King Abdullah University of Science and Technology

KAUST

AMCS / CS 247 – Scientific Visualization
Lecture 2: Introduction, Pt. 2

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Reading Assignment #1 (until Aug 31)

Read (required):

- Data Visualization book, Chapter 1
- Data Visualization book, Chapter 2 until 2.3 (inclusive)
- Download and look at:
  NIH/NSF Visualization Research Challenges report

  `http://tab.computer.org/vgtc/vrc/`
  `NIH-NSF-VRC-Report-Final.pdf`

- Start familiarizing yourself with OpenGL if you do not know it !

Lecture Structure and Grading

Lectures

Weekly reading assignments (required + optional)

- Part of quiz questions (see below)

Programming assignments

- 5 programming assignments; short written report + personal presentation for each

Quizzes

- 4 quizzes, 30 min each;
  announced a week in advance, roughly every 3-4 weeks
- From lectures, (required) reading assignments, programming assignments

Grading: 60% programming assignments; 40% quizzes

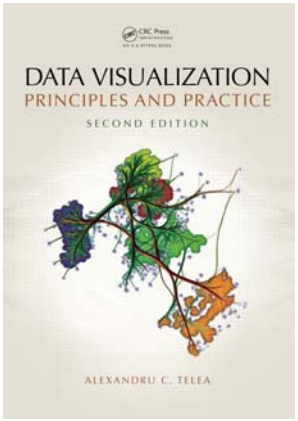
No mid-term/final exam!

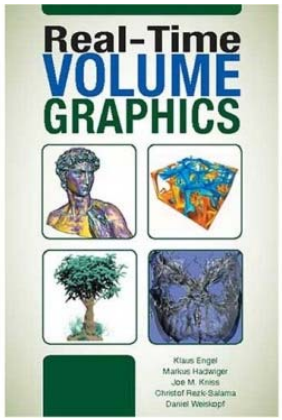
Resources

Course webpage:
`http://faculty.kaust.edu.sa/sites/markushadwiger/Pages/CS247.aspx`

Textbooks:

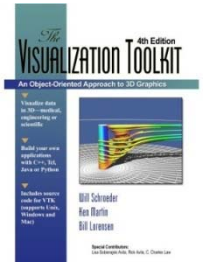
- Data Visualization: Principles and Practice
- Real-Time Volume Graphics

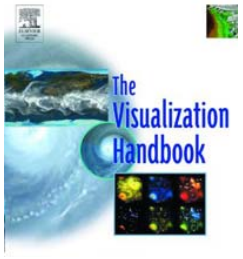


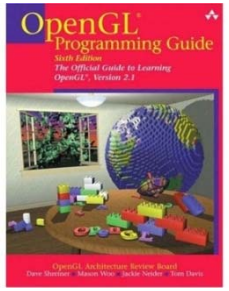


Additional books:

- The Visualization Toolkit:
  An Object-Oriented Approach
  to 3D Graphics (4th Edition)
- The Visualization Handbook
- OpenGL Programming Guide (8th edition, OpenGL 4.3)
  `www.opengl.org/documentation/red_book/`







For GPU, GPGPU, and graphics programming, also look here:

`http://faculty.kaust.edu.sa/sites/markushadwiger/Pages/CS380.aspx`

Programming Assignments (1)

5 assignments

- Based on C/C++ and OpenGL

  (if you know CUDA or OpenCL, you can also use it)

Organization

1. Use *bitbucket/git* to get material and submit solution (**`bitbucket.org/kaust_cs247/cs247_2015`**)
2. Get assignment info and framework by forking the git project
3. Separate Q&A session for each assignment (attendance optional)
4. Submit solution and report via git by submission deadline (Sundays)
5. Personal presentation after submission (Tuesday afternoon after deadline)

Programming Assignments (2)

- Submit via *bitbucket+git* at the latest on day the assignment is due (code, libs, everything that is needed to run your program)

- Submission must include short report (2 pages, pdf), including short explanation of algorithms, your solution, problems, how to run it, screenshots

- Personal presentations (Tuesday after submission), present your program live and explain source code (10-15 min)
  - Sign up for presentation slot in advance
  - Use your own laptop (preferred!) or test on lab machine to guarantee it runs!

