

AMCS / CS 247 – Scientific Visualization

Lecture 3: Introduction, Pt. 3

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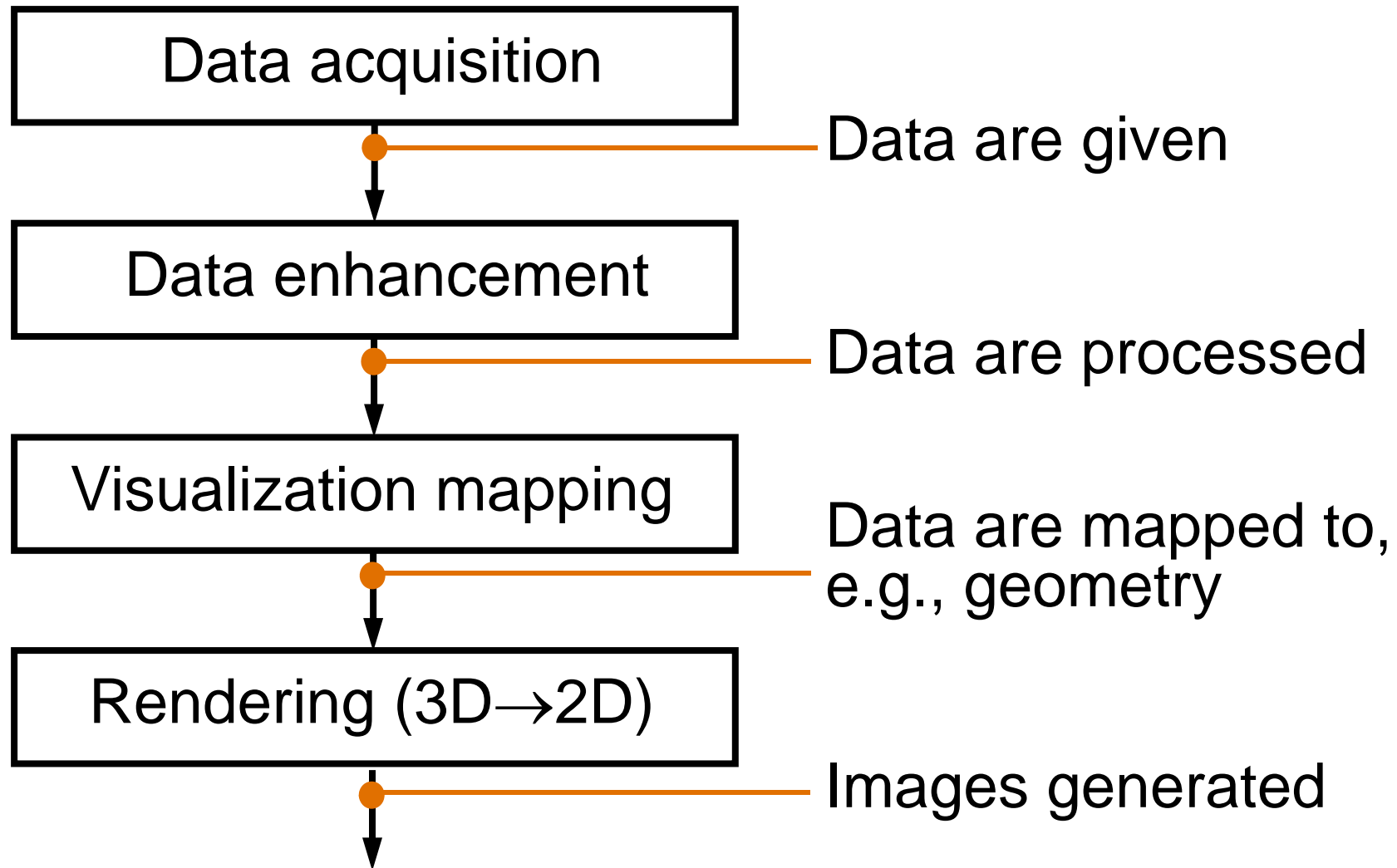
Reading Assignment #2 (until Sep 1)



Read (required):

- Data Visualization book, finish Chapter 2
- Data Visualization book, Chapter 3 until 3.2 (inclusive)
- Continue familiarizing yourself with OpenGL if you do not know it !

