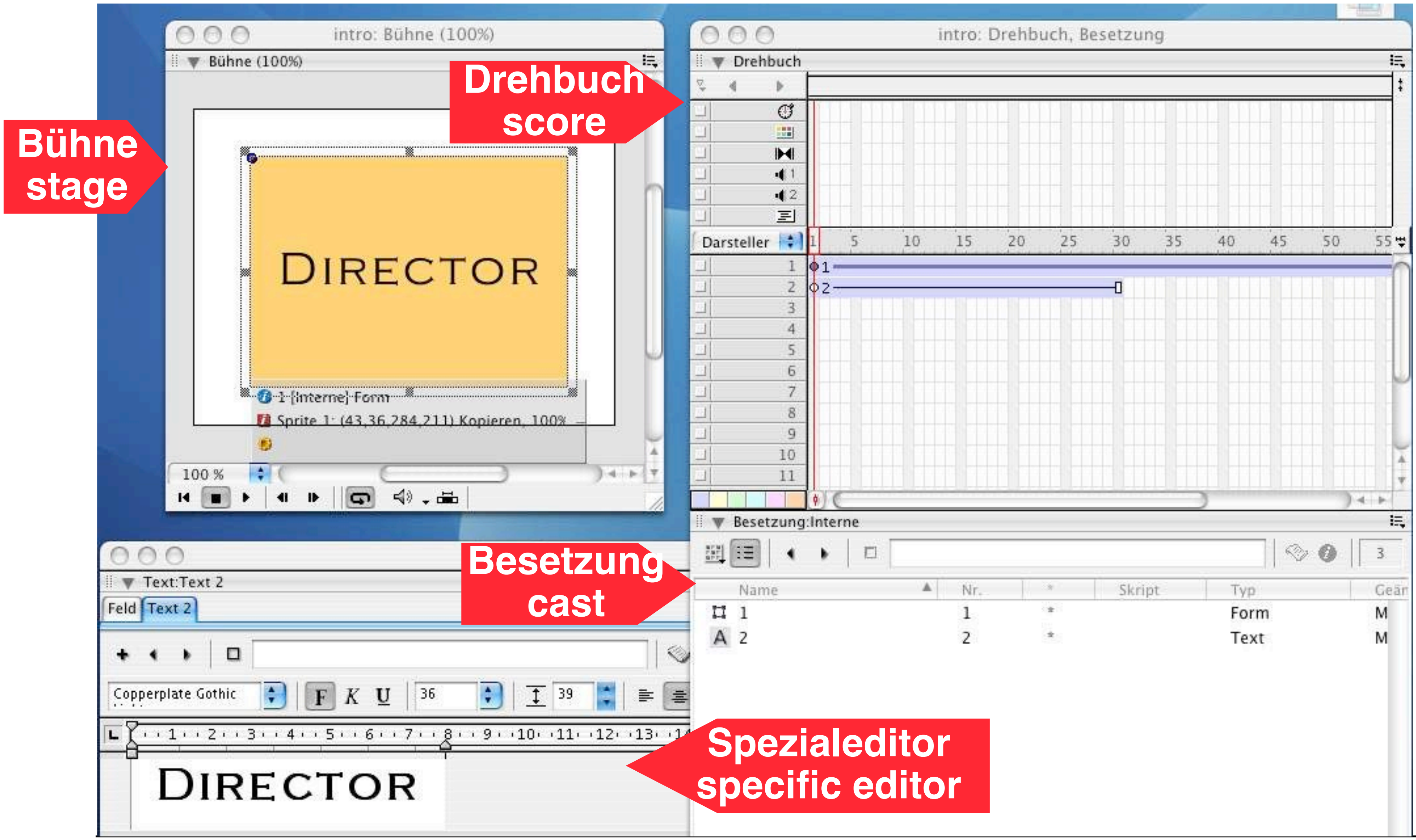
4 Overview on Approaches to Multimedia Programming

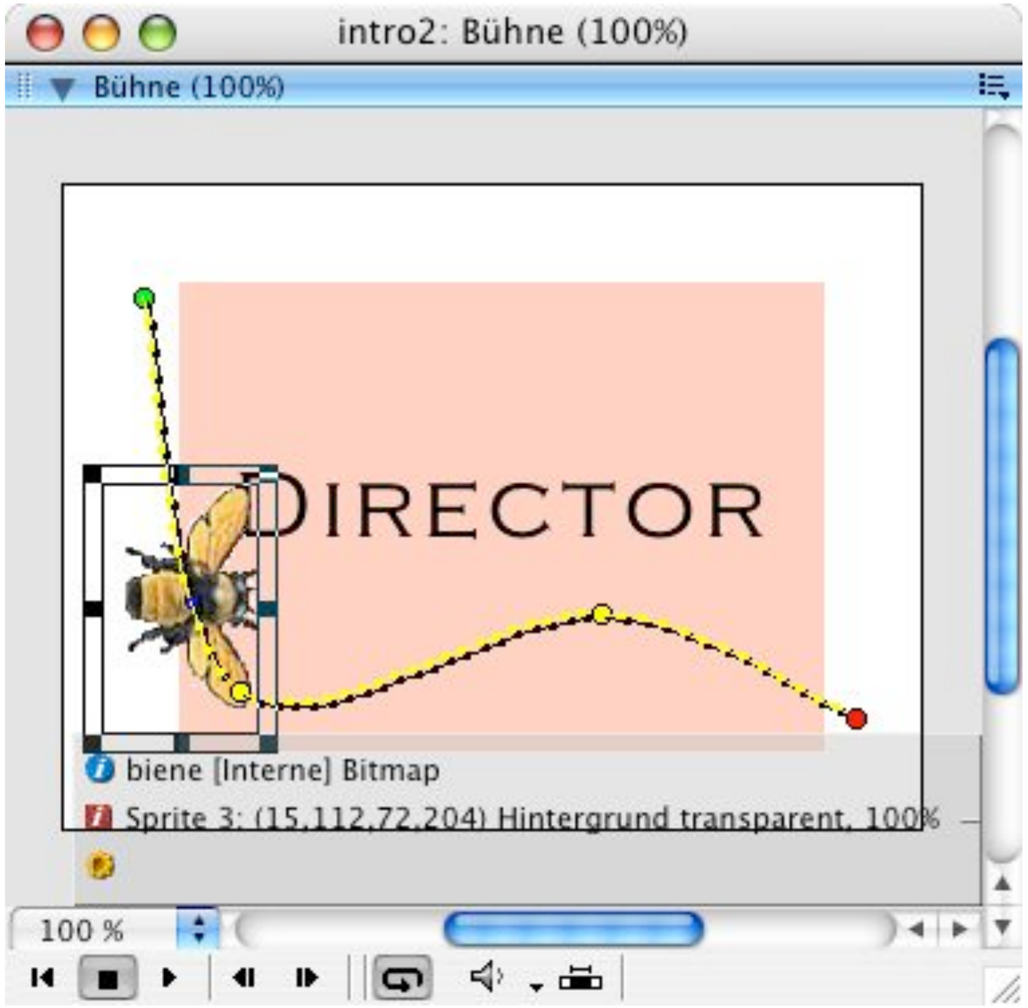
Adobe Director Desktop (German Version)