Programming Assignments (3)

Grading

- Submission complete, code working for all the required features
- Documentation complete (report, but also source code comments!)
- Personal presentation
- Optional features, coding style, clean solution
- Every day of late submission reduces points by 10%
- No direct copies from the Internet!
  You have to understand what you program:
  your explanations during the presentations will be part of the grade!

Programming Assignment #1

Lab sign-up

- Setup bitbucket account, fork repository — until Aug 30
- You can a git client, e.g., from http://git-scm.com/downloads

Q&A assignment 1:

- Aug 30 (Sun) 17:00 – 18:00, Bldg 1, Room 2114

Deadline assignment 1:

- Volume slice viewer — due: Sep 6

Programming Assignment #1: Slice Viewer

Basic tasks

- Load volume data
- Specify volume data as OpenGL 3D texture
- Display slice

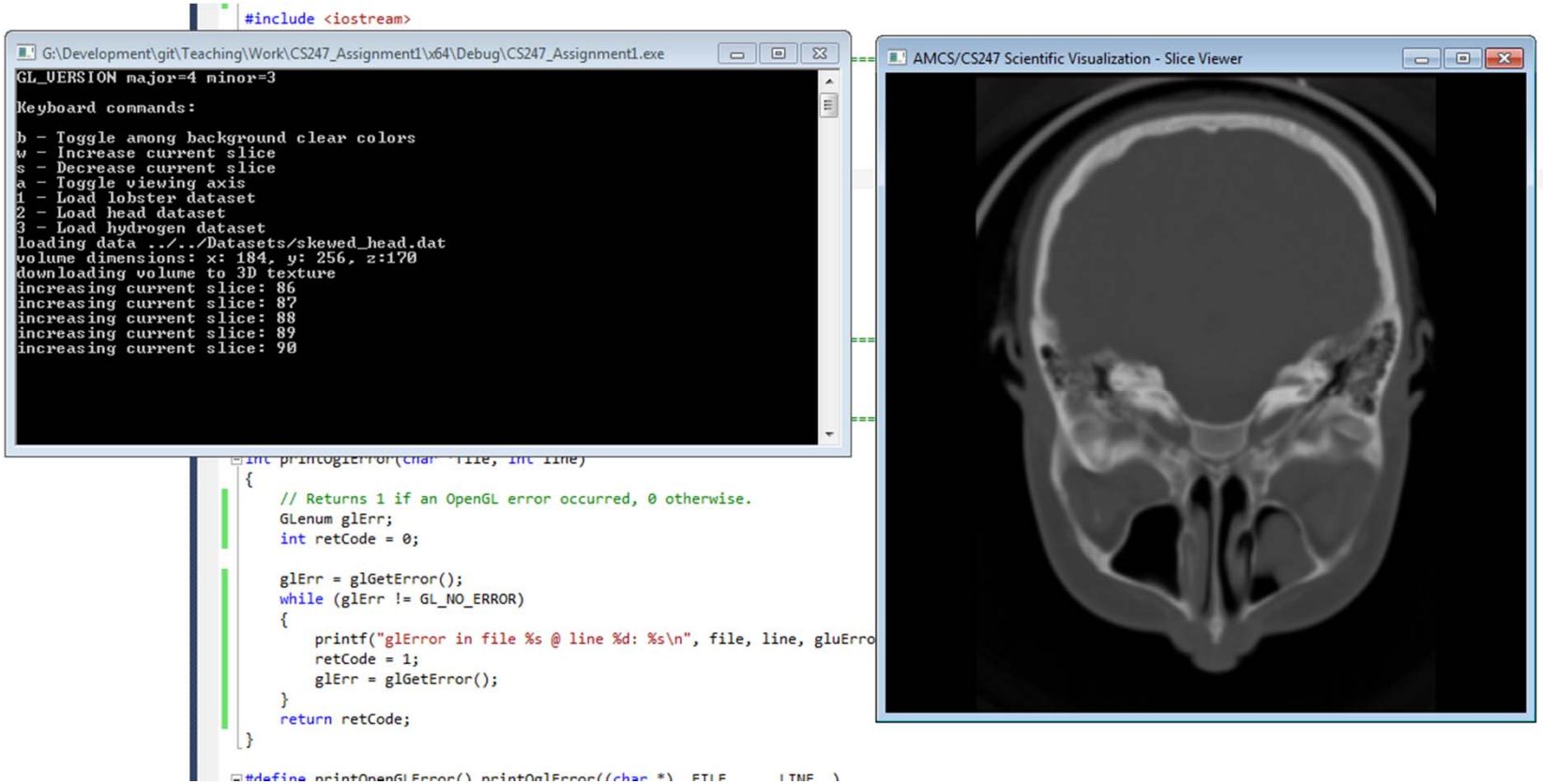
Minimum

- Show one view, for the selected major axis
- Selectable: major axis, slice position
- Make sure the aspect ratio is correct

