Core HTML5 Canvas
Core HTML5 Canvas: Graphics, Animation, and Game Development

Table of Contents

Cover
Half Title
Title Page
Copyright Page
Contents
Preface
Acknowledgments
About the Author
Chapter 1: Essentials
  1.1 The canvas Element
    1.1.1 Canvas Element Size vs. Drawing Surface Size
    1.1.2 The Canvas API
  1.2 Canvas Contexts
    1.2.1 The 2d Context
    1.2.2 Saving and Restoring Canvas State
  1.3 Canonical Examples in This Book
  1.4 Getting Started
    1.4.1 Specifications
    1.4.2 Browsers
    1.4.3 Consoles and Debuggers
    1.4.4 Performance
  1.5 Fundamental Drawing Operations
Table of Contents

1.6 Event Handling
   1.6.1 Mouse Events
   1.6.2 Keyboard Events
   1.6.3 Touch Events

1.7 Saving and Restoring the Drawing Surface

1.8 Using HTML Elements in a Canvas
   1.8.1 Invisible HTML Elements

1.9 Printing a Canvas

1.10 Offscreen Canvases

1.11 A Brief Math Primer
   1.11.1 Solving Algebraic Equations
   1.11.2 Trigonometry
   1.11.3 Vectors
   1.11.4 Deriving Equations from Units of Measure

1.12 Conclusion

Chapter 2: Drawing
   2.1 The Coordinate System
   2.2 The Drawing Model
   2.3 Drawing Rectangles
   2.4 Colors and Transparency
   2.5 Gradients and Patterns
      2.5.1 Gradients
      2.5.2 Patterns
   2.6 Shadows
      2.6.1 Inset Shadows
   2.7 Paths, Stroking, and Filling
      2.7.1 Paths and Subpaths
      2.7.2 Cutouts
Table of Contents

2.8 Lines
  2.8.1 Lines and Pixel Boundaries
  2.8.2 Drawing a Grid
  2.8.3 Drawing Axes
  2.8.4 Rubberband Lines
  2.8.5 Drawing Dashed Lines
  2.8.6 Drawing Dashed Lines by Extending CanvasRenderingContext2D
  2.8.7 Line Caps and Joins

2.9 Arcs and Circles
  2.9.1 The arc() Method
  2.9.2 Rubberband Circles
  2.9.3 The arcTo() Method
  2.9.4 Dials and Gauges

2.10 Bézier Curves
  2.10.1 Quadratic Curves
  2.10.2 Cubic Curves

2.11 Polygons
  2.11.1 Polygon Objects

2.12 Advanced Path Manipulation
  2.12.1 Dragging Polygons
  2.12.2 Editing Bézier Curves
  2.12.3 Scrolling Paths into View

2.13 Transformations
  2.13.1 Translating, Scaling, and Rotating
  2.13.2 Custom Transformations

2.14 Compositing
  2.14.1 The Compositing Controversy

2.15 The Clipping Region
  2.15.1 Erasing with the Clipping Region
Table of Contents

2.15.2 Telescoping with the Clipping Region

2.16 Conclusion

Chapter 3: Text

3.1 Stroking and Filling Text
3.2 Setting Font Properties
3.3 Positioning Text
   3.3.1 Horizontal and Vertical Positioning
   3.3.2 Centering Text
   3.3.3 Measuring Text
   3.3.4 Labeling Axes
   3.3.5 Labeling Dials
   3.3.6 Drawing Text around an Arc
3.4 Implementing Text Controls
   3.4.1 A Text Cursor
   3.4.2 Editing a Line of Text in a Canvas
   3.4.3 Paragraphs

3.5 Conclusion

Chapter 4: Images and Video

4.1 Drawing Images
   4.1.1 Drawing an Image into a Canvas
   4.1.2 The drawImage() Method

4.2 Scaling Images
   4.2.1 Drawing Images outside Canvas Boundaries

4.3 Drawing a Canvas into a Canvas
4.4 Offscreen Canvases
4.5 Manipulating Images
   4.5.1 Accessing Image Data
   4.5.2 Modifying Image Data
# Table of Contents

4.6 Clipping Images
4.7 Animating Images
   4.7.1 Animating with an Offscreen Canvas
4.8 Security
4.9 Performance
   4.9.1 `drawImage(HTMLImage)` vs. `drawImage(HTMLCanvas)` vs. `putImageData()`
   4.9.2 Drawing a Canvas vs. Drawing an Image, into a Canvas; Scaled vs. Unscaled
   4.9.3 Looping over Image Data
4.10 A Magnifying Glass
   4.10.1 Using an Offscreen Canvas
   4.10.2 Accepting Dropped Images from the File System
4.11 Video Processing
   4.11.1 Video Formats
   4.11.2 Playing Video in a Canvas
   4.11.3 Processing Videos

