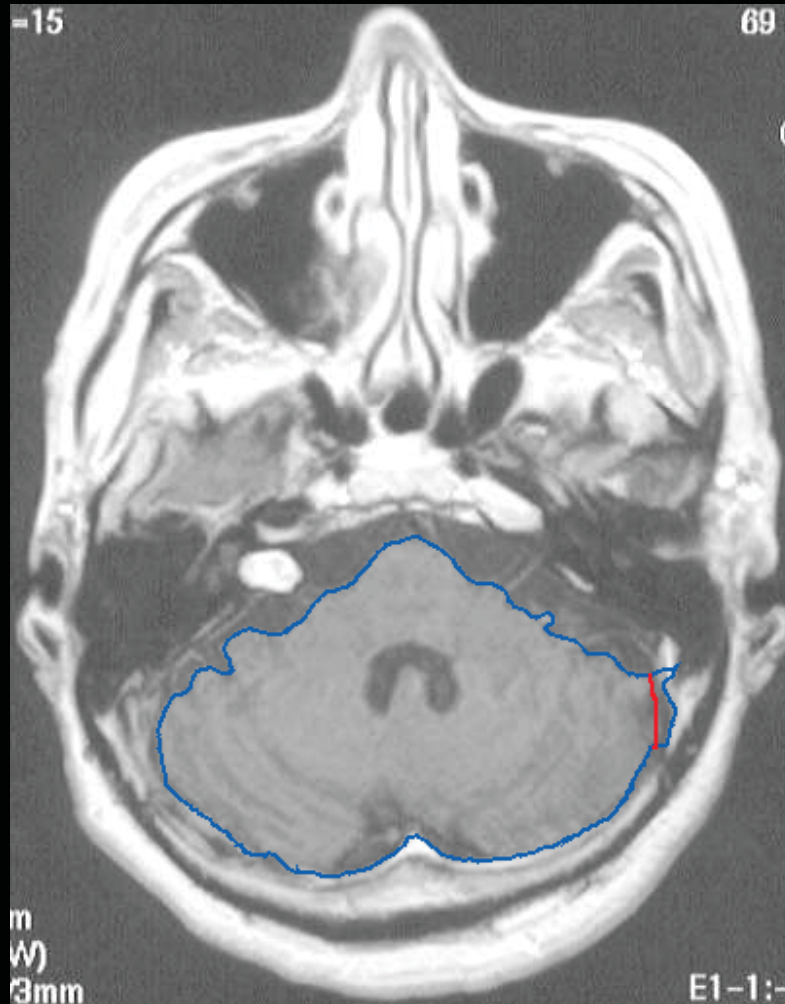


# Resultados

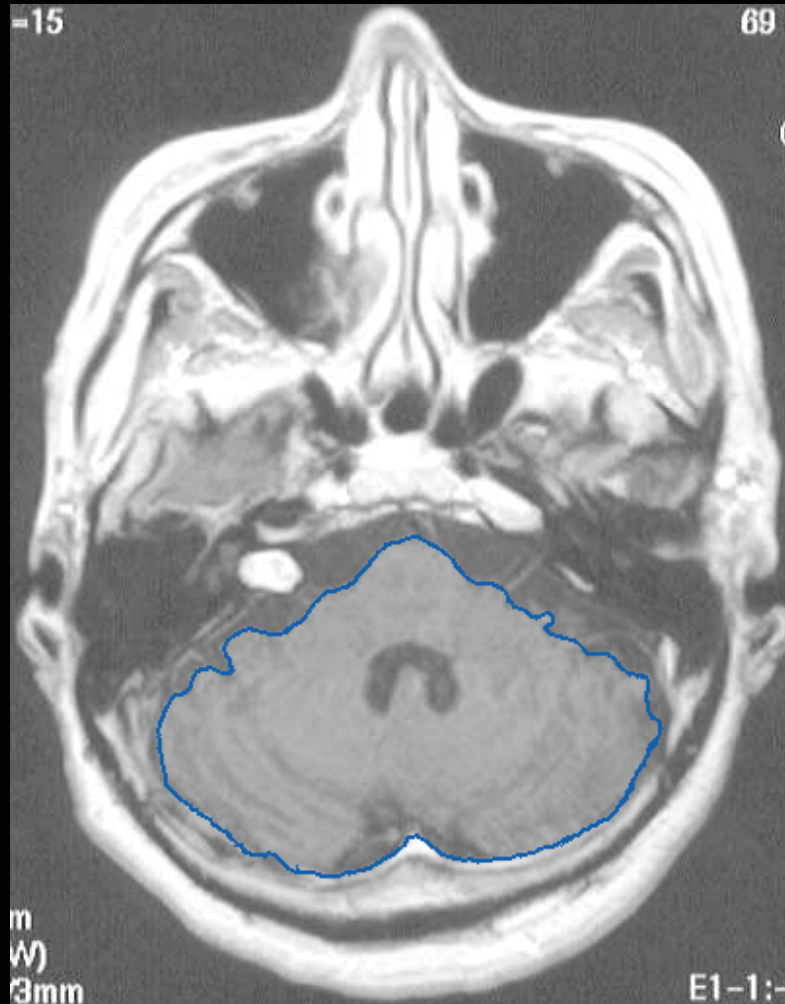