Name	Nr.	*	Skript	Typ
1	1	*		Form
2	2	*		Text

Motion Tweening in Director

- Very similar to Flash but easier
  - Each sprite has a default registration point for a motion path
  - Drawing motion paths is straightforward
  - Key frames used to reshape motion path



biene [Interne] Bitmap

Sprite 3: (15,112,72,204) Hintergrund transparent, 100%

Director: The Lingo Paradigm

- Lingo is the programming language of the authoring tool Adobe Director.
- Lingo is very much inspired by “HyperTalk” (Apple)
- All programming is programming event handlers
- There is no main program
    - Effectively the event handler of “prepareMovie” is kind of a main program
- Program code is only meaningful together with project file of the authoring system
    - No stand-alone programs
- All code is scattered over the project

Object-Orientation in Director: “Parent-Child Programming” (1)

- “Parent script” (class):

```
property pVorname, pNachname

on new me
  return me
end

on fill me, vorname, nachname
  pVorname = vorname
  pNachname = nachname
end
```

Object-Orientation in Director: “Parent-Child Programming” (2)

- Global script (film script):

vornane, nachname are text input fields

```
global lUsers

on prepareMovie
  lUsers = []
end

on fillOut
  temp = new(script "parent script")
  fill(temp, member("vorname").text, member("nachname").text)
  append(lUsers, temp)
  clearfields
end

on clearFields
  member("vorname").text = ""
  member("nachname").text = ""
end
```

SMIL Example: Slide Show (1)

```
<smil xmlns="http://www.w3.org/2001/SMIL20/Language">
  <head>
     <layout>
       <root-layout width="356" height="356"/>
       <region id="brush_region" z-index="1"/>
       <region id="img_region" width="256" height="256“
           left="50" top="50" z-index="2"/>
     </layout>
     <transition id="img_wipe" type="barWipe“
           dur="3s"/>
     <transition id="bkg_wipe" type="barWipe“
           direction="reverse" dur="3s"/>
  </head>
```

SMIL Example: Slide Show (2)

```
...
  <body>
     <par>
        <seq>
          <img region="img_region" src="....jpg" ...
             transIn="img_wipe" fill="transition"/>
          ...
        </seq>
        <seq>
          <brush color="green" region="brush_region"
             ... transIn="bkg_wipe" fill="transition"/>
        </seq>
        <audio src....mp3"  end="32s"/>
     </par>
  </body>
</smil>
```

QuickTime for Java

- The QuickTime media framework (Apple) is available as a programming framework as well for
  - C, C++
  - Java (Wrapper, QT for Java)
  - (for Windows and MacOS only)
- Programs can use the QuickTime for instance to
  - Play movies and audio files
  - Play SMIL presentations
  - Display images
  - Use an extensive file conversion library
  - Compose images by compositing overlays
  - Using built-in graphical transition effects
  - Display simple animations (QT Sprites)
    - » Including movement paths, interactive controls, event handlers

QuickTime for Java Example

```
public Zoo1(String s) {
     super(s);
     setResizable( false );
     setBounds( 0, 0, WIDTH, HEIGHT );
     QTCanvas myQTCanvas = new QTCanvas(
       QTCanvas.kInitialSize, 0.5F, 0.5F );
     add( myQTCanvas );
     try         {
       QTFile imageFile = new QTFile(
         QTFactory.findAbsolutePath("xyz.jpg" ));
       GraphicsImporterDrawer mapDrawer =
         new GraphicsImporterDrawer( imageFile );
       myQTCanvas.setClient( mapDrawer, true );
     }  catch ...
}
```

