

Computergrafik SS 2010

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Institut für Informatik
Universität Osnabrück

Vorlesung vom 06.04.2010

Organisation

- Vorlesung: Mo+Di, 10:15 Uhr, 31/449a
- Übung: Do, 14:15 + 16:00 Uhr, 31/449a
- Übungsblatt am Dienstag
- Übung am Donnerstag
- Testate am Montag, Dienstag, Mittwoch
- Klausur am 05.07.10

stud.ip

The screenshot shows a Mozilla Firefox browser window displaying the Stud.IP login page for the University of Osnabrück. The browser's address bar shows the URL https://studip.rz.uos.de/meine_seminare.php. The page header includes the text "Universität Osnabrück" and the "STUD.IP" logo. Below the header, there is a navigation bar with "Aktuelle Seite: Login" and links for "Datenschutz", "Impressum", "Hilfe", and "Login". The main content area is titled "Stud.IP - Login" and features a login form with the following fields:

- Benutzername: oliver
- Passwort: [masked]

Below the password field, there is a link for "Login für Nutzer anderer niedersächsischer Hochschulen" and an "anmelden" button with a green checkmark. The background of the page is a photograph of a large, yellow, classical building with a central tower. In the bottom right corner, there is a statistics box:

Aktive Veranstaltungen:	33813
Registrierte NutzerInnen:	33918
Davon online:	122
	mehr...

At the bottom left of the browser window, the text "Fertig" is visible.

<https://studip.rz.uos.de>

Google

computer graphics - Google-Suche - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

http://www.google.de/search?hl=de&client=firefox-a&hs=rBq&rls=org.mozilla%3Ade% computer graphics

computer graphics - Google-Suche

Web Bilder Videos Maps News Shopping E-Mail Mehr oliver@uos.de | Webprotokoll | Einstellungen | Abmelden

Google computer graphics Suche Erweiterte Suche

Suche: Das Web Seiten auf Deutsch Seiten aus Deutschland

Web [Optionen anzeigen...](#) Ergebnisse 1 - 10 von ungefähr **94.800.000** für computer graphics. (0,21 Sekunden)

Tipp: [Suchen nur nach Ergebnissen auf Deutsch](#). Sie können Ihre bevorzugten Spracheinstellungen in [Einstellungen](#) angeben.

Computer graphics - Wikipedia, the free encyclopedia ☆ - [[Diese Seite übersetzen](#)]
Computer graphics are graphics created using computers and, more generally, the representation and manipulation of image data by a computer. ...
[Overview](#) - [History](#) - [Image types](#) - [Concepts and Principles](#)
en.wikipedia.org/wiki/Computer_graphics - [Im Cache](#) - [Ähnlich](#)

Computer Graphics World - Home ☆ - [[Diese Seite übersetzen](#)]
Home - CGW explores how leading-edge graphics techniques, including the 3D modeling, animation and visualization are used in such applications as ...
www.cgw.com/ - [Im Cache](#) - [Ähnlich](#)

Computer Graphics: Computer Graphics ☆ - [[Diese Seite übersetzen](#)]
Computer Graphics is about digital models for threedimensional geometric objects as well as images. These shapes and images may represent approximations of ...
www.cg.tu-berlin.de/ - [Im Cache](#) - [Ähnlich](#)

[Ergebnisse Bildersuche nach computer graphics](#) - [Bilder melden](#)

Anzeigen

[Blanx 3D Animation Studio](#)
Computeranimation und Postproduktion
blanx.de

[Computer Graphics](#)
Über 7 Millionen englische Bücher. Jetzt portofrei bestellen!
Amazon.de/englishbooks

[Schalten Sie hier Ihre Anzeige >](#)

Fertig

<http://www.google.de/search?q=computer+graphics>

Amazon

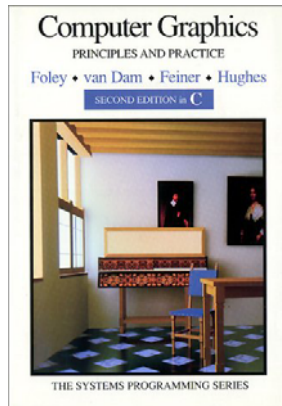
The screenshot shows the Amazon.de website interface. At the top, the browser title is "Amazon.de: computer graphics - Mozilla Firefox". The address bar shows the URL: http://www.amazon.de/s/ref=nb_sb_noss?__mk_de_DE=%C5M%C5Z%D5%D1&url=search-alias%3Dapst. The page header includes the Amazon.de logo, a greeting, and navigation links like "Mein Amazon.de", "Sonderangebote", "Wunschzettel", "Gutscheine", and "Geschenke". A search bar contains the text "computer graphics". Below the search bar, there are navigation tabs for "Amazon.de", "Gutscheine", "Bestseller", "Sonderangebote", "Outlet", "Jetzt verkaufen", "Hollywood", "Disney", and "Sony Entertainment".

The main content area is titled "computer graphics" and shows search results. On the left, there is a sidebar with "Kategorie" and "Beliebige Kategorie" sections. The "Beliebige Kategorie" section is circled in red and lists various categories with their respective item counts: Englische Bücher (16.361), Bücher (917), Software (100), Elektronik & Foto (92), DVD (2), MP3-Downloads (1), and Musik (1). Below this, there is a "Versandoption" section with "Prime" and "Kostenlose Lieferung" options, and a "Web Graphics" section with "Format" options like "Gebundene Ausgabe", "Taschenbuch", and "Hörbuch".

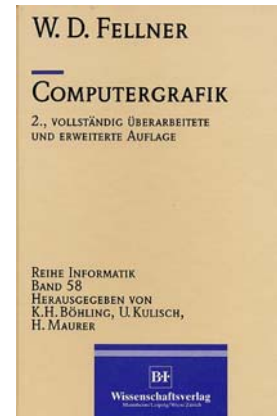
The search results are displayed in a list format. The first result is "Computer Graphics: Principles and Practice in C (Addison-Wesley Systems Programming Series)" by James D. Foley, Andries VanDam, and Steven K. Feiner. It is a "Gebundene Ausgabe" from October 1995, priced at EUR 58,98 (new) and EUR 47,54 (used). The second result is "Math for 3D Game Programming & Computer Graphics (Charles River Media Game Development)" by Eric Lengyel and Lengyel von Delmar, a "Gebundene Ausgabe" from December 2003, priced at EUR 33,95 (new) and EUR 39,10 (used). The third result is "Computer Graphics: Principles and Practice in C" by James D. Foley, Andries van Dam, Steven K. Feiner, and John F. Hughes, a "Taschenbuch" from 1995, priced at EUR 36,99 (used). The sidebar also shows "Lieblingslisten" and a status message at the bottom: "Übertragen der Daten von s0.2mdn.net..."

<http://www.amazon.de>

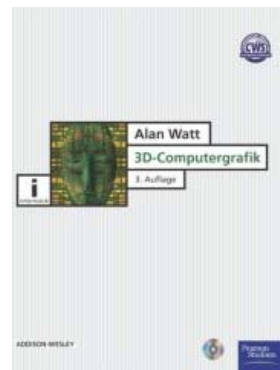
Literatur



James Foley et al:
**Computer Graphics
Principles and
Practice**
2nd Edition
Addison Wesley 1995



Dieter Fellner:
Computergrafik
BI 1994



Alan Watt:
3D-Computergrafik
3. Auflage
Addison Wesley 2002



Klaus Zeppenfeld:
**Lehrbuch der Grafik-
programmierung**
Spektrum 2004

Begleitmaterial

- Skript, gedruckt, 7.50 €
- Skript in HTML
- Skript in PDF
- Folien in PDF
- Videomitschnitt im virtPresenter-Format
- Videopodcast im mp4-Format
- Audiomitschnitt im mp3-Format

<http://www-lehre.inf.uos.de/~cg/2010>

Classroomquiz



Motivation

- Bild sagt mehr als 1000 Worte
- Auge erfasst 40.000.000 Bit/sec
- Lesegeschwindigkeit
= 10 Worte à 5 Zeichen/sec
= $10 \cdot 5 \cdot 8 = 400$ Bit/sec
- \Rightarrow Faktor 100.000

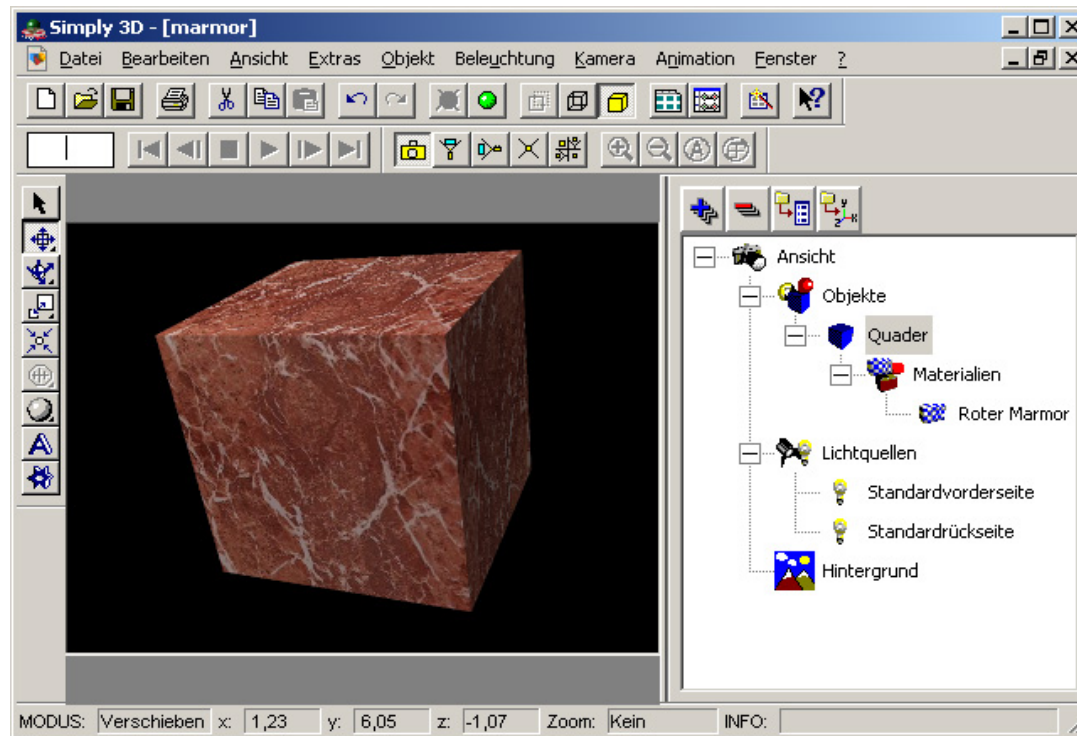
Grafische Datenverarbeitung

- Bildverarbeitung
 - Licht, Radar, Röntgen, Ultraschall, ...
 - Vereinfachung, Verbesserung
- Mustererkennung
 - Analyse von Rasterdaten
 - Optical Character Recognition (OCR)
- Generative Computergrafik
 - Eingabe der Repräsentation
 - Ausgabe der Darstellung

