Department of Architecture and Building Science

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COMPUTER ANIMATION FOR ARCHITECTURAL VISUALISATION

by

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A thesis submitted in partial fulfilment of the requirements of the University of Strathclyde for the Degree of Doctor of Philosophy.

Glasgow, Scotland, United Kingdom.
APRIL 1998
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acknowledgement

In the Name of Allah, the Most Gracious and the Most Merciful.

By the time, Verily Man Is in lost, Except such as have Faith, And do righteous deeds, And join together In the mutual enjoining Of Truth, and of Patience and Constancy.

Quran Al-'Asr 133 : 1-3

I wish to acknowledge the help and assistance of all the individuals who gave their time to discuss and contribute to this thesis.

I would like to thank my supervisor Dr. Alan Bridges for his determination and responsibility in guiding my understanding on the principle issues and design of the thesis; ABACUS, the Department of Architecture and Building Science and AV Media Services staffs.

Thanks are also due to Professor Abu Hasan Ismail (former head of CAD Centre, Universiti Teknologi Malaysia - UTM) who encouraged me to take a PhD at Strathclyde University; Mohd Fuzi Musa, Zulkarnain Hasan and Fauzee Nasir who in particular helped me to retrieve, supply and create the live project animation production sequences; Alan Richtie and George Neilson from Television Production, College of Building and Printing, Glasgow, who helped to produce the special effects.

I am indebted to the following firms, software and hardware manufactures, education, art and architectural-based establishments and production houses for their time, interest and information of the thesis analysis: all of the practice member of the Glasgow Institute of Architects; Murray Grigor, Viz Limited, Fife, Edinburgh, UK; Richard Buday, Archimage, Houston, Texas, USA; Daniel Cox, Thropp Modelmakers Limited, London, UK; Chuan-Chang Wang, Compter Graphics CG (CGCG), Taiwan; David Haxton, The William Paterson College, New Jersey, USA; Tom Maver, University of Strathclyde, Glasgow, Scotland; Tee Sasada, Osaka University, Japan; Lisa Scalzo-Hamm, National Gallery of Art, Washington D.C, USA; Edward Howard, Howard Associates, Ohio, USA; Mark Cass, Alias Wavefront, UK; Nick Homer, Autodesk, UK; Allen Manning, ElectricImage, California, USA.

I must not forget my PhD colleagues in the 1994/95 sessions, my friends and other individuals who helped me in the thesis surveys.

Special thanks go to my wife Shahizon Azura Mohamed Mukari for sparing her valuable time to contribute to this research.

Finally, this thesis dissertation is dedicated specially to my wife, daughter Afiqah, parents and family, for giving me the moral support, care and love to enable me to complete it.

AHMAD RAFI MOHAMED ESHAQ
# table of contents

acknowledgement ................................................................. iii

list of illustrations ............................................................... xiii

video content .................................................................................. xviii

abstract .................................................................................... xxi

introduction ................................................................................ xxii

## CHAPTER 1  ANIMATION IN PRACTICE

1.1 INTRODUCTION .............................................................. 2

1.2 METHODOLOGY ............................................................ 3

1.3 SURVEY QUESTIONS ....................................................... 4

1.4 SURVEY RESULTS .......................................................... 7

1.5 GENERAL INFORMATION .................................................. 8

1.5.1 At What Stage did the Practices Use Computer Animation? .......................................................... 11

1.5.2 Why Choose the Stage? .................................................. 12

1.5.2.1 Building Representation .................................. 14

1.5.2.2 Design Communication .................................. 14

1.5.2.3 Visualisation .................................................. 14

1.5.2.4 Client Requirements ....................................... 15

1.5.2.5 To Impress the Client ..................................... 16

1.5.2.6 Design Development ...................................... 16

1.5.2.7 Competition .................................................. 17

1.5.3 How are Computer Animations Used? ......................... 17

1.5.3.1 Still Presentation .......................................... 20

1.5.3.2 Multimedia Presentation ............................... 21

1.5.4 What Does the Client Use the Animation for? .............. 21
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5.5</td>
<td>Is Computer Animation Part of Architectural Service?</td>
<td>23</td>
</tr>
<tr>
<td>1.5.6</td>
<td>In What Way do the Architects Think that Computer Animation Helps?</td>
<td>23</td>
</tr>
<tr>
<td>1.5.7</td>
<td>How Might Computer Animation in the Field of Architecture Develop?</td>
<td>25</td>
</tr>
<tr>
<td>1.5.7.1</td>
<td>Present Situation of Computer Animation in the Field of Architecture</td>
<td>25</td>
</tr>
<tr>
<td>1.5.7.2</td>
<td>Future Computer Animation in the Field of Architecture</td>
<td>27</td>
</tr>
<tr>
<td>1.6</td>
<td>PRE-PRODUCTION</td>
<td>29</td>
</tr>
<tr>
<td>1.6.1</td>
<td>Do the Architects have any Guideline before Producing Computer Animation?</td>
<td>30</td>
</tr>
<tr>
<td>1.6.2</td>
<td>Does the Computer Animation have any Storyboard?</td>
<td>30</td>
</tr>
<tr>
<td>1.6.3</td>
<td>Is There any Agreement of Fee and Content on the Basis of Storyboard?</td>
<td>36</td>
</tr>
<tr>
<td>1.6.4</td>
<td>The Architect's Opinion of Having a Key Guideline for Computer Animation</td>
<td>37</td>
</tr>
<tr>
<td>1.6.5</td>
<td>Does Film-making Understanding Benefit Architectural Animation?</td>
<td>40</td>
</tr>
<tr>
<td>1.7</td>
<td>PRODUCTION</td>
<td>42</td>
</tr>
<tr>
<td>1.7.1</td>
<td>Who does the Computer Animation?</td>
<td>42</td>
</tr>
<tr>
<td>1.7.2</td>
<td>Computer Animation Packages</td>
<td>46</td>
</tr>
<tr>
<td>1.7.3</td>
<td>Number of Workstations and other Architects Involvement in Computer Animation</td>
<td>49</td>
</tr>
<tr>
<td>1.7.4</td>
<td>To What Extent is Architectural Animation Produced?</td>
<td>50</td>
</tr>
<tr>
<td>1.7.5</td>
<td>Computer Animation Detail</td>
<td>52</td>
</tr>
<tr>
<td>1.8</td>
<td>POST-PRODUCTION</td>
<td>55</td>
</tr>
<tr>
<td>1.8.1</td>
<td>Do the Architects Edit their Computer Animation?</td>
<td>56</td>
</tr>
<tr>
<td>1.8.2</td>
<td>In-House Computer Animation</td>
<td>58</td>
</tr>
<tr>
<td>1.8.3</td>
<td>Production House Service</td>
<td>62</td>
</tr>
<tr>
<td>1.8.4</td>
<td>Computer Animation Cost</td>
<td>66</td>
</tr>
<tr>
<td>1.8.5</td>
<td>Final Distribution</td>
<td>68</td>
</tr>
<tr>
<td>1.8</td>
<td>SUMMARY</td>
<td>71</td>
</tr>
</tbody>
</table>
CHAPTER 2  FILMING ARCHITECTURE

2.1  INTRODUCTION ................................................................. 74

2.2  FILM REVIEW ................................................................. 75

2.2.1  Film Review 1 : The Architecture of Frank Lloyd Wright ............................................. 77
   2.2.1.1  General Overview ............................................. 77
   2.2.1.2  Message and Content ....................................... 77
   2.2.1.3  Cinematography ............................................. 77
   2.2.1.4  Lighting ......................................................... 83
   2.2.1.5  Sound .......................................................... 83
   2.2.1.6  Special Effects .............................................. 83
   2.2.1.7  Detailing ...................................................... 84
   2.2.1.8  Conclusion ..................................................... 84
   2.2.1.9  Advantages ................................................... 84
   2.2.1.10 Disadvantages ............................................... 85

2.2.2  Film Review 2 : Les Envois de Marseille .................................................. 85
   2.2.2.1  General Overview ............................................. 85
   2.2.2.2  Message and Content ....................................... 85
   2.2.2.3  Cinematography ............................................. 85
   2.2.2.4  Lighting ......................................................... 87
   2.2.2.5  Sound .......................................................... 87
   2.2.2.6  Special Effects .............................................. 87
   2.2.2.7  Detailing ...................................................... 87
   2.2.2.8  Conclusion ..................................................... 88
   2.2.2.9  Advantages ................................................... 88
   2.2.2.10 Disadvantages ............................................... 88

2.2.3  Film Review 3 : Masters of Illusion ............................................... 89
   2.2.3.1  General Overview ............................................. 89
   2.2.3.2  Message and Content ....................................... 89
   2.2.3.3  Cinematography ............................................. 89
   2.2.3.4  Lighting ......................................................... 91
   2.2.3.5  Sound .......................................................... 91
   2.2.3.6  Special Effects .............................................. 91
   2.2.3.7  Detailing ...................................................... 92
   2.2.3.8  Conclusion ..................................................... 92
   2.2.3.9  Advantages ................................................... 92
   2.2.3.10 Disadvantages ............................................... 93

2.2.4  Film Review 4 : The Edinburgh Old Town Model ........................................... 93
   2.2.4.1  General Overview ............................................. 93
   2.2.4.2  Message and Content ....................................... 93
   2.2.4.3  Cinematography ............................................. 94
3.2.1.10 Disadvantages .............................................. 122

3.2.2 Analysis 2 : Super House 1 .............................................. 123
  3.2.2.1 General Overview .............................................. 123
  3.2.2.2 Message and Content .............................................. 123
  3.2.2.3 Cinematography .............................................. 123
  3.2.2.4 Lighting ........................................................ 124
  3.2.2.5 Sound ............................................................ 124
  3.2.2.6 Special Effects .............................................. 124
  3.2.2.7 Detailing ...................................................... 124
  3.2.2.8 Conclusion ..................................................... 125
  3.2.2.9 Advantages ................................................... 125
  3.2.2.10 Disadvantages .............................................. 125

3.2.3 Analysis 3 : Commercial Furniture Services 
Incorporation (CFSI) ..................................................... 126
  3.2.3.1 General Overview .............................................. 126
  3.2.3.2 Message and Content .............................................. 126
  3.2.3.3 Cinematography .............................................. 126
  3.2.3.4 Lighting ........................................................ 127
  3.2.3.5 Sound ............................................................ 127
  3.2.3.6 Special Effects .............................................. 127
  3.2.3.7 Detailing ...................................................... 127
  3.2.3.8 Conclusion ..................................................... 127
  3.2.3.9 Advantages ................................................... 127
  3.2.3.10 Disadvantages .............................................. 128

3.2.4 Analysis 4 : University of St. Thomas ......................... 128
  3.2.4.1 General Overview .............................................. 128
  3.2.4.2 Message and Content .............................................. 128
  3.2.4.3 Cinematography .............................................. 128
  3.2.4.4 Lighting ........................................................ 129
  3.2.4.5 Sound ............................................................ 129
  3.2.4.6 Special Effects .............................................. 129
  3.2.4.7 Detailing ...................................................... 129
  3.2.4.8 Conclusion ..................................................... 130
  3.2.4.9 Advantages ................................................... 130
  3.2.4.10 Disadvantages .............................................. 130

3.2.5 Analysis 5 : Campus 92 .............................................. 131
  3.2.5.1 General Overview .............................................. 131
  3.2.5.2 Message and Content .............................................. 131
  3.2.5.3 Cinematography .............................................. 131
  3.2.5.4 Lighting ........................................................ 132
  3.2.5.5 Sound ............................................................ 132
  3.2.5.6 Special Effects .............................................. 132
  3.2.5.7 Detailing ...................................................... 132
  3.2.5.8 Conclusion ..................................................... 133
  3.2.5.9 Advantages ................................................... 133
  3.2.5.10 Disadvantages .............................................. 133
3.2.6 Analysis 6: *Banju Port Renaissance Plan* ........................................ 134
  3.2.6.1 General Overview ..................................................... 134
  3.2.6.2 Message and Content .................................................. 134
  3.2.6.3 Cinematography ...................................................... 134
  3.2.6.4 Lighting ................................................................. 135
  3.2.6.5 Sound .................................................................. 135
  3.2.6.6 Special Effects ....................................................... 135
  3.2.6.7 Detailing ................................................................. 135
  3.2.6.8 Conclusion ............................................................... 136
  3.2.6.9 Advantages ............................................................. 136
  3.2.6.10 Disadvantages ....................................................... 136

3.2.7 Analysis 7: *Kansai International Airport*
( First Proposal )........................................................................ 137
  3.2.7.1 General Overview ..................................................... 137
  3.2.7.2 Message and Content .................................................. 137
  3.2.7.3 Cinematography ...................................................... 137
  3.2.7.4 Lighting ................................................................. 138
  3.2.7.5 Sound .................................................................. 138
  3.2.7.6 Special Effects ....................................................... 138
  3.2.7.7 Detailing ................................................................. 139
  3.2.7.8 Conclusion ............................................................... 139
  3.2.7.9 Advantages ............................................................. 139
  3.2.7.10 Disadvantages ....................................................... 139

3.2.8 Analysis 8: *Kansai International Airport*
( Final Proposal )......................................................................... 140
  3.2.8.1 General Overview ..................................................... 140
  3.2.8.2 Message and Content .................................................. 140
  3.2.8.3 Cinematography ...................................................... 141
  3.2.8.4 Lighting ................................................................. 141
  3.2.8.5 Sound .................................................................. 141
  3.2.8.6 Special Effects ....................................................... 141
  3.2.8.7 Detailing ................................................................. 142
  3.2.8.8 Conclusion ............................................................... 142
  3.2.8.9 Advantages ............................................................. 142
  3.2.8.10 Disadvantages ....................................................... 142

3.2.9 Analysis 9: *Shanghai Railway Station* ..................................... 143
  3.2.9.1 General Overview ..................................................... 143
  3.2.9.2 Message and Content .................................................. 143
  3.2.9.3 Cinematography ...................................................... 143
  3.2.9.4 Lighting ................................................................. 144
  3.2.9.5 Sound .................................................................. 144
  3.2.9.6 Special Effects ....................................................... 144
  3.2.9.7 Detailing ................................................................. 144
  3.2.9.8 Conclusion ............................................................... 145
  3.2.9.9 Advantages ............................................................. 145
  3.2.9.10 Disadvantages ....................................................... 145
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.10</td>
<td>Analysis 10: <em>Urban Hangzhou</em></td>
<td>146</td>
</tr>
<tr>
<td>3.2.10.1</td>
<td>General Overview</td>
<td>146</td>
</tr>
<tr>
<td>3.2.10.2</td>
<td>Message and Content</td>
<td>146</td>
</tr>
<tr>
<td>3.2.10.3</td>
<td>Cinematography</td>
<td>146</td>
</tr>
<tr>
<td>3.2.10.4</td>
<td>Lighting</td>
<td>147</td>
</tr>
<tr>
<td>3.2.10.5</td>
<td>Sound</td>
<td>147</td>
</tr>
<tr>
<td>3.2.10.6</td>
<td>Special Effects</td>
<td>147</td>
</tr>
<tr>
<td>3.2.10.7</td>
<td>Detailing</td>
<td>147</td>
</tr>
<tr>
<td>3.2.10.8</td>
<td>Conclusion</td>
<td>147</td>
</tr>
<tr>
<td>3.2.10.9</td>
<td>Advantages</td>
<td>148</td>
</tr>
<tr>
<td>3.2.10.10</td>
<td>Disadvantages</td>
<td>148</td>
</tr>
<tr>
<td>3.2.11</td>
<td>Analysis 11: <em>Ichthyopolis</em></td>
<td>149</td>
</tr>
<tr>
<td>3.2.11.1</td>
<td>General Overview</td>
<td>149</td>
</tr>
<tr>
<td>3.2.11.2</td>
<td>Message and Content</td>
<td>149</td>
</tr>
<tr>
<td>3.2.11.3</td>
<td>Cinematography</td>
<td>149</td>
</tr>
<tr>
<td>3.2.11.4</td>
<td>Lighting</td>
<td>150</td>
</tr>
<tr>
<td>3.2.11.5</td>
<td>Sound</td>
<td>150</td>
</tr>
<tr>
<td>3.2.11.6</td>
<td>Special Effects</td>
<td>150</td>
</tr>
<tr>
<td>3.2.11.7</td>
<td>Detailing</td>
<td>150</td>
</tr>
<tr>
<td>3.2.11.8</td>
<td>Conclusion</td>
<td>150</td>
</tr>
<tr>
<td>3.2.11.9</td>
<td>Advantages</td>
<td>150</td>
</tr>
<tr>
<td>3.2.11.10</td>
<td>Disadvantages</td>
<td>151</td>
</tr>
<tr>
<td>3.2.12</td>
<td>Analysis 12: <em>Sketches of Rome</em></td>
<td>151</td>
</tr>
<tr>
<td>3.2.12.1</td>
<td>General Overview</td>
<td>151</td>
</tr>
<tr>
<td>3.2.12.2</td>
<td>Message and Content</td>
<td>151</td>
</tr>
<tr>
<td>3.2.12.3</td>
<td>Cinematography</td>
<td>152</td>
</tr>
<tr>
<td>3.2.12.4</td>
<td>Lighting</td>
<td>152</td>
</tr>
<tr>
<td>3.2.12.5</td>
<td>Sound</td>
<td>152</td>
</tr>
<tr>
<td>3.2.12.6</td>
<td>Special Effects</td>
<td>152</td>
</tr>
<tr>
<td>3.2.12.7</td>
<td>Detailing</td>
<td>153</td>
</tr>
<tr>
<td>3.2.12.8</td>
<td>Conclusion</td>
<td>153</td>
</tr>
<tr>
<td>3.2.12.9</td>
<td>Advantages</td>
<td>153</td>
</tr>
<tr>
<td>3.2.12.10</td>
<td>Disadvantages</td>
<td>153</td>
</tr>
<tr>
<td>3.2.13</td>
<td>Analysis 13: <em>ATOM</em></td>
<td>154</td>
</tr>
<tr>
<td>3.2.13.1</td>
<td>General Overview</td>
<td>154</td>
</tr>
<tr>
<td>3.2.13.2</td>
<td>Message and Content</td>
<td>154</td>
</tr>
<tr>
<td>3.2.13.3</td>
<td>Cinematography</td>
<td>154</td>
</tr>
<tr>
<td>3.2.13.4</td>
<td>Lighting</td>
<td>155</td>
</tr>
<tr>
<td>3.2.13.5</td>
<td>Sound</td>
<td>155</td>
</tr>
<tr>
<td>3.2.13.6</td>
<td>Special Effects</td>
<td>155</td>
</tr>
<tr>
<td>3.2.13.7</td>
<td>Detailing</td>
<td>155</td>
</tr>
<tr>
<td>3.2.13.8</td>
<td>Conclusion</td>
<td>155</td>
</tr>
<tr>
<td>3.2.13.9</td>
<td>Advantages</td>
<td>155</td>
</tr>
<tr>
<td>3.2.13.10</td>
<td>Disadvantages</td>
<td>156</td>
</tr>
<tr>
<td>3.2.14</td>
<td>Analysis 14: <em>234 Fulham Road, A New Development of Luxury Homes and Apartment</em></td>
<td>156</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>3.2.14.1</td>
<td>General Overview</td>
<td>156</td>
</tr>
<tr>
<td>3.2.14.2</td>
<td>Message and Content</td>
<td>157</td>
</tr>
<tr>
<td>3.2.14.3</td>
<td>Cinematography</td>
<td>157</td>
</tr>
<tr>
<td>3.2.14.4</td>
<td>Lighting</td>
<td>157</td>
</tr>
<tr>
<td>3.2.14.5</td>
<td>Sound</td>
<td>157</td>
</tr>
<tr>
<td>3.2.14.6</td>
<td>Special Effects</td>
<td>157</td>
</tr>
<tr>
<td>3.2.14.7</td>
<td>Detailing</td>
<td>158</td>
</tr>
<tr>
<td>3.2.14.8</td>
<td>Conclusion</td>
<td>158</td>
</tr>
<tr>
<td>3.2.14.9</td>
<td>Advantages</td>
<td>158</td>
</tr>
<tr>
<td>3.2.14.10</td>
<td>Disadvantages</td>
<td>158</td>
</tr>
<tr>
<td>3.3</td>
<td>RESULTS OF VIDEO ANALYSIS</td>
<td>159</td>
</tr>
<tr>
<td>3.4</td>
<td>GENERAL OVERVIEW</td>
<td>159</td>
</tr>
<tr>
<td>3.5</td>
<td>MESSAGE AND CONTENT</td>
<td>166</td>
</tr>
<tr>
<td>3.5.1</td>
<td>Design Animation</td>
<td>169</td>
</tr>
<tr>
<td>3.5.2</td>
<td>Urban Animation</td>
<td>169</td>
</tr>
<tr>
<td>3.5.3</td>
<td>Detail Design Animation</td>
<td>169</td>
</tr>
<tr>
<td>3.5.3.1</td>
<td>Photo-realistic Rendering and Object Composition</td>
<td>171</td>
</tr>
<tr>
<td>3.5.3.2</td>
<td>Selected Building Component</td>
<td>171</td>
</tr>
<tr>
<td>3.5.3.3</td>
<td>Selected Area</td>
<td>171</td>
</tr>
<tr>
<td>3.6</td>
<td>CINEMATOGRAPHY</td>
<td>172</td>
</tr>
<tr>
<td>3.6.1</td>
<td>Camera Movement</td>
<td>173</td>
</tr>
<tr>
<td>3.6.1.1</td>
<td>Continuous Camera Movements</td>
<td>173</td>
</tr>
<tr>
<td>3.6.1.2</td>
<td>Fixed Camera Station</td>
<td>177</td>
</tr>
<tr>
<td>3.6.1.3</td>
<td>Combination of Continuous Camera Movements and Fixed Camera Station</td>
<td>177</td>
</tr>
<tr>
<td>3.6.2</td>
<td>Visual Attention</td>
<td>178</td>
</tr>
<tr>
<td>3.6.2.1</td>
<td>Photo-realistic Rendering</td>
<td>179</td>
</tr>
<tr>
<td>3.6.2.2</td>
<td>Subject Movement</td>
<td>179</td>
</tr>
<tr>
<td>3.6.2.3</td>
<td>Close up Shot</td>
<td>181</td>
</tr>
<tr>
<td>3.6.2.4</td>
<td>Foreground Framing</td>
<td>183</td>
</tr>
<tr>
<td>3.6.2.5</td>
<td>Special Effects</td>
<td>184</td>
</tr>
<tr>
<td>3.6.3</td>
<td>Depth Illusion</td>
<td>188</td>
</tr>
<tr>
<td>3.6.4</td>
<td>Composition</td>
<td>189</td>
</tr>
<tr>
<td>3.7</td>
<td>LIGHTING</td>
<td>190</td>
</tr>
<tr>
<td>3.8</td>
<td>SOUND</td>
<td>192</td>
</tr>
<tr>
<td>3.9</td>
<td>CONCLUSION SEQUENCE</td>
<td>195</td>
</tr>
</tbody>
</table>
### Table of Contents

#### 3.10 Editing ........................................................................................................... 197

#### 3.11 Time Duration ............................................................................................ 200

#### 3.12 Summary ................................................................................................. 200

---

#### Chapter 4  Elements For Architectural Animation

4.1 Introduction ......................................................................................................... 208

4.2 Differences Between Architectural Films and Animations .................................. 208

4.3 Elements To Make A Successful Architectural Animation ....................................... 227

4.3.1 Storyboard .................................................................................................... 228

4.3.2 Using Available Visual Material .................................................................. 229

4.3.3 Establishing Site Context ............................................................................ 232

4.3.4 Designing the Cinematic Depth .................................................................. 235

4.3.5 Establishing Scale and Proportion ................................................................ 238

4.3.6 Architectural Detailing ................................................................................ 243

4.3.7 Lighting ....................................................................................................... 245

4.3.8 Visual Editing .............................................................................................. 247

4.3.9 Sound Editing .............................................................................................. 251

---

#### Chapter 5  Conclusion

5.1 Introduction ......................................................................................................... 258

5.2 A Checklist Of Elements To Make A Successful Architectural Animation ................. 258

5.3 Future Development ........................................................................................... 264

---

*bibliography* ........................................................................................................ 267

*appendices* ........................................................................................................... 280
list of illustrations

Figure 1 : Key shot sketches 1 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 2 : Key shot sketches 2 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 3 : Key shot sketches 3 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 4 : Key shot sketches 4 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 5 : Key shot sketches 5 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 6 : Key shot sketches 6 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 7 : Key shot sketches 7 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 8 : Key shot sketches 8 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 9 : Key shot sketches 8 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 10 : Key shot sketches 10 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 11 : Key shot sketches 11 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).
Figure 12: Key shot sketches 12 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 13: Key shot sketches 13 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 14: Key shot sketches 14 of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Figure 15: Lighting arrangements by Building Design Partnership (BDP).

Figure 16: Damansara Parade animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 17: Technovation Park simulation, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 18: Storyboard sketches of the interior of the New Ministry of Finance animation.

Figure 19: Storyboard sketches of the interior of the New Ministry of Finance animation.

