6 Programming with Video

Literature:

Clemens Szyperski: Component Software - Beyond Object-Oriented Programming. 2nd ed. Addison-Wesley 2002

M.D. McIlroy: Mass produced software components. In: Naur/Randell (eds.), Software Engineering, NATO Scientific Affairs Div. 1969 (http://www.cs.dartmouth.edu/~doug/components.txt)

Software Components

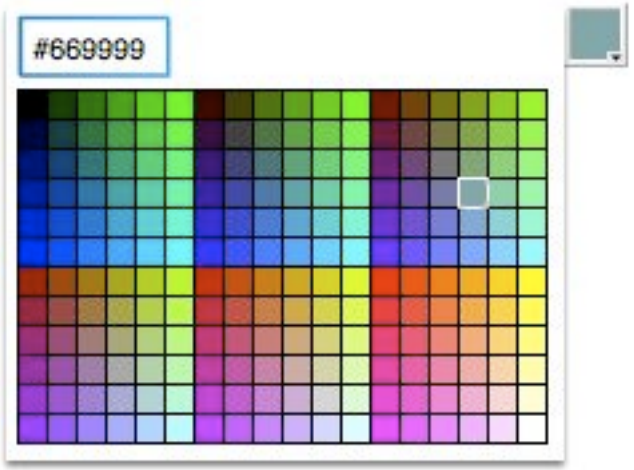
- *Software component:* "A ***software component*** is a unit of composition with contractually specified interfaces and explicit context dependencies only. A software component can be deployed independently and is subject to composition by third parties."
  ECOOP 1996, Workshop on Component-oriented Programming
- Components for visual development environments:
  - Provide well-defined functionality
  - Can be dragged from palette to working area (creating an instance)
  - Can be adjusted by setting parameter values with a *component inspector*
  - Can, in some environments, be connected to other components using visual metaphors
    - » Connecting input and output "ports" with "lines"
- Component is also accessible through programming (API):
  - Parameters can be manipulated by program code (getter, setter)
- There is a marketplace for components
  - Custom components
  - Building blocks for software

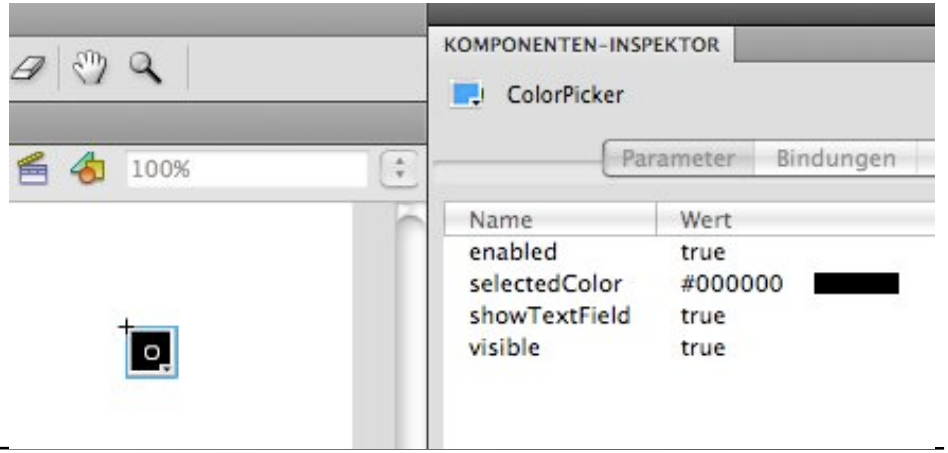
Flash Components

- *Flash component:* A reusable unit of Flash design and ActionScript programming with clearly specified parameters and methods.
- A Flash component encapsulates a ready-made solution that can be incorporated into third-party Flash applications.
- Components delivered with Flash (CS4, examples):
  - User Interface components:
    - » Button, CheckBox, ColorPicker, ComboBox, DataGrid, Label, ProgressBar, ScrollPane, Slider, TextArea, TextInput, ...
  - Video components:
    - » FLVPlayback, ForwardButton, FullScreenButton, …
- File format for Flash components: *.swc*
  - Components are pre-compiled
  - Components cannot be edited by developer
- Components exist also in other platforms (e.g. JavaFX)

Example Flash Component: ColorPicker

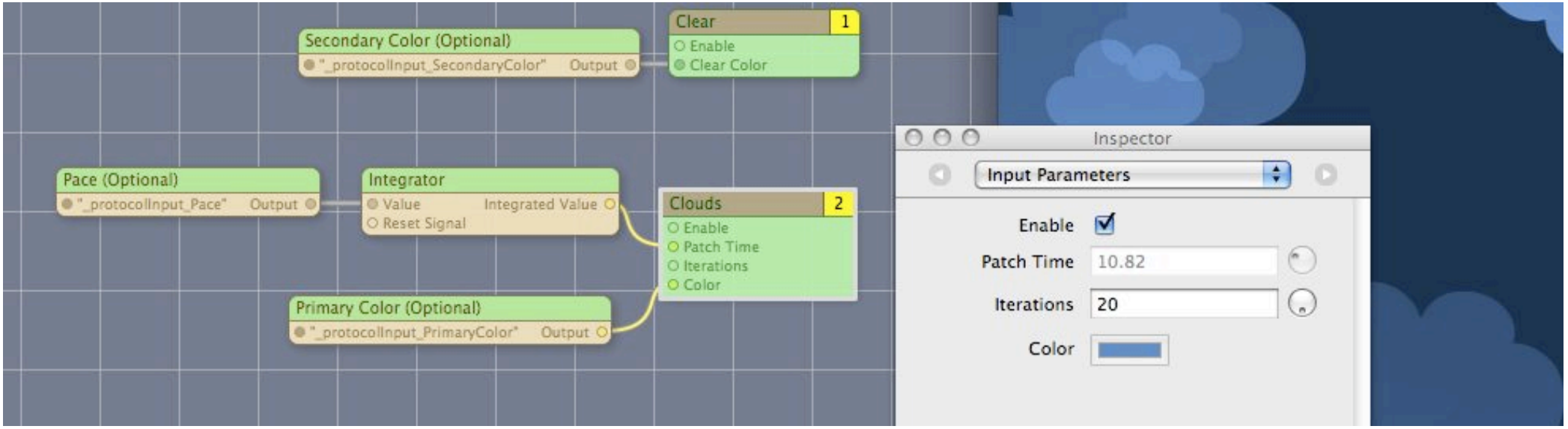
- Layout and basic behaviour are pre-defined
- Component inspector allows customization, e.g.
  - Definition of pre-selected color
  - Display of parts of dialog
- API allows dynamic ActionScript-based adaptation
  - E.g. enabling/disabling
- Components may generate events





Advanced Component Composition

- Some authoring tools and development environments make it possible to visually connect components
- Examples:
  - IBM Visual Age (Eclipse predecessor)
  - Apple Quartz Composer (for graphics rendering)