Anwendungen

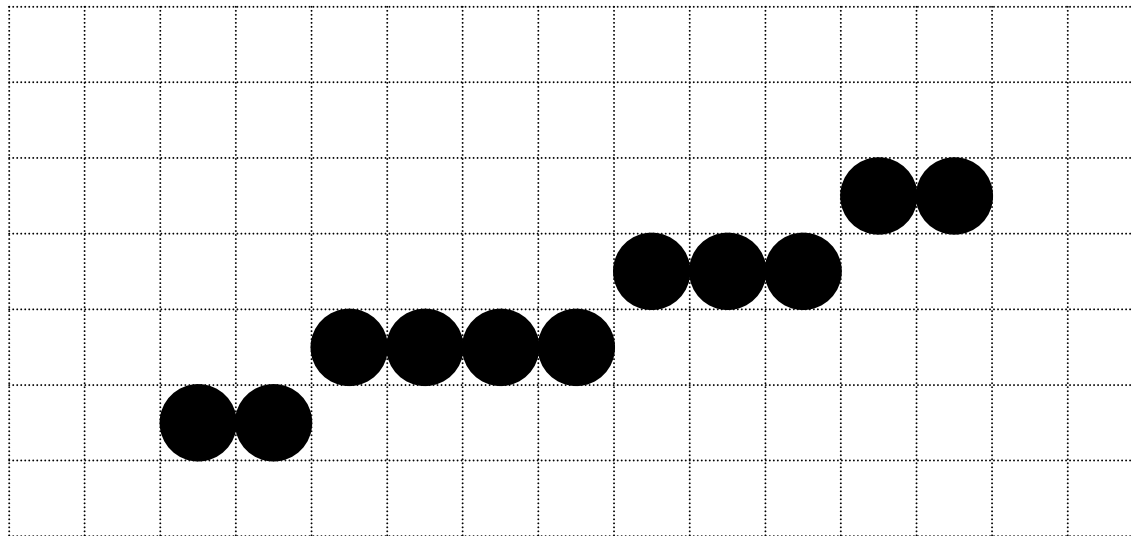
- Business-Grafik
- Grafische Benutzeroberflächen
- Kartografie
- CAD (Haus, Auto,...)
- Visualisierung (Molekül, Strömung, Scan)
- Simulation (Fahrzeug, Flugzeug,...)
- Virtual Reality (Computerspiele,...)