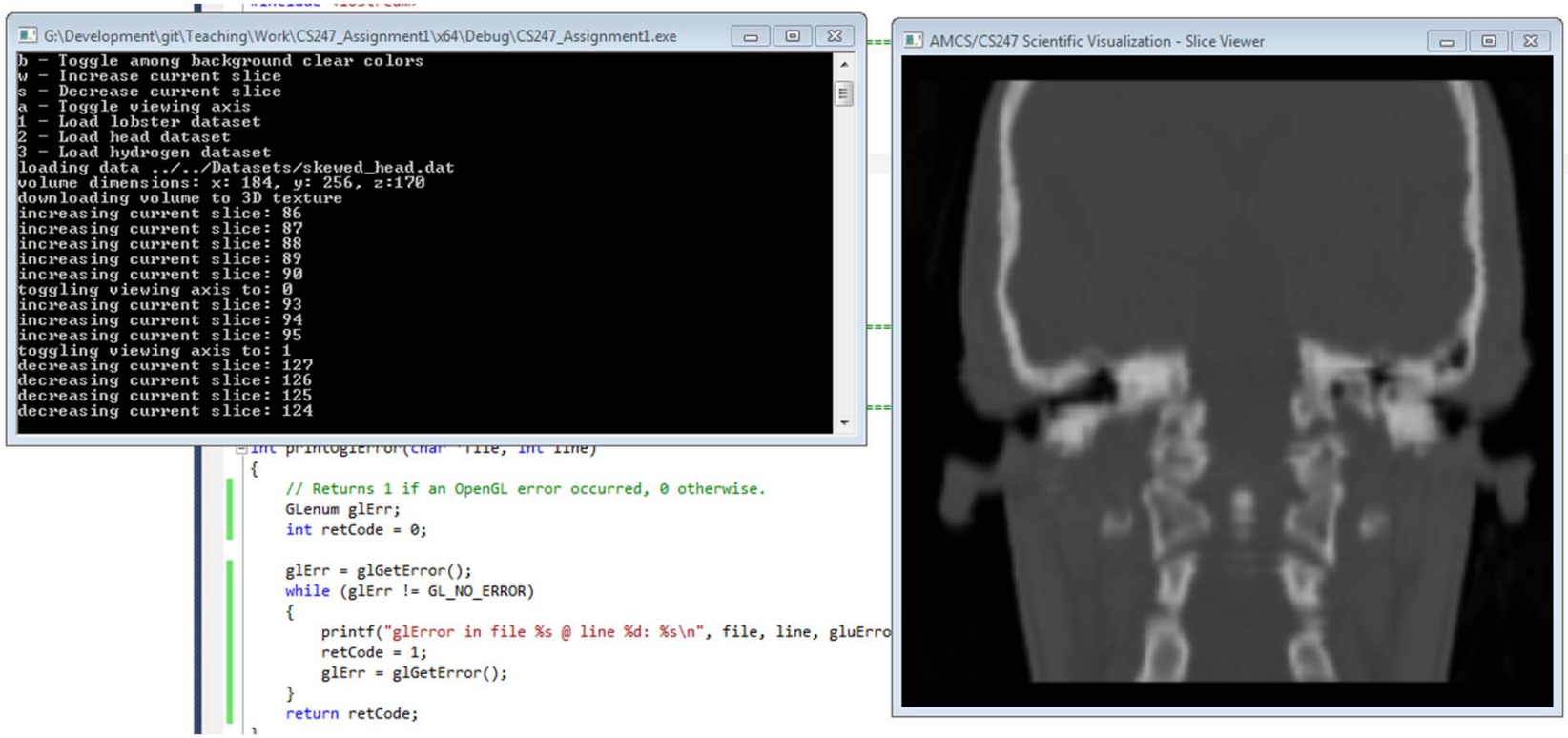
Bonus

- Show all three views simultaneously
- Allow arbitrary slice plane orientations

Programming Assignment #1 Example