http://developer.apple.com/quicktime/qtjava/qtjtutorial

4 Overview on Approaches to Multimedia Programming

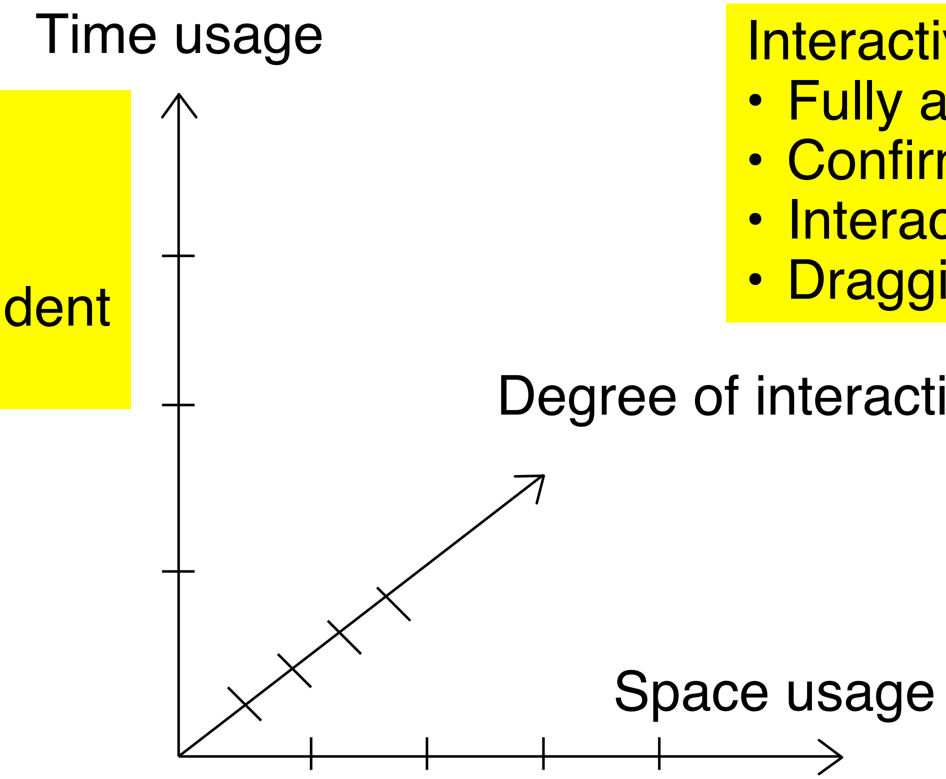
Space, Time and Interactivity

- Multimedia applications have space and time extension
- *Space*:
  - Conveys essential information through graphical design
  - Example: Game
  - Advanced concepts (e.g. ubiquitous applications, AR): 3D space, real world
- *Time*:
  - Progress of time influences presentation
  - Example: Video, audio, animation
- Third dimension: *Interactivity*
  - Degree of user interaction
- Multimedia objects
  - occupy a certain range in space, time and interactivity
  - address a certain number of *modalitites* (auditive, visual, tactile)

Classification Space

Time usage:
- Still picture
- Linear progress
- Interaction dependent progress

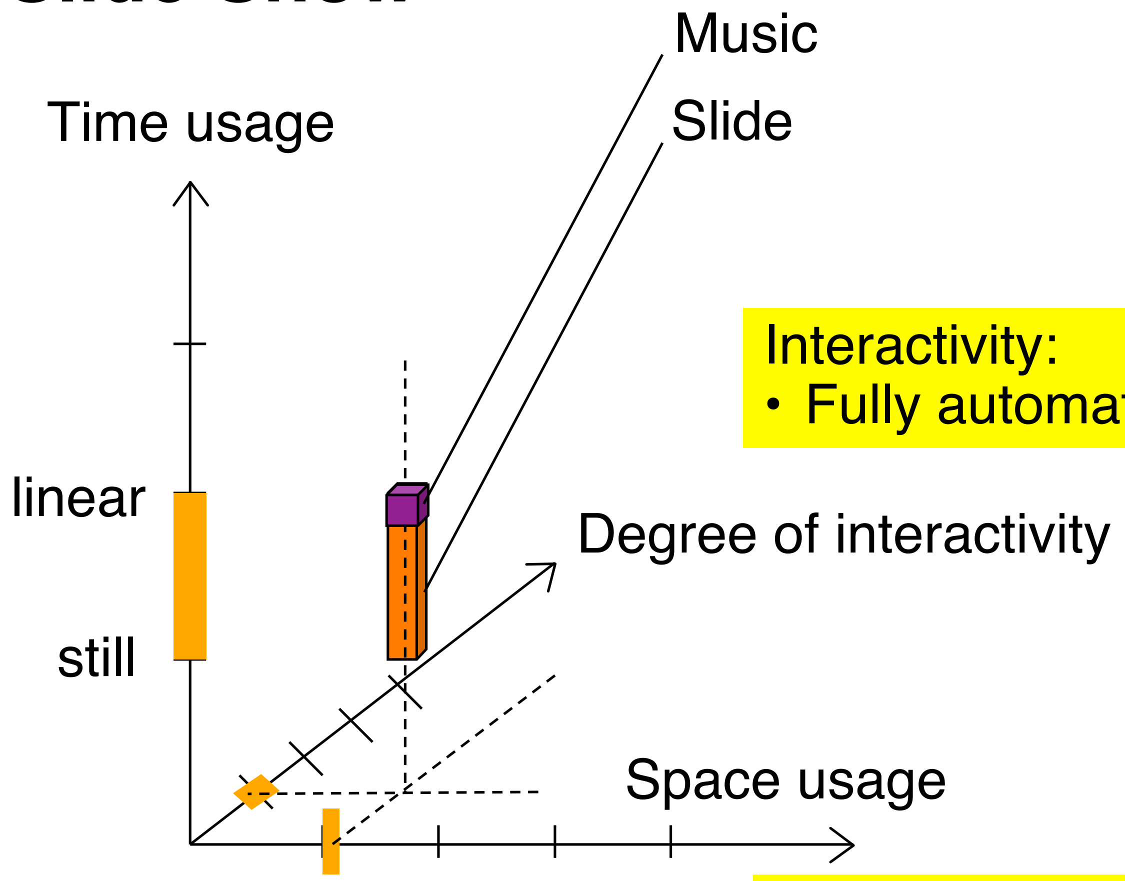
Interactivity:
- Fully automatic
- Confirmations & questions
- Interactive controls
- Dragging of objects