Modellieren, Projizieren, Rendern

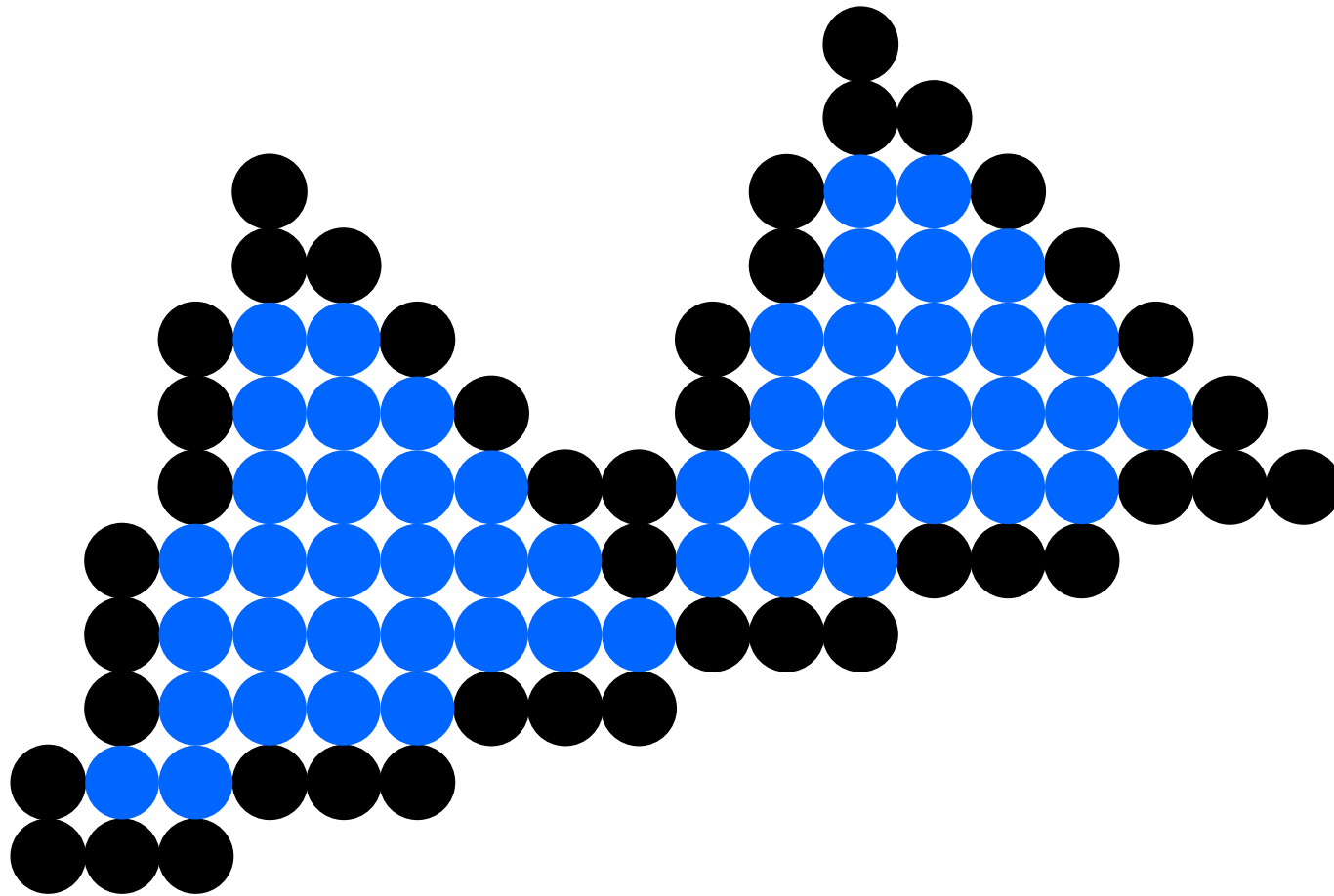


Micrografx Simply 3D

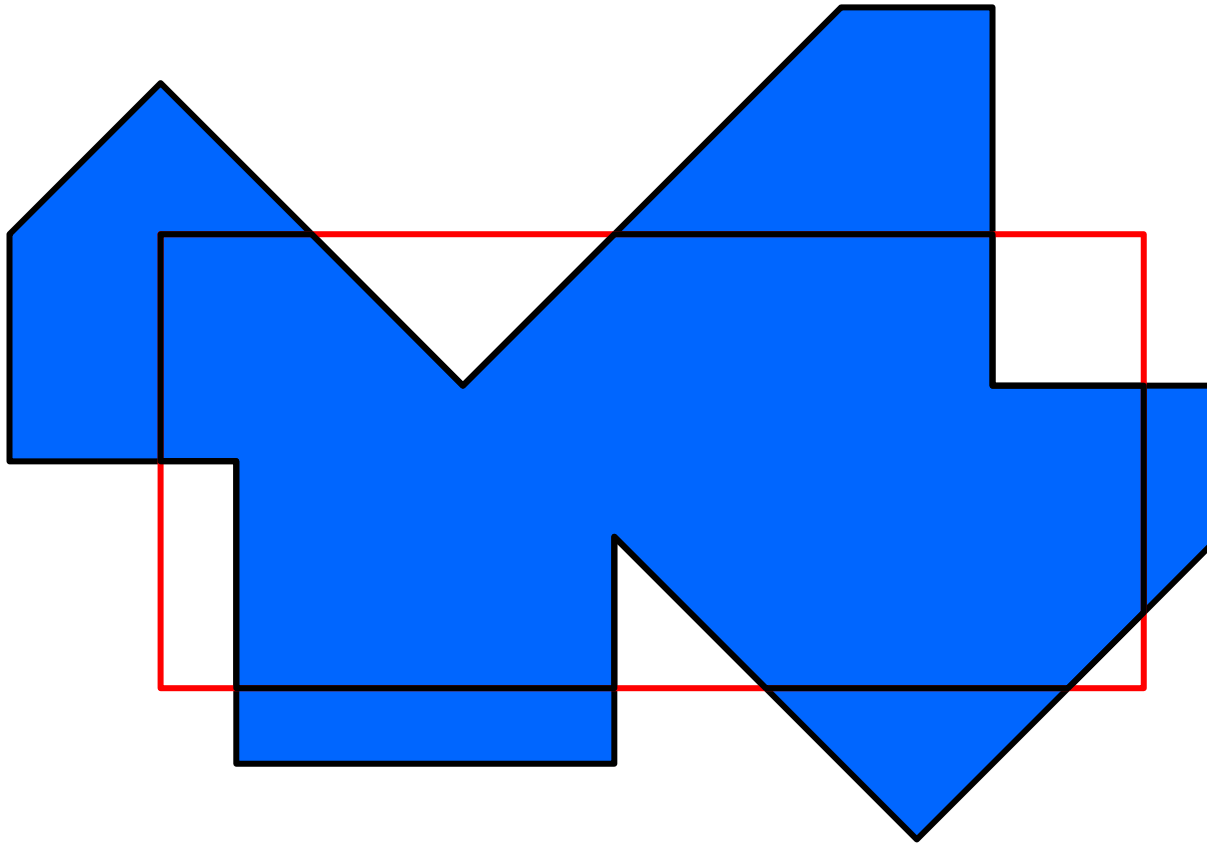
2D-Grundlagen



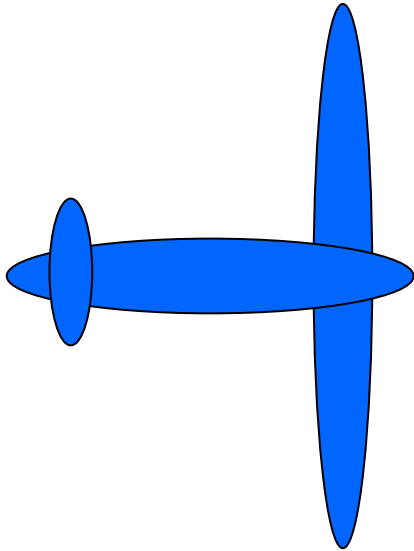
2D-Füllen



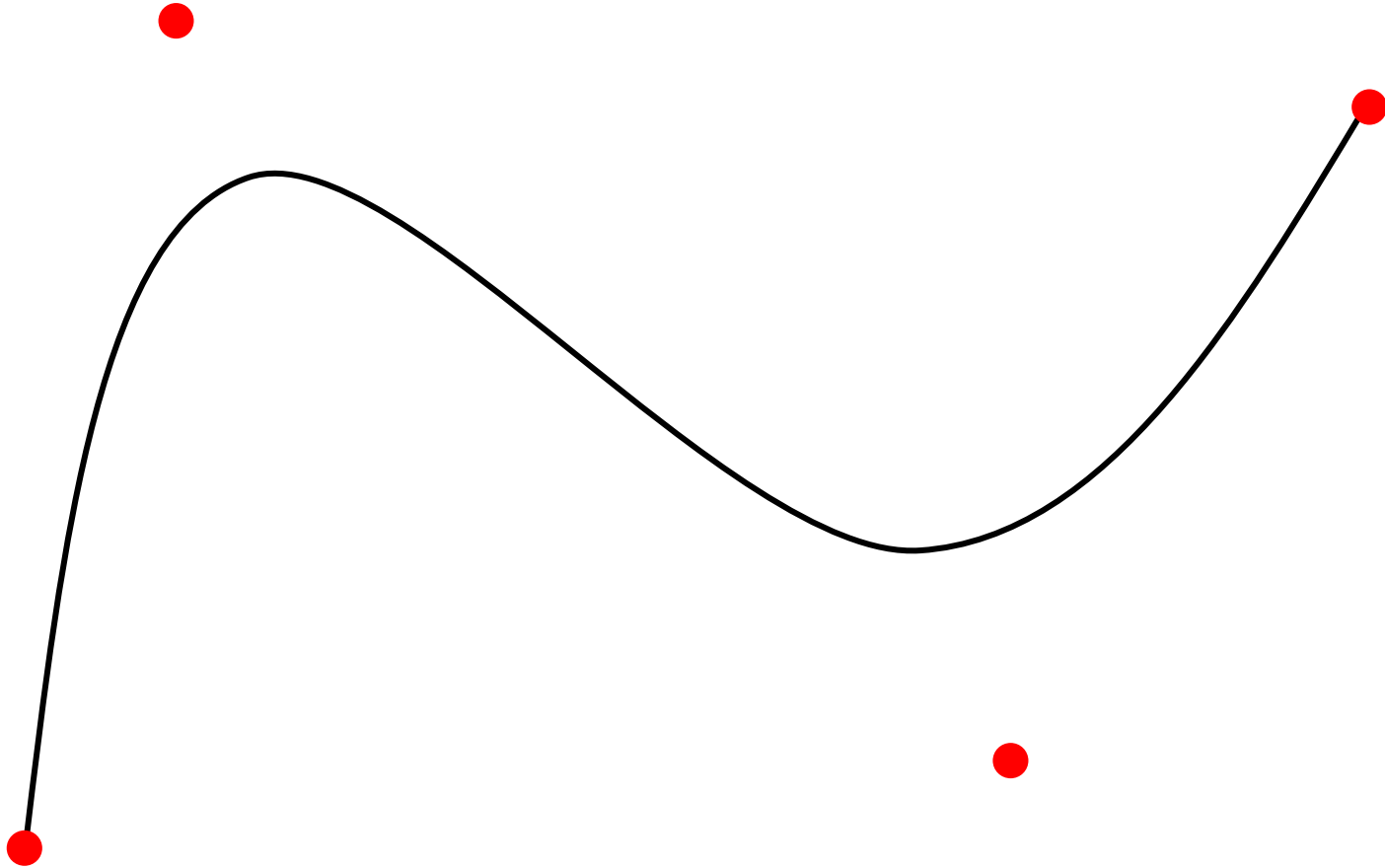
2D-Clipping



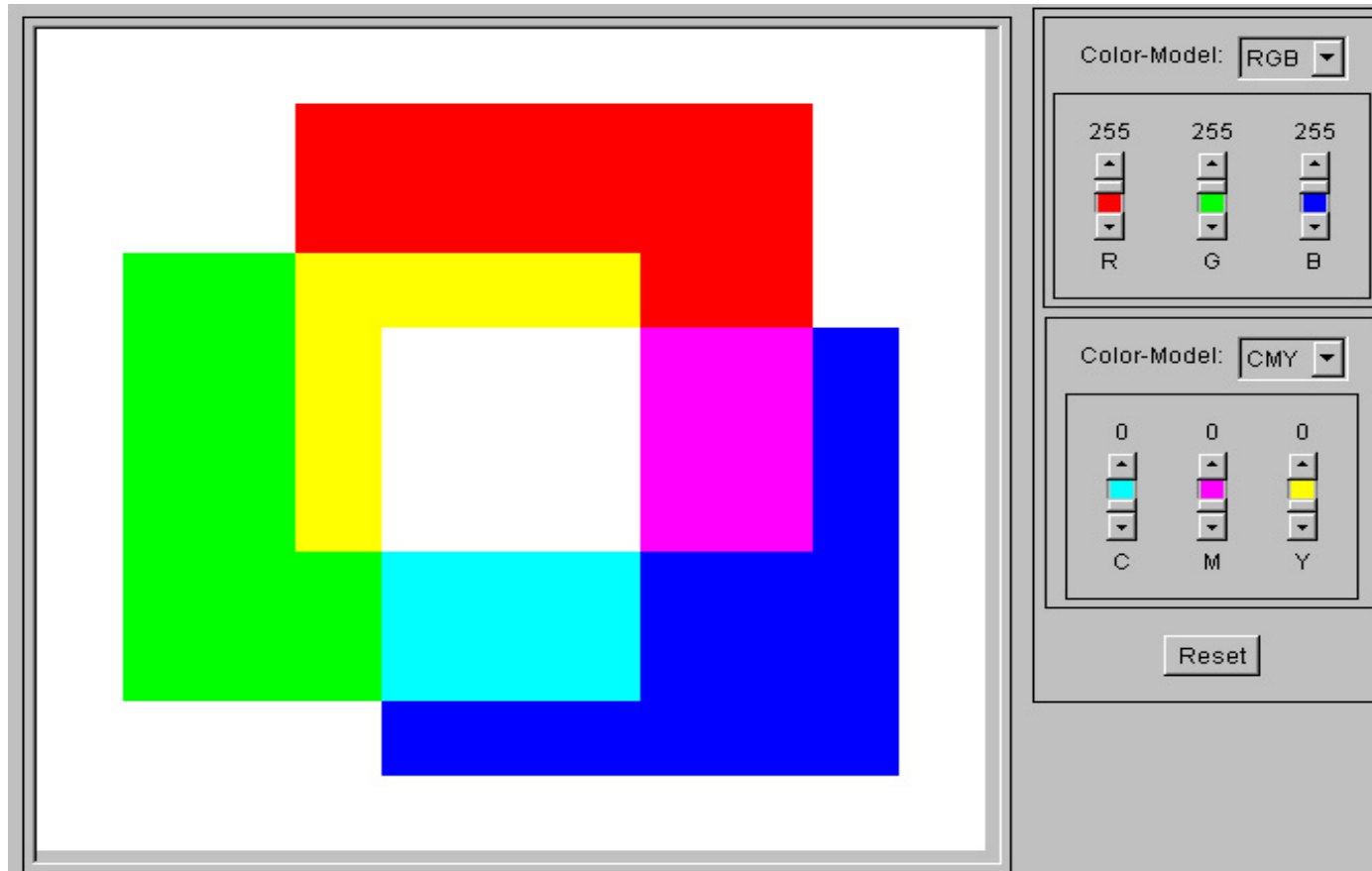
Transformation



Kurven



Farbe



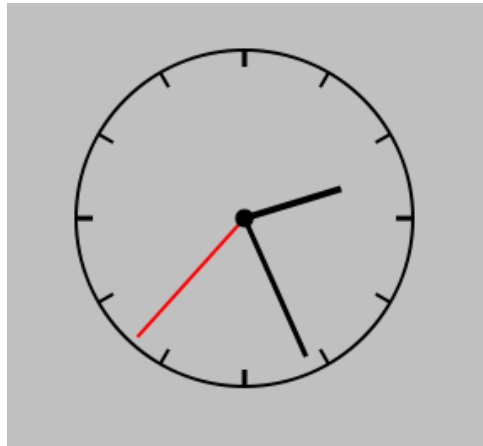
Pixeldateiformate



Macromedia Flash



SVG