Programming Assignment #1 Example



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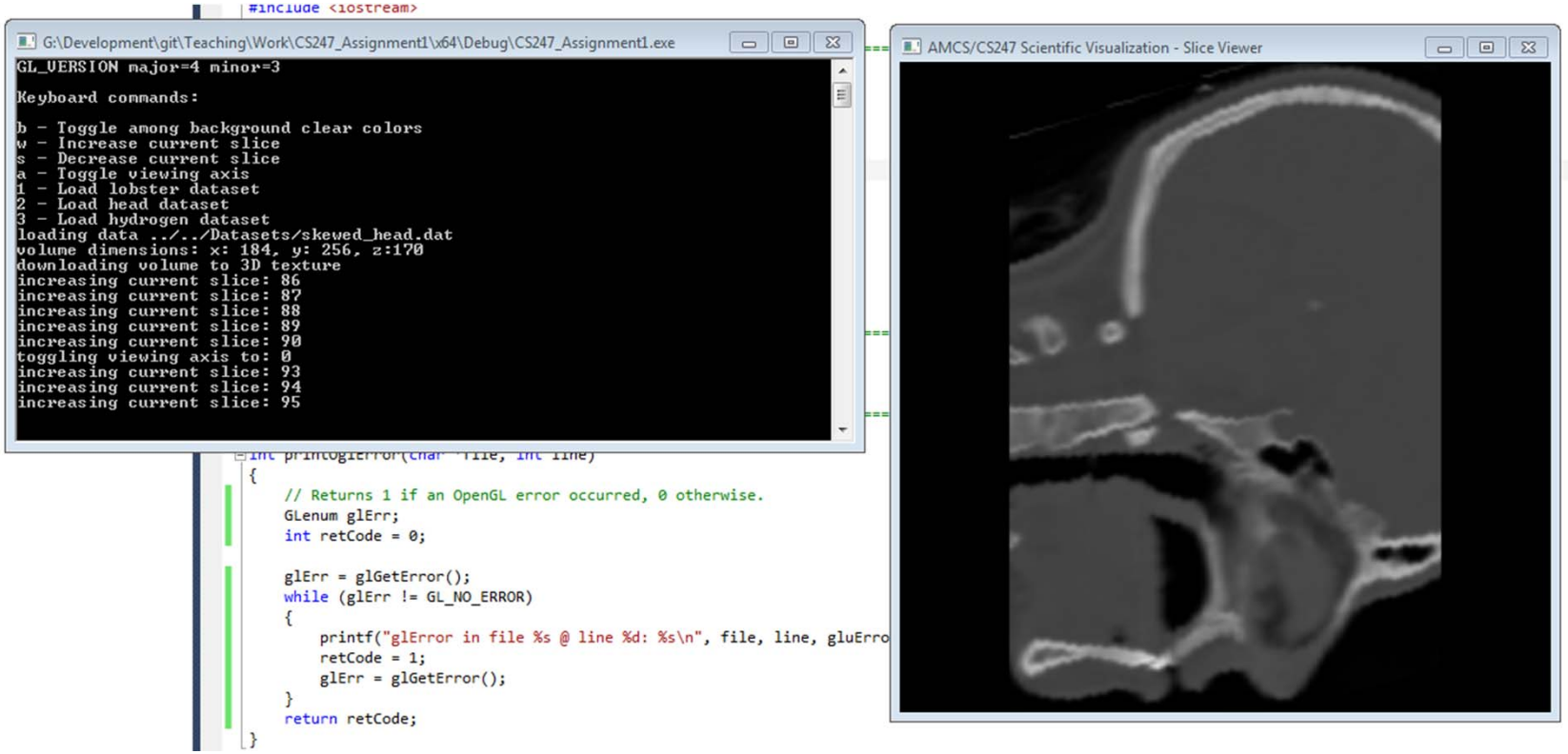