Apple Quartz Composer

6 Programming with Video

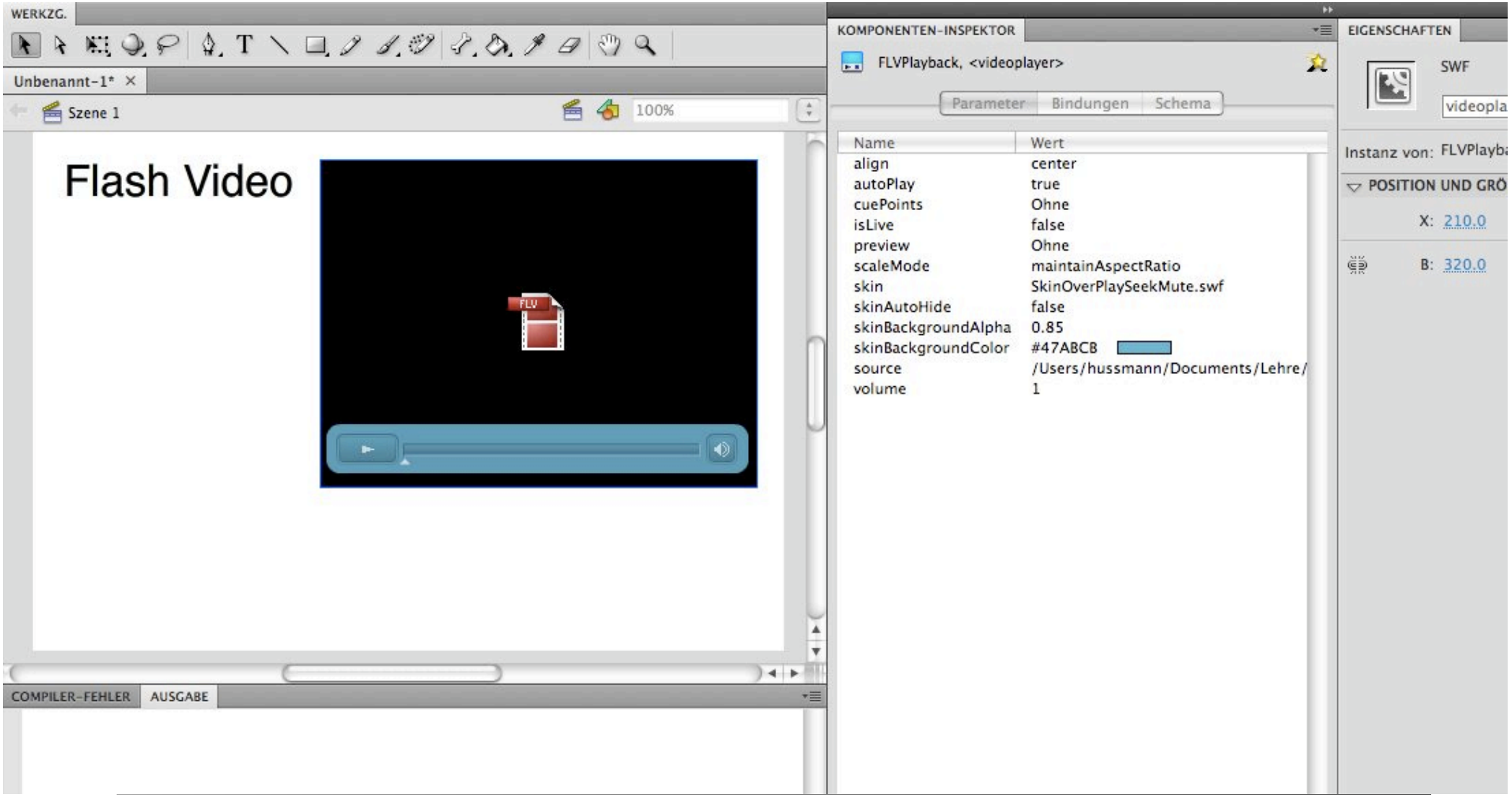
Literature:

Adobe Flash Documentation

Playing Video in Flash

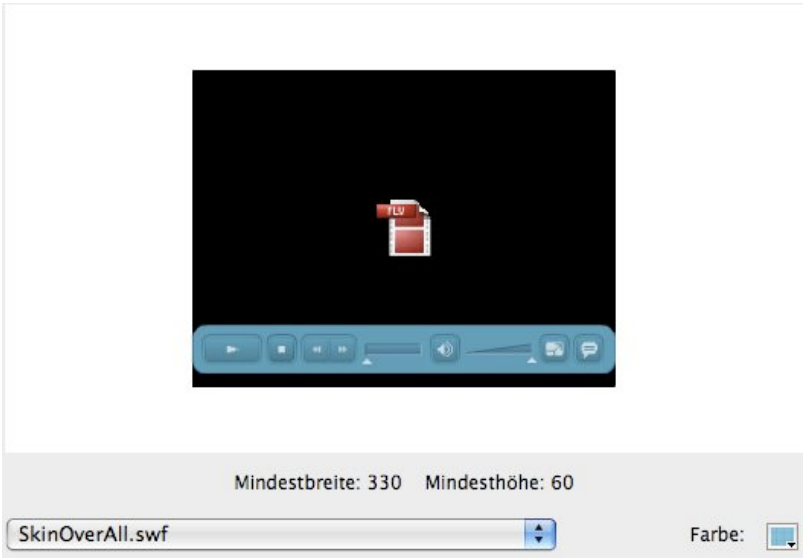
- Embedding video information into animation
  - Leads to very large files (SWF files in the case of Flash)
- External video clips:
  - Editable separately with specialized software
  - Progressive download: play during loading
  - Video played at its own frame rate, not at the rate of the animation
- Support for external video in Flash:
  - FLV (Flash Video) format (partially&recently also other formats)
  - Converters from most well-known video formats to FLV exist
  - Special *Media Components* for easy integration of video
    - » FLVPlayback
    - » Bars: BufferingBar, VolumeBar, SeekBar
    - » Buttons: PlayButton, PauseButton, MuteButton, …
    - » Captioning support

Flash CS4 Video Player Component



Themes/Skins

- Generally:
  - *Theme* or *skin* defines graphical appearance of interface elements
    - » Colours, number of elements, shapes, fonts, …
- For video playback component:
  - Skin defines playback control elements mainly
  - Which buttons exist, in which order, where located
- Predefined skins vs. Custom skins
- Examples (Flash):