# Resultados

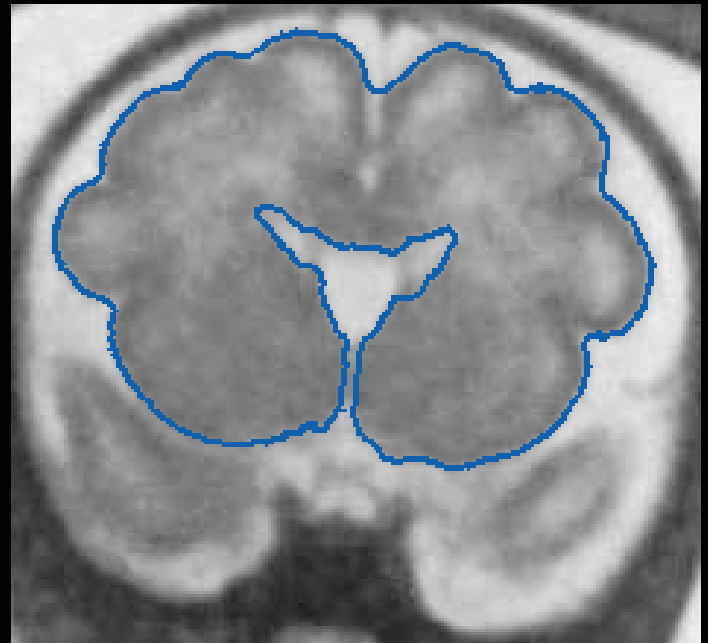
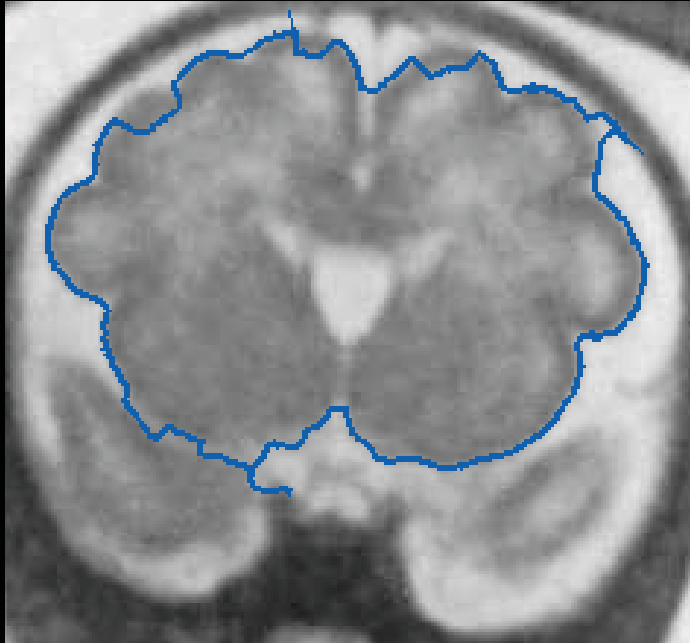


