

Annotation for Presentation: Integrating Text into Medical Illustrations

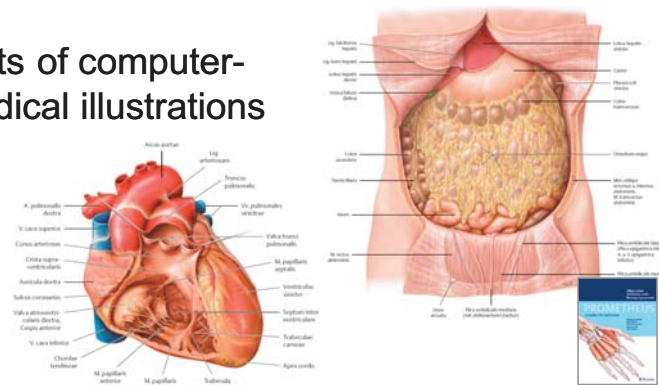
Timo Ropinski

Visualization and Computer Graphics Research Group (VisCG)
University of Münster, Germany

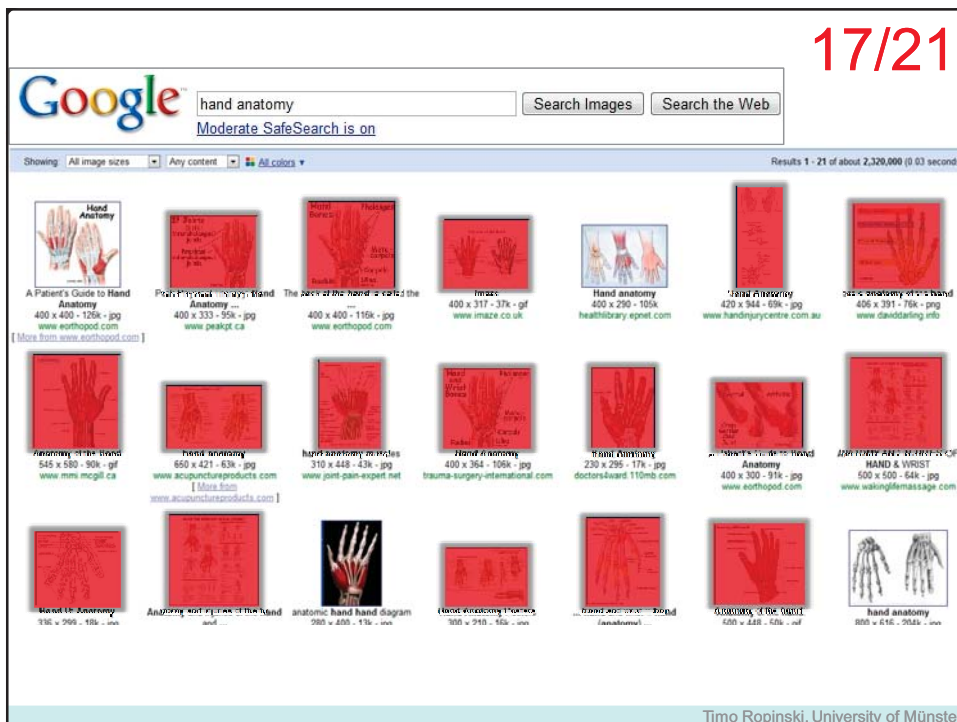
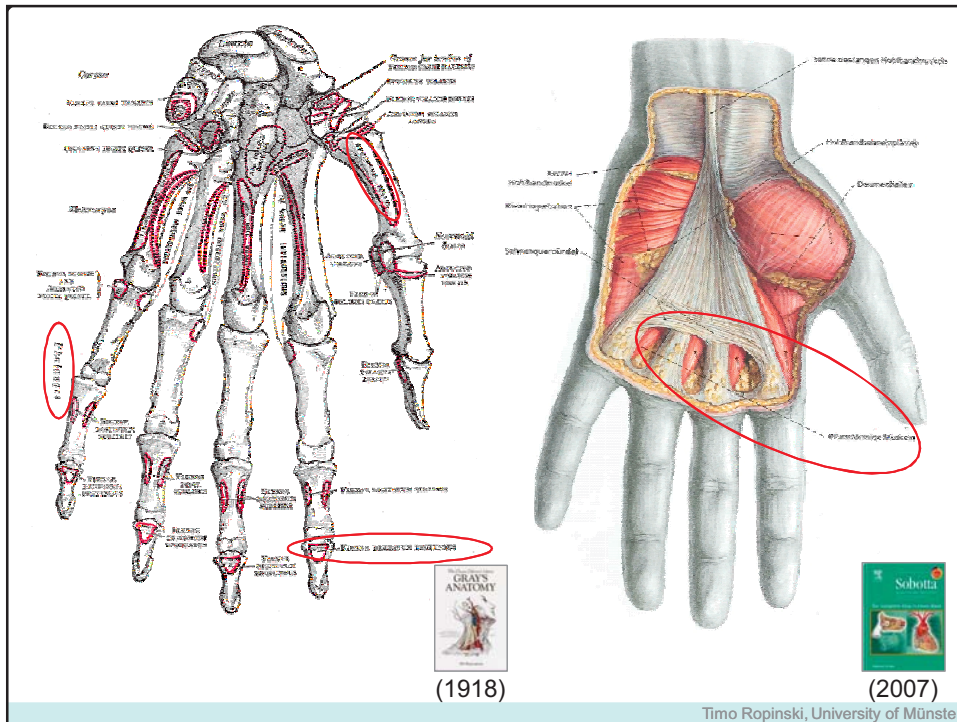