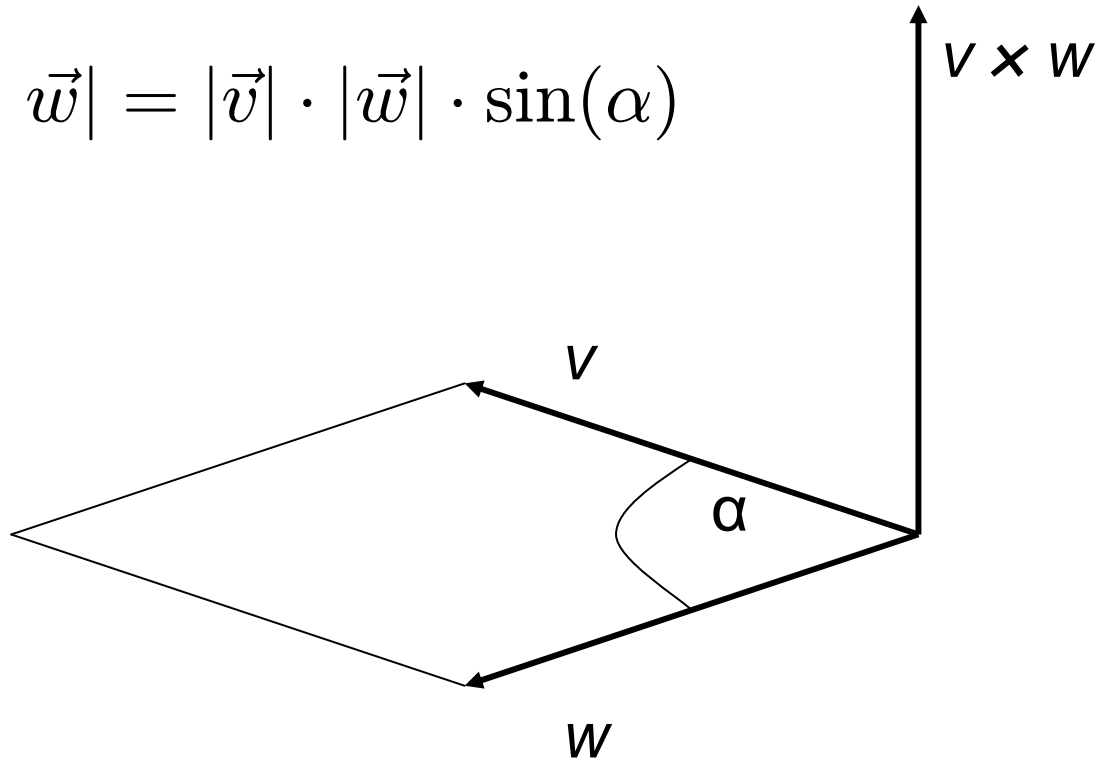


Fraktale



3D-Grundlagen

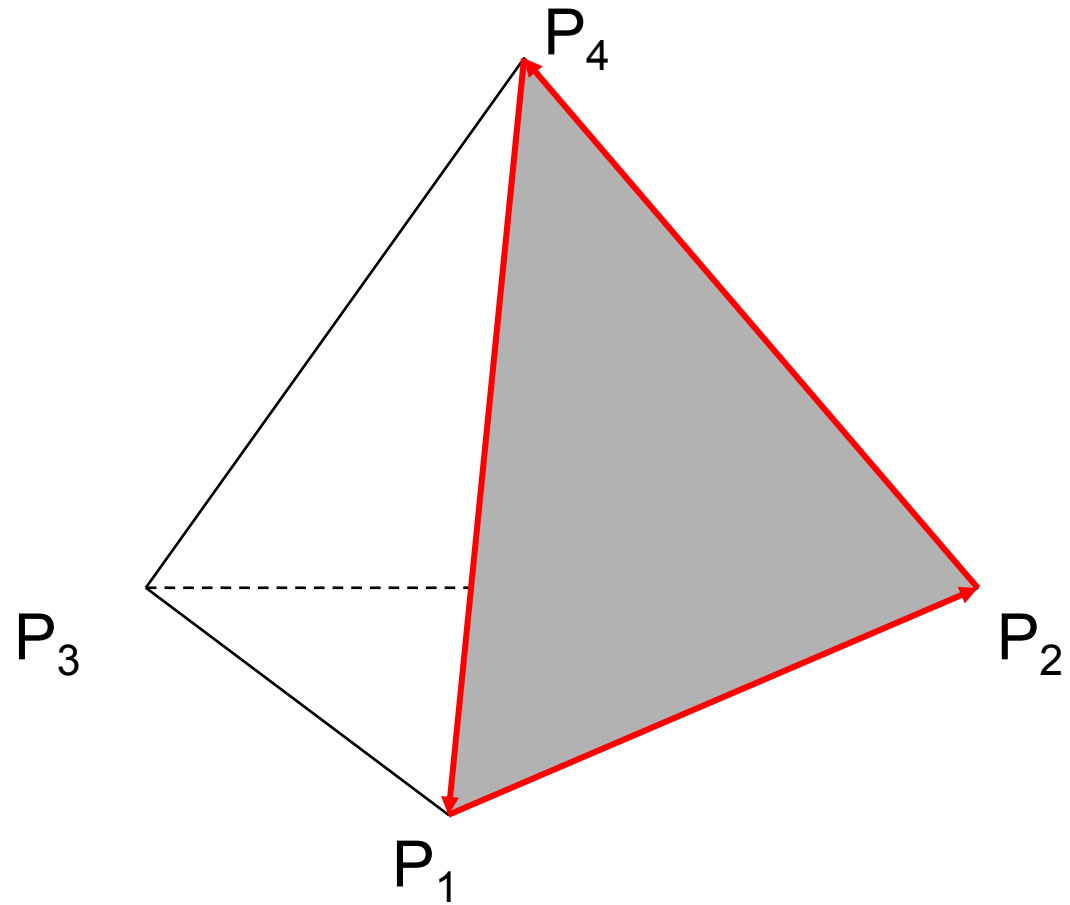
$$|\vec{v} \times \vec{w}| = |\vec{v}| \cdot |\vec{w}| \cdot \sin(\alpha)$$



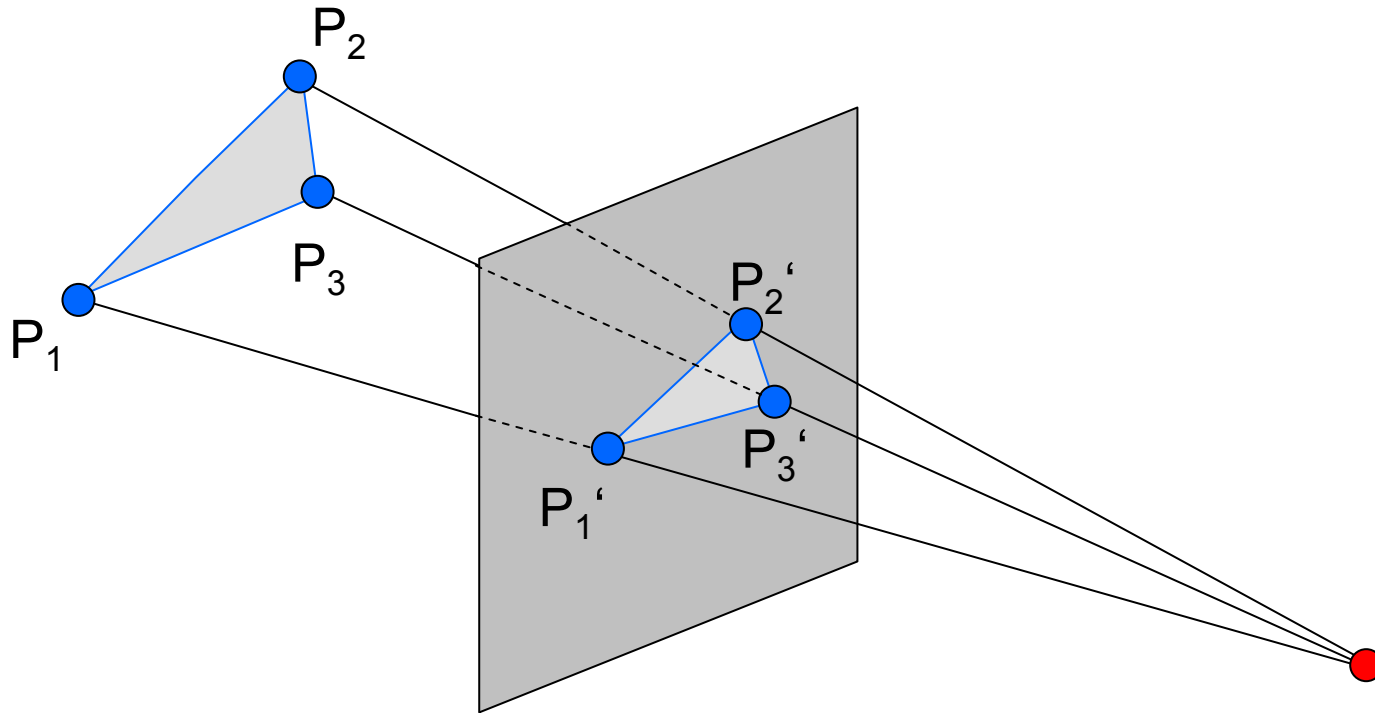
3D-Transformationen

$$R_y(\delta) = \begin{pmatrix} \cos(\delta) & 0 & \sin(\delta) & 0 \\ 0 & 1 & 0 & 0 \\ -\sin(\delta) & 0 & \cos(\delta) & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