The Visualization Pipeline – Overview

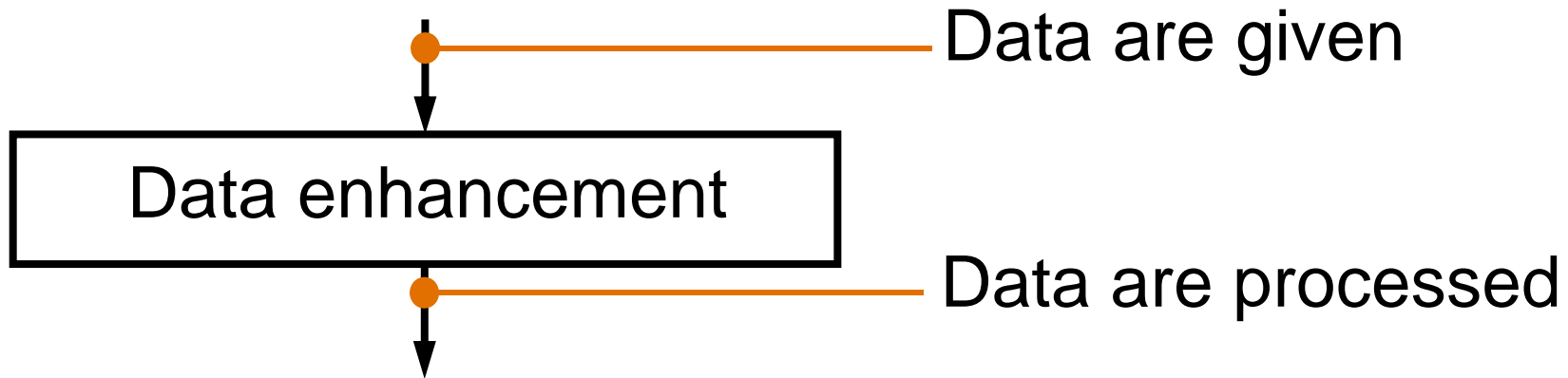


The Visualization Pipeline – Stage 1



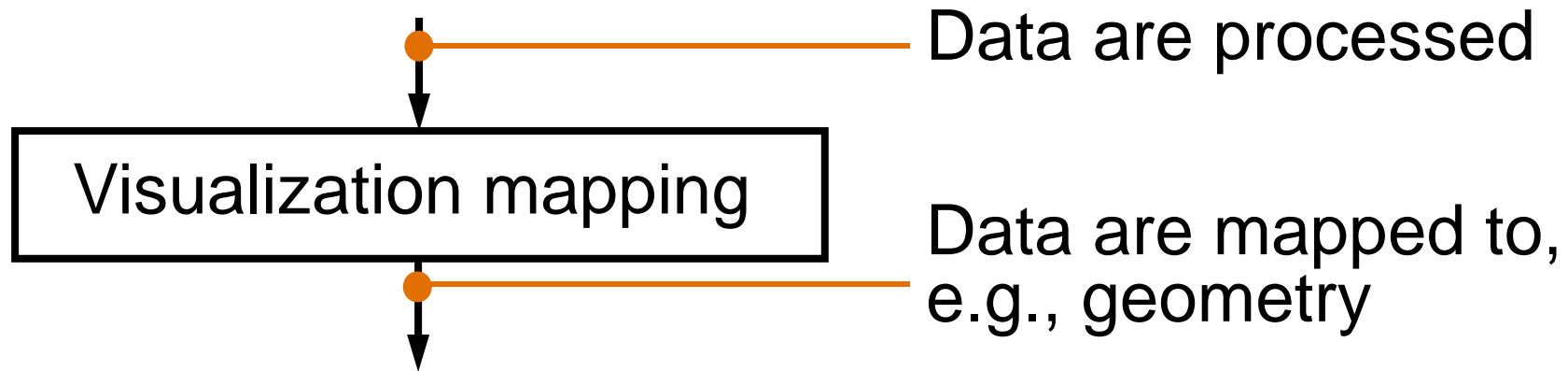
- Measurements, e.g., CT/MRI
- Simulation, e.g., flow simulation
- Modeling, e.g., game theory

The Visualization Pipeline – Stage 2



- Filtering, e.g, smoothing (de-noising, ...)
- Resampling, e.g., on a different-resolution grid
- Data derivation, e.g., gradients, curvature
- Data interpolation, e.g., linear, cubic, ...