Medical Illustration

- Reduce visual **overload**
- Record and disseminates **medical knowledge**
- Visual elements of computer-generated medical illustrations
 - Shading
 - Cutting
 - Deformation
 - Annotation
 - ...



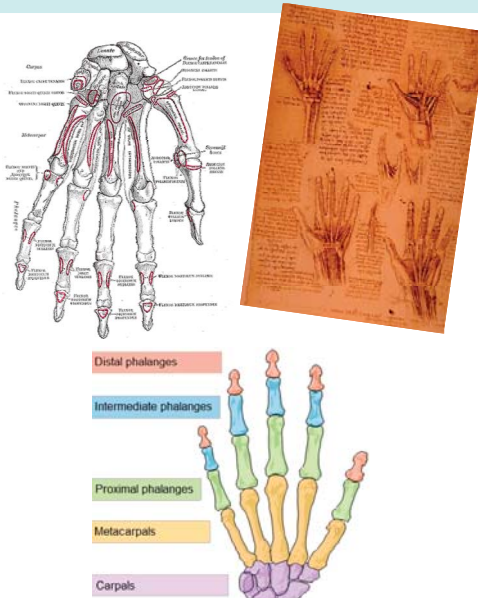
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Labeling Types

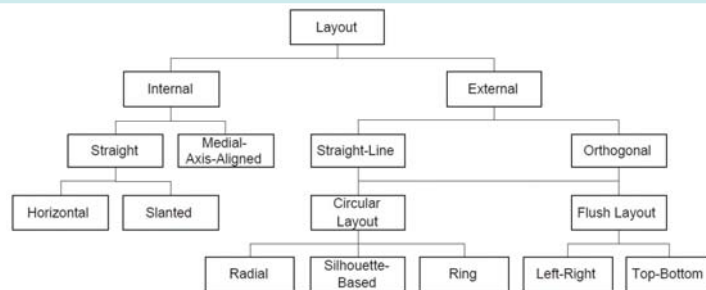
- External labels
- Internal labels

- Color legend
 - Good for clustering
 - Reduced shading cues
- Textual explanations

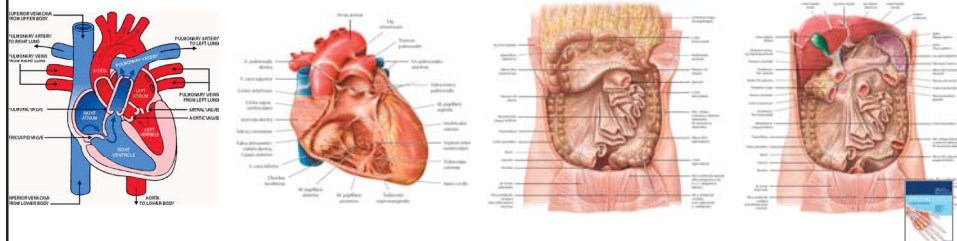


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Label Taxonomy



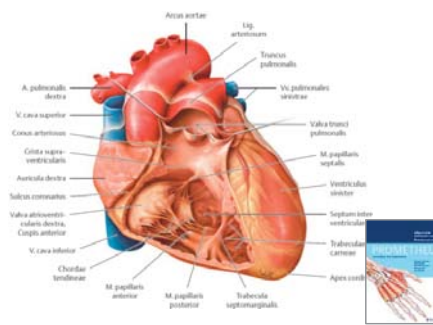
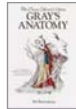
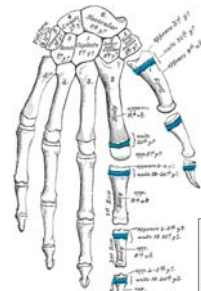
[Götzelmann et al., SG 2005]



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Internal vs. External Labeling

	Internal	External
Association with OOI	+	-
OOI occlusion	-	-
Readability	-	+
Perceptual aspects	proximity	connection



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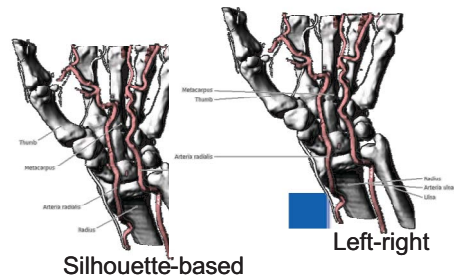
External Labeling

- External labels...
 - ...must **not overlap**.
 - ...must **not have crossing anchor lines**.
 - ...should **not occlude** other structures.
 - ...should be placed **close to their anchor points**.