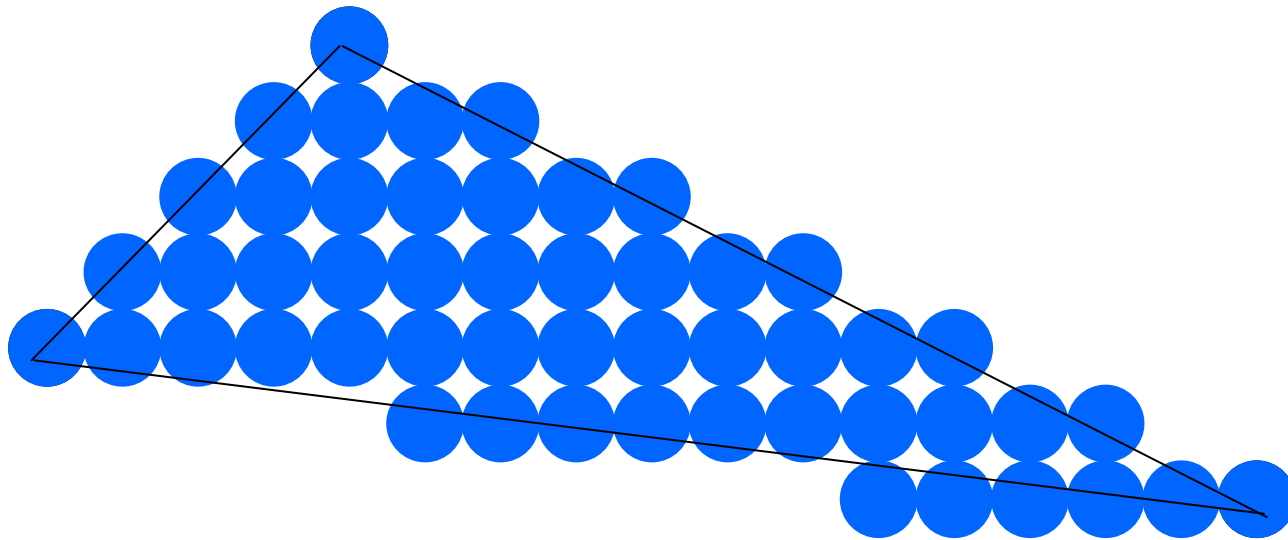
3D-Repräsentation



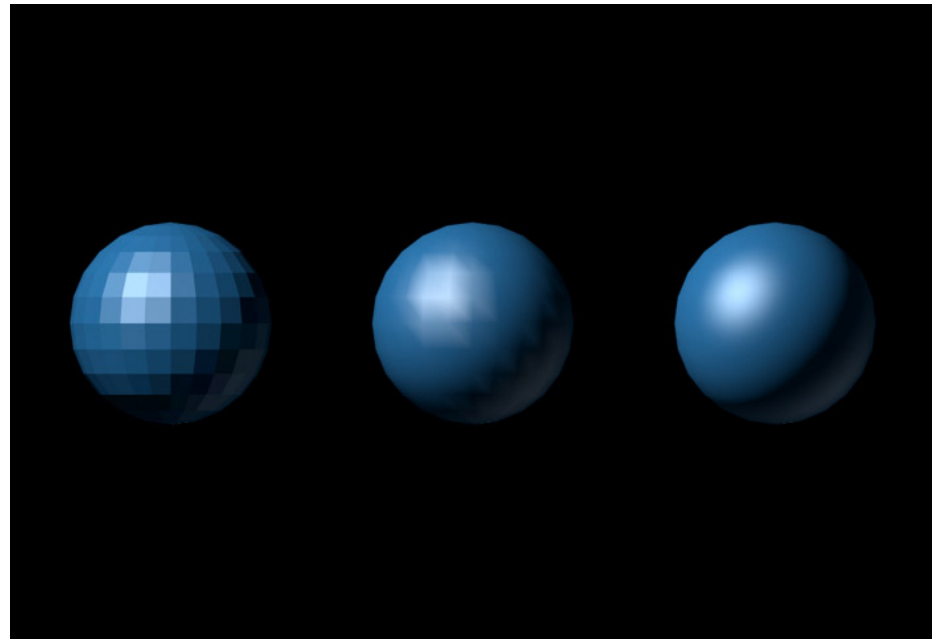
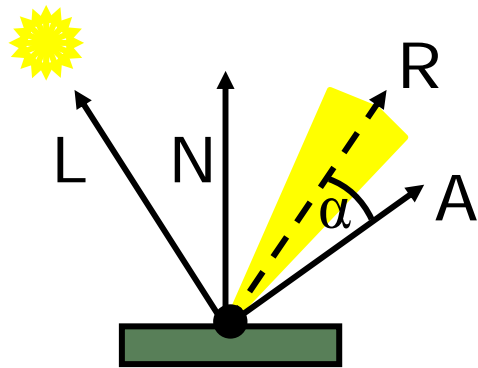
Projektion



