

# Visualization Curriculum Panel:

## Experiences in Teaching Visualization at the University of Stuttgart

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## My Background

- Professor of computer science (visualization) at the University of Stuttgart
- Dean of studies in computer science and software engineering
  - Curriculum and program development
  - Bologna process: re-organizing in BSc and MSc programs



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## Teaching Portfolio

- Courses
  - Computer graphics (introduction)
  - Geometric modeling and animation
  - Image synthesis
  - (Scientific) visualization
  - Information visualization
  - Visual computing
  - Introduction to visualization in science and engineering
- Seminars
- Large-scale team projects
- Lab courses

**Institut für Visualisierung und Interaktive Systeme (VIS)**

uni home suche

Institut Lehre Forschung Projekte Publikationen Aktuelles Intern

VIS - Lehre - Überblick

**Lehre am Institut für Visualisierung und Interaktive Systeme**

Die Abteilungen des VIS-Instituts tragen die universitäre Ausbildung in den Bereichen Computergraphik, Visualisierung, Mensch-Computer-Interaktion, Intelligente Systeme und Computer Vision. In diesen Gebieten werden in verschiedenen Studiengängen jedes Semester mehr als 50 Semesterwochenstunden Lehre erbracht. Allgemeine Informationen über die vom Fachbereich Informatik angebotenen Studiengänge finden sich auf den Studierenden-Seiten der Informatik.

Auf dieser Seite finden Sie zusätzliche Informationen und Empfehlungen, wenn Sie sich in einem der Schwerpunkte des Instituts vertiefen wollen, also in einer der Abteilungen eine vertiefende Prüfung ablegen oder eine Abschlussarbeit (Bachelor-Master-Thesis, Studien-/Diplomarbeit) anfertigen wollen.

**Informationen für**

- Schüler
- Bachelor Informatik
- Vertiefung in Computergraphik/Visualisierung
- Nach der Mensch-Computer-Interaktion im 4. Semester absolvieren Sie im 5. Semester die Module Computergraphik und Imaging Science. Im 6. Semester wählen Sie Bildsynthese, Visualisierung oder beide. Zur Vorbereitung auf die Bachelorarbeit empfehlen wir ein Seminar und das Projekt aus dem Angebot des Instituts zu wählen.
- Vertiefung in Intelligente Systeme
- Parallel zur Mensch-Computer-Interaktion im 4. Semester absolvieren Sie das Modul Imaging Science. Im 5. Semester wählen Sie dann Computer Vision oder Grundlagen der Künstlichen Intelligenz oder beide. Zur Vorbereitung auf die Bachelorarbeit empfehlen wir ein Seminar und das Projekt aus dem Angebot des Instituts zu wählen.
- Vertiefung in Mensch-Computer-Interaktion
- Nach der Mensch-Computer-Interaktion im 4. Semester absolvieren Sie im 5. Semester das Modul Ubiquitous Systeme. Zur Vorbereitung auf die Bachelorarbeit empfehlen wir ein Seminar und das Projekt aus dem Angebot des Instituts zu wählen.
- Bachelor Softwaretechnik
- Es wird erwartet, dass Sie im 4. Semester das Modul Mensch-Computer-Interaktion aus dem Katalog SWT wählen und es wird dringend empfohlen, dass Sie Grundkenntnisse in Numerischer Mathematik erwerben, also das Modul Numerische und Stochastische Grundlagen der Informatik belegen. Für eine Vertiefung bei der der VIS-Abteilung wählen die Einzelkurse für den Bachelor Informatik.

## Incremental Updates

- Complement course material with new techniques from scientific publications
- Update APIs and programming environments
  - Example: shader programming
- Improving visualization projects
  - Often topics from information visualization
  - C# or other programming languages



### Large-Scale Visualization Projects for Teaching Software Engineering

Christopher Millner, Gisle Rains, Michael Burch, and Daniel Weiskopf (University of Stuttgart)

Since 1996, the University of Stuttgart's software engineering major has been complementing the traditional computer science major with more practice-oriented education. Key components of the curriculum are team projects in which up to 12 students collaboratively develop a software system over two consecutive semesters. The projects have four primary learning objectives:

- autonomous development of a viable solution for a given problem,
- project planning and management,
- quality assurance within the project, and
- communication within the team and with an external customer.

Projects should cover all relevant phases of a typical software project: writing a proposal, a project plan, specifications, and design documents; implementation; integration; testing; and a successful acceptance test.

We use these projects to teach software engineering by means of a visualization-centered project, just as others are teaching visualization in a very successful way by means of specific application-centered approaches.<sup>1</sup>

**Project Risks**

The projects are intended to be like a sub-plot of a principal-agent relationship. The students are the contractor. They fill roles typical in a software engineering project:

Because the project is part of a university education, the faculty plays two additional roles. The examiner is responsible for final grading, and the supervisor helps students with technical and organizational questions. The latter usually also reviews documents such as the requirements specification to provide early feedback on what's possible and what's not.

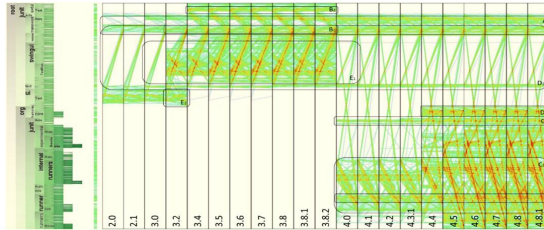
A project regularly starts in the 6th semester of the Diploma (a 13-year program) or in the fourth semester of the software engineering BSc (a 7-year program). (The university is gradually replacing the traditional Diploma program with the BSc and MSc programs, in accordance with the Bologna Process, which is restructuring European academic education.) So, the students' knowledge is limited mostly to basic lectures on mathematics and on practical and theoretical computer science. Few of them have taken introductory computer graphics or human-computer interaction courses.<sup>2</sup> Their programming experience is also often limited.

Thus, the project involves not only the actual project work, which results in a piece of software, but also an accompanying lecture and seminar that fill in missing knowledge of the application area. One of the courses the Visualization Research Center offers on computer graphics, scientific visualization,<sup>3</sup> information visualization, or interactive systems is combined with the project, depending on its topic.

## ***Expanding the Topics Covered***

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- Information visualization and visual analytics
- Refocusing the course on scientific visualization
- Visual computing



## ***Structural Changes***

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- Courses:
  - Imaging science (advanced BSc level)
  - Theoretical and methodological foundations of visual computing (MSc level)
- Goals:
  - Common basis for computer graphics, visualization, and computer vision
  - Complement typical mathematical and theoretical education of computer science students

## ***Outreach***

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- Introduction to visualization in science and engineering
- For non-CS majors
  - Affinity to technical or science topics
  - Some, but often limited programming experience
- Room for practical work
  - Heavily tool-based

### **Introduction to Visualization in Science and Engineering**

Chapter 1:  
Introduction and Examples



Filip Sadlo

## ***Challenges***

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- Growing need for background knowledge from diverse fields
  - Mathematics
  - Computer science
  - HCI, psychology
  - Application background
- Expand the target group
  - Non-CS students
  - Programming skills?