[Brückner & Gröller Vis 2005]

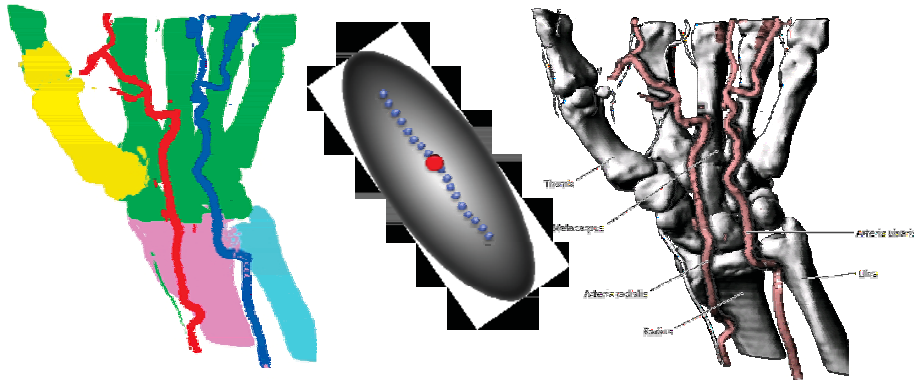
- Focus on *silhouette-base* and *left-right* layout
- Two-step layout algorithm
 1. Determine **anchor point**
 2. Compute **label position**



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1. Determine Anchor Points

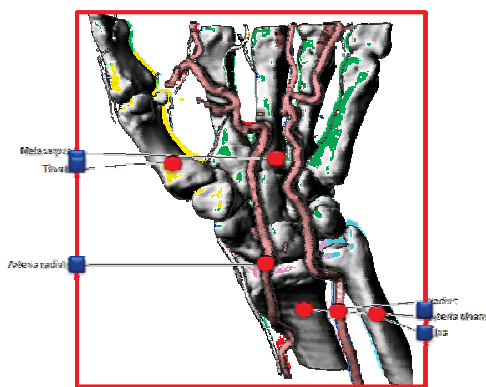
- Anchor points are *placed inside* the corresponding segments
- Can be determined by applying a *distance transform*



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2. Compute Label Position

- Left-right layout
 - Compute *axis-aligned bounding box* in image space

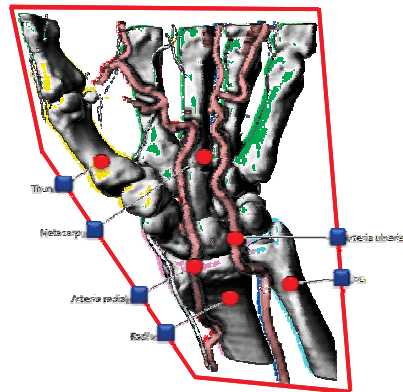


- + easy computation
- bad association

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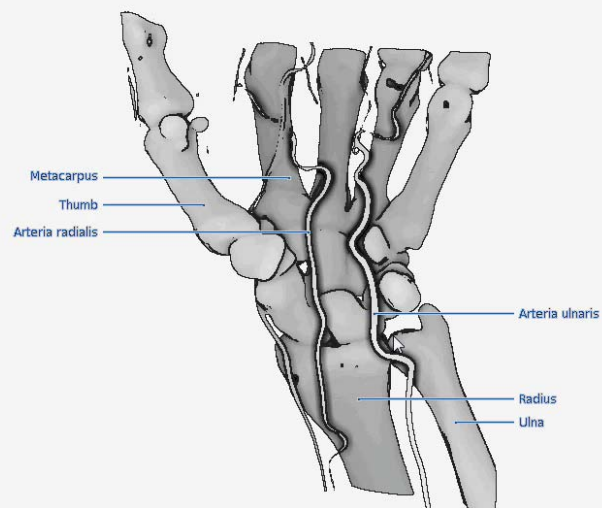
2. Compute Label Position

- Silhouette-based layout
 - Compute **convex hull** in image space



+ good association

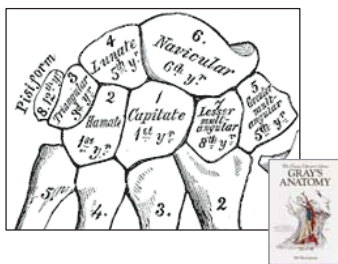
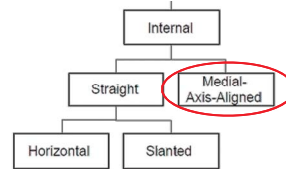
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Internal Labeling

- Internal labels...