Example: Setting a Skin by Program Code

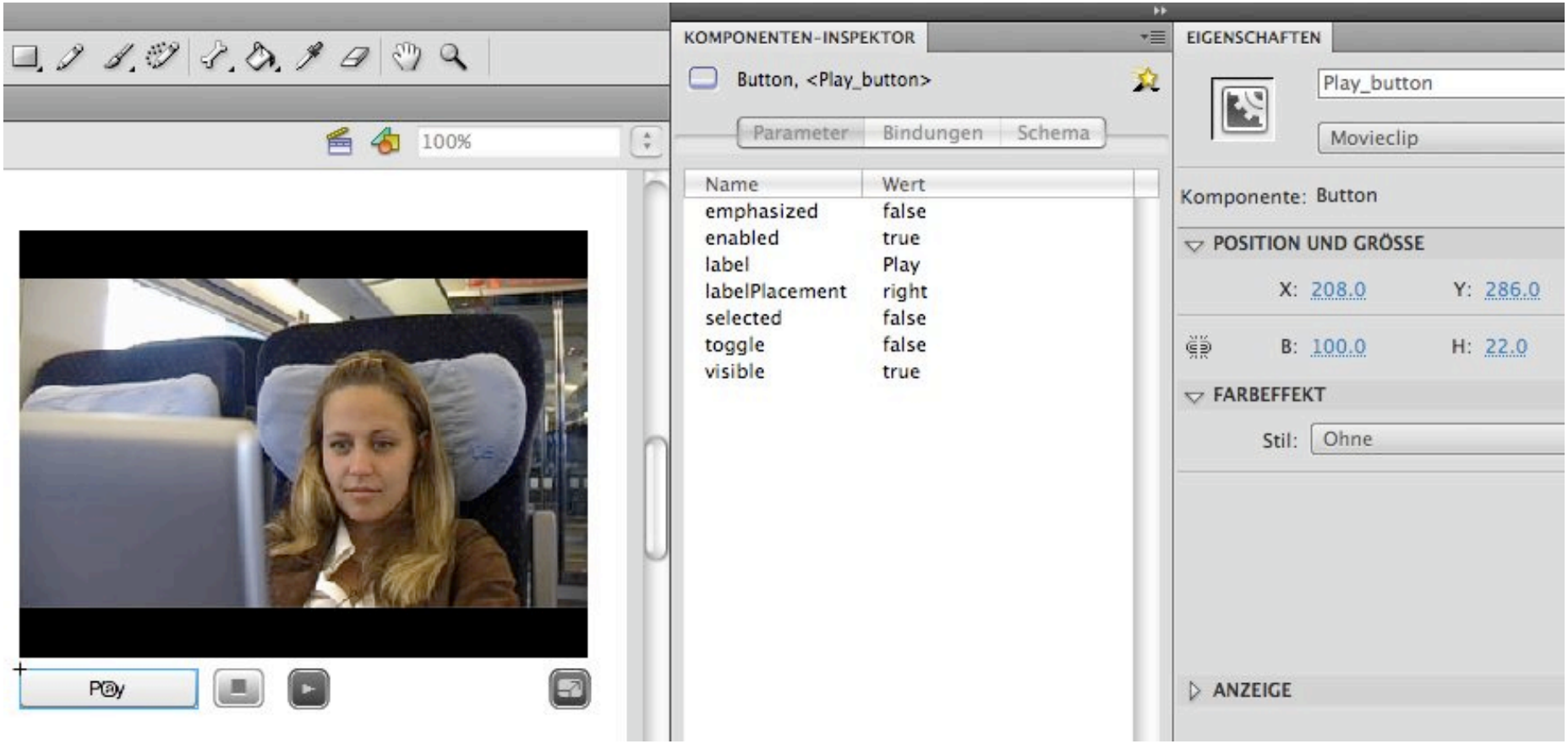
ActionScript 3.0:

```
import fl.video.*;

var flvPlayer:FLVPlayback = new FLVPlayback();

addChild(flvPlayer);
flvPlayer.skin = "./SkinOverAll.swf“
flvPlayer.source = "../videos/OfficeCalling.f4v";
```

Variants of Control Buttons

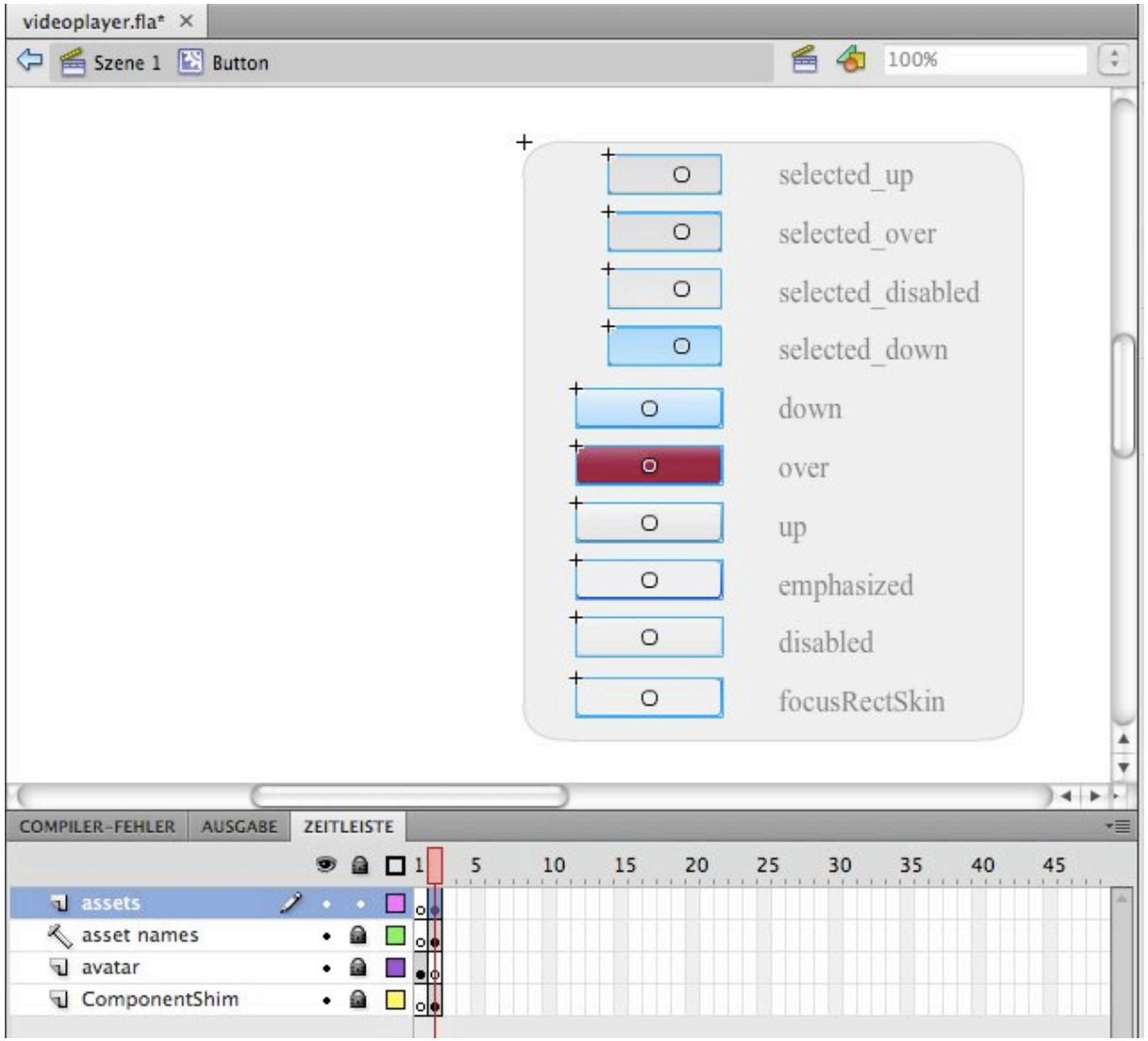
- Control buttons integrated into playback component
  - (Possibly) adjustable by parameters or skins
- Special control button components
  - Flash: Video components “PauseButton”, “PlayButton” etc.
- Use of standard UI components
  - Customized for specific purpose
- Use of pre-designed UI components
  - Bought from external source
  - Loaded from external library