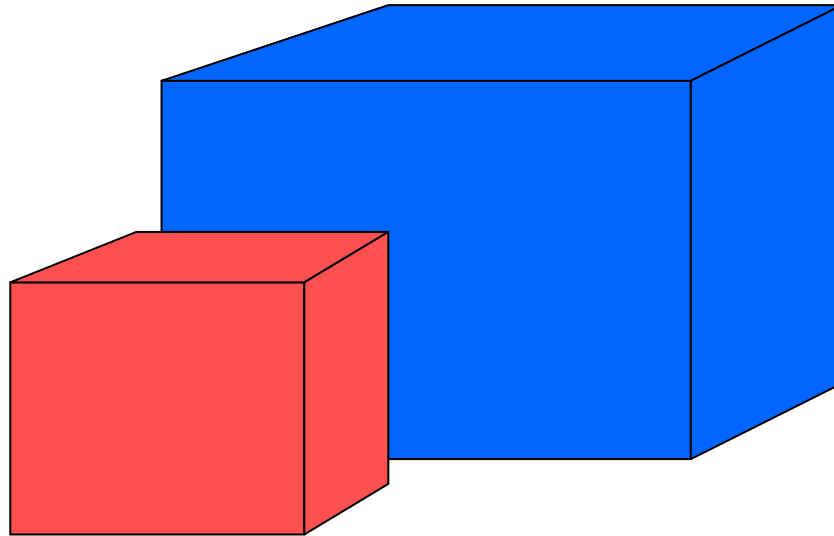
Rendern



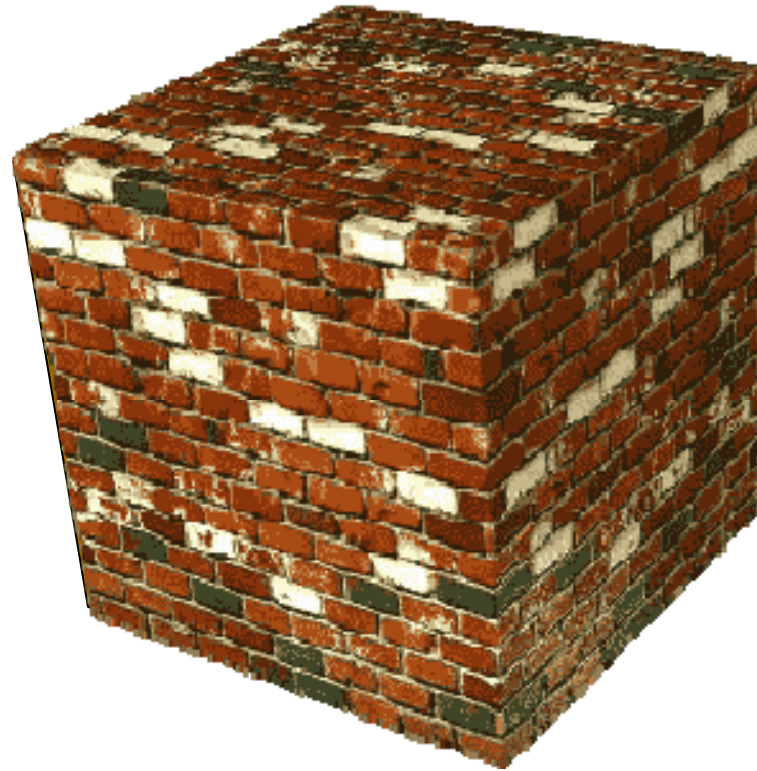
Beleuchtung



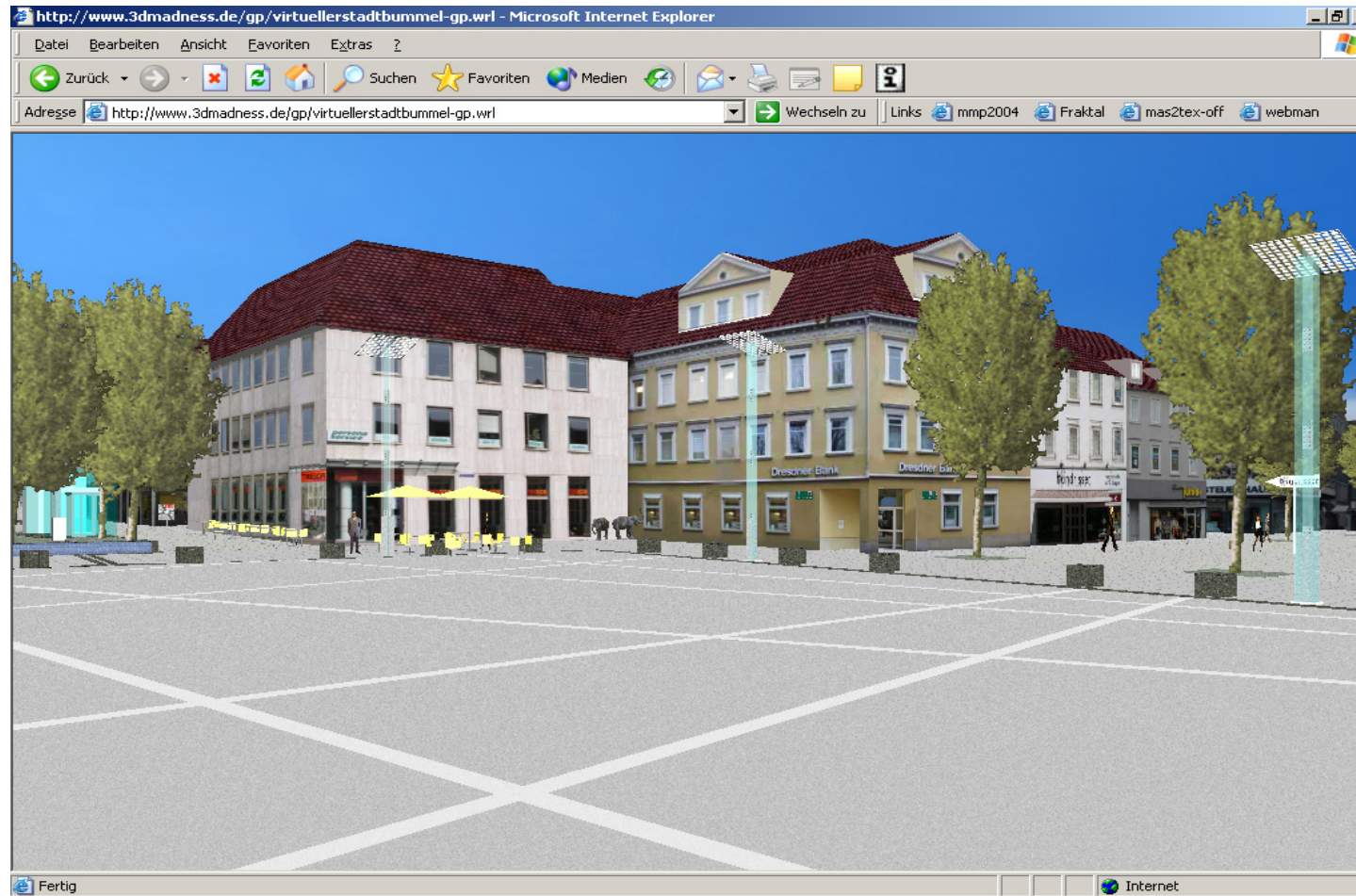
Culling



Texturing

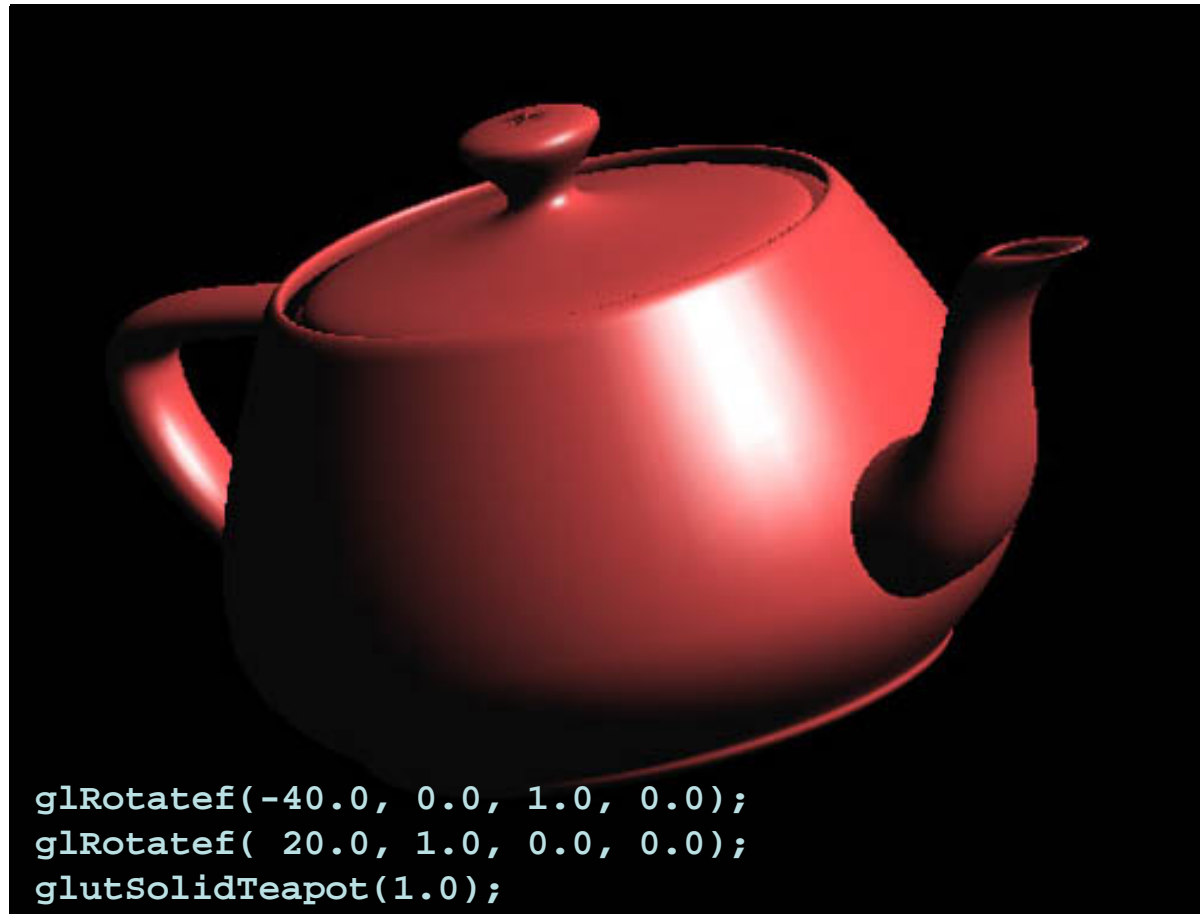


VRML



<http://www-lehre.inf.uos.de/gp/>

OpenGL

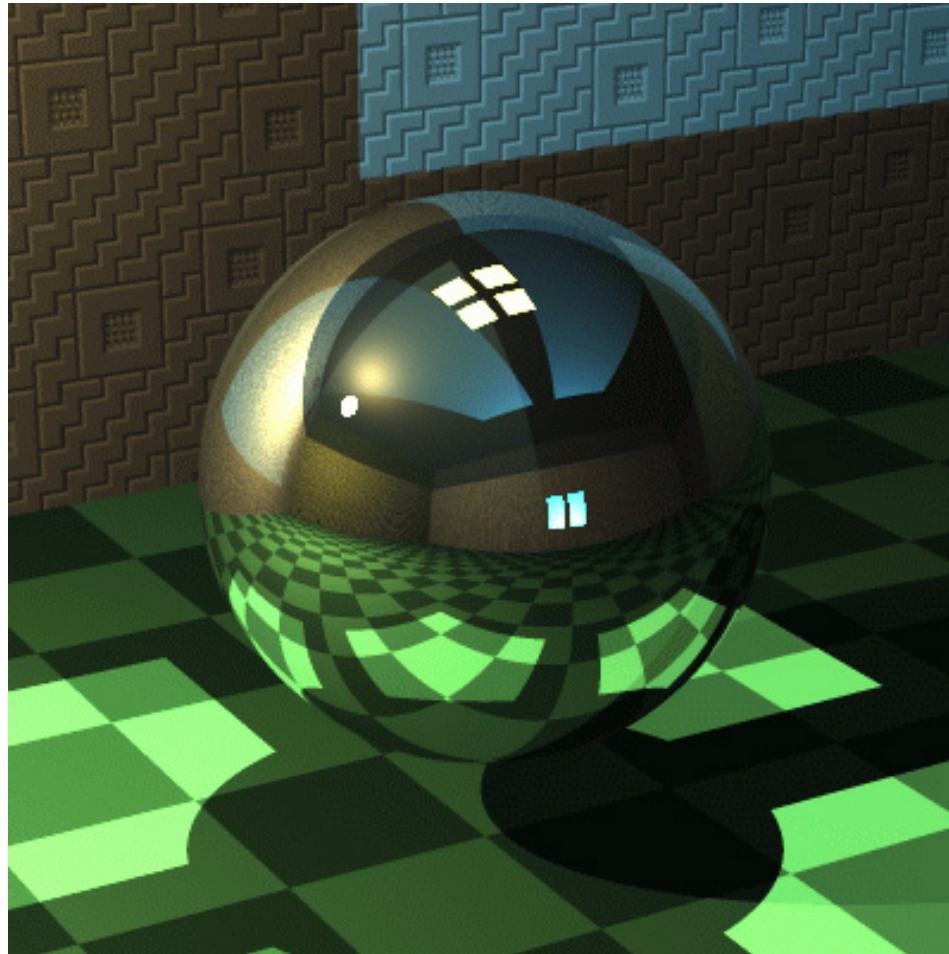


```
glRotatef(-40.0, 0.0, 1.0, 0.0);  
glRotatef( 20.0, 1.0, 0.0, 0.0);  
glutSolidTeapot(1.0);
```