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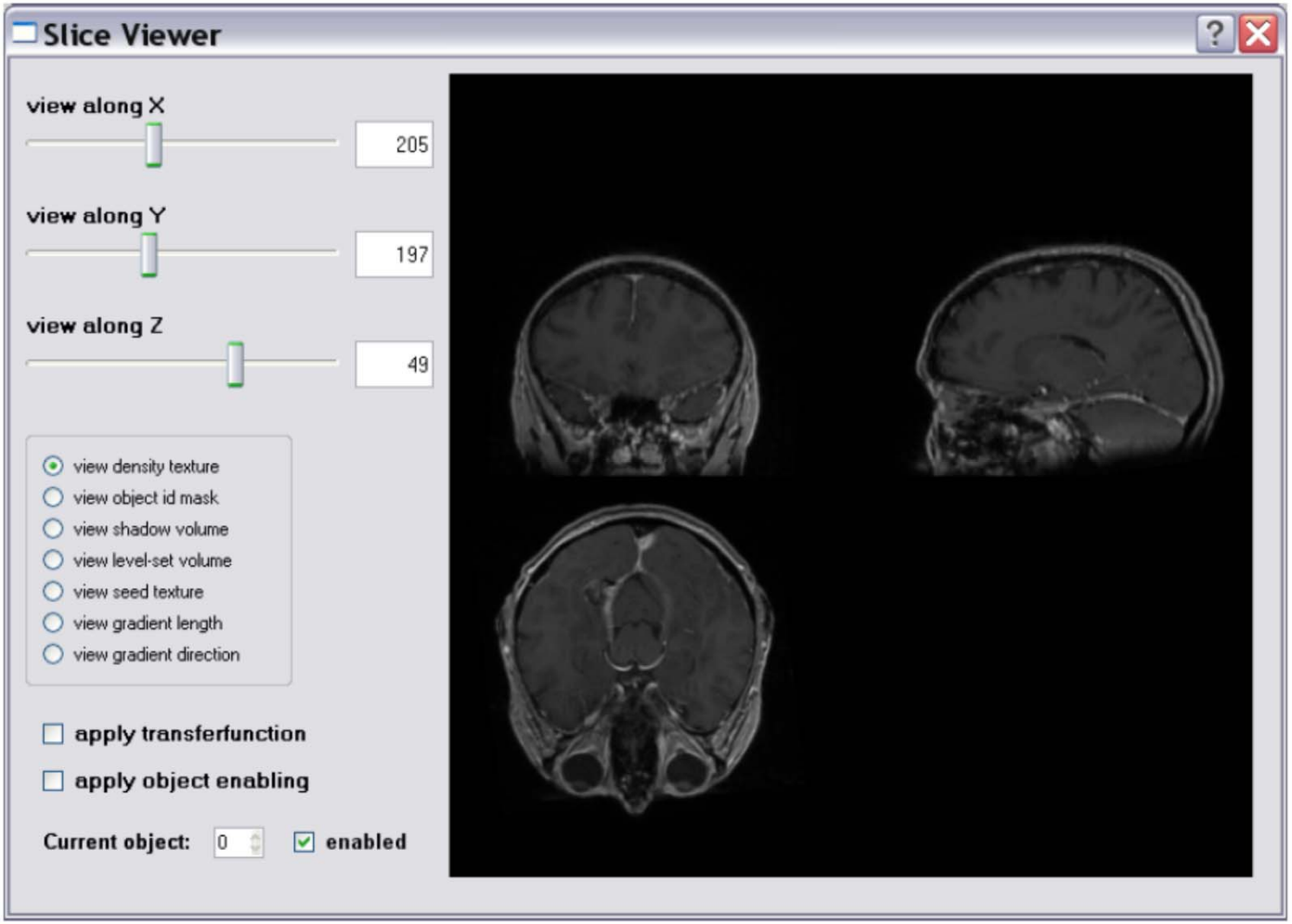