4.12 Conclusion

## Chapter 5: Animation

5.1 The Animation Loop
   5.1.1 The `requestAnimationFrame()` Method: Letting the Browser Set the Frame Rate
   5.1.2 Internet Explorer
   5.1.3 A Portable Animation Loop
5.2 Calculating Frame Rates
5.3 Scheduling Tasks at Alternate Frame Rates
5.4 Restoring the Background
   5.4.1 Clipping
   5.4.2 Blitting
5.5 Double Buffering
5.6 Time-Based Motion
5.7 Scrolling the Background
5.8 Parallax
5.9 User Gestures
5.10 Timed Animations
  5.10.1 Stopwatches
  5.10.2 Animation Timers
5.11 Animation Best Practices
5.12 Conclusion

Chapter 6: Sprites
  6.1 Sprites Overview
  6.2 Painters
    6.2.1 Stroke and Fill Painters
    6.2.2 Image Painters
    6.2.3 Sprite Sheet Painters
  6.3 Sprite Behaviors
    6.3.1 Combining Behaviors
    6.3.2 Timed Behaviors
  6.4 Sprite Animators
  6.5 A Sprite-Based Animation Loop
  6.6 Conclusion

Chapter 7: Physics
  7.1 Gravity
    7.1.1 Falling
    7.1.2 Projectile Trajectories
    7.1.3 Pendulums
Table of Contents

7.2 Warping Time
7.3 Time-Warp Functions
7.4 Warping Motion
  7.4.1 Linear Motion: No Acceleration
  7.4.2 Ease In: Gradually Accelerate
  7.4.3 Ease Out: Gradually Decelerate
  7.4.4 Ease In, Then Ease Out
  7.4.5 Elasticity and Bouncing
7.5 Warping Animation
7.6 Conclusion

Chapter 8: Collision Detection
8.1 Bounding Areas
  8.1.1 Rectangular Bounding Areas
  8.1.2 Circular Bounding Areas
8.2 Bouncing Off Walls
8.3 Ray Casting
  8.3.1 Fine-Tuning
8.4 The Separating Axis Theorem (SAT) and Minimum Translation Vector (MTV)
  8.4.1 Detecting Collisions with the SAT
  8.4.2 Reacting to Collisions with the Minimum Translation Vector
8.5 Conclusion

Chapter 9: Game Development
9.1 A Game Engine
  9.1.1 The Game Loop
  9.1.2 Loading Images
  9.1.3 Multitrack Sound
  9.1.4 Keyboard Events
Table of Contents

9.1.5 High Scores
9.1.6 The Game Engine Listing

9.2 The Ungame
  9.2.1 The Ungames HTML
  9.2.2 The Ungames Game Loop
  9.2.3 Loading the Ungame
  9.2.4 Pausing
  9.2.5 Key Listeners
  9.2.6 Game Over and High Scores

9.3 A Pinball Game
  9.3.1 The Game Loop
  9.3.2 The Ball
  9.3.3 Gravity and Friction
  9.3.4 Flipper Motion
  9.3.5 Handling Keyboard Events
  9.3.6 Collision Detection

9.4 Conclusion

Chapter 10: Custom Controls
  10.1 Rounded Rectangles
  10.2 Progress Bars
  10.3 Sliders
  10.4 An Image Panner
  10.5 Conclusion

Chapter 11: Mobile
  11.1 The Mobile Viewport
    11.1.1 The viewport Metatag
  11.2 Media Queries
    11.2.1 Media Queries and CSS
Table of Contents

11.2.2 Reacting to Media Changes with JavaScript

11.3 Touch Events
   11.3.1 Touch Event Objects
   11.3.2 Touch Lists
   11.3.3 Touch Objects
   11.3.4 Supporting Both Touch and Mouse Events
   11.3.5 Pinch and Zoom

11.4 iOS5
   11.4.1 Application Icons and Startup Images
   11.4.2 Media Queries for iOS5 Application Icons and Startup Images
   11.4.3 Fullscreen with No Browser Chrome
   11.4.4 Application Status Bar

11.5 A Virtual Keyboard
   11.5.1 A Canvas-Based Keyboard Implementation

11.6 Conclusion

Index