# 7 Software Engineering Techniques for Multimedia Software



Literature:

Gamma/Helm/Johnson/Vlissides: Design Patterns, Addison-Wesley 1994
*(= „Gang of Four“, „GoF“)*

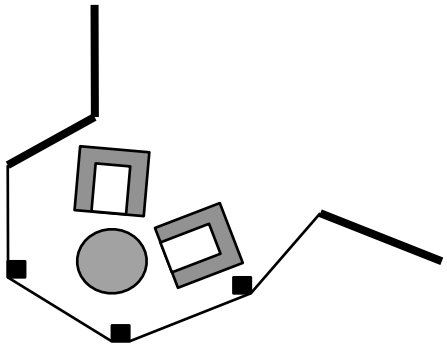
# Design Patterns

- A *design pattern* is a generic solution for a class of recurring programming problems
  - Helpful idea for programming
  - No need to adopt literally when applied
- Origin:
  - Famous book by Gamma/Helm/Johnson/Vlissides (“Gang of Four”)
    - » List of standard design patterns for object-oriented programming
    - » Mainly oriented towards graphical user interface frameworks
    - » Examples: Observer, Composite, Abstract Factory
- Frequently used in all areas of software design
- Basic guidelines:
  - Patterns are not invented but recovered from existing code
  - Pattern description follows standard outline
    - » E.g.: Name, problem, solution, examples

# Window Place: Architectural Pattern

Christopher Alexander et al., A Pattern Language, 1977
(quoted in Buschmann et al. 1996)

- **Problem:** In a room with a window and a sitting opportunity users have to decide whether to have a look or to sit.
- **Solution:**
  At least one window of the room shall provide a sitting place.
- **Structure:**



Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.

Christopher Alexander et al., A Pattern Language

# Description of a Design Pattern

- Name
- Problem
  - Motivation
  - Application area
- Solution
  - Structure (class diagram)
  - Participants (usually class, association und operation names):
    - » Role name, i.e. place holders for parts of implementation
    - » Fixed parts of implementaton
  - Collaboration (sequence of events, possibly diagrams)
- Discussion
  - Pros and cons
  - Dependencies, restrictions
  - Special cases
- Known uses

# 7 Software Engineering Techniques for Multimedia Software

7.1 Design Patterns: The Idea

7.2 Patterns for Multimedia Software 

7.3 Gang-of-Four Patterns Applied to Multimedia

7.4 Modeling of Multimedia Applications

# Patterns for Multimedia Software

- The following catalog of patterns is not taken from literature, but derived from the material in this lecture
  - Work in progress, needs to be revised/completed
- Types of patterns:
  - Cross-platform patterns
  - Patterns specific for a certain platform (e.g. Flash, Pygame, JavaFX)

# Cross-Platform Multimedia Pattern: Event Handler

- Program code is not executed sequentially but triggered by events
- Space usage: any
- Time usage: Interaction dependent
- Interactivity: any
- Examples:
  - ActionScript event handlers
  - Lingo event handlers
  - JavaFX event handlers
  - Python event handlers
  - ...

# Cross-Platform Multimedia Pattern: Clockwork

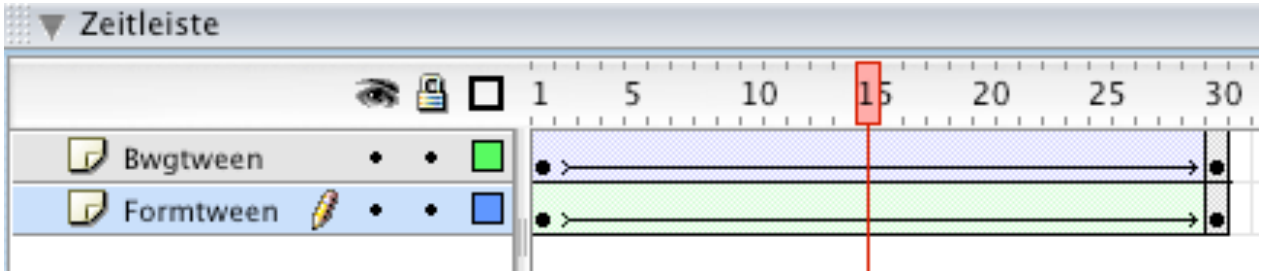
- The current properties of presentation elements are derived from the current value of a “clock” ticking at regular time intervals
- Time usage: Linear progress
- Limited interactivity: Automatic or confirmations&questions
- Usually combined with static layout or scenes and objects
- Examples:
  - Timeline in Flash, Director
  - EnterFrame-Events in Flash ActionScript
  - Ticking scripts in Squeak
  - PActivity in Piccolo


```
PActivity flash =
        new PActivity(-1, 500, currentTime + 5000) {

        protected void activityStep(long elapsedTime) {
        … }
```