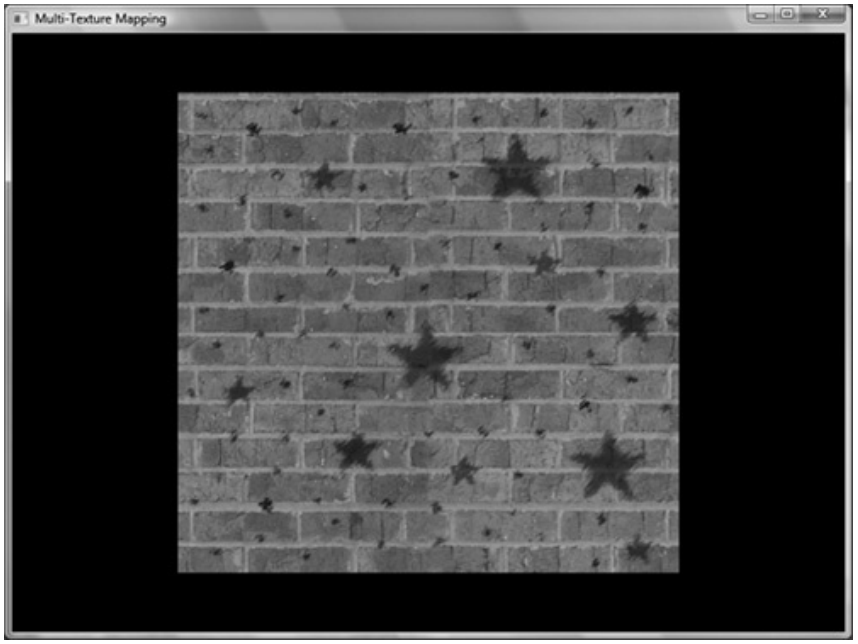
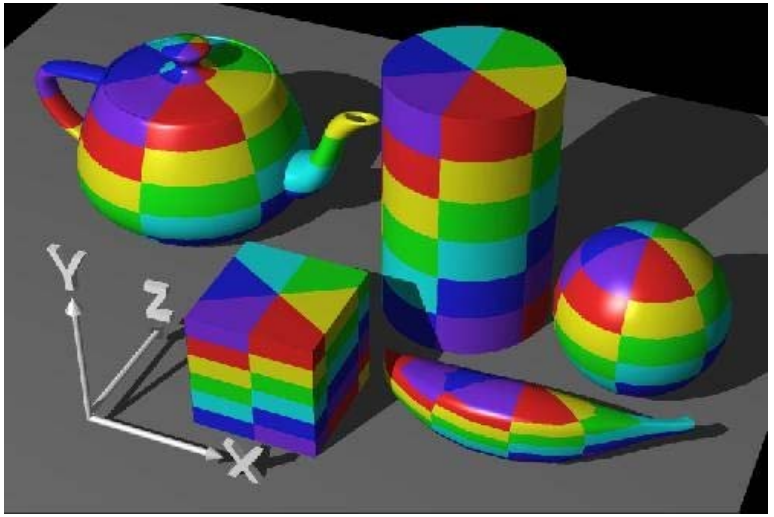
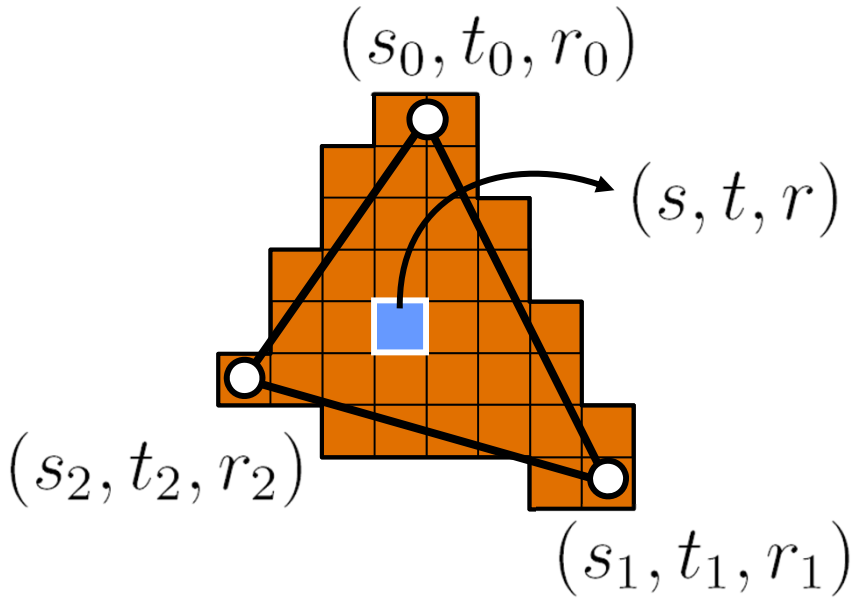