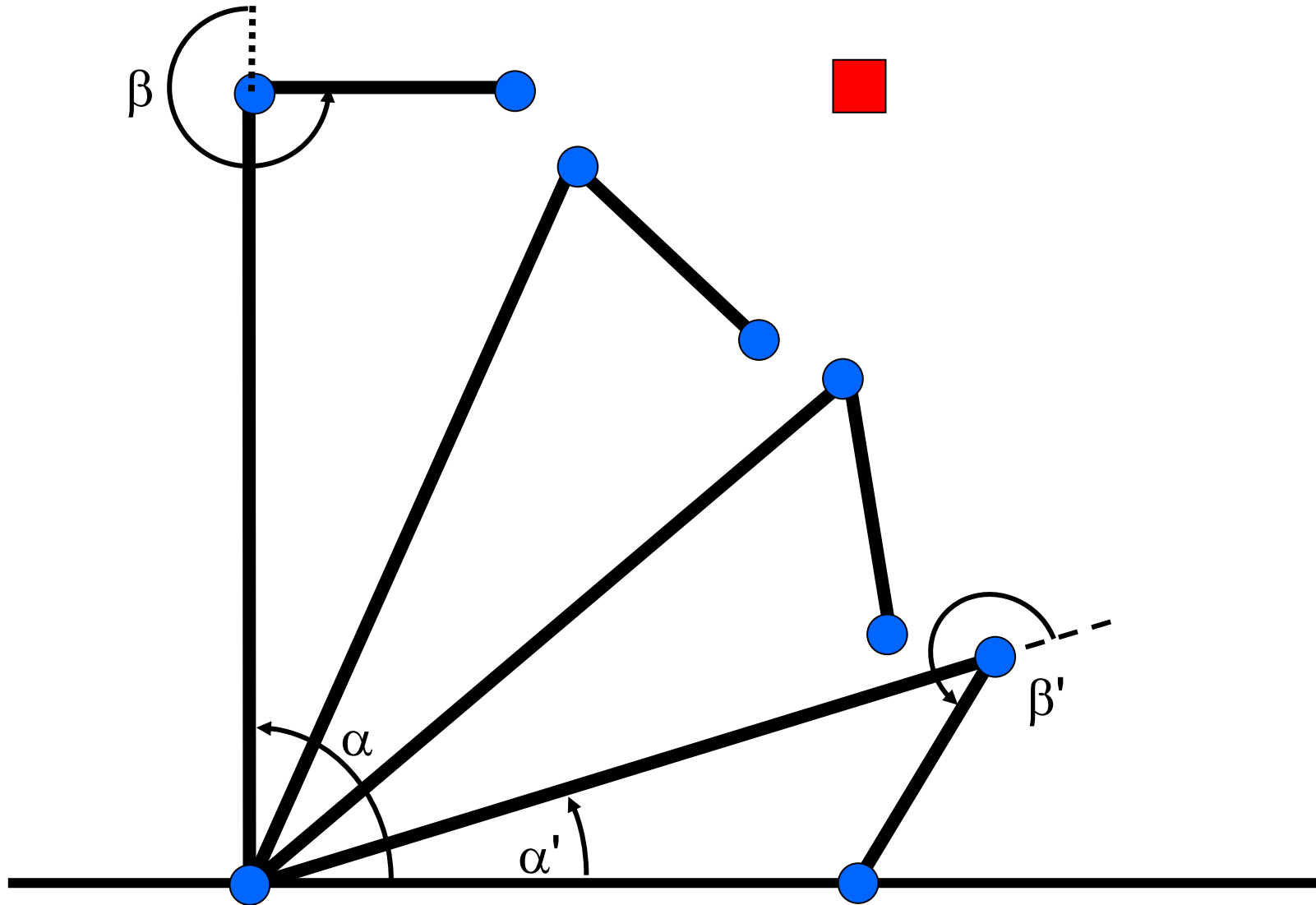

Radiosity



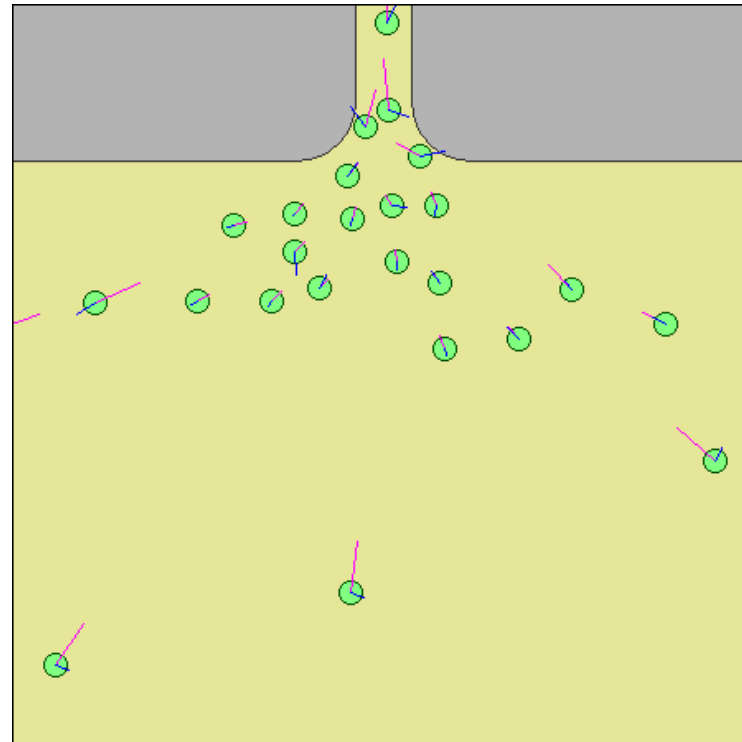
Ray Tracing



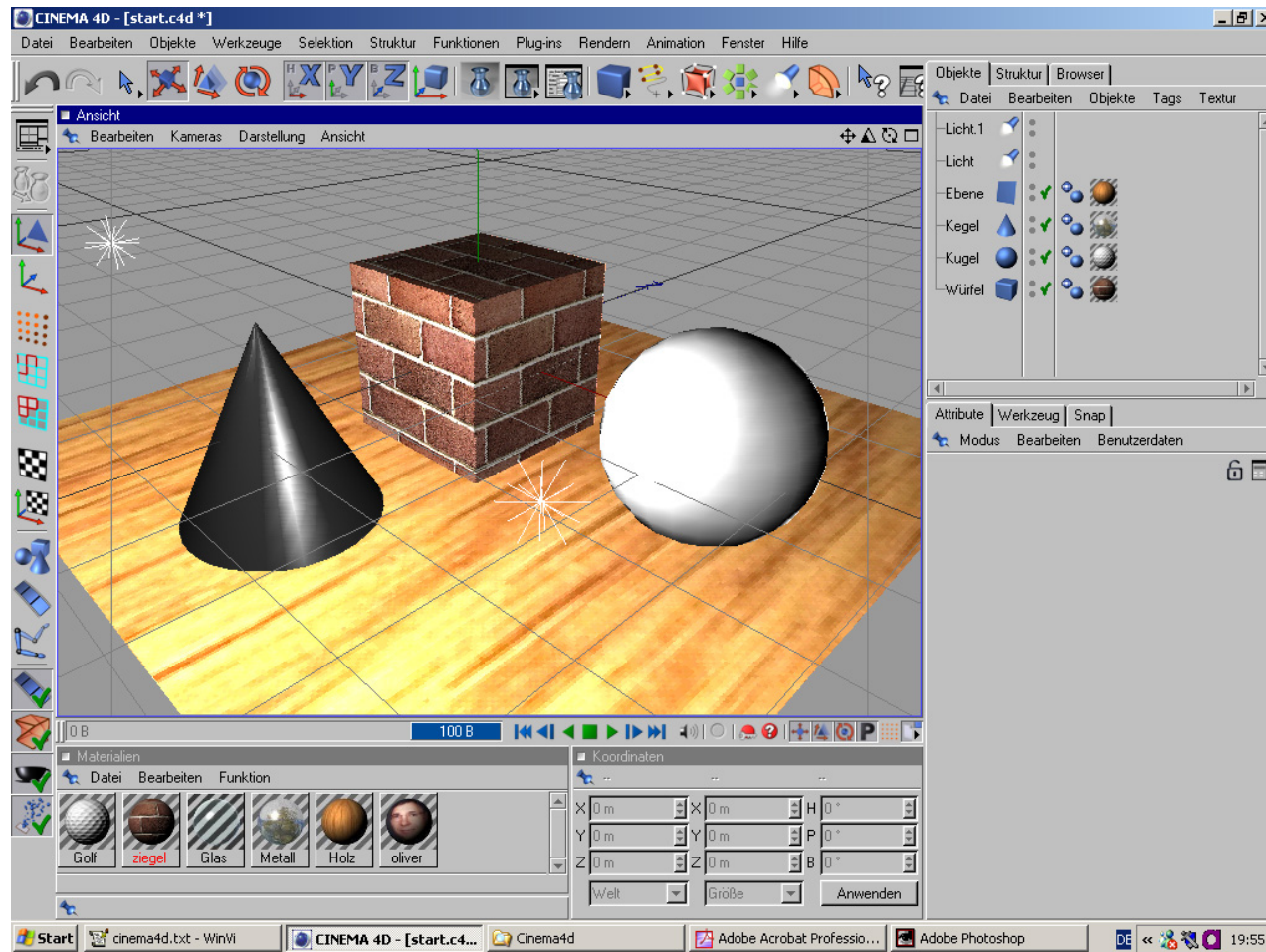
Inverse Kinematik



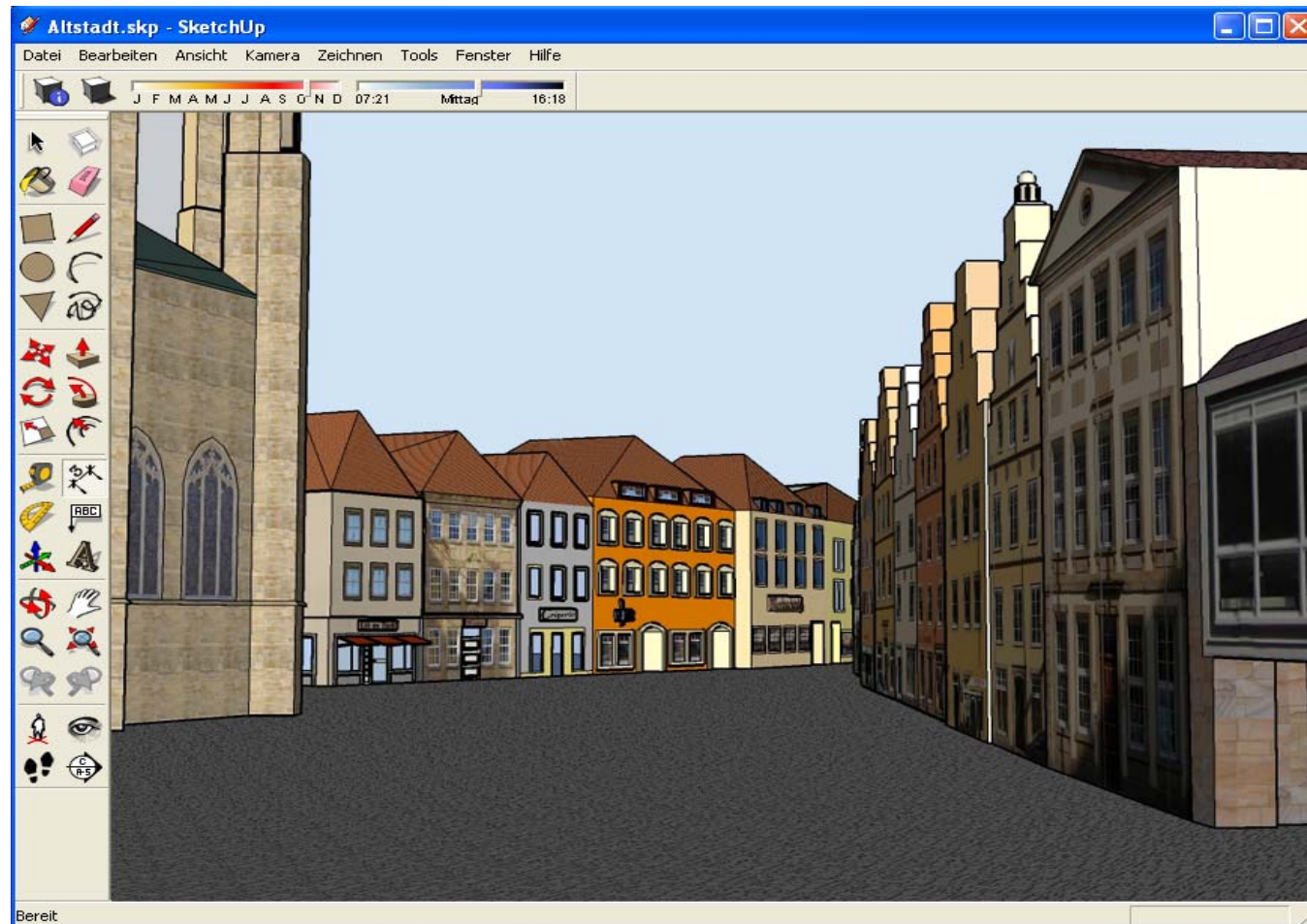
Partikelsysteme



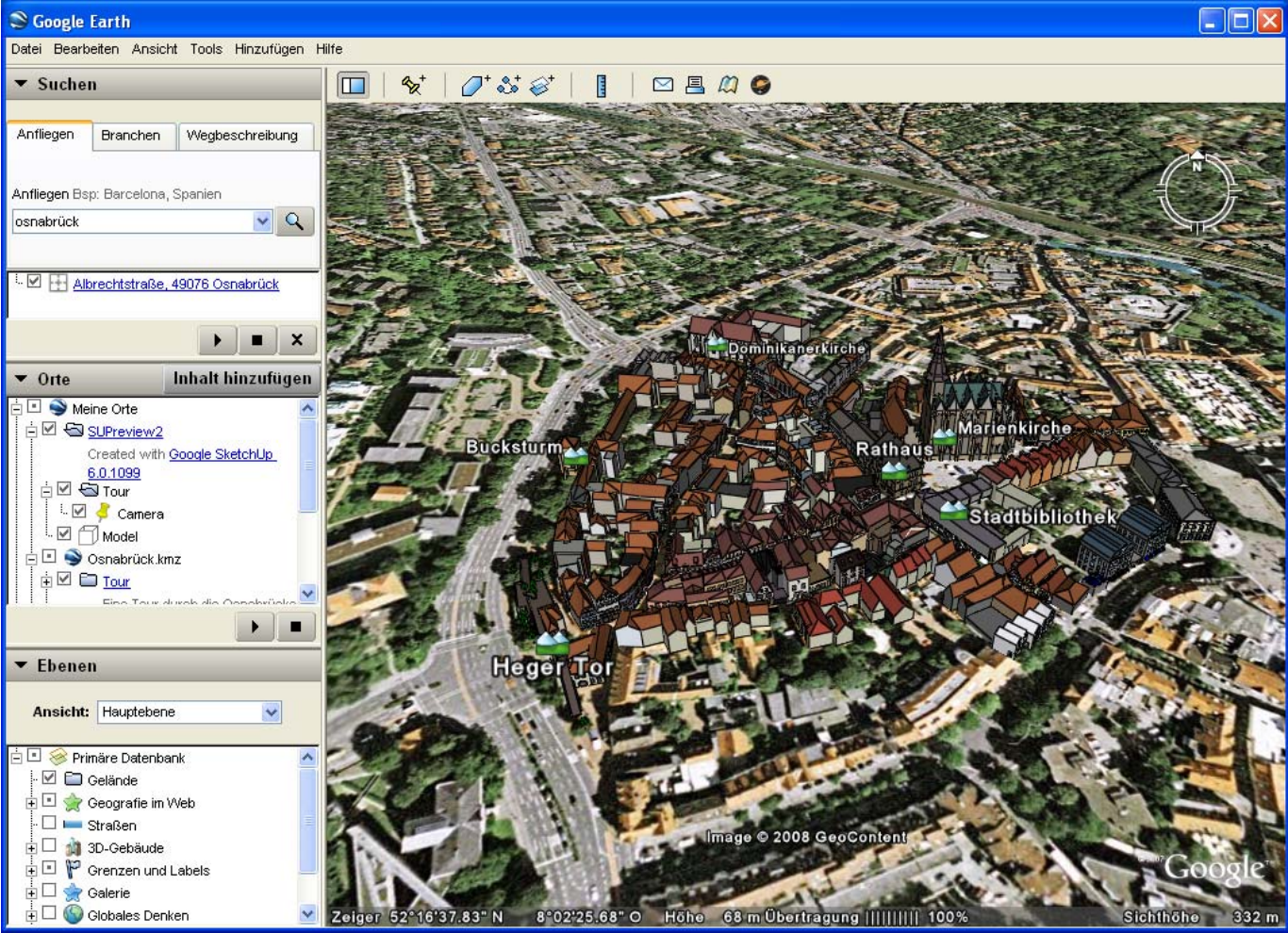
Maxon Cinema4D



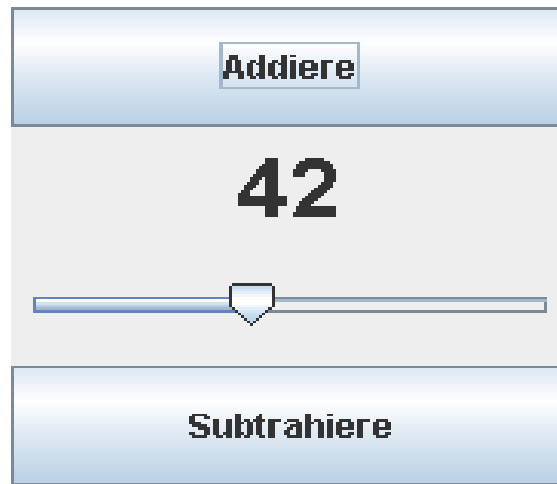
Google SketchUp



Google Earth



Kapitel 2: Grafische Benutzeroberflächen



GUI-Programmierung

- Windowmanager
- AWT (Abstract Window Toolkit)
 - reicht Kommandos weiter an Betriebssystem
 - plattformabhängig
- Swing
 - pure Java
 - einheitliches Look & Feel

GUI-Komponenten

- JFrame
- GridLayout
- JButton
- JLabel
- JSlider
- ActionListener
- actionPerformed

RaufRunterApplikation.java

```
import java.awt.*; import java.awt.event.*; import javax.swing.*;

public class RaufRunterApplikation extends JFrame {
    private int    zaehler  = 42;
    private JButton rauf    = new JButton("Addiere");
    private JLabel ergebnis = new JLabel("42 ",JLabel.CENTER);
    private JSlider schieber = new JSlider(0, 100, zaehler);
    private JButton runter  = new JButton("Subtrahiere");

    public RaufRunterApplikation() {
        setLayout(new GridLayout(0,1));
        add(rauf); add(ergebnis); add(schieber); add(runter);
        rauf.addActionListener(new ActionListener(){
            public void actionPerformed(ActionEvent e){
                zaehler++;
                ergebnis.setText(zaehler + " ");
                schieber.setValue(zaehler);
            }
        });
        runter.addActionListener(new ActionListener(){
            public void actionPerformed(ActionEvent e){
                zaehler--;
                ergebnis.setText(zaehler + " ");
                schieber.setValue(zaehler);
            }
        });
        pack(); setVisible(true);
    }

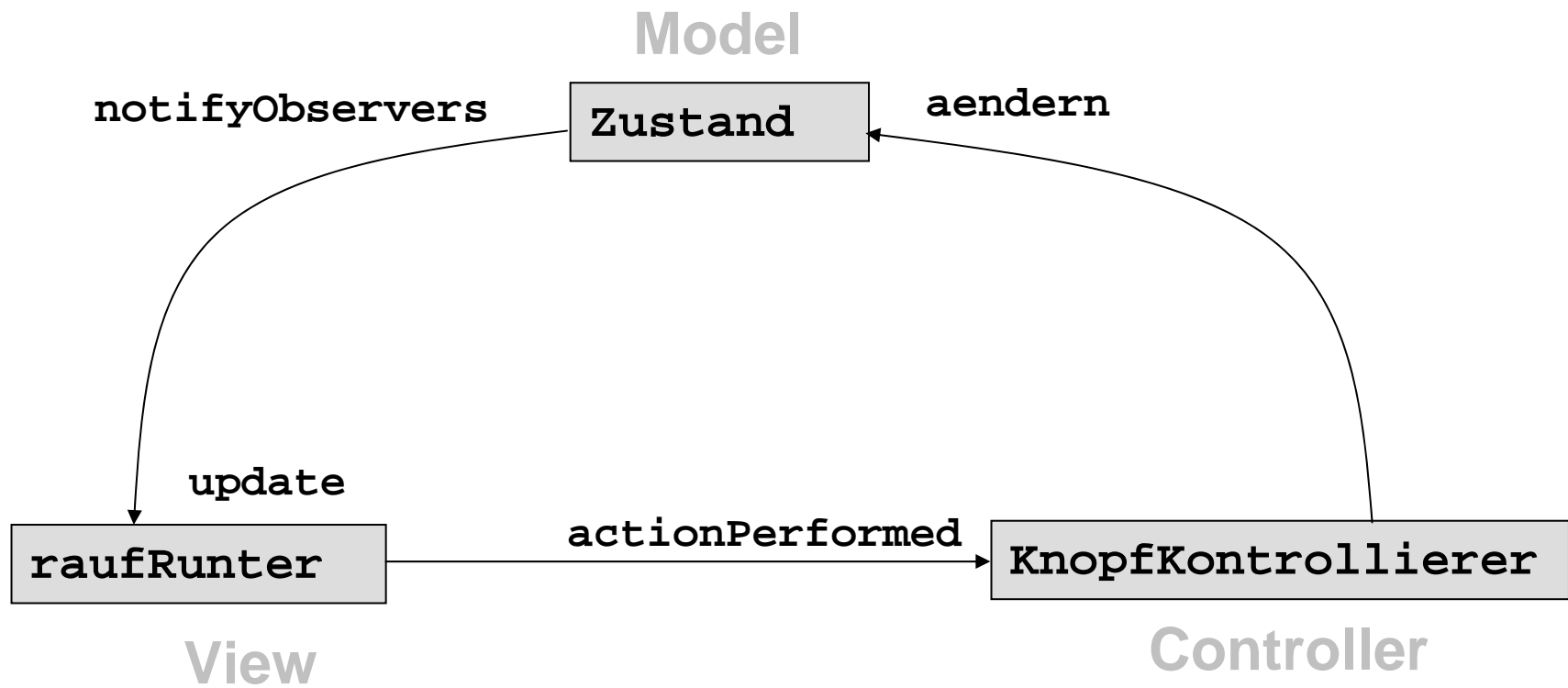
    public static void main (String [] args) {
        new RaufRunterApplikation();
    }
}
```

Control

Model

View

Model-View-Controller



Zustand.java

```
import java.util.Observer;
import java.util.Observable;

public class Zustand extends Observable{

    private int zaehler;

    public Zustand(int zaehler){
        this.zaehler=zaehler;
    }

    int get(){return zaehler;}

    void aendern(int delta){
        zaehler = zaehler + delta;
        setChanged();
        notifyObservers();
    }
}
```

KnopfKontrollierer.java

```
import java.awt.*;
import java.awt.event.*;