# Cross-Platform Multimedia Pattern: Interpolation

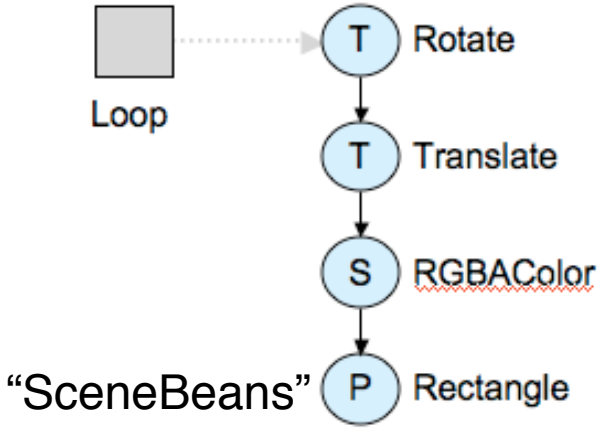
- A parameter (usually regarding a graphical property) is assumed to change its value continuously dependent of another parameter (e.g. time). The dependency can follow a linear or other rules of computation.
  - Fixed values for the dependent parameter are given for certain values of the base parameter.
  - Intermediate values of the dependent parameter are computed by interpolation.
- Space usage: scenes&objects mainly
- Time usage: Linear progress only
- Usually combined with low interactivity (on this level)
- Examples:
  - Tweening in Flash
  - Animation methods in Piccolo
  - JavaFX interpolators

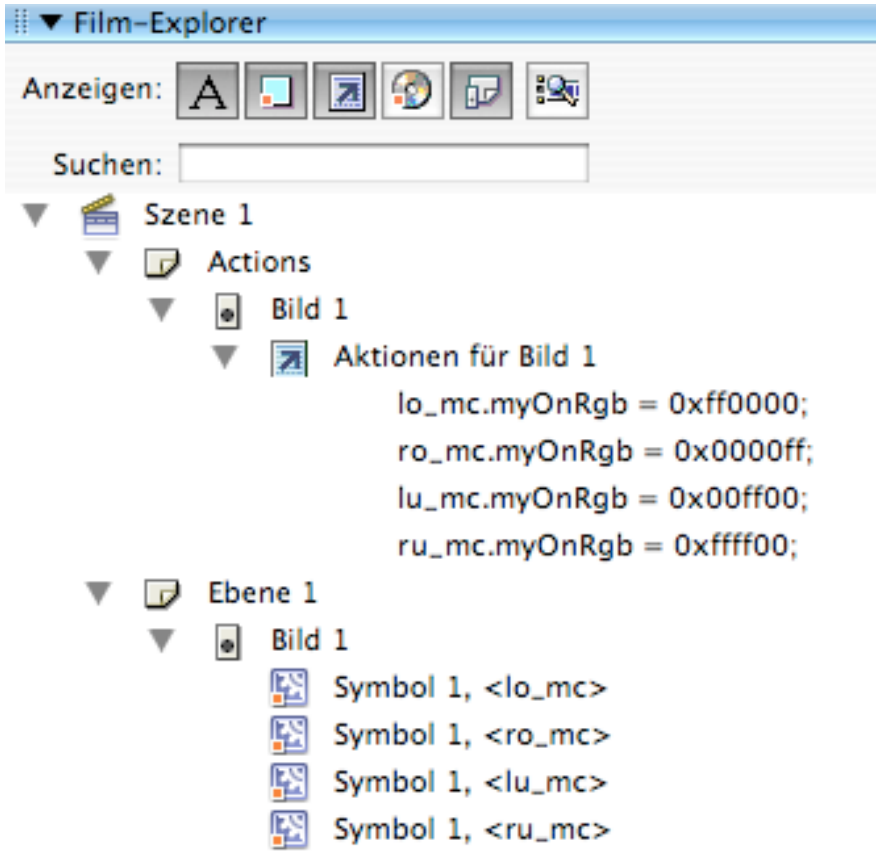



```
PActivity a1 =
     aNode.animateToPositionScaleRotation(0, 0, 0.5, 0, 5000);
```

# Cross-Platform Multimedia Pattern: Scene Graph

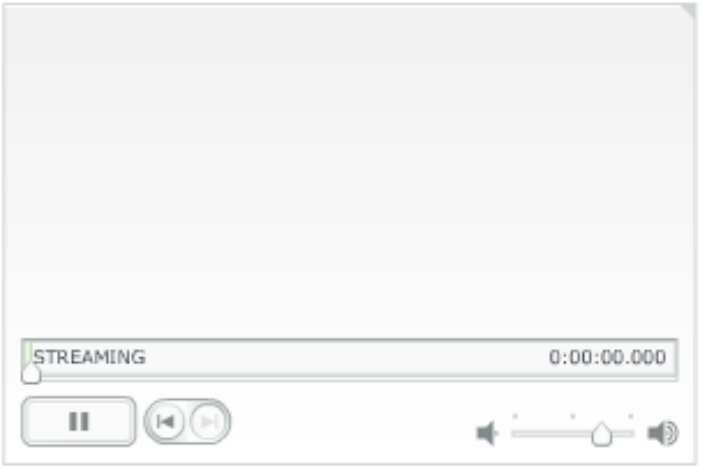
- Graph structure comprises all represented objects together with the operations (transformations) applied to them
- Space usage: Scenes&objects or fully dynamic
- Time usage: Linear progress or interaction dependent
- Examples:
  - Scene graph of JavaFX
  - Scene graph of Piccolo
  - Implicit: Film Explorer view in Flash



# Multimedia Pattern for Selected Platforms: Player Component

- For standardized time-dependent media types, a pre-fabricated component is made available which provides
  - Playback of associated media files
  - Standard VCR-style controls (play, pause, stop, rewind)
- Space usage: any
- Time usage: Linear progress
- Interactivity: Interactive controls
- Examples:
  - Flash FLVPlayer component
  - JMF Player component
  - QuickTime player in QT4Java




```
try {
      p = Manager.createPlayer(new MediaLocator("file:"+file));
      p.addControllerListener(new ContrEventHandler());
      p.realize();
    }
```