Space usage:
- Static layout
- Scenes
- Scenes & objects
- Fully dynamic

Example 1: Slide Show

Time usage:
- Still picture & Linear progress



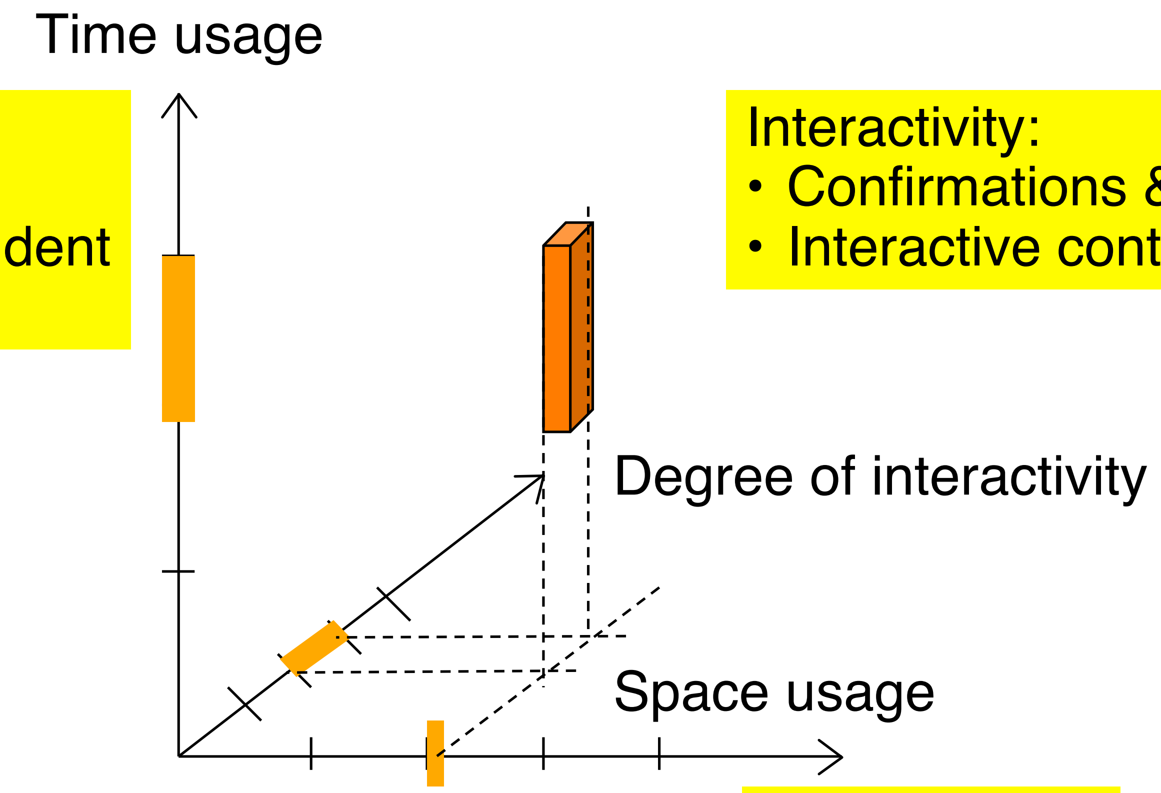
Interactivity:
- Fully automatic

Space usage:
- Static layout

Example 2: Animated Product Presentation

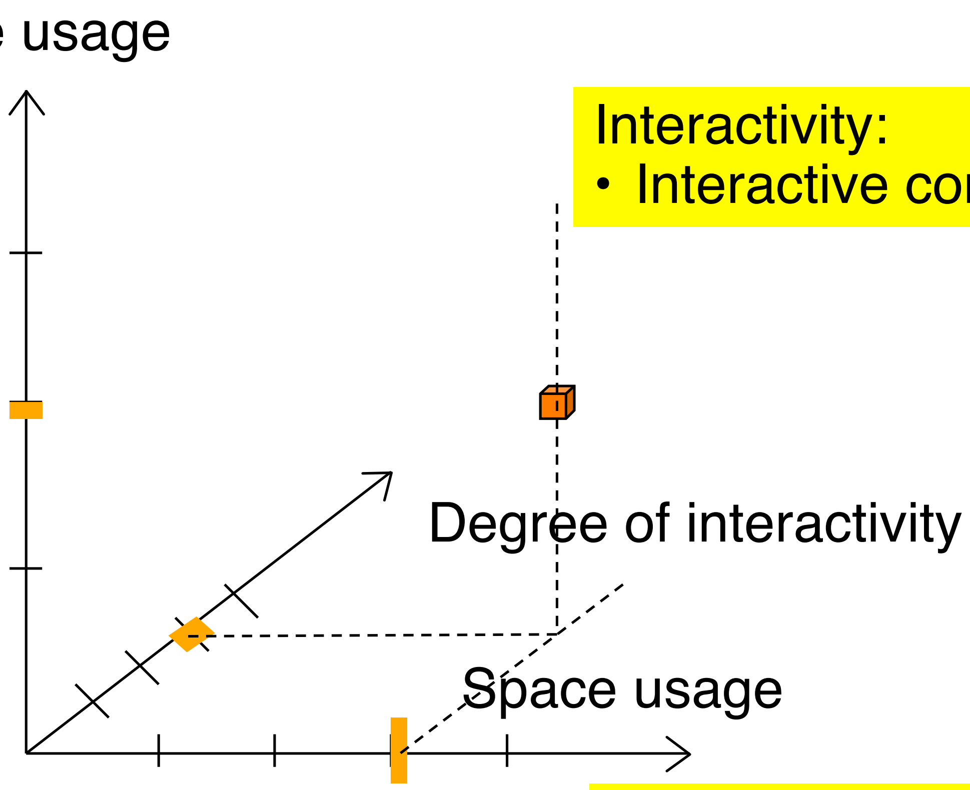
Time usage:
- Linear progress
- Interaction dependent progress