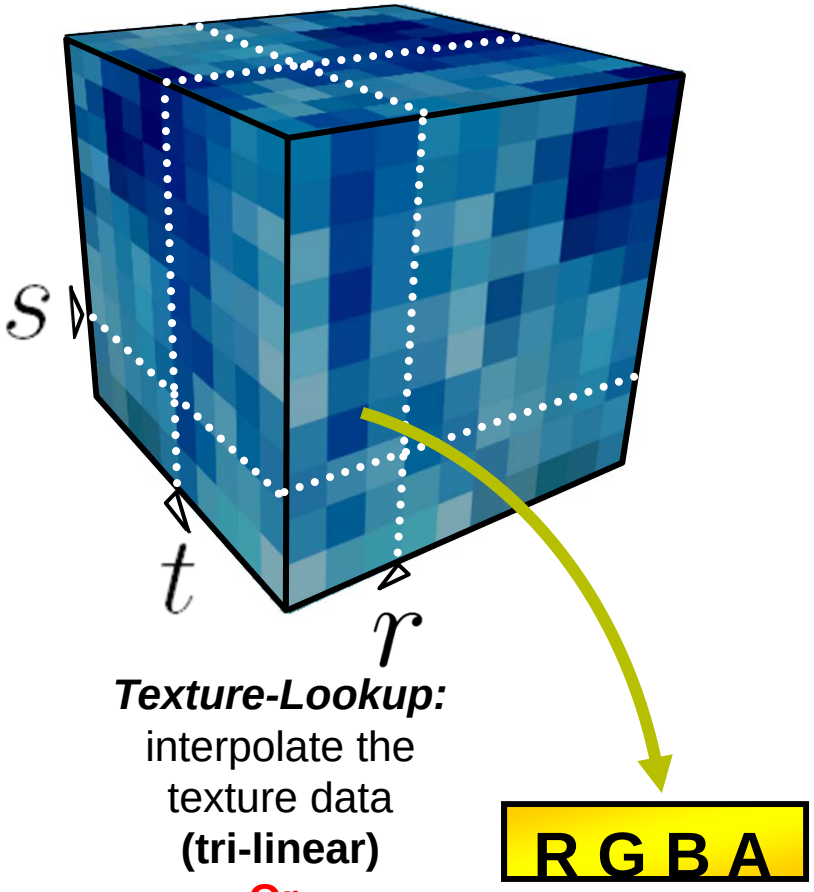
Texture Mapping





3D Texture Mapping





For each fragment:
interpolate the
texture coordinates
(barycentric)
Or:
Use arbitrary, computed coordinates

Texture-Lookup:
interpolate the
texture data
(tri-linear)
Or:
Nearest-neighbor for "array lookup"

What is Scientific Visualization? (1)

The use of computer graphics for the analysis and presentation of computed or measured scientific data

- Started in 1987 by the US National Science Foundation (NSF) in the "Visualization in Scientific Computing" report

  `http://www.evl.uic.edu/core.php?mod=4&type=3&indi=348`

- First IEEE Visualization conference 1990

- 2006 NIH/NSF Visualization Research Challenges Report, Chris Johnson et al.

  `http://tab.computer.org/vgtc/vrc/`
  `NIH-NSF-VRC-Report-Final.pdf`

"The purpose of computing is insight, not numbers"
Richard Hamming, 1971

Thank you.

Thanks for material

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