public class KnopfKontrollierer implements ActionListener {

    private Zustand z;
    private int delta;

    public KnopfKontrollierer(Zustand z, int delta) {
        this.z      = z;
        this.delta  = delta;
    }

    public void actionPerformed(ActionEvent e) {
        z.aendern(delta);
    }
}
```

RaufRunter.java, Teil 1

```
import java.util.*;
import java.awt.*;
import javax.swing.*;

public class RaufRunter extends JPanel implements Observer {

    private JButton rauf;
    private JButton runter;
    private Zustand z;
    private JLabel  ergebnis;
    private JSlider schieber;
    private Font    font;

    public void update(Observable z, Object dummy){
        ergebnis.setText(((Zustand)z).get() + " ");
        schieber.setValue(((Zustand)z).get());
    }
}
```

RaufRunter.java, Teil 2

```
public RaufRunter() {
    setLayout(new GridLayout(0,1));
    rauf    = new JButton("Addiere");
    runter  = new JButton("Subtrahiere");
    schieber = new JSlider(0,100,42);
    ergebnis = new JLabel("42",JLabel.CENTER);
    font = new Font("SansSerif",Font.BOLD,30);
    ergebnis.setFont(font);
    add(rauf);
    add(ergebnis);
    add(schieber);
    add(runter);
    z = new Zustand(42);
    z.addObserver(this);
    KnopfKontrollierer raufK;
    raufK = new KnopfKontrollierer(z,+1);
    rauf.addActionListener(raufK);
    KnopfKontrollierer runterK;
    runterK = new KnopfKontrollierer(z,-1);
    runter.addActionListener(runterK);
}
}
```


RaufRunterApp.java

```
import java.awt.BorderLayout;
import javax.swing.JFrame;

public class RaufRunterApp {

    public static void main(String args[]) {
        JFrame rahmen = new JFrame("RaufRunter-Applikation");
        rahmen.add(new RaufRunter(),BorderLayout.CENTER);
        rahmen.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        rahmen.pack();
        rahmen.setVisible(true);
    }
}
```

RaufRunterApplet.java

```
import java.awt.BorderLayout;
import javax.swing.JApplet;

public class RaufRunterApplet extends JApplet {

    public void init() {
        add(new RaufRunter(), BorderLayout.CENTER);
    }
}
```

RaufRunter.html

```
<HTML>
  <HEAD>
    <TITLE>RaufRunter-Applet</TITLE>
  </HEAD>
  <BODY>
    <CENTER>
      <H1>RaufRunter-Applet</H1>
      <APPLET
        width    = 200
        height   = 150
        code     = "RaufRunterApplet.class"
        archive  = "raufRunter.jar">
      </APPLET>
    </CENTER>
  </BODY>
</HTML>
```

Dateisystem