# Resultados



# Conclusions

- | Human in the loop improves segmentation







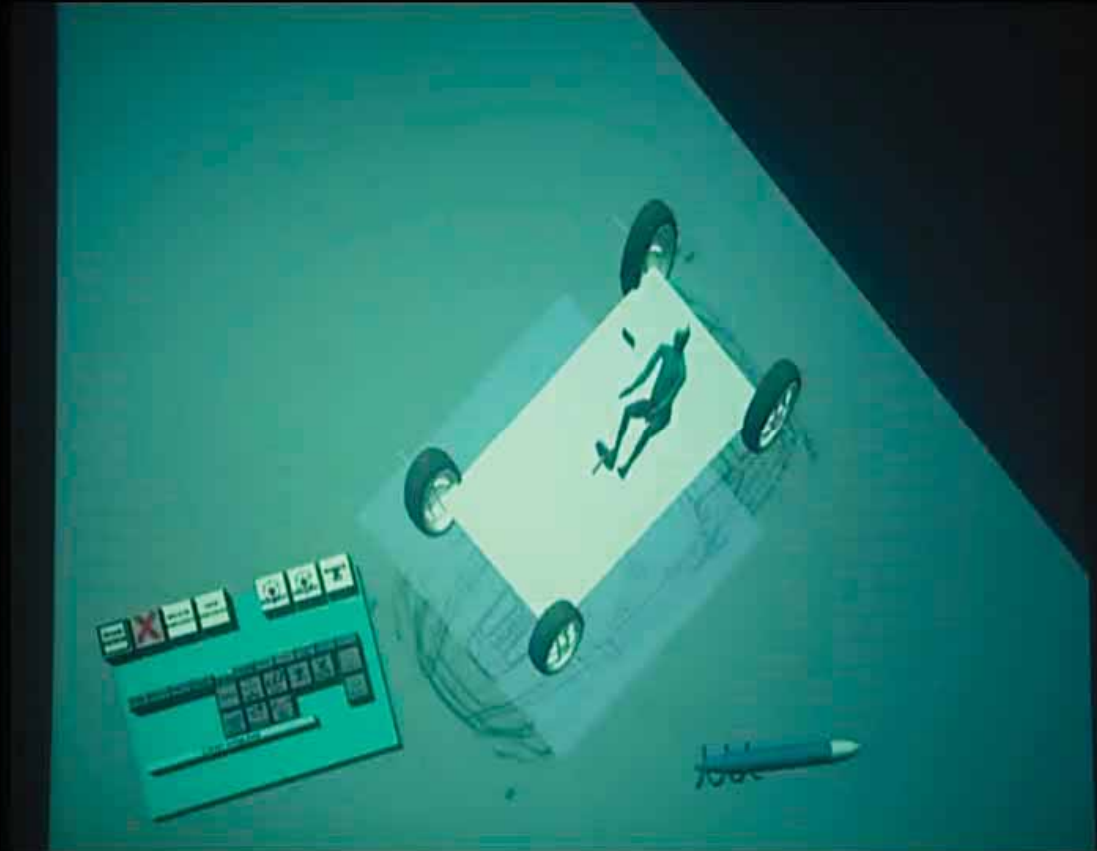
# *SKETCHING IN THREE DIMENSIONS*

# SketchAR Setup



# SketchAR free form sketching

- PIP/Pen
- Virtual Paper Metaphor
- Sketch on plane
- 3D pick/select/copy/move
- Mirror plane
- 3D Curve Sketching
- Skin Surface
- Snapping / Highlighting
- Animated pie menus
- Edit: Delete / Curve / Surface