Customizing a Button for Video Control (1)



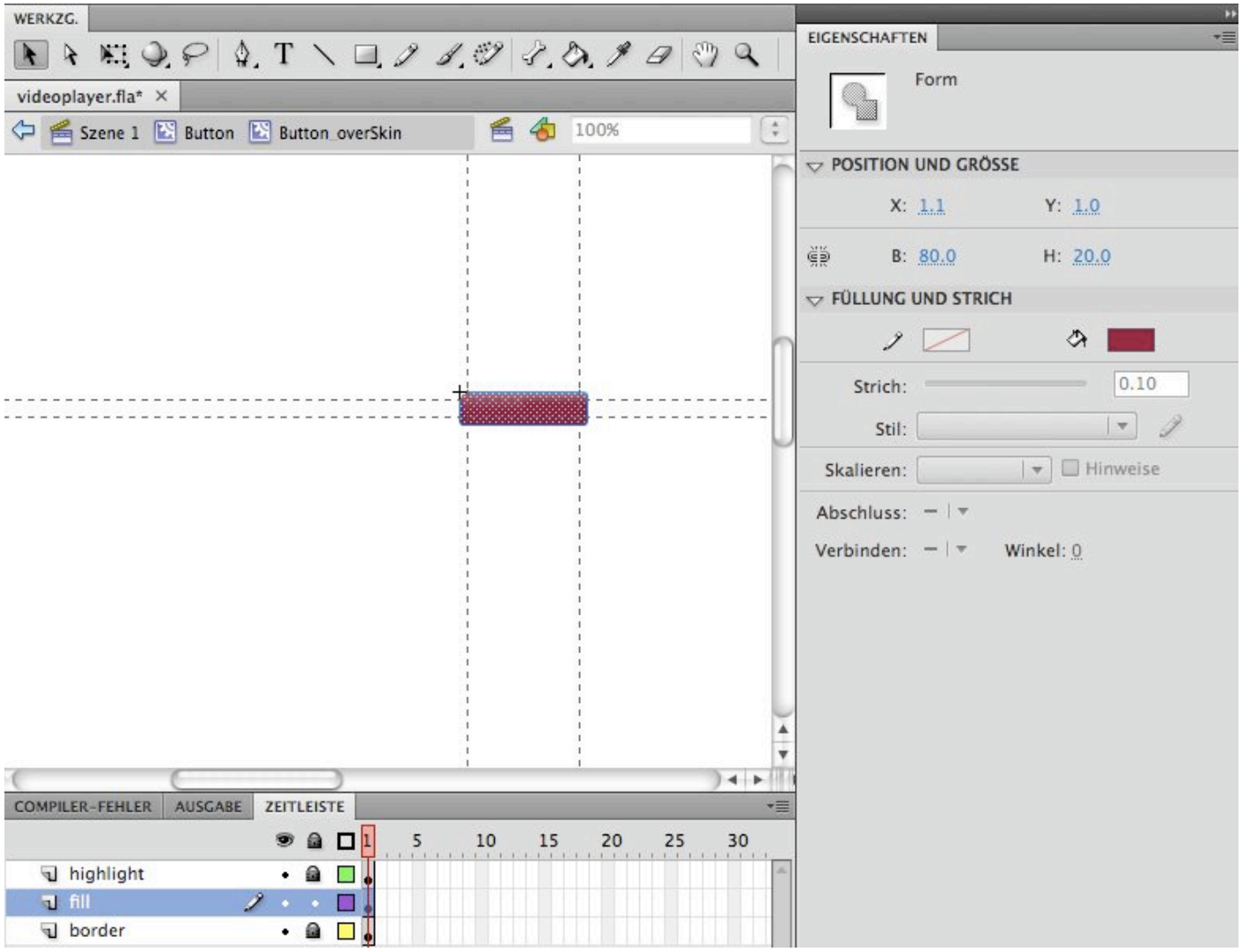
- Standard UI component: Button
  - Drag&drop, label parameter set

Customizing a Button for Video Control (2a)



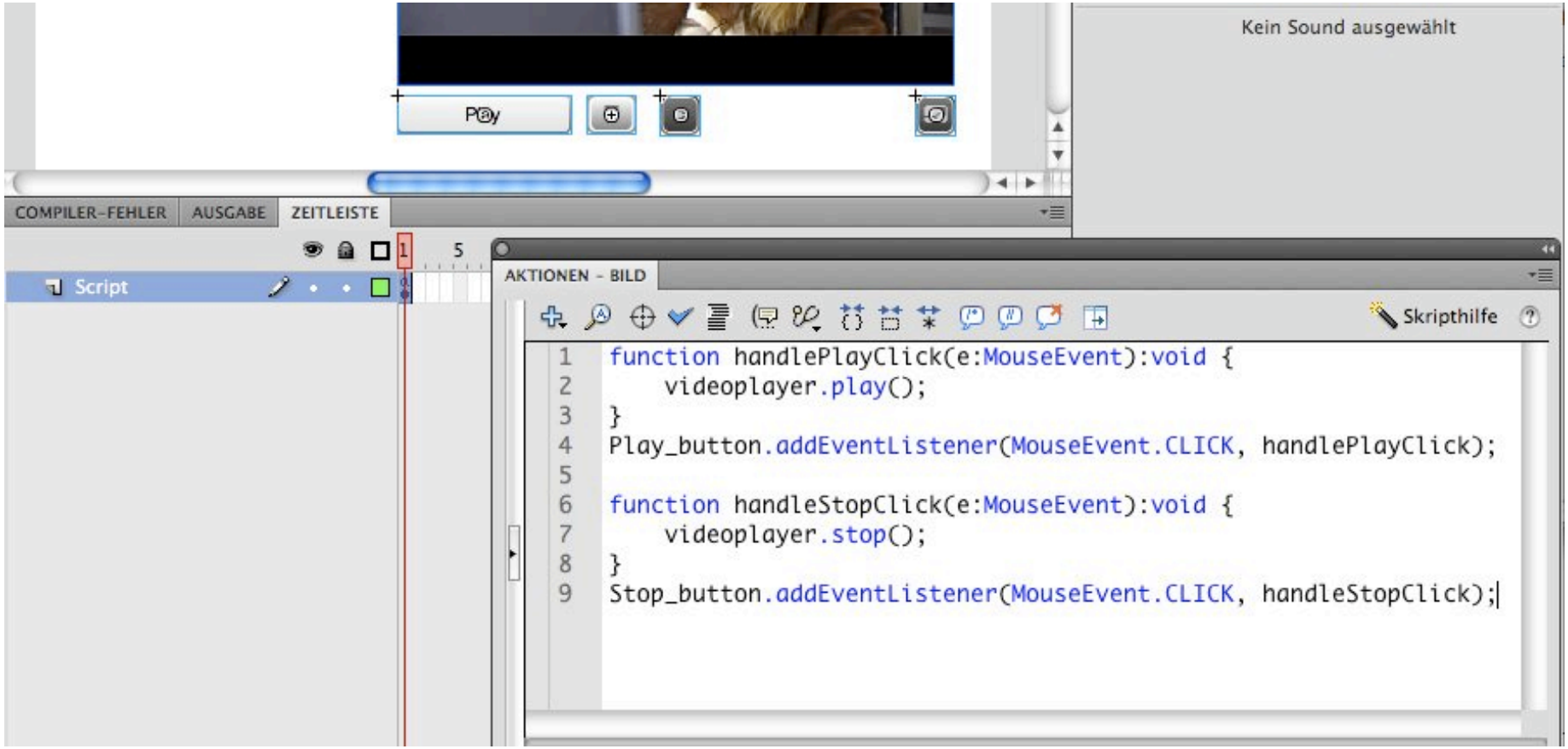
- Timeline of Button component
  - Contains nested graphics for state visualization
- An example for fully visual component customization