Interactivity:
- Confirmations & questions
- Interactive controls



Space usage:
- Scenes

Example 3: Game

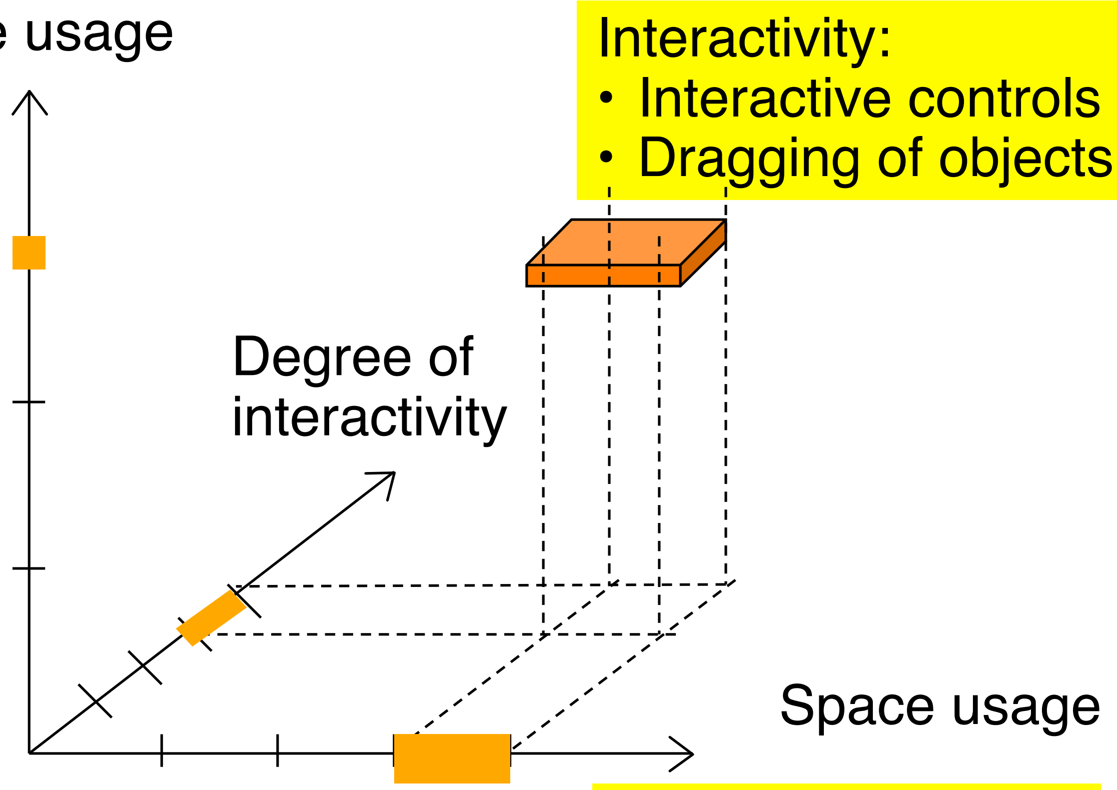


Time usage:
- Interaction dependent progress

Interactivity:
- Interactive controls

Space usage:
- Scenes & objects

Example 4: Virtual World



Time usage:
- Interaction dependent progress

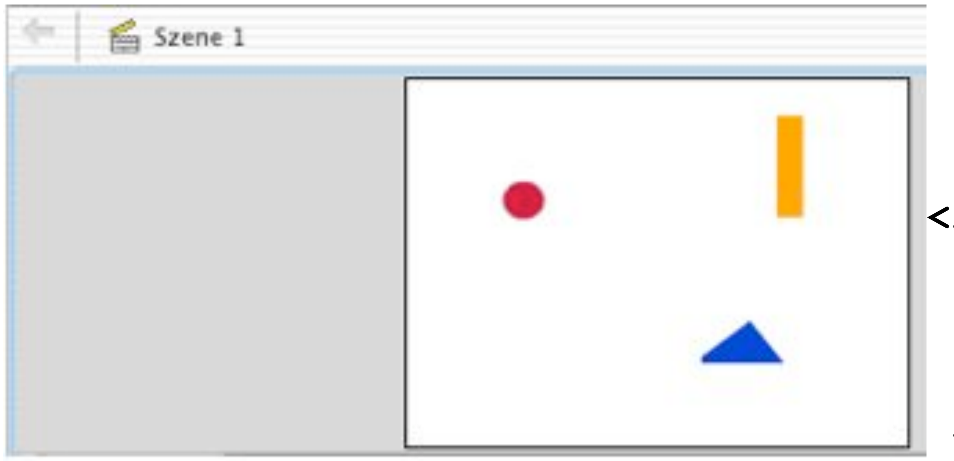
Interactivity:
- Interactive controls
- Dragging of objects