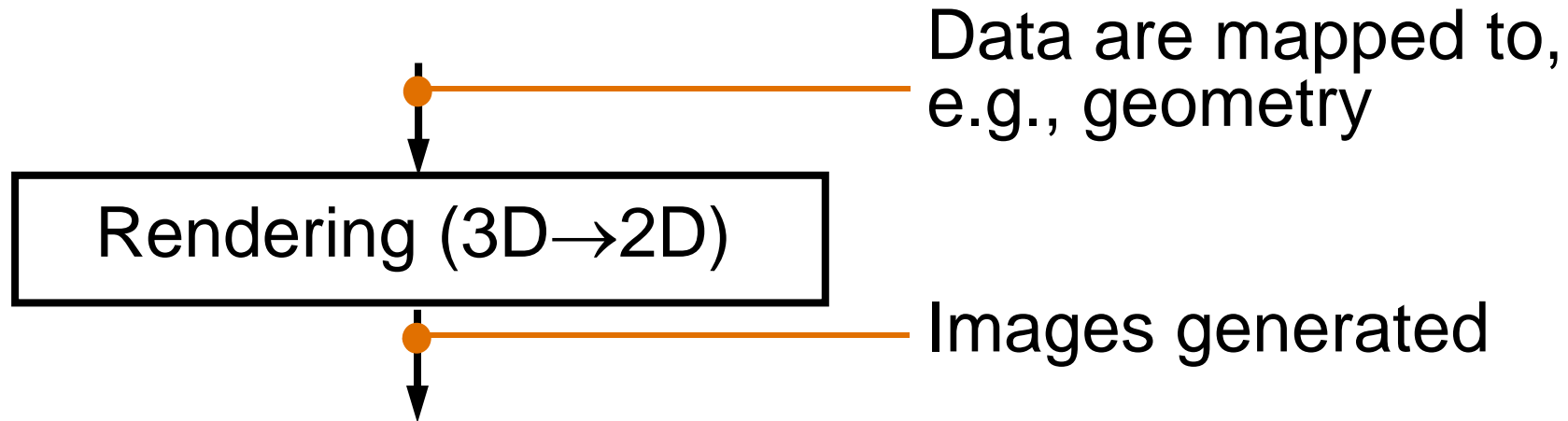
The Visualization Pipeline – Stage 3



Make data “renderable”

- Iso-surface calculation
- Glyphs, icons determination
- Graph-layout calculation
- Voxel attributes: color, transparency, ...

The Visualization Pipeline – Stage 4



Rendering = image generation with computer graphics

- Visibility calculation
- Illumination
- Compositing (combine transparent objects, ...)
- Animation

Data Generation, Visualization, Interaction



Coupling varies considerably:

- Data generation (data acquisition):
 - Measuring, simulation, modeling
 - Can take very long (measuring, simulation)
 - Can be very costly (simulation, modeling)
- Visualization (rest of visualization pipeline):
 - Data enhancement, visualization mapping, rendering
 - Depending on computer, implementation: fast or slow
- Interaction (user feedback):
 - How can the user intervene, vary parameters

Passive Visualization



All three steps separated:

- Off-line data generation

- Measurements
- Simulation
- Modeling

- Off-line Visualization

- Previously generated data are visualized
- Result: video or images/animation

- Passive Visualization

- Viewing of the visualization results



Interactive Visualization



Only data generation is separated:

- Off-line data generation

- Measurements, Simulation, Modeling

- Interactive visualization

- Previously generated data are available
- Visualization program allows interactive visualization of the data
- Possibilities:
choice, variation, parameterization of the visualization technique
- Nowadays widespread
- Focus of this course!