Customizing a Button for Video Control (2b)



Customizing a Button for Video Control (3)

- Adding event handler as script code
  - References to component instances



Video Player Component in JavaFX (1)

http://javafx.com/samples/SimpleVideoPlayer/

```
package simplevideoplayer;

import javafx.stage.Stage;
import javafx.scene.Scene;
import com.sun.fxmediacomponent.*;
import javafx.scene.Group;

def mediaUrl:String ="http://....flv";

var vidWidth = 512;
var vidHeight = 288;
var fullWidth = 640;
var fullHeight = 360;

var mediaBox:MediaComponent = MediaComponent {

    mediaSourceURL : mediaUrl
    visible:true
    translateX: 0
    translateY: 0
    mediaViewWidth : fullWidth
    mediaViewHeight: fullHeight
    staticControlBar: false
    mediaPlayerAutoPlay: true
    volume: 0.5
};                                          ...contd.
```

Video Player Component in JavaFX (2)

http://javafx.com/samples/SimpleVideoPlayer/

```
    ...
var mediaBox:MediaComponent = MediaComponent {
    ...
};

// Description to be displayed when the mouse is over the component
mediaBox.mediaDescriptionStr = "...";
// Duration to be displayed when the mouse is over the component
mediaBox.mediaDurationStr = "9:56";
// Title to be displayed when the mouse is over the component
mediaBox.mediaTitleStr = "Big Buck Bunny";

Stage {
   title: "Simple Media Player"
   scene: Scene{
       width: fullWidth
       height: fullHeight
       content: mediaBox
       stylesheets: [
          MediaComponent.css_skins
      ]
   }
}
```

6 Programming with Video

Literature:

Florian Plag, Roland Riempp: Interaktives Video im Internet mit Flash, Springer 2006 (und www.video-flash.de)

Uwe Kühhirt, Marco Rittermann: Interaktive audiovisuelle Medien, Fachbuchverlag Leipzig 2007

Events Generated by Media Components

- Various events are reported by Media Components to the surrounding application for flexible reaction:
  - Adjustments like change of volume
  - Media events like reaching end of media
  - User-defined events when reaching specific positions *(cue events)*

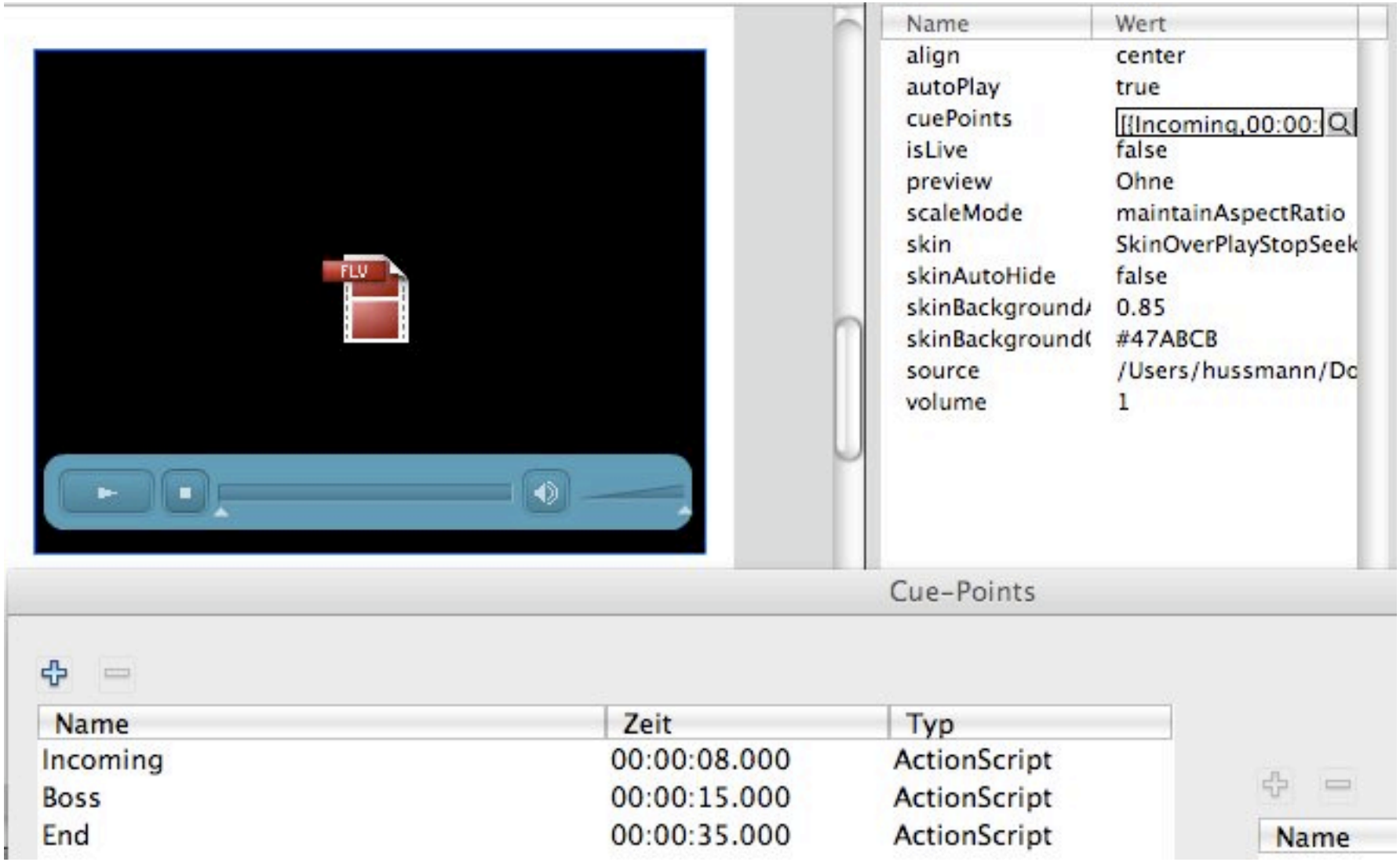
- Reaction to media events requires *EventListener* objects for media specific events, e.g. **`SoundEvent`**:

```
function handleSoundUpdate(e:SoundEvent):void {
   trace("volume/pan changed");
}
videoplayer.addEventListener
   (SoundEvent.SOUND_UPDATE, handleSoundUpdate);
```