Figure 20: Key shots of the lobby sequence of the New Ministry of Finance animation.

Figure 21: Key shot of the Unity Temple, The Architecture of Frank Lloyd Wright, courtesy of Murray Grigor.

Figure 22: Introduction key shots of Masters of Illusion, National Gallery of Art Washington.

Figure 23: Introduction shot of Sketches of Rome, courtesy of The William Paterson College.

Figure 24: Introduction key shots of the Guggenheim Museum, The Architecture of Frank Lloyd Wright, courtesy of Murray Grigor.

Figure 25: Conclusion key shots of My Sweet Home, courtesy of CGCG.

Figure 26: Introduction key shots of Falling Water, The Architecture of Frank Lloyd Wright, courtesy of Murray Grigor.

Figure 27: Key shots of Les Envois de Marseille, courtesy of Gamsau / Video 13 INA.

Figure 28: Key shots of Kansai International Airport (First) animation, courtesy of Osaka University.

Figure 29: Introduction key shots of Masters of Illusion and the New Ministry of Finance animation.
Figure 30 : Key shots of the Gale House, *The Architecture of Frank Lloyd Wright*, courtesy of Murray Grigor.

Figure 31 : Key shots of the *New Ministry of Finance* animation.

Figure 32 : Key shots of the Johnson Wax Administration Building, *The Architecture of Frank Lloyd Wright*, courtesy of Murray Grigor.

Figure 33 : Key shots of *Kansai International Airport (Final)* animation, courtesy of Osaka University.

Figure 34 : Chroma-key shot of the *New Ministry of Finance* main lobby.

Figure 35 : Chroma-key shot of the *New Ministry of Finance* office reception.

Figure 36 : Chroma-key shot of the *New Ministry of Finance* office.

Figure 37 : Chroma-key shot of the main ritual hall of *Chen Lung Tien* animation, courtesy of CGCG.

Figure 38 : Close up key shots of the Hollyhock House, *The Architecture of Frank Lloyd Wright*, courtesy of Murray Grigor.

Figure 39 : A ‘particle’ effect key shots of the ‘bracket’ detailing in *Chen Lung Tien* animation, courtesy of CGCG.

Figure 40 : Tracking key shots of Ennis House living room, *The Architecture of Frank Lloyd Wright*, courtesy of Murray Grigor.

Figure 41 : Key shots of the Tonken House, *The Architecture of Frank Lloyd Wright*, courtesy of Murray Grigor.

Figure 42 : Key shots of the Ward Willits House, *The Architecture of Frank Lloyd Wright*, courtesy of Murray Grigor.

Figure 43 : Key shots of the *Banju Port Renaissance Plan* animation, courtesy of Osaka University.

Figure 44 : A dissolve effect used in *Damansara Parade* animation experiments.

Figure 45 : A special lighting effect of the Buddha statues, *Chen Lung Tien* animation, courtesy of CGCG.

Figure 46 : Key shots of Mantegna’s ceiling detail, *Masters of Illusion*, National Gallery of Art Washington.

Figure 47 : Close up key shots of Mantegna’s ceiling detail, *Masters of Illusion*, National Gallery of Art Washington.

Figure 48 : Key shots of two-dimensional objects and lighting effects, *Masters of Illusion*, National Gallery of Art Washington.

Figure 49 : Chroma-key shot of *ATOM* animation, courtesy of Thorp Modelmakers.
Figure 50 : *Johor Bahru City* virtual reality simulation, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 51 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 52 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 53 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 54 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 55 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 56 : *Technovation Park* simulation, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 57 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 58 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 59 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 60 : *Damansara Parade* animation sequence, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Figure 61 : A Diagram of *Media100® xs* (*Data Translation®*) non-linear set-ups.
Colour Plate 1 : An isometric view shot of the Edinburgh Waverley Railway Station Extension, courtesy of Building Design Partnership (BDP).

Colour Plate 2 : Production key shot of the interior of the New Ministry of Finance animation.

Colour Plate 3 : Production key shot of the interior of the New Ministry of Finance animation.

Colour Plate 4 : Production key shot of the exterior of the New Ministry of Finance animation.

Colour Plate 5 : Johor Bahru City virtual reality simulation, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).

Colour Plate 6 : Johor Bahru City virtual reality simulation, courtesy of CAD Centre, Universiti Teknologi Malaysia (UTM).
video contents

The video format is VHS-Pal system. Please adjust the brightness, colour, balance, volume and tracking according to your own monitor and videocassette recorder (VCR) equipment to get the best display.

The Main Opening Title 20 seconds

Using Available Visual Material 2 minutes 32 seconds

CLIP 1 Unity Temple, The Architecture of Frank Lloyd Wright.
CLIP 2 Masters of Illusion.
CLIP 3 Sketches of Rome.
CLIP 5 Campus 92.
CLIP 6 My Sweet Home.

Establishing Site Context 2 minutes 51 seconds

CLIP 7 The Architecture of Frank Lloyd Wright.
CLIP 8 The New Ministry of Finance, Malaysia.
CLIP 10 Les Envois de Marseille.
CLIP 11 Kansai International Airport (First Proposal).

Designing the Cinematic Depth 1 minute 14 seconds

CLIP 12 Gale House, The Architecture of Frank Lloyd Wright.
CLIP 13 The New Ministry of Finance, Malaysia.
CLIP 14 Masters of Illusion.
CLIP 15 The New Ministry of Finance, Malaysia.
CLIP 16 Damansara Parade, Malaysia.
Establishing Scale and Proportion

- CLIP 17 Johnson Wax Administration Building, *The Architecture of Frank Lloyd Wright*.
- CLIP 18 *Kansai International Airport (Final Proposal)*.
- CLIP 19 *Damansara Parade, Malaysia*.
- CLIP 20 *The New Ministry of Finance, Malaysia*.
- CLIP 21 *Chen Lung Tien*.

Architectural Detailing

- CLIP 23 *Chen Lung Tien*.
- CLIP 25 *ATOM*.

Lighting

- CLIP 27 *My Sweet Home*.
- CLIP 30 *Banju Port Renaissance Plan*.

Visual Editing

- CLIP 31 *Masters of Illusion*.
- CLIP 32 *Damansara Parade, Malaysia*.
- CLIP 33 Slow Motion, *The New Ministry of Finance, Malaysia*.
- CLIP 34 Chroma-key, *The New Ministry of Finance, Malaysia*.
- CLIP 35 Cut, *Damansara Parade, Malaysia*.
- CLIP 36 Visual Clue, *Damansara Parade, Malaysia*.
- CLIP 37 Pan, *Damansara Parade, Malaysia*.
- CLIP 38 Camera Movement, *Damansara Parade, Malaysia*.
- CLIP 39 Speed, *Damansara Parade, Malaysia*.
- CLIP 40 Editing Platform, *Damansara Parade, Malaysia*.
Sound Editing  

6 minutes 37 seconds

CLIP 41 Using a background sound, *Masters of Illusion*.
CLIP 42 Using different background sounds, *Damansara Parade, Malaysia*.
CLIP 43 Composing background sound, *Masters of Illusion*.
CLIP 44 Composing background sound, *Chen Lung Tien*.
CLIP 46 Using sound effects in animation, *The New Ministry of Finance, Malaysia*.
CLIP 48 Using natural sound effects in animation, *South Garden*.
CLIP 49 Using natural sound effects of human activities, *Les Envois de Marseille*.
CLIP 51 Voice-over in animation, *British Pavilion, Seville Expo*.
CLIP 52 Narration by the presenter, *Masters of Illusion*.
CLIP 53 Include 'chroma-key' with narration effects, *ATOM*.

Credits  

21 seconds

TOTAL REEL DURATION  

24 minutes 14 seconds
This thesis critically reviews the state of architectural animation, and relates this specific field to the more general motion-based representations, particularly traditional film-making techniques. It identifies key elements from traditional film-making and shows how these elements can improve computer-based architectural animation. The process of identification of the key elements from traditional film-making starts with a critical survey of the use of motion-based representation in local architectural practices and an empirical analysis of several architectural-based documentary films and past and present computer animations.

All of the key ideas are illustrated on video by comparing real shooting clips to digital sequences focusing on production and post-production works. Some of these were implemented in two live projects (Ministry of Finance, Malaysia and Damansara Parade) for architects to understand the real problems and potentials in each process. These sets of illustrations expand the architect ideas to make full use of the motion-based process to improve the skill of combining architectural information in a good animation. The overall production process becomes more efficient when the motion-based footage is edited using a non-linear editing platform as it enhances the professional appearance as well as vastly saving most of the production time.

The thesis concludes with specific recommendations relative to the stage at which the animation is produced. This technology can be best utilised with the right skills (a gained from film-making) and an understanding of each stage that requires a different level of input and gives a certain impact to the viewers.
introduction

This thesis critically reviews the state of architectural animation, and relates this specific field to more general motion-based representation, particularly traditional film-making techniques. It then identifies key elements from film-making and shows how these elements can improve computer-based architectural animation.

Animation is one of a number of representation techniques in the construction business (especially the design field) developed to store and exchange information and communicate design ideas. Architects often focus on this visualisation method as a representation model for clients and other related professionals to understand the building or spaces created. The demands on architects to change from traditional drawings to animation arises as the medium itself provides a more understandable and powerful communication process.

Although recent technology in motion-based representation has vastly improved, the state of architectural animation remains the same. Some architects who have invested a huge amount of money in the latest recording art technology may create even worse animations. There is little concern to learn and understand film-making skills and the possibilities of design animation, either in architectural education and research or in practice.

Finding a good architectural film to study is relatively difficult. As Grigor (1998) explains, “in many big countries especially America and Europe, architecture is big news. However, there aren’t many films about architecture, which is very bizarre.” This emerging field has only recently been addressed academically, one of the first conferences being a Symposium on Cinema and Architecture held at Cambridge University in 1995, the proceedings of which have just been published (Penz and Thomas 1997).

Films and videos on architecture may be documentary and commercially produced to describe new building proposals, history and conservation or building environment. In a critical research on German and Swiss films, Janser (1997) categorises film on architecture as films for special interest groups (e.g. architects and planners), client’s own archive (e.g. filming the construction progress), industrial purposes, commercial (e.g. newsreel) and independent production.
Although there is much evidence that architects have been involved in motion-based representation (particularly computer animation) there is no information on the extent to which this technology and 'Cinema and Architecture' benefits architects in design practice. Therefore, Chapter 1 introduces a survey of how architectural practices currently utilise computer-based animation as the author conducts a short interview with individual practice member of the Glasgow Institute of Architects. This includes a brief description about the individual firm and how they utilise this technology in their design process, particularly by looking at which working stage the architects produce computer animation. It also covers the architect's awareness of film-making and their opinion on the future of this specific field.

The need to understanding some film-making techniques become more critical as the tools to produce architectural animations become more easily available and the inexperience in manipulating motion sequences become more evident. Therefore, this thesis continues in Chapter 2 to select a number of architectural-based films, particularly documentaries and makes an empirical analysis of how architectural-related information (especially building) is filmed professionally. Explanation is focused on the general overview, main content and cinematography.

For the analysis of the prize winning documentary, *The Architecture of Frank Lloyd Wright*, the author interviewed the director, Murray Grigor and reports his views on filming architectural information and the future of motion-based architectural representation. From here, architects may learn how film-directors prepare to establish the film sequences to get plenty of cutting options, a creative and best shot of the subject, and how they utilise the cinematic nature to enhance the subject illusion and hold viewers' attention with a keener interest.

A few minutes of architectural animation can affect the participant's understanding and decision making process but production pressures become significant as the architects try to keep within budget and time constraints. This often cramps motion-based representation resulting in many viewers failing to interpret the design positively as they miss a lot of vital information that explains the design. Recognising this problem, Chapter 3 reviews critically several past and present architectural animation produced by architectural practice, education establishment and production house. In order to support the whole analysis, twenty five people including architectural students, professionals and laymen previewed several video samples. This investigation outlines the key elements that form the architectural animation as well as indicating the problems and potentials.
All of the key ideas developed by the author, architectural practices, education establishments and production companies are presented in Chapter 4. Digital sequence illustrations were compared to real shooting footage and compiled in a form of video format submitted along with the thesis focusing on the production and post-production works.

Two live projects were digitally modelled to really expand the understanding of animation problems and potentials. All camerawork and sequence experiments in the Ministry of Finance Office, Malaysia are carried out on the typical computer-aided design (CAD) equipment. However, the Damansara Parade simulation (originally designed for interactive representation - virtual reality) is created using the high-end workstation (both computer systems are explained in Appendix 4). The video reel is built up in the rough-cutting process earlier to get key examples before finally edited using non-linear platform.

This thesis is concluded in Chapter 5 by critically evaluating the architectural practices survey, architectural-based documentary films and computer animation. It then recommends principles for architects to get the best results for designing computer-based architectural animation and future developments in this visualisation field.
chapter 1

animation in practice
1.1 INTRODUCTION

Through history architects have developed and used different ways of representing design information. One of the main reasons for this development is the desire to convey a better understanding of the design to the viewer. The traditional methods of communication in architectural design, especially static representations, create difficulties for the layman or non-professional participant to fully understand the design proposals.

The nature of the static medium itself means that it cannot give the participants the necessary information with regards either to the design’s potential or possible problems. Thus, communication and collaboration between the architect and other participants is limited. Also, alteration to the design becomes difficult within a limited time period.

The constraints of static-based representations have led some architects to change to computer motion-based representations. As Grigor (1994) explains, “since our knowledge of buildings comes from seeing isolated facades (the building as painting) or forms (the building as sculpture), only filming can deliver the essential spatial dimensions of space and volume.” This implies the importance of film sequences as a medium to be developed in the design process.

Although at present the choice of computer motion-based representations seems to look promising and may improve the design process, many architects feel at a loss as their representations using this technique do not have a strong identity or character and there are no precedents to refer to. The basic skills used in the static representations such as light and shadow, colour contrast, scale and proportion, composition and rendering are not always applied in the motion-based representations.

Design animations are sometimes even worse than the static-based representations as architects lack an understanding of how the motion-based technique works. They have little or no information about how film is formed to convey ideas. As Kruse (1994) says, “one of the things that architects can get carried away with is they think they’ll be doing the stuff that looks like it
came from (the high-end production house) Industrial Light and Magic. They don’t realise until they’ve tried (animating) for the first time just what a task those people really face.” Indeed, there are certain simple rules and principles which should be understood carefully before getting involved in any of the motion-based representations.

Thus, in order to gain an understanding of the use of motion-based representation this thesis presents a survey of how architectural practices currently utilise computer-based animation (see Appendix 1 for further reference).

1.2 METHODOLOGY

Although there is much evidence that architects have been involved in motion-based representation (particularly computer animation) there is no information on the extent to which this technology benefits or is utilised by architects in design practice.

Consequently, all of the practice member of the Glasgow Institute of Architects were contacted by phone to determine if they were interested in participating in a survey. Out of forty six practices contacted, only thirteen considered animation as part of their design representation (see Table 1). The author then arranged to visit these practices.

A short interview was conducted at the practice lasting between twenty minutes to one hour. The architects were asked general questions about their practice before continuing to more specific questions regarding the process of the animation (pre-production, production and post-production).

All of the architects were extremely helpful and were interested in the topic of the thesis particularly the idea to improve the computer-based architectural animation.
1.3 SURVEY QUESTIONS

Not all of these questions were specifically asked, as they were normally answered in the general discussion at the start of the interview. These questions were constructed to give a basis on which to analyse the information that was received in a logical manner. In fact, in some way it helps to identify when, why and how architects use animation and to what extent this motion-based representation was utilised.

Interview date & time : 
Person interviewed : 
Size of firm / classification: 
Staff : architects : total staff : 
No. of animations produced : 

GENERAL INFORMATION

1. At what stage do you start to use computer animation and why? e.g. early stage / design stage or option / construction stage.

2. How are they used?

3. What does the client use the computer animation for?

4. Is computer animation part of the architectural service? YES / NO e.g. the client have to pay extra - (inclusive or exclusive of the design).

5. In what way do you think that computer animation helps? e.g. design process / impressive presentation / marketing purposes / win a project.

6. How might computer animation in the field of architecture develop?

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation? film-making / documentary / television production.
8. Does the computer animation have a storyboard?  
YES / NO.

9. How long does it take to produce the storyboard before it is finalised?

10. Is there any agreement of fee and content on the basis of storyboard?  
YES / NO.

11. Do the clients usually require a storyboard before making the computer animation?  
YES / NO.

12. If YES, does the storyboard influence the animation project from the client?

13. What is your opinion in having a key guideline before producing computer animation?

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?  
YES / NO.

PRODUCTION

15. Who does the computer animation?

16. Did you have any background knowledge before producing computer animation?  
e.g. CAD courses or school of architecture / film-making knowledge / video production.

17. What type of software and hardware are used to create the computer animation?  
hardware: PC / Mac / SGI / Sun.  
Software:

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?

19. To what extent do you go to produce the computer animation?  
Relying just on the CAD software that is available in the company.

20. How much detail would go into producing the computer animation?  
e.g. model with or without site context, e.g. general exterior / general exterior and interior modelling / with selected detailing and area / photo-realistic rendering.
POST-PRODUCTION

21. Do you edit your computer animation?

22. Who usually deals with the post-production part of the computer animation (editing)?
   in-house / production house.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?
   e.g. reduce the overall cost / manageable.

24. How long do you spend to complete the computer animation?

IF SENT TO THE PRODUCTION HOUSE

25. Why do you send out to the production house to produce the computer animation?
   e.g. no equipment or expertise / expensive set-up.

26. Are you satisfied with the end product?

27. How many consultations are required before getting the end product?

28. How long do they spend to complete the computer animation.

29. Is it costly?
   e.g. ranging from

30. In what format do you present the computer animation?
   e.g. on screen only / video / film / QTVR / multimedia / VR.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   e.g. walk-through fast / crude rendering and modelling / rendering material / the selected format.

1.4 SURVEY RESULTS

Although computer technology has developed extensively in computer graphics, computer-aided design (CAD) and other motion-based representations for the last ten years, this survey shows that animation is still
not a common representation choice in architectural practice as shown in Bar and Pie Chart 1.

In fact thirty three out of forty six practices in Glasgow, concentrate on still modelling. There is still one firm that totally used manual presentation. Sixteen firms produce two-dimensional drawings and perspectives of which four of them include a minimal three-dimensional modelling. The vast majority of the architectural firms combine their still presentation with two-dimensional and three-dimensional building representation.

Bar Chart 1: Use of computer representation in forty six Glasgow architectural practices.
1.5 GENERAL INFORMATION

This section describes briefly the individual firms who use animations (Table 1) and how they utilise computer animation and incorporate this technology in their design process (Table 2), particularly by looking at which working stage the architects produce computer animation. It also covers the architect's opinion on the future of this specific field, and whether computer animation was an integral part of the service architects provide to the clients.
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Table 1: General information of the individual architectural practice in Glasgow.
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**KEY:**  
RES : Residential, PB : Public Building, RET : Retail, OFF : Office,  
IND : Industrial, EDU : Educational, COM : Commercial,  
SIA : Site Impact Analysis, LEI : Leisure.

Table 2: Animations produced by Glasgow architectural practices.
1.5.1 At What Stage did the Practices Use Computer Animation?

Computer animations are used at different stages in design process (particularly concentrated on office, residential and public building design, see Table 2). This survey shows that most architects produce animation in the briefing (inception and feasibility) and sketch plans (outline proposals and scheme design) stages. However, six firms include computer animation as a detail design stage representation (see Bar and Pie Chart 2).

![Bar Chart 2: At what stage do you start computer animation?](chart.png)
There are several reasons why architects establish a specific stage to use computer animation in the design process. In general, most of the selected stages were used to ensure that viewers will understand the design through the media which they are familiar with - a motion-based representation. This is due to the fact that almost all of the architects interviewed claimed that most of their viewers (particularly the client, public but also engineers and contractors) cannot understand architectural drawings, especially two-dimensional representations.

Therefore, one of the key reasons that most architects concentrate on the early stages of the design is to ensure that all of the related parties understand the proposals. As Kelman (1998) from Building Design Partnership (BDP) says, “it is important for the architects to pin down from the very beginning stage what sequence will be presented and to obtain agreement between both parties (the architects and clients) to avoid any major re-modelling or changes of the design which obviously require a vast amount of time and money.”

This key reason basically includes building representation, design communication and visualisation. Apart from these, the animation is chosen
at a specific stage by the architects as required by the clients and to impress them as part of the design development and submission. See Bar and Pie Chart 3.
1.5.2.1 Building Representation

The design is represented in the form of animation as a potential platform to enable the viewers to see and understand the building easily before it is built. For example, Geoffrey Reid Associates use their building representation to convince the planner in getting the design approval. In fact, one of the animated sequences is purposely made to analyse the visual impact based on a few 'driving mode' walk-throughs on the proposed site to outline the potentials and problems (e.g. the main route and potential building appearance from certain distance) before starting any design.

1.5.2.2 Design Communication

The final approval of architectural design mostly depends on the client (including the public). Throughout the design process, an architect always faces continuous building amendments. Clients that are unable to visualise and understand their building representations are prone to make incorrect decisions.

This survey shows that most of the architects agreed that the computer-based animation is a powerful medium to attract clients in getting projects and help them make faster decisions. The design process is made easier and kept on schedule. Thus, six out of thirteen practices prefer animation in the design stage to allow good decision making from the participants by having a quality communication platform.

1.5.2.3 Visualisation

Architectural drawings normally look abstract or ambiguous for non-architecturally based professionals and lay people. An architect's interpretation of a building might be different from what the audience will perceive.

With animation there is the potential to bring together the design thinking of the architect and other parties consistently from the beginning to
the final design stage through good visualisation. Indeed, design awareness becomes more explicit when the participant is represented in a well-told story and is allowed to browse through the animation. As Kelman (1998) from Building Design Partnership (BDP) summarises, “in all animations what is really important is that the client is well aware and informed on what the animation is all about.”

On all of Building Design Partnership’s (BDP) recent projects the clients were first shown a preliminary or ‘pilot’ animation. For instance, in the Waverley Railway Station (Edinburgh, Scotland) project, a few potential sequences were established at certain point-of-view shots to enable the clients to see from the exit point what the surroundings look like (i.e. building landmarks) in relation to the proposed building.

1.5.2.4 Client Requirements

Some clients specifically require the architects to produce an animation at specific stages mainly for funding and public information. Most of the clients prefer the early stages due to the fact that funding often takes a certain period of time to secure.

On the other hand, The Miller Partnership created animation sequences of the Middlesbrough Stadium as an update design information for the public to view and experience the new football stadium. The animation representation was required by the client after seeing the first stadium animation proposal developed by the contractor’s in-house production. The interactive sequences allow the viewers to view as well as key in information such as walk-through, goal shooting together with the sound effect, view the stadium from any of the chosen seat and fly-through using the keyboard and joy-stick.
1.5.2.5  To Impress the Client

Although most of the firms agree that animation impressed their viewers, only two specifically used it for this purpose in the design stage. This early stage representation is basically used to get public attention and present the design information. Page and Park did this in two museum proposals in Cambridge and Paisley.

RMJM Glasgow prefers the later design stage as more information can be included to give a better impression to the client. This is due to the fact that the overall design and space planning is completed and texture can be mapped out to the building facade as well as a suggestion of light arrangement. As Stallon (1998) says, “animation representation plays a major role as an impressive finished product and anything that extraordinary will help in the design.”

In contrast, only one architect feels that their clients are not impressed by the technology (animation) perhaps because of the minimal rendering (without any photo-realistic) and crude sequence. As Brown from Fraser Brown Partnership (1998) explains, “the client may wonder why the architects waste their money on investing in animation. What they want is actually something that shows the building works for them.”

1.5.2.6  Design Development

Most of the interviewed architects agreed that animations that were created in the earlier stage do not provide a major improvement in the design development. This is mainly because this representation only provides a better visualisation (i.e. mass form) to clients who often cannot understand two-dimensional drawing.

However, if the animation is produced at a later stage, it helps architects to develop their design. With extensive detail of the material, colour, light, shadow, reflection and camera trajectory, a lot of quality decisions can be outlined critically as the animation gives almost a complete building representation. As Simmonds (1998) from Page and Park mentions,
“decisions can be justified quickly as the animation input deals with material selection in photo-realistic rendering which physical models cannot.”

HLM Architects developed a form of animated sequence showing a sun path to identify the natural lighting effect quality in the New Hairmyres Hospital, East Kilbride design. This information helps them to suggest a few facade alternatives and energy conservation strategies to the clients particularly to make full use of natural lighting.

1.5.2.7 Competition

Most architectural competitions prefer a paper-based drawing or physical model as a submission requirement. There are two occasions that animation helped the firm to win the projects.

Page and Park’s winning scheme for the New Paisley Museum included a form of motion-based representation (video) at the detail design stage. With a complete photo-realistic rendering, selected spaces and cinematography the sequence reveals the architect’s idea to give a better visualisation to the clients. Similarly, Fraser Brown Partnership, a few seconds of animated sequence helped them to win the housing competition project although the firm had to pay the animation fee (i.e. free service to the client).