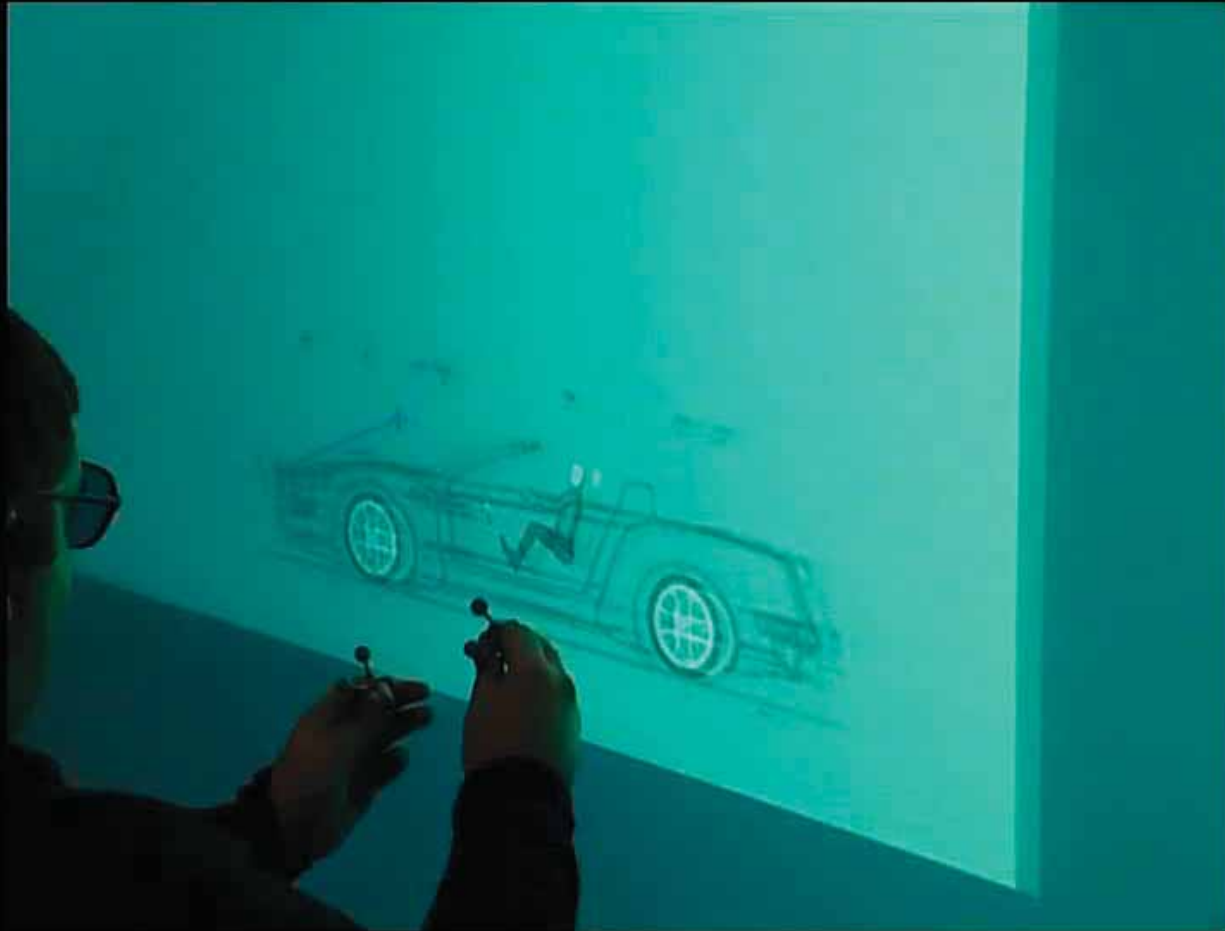


Background by  GIUGIARO

# ***2-Handed Virtual Taping***

- | Gadget-Free Interaction**
- | No Gloves, No Polhemus or other devices**
- | Camera-based optical tracking**
- | IR for precision, but could drop reflective tags in future**
- | GESTURES + Speech Commands**
- | Undo as backtracking gesture**