Cue Points

- A *cue point* marks a specific point in time during media playback.
  - Specification by *time stamp* relative to media start time
  - Definition in authoring system: Interactively or by numbers
  - May be defined by script code
- Internal cuepoint: Embedded into movie file
  - Flash: navigation cuepoints(for direct positioning) and event cuepoints (for interaction with web browser)
- External cuepoint: Defined outside movie file
  - Flash: ActionScript cuepoints
  - When reaching a cue point, an (AS) event is fired

Cue Points in Authoring System

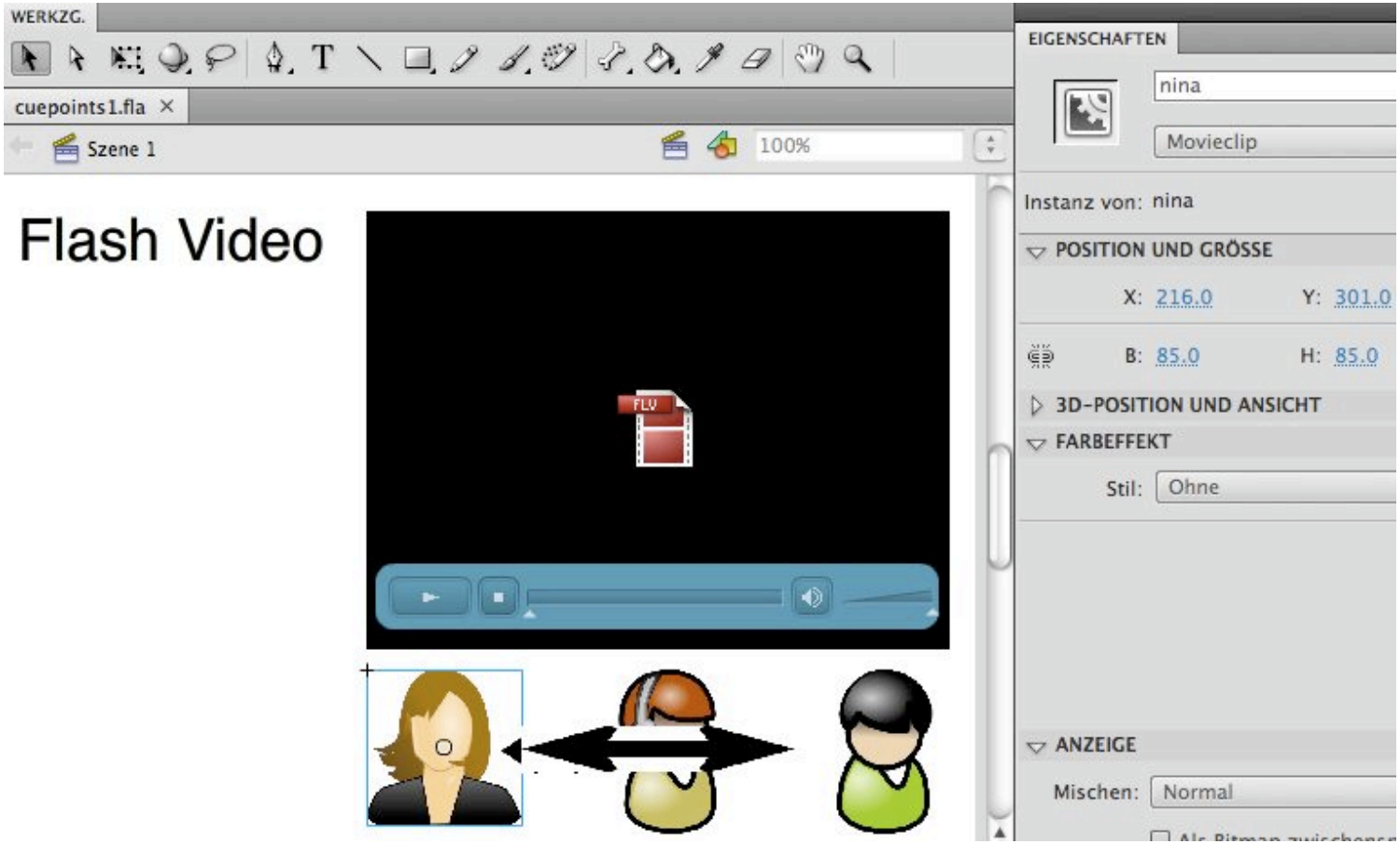


Cue Points Defined by Script

```
var cuePt1:Object = new Object();
cuePt1.time = 0.08;
cuePt1.name = “Incoming“;
cuePt1.type = "actionscript";
videoplayer.addASCuePoint(cuePt1);

videoplayer.addASCuePoint(0.15, “Boss");
```

Synchronizing Video and Animation (1)

- Cue point events can trigger animation actions
- Simple example: Visibility of symbolic annotations



Synchronizing Video and Animation (2)

```
sekr.visible = false;
boss.visible = false;
pfeil1.visible = false;
pfeil2.visible = false;

videoplayer.addEventListener
   (MetadataEvent.CUE_POINT, cpT_listener);
function cpT_listener(e:MetadataEvent):void {
   if (e.info.name == "Incoming") {
      sekr.visible = true;
      pfeil1.visible = true;
   }
   if (e.info.name == "Boss") {
      sekr.visible = false;
      boss.visible = true;
      pfeil2.visible = true;
      pfeil1.visible = false;
   }
   if (e.info.name == "End") {
      boss.visible = false;
      pfeil2.visible = false;
   }
}
```

How to Realize Real Interaction in Video?

- Real interaction means:
  - Pointing to regions in video window identifies objects
  - Clicking on a region or symbol modifies video scene
- Scene needs to be *decomposed:*
  - Parts/objects of video playback can be made (in)visible by script code
  - Objects can be moved around in video
- Easy solution:
  - *Overlaying* of videos
- Two main techniques:
  - *Masking* cuts out specific parts from a video
    - » Prerequisite: Objects are easy to identify and do not move much
  - *Alpha channel* videos overlayed on other videos
    - » Prerequisite: External production of video with alpha channel
    - » Using video effect software (e.g. AfterEffects)

Application Examples (1)

#01: Gipsy Voices

Ein Hauptmenü in Form einer leeren Bühne lädt den Nutzer dazu ein, spielerisch zu erkunden, welche Musiker in der Band "Gipsy Voices" spielen. Klickt der Anwender eine Person an, öffnet sich ein Fenster, das mehrere Videos zur jeweiligen Person bietet.

www.video-flash.de

Application Examples (2)

#02: Hutshop
Dieser Entwurf soll einen Eindruck vermitteln, wie eine Produktpräsentation mit Videos im Internet ausssehen könnte. Es werden freigestellte Videos verwendet.