- ... must **not occlude** each other.
- ... should support good **readability**.
- ... should **not intersect the silhouette** of the OOI.
- ... should **emphasize the structure** of the OOI.

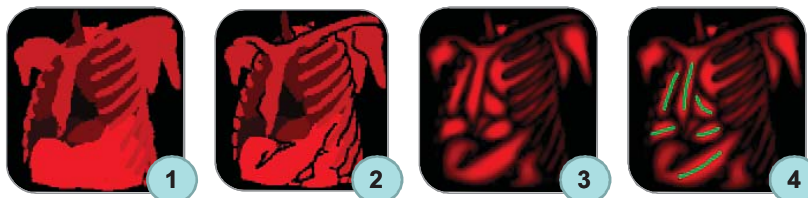


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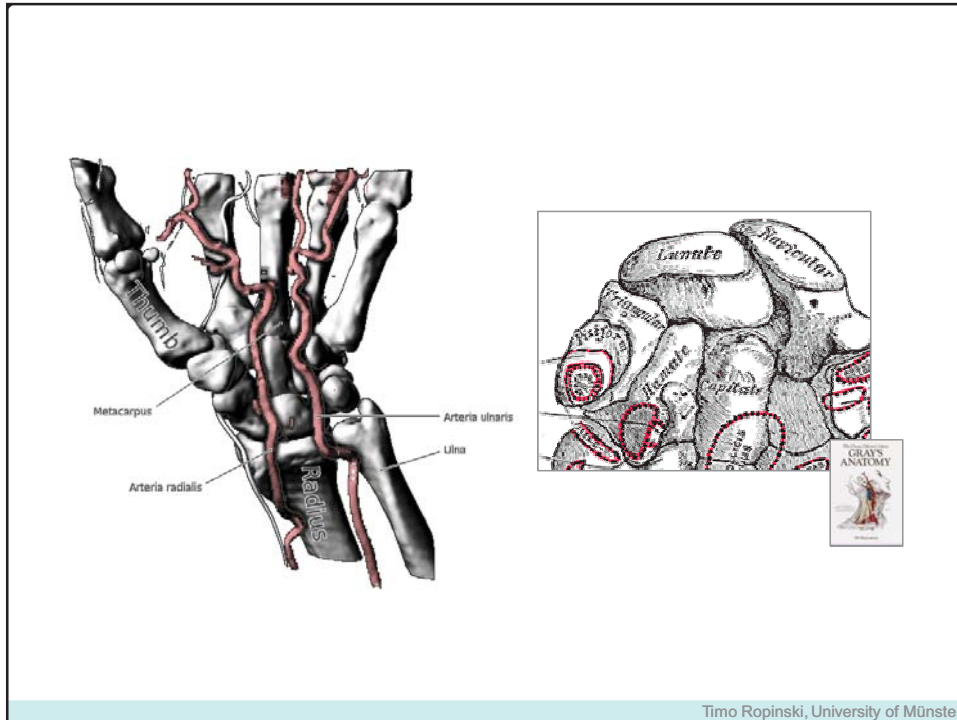
Medial-Axis-Alignment

- 2D shape fitting

1. Generation of an **ID map**
2. Identification of **ridges**
3. Generation of a **distance map**
4. **Medial-axis** determination



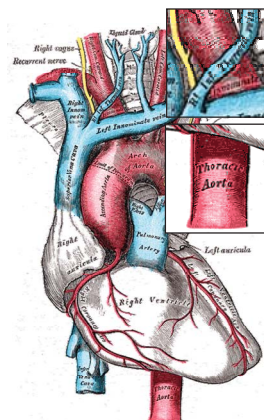
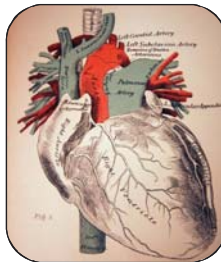
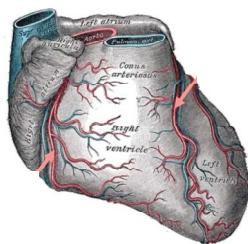
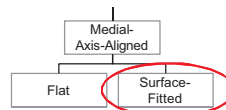
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Surface-Alignment