However, animation does not necessarily ensure a successful result to win a competition. This happened to The Parr Partnership, when one of their industrial design projects did not win a competition even though it was presented in the form of an animated sequence.

1.5.3 How are Computer Animations Used?

This survey shows that the way the animation is utilised relates to the stages selected by the architects. However, animation may be intended as part of the whole design representation together with still images and multimedia sequences. See Bar and Pie Chart 4.
The main source used to create the animated sequences is typically other CAD data (see Bar and Pie Chart 5). The architects basically transfer and exchange files before extruding the building information into a three-dimensional model. Only one firm (Vernon Monaghan Architects) models all of their animations from scratch since it makes the overall animation process
easier and faster without any missing polygons as often occurs in data exchange file (dxf).

Three out of thirteen architectural practices combine both animation tasks due to the fact that most architects receive individual information from other parties with various softwares. Firstly, they create the basic building model and layout. Then, the architects manipulate the camera path and other rendering features to form a series of animated sequences.

Bar Chart 5: Is the computer animation being developed from other CAD data?
1.5.3.1 Still Presentation

Compared to other usage, computers still dominate most of the practices still representations. A lot of the architects establish a few important shots from the animated sequences to be included as part of the architectural documentation such as building reports, paper-based presentation and brochures.

For example, in the Edinburgh Airport Extension projects design by The Parr Partnership, the architects selected a few key shots from the photorealistic rendering sequence to submit in the full report and paper-based presentation required by the client (BAA).

On the other hand, Kaleidoscopic updates their practice brochures with the present animation projects in colour stills. In fact, most of their clients request larger format still computer images for public exhibitions.

Only one firm (The Miller Partnership) does not see the point of having many still images as the initial idea was to convince and communicate design through motion-based representation.
1.5.3.2 Multimedia Presentation

Two architectural practices integrate their animation sequences as part of the interactive building representation. Animated sequences were organised into a CD-ROM (Compact Disc Read Only Memory) for the client to view interactively with few elements (e.g. buttons) to link with other information such as text, graphics and sound.

In one of Kaleidoscopic's recent commercial projects, MacKenzie's suggests a multimedia production for the Strathclyde Police. A few sequences passing through various buildings and surroundings (e.g. derelict area, housings and streets with dim lighting) were included in the CD-ROM to show and draw public awareness of how crime can occur and be prevented.

1.5.4 What Does the Client Use the Animation for?

In general most clients require the architects to develop animation for them to present their project to other parties. According to RMJM, developers often require an animation to be submitted along with their design. They find that animation is an effective marketing tool to draw public attention to invest in and buy their properties.

In the case of BAA, the clients had the experience in visualising design through animation, and required The Parr Partnership to develop animation throughout the design process. In fact, two animations (mass modelling and high-end photo-realistic rendering) were created for the BAA Chief Executive Design Group approval.

Five firms explained that their clients use the animation to get funding. For example, Keppie Design clients use animation as a 'public relations' (PR) exercise to present their project to the trustee, planner and local council.
Considering visualisation, Vernon Monghan Architects presented one of their housing projects to Scottish Homes in conjunction with Glasgow 1999 City of Architecture. On the other hand, Miller’s client found that the animation exhibition attracts a lot of the football fans and general public to try the interactive experience as a weekend event.

The summary of how the clients use animation is shown in Bar and Pie Chart 6.

[Bar and Pie Chart 6: Animation utilisation by the client]

Bar Chart 6: What does the client use the animation for?

Pie Chart 6: What does the client use the animation for?
1.5.5 Is Computer Animation Part of Architectural Service?

Generally, computer animation is not part of the standard architectural service (see Bar Chart 7). In fact, only 24% of the practices include animation as part of the service which focus on mass model animation. Most of the architects that did combine the service (38%) have changed their policy and now require the client to pay extra. There are several important reasons why most firms abolished the inclusive service.

Two firms stopped producing animation due to the high cost and time involved, extensive labour and lack of expertise in the production. Although theoretically all of the animations created cost extra, none of the clients were willing to pay and expect the animation as part of the overall presentation.

![Bar Chart 7: Is computer animation is part of architectural service?](image)

1.5.6 In What Way do the Architects Think that Computer Animation Helps?

This survey shows that there is a clear relationship between the way that architects think about computer animation (Bar Chart 8 and Pie Chart 7) and why they select a certain stage. Most of them agree that animation technology vastly helps to impress the viewers. This is associated
with the motion-based medium and the idea to reveal three-dimensional forms when explaining design with viewers who are not familiar with drawings.

For the client, this 'eye catching' technology increases the chance to promote, sell or even win competitions. In the architect's point of view, the high quality rendering and selection of key shots make the design process easier as the client understands the design and knows what they require (e.g. form amendment and material selection) through visualisation.

Bar Chart 8: In what way do you think that computer animation helps?
Although most firms have different opinions on how architectural animation may develop, there are a few key similarities that architects agree with. These opinions are basically divided into two main categories which are the present and future of computer animation in the field of architecture.

### 1.5.7.1 Present Situation of Computer Animation in the Field of Architecture

This survey shows that almost all architects relate the present situations before suggesting any idea in the future development of computer-based architectural animation. For example, in terms of the animation capability and quality, many firms notice that the present motion-based technology for architects is still slow and require a lot of input even to develop a simple modelling and animated sequence. See Bar Chart 9 and Pie Chart 8.
Present CAD platforms are still not being developed to maximise the rendering power for the large files that are often faced in building animation. Thus, architects have to delete a lot of building features and concentrate on a simple crude modelling. The effect becomes even worse in interactive simulation. This makes Kelman from Building Design Partnership (BDP) doubt the point of giving the interactive freedom in the crude environment for the client to experience in the virtual environment.
Animation requires a greater amount of information input before individual images can be manipulated although in reality the design does not have that level of detail in the early stage of design. If the architects proceed with this animation, it is a risk for them to use the ‘unresolved’ design to explain and can discourage the client on what the architects are doing on the design. That is why Maclachlan from Maclachlan Monaghan Architects suggests to concentrate architectural animation at the design or advanced design stage to ensure the building representation will convince (more detailing input) and make the client understand the sense of space better.

Another important reason that concerns many architects is the cost and time consumed. Cheaper software and hardware still prolongs the production time. The cost and time period becomes even greater when the numbers of animators in a large firm is too small. For instance, one of the key reasons that Geoffrey Reid Associates have to freeze up computer animation in the design process is due to the fact that only one out of forty eight architects and technicians is in charge of the motion-based production.

According to Dickie (1998) from Miller Partnership, “animation in the field of architecture is still a back end application since it is not a common representation practice.” The difficulties in finding cheaper hardware and software and expertise to model fast three-dimensional animation makes many architects concentrate on a large project that can cover the intensive labour production.

1.5.7.2 Future Computer Animation in the Field of Architecture

In this survey, five architects agree that in future animation is more than a presentation tool (see Bar Chart 10 and Pie Chart 9). In fact, this motion-based representation will develop better as a design platform for the designer to make the full use of this technology. Building manipulation should become easier and more efficient particularly with fast rendering power and production processes. Animation that associates with interactive representation will be widespread in architectural practices for the viewers
and architects to instantly change the building material, colours and objects mainly to visualise the impact in the virtual environment.

Bar Chart 10: Architects opinion in the future of architectural-based computer animation.

Pie Chart 9: Architects opinion in the future of architectural-based computer animation.

In order to get a successful result, three firms suggest that architects need to focus on animation as a specialisation either as an in-house or a separate business. According to Archer from Cooper Cromar Associates
(1998), “a good animation cannot be achieved unless the architects choose animation as a speciality since it is not a continuous task that many architects do as they often forget the process of developing the sequence.”

At present three firms had a separate unit specialising in animation and modelling. RMJM and Building Design Partnership (BDP) have started this motion-based service in-house as they found that it has the potential market particularly in the construction business. They believe that having a separate unit will polish the animation skill better as the architects can concentrate on the process, technique and other motion-based knowledge. On the other hand, Architectural Design Associates have changed totally into Kaleidoscopic for the last two months focusing on computer modelling, animation and interactive business.

1.6 PRE-PRODUCTION

Traditional film-making suggests storyboards to be the best aid in establishing important cinematic features and locations before starting any real or virtual shooting. As Kawin (1992) says, “to sketch something out beforehand can be just as important to the film-maker as it is to a painter.” In many cases, shooting cannot proceed until all key features are finalised onto storyboards.

Thus, this section reports how architects start to create their animation by critically understanding the development process and needs from the very beginning of the production.

1.6.1 Do the Architects Have Any Guideline Before Producing Computer Animation?

None of the surveyed architectural practices have any guideline or references (particularly film-making or any other motion-based representation understanding) before starting to produce their animation.
Most building sequences were manipulated based on the designer's point of view and often agreed with the client.

1.6.2 Does the Computer Animation Have Any Storyboard?

This survey shows that only three out of thirteen firms consider storyboard in the making of architectural animation. In fact, only one firm (i.e. Kaleidoscopics) really put forward storyboard as their key preliminary indication to the client before starting to develop the animation. HLM Architects seldom sketch more than a few key shots just for the internal production references and as a mechanism to ensure they include those shots in the computer sequence.

Two of these firms found that the paper-based storyboard creates several difficulties in a sense that the sketched key shots do not appear the same as the computer animated sequence. Apart from higher time spending (i.e. one to three days to complete), many clients do not understand and cannot visualise these sketches in relation to the animation product (as happened with Kaleidoscopics' clients). This firm has the intention to diversify their original form of storyboard into a 'pilot' or 'preliminary' animation and develop straight on the computer.

Instead of using paper-based sketches, Building Design Partnership (BDP) create a 'pilot' animation on most of their design projects. This animation is developed at ten frames per second and presented on quarter size screen resolution. Only in a few occasions, some key shots are printed out (crude rendering) together with the animation to discuss with the client before further animation work can be carried out. Fifteen snap shots of the Waverley Railway Station animation sequence are shown in Figures 1 to 14.
Figure 1: Key shot 1

Figure 2: Key shot 2
Figure 3 : Key shot 3

Figure 4 : Key shot 4

Figure 5 : Key shot 5
Figure 6: Key shot 6

Figure 7: Key shot 7

Figure 8: Key shot 8
Figure 9: Key shot 9

Figure 10: Key shot 10

Figure 11: Key shot 11
Figure 12: Key shot 12

Figure 13: Key shot 13

Figure 14: Key shot 14
At some point, the architects will suggest the client to stop and thus fix the animation sequence. After finalising the preliminary animation there will be no further changes and come to an agreement before the architects prepare to develop the final product.

This preliminary animation helps Building Design Partnership’s (BDP) clients to understand the process and initial product that they will get.

1.6.3 Is There Any Agreement of Fee and Content on the Basis of Storyboard?

Generally, none of the firms make or depend totally on the storyboard for the fee agreement. Most of the practices suggest their client pay for the animation on a fixed fee basis. Fraser Brown Partnership and Keppie Design recently consider a lump sum charge since the animation nowadays requires an intensive labour and high production cost. On the other hand, Page and Park might consider time scale charges for a client that requires animation. Only one firm includes animation as a free service for design representation. Charging methods for animation in this survey are shown in Bar Chart 11 and Pie Chart 10.

Bar Chart 11: Is there any agreement of fee and content on the basis of storyboard?
1.6.4 The Architect's Opinion of Having a Key Guideline for Computer Animation

In this survey, the vast majority of the architects agree that there is a need to have a key guideline for computer animation in the field of architecture. In fact, five architects say that this guideline is crucial to ensure that architects as the director understand what is involved in the process of making a good animation (refer to Bar Chart 12 and Pie Chart 11).
Bar Chart 12: What is your opinion in having a key guideline before producing computer animation?

Pie Chart 11: What is your opinion in having a key guideline before producing computer animation?

As Palmer (1998) explains, “we do not want to make a fly-through with sixty miles per hour of speed, instead we need to bring the viewer’s eye into custom, so that they will understand easier.” He also recommends that architects should be aware of what is happening on television and movie or other motion-based representation. Certain cinematic understanding such as a correct
sequence tempo (e.g. twenty five frames per second) should be understood carefully.

Two firms feel that the key guideline is only required to fulfil a specific presentation criteria such as corporate video, film and television-based presentation. According to Duffy (1998), “most architects do not have any idea of what differences and problems arise when transferring the computer sequence onto tape. Red colour resolution obviously does not turn out well in this analogue medium.”

Some of the architects set out a few key considerations in order to ensure the animated sequence is maintained to the approximate human experience of the building. For example, Page and Park Architects avoids unusual camera angles and movements (fly-through) instead maintaining a low angle shot especially at eye level. In a few cases, the clients specifically require the architects to establish the point-of-view shot taken through a window. For Building Design Partnership (BDP), the architects do not want their clients to think that they were looking at the ‘real’ product images or ‘Disney-kind’ movies through the animated sequence. On the other hand, the architects try to make sure their clients understand and can visualise the representation of a computer-generated building ‘model’.

However, two architects have different opinion for not having animation guideline. Fraser Brown Partnership believes that imagination is the key to produce a good animation due to the fact that architects have already been trained in the visual art and understand better three-dimensional space and time. With this knowledge, Brown feels that architects can put the sequence together and a proper training will polish the animation as an extra task for the architects to consider.

On the other hand, Cooper Cromar Associates believes that it is not important mainly because most architects only concentrate to model and animate a simple building. All editing and film-making process can be developed by post-production experts.
1.6.5 Does Film-making Understanding Benefit Architectural Animation?

All of the architects that agree on having a key guideline believe that film-making understanding is crucial due to the fact the cinematic principles can be found in film-making. In fact, nine out of eleven firms have similar opinion on this matter as shown in Bar Chart 13 and Pie Chart 12. According to Palmer (1998) from Keppie Design, “there is a certain background for the architects to know and understand the viewer’s perception particularly the ‘eye contact’.”

However, many architects feel that in-depth knowledge should be avoided simply because the effort and time spent in real architectural practice is minimal and obviously does not relate architectural animation. What is best for the architects are basically to understand and apply those key principles.

In this survey, a few architects believe that relying just on architectural knowledge is not enough to ensure a good animation. As Kelman (1998) explains, “there are a lot of skills in film-making that architects don’t have. What’s really happen in the practice is that most animation development is in the process of try and error to get the best shot.” Therefore, having the film-making principles will ensure a good result as the architects refer to the people who are expert in the motion-based illusion.
Bar Chart 13: Why film-making or other related knowledge is important to produce a good animation?

Pie Chart 12: Why film-making or other related knowledge is important to produce a good animation?
1.7  PRODUCTION

Animation production is basically the stage where the virtual shooting starts. Architects will prepare by means of modelling and manipulating building to form the sequence.

Therefore, this section finds out the process involved by looking at the number of animators involved and their background knowledge of computer animation. Considering the technical aspect, it also reports the number of workstation, type of hardware and software used in the production. Most importantly, the idea is to critically observe to what extent they and other staff utilise computer animation particularly the application of the packages and the representation detail.

1.7.1  Who Does the Computer Animation?

In this survey, computer animation is basically produced by architects (eighteen persons) and architectural technicians (fifteen persons). Most firms allocate at least two to three animators and combine both architects and technicians to create animation (Bar Charts 14 and 15 and Pie Charts 13 and 14). Four firms establish only one animator and three have more than four animators.
Bar Chart 14: Who does the computer animation?

Pie Chart 13: Who does the computer animation?
Bar Chart 15: How many person are involved in the production of the computer animation?

Pie Chart 14: How many person are involved in the production of the computer animation?

Most of the animators developed the computer skills from architectural school and as a personal interest. None of the architects and technicians have any video, film-making or motion-based skills (see Bar Chart 16 and Pie Chart 15). Only few architects have experienced in animations between ten to fifteen years. But most of the firms produce animation for the last seven years. In fact, Maclachlan Monaghan Architects only had three months experience.
Three firms include CAD training for the architects varying from in-house and external training centre. For example, in order to encourage and develop the animation quality, Keppie Design sponsors their staff to attend a short and long term CAD course. For the short courses, apart from free
software upgrading, the 'customer service' packages offer the architects to attend a five days intensive Microstation training. This course starts with three days of introductory application (two-dimensional drafting). After the individual has familiarised and applied the skills in real projects, the training then continues for implementation of modelling and animation. For the long term courses, some architects attend the Computer Aided Building Design (MSc CABD) course organised by Strathclyde University on a part time-basis.

Alternatively, HLM Architects develops their animator's skills by exchanging ideas from other architectural practices. The animator normally gets the information from other architects in the form of final distribution formats (e.g. video and CD-ROM) as a reference before developing the animation.

### 1.7.2 Computer Animation Packages

Architects use a wide range of computer packages to develop CAD drawings and animations. However, in this survey, almost all architects rely on the CAD software to produce their animation as shown in Bar Chart 19. Most of the rendered animation sequences are sent out in the form of cartridge to the production house to be transferred onto videotape with simple title and background sound.

Animation platforms in the practices concentrate on PC-based packages. In fact, only four firms use Mac hardware as shown in Pie Chart 16. The selection of working platform is based on the architect's preferences and familiarities on the software and hardware to develop the animation (Bar Chart 17).

For the PC-based, many architects develop two-dimensional and three-dimensional images in AutoCAD. All of the images are often manipulated and rendered in 3D Studio Max. Two of the large firms (i.e. Building Design Partnership and Keppie Design) prefer a cross-working platform due to the fact architects often get various files (e.g. 'dwg' file) from other building professional such as engineers and surveyors before
they can develop architectural animation. As Palmer (1998) explains, “in Microstation what you see in Mac will appear exactly the same as on PC screen. Most importantly it allows the architects to ‘chop and slice’ instantly 3D model to see in plan and section rather than view 3D model and 2D drawings separately like other CAD packages.”

Architects with the Mac-based working platform develop in their basic modelling by using software such as MiniCAD, ArchiCAD and Architrion. Advanced modelling, rendering (e.g. texture mapping, ray tracing and lighting) and animation (e.g. creating camera path and object movements) is developed in Strata Studio Pro, Ray Dream Designer and Artlantis. Interestingly, several architects that had PC experience found that the Mac platform was more user friendly, especially the process to develop the animation which was faster and easier.

![Pie Chart 16: Computer platform used to create the architectural animation.](image-url)
Bar Chart 17: What type of hardware and software are used to create the computer animation?
1.7.3 Number of Workstations and Other Architects Involvement in Computer Animation

Twelve firms that develop animation in-house assign only one workstation to work with (see Bar Chart 18 and Pie Chart 17). The main reason for this is that most of the powerful software and hardware (e.g. higher RAM and graphic board resolution) have a restricted licence policy and required a high cost for additional workstations.

Therefore, in order to make the production more efficient, most architects distribute their production process into a different workstation. For instance, Kaleidoscopic sets up 6 workstations as a ‘render farm’ and two for advanced modelling based on the project and the amount of detailing required.
Unfortunately, the animation skills is focused on the animators due to the fact that most of other architectural staffs have been assigned with a specific job with high design workload. In fact, the lack of computer knowledge from previous architectural school makes some of them not interested.

1.7.4 To What Extent is Architectural Animation Produced?

Most of the surveyed architects rely on in-house CAD facilities to produce architectural animation (see Bar Chart 19 and Pie Chart 18). A building model is developed based on the software availability and plug-in combination which enable architects to explore simple special effects. Some architects keep this way due the fact that recent software with reasonable price does not meet the design needs. Many CAD packages are difficult and complicated to learn.
Bar Chart 19: To what extent do you go to produce the computer animation?

Pie Chart 18: To what extent do you go to produce the computer animation?

If a special representation is required, architects normally hire a special service bureau to organise their architectural footage. In most cases, editing is just developed by putting together few moving sequences and still images with background sound and title compliment.

There are a few firms that consider to develop a better storyline by combining the animated sequences and images with voice-over and other’
real ‘on-site shooting. All of these applications depend on the design and client’s budget. In one of the high-rise proposals in Dubai, RMJM developed an extensive detail of the animation by showing the client how the building develops in stages throughout day and night time. Many sequences are enhanced with voice-over explanations organised in the form of a short documentary. According to the architects the feedback was very good as the client understood the construction process through the visual and aural representation which is often ignored in many architectural animation.

1.7.5 Computer Animation Detail

This survey shows that most architectural animation were developed by representing the external building form together with site context (see Bar Chart 20 and Pie Chart 19). Some architects include a few still elements such as car, tree and people to compare scale and proportion. Cooper Cromar Associates uses existing buildings context developed by ABACUS (University of Strathclyde) to compose in the Glasgow City Centre design proposals. But, many animations have a very minimal visual reference and sometimes none to identify the overall size of the building and space even in a photo-realistic rendering.

Bar Chart 20: How detail would you go in producing the computer animation?
Pie Chart 19: How detail would you go in producing the computer animation?

Many architects start with a reasonable rendering by means of mass modelling using the basic colour, lighting effect and minimal texture mapping in their animation (see Colour Plate 1). Animations which were developed in the advance design stage particularly on large projects, are normally established with a high quality rendering and special effect representation. Important space (e.g. interior) is completed with photo-realistic rendering such as ray tracing to get the reflection effect.
In fact, Geoffrey Reid Associates only concentrates on the high end rendering and advanced visual features of three-dimensional still images to save time and computer memory. Alternatively, RMJM created a ‘monochrome’ animation when designing the Prado Museum in Madrid. The architects tried to relate the proposal with the old historical site context in the form of a black and white representation. In fact, according to the architects even the slide presentation sequence follows this monochrome idea to explain the designer’s intention and convince the client.

An example of lighting arrangement and facade design developed by Building Design Partnership (BDP) before rendering the animation sequences is shown in Figure 15.
1.8 POST-PRODUCTION

Increasing demand from clients have changed architects’ awareness of the need to improve their design presentation. This has led to an increasing use of both interactive and non-interactive recording art. However, when it comes to final distribution, many architectural representations lose the viewer’s interest and understanding.

One of the main reasons for this problem is a lack of knowledge of post-production. Design material or information is not being prepared with reference to post-production, instead, many architects simply create a few beautiful moving or still images.

Post-production is the stage where all the sequences are put together to form a well-told story. Thus, with a clear understanding of the storyline designers can then start to prepare a series or selection of better footage.

Therefore, in order to get the best improvement in architectural animation and awareness of the importance of post-production, this section

Figure 15: Lighting arrangements by Building Design Partnership (BDP).
reports the architect’s application on post-production particularly editing the animated sequences. At the same time, it identifies where this process is developed, the cost and final distribution format.

1.8.1 Do the Architects Edit Their Computer Animation?

In general, most of the animations developed in architectural practice were not edited by the architects as shown in Bar Chart 21 and Pie Chart 20. Only two firms edit the architectural sequences. This is due to the fact that a lot of them depends only on CAD hardware and software availability in their firm which obviously do not provide any editing facilities.

Even some of the architects interpret post-production as transferring the computer images onto video tape or other format with few titles and a background sound. Cooper Cromar Associates feels that editing process is not meant for architects to develop instead the post-production expert should handle it.

Bar Chart 21: Do you edit your computer animation or just produce walk-through and show it to the client?
Pie Chart 20: Do you edit your computer animation or just produce walk-through and show it to the client?

In contrast with many architects, computer animation in the field of architecture should be developed by architects particularly the production and editing. Only for certain circumstances such professional presenter or voice-over and 'real' shooting, it would be easier if it is developed by the post-production professional mainly because the process requires a high skill expert and special equipment.

Building Design Partnership (BDP) has had a bad experience when sending out few of their architectural information to be developed by the production house. Important building areas and clips that are supposed to be addressed were edited out and obscured with other less important objects and wrong camera trajectory. As a result, the architects cannot convince the clients through the computer sequence mainly because of too many contradictory ideas involved. As Kelman (1998) explains, “the architects obviously will understand the building better, therefore they should be the director and editor to ensure the clients get the best result out of it.”

Before sending out for final editing and distribution in the service bureau, the firm (BDP) will ensure that all of the necessary images are produced and selected by the architects.
In a more advanced animation process, RMJM and Kaleidoscopic establish a post-production division to make sure that all of their architectural sequence are selected and edited by the architects before producing the final distribution for the clients. For example, MacKenzies from Kaleidoscopic use Premiere software specifically for non-linear editing purposes. Clients can view their edited sequences before transferring onto any format.

1.8.2 In-House Computer Animation Development

This survey shows that only two firms send out all of their animations to the production house to be developed from scratch. Eleven of the practices depend on the service bureau to edit their animated sequence on which three of them basically use the production house facilities to transfer computer images onto video only without editing (refer to Bar Chart 22 and Pie Chart 21).

The main reason for this is to reduce the overall cost since many clients are not willing to pay extra for the service provided by the architects. Eight firms agree that developing animation in-house quickens the production as all information is at hand. Any changes and re-modelling can be dealt instantly without having to give a longer development period.
Bar Chart 22: Who usually deals with the post-production part of the computer animation?

Pie Chart 21: Who usually deals with the post-production part of the computer animation?

In fact, three of the firms believe that in-house production allows a better design development as it encourages the staff to get involved and develop their animation skill. Design therefore can become more integrated with the recent technology. As Duffy (1998) from Vernon Monaghan Architects says, “any firm that doesn’t integrate animation or other modelling representation in their design falls behind.”
Reasons for many architects choosing to develop animation in-house is summarised in Bar Chart 23 and Pie Chart 22.