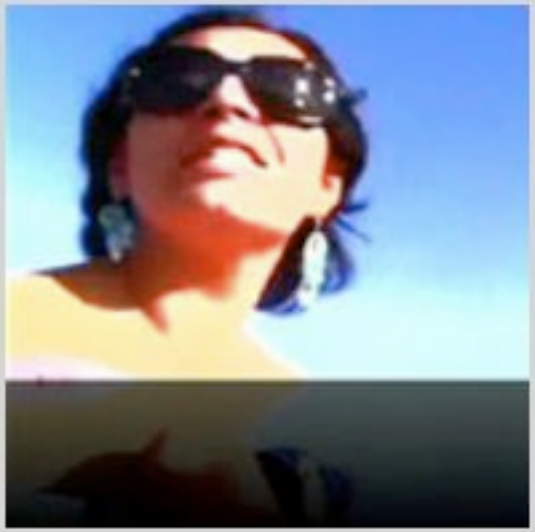
www.video-flash.de

Application Examples (3)

#08: Hot-Spots
Beim Encoding des verwendeten Videos wurden Cue-Points eingebettet, die beim Abspielen der Anwendung die Bezeichnung und die Position eines Hot-Spots bestimmen. Die weiterführenden SWF-Dateien werden ebenfalls in Abhängigkeit des CuePoint-Namens nachgeladen.

www.video-flash.de

Application Examples (4)

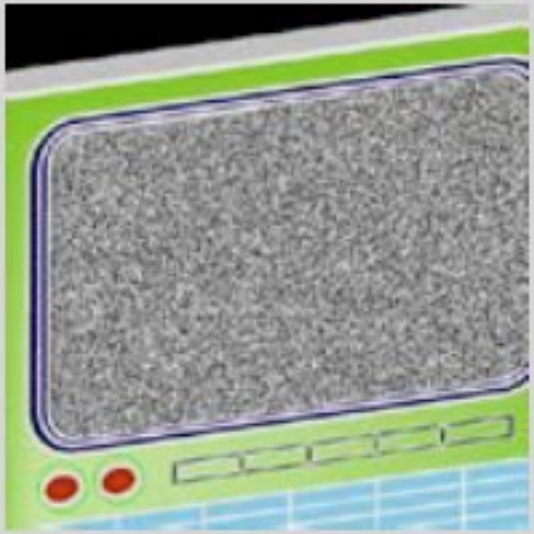


#15: Reflektionen

Ein schöner Effekt ist die Erzeugung von Reflektionen, wodurch die Anmutung einer Rich-Media-Anwendung erhöht wird. In diesem Beispiel wird ständig das aktuelle Videobild mithilfe der BitmapData-Klasse dupliziert, dann gespiegelt und unterhalb des Videos wieder eingefügt. Eine halbtransparente Maske sorgt für ein weiches Ausblenden der Reflektion.

www.video-flash.de

Application Examples (5)

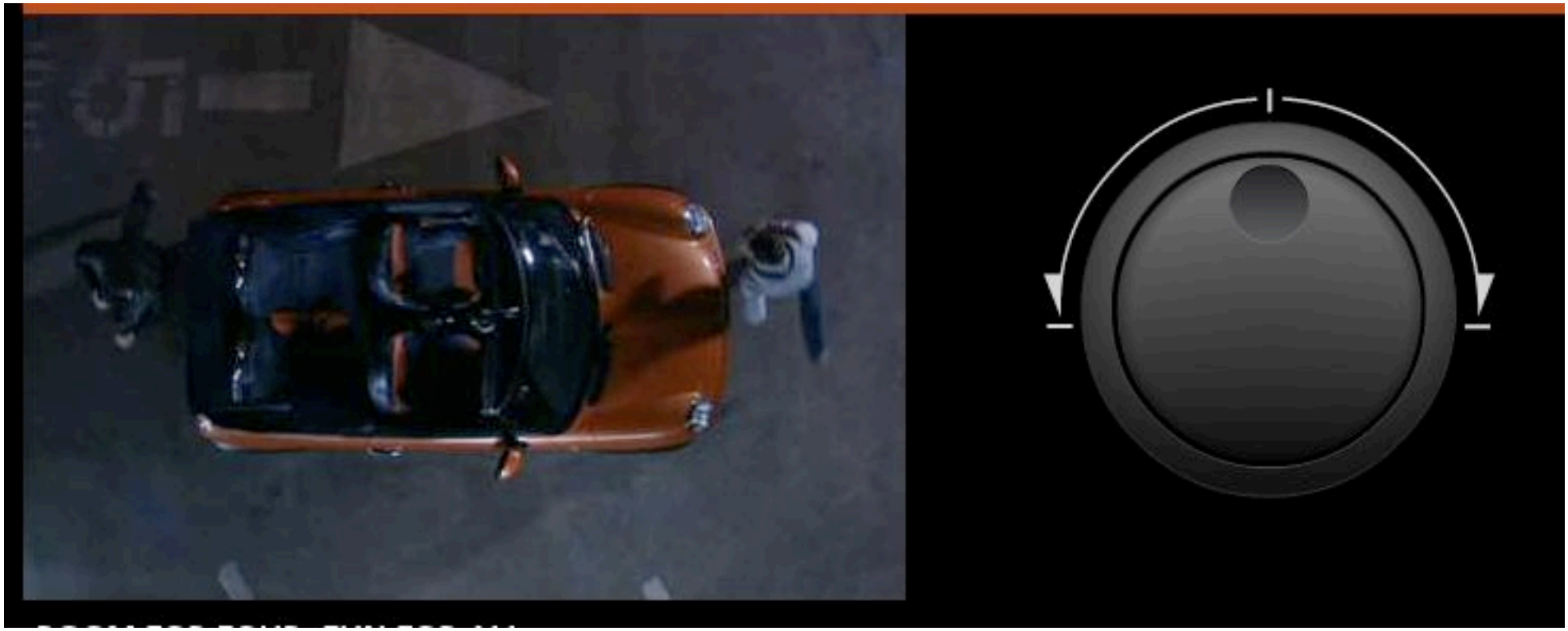


#18: Fernsehgerät
Über eine Maskierung wird das Video in die Abbildung des TV-Geräts eingepasst. Das schwarz-weiße Rauschen des TVs kann mit der „Noise"-Funktion der Bitmap-Klasse erstellt werden, die ein Pixelbild mit zufälligen Störungen erzeugt.