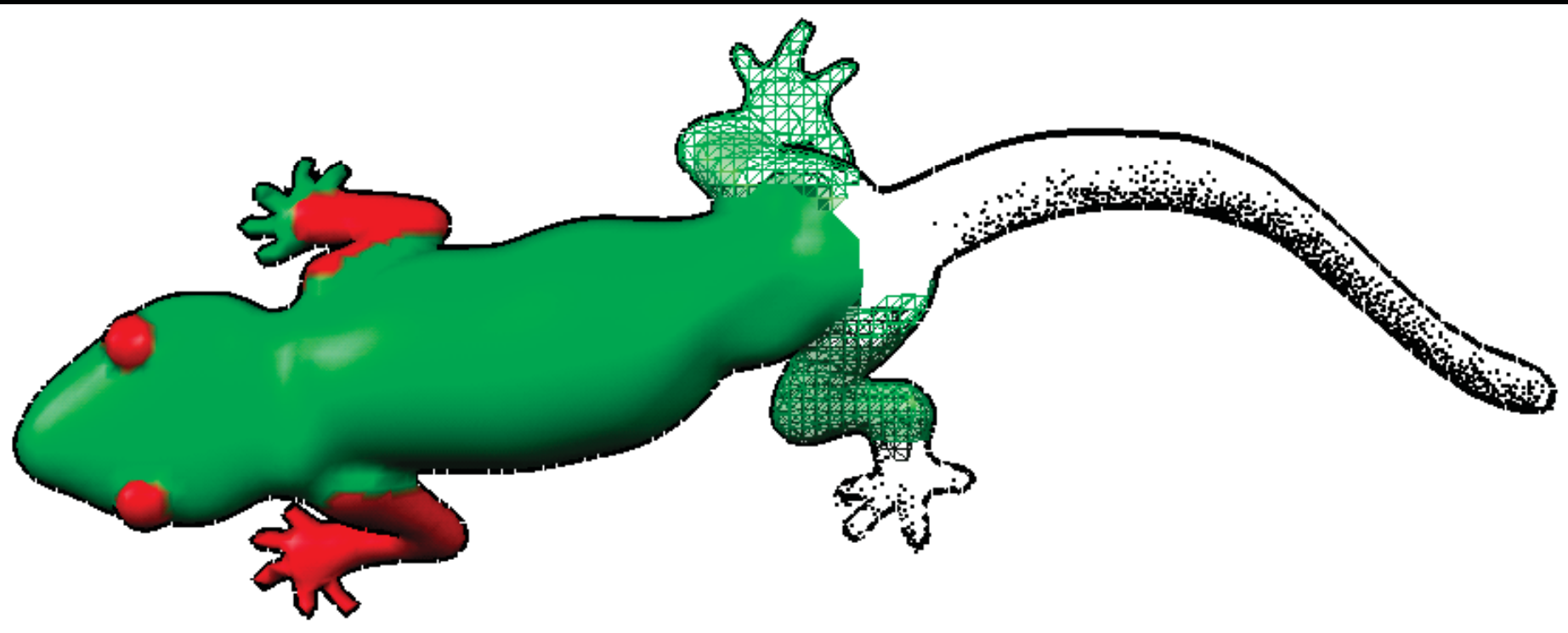
# 2-handed 3D Virtual Taping



Background by




# *Ongoing Work – Sketching Styles using BlobTree Cae 2009*





# IMPROVE

A man in a dark blue sweater and blue jeans is standing in front of a large-scale display. He is pointing at the display with his right hand. The display shows a 3D scene with a sphere and several cubes. The scene is rendered in a greenish-yellow color scheme. The display is composed of multiple panels, and the man is holding a small device in his left hand. The background is a plain wall.

**Interacting with Large Scale  
Displays  
FP6 European Project  
4096 x 2264 display**



# *Basic Ideas*



**Use Gestures**  
**Pointer/Based Interaction**  
**No clicking**  
**Marking menus**  
**See Video**

# ***RISCI Conclusions***

- | **Calligraphic Interfaces are good for you**
- | **Ambiguity is good. Errors are great!**
- | **Reduced Command Set ...**
- | **Yet surprisingly functional !**
- | **Expectation lists**
  - | **Self-disclosing**
  - | **User controls interaction**
- | **Sketches + Constraints = Drawings**

# *Things that work*

- | Sketching Interfaces expressive
- | Concise Commands
- | Human-in-the-loop better'n faster!
- | Combine Sketching with Recognition + Application (AI + NS)
  
- | Eurographics Sketch-Based Interfaces and Modeling (<http://www.eg.org/sbm>)
  - | Since 2004

# *Things that need extra work*

- | Precision needs external constraints to happen
- | Sketching is inherently 2D
- | Need support surface
- | Sketching in 3D not clearly a good thing
- | Non-self disclosing

# ***Take-Home ideas***

- | **Calligraphic Interfaces reduce complexity by focusing on familiar drafting techniques**
- | **Good for early stages of design**
- | **Make errors your friends**
- | **Reduce command set**

# Coda

- | Thanks for Listening!
- | Questions ?
- | Refs:
- | Research Group:
- | <http://vimmi.inesc.pt/>
- | Videos, papers, reports