Bar Chart 23: Why do you prefer in-house production?

In general, the production stage dominates the overall motion-based development period. In fact, architects only spend one to three days for editing. Most animation is completed within one to four weeks. Early stage animation developments (i.e. inception and feasibility) usually needs less
than a week as building representation is created in the form of simple or mass modelling. As Kelman (1998) explains, “the clients can’t expect them to put a lot of information especially material selection because the designers themselves are still in the process of developing design ideas.”

However, the architects usually require more than four weeks when the animation is involved with voice-over explanation, real shooting comparison, special effect (e.g. 'fog' effect) and high end photo-realistic rendering. In fact, some firms spend up to two months to produce a few minutes of a computer-based documentary.

Bar Chart 24 and Pie Chart 23 explains the time spend in the surveyed architectural practices.

Bar Chart 24: How long do you spend to complete the computer animation?
1.8.3 Production House Service

There are several important reasons why most architects prefer to send their animation (particularly editing) to a production house or service bureau for them to develop (see Bar Chart 25 and Pie Chart 24).

Generally, many firms are not fully equipped with the high end production or post-production facilities or have enough expertise. Apart from longer time to spend in this motion-based representation, three practices say that the setting up especially for post-production is expensive.

Kaleidoscopics will hire for one hour a recording studio to record the voice-over to include in their animation. They feel that this method is more economical and easier since the present service is still cheap (e.g. £75 per hour to hire the recording studio) and the architects depend on the sound experts.

One of RMJM educational building projects, is developed and funded by Strathclyde University (ABACUS) to create an interactive presentation of a lecture theatre. The viewers can explore any of the designated view to see and compare the sightlines.
Initially, all of the interviewed architects were satisfied with the product developed by the service bureau. This is due to the fact that most of the animation sequence last for less than three minutes. As Cooper (1998) from The Parr Partnership explains, “there is nothing much the editor can do
However, the architect’s main concern is to ensure that the animation is in their control. All shots should be prepared and suggested by the architects before sending to the production house either to edit or to form a high quality rendering images.

In most occasions, architects need to reduce and re-model the animated objects because the file is too large for the production house to develop. Therefore, the firms that depend totally on the production house service need to plan ahead in the building planner so that the animators can spend enough time to develop the animation without requiring any extra charges for overtime and immediate production.

Concerning consultation, architects normally meet one or two times with the service bureau during the development process (refer to Bar Chart 26 and Pie Chart 25). Three firms allocate three to five meetings. Keppie Design meet up to six times with the production house on a few of their large project animations just to ensure that all of the important sequences are highlighted. Only one firm let the animators develop their animation.
Compared to in-house production, time spent by the service bureau to complete the animation is less since the work to be done is just rendering and simple editing. In fact, three out of eleven firms were required by the production house to develop their large animation projects between four to six weeks particularly when the sequences include interactive presentation and special effects. See Bar Chart 27 and Pie Chart 26.
Bar Chart 27: How long do they spend to complete the computer animation?

Pie Chart 26: How long do they spend to complete the computer animation?

1.8.4 Computer Animation Cost

A complete computer-based architectural animation presented on video is between £1000 to £2000 per minute. However, the cost can be more than £2000 per minute particularly when the reel includes real shooting.
sequences, 'chroma-keying' (blue screen) effects, surface reflections and high end texture mapping.

However, all of the service that cost less than £1000, is for a special purpose only. For example, Vernon Monaghan Architects spend £450 for editing whereas Kaleidoscopics pay £300 in the recording studio to get voice over service.

A general cost range of animation service paid by the architects to the production house is explained in Bar Chart 28 and Pie Chart 27.

![Computer animation cost per minute](attachment:image.png)

Bar Chart 28 : What is the computer animation cost range?
11.1%

Computer animation cost per minute

Pie Chart 27: What is the computer animation cost range?

1.8.5 Final Distribution

On average three to five animations were produced by four medium size firms, one large and small firm. Three practices developed between seven to ten animations. However, three firms have developed up to twenty five animations for the last three years which represents two large (i.e. RMJM and Building Design Partnership) and one small (i.e. Kaleidoscopics) practices.

Most animations were presented to the clients in the form of on screen and video presentations. Seven practices prefer an interactive format particularly CD-ROM and Quicktime Virtual Reality (QTVR). The overall cost is cheaper than video since the animated sequence normally requires a minimal resolution (half screen quality). For a large audience, some of them present this information via computer projection.

However in order to get a more flexible movement through building interactively, a few firms suggest the clients to explore using interactive technology. For example, in one of The Miller Partnership’s football stadium designs, the viewers can use a joystick to experience the building and as well as taking a penalty shot virtually. On the other hand, Kaleidoscopics forms a
Digital Video Interactive (DVI) to get a better resolution quality to visualise the proposal building interactively. See Bar Chart 29 and Pie Chart 28.

The feedback that the architects received from their clients on the animated sequence presentation in general was good. Apart from holding the viewers attention with this ’eye catching’ technology, most animation reveals the three-dimensional effect and allows better design communication.
as viewers are familiar with the motion-based representation (television and movies).

However, a few problems that occur mostly dominate on the crude building rendering as shown in Bar Chart 30 and Pie Chart 29. For instance, Vernon Monaghan Architects client’s having difficulties on some of the building planes which was too bright due to the architects avoid ray tracing to get the reflection effect.

For Kaleidoscopic, two of their clients misunderstood the final result of what they will get due to the fact that the clients do not understand the sketch storyboard. Building Design Partnership (BDP) stopped sending any animation to the service bureau specifically for production since the architects do not get the best result with important shots being obscured by wrong camera trajectory and unimportant elements.

Bar Chart 30: Do the client or the viewers have any difficulties in understanding the computer animation?
Pie Chart 29: Do the client or the viewers have any difficulties in understanding the computer animation?

1.9 SUMMARY

In general, computer animations were developed by architects at different stages particularly in the briefing and sketch plan stages for building representation, design communication and visualisation. It is specifically selected in the early design stage (simple modelling) to ensure that all design problems and potentials can be justified earlier (especially with clients who are not familiar with drawing). However, animations that were developed in the sketch plan and later stages allow a positive feedback and decision from the viewers (client) as the animation input deals with a quite extensive detail.

Most of the animations were created based on the architect’s point of view without any storyboard (or film-making basis) due to the fact that they only last for few minutes (i.e. less than three minutes). However, the vast majority of the architects agree that there is a need to have a key guideline (particularly film-making principle) for future architectural animation as an aid to get a good storyline and to aid keeping within time and budget constraints.
Practices that developed animation with a proper storyboard find difficulty during the production as the sketches were not similar to the production shot (or cannot achieve) and sometimes confuse the clients with the animation result. However, a preliminary or 'pilot' animation helps several firms to get the most appropriate sequence idea and prepare the fee agreement before the animation is finally produced.

In the survey, one reason why animation application in the field of architecture is minimal is that most architects developed their skill as a personal interest (often from architectural education) although there is evidence of CAD training and exchanging idea through firms. However, the range of CAD applications for architectural purposes are increasing and developing along with the new technology.

Almost all architects prefer in-house production to ensure the subject is well-presented (within architect's control). The motion-based product vastly depends on the CAD packages and facilities (often do not support editing) available at each firm. Many architects create animation with a reasonable rendering showing the general exterior and context in the form of on-screen and video presentation. Scale references (e.g. human, trees and car) were often added later as a computer still. Photo-realistic rendering is applied on the later design stage as more design information and decisions were developed.

Post-production exists in the form of simple editing on a large and special project (for public presentation or when required by the clients) as a 'stand alone' animation. However, the result were even better when architects develop the sequence as a short documentary with high quality rendering, narration and special effects to give a good understanding and design feedback.

Above all, many architects agree that animation should be used as an aid to get a better design (viewers were presented with the medium that there are familiar which can reveal the three-dimensional effect). However, in order to get the best of it, they suggest animation should be focused as a speciality or separate business.
chapter 2

filming architecture
2.1 INTRODUCTION

In general, a motion-based representation has the ability to encourage viewers to appreciate buildings or design information in many different ways. For architects, this representation should be a platform which can lead towards a better understanding of the design, marketing strategy and decision making process.

A film can create perspectives, scales, depths and detail as if the viewers are looking, walking or passing through the sequences. In fact, the sequences can include representation, which would be expensive, difficult or impossible in the real world. Architects, therefore, need to appreciate the full potential of the film medium before starting to manipulate design into motion-based representations.

A blank screen will only present depth if the image field is utilised carefully. Otherwise, a background, middleground and foreground will remain two-dimensional, not a space that is represented as a three-dimensional illusion. The subject must be presented in a different level of colour contrast, light and shadow and film planes. The film camera should be placed in a certain position to get the best result of the subject, so that building will not look flat on the screen. As Rattenbury (1995) summarises, “all film-makers, can if they choose, make you look at buildings and spaces for so long that you begin to understand them in a different way.”

Films also have the capability to explain the subjects better when manipulating them with a clear movement. A building itself is a static subject, therefore, shooting buildings without any movement will lose the viewer’s attention. This is due to the fact that our normal experience of buildings coincides with movement such as walking and looking through the spaces. Human vision can be more easily drawn to an object through motion rather than without it.

There are several choices that architects can integrate and explore with regard to movement in filming building sequences. One of the choices is by establishing a moving element in a space such as people walking, doors and
windows opening. Another choice would be creating a sequence by moving the camera towards, away or passing through the subjects as if the viewers were experiencing the space in approximation to reality. With these movements, the building space is visualised with perspectives, scale and proportion as well as focusing attention.

Many of the freedoms in motion-based representation have been abused and taken for granted in most architectural computer animation. Because of their inexperience in manipulating motion sequences, many architects simply produce animations based on a few different shots. The potential of depth illusion is not utilised carefully with background, middleground and foreground in the image field. Architects often present cinematic movements as a vertiginous fly-through.

Architects, therefore, need to learn how film makers utilise the film potential to form a good storyline. They need to develop their motion-based representation using the appropriate film techniques which suit architectural animation.

However, although there is a lot of evidence of public awareness on the built environment, films on architecture are still very rare on our television today. Finding a good architectural film to study for references and understanding the key elements to guide the architects in the motion-based representation is relatively difficult. Chapter 2, therefore, selects a number of architectural-based films, particularly documentaries and makes an empirical analysis of how architectural-related information (particularly building) is filmed professionally.

### 2.2 FILM REVIEW

Four films related to architectural information are reviewed in detail and shown in Table 3. These films were specifically selected as they have several key elements and techniques of film design which may suggest ways to improve computer-based architectural animation. The analysis covers the
general idea and content, film-making techniques, and any special features of each film.

For the analysis of the prize winning documentary (Montreal and Mexico City award), *The Architecture of Frank Lloyd Wright*, the author interviewed the director, Murray Grigor. The director views on filming architectural information and the motion-based representation development in the field of architecture are reported here (see Appendix 2 for further reference).

<table>
<thead>
<tr>
<th>No</th>
<th>Production</th>
<th>Title</th>
<th>Duration</th>
<th>Year</th>
</tr>
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<tbody>
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<td>2</td>
<td>Gamsau / Video 13 INA.</td>
<td><em>Les Envois de Marseille</em></td>
<td>13 1991</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>National Gallery of Art, Washington USA.</td>
<td><em>Masters of Illusion</em></td>
<td>30 1991</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>University of Strathclyde, Glasgow UK.</td>
<td><em>The Edinburgh Old Town Model</em></td>
<td>11 1992</td>
<td></td>
</tr>
</tbody>
</table>

Key: * Analysis and interview with the director.

Table 3: List of computer-based architectural animation video analysis.
2.2.1 Film Review 1

<table>
<thead>
<tr>
<th>Title</th>
<th>THE ARCHITECTURE OF FRANK LLOYD WRIGHT</th>
</tr>
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<tbody>
<tr>
<td>Directed by</td>
<td>Murray Grigor.</td>
</tr>
<tr>
<td>Duration</td>
<td>1 hour 15 minutes (film).</td>
</tr>
<tr>
<td>Project &amp; Year</td>
<td>Documentary 1983.</td>
</tr>
</tbody>
</table>

2.2.1.1 General Overview

- The film is introduced by a clear title The Architecture of Frank Lloyd Wright.
- The sequence starts by showing Wright's biography particularly how he developed his design knowledge before becoming one of the great architects. This includes his experience in post-war American architecture and observation of the Japanese Shrine and other buildings in the Columbian Exposition 1893.

2.2.1.2 Message and Content

- The film explains most of Wright's design masterpieces throughout his life.
- It also reveals the architect's idea on the individual design by relating the key building features with nature in close-up shot.

2.2.1.3 Cinematography

- The director often relates the architect's design by imposing a few long shots and close ups with the nature and the surrounding. In some circumstances, a 'pulling focus' effect is established on some detail to explain the key features in the design.
- Almost all of Wright's buildings were established with two-dimensional and three-dimensional still drawings (original) before being imposed at the same viewpoint.
- A few walk-throughs particularly the in-depth movement follow the diagonal and curve camera path through column, arch, window and door to reveal three-dimensionality.
- The director always pauses frame before changing into a different camera viewpoint and establishes a fade before change into a new sequence segment.
- He also establishes many slow transitions (dissolve effects) to relate Wright's ideas with nature.
- The location of the individual building is established in the form of several lengthy shots (e.g. aerial view, long shot and full shot). Moreover, in order to make this sequence more interesting and to draw attention, objects in the foreground are normally used as a natural second frame to establish depth illusion or objects (car moving and people walking) are allowed to enter or pass by the fixed frame trajectory.
- Most of the building facades are established from an angle shot to reveal the three-dimensional form.
- Several of Wright's famous buildings were explained in different environments by means of comparing the sequence with seasons or daytime and night time effect.
- The director chooses a low angle shot to accentuate the identity of the building (high-rise) or location (hillside).
- All of the aerial view shots are followed by a ground level cut.
- The idea to establish a point-of-view shot gives a clear link between individual space particularly by linking with a colour contrast sequence or element.
- The construction shots of Guggenheim Museum are captured through a circular window to enhance the key form (circular) of the design.
<table>
<thead>
<tr>
<th>No</th>
<th>Sequence</th>
<th>FT</th>
<th>WT</th>
<th>FCS</th>
<th>WT &amp; FCS</th>
<th>Fixed Frame</th>
<th>VCM</th>
<th>HCM</th>
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<tr>
<td>1</td>
<td>Introduction</td>
<td>1</td>
<td>1</td>
<td>3 tilts 7 zooms</td>
<td>1 tilt</td>
<td>7</td>
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<td>5</td>
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<td>2</td>
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<td>1</td>
<td>1 pan 3 tilts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FLW House &amp; Studio Oak Park</td>
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<td>2</td>
<td>2 zooms</td>
<td>4</td>
<td></td>
<td>3</td>
<td></td>
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<td>Larkin Administration Building</td>
<td>1</td>
<td>2</td>
<td>2 tilts 2 rolls 1 zoom</td>
<td>4</td>
<td>6</td>
<td></td>
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<td>5</td>
<td>Unity Temple</td>
<td>1</td>
<td>2</td>
<td>2 pans 4 tilts</td>
<td></td>
<td></td>
<td>3</td>
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<tr>
<td>6</td>
<td>Heurtley House</td>
<td>1</td>
<td>2</td>
<td>1 pan 2 tilts 2 zooms</td>
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<td>2</td>
<td>1</td>
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<td>Bradley House</td>
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<td>1</td>
<td>1 tilt</td>
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<td>8</td>
<td>Ward Willits House</td>
<td>1</td>
<td>1</td>
<td>1 pan</td>
<td>1</td>
<td>4</td>
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<tr>
<td>9</td>
<td>Dana House</td>
<td>2</td>
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<td>1 pan 1 tilt</td>
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<td>1</td>
<td>1 pan 1 tilt 1 zoom 2 pfc</td>
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<td>12</td>
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<td>1 pan</td>
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<td>1</td>
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<td>Midway Gardens</td>
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<td>1 tilt</td>
<td></td>
<td></td>
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<td>15</td>
<td>Japan Imperial Hotel</td>
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<td>66</td>
<td>14</td>
<td>11</td>
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**KEY**
- FLW : Frank Lloyd Wright
- FT : Fly-through
- WT : Walk-through
- FCS : Fixed Camera Station
- VCM : Vertical Camera Movements
- HCM : Horizontal Camera Movements
- pfc : Pulling Focus

Table 4: Sequence choices in *The Architecture of Frank Lloyd Wright* documentary (segment 1 to 17).
<table>
<thead>
<tr>
<th>No</th>
<th>Sequence</th>
<th>FT</th>
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<th>FCS</th>
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<td>Taliesin Fellowship Complex</td>
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KEY  FLW : Frank Lloyd Wright, FT : Fly-through, WT : Walk-through,  
FCS : Fixed Camera Station, VCM : Vertical Camera Movements,  
HCM : Horizontal Camera Movements, pfc : Pulling Focus.

Table 5 : Sequence choices in The Architecture of Frank Lloyd Wright documentary  
(segment 18 to 33).
Table 6: The total sequence choices in *The Architecture of Frank Lloyd Wright* documentary.

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Table 7: Shot choices in *The Architecture of Frank Lloyd Wright* documentary (segment 1 to 17).
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**KEY**  

Table 8: Shot choices in *The Architecture of Frank Lloyd Wright* documentary (segment 18 to 33).

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**KEY**  

Table 9: The total shot choices in *The Architecture of Frank Lloyd Wright* documentary.
2.2.1.4 Lighting

- Most of sequences were established to show how natural lighting reveals the interior spaces through window, door and roof. Several interesting effects are shown in Falling Water (moving coloured shadow on cantilever balcony) and Ennis House (the orange light and shadow were thrown on Wright’s patterned blocks).
- In Tonken House, the director establishes a sequence from daytime to night time environment showing the effect between natural and artificial lighting arrangements lit through the concrete block.

2.2.1.5 Sound

- A voice-over or narration is used in all of the segments to explain individual sequence.
- Several sequences were enhanced with sound effects such as car moving, people walking and other activities on individual buildings. In fact, in Wright's own house in Oak Park, the director includes a sound effect of children playing in the playroom.
- In Jacob’s and Tonken’s house, interviews were carried out to explain Wright's ideas to design their home and how it effects the users’ utilisation of certain space.

2.2.1.6 Special Effects

- There is no special effect by means of computer application. However, in Tonken House, the effect of daytime to night time was established by increasing the sequence speed (frame per second) to enhance the transformation effect.
- Glass matte photographs were developed to explain the great fire that ruined most of the buildings in Chicago.
2.2.1.7 Detailing

- Almost all of the individual buildings were revealed through a detailing sequence in close-up shots. In fact, many of the full shot and medium shot sequences allow the viewers to understand Wright’s idea of how building detailing is integrated in an individual masterpiece.

2.2.1.8 Conclusion

- The director concludes the film in a similar way to the introduction as the camera captures the aerial view shot of Frank Lloyd Wright's Foundation in Taliesin.

2.2.1.9 Advantages

- The idea to develop the sequence in chronological order of Wright's buildings become even better as the director establishes certain elements of that period (particularly the car).
- Compared to others, this is the only architectural film that includes several different environmental effects such as establishing shots in winter, summer, autumn and spring or daytime and night time.
- Most sequences in close up and full shot (particularly showing the building facade) were established without using wide-angle lens and taken from an angle that reveals the real three-dimensional space. These 'natural view' reveal detailing in extensive detail to draw the viewer's attention.
- The director often relates natural elements (i.e. inspired by the architect to integrate and maintain in his design) by establishing the site in point-of-view shot and close up.
- In Falling Water and Ennis House, several effects of the natural lighting were captured to explain the quality of each space.
2.2.1.10 Disadvantages

- The viewers might have difficulty in identifying the interviewed persons as none of them were mentioned either by voice-over or initial title.

2.2.2 Film Review 2

| Title: LES ENVOIS DE MARSEILLE |
| Directed by: Gilbert Racina. |
| Duration: 13 minutes (PAL). |

2.2.2.1 General Overview

- The film starts with a camera movement approaching Marseille Port from sea (as the Greek's traders travelled by boat) on several different angles in long shots.
- The sequence is then imposed with the title - Les Envois de Marseille.

2.2.2.2 Message and Content

- The film recreates the ruined port of Marseille through a combination of real and computer visualisation. This includes the history (still images) of how the Greek traders developed Marseille tracing the Greek architecture, tradition and life style.

2.2.2.3 Cinematography

- Most of the sequences were established in a fixed frame shot particularly by 'chroma-keying' the computer sequence with real images or vice
versa. For example, a point-of-view shot taken from a lower angle of the vineyard establishes the location of the public building (i.e. on the hill).

- The director develops several still shots by superimposing two different images to establish a relationship (i.e. the function or experience of individual space such as the market place and internal courtyard).
- A long and full shot of computer images were often 'chroma-keyed' with the real foreground object (e.g. tree branches) to illustrate depth.
- A walk-through sequence from a lower to horizontal angle shot enhances the grandeur of the public building (temple). In fact, as the camera pauses in front of the opening door, the viewer's attention is held to see the surrounding (the square and other Iona temples) in long shot.
- A few object movements were established in the form of door and window opening such as establishing a view overlooking the sea (imposed in real images) from a Chapel.

<table>
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KEY FT : Fly-through, WT : Walk-through, FCS : Fixed Camera Station.

Table 10 : Sequence choices in Les Envois de Marseille documentary.

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</table>

KEY LS : Long Shot, FS : Full Shot, MS : Medium Shot, CU : Close up.

Table 11 : Shot choices in Les Envois de Marseille documentary.
2.2.2.4 Lighting

• All of the sequences (real and computer images) were arranged with a general lighting effect (daytime).

2.2.2.5 Sound

• Narration is in French.
• A sound effect of trading activities enhanced the computer walk-through sequence in the market place.

2.2.2.6 Special Effects

• A lot of 'chroma-key' of computer and real images (in still) were included in the whole sequence particularly to show the approximate building representation on the actual site and the trading activities.
• Several computer sequences were imposed together with the real shooting to highlight the function of individual space. For instance, the pool in the internal courtyard (computer images) is combined with water sequence to explain the function of the space (collect the rain water).

2.2.2.7 Detailing

• 23% of the total sequences were captured in close up shots which mostly explain the building detailing. In fact, many full shots have a quite extensive detail of the material and features of Greek architecture.
2.2.2.8 Conclusion

- The film ends with similar sequence to the introduction as the camera frames the view of the port facing the way to Greece.

2.2.2.9 Advantages

- The idea to 'chroma-key' several computer sequences onto real images or vice versa gives a good visual impact to understand the location especially with point-on-view and long shot at lower angle. With a real object such as trees in the foreground, the overall composition becomes better due to the presence of depth illusion.
- The slow dissolve transition between the real shooting and computer image (close up shot) on the market place with the sound effect (i.e. trading activities) holds the viewer's attention as it reveals the trading experience.
- The way to establish most of the sequences (particularly the computer images) in a fixed frame shot with different viewpoints allow the viewers to visualise the detailing better.

2.2.2.10 Disadvantages

- None of the computer or the 'chroma-key' sequences have any human figure reference to identify the scale of the building.
2.2.3 Film Review 3

<table>
<thead>
<tr>
<th>Title</th>
<th>MASTERS OF ILLUSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed by</td>
<td>Rick Harper.</td>
</tr>
<tr>
<td>Duration</td>
<td>30 minutes (PAL).</td>
</tr>
<tr>
<td>Project &amp; Year</td>
<td>Documentary 1991.</td>
</tr>
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2.2.3.1 General Overview

- The film is introduced by a clear well presented title Masters of Illusion.
- It continues with a set of models and special effects created in the studio as in a ‘Star Wars’ film scenario.
- This is followed by several key explanations of the artistic and scientific discoveries made by the Renaissance masters.

2.2.3.2 Message and Content

- As Burke (1991) explains, “This is a film about how to see, what we see, or what we think we see.”
- It also illustrates a general understanding of the special effects and ideas based on the Renaissance masters by structuring the storyline in the form of visual communication development through drawing, fresco, sculpture, building, perspective and wood veneer.
- To explain and reveal the Renaissance’s still masterpieces through a motion-based illusion.

2.2.3.3 Cinematography

- The idea of the story begins by looking at the world globe (specifically the European continent - Italy) with the camera zooming in until the clip is imposed onto the city of Florence at a quite high level. Then, the camera
pans slowly from left to right for the viewer to see the city at a glance before cutting into a Cathedral Santa Maria del Fiore sequence at the lower level.

- Each master is introduced by their own figure (either in three-dimensional, two-dimensional drawing or sculpture) in close up shot.
- Most of the artistic and scientific discoveries by the masters are explained and compared using 'glow' effect sequences to give the viewer a clear understanding.
- A lot of the masterpieces are visualised through various zooming in close-up and medium shots. For large drawings, the directors establishes a tilt or pan to capture the whole still.
- In order to explain the location of the painting, the viewer explores continuously from external to internal spaces until they recede to the actual location at the eye level point of view.
- The anamorphic art is established by moving the camera at the correct angle to reveal the drawings.
- The depth of the Renaissance still masterpieces (e.g. inlaid wood veneer in one of the palaces in the city of Urbino) are revealed as the director zooms out before pausing the sequence with foreground object.
- The narrator’s figure is used as a direct comparison of light and shade in film making.