www.video-flash.de

Application Examples (6)

http://www.mini.com/com/en/mini_cabrio_film_clips/index.jsp

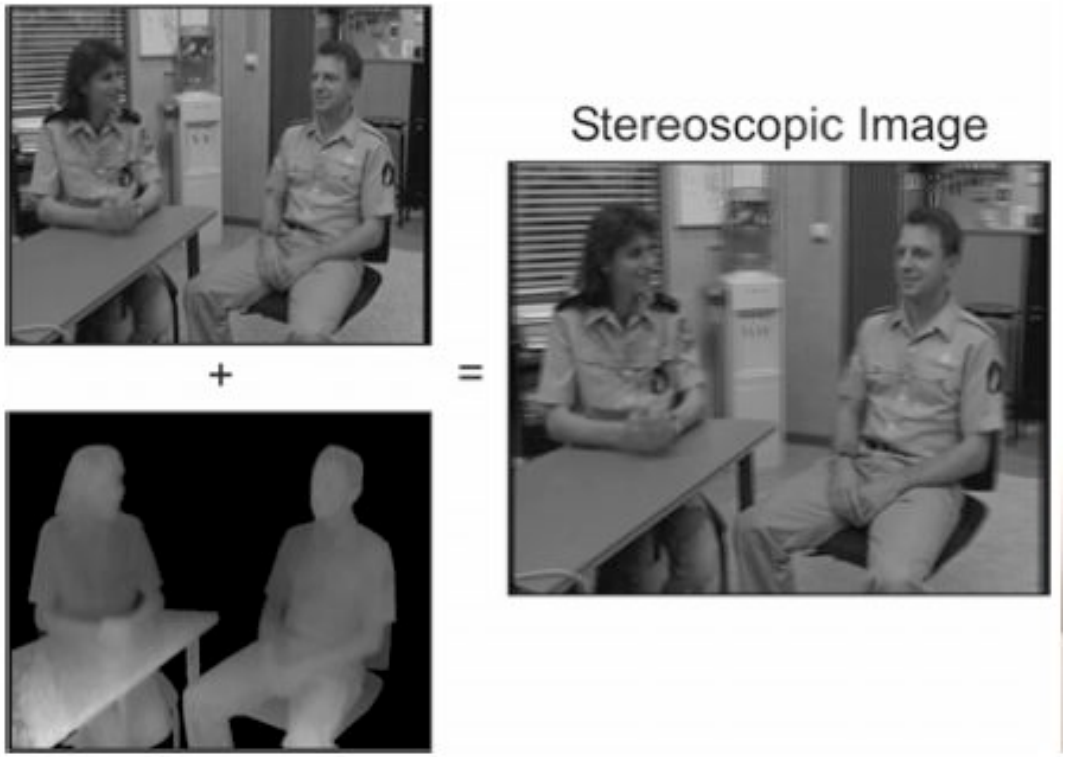


Video Scenes in MPEG-4

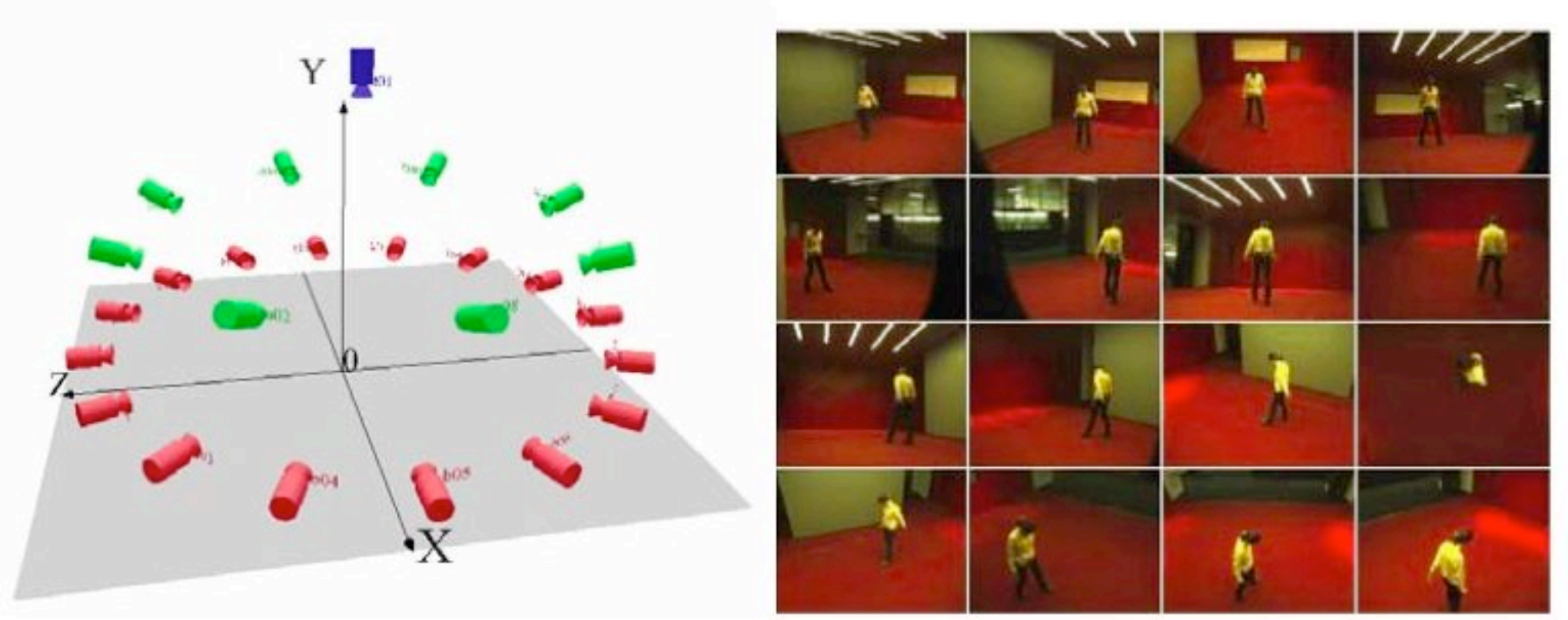
- MPEG-4: Binary Format for Scenes (BIFS)
  - Spatial and temporal composition of media objects to a scene
  - Structure of a scene and its behavior
- Media objects within a scene can be manipulated
  - moving, adding, deleting objects
- 2D and 3D scenes (and combinations thereof) are possible
  - MPEG-4 contains VRML scene graphs
- *Shaped Video Objects:* Masked object in front of background
- Java interface for manipulation through program code

3D Video Objects

- Video object (e.g. video of a person speaking) as part of 3D scene
  - Requires rendering of adequate view from different angles
- Coding of 3D video objects:
  - "Primary representation": Multiscopic recording
  - "Secondary representation": Synthesis of views
    - » E.g. morphing techniques
    - » Requires additional information about object, for instance *depth map*



3D Video Object Acquisition



Smolic/Kimata/Vetra 2005,
Mitsubishi Electric Research Labs