Space usage:
- Scenes & objects
- Fully dynamic

4 Overview on Approaches to Multimedia Programming

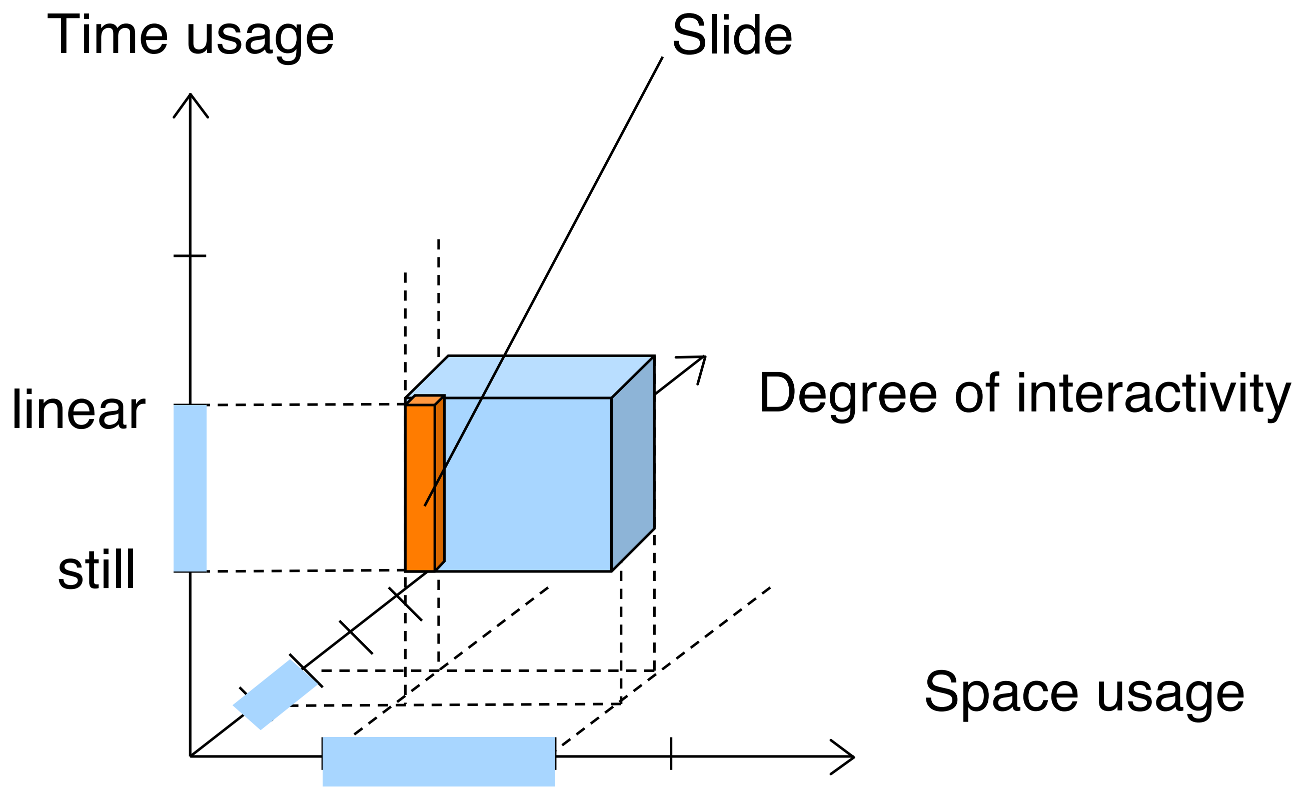
Multimedia Development Pattern: Space Layout

- The location of objects in the presentation space is fixed by assigning coordinates to the objects.
- Space usage:
  - Static layout, scenes or scenes&objects
- Usually combined with highly automatic time usage and low interactivity
- Examples:
  - SMIL layout
  - Flash & Director stage
  - JGoodies Swing layout



```
<layout>
  <root-layout width="356" height="356"/>
  <region id="brush_region" z-index="1"/>
  <region id="img_region" width="256" height="256‟
 left="50" top="50" z-index="2"/>
</layout>
```

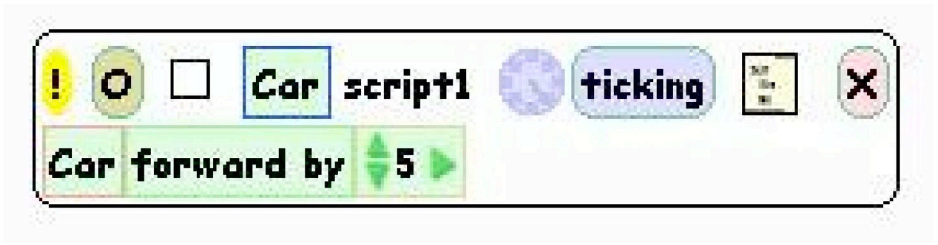
Pattern Space Layout: Application Range



Each pattern has an application range.
It is suitable for multimedia applications the properties of which are within its range.