<table>
<thead>
<tr>
<th>No</th>
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<th>WT</th>
<th>FCS</th>
<th>WT &amp; FCS</th>
<th>Fixed Frame</th>
<th>FCS Combination</th>
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</table>

**KEY**  
FT : Fly-through, WT : Walk-through, FCS : Fixed Camera Station.

Table 12: Sequence choices in *Masters of Illusion* documentary.
<table>
<thead>
<tr>
<th>No</th>
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<th>MS</th>
<th>CMS</th>
<th>CU</th>
<th>BCU</th>
<th>Combination</th>
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<td>50</td>
<td>24</td>
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<td>126</td>
</tr>
</tbody>
</table>

KEY  
LS : Long Shot, FS : Full Shot, MS : Medium Shot, CMS : Close Medium Shot, 
CU : Close up, BCU : Big Close Up.

Table 13 : Shot choices in Masters of Illusion documentary.

2.2.3.4 Lighting

- Several lighting effect methods are used to explain the key elements in painting and how they can be applied to film making.
- The effect of natural and artificial lighting are displayed clearly at a different angle.

2.2.3.5 Sound

- Several pieces of background music are composed together with the clips, in correct timing.
- In fact, actual sounds (i.e. activities) are used in certain space sequence to create realism.
- Most of the important sequences are well described by the presenter - James Burke (including voice over).

2.2.3.6 Special Effects

- A 'glow line' effect is applied to illustrate perspectives and paintings.
- In several paintings and titles, a 'glittering' effect is used. However, a 'rippling' effect is applied to transform one of Uccello's drawings.
- The presenter's image is twisted when mentioning that many earlier painting have a flat look.
2.2.3.7 Detailing

- Almost all of the masterpieces and their innovations are explained in great detail. This is achieved either by comparing or imposing the close-up shots or a transformation from a basic form directly to an actual drawing.

2.2.3.8 Conclusion

- Towards the conclusion, the film focused on the High Renaissance period as the director zooms out Raphael's fresco called the School of Athens to capture all the masters' images in long shot.
- The story ends up using the same title sequence as was introduced at the beginning - The National Gallery of Art.

2.2.3.9 Advantages

- The set of models as in 'Star Wars' film gives a good impact to grab the viewer's attention in the introduction sequence.
- The 'glow line' effect used to illustrate perspective composition in most paintings help the viewers to understand the development and innovation in still illusion from Early to High Renaissance.
- A good attempt to explain the idea of light and shadow using the basic forms before showing a few sample of the masterpieces.
- The importance of camera placement, lighting, special effect and film making techniques are defined clearly with few still and animated sequences.
- Each of the important clips is described using consistent close-up shots with a slow camera movement.
- A good attempt to reveal the two-dimensional masterpieces into three-dimensional sequences by establishing different camera placements.
- The combination of narration, background and sound effect establishes the atmosphere of the space illusion through painting.
2.2.3.10 Disadvantages

- This type of film usually requires special film making equipment and expertise, which might lead to high production costs.

2.2.4 Film Review 4

<table>
<thead>
<tr>
<th>Title</th>
<th>THE EDINBURGH OLD TOWN MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directed by</td>
<td>ABACUS and AV Media Services,</td>
</tr>
<tr>
<td></td>
<td>University of Strathclyde, UK.</td>
</tr>
<tr>
<td>Duration</td>
<td>11 minutes (PAL).</td>
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2.2.4.1 General Overview

- A clear title is displayed as The Edinburgh Old Town Model.
- It starts with an overview of the actual Old Town in computer generated images from general to detail, with several interviews.

2.2.4.2 Message and Content

- The animation justifies the function of the Old Town Renewal Trust by preserving the Old Town in collaboration with ABACUS, Department of Architecture and Building Science, University of Strathclyde.
- It also explains to the viewers how computer images can be useful in helping the public and trustee to understand and visualise the impact of any design proposal in the conservation area.
- Several chosen sites (i.e. Hunter Square and the extension to the Museum of Scotland) are focused on particularly in planning process.
2.2.4.3 Cinematography

- The film starts with a pan from right to left at a high angle shot. This is followed by a dissolve transition of a fly-through computer sequence at the same angle as the camera moves in sideways from left to right.
- The proposed design facade is imposed onto computer images with the same angle to allow a better visualisation.
- A few real sequences are captured from a close-up view (i.e. focusing the street name) as the camera zooms out and tilt down to frame the actual site in long shot at the eye level shot.
- Most of the computer sequences are established in the form of in-depth and reverse fly-through sequence.
- A few clips are visualised at eye level shots.

<table>
<thead>
<tr>
<th>No</th>
<th>Sequence</th>
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<th>WT</th>
<th>FCS</th>
<th>WT &amp; FCS</th>
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</table>

KEY  FT : Fly-through, WT : Walk-through, FCS : Fixed Camera Station.

Table 14 : Sequence choices in Edinburgh Old Town Model documentary.

<table>
<thead>
<tr>
<th>No</th>
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<th>CMS</th>
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</table>


Table 15 : Shot choices in Edinburgh Old Town Model documentary.
2.2.4.4 Lighting

- General lighting is used in the whole computer modelling.

2.2.4.5 Sound

- Background music with good timing complements this animation.
- Most of the important sequences are explained by the Edinburgh Trustee and animators especially the importance of the computer simulation in visualising the old town.

2.2.4.6 Special Effects

- Several real clips were imposed on a specific site with the computer images to see the impact before the building is built.

2.2.4.7 Detailing

- Only a general overview of the city is displayed with a minimum amount of detail.

2.2.4.8 Conclusion

- The film ends with a fly-through of the city until it reaches one of the highest sites looking at Edinburgh Castle captured in a shot.

2.2.4.9 Advantages

- A good visual impact analysis for the proposal before it is built at the actual site.
- There is always a transition between the existing site to the computer model using the same point of view and movement.
• The narration and interviews make this film more interesting and easy to understand.
• The use of multimedia presentation (real video clips) helps to convey the character of the city more clearly.

2.2.4.10 Disadvantages

• The introduction of the real sequence (camera pans from left to right) distracts the viewer’s attention as the director cut into a sideways movement from right to left (computer sequence).
• The colour scheme of the whole urban area is not the same as in reality due to the fact that there is not any texture mapping applied.
• There are no clear titles or street names of any images.
• Almost all of the computer images is a fly-through sequence instead of walk-through as the city is supposed to be experienced. Moreover, the motion is sometimes too fast for the viewers to be able to recognise the character of the city.

2.3 RESULTS OF FILM REVIEW

The results of these documentaries review were extracted from a critical observation of each film and the interview carried out with one film director. The author has selected a similar heading to the computer animation analysis to ensure a direct comparison can be derived before developing key recommendations at the end of the thesis.

2.4 GENERAL OVERVIEW

As in other documentary films, the directors often grab the viewer’s attention in the very beginning of the sequence as two of the selected films illustrate. All films were presented with a clear title and narration (presenter or voice-over).
However, the most prominent example to hold the viewer's attention in the introduction sequence is shown in Masters of Illusion. The director, Harper, establishes a sequence transformation from a sketch perspective (with a 'glow' effect highlight) into a set of miniature model in the studio as was developed in a 'Star Wars' film scenario. The viewer's attention is grabbed as the starship enters the frame with a complete lighting and sound effects (high pitch) arrangement. On the other hand, the Edinburgh Old Town Model film draws the viewer's attention by dissolving the real images of the city into a few computer generated fly-through sequences (aerial view and high angle shot).

In contrast, Racina and Grigor introduce their films with a slow pace sequence before developing the idea consistently. In Les Envois de Marseille, the director captures a few different long shots by moving the camera towards the port (recreating the effect of travelling by boat) as if to show how the Greeks first came to Marseille. Alternatively, in The Architecture of Frank Lloyd Wright, a long shot of the Prairie is established (fading the title line into the horizon) to show the place where the architect started his life before becoming a genius of architecture. This includes an aerial view shot of Wright’s Foundation in Taliesin and several original clips of his experience in the post-war American architecture as well as observations on the Japanese Shrine and other buildings in the Columbian Exposition of 1893.

### 2.5 MESSAGE AND CONTENT

Architectural information is often filmed and developed in the form of documentary as the medium itself allows the information to be conveyed clearly.

Unlike the Mies Van de Rohe and Philip Johnson building (i.e. particularly the glass building), Wright believes that his architecture cannot be photographed and explained as one single image due to the symmetrical design. Photographs can only capture part of the building. As Grigor (1998) explains, “in Wright’s design, photographs could never be captured to really
understand his idea. Therefore, through filming I can reveal the approximate visit to the real building as you can move closer to the space and show the turn to reveal the idea of progression in space. " Thus, The Architecture of Frank Lloyd Wright brings the viewers to experience Wright's design masterpieces throughout his life in chronological order.

In Les Envois de Marseille, the director represents the ruined port in Marseille with a combination of real and computer visualisation as the main storyline. A lot of the 'predicted' buildings (computer sequences) were imposed on the real site using 'chroma-key' technique (i.e. blue screen) especially to explain how the Greek traders developed the city near to the port of Marseille following Greek architecture, tradition and lifestyle.

On the other hand, the Edinburgh Old Town Model film was developed for public awareness of any building proposal in this conservation area before it is built. The director establishes several computer sequences (animation) for the viewers to visualise the design impact on the overall site.

Harper films several fine art collections in the National Gallery of Art, Washington. This reveals the key understanding of illusion based on the Renaissance masters by structuring the storyline in the form of visual communication development through drawing, perspective, fresco, sculpture, building, perspective and wood veneer.

2.6 CINEMATOGRAPHY

Sequence preparation requires the architects first to understand camerawork since it determines the result of motion-based productions. Otherwise, buildings will look flat rather than three-dimensional or will be visualised as a passive and empty space. Thus, critical camerawork should always provide keener visual interest by careful control of the camera distance, angle and the use of lenses. Although in general the idea to
establish a sequence in an architectural-based film is a personal choice, there are a few key elements in cinematography that should be critically justified.

Most clients often ask the architect a more straightforward question such as the number and size of bathrooms, kitchen units, living rooms and garages instead of asking about the type of the house. According to Grigor (1998), “what makes the great house is actually the way you experience inside and outside the house which most people don’t do it. So, I incorporate this important ‘psychological space’, journeys, in most of my architectural film.”

He also believes that cinematography and other cinematic elements should be compromised (highlighted or ignored) when filming architectural information due to the fact the viewers often come from different backgrounds (e.g. public and professional) particularly when the production is made for mainstream television such as the British Broadcasting Corporation (BBC) and Channel 4. Most viewers prefer the sequence to move along whereas architects often appreciate a slower movement, particularly when seeing detailing and drawing. Otherwise, the television producer might criticise or even worse, they just would not accept the film for presentation or sponsorship.

### 2.6.1 Sequence Choices

This film review shows that most directors prefer to establish a fixed frame sequence or allow the camera to move on a fixed station by means of pan, tilt, roll and zoom as shown in Bar Chart 31. Almost all of the motion camera sequence is established with a clear pause, particularly before changing to a different viewpoint.
Bar Chart 31: Directors' selection of sequences when filming architectural-based documentary.

Sequence choices in architectural-based documentary
2.6.1.1 Establishing Sequence in a Fixed Frame Shot

Apart from establishing a moving element entering or passing by the still frame, several effective techniques were observed which draw the viewer’s attention.

In *Les Envois de Marseille*, the director imposes two different images between the computer image and the real sequence to establish the relationship (e.g. the function of the internal courtyard or experience of the market place). Several computer images of the Greek temples and other important buildings were 'chroma-keyed' on the real site in long shot. In fact, a point-of-view shot taken from a lower angle of the vineyard allows the viewers to establish the location of the public building (i.e. on the hill).

On the other hand, Grigor shows the fixed frame shot in a few interesting ways. Building facades are often established from close up shots to see Wright’s exploration of detail design. In *Falling Water*, the director captures the stonework facade with the reflection of water and moving colour shadows on the cantilevered balcony, whereas the *Guggenheim Museum* construction stages sequence is established through a circular window on a dark foreground to enhance the key form (circular) of the design. In the *Tonken House* film, the director increases the sequence speed (frames per second) for the viewers to visualise the changing effect on the coffered blocks from daytime to night time.

In *Masters of Illusion*, the viewer’s attention is held by suggesting a few ideas of special effects in a fixed frame shot. When comparing Brunelleschi’s discoveries on linear perspective to earlier painting, Harper establishes a 'glow' effect on the painting composition. But in Uccello’s drawing he transforms a sequence from a ‘rippling’ effect into a three-dimensional wire-frame model. Some of the anamorphic arts were established by moving the drawings at the correct angle to reveal the illusion.

However, although in Bar Chart 31, the *Edinburgh Old Town Model* shows the highest application of fixed frame sequence, most of them were interview sequences (the trustee and animator) and real shots on the site. In fact, only one computer model was imposed onto the site drawing the
viewer’s attention due to the fact that the impact of the new proposal can be visualised clearly in a fixed frame shot.

2.6.1.2 Establishing Sequence in a Fixed Camera Station

This analysis shows that pan dominates the directors’ choice when moving their film camera on a fixed station particularly when establishing the site context horizontally. For example, in Masters of Illusion the director pans the camera from left to right to frame the city of Florence before cutting to a horizontal shot of Cathedral Santa Maria del Fiore. Grigor reveals the ‘coffered’ blockwork by Wright in the Tonken House sequence with several slow tempo pans in full shot and close ups.

However, without a careful camera movement, the fixed camera station can hinder the smooth flow of the storyline. For instance, in the introduction sequence of the Edinburgh Old Town Model, the viewer’s attention is distracted when the sequence cuts to a different panning direction.

Tilt is another common technique used to capture vertical features. Some interesting trajectories were shown in Wright’s film particularly to enhance the height and volume of the main atrium in the Guggenheim Museum and Johnson Wax Building sequences. In fact, by tilting the camera up from a very low angle shot near the water stream, the director captured both the location and the natural integration of Falling Water in one sequence. However, tilt is not used in Les Envois de Marseille film.

In this film review, roll is not a common choice to establish architectural information as only 4% is applied in The Architecture of Frank Lloyd Wright sequence. In most cases, Grigor rolls the camera from a higher point (balcony) looking down at the lower level space such as when establishing the skylight and working space in the Larkin Administration Building sequence.

Apart from pan and tilt, few dramatic effects such as zoom were developed in these documentary films. Harper reveals many of the Renaissance masterpieces using this technique. For example, the depth
illusion of the most prominent wood veneer in the palace of Urbino is revealed as the camera zooms out in a slow tempo from medium to full shot before pausing the sequence with clear foreground objects.

Zoom is also applied occasionally in Wright’s film as an alternative to cutting from one shot to another. In the introduction shot, the camera zooms in on the fireplace in close shot before cutting to a few still sequences of building ruins caused by war. He also establishes a ‘focus pull’ from the background to foreground object when relating the window’s solution in the Robie House sequence (viewing outside with privacy).

Grigor personally tries to avoid zooms when filming architectural information particularly building because it is not a genuine movement since it pulls the object closer in terms of perspective: what he called a ‘knee jerk’ which often causes a perspective distortion. As he experienced once in a Mackintosh film documentary, some viewers found the reading space far too small compared to their perception in the film sequence when they visited the real Mackintosh School of Art library. As Grigor (1998) explains, “I thought that this might be a good illusion compromise, but in reality, it spoils the sequence and misleads the viewer’s perception.”

Bar Chart 32 summarizes the directors choice when fixing the camera station to film architectural-based documentary.
2.6.1.2 Establishing Sequence by Camera Movement

This review shows that most film directors get their motion camera to follow a curved path and in-depth tracking movements by means of walk-through and fly-through sequences.

A few effective tracking techniques were shown in the Masters of Illusion sequence. For example, Harper moves the camera following a curved
path to reveal the location of the extraordinary wall painting work by Masaccio (The Trinity) in a slow tempo passing the foreground objects.

In-depth movements can be seen clearly in many of the computer images in *Les Envois de Marseille*. In one particular sequence, a walk-through from a lower to horizontal angle shot enhances the grandeur of the main entrance city wall that enclosed the public buildings. As the camera pauses in front of the opening door, the viewers were shown the Iona temple in long shot.

Apart from suggesting a diagonal movement when filming building interiors, Grigor prefers a lateral movement to frame the subject vertically and horizontally. In Wright's blockwork era, a lot of vertical camera movements were established by cutting the hollyhock flower to Wright's abstract motif in close up and by looking at the concrete parapets, colonnades, planters and furniture design. In fact, he establishes nine different angles and shots by increasing the height of the camera particularly when showing the building form and the volume of the atrium court in the Larkin Administration Building. In Wright's own house and studio, the camera is moved sideways to capture the two predominant features - the wood shingles and high roof gable in full shot.

Unlike these films, *Edinburgh Old Town Model* focuses camera movements in most of the computer model as a continuous fly-through sequence.

### 2.6.2 Shot Choices

A good choice of shot often comes from critical camerawork before being developed into a sequence. By positioning the camera correctly, viewers can get the illusion of either being far from, or close to the subjects in the shot. Although, in general, camera manipulation often focuses on the distance and angle of the camera, there are a few important features that were observed in this architectural-based film documentary review.
Two of the most prominent shots used to explain architectural information are full and close up shot as they make up more than 12% of the overall shots.

In these documentary films, many director cut the long shot to full shot to get a slightly bigger subject. In many cases, it provides the viewers with enough film space to establish the building context. In The Architecture of Frank Lloyd Wright film, the shot composition does not just explain the place and material, but also creates an era by establishing a car of each period (e.g. 1906 with horse buggies, 1936 car in Johnson Wax building and 1953 Cadillac in Tonken House). As Grigor (1998) explains, “these are the things (enigma) that tie together to reveal the identity of the architect towards his building.”

The film directors also enhance the subject with a close up shot to enable the viewers to see it in great detail: on average 24% of close up shots were used like this. In fact, Harper establishes most of the Renaissance’s masterpieces in slow speed close up with a few suggestions of camera movements such as Michelangelo’s paintings on the ceiling of the Sistine Chapel. On the other hand, Grigor selects a few important building details taken from different angles to establish the identity of each of Wright’s house designs (e.g. Dana house - butterfly lamp).

In Les Envois de Marseille, the close up shot is best shown when the directors intercut (slow dissolve) the walk-through sequence of the market place with traders’ activities (fruit and linen trading) and establishing the Greek columns. In contrast, Edinburgh Old Town Model utilises close up as real life shooting on a few architectural features (e.g. signage and sandstone ornament) and interview sequences (sometimes in close medium shot).

Most medium shot is developed as a link sequence to create a consistent change in visual representation. However, when the director establishes a longer zooming (e.g. from close up to full shot), these sequences becomes a combination shot as often seen in Masters of Illusion.
The shot choices in these documentary films is shown in Bar Chart 33.

Bar Chart 33: Directors’ selection of shots when filming architectural-based documentary.
2.7 LIGHTING

According to Metzstein (1998), “it’s really like you’ve been to all of Frank Lloyd Wright houses after seeing Grigor’s film. Each of his houses is revealed with different architectural experience particularly to film building in different season and time (day and night) which is important but very rare in architectural films.”

In fact, none of the reviewed documentary films particularly considers different lighting environments as many sequences accept a general lighting (i.e. natural or artificial) to illuminate the space, form, facade, detailing and material. A dark backdrop was established to enhance the colour contrast between the old town computer model and the sky. In many cases, both the Edinburgh Old Town Model and Les Envois de Marseille sequences simply present daytime lighting.

However, there are several effective lighting arrangements captured by the film directors to show their impact on individual building objects. In Tonken House, Grigor allows a few minutes of transition sequence from daytime (natural) to night time (artificial - interior lighting) to reveal the pattern of coffered concrete block. Apart from filming Falling Water in spring and winter, a natural light and shadow was captured especially on the cantilevered balcony in various full and close up shots during the colourful autumn.

In Masters of Illusion, lighting is used to explain the key elements in painting and how directors utilise it in film-making. In one particular sequence Harper uses the narrator’s figure as a direct comparison of light and shade before presenting a more intricate lighting arrangement in the Renaissance masterpieces.
2.8 SOUND

The use of sound in the analysed documentary films is well-developed compared to many ‘stand alone’ architectural-based computer animation. The director includes a composed background sound with good timing to synchronise between visual and aural representation. Important sequences were enhanced with narration (voice-over or presenter) and a few sound effects either recorded directly when filming or added later in post-production.

With narration, viewers understanding of the subject or sequence is easier. As Grigor (1998) explains, “because we live in a very journalistic world, some information may be added and has to be brought out so that viewers, particularly lay people, can understand easily, as they would expect from the television experience (e.g. important sequence is enhance with narration).” In Space and Light (1972), the director films Saint Peter's College, Cardross as it is. Most sequences were developed to feel the actual acoustic and daily activities in the seminary such as the echo of the footsteps when walking and climbing the staircase, lectures and food preparation. In fact, there is no narration except minimal background sound.

Sound can be interesting as well as helping the viewers to understand an individual sequence. In Masters of Illusion, the presenter’s image is twisted when comparing to the earlier painting (flat look). On the other hand, the owner of Tonken House explains Wright’s solution of how to support the flat roof using concrete blocks. All important sequences in Edinburgh Old Town Model and Les Envois de Marseille were explained through voice-over.

Another effective way to draw the viewers attention is shown in Les Envois de Marseille as the director enhances the market place sequence with sound effects of trading activities. For Grigor, a sound effect of a moving car and people walking inside or passing by the building justifies the scale and time of each of Wright’s house. Moreover, in his Mackintosh film, as the camera passes the dark entrance of the Hill House in Helensburgh, the sound of two ticking clocks creates a different feeling of the space.
2.9 SPECIAL EFFECTS

In the reviewed documentary films, most directors use computer sequences for special effects. In *Edinburgh Old Town Model* some animations are used to show the overview of the city and the visual impact of the proposal in the conservation area. Harper introduces a 'glittering' title effect before illustrating several scientific and artistic discoveries by the Renaissance masters, such as developing a 'glow' line in perspectives and 'rippling' effect when transforming Uccello's drawing. As a more advanced special effect, Racina films some real sequences on blue screen before superimposing them with the computer still using a 'chroma-key' technique.

In *The Architecture of Frank Lloyd Wright*, a few layers of glass matte photographs were composed to depict the great fire that ruined most of the buildings in Chicago by moving the camera sideways in close up. The film also combines the overall sequences with several original shots taken by Wright during his lifetime such as in the introduction shot (site visit), Larkin (low angle shot) and Johnson Wax Administration Buildings (test column sequence).

2.10 CONCLUSION SEQUENCE

This film analysis shows that only one documentary (*Edinburgh Old Town Model*) ends the film sequence by selecting a particular site or space. However, most directors conclude the story in a similar way to the introduction sequence.

Grigor establishes an aerial view shot of Wright's last building project which was his own foundation in Taliesin. In *Masters of Illusion*, the same title effect is used after the camera zooms out of Raphael's finest fresco (i.e. the School of Athens) to capture all of the Renaissance master images in long shot. Racina ends *Les Envois de Marseille* by framing the view of the port.
facing towards Greece since the Greeks were the first who came to trade, build the new city and live in Marseille.

All of these documentary films were concluded with a clear narration before being superimposed or faded out with the final credits.

2.11 SUMMARY

In general, although film is expensive to produce, the documentaries that are developed in this medium show a greater quality than video particularly in the visual and sound resolution and the cinematic space used to establish the subject with minimal visual distortion or restriction. However, there are several important similarities, especially the way the subjects are developed, that are useful to improve architectural animation.

In terms of sequence preparations, most film directors concentrate on a fixed frame shot (46.2%) and allow the camera to move within a fixed station (34.7%) as shown in Bar Chart 34. Camera movements were established in a slow tempo particularly in full shot and close up (particularly in The Architecture of Frank Lloyd Wright film). In fact, the directors often use the film camera in a natural way of seeing things (i.e. eye level shot).

Fixed frame shots are not presented as still images (with object movement) but are used as an exploration sequence of detail design. The directors film building facades and other architectural objects from several interesting angles to reveal the three-dimensional form and the effect of the subject on the building (e.g. wall texture, water reflection and moving shadows in Falling Water). Certain elements are explained using a special effects transformation (e.g. 'glow ' effect, in Masters of Illusion ) and ' real ' or still clips superimposition (' chroma-key ' sequence in Les Envois de Marseille ) in order to give a clear understanding of the subjects. In fact, in The Architecture of Frank Lloyd Wright film, Grigor establishes several important objects (car and people, complete with the costumes) to relate individual building period.
When establishing a subject on a large area (especially long shot and full shot), many directors tilt (31.8%) and pan (22.1%) the film camera to capture the subject within the site context and space volume as shown in Bar Chart 35. Roll and zoom (including 'focus pull') were used occasionally as a cutting alternative or to direct viewers attention between shots except in *Masters of Illusion* (76%, Bar Chart 32). The director zooms in most of the Renaissance’s masterpieces to see the subject (e.g. drawings, frescos, sculptures and wood veneers) in extensive detail as some of them are established in big close up shots. Apart from this, some important objects were also explored by tracking the camera in sideways and passing through spaces (usually in diagonal and curved path) in consistent tempo, thus, aiding the visual indication.
Bar Chart 35 : The overall choices of camera movement in a Fixed Camera Station in architectural-based documentary film.

Individual building sequence is often introduced with a full shot (i.e. 28.9%, enough to explain the building context) before cut into medium shot and a lot of close ups (23.8%). However, building on a large area or a large scale development are often established with long shots and aerial view shots (see Bar Chart 36).

A link between one space to another is achieved through a point-of-view shot such as shooting from a balcony and the highest point of the site. For this reason, in order to ensure the viewers get a consistent motion-based experience, this shot is often included with an obvious visual reference e.g. detailing, moving objects, colour and texture). Two directors structured the storyline in a chronological order (linear) with a careful selection of objects to establish the approximate context (e.g. car of each period in *The Architecture of Frank Lloyd Wright*, as described in Shot Choices section of this chapter).
All of the documentary sequences were edited. Apart from cutting into different type of shots, several transition sequences (such as fade and dissolve) are used to give a consistent representation. Most of the important subjects are enhanced with a composed background sound and narration (either by voice-over or a presenter) in a good timing. Some directors use natural sound effects to draw viewers attention to the subject (e.g. sound effect of trading activities in *Les Envois de Marseille*). Each film is narrated with a clear conclusion which usually ends the story in a similar way to the introduction sequence.
chapter 3

architectural animation
3.1 INTRODUCTION

Until now, architects have always changed from one medium to another when creating architectural animation. Designers who are involved partly or totally with computers may consider their animation as a high quality production, but the reality is that many do not achieve the desired result. The animation has no identity or character and their objective or message is indistinct.

A few minutes of architectural animation walk-through means a lot to architects, engineers, clients and viewers. Even removing or adding a line, or a variation in colour, texture and lighting can effect the participants understanding before making any decision. In order to keep the production within budget, architects try to cramp this set of elements without any storyline. As a result, viewers often receive misleading information or miss the vital element.

Nowadays, visualisation, particularly animation, has been accepted as another speciality in the field of architecture. Thus, in order to ensure this business is a success, there is a need to pay special attention to the basic strategy and aspect of communication through visual and audio representation. This is mainly because both representations often fail to convince the participants.

Thus, to critically see the representation problem and potential including the character and identity, Chapter 3 will report an empirical analysis of past and present computer-based architectural animations presented in video format. The selection of material is based on the critical study and understanding of motion-based representation particularly film-making.

In order to support the whole analysis, twenty five people including architectural students, professionals and laymen previewed several video samples. This investigation produced a general questionnaire which focuses on their interpretation and understanding of each animation (refer to Appendix 3).
The following key headings cover the fundamental areas which were included in the analysis:

- General Overview.
- Message and Content.
- Cinematography.
- Lighting.
- Sound.
- Special Effects.
- Detailing.
- Conclusion.
- Advantages.
- Disadvantages.

These analysis and survey results will be used to guide architects awareness and outline the key elements before creating any architectural animation and filming building.

### 3.2 VIDEO ANALYSIS

A list of the computer-based architectural animation videos which were analysed is shown in Table 16. Fourteen videos related to architectural animation were selected for evaluation at the beginning of the research. Most of these are produced by architectural practices or production houses mainly for communicating between clients or other disciplines, getting projects, competitions and building environment information. Explanations are shown individually.
<table>
<thead>
<tr>
<th>No</th>
<th>Production</th>
<th>Title</th>
<th>Duration</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 1</td>
<td>CGCG Taiwan</td>
<td>Chen Lung Tien</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>* 2</td>
<td>Howard Associates USA</td>
<td>Super House 1</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Archimage, Houston USA</td>
<td>Commercial Furniture Services Incorporation (CFSI)</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Archimage, Houston USA</td>
<td>University of St. Thomas</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ex Machina (Ex M) France</td>
<td>Campus 92</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>Osaka University Sasada Lab Japan</td>
<td>Banju Port Renaissance Plan</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>7</td>
<td>Osaka University Sasada Lab Japan</td>
<td>Kansai International Airport (First Proposal)</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>8</td>
<td>Osaka University Sasada Lab Japan</td>
<td>Kansai International Airport (Final Proposal)</td>
<td>2</td>
<td>39</td>
</tr>
<tr>
<td>9</td>
<td>Osaka University Sasada Lab Japan</td>
<td>Shanghai Railway Station</td>
<td>5</td>
<td>42</td>
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<tr>
<td>10</td>
<td>Osaka University Sasada Lab Japan</td>
<td>Urban Hangzhou</td>
<td>6</td>
<td>47</td>
</tr>
<tr>
<td>11</td>
<td>The William Paterson College, New Jersey USA</td>
<td>Ichthyopolis</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>12</td>
<td>The William Paterson College, New Jersey USA</td>
<td>Sketches of Rome</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Thorp Modelmakers Limited, London, UK</td>
<td>234 Fulham Road: A New Development of Luxury Homes and Apartments</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Key: * Analysis with questionnaire.

Table 16: List of computer-based architectural animation video analysis.
3.2.1 Analysis 1

<table>
<thead>
<tr>
<th>Title</th>
<th>CHEN LUNG TIEN</th>
</tr>
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<tbody>
<tr>
<td>By</td>
<td>CG Computer Graphic (CGCG) Taiwan.</td>
</tr>
<tr>
<td>Duration</td>
<td>3 minutes 15 seconds (NTSC).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1993.</td>
</tr>
</tbody>
</table>

3.2.1.1 General Overview

- There is a clear title shown in this project - Chen Lung Tien (Buddhist Temple).
- The site is surrounded by a green area.
- The animation path brings the viewer to experience the general external overview of the building by a cutting few different clips approaching to the temple in high and horizontal angle shot before the camera reaches the top view of the temple.

3.2.1.2 Message and Content

- A place for worship (i.e. a statue of Buddha).
- There is a good access to the temple (e.g. the circulation internally and externally and car parks).
- The design of the temple is mainly influenced by Chinese architecture and is shown in great detail (e.g. column and bracket).
- The grandeur of the building is shown by comparing it with human scale ('real' clips) and building proportion in lower angle shots.

3.2.1.3 Cinematography

- The viewer starts to enter the building looking at the lower angle shots and in a walk-through a series of ornamental columns. The low angle shot enhances the grandeur of the temple.
• In a pause position the director establishes a full shot symmetrically focusing at the main ritual area together with the appearance of the 'daibutsus' (i.e. large representation of Buddha) in the form of special effect (i.e. 'particle' effect) and high pitch sound. Following a slow tracking, the camera moves away to get the long shot for the viewers to see the whole ritual space (main hall). This is continued with several different angle shots and sideways movement to show the 'sacred' space.

• In order to experience the massiveness of the daibutsus, the camera starts to encompass them in full shot and close up establishes at low angle shot.

• The camera moves down from the upper level balcony to eye level shot helps to explain the high volume internal space. Then, it moves from left to right from the back of the daibutsus following a curve path.

• The director concludes the sequence by establishing a fast moving camera and transition between internal and external space together with a high pitch sound.

3.2.1.4 Lighting

• The external sequence is established by general lighting effect.

• The special lighting effect is focused on the daibutsus and other architectural features (e.g. columns and brackets). Dim lights are applied in internal spaces such as the main hall and upper level balcony.

3.2.1.5 Sound

• A high pitch sound is used to hold viewers attention on a specific feature particularly the statue of Buddha is revealed.

• On the other hand, the director applies a few different composed background sounds to relate the function of the external and internal space.
3.2.1.6  Special Effects

- Generally, a ’fog’ lighting effect is created in the internal spaces.
- The director highlights the statue of Buddha and the ’dragon-shape’ bracket by imposing them with a stream of light and ’particle’ effect.
- Several virtual people are imposed into the main ritual hall (e.g. walking and praying) to establish the scale, proportion and activities in the internal environment.
- The end sequence is edited and transformed to the project logo using a ’rippling’ effect.

3.2.1.7  Detailing

- The detailings (i.e. form, material and component) are shown to give a general idea of the massiveness of the building and architecture.
- The structural component such as columns and brackets are demonstrated in extensive detail by adding ’ray tracing’ (reflections), light and shadow.
- The initial colour scheme in the space itself is quite dark and dim to create a contrast between the important features and the ritual space.

3.2.1.8  Conclusion

- Towards the end, the camera moves progressively away from the main building following the starting path in reverse order.
- Then, the clips are transformed to the project logo.

3.2.1.9  Advantages

- A general context of the building is shown.
- The form, material, structure, texture, colour and space are explained in great details.
- The ’fog’ effect gives almost a true perspective effect.
• The idea to 'chroma-key' the 'real' peoples in the main hall sequence leads this particular computer animation to look real and different from the others particularly when comparing scale and proportion.

• The use of special effects such as the 'particle' effect (bracket and statue of Buddha) and 'rippling' effect (project logo) draw viewers' attention.

• Since the project is related to a religious or in particular, a Buddhist temple, the camera eye manages to capture the main element (i.e. daibutsus) in almost frame shots. In one particular sequence, the director establishes a deep focus looking towards the statue.

• Important sequence to draw viewers attention is enhanced with a high pitch sound. Whereas, a slow compose background sound compliments the overall mood.

3.2.1.10 Disadvantages

• This kind of animation might result in a high cost of production particularly when involving blue screen shot to 'key-in' the 'real' figure movements onto the moving digital images.

• The wide angle lens shooting taken near to the subject 'flatten' the internal perspective of the main hall looking towards the daibutsus.

• The absence of the 'initial' graphic indications (i.e. project location and area name) or voice-over makes viewers unable to understand the design location.
3.2.2 Analysis 2

<table>
<thead>
<tr>
<th>Title</th>
<th>SUPER HOUSE 1</th>
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<tbody>
<tr>
<td>By</td>
<td>Howard Associates - USA.</td>
</tr>
<tr>
<td>Duration</td>
<td>56 seconds (NTSC)</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1994</td>
</tr>
</tbody>
</table>

3.2.2.1 General Overview

- The animation starts with camera moving sideways at eye level to get the long shot of the house.
- Then, it continues to enter the building at approximately two metres high through the main entrance.

3.2.2.2 Message and Content

- It gives a general idea to the viewers of what the building exterior and interior look like. Thus, with a photo-realistic rendering, the representation helps to show the building material (e.g. timber floor and staircase and facing brick wall).
- A diagrammatic representation of building layout in two-dimensional (i.e. plan) and three-dimensional (i.e. isometric) form displaying the basic services units.

3.2.2.3 Cinematography

- The director introduces the sequence by allowing the camera moves in sideways and curve path from right to left in order to get the long shot of the house frontage.
- This sequence is then cut into a close up shot of the main entrance passing through the entrance and encircling the chandelier in a slow tempo.
• The house detailing is established by suggesting a few continuous in-depth and sideways movements internally.
• A fast dissolve on the extreme close up shot of the door knob is framed before the camera moves away from the building.
• The director ends the shot by allowing the camera enters the front doors and fades into two-dimensional and three-dimensional wire-frame diagrammatic layout of building services.

3.2.2.4 Lighting

• A night environment is established by arranging several up and down lighting at the main entrance of the building with a dark background.
• The internal spaces are lighted generally to reveal the basic form.

3.2.2.5 Sound

• Background music is used in this animation.

3.2.2.6 Special Effects

• A wire-frame diagrammatic layout includes a typical floor plan and an isometric view of the services unit.

3.2.2.7 Detailing

• The detailing of the building is shown as a high-end photo-realistic rendering particularly on the building planes (e.g. floor and wall) door and window units.
3.2.2.8 Conclusion

- The animation ends by fading out from the building services layout sequence.

3.2.2.9 Advantages

- A good attempt in explaining the building material with a high-end photo-realistic rendering together with few lighting highlights.
- A simple diagrammatic layout in two-dimensional and three-dimensional view helps to give the key information of the building services units.

3.2.2.10 Disadvantages

- There is no introduction title and credit of 'the end' to maintain the cinematic standard.
- Most of the sequences are actually a fly-through instead of a walk-through (i.e. as the normal camera eye).
- The building is located without any site context.
- The atmosphere internally and externally is rigid since there is no movement such as people, trees and cars. Therefore, the scale and proportion comparison is difficult for the viewers when visualising.
- There is no colour coding or graphic indication to explain the services unit.
3.2.3 Analysis 3

<table>
<thead>
<tr>
<th>Title</th>
<th>COMMERCIAL FURNITURE SERVICES INCORPORATION (CFSI)</th>
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<tr>
<td>By</td>
<td>Archimage, Houston USA.</td>
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<tr>
<td>Duration</td>
<td>13 seconds (NTSC).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation (Interior) 1993.</td>
</tr>
</tbody>
</table>

3.2.3.1 General Overview

- A clear title of the project is shown as - the Commercial Furniture Services Incorporation.
- The animation starts a high angle shot looking at the two-dimensional interior design layout plan.
- Then, the camera continues moving closer to the interior spaces.

3.2.3.2 Message and Content

- This animation explains how the designed furniture can suit an office.
- CFSI has got a furniture production plan.

3.2.3.3 Cinematography

- The sample of the furniture production layout is introduced by placing the camera at the higher point of view to establish three-dimensional form.
- The sequence is then cut to another viewpoint before the camera starts to move down continuously as a fly-through sequence and dissolving into the interior space walk-through.
3.2.3.4  Lighting

• The overall animated sequence is lit with a general lighting.

3.2.3.5  Sound

• Background music is used in the animation.

3.2.3.6  Special Effects

• None.

3.2.3.7  Detailing

• There is no specific detailing established in this animation except one close-up shot before the sequence end.

3.2.3.8  Conclusion

• The animation ends with a close-up shot focusing on the information paper - *CFSI Has A Plan*.

3.2.3.9  Advantages

• A general understanding of the location and furniture design are suitable, when establishing shot at high angle to get the isometric view with a two-dimensional layout plan as the base.
• The sequence pauses with close-up shots on a piece of paper - *CFSI Has A Plan* as a clear message.
3.2.3.10 Disadvantages

- The sequence during the walk-through of the internal space is quite fast. This makes it difficult for the viewer to observe the furniture and spaces in detail.

3.2.4 Analysis 4

<table>
<thead>
<tr>
<th>Title</th>
<th>UNIVERSITY OF ST. THOMAS</th>
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<tbody>
<tr>
<td>By</td>
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<tr>
<td>Duration</td>
<td>27 seconds (NTSC)</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1993.</td>
</tr>
</tbody>
</table>

3.2.4.1 General Overview

- There is a clear title shown in the project as University of St. Thomas.
- The directors introduces the sequence by allowing a few basic geometrical objects enter the still frame at eye level shot.

3.2.4.2 Message and Content

- A chapel is proposed at the University of St. Thomas.
- A conceptual representation of how a simple geometrical form can be transform into a functional building design.
- This animation explains the effect of natural lighting used in the design.

3.2.4.3 Cinematography

- The viewers attention is hold through a 'ripping' effect when transforming the title into the design animation.
• The chapel is interpreted by a series of transformations from the geometrical shape (e.g. sphere and cube) to a simple and practical functional building.
• The camera point of view is always maintained at eye level.
• In order to enhance the effect of natural lighting and space volume, the camera pans slowly (from right to left) and tilts up focusing on the stream of light, rays through the crescent and the high level window.

3.2.4.4 Lighting

• The director establishes a special lighting effect in the form of light stream entering the high level windows and the crescent as if how natural lighting help to illuminate the interior of the chapel.

3.2.4.5 Sound

• Background music is used in this animation.

3.2.4.6 Special Effects

• A 'rippling' effect is presented as a transition sequence from external to internal movement.
• The main special effects is represented as natural light ray in the interior sequence.

3.2.4.7 Detailing

• The most obvious detailing is established as the special lighting effect.
3.2.4.8 Conclusion

- This animation ends by introducing a fixed camera shot trajectory (i.e., tilt) and pause to get the low angle shot on the building facade.

3.2.4.9 Advantages

- A good attempt to establish architectural lighting using the special effects in a slow pan and tilt movement.
- The idea to relate and use the basic geometrical shape to transform into a functional facade and space. Most importantly, the introduction of objects movement (e.g., bouncing sphere) on a fixed frame hold viewers' attention.

3.2.4.10 Disadvantages

- There is no information about the site context in this animation. Therefore, it remains vague for the viewer whether the project is an extension, new or something else.
- Without establishing any human figures in the building set it is difficult for the viewers to compare the scale and building proportion.
- The absence lighting arrangement in the interior space makes the form of the interior space is vague.
3.2.5 Analysis 5

<table>
<thead>
<tr>
<th>Title</th>
<th>CAMPUS 92</th>
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<tbody>
<tr>
<td>By</td>
<td>Ex Machina - Ex M, France.</td>
</tr>
<tr>
<td>Duration</td>
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</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1992.</td>
</tr>
</tbody>
</table>

### 3.2.5.1 General Overview

- A clear title showing the project as Campus 92.
- The animation starts with an extrusion of a mass building model on the site establishing from a high angle shot.
- Then, it continues showing some of the refurbishment (i.e. demolition of the high-rise building) to a new low-rise building as the camera moves down to an eye level shot.

### 3.2.5.2 Message and Content

- This is a refurbishment and new proposal of Campus 92 project which includes several sport facilities and student residences.
- The director explains the advantages of the low-rise design proposal through camera trajectories experience on several selected area.
- Shows a Light Rail Transit (LRT) as one of the main transportation links to the campus.

### 3.2.5.3 Cinematography

- The story is experienced mostly on high angle shots based on the 'bumble bee' movements.
- The refurbishment transition is represented by using a 'strobing' technique to transform the high-rise into a low-rise building as the
camera from a high angle moves down following a curve path to a low angle shot.
• A zoom from an aerial view shot is followed by a cut when changing into a ground level shot. In a fixed frame, a canoe moves into the frame.

3.2.5.4 Lighting

• Externally, a general lighting effect is created in this animation.
• A special lighting effect is observed as a 'flashing' or light 'blink' in the LRT tunnel.

3.2.5.5 Sound

• Background music with good timing is composed to synchronise with the overall sequences.

3.2.5.6 Special Effects

• The special effect is shown as a 'strobing' sequence (i.e. extruded) that demolish and transform the old high-rise building to the new campus design.
• The bumble bee and a golf stick is 'chroma-keyed' onto the 'real' clip taken from a lower angle of a golf field.

3.2.5.7 Detailing

• There is only a minimum amount of detailing represented in the form of selected area with an extensive photo-realistic rendering.
3.2.5.8 Conclusion

- Towards the end, a sequence shows the train moving away from the tunnel before being transformed into a globe.

3.2.5.9 Advantages

- The idea to start the animation from a basic three-dimensional extruded building block; then shows a demolition of the existing high-rise building to the proposal in a consistent sequence.
- Allowing a moving objects (e.g. the bumble bee, the canoe and train) enter the fixed frame draw viewers attention.
- A 'real' clips of the golf field is edited together to explain the proposed campus facilities.

3.2.5.10 Disadvantages

- The lack of graphic indications on the site or any of the selected space makes the viewers difficult to recognise.
- In reality, the movement of people is essential to understand and create the sense of place which is seldom found in the sequence. In fact, most movements is established as a 'bumble bee' fly-through.
3.2.6 Analysis 6

<table>
<thead>
<tr>
<th>Title</th>
<th>BANJU PORT RENAISSANCE PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>By</td>
<td>Osaka University Sasada Laboratory.</td>
</tr>
<tr>
<td>Duration</td>
<td>3 minutes 21 seconds ( NTSC ).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Urban Animation 1993.</td>
</tr>
</tbody>
</table>

3.2.6.1 General Overview

- This animation is introduced by a clear title of the project - Banju Port Renaissance Plan.
- A general overview (i.e. location plan including notation) is established from bird’s eye view showing the new proposal in two-dimensional.
- As the camera rolls, the three-dimensional model of the overall site is revealed.

3.2.6.2 Message and Content

- An extension proposal of a waterfront development area surrounded by a hilly site.
- This animation explains that several recreational spaces with facilities and activities are happening during day and night (i.e. picnic area, wind surfing and resting area).
- The recreational spaces are passed through by a motor way.

3.2.6.3 Cinematography

- The sequence starts by zooming towards the site from a bird’s eye view shot in half zoom before imposing the proposal with the two-dimensional diagrammatic layout.
• A basic form of building block is visualised by several fly-throughs at a higher level focusing towards to the coast line (i.e. the camera moves sideways from right to right).
• The hilly site backdrop creates a perspective effect to show a different colour contrast between the foreground, middle ground and background.
• Several still images are presented in few different angles at eye level to show the quality of spaces in the form of medium shot, full shot and close up shot.

3.2.6.4 Lighting

• A general lighting is used in most of the internal and external sequence.
• However, one of the clips is represented with a special lighting effects indicating two different atmospheres (i.e. day and night time).

3.2.6.5 Sound

• Background music is used in this animation.

3.2.6.6 Special Effects

• A 'particle' technique is used to show the fireworks effect.
• A special lighting effect is established at the same camera angle to comparison between day and night time.

3.2.6.7 Detailing

• Detailing sequences are shown as a few selection of recreational areas.
3.2.6.8 Conclusion

- Towards the end, a camera moves in-depth passing through the pavilion and pause at the edge of the waterfront. Before ending the sequence with a sideways movement along the coastline, a fireworks display is revealed to attract viewers attention with a dark background.

3.2.6.9 Advantages

- The story begins with a two-dimensional sequence (i.e. from existing location plan to proposal). Then, the camera rolls to form a three-dimensional view with a consistent approach to the overall site.
- The master plan (i.e. two-dimensional proposal) is explained with a complete notation including site context.
- The perspective effect (i.e. depth illusion) is revealed on the hilly site backdrop along the coastline in a different colour contrast.
- Although the activities are shown in still images, a moving camera towards the beach showing the fireworks display helps to enhance one of the real activities.
- The idea to pause frame before changing camera viewpoint makes the viewers easier to maintain the visual orientation.

3.2.6.10 Disadvantages

- There is no movement of people and cars which is important to reflect the actual environment and hold viewers attention.
- Most of the moving camera are established at the higher level (the fly-through) instead of the lower level (walk-through).
3.2.7 Analysis 7

<table>
<thead>
<tr>
<th>Title</th>
<th>KANSAI INTERNATIONAL AIRPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( First Proposal )</td>
</tr>
<tr>
<td>By</td>
<td>Osaka University Sasada Laboratory.</td>
</tr>
<tr>
<td>Duration</td>
<td>6 minutes 26 seconds ( NTSC ).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1987.</td>
</tr>
</tbody>
</table>

3.2.7.1 General Overview

- A clear title showing Kansai International Airport project.
- The director establishes an aerial view shot from high angle looking down at the context and the main link between the mainland and the new airport.

3.2.7.2 Message and Content

- The main link has a double carriageway; the upper level is a motor way, whereas the lower level is a railway track.
- A new international airport is proposed away from the mainland.
- This site is surrounded by water, including the context between mainland and the new airport.

3.2.7.3 Cinematography

- The story starts by positioning the camera at high level looking at site view of the site in long shot. In a pause position, a moving car enters the frame before cut into eye level shot ( driving mode ).
- This is followed by establishing a few different camera trajectories such as sideways and in-depth movements parallel with the moving vehicle.
- The camera pauses at the main entrance in full shot as well as framing KANSAI billboard.
• As the sequence fades out, a 'real' clips presentation is displayed in the form of an in-flight environment (i.e. announcement, safety precaution and communication to the air traffic controller).
• The approaching sequence to the airport for landing is shown in a slow and consistent motion taken from high angle before cut to a sequence of the camera lowering the height and pause at the controlling tower.
• In the control tower, the directors establishes a point of view shot looking down to the runway and terminal building framed by the foreground window frame.

3.2.7.4 Lighting

• There is no special lighting effect in this animation except a general illumination to reveals the basic building form.

3.2.7.5 Sound

• Two different background music are used to differentiate between the main introduction sequence and the overall animation.
• The selection of background music creates a sense of 'welcoming' especially when the aeroplane is approaching the runway for landing.
• Several announcements are given by the cabin crew of Japanese Airline.
• A voice-over of an actual communication between the pilot and the air traffic controller.

3.2.7.6 Special Effects

• The in-flight situation is created by using a 'real' clips as a multimedia representation.
3.2.7.7 Detailing

• There are no special building detailing established except a few selection of the internal departure point and viewing areas.

3.2.7.8 Conclusion

• This animation ends with the camera moves away at high angle shot and zooms out before the camera turns 360° to get the aerial view (approximate to the introduction sequence).

3.2.7.9 Advantages

• A consistent explanation of context from two-dimensional to three-dimensional animation (i.e. the link between the mainland to the airport).
• The multimedia presentation (i.e. in-flight and air traffic controller communication) creates a more realistic airport situation.
• Establishing a moving objects in a long shot draws the viewers’ attention.
• The idea to establish the entrance sequence together with the billboard (KANSAI) gives a name of the airport.

3.2.7.10 Disadvantages

• Internal space experience is minimal.
• The animation lacks realism by its inability to portray the busy environment of the airport especially the movement of peoples.
• There is no graphic indication to explain the site.
• The speed of the train is actually slower than the car.
3.2.8 Analysis 8

<table>
<thead>
<tr>
<th>Title</th>
<th>KANSAI INTERNATIONAL AIRPORT (Final Proposal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By</td>
<td>Osaka University Sasada Laboratory.</td>
</tr>
<tr>
<td>Duration</td>
<td>2 minutes 39 seconds (NTSC).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1993.</td>
</tr>
</tbody>
</table>

3.2.8.1 General Overview

- A clear title with an introduction background music indicates the project - Kansai International Airport from the main link (i.e. the bridge).
- Viewer is introduced by a general overview of access to the airport (i.e. by car, train and coach).

3.2.8.2 Message and Content

- A new design airport surrounded by water with a main link of transportation is proposed.
- There are several possibilities of access (i.e. by car and coach using the expressway; train and nearby port).
- The animation explains horizontal and vertical access inside the terminal building particularly the circulation flow pattern during departure.
- A general overview of external and internal spaces (i.e. establishing several potential viewpoints from the upper level and the main atrium).
3.2.8.3 Cinematography

- The story begins with the arrival of a passenger and flight. The viewer is approached in a fast sequence showing the movement of the train, cars and buses.
- In order to create the internal environment of the passenger flow pattern more realistic, the camera follows the path of the train and elevator at eye level.
- A different sequence of movement is used in order to differentiate between types of transportation (i.e. plane, car and train).
- The viewer's journey is brought via an in-depth camera movement through a long atrium and tilts up. In a fixed position, the director establishes an elevator to move up and enter the frame.
- Most of the internal sequences are represented in the form of sideways and in-depth camera movements at eye level shot.

3.2.8.4 Lighting

- General lighting is used internally (i.e. natural and artificial lighting effect).
- Different environments are created, during day and night using special lighting effect.

3.2.8.5 Sound

- Few different background music are used to differentiate between the main introduction sequence and the overall animation.

3.2.8.6 Special Effects

- An 'evening sun' lighting effect is used towards the conclusion sequence as the backdrop.
3.2.8.7  Detailing

- Generally, some of the clips showing the roof structure and the curved facade looking to the runway in medium shots.

3.2.8.8  Conclusion

- The animation ends with a bird’s eye view trajectory of the overall site with a high pitch sound.

3.2.8.9  Advantages

- A general idea of the site context is shown together with several mediums of transportation to the airport.
- The internal spaces scale are established by the still human figures and other airport furniture.
- A good explanation of horizontal and vertical access for passengers departure flow pattern.
- The bird’s eye view shots help the client to get a general understanding of the airport (i.e. facilities and runway organisation).
- The idea to introduce a subject movement in a fixed frame sequence.

3.2.8.10 Disadvantages

- The internal space looks rigid because the activities (e.g. movement of people) are not shown as in reality during the walk-through.
- The link between the mainland to the island is not indicated clearly as the camera starts focusing somewhere at the middle of the bridge.
- The director establishes the introduction shot (showing the main link) with a continuous fly-through from the high angle to the horizontal angle creates a lot of sequence repetitions.
3.2.9 Analysis 9

<table>
<thead>
<tr>
<th>Title</th>
<th>SHANGHAI RAILWAY STATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Japan - China Joint Project 3)</td>
</tr>
<tr>
<td>By</td>
<td>Osaka University Sasada Laboratory.</td>
</tr>
<tr>
<td>Duration</td>
<td>5 minutes 42 seconds (NTSC)</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1990.</td>
</tr>
</tbody>
</table>

3.2.9.1 General Overview

- The project title - Shanghai Railway Station is clearly shown.
- The directors introduces the sequence with a two-dimensional diagrammatic location plan (i.e. showing the railway line) before zooms into the actual site.

3.2.9.2 Message and Content

- The animation shows the existing transportation link in the city of Shanghai with a new proposal of a railway station.
- The site itself explains it is located in an urban area.
- The proposal site is explained briefly through two-dimensional site plan graphic representation (i.e. the white circle presents the site and its surrounding and the red and blue boxes link to a major area).
- A general layout of internal and external spaces.
- One of the sequences demonstrates the passengers flow pattern from the arrival point to departure point.

3.2.9.3 Cinematography

- The sequence starts with an two-dimensional aerial view shot showing the basic design layout before the camera zooms closer to frame the site.
• A 'glow' effect establishes the flow of passengers from an aerial view shot.
• At a pause position, the camera rolls down slowly to reveal the three-dimensional building form followed by a continuous fly-through around the site for few minutes before dissolves into eye level shot.
• The camera moves in 'driving' mode and pause at one point looking up to the frontage and billboard of the entrance.
• The directors establishes a continuous walk-through inside the terminal building from the arrival to departure point.

3.2.9.4 Lighting

• A general lighting effect is used to illuminate the external and internal space.

3.2.9.5 Sound

• All of the sequences are mixed with background music.

3.2.9.6 Special Effects

• The diagrammatic of passengers flow in the terminal building is represented by a 'glow' effect.

3.2.9.7 Detailing

• Building detailing is basically shown with a few selection of interior sequences.
3.2.9.8 Conclusion

• This animation ends with a fixed frame sequence as the train moves away from the foreground (departure point).

3.2.9.9 Advantages

• The animation is introduced by showing a two-dimensional location plan before transformed into a three-dimensional site by rolling the camera.
• The passenger flow pattern is explained through a movement of the ‘glow’ effect diagrammatically taken from a high angle shot.
• The way the viewer approaches and experiences the internal spaces is always maintained at the eye level.

3.2.9.10 Disadvantages

• Establishing a slow tempo of the camera movement in the long shot and fly-through distracts view attention.
• The continuous camera movement from rolling down at the aerial view shot to a fly through around the terminal building creates a lot of sequence repetition.
• The background of western jazz music is not quite appropriate for this animation. Perhaps, it would be better if traditional Chinese instrumental was used.
• A movement of car and train are not enough to create the actual railway station environment. In fact, the movement of peoples is essential to portray the real activity.
3.2.10 Analysis 10

<table>
<thead>
<tr>
<th>Analysis 10</th>
</tr>
</thead>
</table>
| **Title** : URBAN HANGZHOU  
  ( Japan - China Joint Project 3 ) |
| **By** : Osaka University Sasada Laboratory. |
| **Duration** : 6 minutes. 47 seconds ( NTSC ). |
| **Project and Year** : Urban Animation 1990. |

3.2.10.1 General Overview

- A clear title showing an animation of Hangzhou urban area.
- The Hangzhou waterfront area is approached at eye level by imposing the 'real' sequence on computer animation.

3.2.10.2 Message and Content

- The animation is useful for assisting the viewer to compare the existing waterfront and urban area with the wire-frame animation.
- This animation also gives a visual impact analysis on the new high-rise building proposal in the city of Hangzhou. The directors establishes a driving mode sequence for the viewers to experience the city along the waterfront and the urban area.

3.2.10.3 Cinematography

- The animation starts by showing several 'real' sequences in long shot together with a graphic indication (i.e. the site is explained in white box).
- The director relates few animation (wire-frame model) sites with the 'real' clips at the same camera angle, eye level and movement.
• A wire-frame animation is used to represent old building blocks whereas, the complete rendering sequence is either for new or high-rise building.
• The director maintains the motion camera at eye level shots.
• Almost all buildings are explained by an aerial view fly-through to show the context.

3.2.10.4 Lighting

• General lighting is used to emphasise the building form and urban fabric on a dark background.

3.2.10.5 Sound

• A background music is used in this animation.

3.2.10.6 Special Effects

• None.

3.2.10.7 Detailing

• Building detailing are explored in medium close walk-through and fly-through focusing on the selected high-rise proposals.

3.2.10.8 Conclusion

• Towards the end, the director establishes a high angle shot looking at the city before imposing the sequence into the 'real' clips placed on the same camera trajectory.
3.2.10.9 Advantages

- Hangzhou waterfront and urban area is compared and explained by imposing between the reality (i.e. the existing site) and computer animation by following the same angle, view and movement.
- The idea to present the existing urban model in wire-frame animation and render only on the proposal building.
- This city is experienced at eye level camera viewpoint.
- Showing the overall urban fabric context in with several aerial views shots and fly-through.

3.2.10.10 Disadvantages

- The western background music is inappropriate for this animation especially to present Hangzhou city (eastern culture).
- There are no clear explanations of the site in terms of notation (i.e. the area and street name). The graphic indication (rectangular box) onto the 'real' clips is not enough to give the viewers a clear understanding.
- The wire-frame animation often confuses the viewers to visualise the city.
- The absence of object movements (e.g. cars and peoples) and street furniture loosen the real city experience. In fact, with a lot of aerial fly-through movements in a slow tempo distract the viewers attention.
3.2.11 Analysis 11

<table>
<thead>
<tr>
<th>Title</th>
<th>: ICHTHYOPOLIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>By</td>
<td>: The William Paterson College - New Jersey, USA.</td>
</tr>
<tr>
<td>Duration</td>
<td>: 2 minutes 24 seconds ( NTSC ).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>: Architectural History Animation 1994.</td>
</tr>
</tbody>
</table>

3.2.11.1 General Overview

• A clear title of the animation is shown as *Ichthyopolis*.
• The animation starts by imposing several still images at certain angles followed by a camera movement ( underwater animated sequence ).

3.2.11.2 Message and Content

• This animation explains about several original buildings which at present are an underwater ruins.

3.2.11.3 Cinematography

• Each original building sequence always starts with the transformation of two-dimensional still images to three-dimensional walk-through or vice versa.
• The camera movement is based on the diver's point of view and maintained at eye level.
• Almost all shots are established with a clear foreground, middle ground and background to explain the distance and depth.
• The director allows few moving elements ( e.g. fish, starfish and plant) to enter the fixed frame position helps to draw the viewers attention.
• Most of the underwater motion sequences are established in full shot, medium shot.
3.2.11.4 Lighting

- A dim lighting effect illuminates the overall underwater sequence.
- The original building models are established with general lighting.

3.2.11.5 Sound

- Background music is used for this animation.

3.2.11.6 Special Effects

- An underwater architecture environment is well produced. A clear attempt in creating the sea creatures in a smooth movement, light rays and shades.

3.2.11.7 Detailing

- The ruins are composed into the underwater set and rendered with a high photo-realistic rendering to form the building detailing.

3.2.11.8 Conclusion

- Following the introduction, the director ends the sequence by transforming the sea creatures into birds and allow them to enter the fixed frame shot.

3.2.11.9 Advantages

- Each building or space is represented by a transformation of the original two-dimensional drawings or building models onto an existing underwater ruin (i.e. three-dimensional animation) or vice versa at the same camera angle and distance.
The clear composition of element in cinematic plane and movement of the underwater creatures entering the fixed frame shot give a better depth illusion and hold visual attention.

A curve path with slow camera movement at horizontal and high angle point of view relates to the diver's point of view.

3.2.11 Disadvantages

There is no exact information (i.e. name and location) for each clip.

3.2.12 Analysis 12

<table>
<thead>
<tr>
<th>Title</th>
<th>SKETCHES OF ROME</th>
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</thead>
<tbody>
<tr>
<td>By</td>
<td>The William Paterson College - New Jersey, USA.</td>
</tr>
<tr>
<td>Duration</td>
<td>2 minutes (NTSC).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Architectural History Animation 1992.</td>
</tr>
</tbody>
</table>

3.2.12.1 General Overview

A clear title of the animation is displayed as *Sketches of Rome*.

The animation begins with a movement of the camera closer to the sketch book before flips through the specific two-dimensional sketches and forms a three-dimensional walk-through.

3.2.12.2 Message and Content

The film reveals the viewer experience from the two-dimensional sketches to three-dimensional walk-through illusion.
3.2.12.3 Cinematography

- Each space starts with crude two-dimensional sketches to a series of walk-throughs and ends similar sketches and point of view.
- The space depth is established with a clear light and shadow arrangement in the foreground.
- The camera point of view is always maintained at the eye level.
- The director suggests a few moving objects (e.g. birds and glittering dust) to enter the fixed frame to draw viewers attention and justify the space volume and depth.
- In sequences of the Pantheon, the camera movement and shots are established symmetrically to portray the classical influence.

3.2.12.4 Lighting

- In the courtyard, there is a clear contrast of light and shade between the open air space and the surrounding corridor.
- The special lighting effect to create the light stream through the Pantheon indicates as if how natural lighting illuminates the interior space and volume

3.2.12.5 Sound

- Background music is used for this animation.

3.2.12.6 Special Effects

- A multimedia presentation is used especially in the transformation between two-dimensional sketch drawing to three-dimensional walk-through or vice versa.
3.2.12.7 Detailing

- The detailings are established with several objects composition with a high photo-realistic rendering (e.g. colour scheme, material, columns and dome ornament).

3.2.12.8 Conclusion

- All clips are ended with crude two-dimensional sketches the same as they are introduced.

3.2.12.9 Advantages

- The idea to explain building representation from two-dimensional sketches to a three-dimensional walk-through following a 'storybook-like' sequence strengthen and make the storyline more interesting.
- The camera trajectory is maintained at eye level with a few suggestion of object movements to draw viewers attention.
- The dark foreground (covers with shadow) objects reveals the depth in each space.

3.2.12.10 Disadvantages

- Each animation segment lacks of graphic or sound information to explain the particular sketches. Therefore, it could be anywhere in Rome.
3.2.13  Analysis 13

<table>
<thead>
<tr>
<th>Title</th>
<th>: ATOM</th>
</tr>
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<tbody>
<tr>
<td>By</td>
<td>: THORP Modelmakers Limited, London, UK.</td>
</tr>
<tr>
<td>Duration</td>
<td>: 1 minute ( PAL ).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>: Design Animation 1997.</td>
</tr>
</tbody>
</table>

3.2.13.1  General Overview

- There is no title in this animation.
- The animation starts with a camera on eye level shot approaching the main entrance of the ATOM office.

3.2.13.2  Message and Content

- The animation sequences dominate the interior features as the main visualisation, although part of the clips show the front facade of the building.

3.2.13.3  Cinematography

- The sequence starts with a continuous long shot walk-through before dissolving into close up shot of the main entrance.
- As the door opens, a 'real' figure of a woman sitting in the reception desk verbally informs that 'the meeting in the conference room is upstairs'.
- Then, the camera pans slowly to the left and moves towards the stairs to the upper level for few seconds.
3.2.13.4 Lighting

- A general lighting is used to emphasise the interior and exterior detail.

3.2.13.5 Sound

- A background sound is used continuously.
- A voice-over with echo of the 'real' figure indicates the conference rooms location relates the double volume interior space.

3.2.13.6 Special Effects

- A 'real' figure (i.e. a woman) sitting at the reception desk is imposed ('chroma-key') as part of the introductory sequence.

3.2.13.7 Detailing

- The interior detail of the office is revealed by a photo-realistic rendering to indicate timber panel, glass-block, furniture layout and other office features.
- Element such as the office furniture (i.e. chairs and tables) allows the viewers to understand the scale and proportion of the space.

3.2.13.8 Conclusion

- The sequence ends with a full shot walk-through and pause at the upper level staircase.

3.2.13.9 Advantages

- All sequences are consistently edited between the shots to explain the animation with a suggestion of transition sequence (e.g. dissolve).
• There is a good attempt to use the main entrance as the natural foreground to frame the subject - the reception space.
• The suggestion of a slow tempo camera movement enables enough time for the viewers observation.
• The ' real ' figure indicates a clear explanation of the conference room location as well as holding the viewers attention.

3.2.13.10 Disadvantages

• The is no clear introduction title of the animation.
• The interior sequence is basically established as a continuous walk-through even when the camera changes into pan movement.

3.2.14 Analysis 14

<table>
<thead>
<tr>
<th>Title</th>
<th>234 FULHAM ROAD : A NEW DEVELOPMENT OF LUXURY HOMES AND APARTMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>By</td>
<td>THORP Modelmakers Limited, London, UK.</td>
</tr>
<tr>
<td>Duration</td>
<td>1 minute 2 seconds ( PAL ).</td>
</tr>
<tr>
<td>Project and Year</td>
<td>Design Animation 1997.</td>
</tr>
</tbody>
</table>

3.2.14.1 General Overview

• This animation starts with a fading in of the title project - 234 Fulham Road : A New Development of Luxury Homes and Apartments with a few different still backgrounds of the site.
3.2.14.2 Message and Content

• The animation shows the viewers a visual impact of the new residential scheme development particularly on material and facade treatment (e.g., door, window and the external wall).

3.2.14.3 Cinematography

• The story is introduced with several computer stills taken from different angles, mostly eye level shots.
• It then continues with ‘in-depth’ movement as the camera moves away to show the illusion of depth.
• Following the camera path, the ‘real’ figure is imposed in close-medium shot looking at the building.
• The animation ends with a still representation approximate the same as the beginning shot.

3.2.14.4 Lighting

• A general lighting effect differentiates the colour, form and texture of the building.

3.2.14.5 Sound

• A background sound is used throughout the sequence.

3.2.14.6 Special Effects

• A ‘real’ figure is established in close-medium shot following the ‘in-depth’ camera movements as if viewers were experiencing in the actual site.
3.2.14.7 Detailing

- The attempts to establish several medium and close-medium shots in a photo-realistic rendering (e.g. texture mapping) allow the viewers to visualise better on the building detail such as brickwork, window, door and street lighting.

3.2.14.8 Conclusion

- A still shot concludes the sequence which is approximately the same as the introduction shot.

3.2.14.9 Advantages

- Suggesting the eye level shots and sequences with the 'real' figure following the camera tracks draws viewers attention.
- A slow tempo on most of the sequences helps the viewers to recognise and understand the design.

3.2.14.10 Disadvantages

- The 'real' figure suggestion in close-medium shot (i.e. the frame dominates three quarters of the human figure) does not give a clear scale and proportion of the building for comparison. Also, there is an obvious flickering on most of the 'real' edges causing by inaccurate 'chroma-keying'.
- Other important elements such as cars and trees that can enhance the overall building scale are not fully utilised.
3.3 RESULTS OF VIDEO ANALYSIS

All of the results are directly extracted from this empirical analysis to show the reality about computer-based architectural animation. Most importantly, these headings can give an architect an awareness of how the medium works with regard to its originality, identity, character and message before starting any architectural animation.

3.4 GENERAL OVERVIEW

Nowadays, most people are aware with certain cinematic standard due to the exposure on motion-based communication such as television news, advertisement, documentary, drama, stories and film movies as part of the daily life. Therefore, this experience creates some expectations by the viewers in regards to the basic cinematic elements which obviously shown as introduction title and credit or 'the end', 'initial' title for further graphic indication, sound effects and other means of film design.

In the surveyed analysis, twenty three out of twenty five participant recognise that *Super House 1* animation is represented without any title. Without given an enough time for the title sequence, the viewers is still unable to recall whether *Chen Lung Tien* animation has any title or not as seven participants answered no and four were unsure (see Bar Chart 37 and Pie Chart 30).
Do you see any title of the animation?

Bar Chart 37: Shows how title effects the viewers visual indication.

In fact, two out of fourteen animations still lack a main title which are Super House 1 and ATOM animation. None of the sequences implement an’
initial "title even when the sequence requires a graphic indication to explain the specific architectural information. Thus, as a result, sixteen out of twenty five participants did not understand and were unsure of the diagrammatic services model layout representation in Super House 1 (see Bar Chart 38 and Pie Chart 31).

Bar Chart 38: Super House 1 questionnaire shows how the effect that viewers will get of not establishing any graphic indication.

Pie Chart 31: Super House 1 questionnaire shows how the effect that viewers will get of not establishing any graphic indication.
In general, many of the analysed animations start with a horizontal angle shot (i.e. eye level shot) before developing into a more specific design sequence as shown in Bar Chart 39 and Pie Chart 32. Six of the analysed animations establish a high angle shot (including a bird’s eye view shot) to give the viewers a better visualisation on the building in relation to its surrounding. None of the animation introduces the sequence with a lower angle shot.

Bar Chart 39: Choices of shot to start computer-based architectural animation.

Pie Chart 32: Choices of shot to start computer-based architectural animation.
Showing a model of building with its surrounding is important in design process for building control and to understand how they suit in the real site. However, most of the animations were modelled without site context (Bar Chart 40 and Pie Chart 33). In this analysis, eight out of fourteen animations represent the building as a 'stand alone' subject. In fact, the animation with site context mainly applied in the urban (e.g. Urban Hangzhou) and large scale of design animations (e.g. Shanghai Railway Station).

Bar Chart 40: Director's idea of the general overview sequence in the analysed animation.
The idea to give the viewers an overview of the animation becomes more convincing when seven of the analysed animations establish a two-dimensional and three-dimensional model transformations sequence. In this circumstances, the director prefers the changes from two-dimensional to three-dimensional or vice versa (Bar Chart 41 and Pie Chart 34). For example, in the Sketches of Rome animation each of the new key sequence was changed from two-dimensional still sketches to three-dimensional walk-through and other camera movement suggestions.
Two animations have creatively transformed the building model from three-dimensional subject to three-dimensional proposal. One of these ideas was presented in the form of demolition from the old high-rise building to the low-rise campus design (i.e. Campus 92 animation). Alternatively, Buday introduced the chapel of University of St. Thomas by establishing a few three-dimensional forms (e.g. sphere and cube) before transforming these objects into a functional architectural space.
3.5 MESSAGE AND CONTENT

Undoubtedly, all of the animations were made for a specific reason. Eleven out of fourteen animated sequences are basically a new design proposal. Two of the remaining animated sequences represent an architectural conservation (i.e. Ichthyopolis and Sketches of Rome animations) and one building renovation (i.e. Campus 92 animation) as shown in Bar Chart 42 and Pie Chart 35.

Bar Chart 42: Message and Content representation in architectural-based animation.
These animations vary from interior and exterior design, architectural features, building services, structure and other environmental aspects. Whatever the intention and target, they fall within three different domains (Bar Chart 43 and Pie Chart 36):

- Design Animation.
- Urban Animation.
- Detail Design Animation.

In this analyses, all of the animators combine at least two different domains to form the complete animated sequence. In fact, most of the combinations include detail design animation and produce on the animated film methodology. Many individual shots are developed into a linear structure storyline. For instance, the *Sketches of Rome* animation creates a series of different clips of each designated building following a 'storybook-like' representation. Each of the new building segments starts with a two-dimensional sketch before being transformed into a three-dimensional walkthrough.

Generally, all of the animated representation concentrated on visual rather than aural communication. Buildings were modelled with a high-end photo-realistic rendering, a lot of camera movements and a few of still clips.
Most of the animations did not include a narration or voice-over to explain the key purpose of the animation, the specific space or building sequence. In fact, sound representation is basically appeared as a background compliment.

Bar Chart 43: Message and Content sequence in architectural-based animation.

Pie Chart 36: Message and Content sequence in architectural-based animation.
3.5.1 Design Animation

This empirical analyses shows that design animations dominate most of the motion-based representations. Architectural subjects are put into the cinematic set as a design representation.

For example, in the *Ichthyopolis* animation, Haxton suggests the design animation by creating an approximation of the original underwater building ruins. Each of the ruined areas starts with a two-dimensional drawing followed by several different movements in the 'diver's' point of view to show three-dimensional transformation effects.

3.5.2 Urban Animation

Urban design animation focuses on a larger scope of contextual site and design issues, often represented as a model of a city, town or other building-related environment. Because of the large scale, the proposal is usually differentiated by showing, the form of building blocks or wire frames animation to reduce the size of the digital files. A few of the selected areas may be highlighted with the basic building elements (wall finishes, door, window, building structures) including the photo-realistic renderings.

In the *Urban Hangzhou* animation, wire-frame modelling is used to represent old building blocks, whereas the complete rendering sequences establish the new urban proposal. Also, in a certain area the existing site shot is imposed on the virtual model by maintaining the same camera angle, distance and movement for a visual impact observation.

3.5.3 Detail Design Animation

All of the analysed animations introduce a detailed design to be part of the overall animated sequences. These sequences are normally represented in close up shots with slow tempo, strong colour contrast and a few suggestions of special effects. Comparing to other sequence domains, detail
design animation draws viewers attention due to the fact that objects are larger and more detail for observation.

Generally, the choice of the detailing was based on the size of the design scheme itself. Although theoretically architectural detailing will normally refer to building components such as jointing, selected building material on a specific plane and other architectural features, this analysis identifies the detailing as three different categories (see Table 17). Detailing were shown as:

- Photo-realistic Rendering and Object Composition.
- Selected Building Component.
- Selected Area.

<table>
<thead>
<tr>
<th>No</th>
<th>Production</th>
<th>Detailing Sequence shown as Photo-realistic Rendering and Object Composition</th>
<th>Detailing Sequence shown as Selected Building Component</th>
<th>Detailing Sequence shown as Selected Area</th>
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<tbody>
<tr>
<td>1</td>
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<tr>
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<td>CFSI</td>
<td>yes</td>
<td></td>
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</tr>
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<td>Banju Port</td>
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<td>yes</td>
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</tr>
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<td>yes</td>
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<td>12</td>
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<td>14</td>
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<td></td>
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<td>6</td>
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</table>

Table 17: Summary of detail sequence in the empirical analysis of computer-based architectural animation.
3.5.3.1 Photo-realistic Rendering and Object Composition

Compare to other type of detailing, photo-realistic rendering and object composition dominates the director choices to explain design ideas in a more intricate detail to give the viewers a better understanding of the animation as well as drawing attention. A sequence is actually highlighted with an extra high photo-realistic rendering by adding shadow, ‘ray tracing’ (i.e. reflection effect), special lighting effect and composed in the building set.

In general, most of this type of detailing was established in a design animation (i.e. single design building) presented in full shot, medium shot and close-up shot. For example, in Campus 92 animation the director selects a full shot taken from a low angle camera to explain how the sitting area, flooring and planting were integrated together as part of the external campus environment. On the other hand, the level of detail shown in ATOM animation explains the building material. The walk-through movement in a slow pace following the staircase indicates the glass-block and steel staircase as the selected material.

3.5.3.2 Selected Building Component

Three of the design animations select few of the building components to explain the detail sequence. For example, in Chen Lung Tien the director presents the building detailing as a ‘particle’ effect transformation into a ‘dragon-shape’ brackets and three large representation of Buddha (i.e. ‘daibutsu’). In Super House 1 animation, a three-dimensional wire-frame model is established to show the basic building services layout in the house.

3.5.3.3 Selected Area

In a large scale design and urban animation, only few selection of still and moving sequences were included as the detail design animation. For instance, in Campus 92, the director establishes a lower angle shot sequence on a particular student resident area with greater detail of sitting
arrangement, entrance arch and building finishes in a significant composition. Whereas, the impact analysis is compared in one of the selected building (pavilion) of Banju Port Renaissance Plan animation by introducing a special lighting effect between daytime and night time at the same distance and camera angle.

3.6 CINEMATOGRAPHY

This analysis shows that camera movement dominates the way the cinematography is explored. In fact, 66% of the animated sequences include camera movement in the form of walk-through, fly-through and fixed camera station trajectories (pan, tilt, roll and zoom). Only 34% of the sequences used fixed frame or still images as part of the overall sequences. See Bar Chart 44.

![Bar Chart 44: Sequences choices in architectural-based computer animation.](chart)

Although a lot of architects treat the virtual camera as the observer's eye to frame and establish building sequences, the freedom of camera movements in many cases have been abused. Most architectural animation represents architectural sequence as a continuous fly-through and walk-through.
However, architects’ awareness of the basic understanding of camerawork is often ignored. Many shots do not provide visual interest because either there are not enough sequences or there are too many repetitions of views. This often results in a sudden change of visual observation between one shot to another. Among the obvious cinematic features observed were:

- Camera Movement.
- Visual Attention.
- Depth Illusion.
- Composition.

### 3.6.1 Camera Movement

In this analysis, camera movements can be classified into three main categories:

- Continuous Camera Movements.
- Fixed Camera Station.
- Combination of Continuous Camera Movements and Fixed Camera Station.

#### 3.6.1.1 Continuous Camera Movements

Continuous camera movements represent a fly-through and walk-through. This analysis shows that this technique dominates the architects preferences to show their building information. In fact, 51% of the total sequences (i.e. 183) represents a continuous camera movement which gives various results (Bar Chart 44).

22% of the total sequences were shown as fly-through in the form of high angle and aerial view (bird’s eye view) shot. In Banju Port Renaissance Plan animation, the directors establishes few different fly-throughs at high
level focusing towards the coastline by allowing the camera move sideways and above the site to show the context of the recreational area.

Walk-through sequences frame the subject as if the viewers are looking at eye level shot. In ATOM animation, the way that the architect organises the overall sequence was by maintaining all of the moving sequence at eye level shot walk-through. In order to avoid monotonous, the sequences were combined with long shot, medium shot and a few close ups with object movements, camera pans and link with a transition effect (e.g. dissolve).

Only 7% of the total sequences prefer a combination of fly-through and walk-through often shown in the introduction sequence. For instance, Sasada establishes a continuous fly-through movement from an aerial view shot focusing the main route that link between the mainland and the airport (Kansai) to the ground level shot. This technique increases the repetition of similar shots and rendering time. On the other hand, in Campus 92 animation the director introduces a cut sequence from bird’s eye view shot to an eye level shot to achieve the same effect.

A continuous camera movement on a specific occasion reveals the three-dimensional space and subjects representation. A few effective examples of continuous camera movements can be seen in Chen Lung Tien animation. The director explains the main hall space by suggesting a few different motion camera strategies.

A sideways camera movements from left to right at high angle capturing the ritual activities of the ’ real ’ people in long shot describes the size, scale and relationship between one space to another. The visual attention becomes even better as the camera follows a slow tracking away (i.e. in-depth movement) symmetrically in-between the space and object (column) to get the full shot from a pause position in front of the statues that were revealed in the form of special lighting effects. The detailing of Buddha (’ daibutsus ’) is experienced by encompassing (i.e. curve path ) one of the statue at a lower angle shot to enhance the massiveness, form and other important features.
Alternatively, in ATOM animation, a few diagonal camera movements established in the interior office walk-through also helps to enhance the three-dimensionality of the space and subjects.

Unfortunately, a lot of the animation sequences with continuous camera movements fail to attract and explain the viewers better on the subject. It happens commonly as directors did not establish the right tempo appropriately in references to the sequence and allows a continuous camera movement with a sudden change of different viewpoint.

Thus, this analysis finds that pausing frame before the camera changing viewpoint is essential to retain viewer orientation and concentration on the sequence. However, out of ten only one animation (i.e. Banju Port Renaissance Plan) pauses frame whenever the camera start to change a different viewpoint on a moving sequence. See Bar Chart 45.
Bar Chart 45: Consideration to pause frame in moving sequence when camera changes viewpoint in architectural animation.

The inconsistency of visual navigation deteriorates especially when the continuous movement is combined with fixed camera station trajectory. For example, on one sequence of the final proposal of Kansai International Airport animation, as the camera moves in-depth with a fast tempo through the main lobby, viewers attention is distracted when the camera suddenly tilts up without pausing frame.
3.6.1.2 Fixed Camera Station

Establishing a camera on a fixed position allows the directors to manipulate building sequences in the form pan (horizontal), tilt (vertical), roll and zoom (moving the lenses). However, the application using the fixed camera station trajectory is very minimal (7%) compared with other types of movements in the analysis of computer-based architectural animation. See Bar Chart 46.

Thirteen out of one hundred and eighty-three sequences establish fixed camera station to be part of the building representation. Four out of fourteen animations do not apply this technique except manipulating building as fly-through and walk-through sequence. These animations are Super House 1, CFSI, University of St. Thomas and 234 Fulham Road Residential Development.

In the fixed camera station pan dominates the trajectory choices (3.2%), followed by zoom (1.6%), tilt and roll (1% each). In general, most animations use at least two different types of fixed camera movement as part of the whole sequence. For example, in Sketches of Rome animation, Haxton pans the camera to view the courtyard after cutting from the introduction sequence. In the sequence of the Pantheon, on a high angle fixed frame position, the camera tilts down to capture the space volume and the light stream that enters the dome together with a ‘glittering’ effect to draw viewers’ attention. Alternatively, tilting up the camera from a low angle shot enhances Chen Lung Tien temple main entrance.

3.6.1.3 Combination of Continuous Camera Movements and Fixed Camera Station

Most architects prefer to combine their fixed camera station sequence with the continuous walk-through and fly-through which this analysis shows 7% in total as shown in Bar Chart 46.
In order to show a continuous changes from two-dimensional to three-dimensional, Sasada establishes most his animated sequence introduction with an aerial view shot at fixed position followed by a fly-through towards the site. As the camera starts to roll at the intermediate position, the movement consistently reveals the three-dimensionality of the site. An example of this technique can be seen on Banju Port Renaissance Plan animation.

However, the combination of fixed camera station with continuous camera movement can distract viewers concentration. In Shanghai Railway Station animation, the introduction sequence start with two-dimensional master plan indicating the site. Once the camera rolls and continues with fly-through movement in long shot viewers attention is lost. This is mainly because the director establishes the lengthy shot in a very slow tempo for few minutes before cut into horizontal level shot.

### Bar Chart 46: Controlling motion camera in architectural animation.

3.6.2 Visual Attention

Several cinematic ideas were noticed in the analysed animation to draw viewer’s attention mostly focused on visual representation. These techniques include:
• Photo-realistic Rendering.
• Subject Movement.
• Close-up Shot.
• Foreground Framing.
• Special Effects.

3.6.2.1 Photo-realistic Rendering

Photo-realistic rendering dominates the idea to draw viewers attention as well as explaining the design information. Most architectural space and building were rendered in the form of texture mapping, ray tracing (reflection effect), light and shadow to indicate the 'real' effect on the material, form and architectural feature proposed in the design representation.

In Super House 1 animation, the use of texture mapping on the building plane (e.g. floor and facade) differentiates between the timber floor and facing brick wall. The three-dimensional effect of individual subject and building form reveals as the director lights them from an angle with few ray tracings.

3.6.2.2 Subject Movement

Moving objects in animation have shown a very effective way to draw viewers attention and enhance the sequence. As proven in a survey on Chen Lung Tien animation, all of the participants recognised movement of the 'real' human figures that were established in the main ritual (i.e. prayer) hall (see Bar Chart 47 and Pie Chart 37).
Bar Chart 47: Chen Lung Tien questionnaire shows how movements effect viewers attention.

Pie Chart 37: Chen Lung Tien questionnaire shows how movements effect viewers attention.

The idea to include subject movement often focuses on a fixed frame shot. This technique films the shot with the camera in a still position but allows an object or other elements to create the movements. The pattern varies from a lateral, in-depth, diagonal or free movement.
The lateral and in-depth movements usually portray two-dimensional effects on screen, although the building itself is three-dimensional as the subject moves either from side to side (lateral) or toward or away (in-depth) from the camera. In *234 Fulham Road Residential Development animation*, the in-depth movement of the 'real' woman figure in close-medium shot makes the figure and the overall composition looks flat.

Some directors utilised their subject function and type as door and window opening, closing, sliding and a movement of elevator. Haxton allows a few different moving elements following a curve path in a fixed frame such sea creatures entering the underwater ruin building (i.e. *Ichthyopolis*) and birds moves away from the screen to show the depth in the courtyard (i.e. *Sketches of Rome*). Sasada suggest a diagonal movements showing a few moving vehicles in both of his first and final proposal of *Kansai International Airport* animation, which helps a lot to draw viewers attention on long shot sequence.

Compare to the lateral and in-depth movements, this analysis shows that the diagonal and free movements give a more surprising effect to enhance three-dimensionality of the space and the subject within a certain control of speed and the camera height.

### 3.6.2.3 Close up Shot

It is obvious that our visual draws more attention on larger object often shown in close-up shot. Architects commonly rely on this shot to show building components, joints and other detailing to enable the viewers to see them in extensive detail. In *Chen Lung Tien* animation survey, twenty two out of twenty five participants recognise the building detailing as most of them were established in close up shot (see Bar Chart 48 and Pie Chart 38).
Is any important building feature and detailing (i.e. columns and beams) highlighted?

Bar Chart 49: This bar chart shows that most viewers recognise better as the detailing in *Chen Lung Tien* animation were shown in close up shot.

However, most close up shots in the analysed animations differ from real shooting in a sense that the background do not fades (i.e. out of focus) when the camera focuses on the subject. In real shooting, this effect creates a clear contrast as well as a focus of visual interest to enhance the subject. However, in *Chen Lung Tien* animation, the director try to achieve similar
effect by introducing 'fog' effect which dim the overall background to enhance the foreground object. The three-dimensional effects is revealed as the camera moves following a curve path focusing on the subject such as the daibutsu (i.e. statue of Buddha)' dragon-like' columns and brackets.

This analysis also shows that close-up shot works effectively in a slow tempo as viewers have enough time to understand and visualise the subject detail.

3.6.2.4 Foreground Framing

This empirical analysis shows that a lot of architects prefer to concentrate on foreground framing to enhance the depth illusion in the overall composition. A good example of this technique was presented in Sketches of Rome animation.

In the courtyard sequence, Haxton carefully establishes the walk-through, fixed camera movement (i.e. pan) and pause sequences with a strong foreground colour contrast (dark) to be included in the frame which enhances by the cast shadow. In this circumstances, the viewers attention was focused on the centre of the courtyard (i.e. light area).

Some directors utilise foreground object to frame the subject. As an example, Sasada establishes a viewpoint from the control tower of Kansai International Airport animation looking at the main runway and terminal framed by the window frame. A similar effect is shown in Figure 16.
3.6.2.5 Special Effects

This analysis shows that twelve out fourteen animations include special effects as part of the sequence representation. In this cases, architects commonly use at least one visual effect in their animation (Bar Chart 49 and Pie Chart 39). None of these animations include any sound effects such as moving car and fountain except complementing the visual representation with a high pitch sound effect (only applied in Chen Lung Tien animation).
The use of Special Effects in computer animation

Bar Chart 49: Special effects application in architectural animation.

Pie Chart 39: Special effects application in architectural animation.

Undoubtedly, these special effects give an astonishing result particularly to make sure viewers focus attention and understand the subject. In fact, few animators attempted to highlight the main subject or space through special effects. The creation of the special effect varies from animated sequence in production stage and editing techniques as shown in Bar Chart 50 and Pie Chart 40.
Special lighting techniques dominate the special effect application. Few of Sasada building exteriors were compared with daytime and nighttime lighting effect such as in Banju Port Renaissance Plan and Kansai International Airport (Final) animation. To further emphasize the function of certain spaces, he uses a 'glow' effect to show a diagrammatic flow pattern of the passengers in Shanghai Railway Station animation.
In the *Campus 92* (Ex-Machina) animation, a ‘strobing’ technique enhances the transformation of the high-rise buildings demolition by extruding into a new proposal of low-rise buildings. A few different shots viewed from a high angle, gives a better visual impact of the new proposal.

Alternatively, some of the animators combine multimedia clips when comparing or establishing the context in the story. For example, Sasada introduces ‘real’ shots of an in-flight plane which includes a narration by the stewardess on the safety procedures and the air traffic controller before landing in *Kansai International Airport*. This is followed by a bird’s eye view shot looking at the new airport and a low angle shot looking up to the aeroplane approaching to land. These multimedia combinations allow the viewer to recognise that the design relates to an airport.

Another special effect that gives a very effective result to the building scale and composition is produced in *Chen Lung Tien* (Buddhist temple) animation. The appearance of the ‘real’ peoples walking and praying in the grand hall of the temple automatically draws the viewers’ attention as shown in Bar Chart 47. However, this effect appears slightly two-dimensional in the *234 Fulham Road* animation as the camera is established using in-depth movements with a close-medium shot of a ‘real’ human figure.

Only one animation (*Ichthyopolis*) utilised the building ruins with underwater special effects to indicates present situation of the site. A few sea creatures movements and light reflection effects reveal the overall underwater environment.

Instead of concentrating on the production stage special effect, few directors manipulate their sequences in the post-production. This technique is shown as title and ‘rippling’ effect. For example, in *University of St. Thomas* introduction shot, Buday edits the sequence to get the ‘rippling’ effect before transforms into the interior sequence. The similar effects also applied in the end sequence of *Chen Lung Tien* animation.
3.6.3 Depth Illusion

Although there are many ways to reveal depth in film design, this analysis shows that depth illusion only focused on the building and space composition by suggesting a few differences between foreground, middle ground and background colour.

Most images in the background and middle ground are almost as clear as foreground objects. Therefore, because most modelling looks artificial, the 'real perspective' illusion (the image becomes clear as the camera moves towards the object and vaguer as it moves away) does not exist.

Only one animation (Chen Lung Tien) represents a quite distinct cinematic depth in the internal sequences by using the 'fog' effect. However, this special effect technique does not really convince all of the viewers visual recognition as eleven were unsure and three participants did not see any of this effects. See Bar Chart 51 and Pie Chart 41.

Bar Chart 51: Shows that fourteen participants still were unsure and did not see any fog effect in the internal space of Chen Lung Tien animation.
Is there any dim light or 'fog' effects in the internal space?

Pie Chart 41: Shows that fourteen participants still were unsure and did not see any fog effect in the internal space of Chen Lung Tien animation.

3.6.4 Composition

Composition in the film sense is not fully utilised and the 'rule of third' (see Figure 17) is sometimes forgotten. Subjects in the foreground framing are mostly established by chance on a quite fast walk-through. The main features are no longer within the appropriate cinematic boundary, and such effects prevent the viewer from realising the quality of seeing a space.

Apart from this, most sequences concentrate on standard camera lenses. Only a few of the animations use wide angle and telephoto lenses to compose architectural images. In fact, many shots are established from eye level to high angle and in most circumstances, they show a 'fly-through' or 'superman-like' experience.
3.7 LIGHTING

The overall concentration on light and shadow is evident in all of the analysed animations. All of the animations apply general lighting effect to light building and the surrounding. In fact, dim and fill lights are amongst the common applications.

Eight out of fourteen animations try to fit in a special lighting effects as a comparison. For instance, the *Banju Port Renaissance Plan* animation portrays two different lighting moods - night time and daytime framed at the same camera angle and distance. Whereas, the *University of St. Thomas* and *Sketches of Rome* sequences include a 'light rays’ effect through a high level window and Pantheon dome, as if the natural light will illuminate the space.

A good attempt to highlight the building form is shown in *Super House 1* animation. The director try to arrange few up and down lighting on the entrance facade and the front garden to reveal the three-dimensional effect of the material, form and space of the house with dark background.
(showing the night time environment). The effect become even better when a walk-through is established in medium and close up shot passing by the dim entrance lamp before entering the interior.

Apart from this technique, several directors utilise the special lighting idea in the form of 'particle' effect on the selected sequence. For instance, in the end sequence of *Banju Port Renaissance Plan*, Sasada introduces 'fireworks' display backdrop with a lot still human figures along the waterfront looking at it in long shot. On the other hand, in *Chen Lung Tien* animation, the particle effect joints to form the 'dragon-like' brackets and statue of Buddha. Lighting application on all of the fourteen animations are summarised in Table 18.

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<th>No</th>
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<td>- daytime and night time effect. - fireworks (particle effect).</td>
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<td></td>
<td>TOTAL (yes)</td>
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Table 18: Summary of the lighting application in the analysed animation.

3.8 SOUND
Sound is another key sense of indication for a normal people to recognise and understand objects. As proven in the surveyed animations, twenty three out of twenty five participants accept that there is no voice-over or narration in Chen Lung Tien and Super House 1 sequences (see Bar Chart 52 and Pie Chart 42).

Bar Chart 52: Sound recognition of Chen Lung Tien and Super House 1 animations in the surveyed analysis.
Is there any voice over or narration in the animation?

Pie Chart 42: Sound recognition of Chen Lung Tien and Super House 1 animations in the surveyed analysis.

However, unlike film-making sound in computer-based architectural animation is minimally utilised. Most directors mix background sound as a compliment to avoid boredom. In fact, out of fourteen only two particular sequences were applied with narrative elements.

This empirical analysis shows that the director mixes sound in their animated sequences in two different forms (see Bar Chart 53 and Pie Chart 43). Eleven animations basically depends on the first form as the whole sequences were mixed with a single background sound simultaneously. Two of these animations (both of Kansai International Airport animations) use a few different background sounds to differentiate between the introduction sequence and the overall animation.

However, only one animation composes a background music in relation to the sequences importance. Individual sequence is edited with a specific sound pitch to synchronised with the overall mood. For instance, in
Chen Lung Tien animation, the director integrates the full shot sequence at fixed position with a high pitch sound parallel with the appearance of the three 'daibutsus' (statue of Buddha). As the camera moves away from the statues the background sound was tuned down consistently with a slow tempo following the camera path to frame in long shot.

None of the animations have considered sound effects in relation to space and elements (e.g. a door opening, space, volume and moving car) except in ATOM and the first proposal of Kansai International Airport animation. In ATOM animation, the director enhances the double volumes effect of the office reception by echoing the narration. On the other hand, Sasada introduces a voice-over communication between the pilot and air-traffic controller before the aeroplane lands at Kansai International Airport (first proposal), to create the airport situation.
3.9 CONCLUSION SEQUENCE

There are several ways that animators conclude their animations. Most directors end their sequence with different ending from the introduction shot. Only five animations considered the end sequence in relation to the beginning shots (see Bar Chart 54 and pie Chart 44). For instance, in Chen Lung Tien animation, a camera is established by moving progressively away from the main building following the starting path in reverse order. Using the last shot the conclusion is further emphasised with a transformation in a 'rippling' effect to the project logo.

As an alternative, a selected space or shot will justify the animation conclusion. In the Banju Port Renaissance Plan animation, one of the external recreation areas is selected to show the changes from daytime to night time with a fireworks effect established in the background before fading out.

Similar to the introduction title, the end sequence is also part of the cinematic standard and visual indication to conclude the sequence. However, there is still one animation that ends without any credits or 'the end' as
occurred in *Super House 1* animation. Although the overall animation can impress the viewers, but without this simple graphic indication, the production lacks the professional look.

Bar Chart 54: Shows how director ends their computer animated sequence.

Pie Chart 44: Shows how director ends their computer animated sequence.
3.10 EDITING

This analysis shows that editing is one of key elements that influence the visual and aural understanding. Special effects and photo-realistic renderings to form a beautiful image do not necessarily ensure that viewers will understand the animation. As shown in Bar Chart 55 and Pie Chart 45, although Chen Lung Tien animation includes a lot of special effects and high quality photo-realistic renderings, the difference is insignificant compare to Super House 1. However, without editing the results become clearer as six out of the twenty five participants said that they did not understand Super House 1 animation.

Bar Chart 55: Viewers understanding of the surveyed animations.
Pie Chart 45: Viewers understanding of the surveyed animations.

In general, only a few animations suggest a smooth flow sequence through editing. The others simply put together all the shots and add background sound. Important effects such as fade in or out, dissolve, cut and other transition techniques are not taken into consideration. Besides, relationships between visual and aural tempo are often un-synchronised.

The effect of unedited animated sequence become obvious when the architects suggest a continuous camera movements. For example, in Shanghai Railway Station animation, 87.5% of the total sequences is established as a camera movement in the form of walk-through, fly-through and a combination with fixed camera station. Thus, this motion continuation prolong the animation up to five minutes forty two seconds of representation just in within seven different cut (see Bar Chart 56 and Pie Chart 46).
Bar Chart 56: Unedited sequences is obvious when architects allows a continuous camera movement.

Pie Chart 46: Unedited sequences is obvious when architects allows a continuous camera movement.

In certain circumstances, editing with a multimedia presentation can improve the architectural animation. For example, Sasada imposes several 'real clips' in many of his animations to give a better understanding of each design and its context. In Kansai International Airport animation (first proposal), a few seconds of 'real' shooting of in-light environment (i.e.
announcement and safety precaution by the cabin crew) relates the viewers to the airport design.

### 3.13 TIME DURATION

This analysis shows that three minutes is the average representation time for architectural animation. The shortest period is 56 seconds presented in the *Super House 1* animation. However, it can be up to seven minutes particularly when combining with other 'real' clips and the directors allow a continuous fly-through and walk-through movement.

### 3.14 SUMMARY

All of the analysed animations were created as 'stand alone' computer-generated sequences of building representations and last three minutes on average. Building sequences were focused on visual representation with a simple background sound (without any narration). This includes a simple title for each animation (with credit) but without any 'initial' title particularly when the sequences are combined with other forms of visual information.

Most animators start the sequence with horizontal angle (14.3%) and high angle shots (10.7%) in the form of walk-through, fly-through or aerial view shots without any site context (see Pie Chart 47). Buildings becomes more vivid (three-dimensional) as some architects establish a diagonal and curved path at eye level shot. In fact, in *Banju Port Renaissance Plan* and *Shanghai Railway Station*, as the camera rolls the layout plan, the three-dimensional form is revealed.
Building representations are created at later design stage as a new design proposal (26.2%) with photo-realistic rendering. This includes a combination of detail design sequence (33.3%, i.e. high-end rendering resolution such as reflection, texture mapping and shadow) to explain the material and building form. Only a few animations are developed as building renovation (2.4%) and conservation (4.8%). For urban scale projects, important spaces are developed in a quite complete building set especially to show the activities in the film space (see Pie Chart 48).
Pie Chart 48: Directors’ idea on the Message and Content sequence in computer animation.

The vast majority of the animated sequences were established by moving the camera (51.9%) in a quite fast fly-through and walk-through (e.g. sideways, in-depth, curved and diagonal paths). As a result, important sequences in the foreground are often visualised by chance as long shots and a combination of shots (represented in the form of sequence repetitions). See Pie Charts 49 and 50.

Pie Chart 49: The overall sequences choices in architectural animation.
Pie Chart 50: The overall shot choices in architectural animation.

Without careful camera control (especially when animators fail to consider pausing frame before changing different viewpoints, Pie Chart 51), many animations create inconsistency in visual navigation and distract the viewers' attention. None of the analysed animations gave any 'initial' graphic indication or other relevant cinematic standard (e.g. some animation were even presented without main title). This again leads to difficulties in understanding specific building representations (see, for example, