4 Overview on Approaches to Multimedia Programming

4.1 History of Multimedia Programming
4.2 Squeak and Smalltalk: An Alternative Vision
4.3 Director and Lingo: Advanced Multimedia Authoring
4.4 Frameworks for Multimedia Programming

Literature:
historyofMM.html
Mark Guzdial: History of Squeak
Lecture notes at http://coweb.cc.gatech.edu/cs2340/3608
http://minnow.cc.gatech.edu/squeak/3139
Ivan Sutherland’s Sketchpad, 1963

First object-oriented drawing program
Master and instance drawings
Rubber bands
Simple animations
Alan C. Kay

- U. Utah PhD student in 1966
  - Read Sketchpad, Ported Simula
- Saw “objects” as the future of computer science
- His dissertation:
  Flex, an object-oriented personal computer
  - A personal computer was a radical idea then
  - How radical?

"There is no reason anyone would want a computer in their home."
(Ken Olsen, Digital Equipment Corp, 1977)

Further stations of Alan Kay’s life:
- Stanford Artificial Intelligence Laboratory
- Xerox PARC
- Apple, Atari
- Disney Interactive
- Viewpoints Research Institute
- Hewlett-Packard

from M. Guzdial
The FLEX Machine

- “A personal computer for children of all ages”
- Includes pointing device
The Dynabook Vision

- Small, handheld, wireless(!) device – a new medium
- Can be used creatively by everybody, in particular children, for learning
- Xerox PARC Learning Research Group, early 70s
Xerox PARC Learning Research Group: Smalltalk-72

- Object-oriented programming system
  - Mouse
  - Windows
  - Icons
  - Pop-up menus

- Uses simple object-oriented language “Smalltalk”

- Idea of user interface: Make computers easy to use for everybody

- Idea of language: make programming both more simple and more powerful (e.g. include multimedia: sound)
The Alto

- The machine the prototype of which impressed Steve Jobs so much that he decided to produce the Lisa/Macintosh kind of computers for the mass market (1979)
  - Graphical user interface
  - Networked via Ethernet
  - Programming language Smalltalk
History of Multimedia Authoring

  – Leads to multiple windows, mouse, hypertext, composite text/graphic editing, outlining software, ...
• Text-based Hypertext Authoring:
  – 1968, Andries Van Dam: Hypertext Editing System
  – 1972, CMU: “ZOG” Hypertext collaboration tool
• 1976: DARPA proposal “multiple media”
• 1982, Peter Brown: “Guide”, Hypertext authoring with graphical interface
• 1984: Apple Macintosh
• 1985: Windows 1.0
• 1985: Commodore Amiga:
  – The first true multimedia computer (advanced graphics, sound, video)
• 1985: MIT Multimedia Lab (Negroponte, Wiesner)
• 1986: Xerox PARC “NoteCard”
• 1987: Apple HyperCard
• 1988: Macromedia Director
Commodore Amiga

- Erscheinungsjahr: Mitte 1985 (Deutschland 1986)
- Arbeitsspeicher 256KByte Chip-Ram
- CPU: Motorola 68000, 7,16Mhz NTSC, 7,09Mhz PAL
- Grafik (u.a.):
  - 320*200/256 (32/4096 Farben)
  - 640*200/256 (16 Farben)
- Sound: 8Bit 4 Kanal Stereo, 29Khz
- Massenspeicher: 1 Diskettenlaufwerk 880KByte
- Betriebssystem: Kickstart 1.0, 1.1, 1.2, 1.3 (Rom auf Diskette)
- Einführungspreis: 6000,- DM
Atari Mega ST

- 1988
- CPU Motorola 68000 8 MHz
- Ram 1 bis 4 MByte
- Grafik
  - 640 x 200 (4 Farben)
  - 320 x 200 (16 Farben)
- Tongenerator: 3 Stimmen
  - MIDI Interface
- Ca. 2000 DM
- Typische Anwendungen:
  - Spiele
  - Musik
  - Ausbildung (Schulen)
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Squeak
EToys: Visual Programming in Squeak
Introduction to Smalltalk

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Literature:
http://www.squeakland.org
Back to the Future: Squeak

• Smalltalk:
  – Developed 1972
  – Commercial versions from 1980 on

• 1995: Alan Kay, Dan Ingalls, Ted Kaehler at Apple
  – Still want "A development environment in which to build educational software that could be used—and even programmed—by non-technical people and by children"
  – Build on Open Source Software strengths
    » Use the distributed power of Internet-based programmers
  – Available Smalltalk versions had lost many media capabilities

• Later on, the Squeak team moves to Disney
  – “It’s all about media”

• Multimedia in Squeak:
  – 16 voice music synthesis
  – 3-D graphics, MIDI, Flash, sound recording
  – Network: Web, POP/SMTP, zip compression/decompress
Squeak as a Classroom Tool for Schools

• Vision:
  – Children use complex multimedia computations (graphics, sound, animations) like a desktop calculator

• Example: Physics
  – experiments regarding physical observations
    » Building a computer model of real-life behaviour
  – Video: The Gravity project

• Prerequisites:
  – Fully visual programming
  – Large coverage of graphics and animation
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Electronic Toys: EToys

Alan Kay, EToys and Simstories in Squeak

“EToys are computer environments that help people learn ideas by building and playing around with them. They help an “omniuser” - usually a child - create a satisfying and enjoyable computer model of the idea and give hints for how the idea can be expanded. SimStories are longer versions of EToys that - like essays - string several ideas together to help the learner produce a deeper and more concerted project. A good motto for EToys and SimStories is: We make not just to have but to know. Another motto that applies here is: Doing with images makes symbols. That is, the progression of learning moved from kinaesthetic interactions with dynamic images to a symbolic expression of the idea.”
Basics of Squeak Interaction (1)

- Squeak assumes a three-button mouse
- Menus are invoked by clicking on objects
  - clicking on surface opens “world” menus
- “Red”
  - Windows: left-button click
  - MacOS: simple click
- “Yellow”
  - Windows: middle-button click
  - MacOS: option + click
- “Blue”
  - Windows: right-button click
  - MacOS: + click

(A different colour mapping... )
Basics of Squeak Interaction (2)

• Flaps:
  – Areas which can be opened or closed in a drawer-style
  – Often used as repositories (“parts-bins”)

• Collapsing windows:
  – A window can be collapsed or expanded

• Tiles:
  – Objects can be represented by “tiles” (see below)
Etoys: Example “Car Race” (1)

• Step 0: Create a new empty project
  – world menu -> open...
  --> morphic project
  – enter new project by double-click

• Step 1: Draw the things with which we want to play
  – Very simplistic bitmap-oriented painting tool

• Step 2: “Keep” the drawing
  – We get a Squeak object
    » Free form, not square
  – Can be moved around
“Halo” of a Squeak Object

• The “halo” is a circular graphic menu which can be invoked on any object by a mouse click
  – “blue” click
  – special “playfield configuration” (preferences): invoked just by mouse over
Squeak Viewers

• Step 3: Create a viewer (e.g. via the object’s halo)
  – Special flap for quickly showing and hiding the viewer
  – Rename sketch in viewer e.g. to “Car”

• Shows categories of properties and commands for objects
  – Categories: Object is derived from a subclass in a complex class hierarchy
  – Viewer can show many different categories in parallel

• Commands can be immediately executed (exclamation mark button)
  – Car can be moved, turned
    (Note: Orientation to be set in “rotate” mode to define direction of movement)
Squeak Scripts

- **Script:**
  - simple sequence of commands
  - executed under user control or automatically through a timer ("ticking").
- Represented by windows
  - created by drag-and-drop
  - “Tiles” represent objects and actions
- Step 4: Create a script
  - “add new script” in viewer
  - drag “empty script” onto surface
- Step 5: Add forward command
  - drag it from the Car viewer
  - adjust the parameter(s)
**Running a Script**

- Step 6: To control all scripts, use a new script control object.
  - To be found under the “Widgets” flap, like many other helpful tools
- All scripts of the project are simultaneously started and stopped through one button
  - Again just one drag operation to instantiate the object
- Example: Now car can be “driven” forward (till the border of the screen)
Object Interaction in Scripts

- Parameters of script commands can be computed from other objects’ properties (by dragging the property onto the parameter location)
- Local adjustments can be added at the end (factor, offset etc.)
User Control through Graphical Objects

- Graphical manipulations can be used to control other objects
- Example:
  - Steering wheel graphics
    » Drawn by hand
    » Viewer attached
  - Rotated by user (e.g. through halo operations)
  - Heading of wheel is transferred to car
  - A “servo steering” i.e. a less sensitive transfer is recommendable
Watcher

- The values of object properties can be easily shown on the screen
  - Updated regularly and automatically
- Technically, this is an “Observer” mechanism
  - Hidden behind simple drag&drop interface
- Watcher:
  - Simple watcher (value), Detailed watcher (value plus label)
  - Can be obtained from menu left of property (in viewer)
  - Can be placed anywhere on screen
Sensors for Environment

• Squeak objects can easily observe where they are currently located
  – Through coordinates
  – Simpler: through colours

• **Sensors:**
  – Realizable as special parts of the graphics with a unique colour
  – “color x sees color y” test: Which colour is below the sensor?

• Example:
  – Grey road, car with two sensors
  – Alert lamp shall go red when one of the sensors is not on road
Example: Alert Lamp

Test tile
Test on left sensor
Alert lamp
Test on right sensor
Assignment (dragging the green-on-purple arrow right of properties)
Example: Auto-Steering

- Interaction among objects can be designed in communication loops
- Example:
  - Car automatically moves forward
  - Sensor detects border of road
  - Car automatically steers to stay on the road
- Enables complex interactive learning experiences (setting up feedback loops)

Wheel control better removed at this stage?