Multimedia Development 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

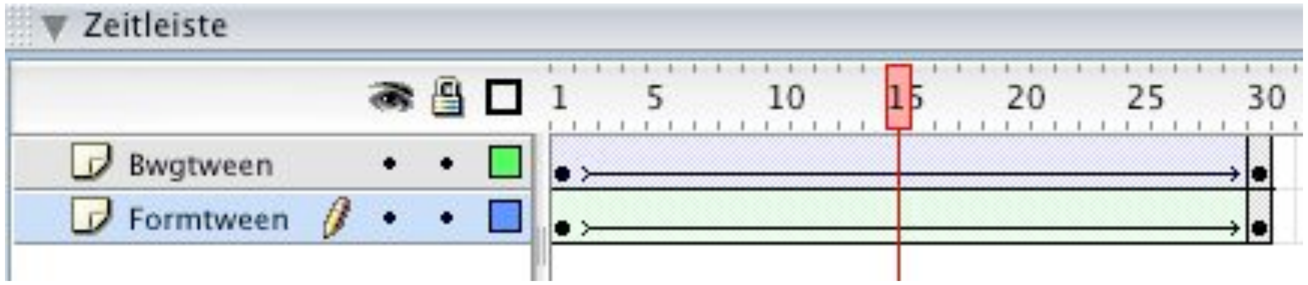


```
PActivity flash =
        new PActivity(-1, 500, currentTime + 5000) {

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

Multimedia Development Pattern: Interpolation

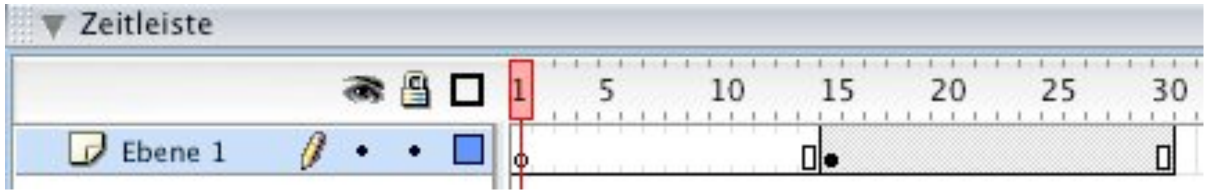
- A parameter (usually regarding a graphical property) is assumed to change its value continuously dependent of another parameter (e.g. time). The dependency can follow a linear or other rules of computation.
  - Fixed values for the dependent parameter are given for certain values of the base parameter.
  - 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



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

Multimedia Development Pattern: Scheduled Time

- An activity is assumed to start at a given point in time. The start time is specified
  - in absolute terms, or
  - relatively to another activity
- Time usage: Mainly automatic
- Low interactivity
- Examples:
  - SMIL time specifications (begin attribute)
  - Placement of code or object in certain frame in Flash
  - setStartTime() and startAfter() methods in Piccolo



```
a1.setStartTime(currentTime);
a2.startAfter(a1);
a3.startAfter(a2);
```

Multimedia Development Pattern: Process Algebra

- Presentation is built from atomic parts (processes) each of which is executed sequentially.
- Presentation is constructed using operations similar to mathematical process algebra: sequential composition, parallel composition, repetition, mutual exclusion,synchronisation options
- Time usage: Linear progress
- Space usage: Scenes or scenes&objects
- Low interactivity
- Examples:
  - Animations class of JGoodies
  - SMIL body: seq, par, excl
  - Sequence of frames and parallelism of layers in Flash

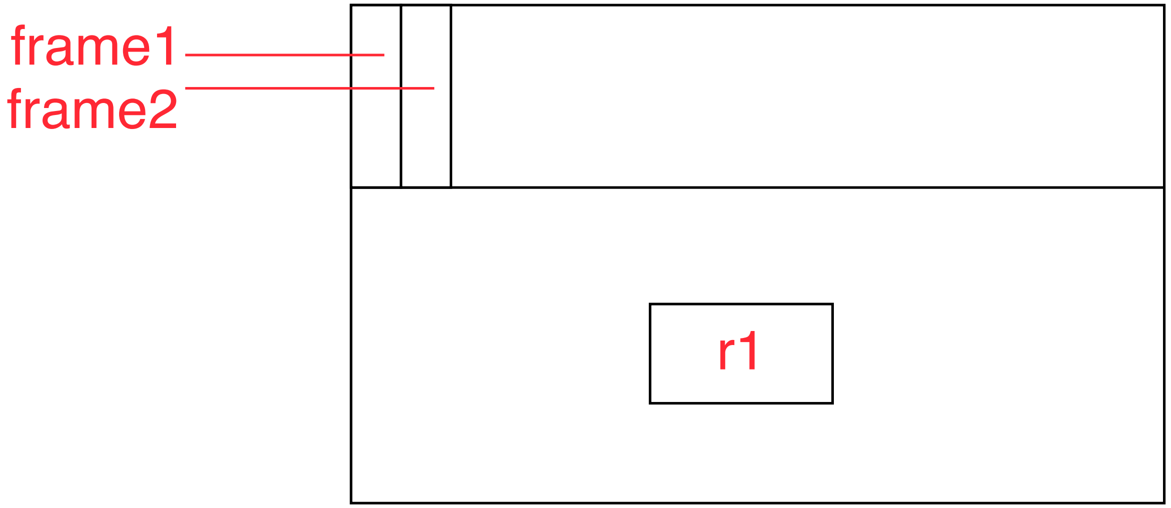
Various Representations of a Single Concept

```
<layout>
  <region id="r1" ...>
</layout>
<body>
  <seq>
      ...frame1
      ...frame2
  </seq>
</body>
```

XML

```
Component r1 = ...;
Animation frame1 = ...;
Animation frame2 = ...;
Animation all =
  Animations.sequential(
    new Animation[]{
      frame1, frame2});
```

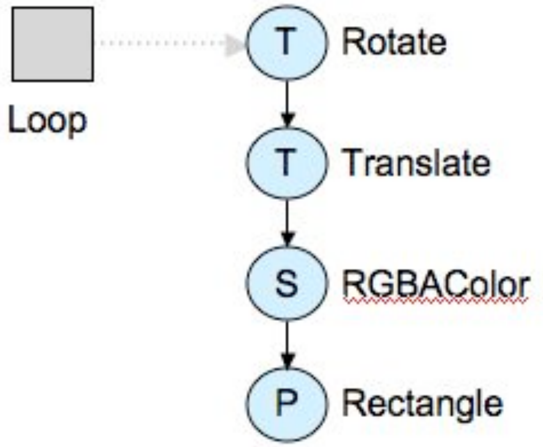
Java

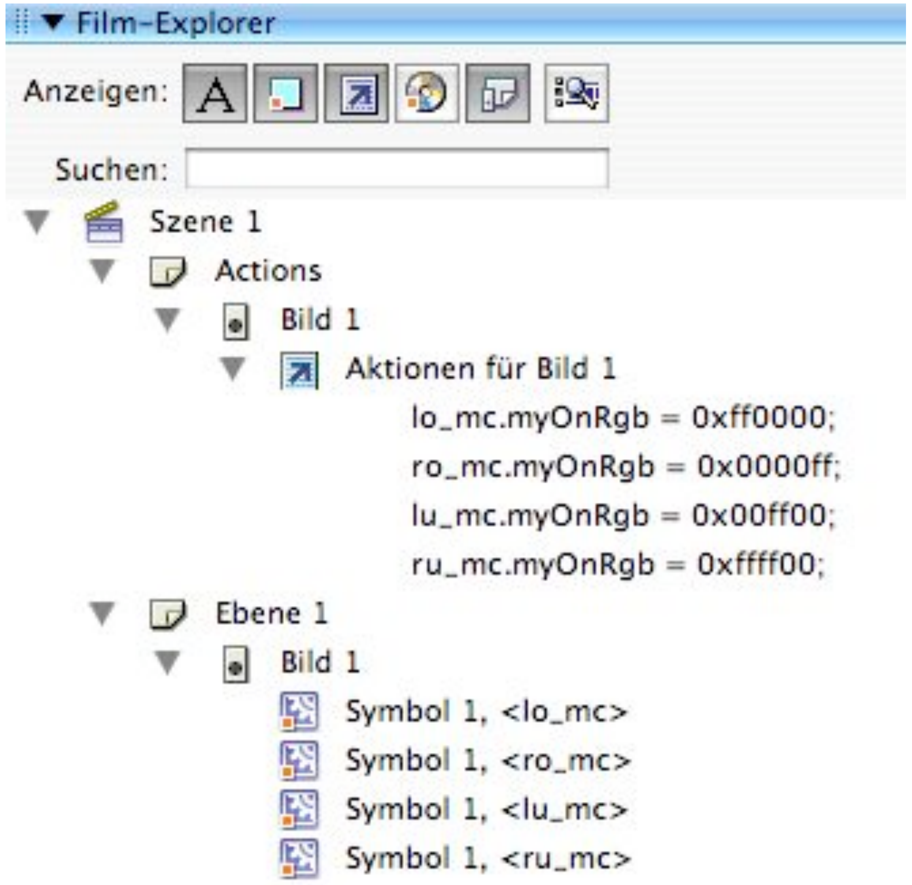


Authoring Tool (Flash-like)

Multimedia Development 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 SceneBeans
  - Scene graph of Piccolo
  - Implicit: Film Explorer view in Flash

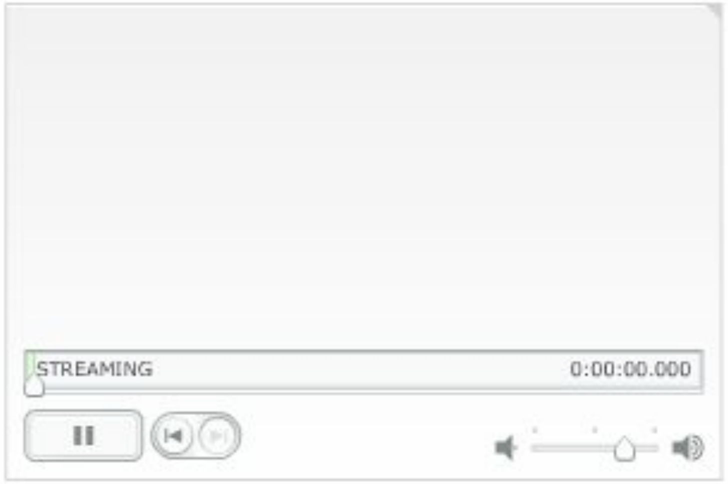




```
Szene 1
  Actions
    Bild 1
      Aktionen für Bild 1
        lo_mc.myOnRgb = 0xff0000;
        ro_mc.myOnRgb = 0x0000ff;
        lu_mc.myOnRgb = 0x00ff00;
        ru_mc.myOnRgb = 0xffff00;
  Ebene 1
    Bild 1
      Symbol 1, <lo_mc>
      Symbol 1, <ro_mc>
      Symbol 1, <lu_mc>
      Symbol 1, <ru_mc>
```

Multimedia Development Pattern: 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 MediaPlayback component
  - JMF Player component
  - QuickTime player in QT4Java



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

Multimedia Development 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
  – JMF event handlers
  – Squeak/Smalltalk event handlers
  – ...

4 Overview on Approaches to Multimedia Programming

Properties of Development Tools & Languages

- Supported multimedia development patterns (see above)
- Supported kinds of application (see above classification)
- Visual programming vs. Textual programming
  - Graphical editor vs. Textual vector data
    - » Example: Flash vs. Piccolo
  - Integration of scripting language
    (script-less, integrated, separated, script-based)
    - » Example: Script types in Flash
- Degree of abstraction & platform-independence
  - Modeling language vs. Programming language
  - Code generation, compilation, reverse engineering, round-trip engineering
    - » Example: MML
- Run time/ Design Time Trade-Off
  - Compilation process or seamless interaction with living world
    - » Example: Flash vs. Squeak

Conclusion

- What do you expect from the next generation of multimedia programming technologies?
- What is your forecast about the role multimedia programming will play in the future of software development techniques?