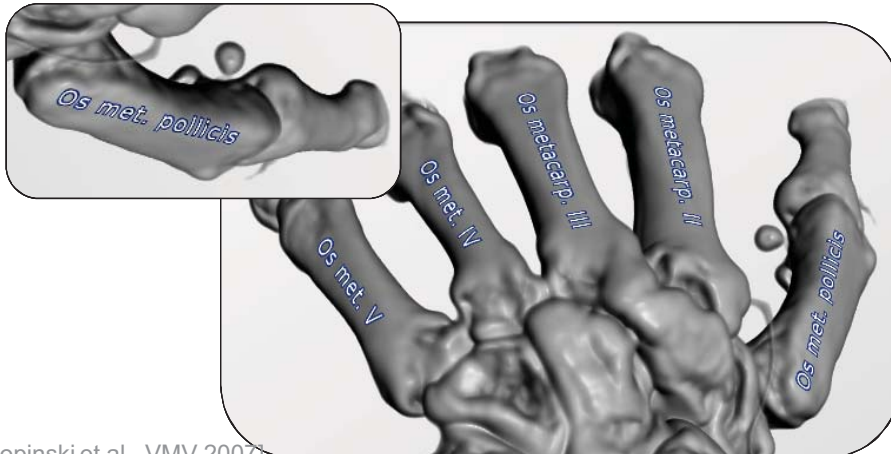
- 3D shape fitting
 - Exploit **improved association** of internal labels
 - Reduce drawbacks resulting from shape occlusion
- ⇒ **use distortion as visual element**



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Internal 3D Labeling

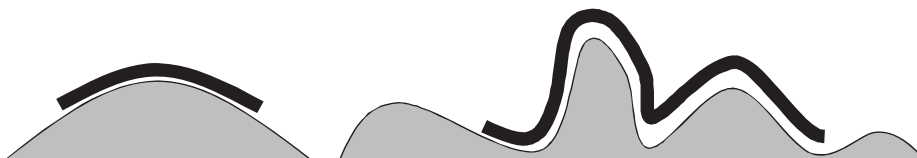
- Internal 3D labels should...
 - ... mimic **surface structures**.



[Ropinski et al., VMV 2007]

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Internal 3D Labeling

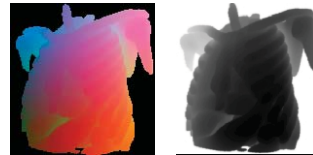


- Surface fitting requirements
 - Abstraction** from surface detail must be possible
 - Interactivity** desired

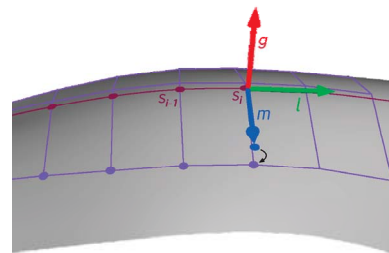
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3D Surface Fitting

- Problem: surface in most cases not given
 - Identification of the entry parameters at the object
 - Generation of a depth map



- Approximation of the surface by using Bezier-patches



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3D Surface Fitting

- Object borders may be crossed by labels



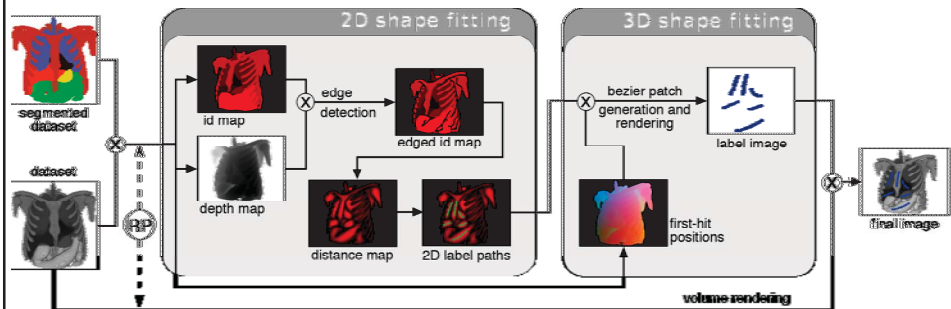
- Can be avoided through edge detection



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Algorithm Overview

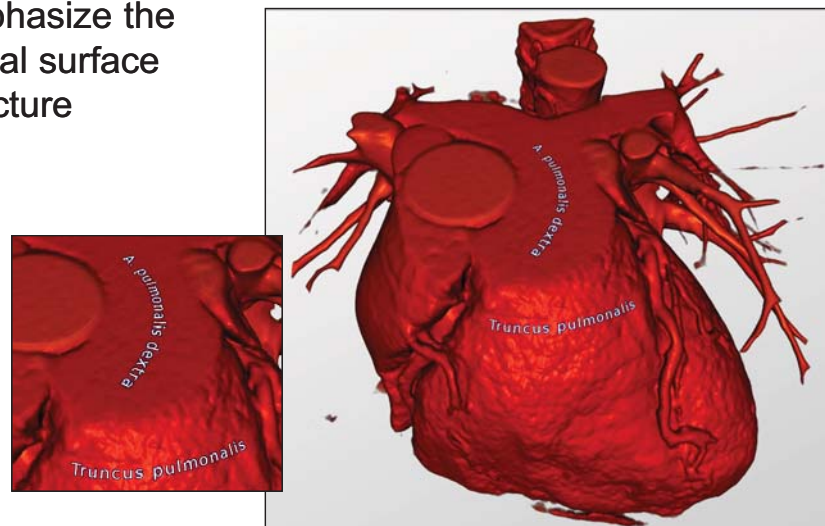
- Two main steps:
2D shape fitting & 3D surface fitting



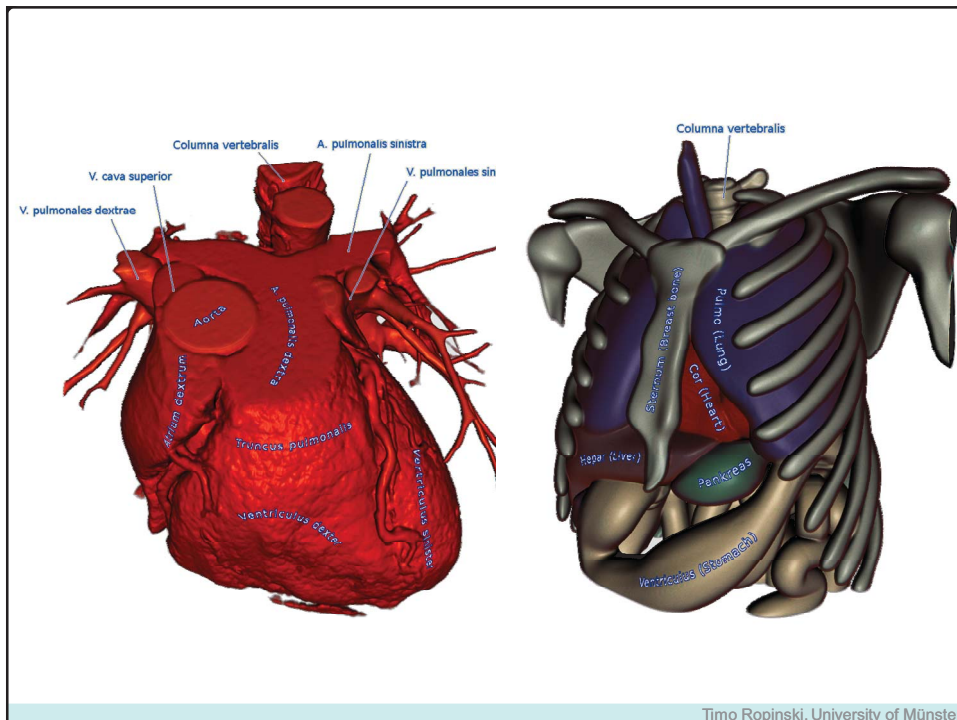
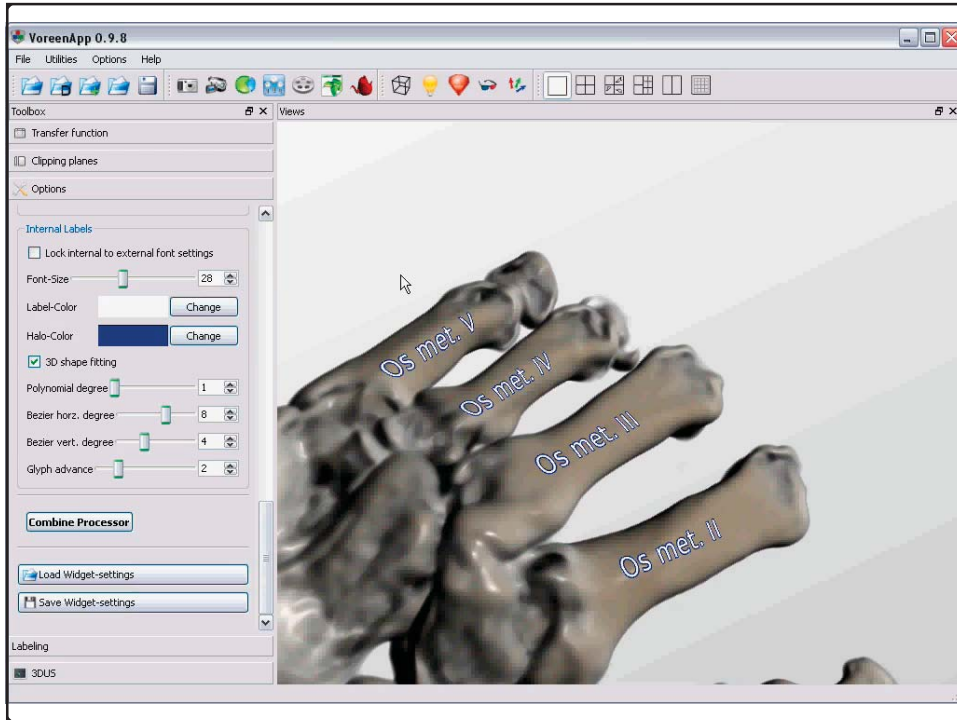
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2D/3D Comparison

- Emphasize the global surface structure



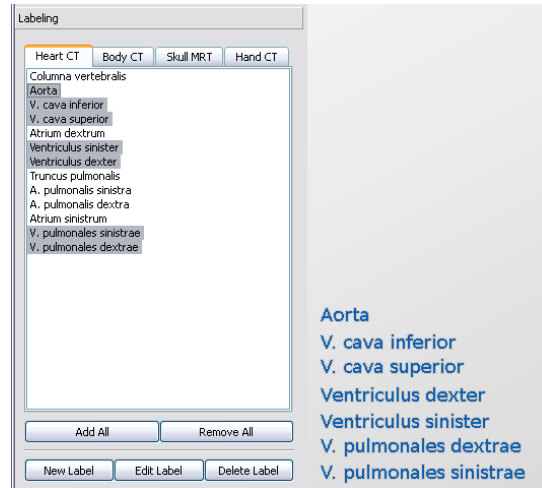
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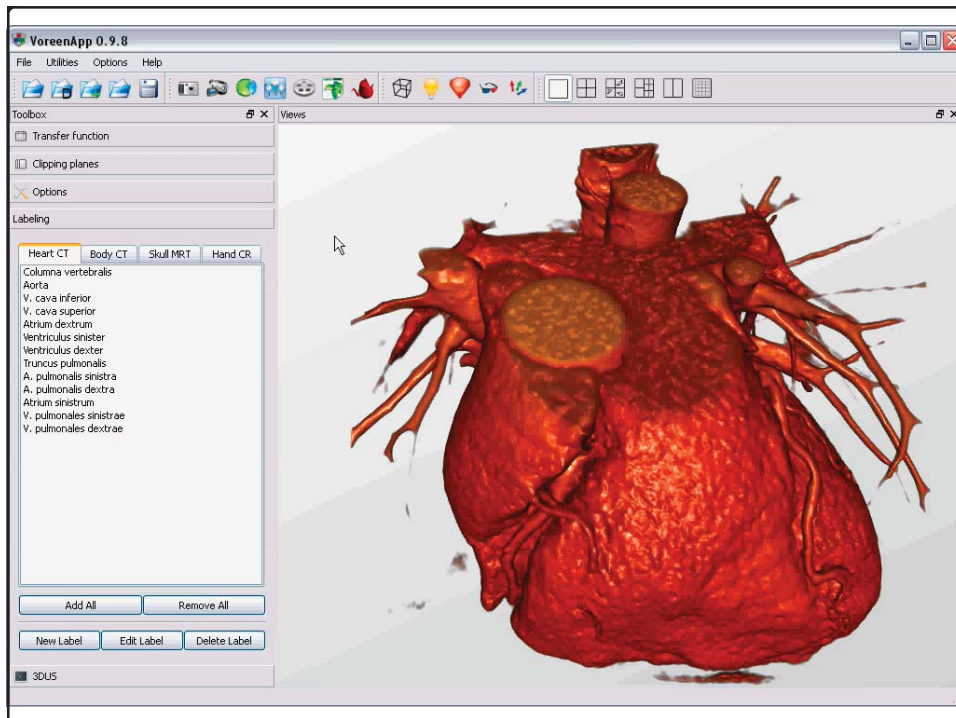
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Without Segmentation

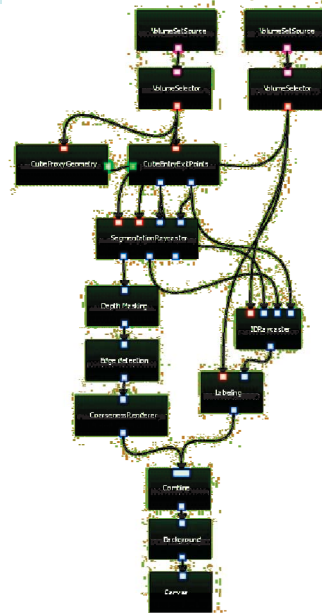
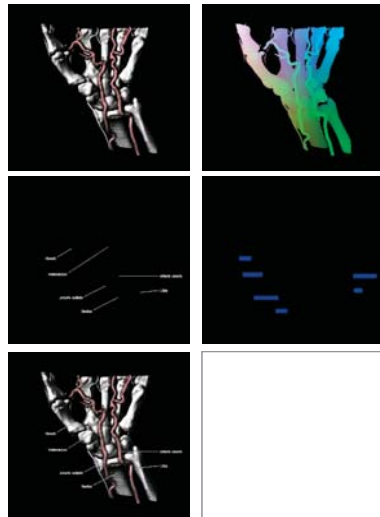
- Drag-and-drop labels out of a study set



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Technical Realization

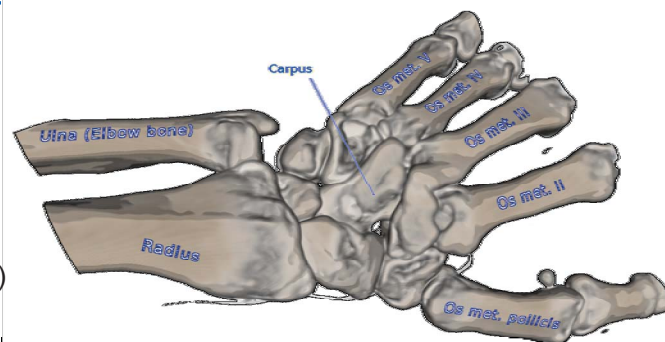


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Readability Remarks

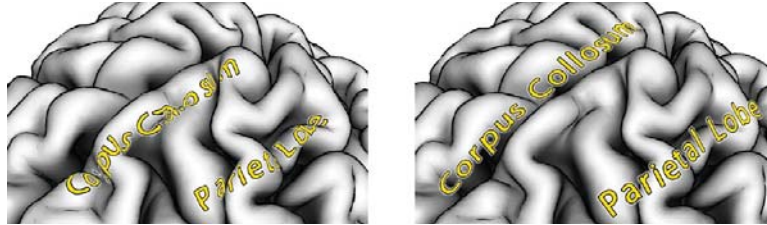
- Concept of **readability** can be applied to
 - the **individual labels**, or
 - the **whole illustration**

Carpus
 Os met. pollicis
 Os met. II
 Os met. III
 Os met. IV
 Os met. V
 Ulna (elbow bone)
 Radius

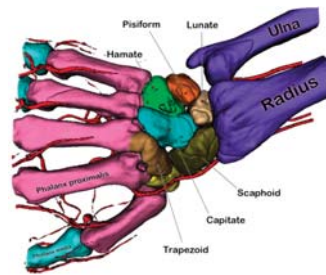


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Other Approaches



[Cipriano & Gleicher, Vis 2008]

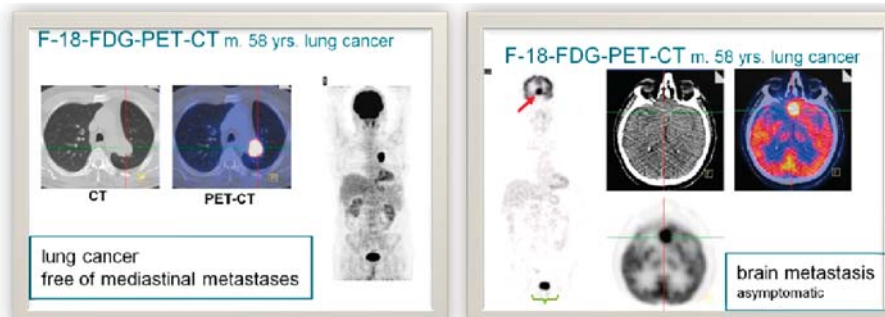


[Bürger et al., Vis 2008]

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Interactive Closeups

- To allow more text placement as well as **detail views**, objects may also be set apart
 - Interactively integrate **closeup regions**
 - Allow **additional text** integration

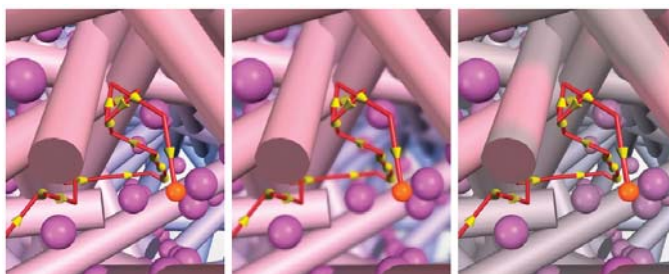


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What I didn't cover

- Image space **coherence** in interactive environments
- Integration of **dynamic graphical annotations**
 - Annotate function besides the structure
- Linking between **text and images**



[Falk et al., PaVis 2009]



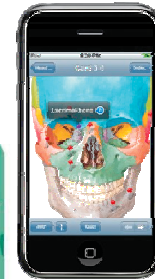
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Open Questions

- Better understanding of **perceptual aspects** of textual annotations
 - Improve readability on **small devices**
 - Discuss **limitations and benefits** of algorithmic labeling techniques
 - Develop **guidelines** for adequate labeling
-
- Produce audio books (=Hörbuch)



Blausen Human Atlas



Netter's Anatomy



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Thank You!

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