Interactive Steering



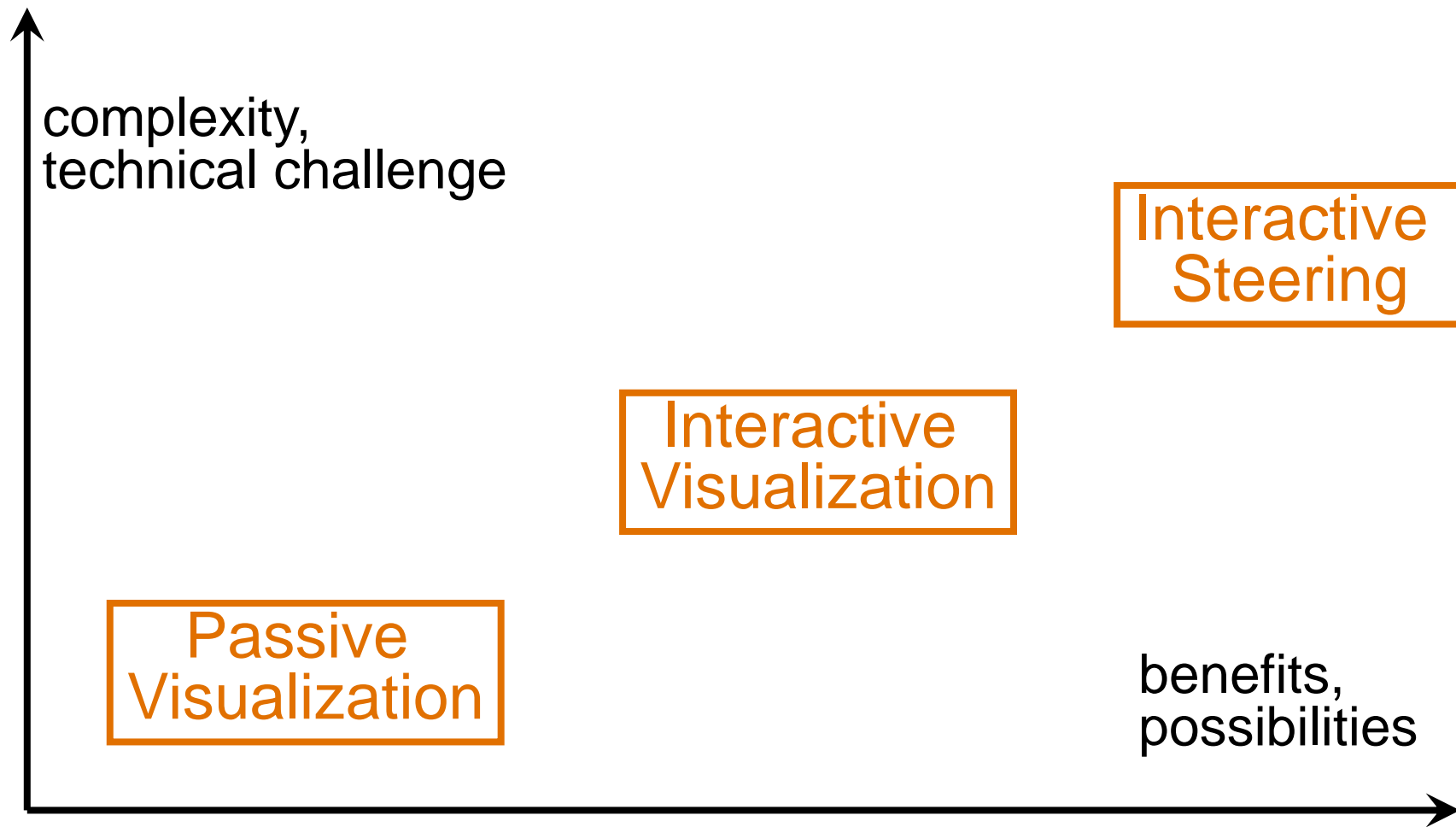
All three steps coupled:

- **Interactive steering**

- Simulation and/or modelling (measuring) generate data “on the fly”
- Interactive visualization allows “real-time” insight into the data
- Extended possibilities:
user can interfere with the simulation and/or the modeling, change the design, ...
- Often requires lots of effort, very costly



Visualization Scenarios



Thank you.

Thanks for material

- Helwig Hauser
- Eduard Gröller
- Daniel Weiskopf
- Torsten Möller
- Ronny Peikert
- Philipp Muigg
- Christof Rezk-Salama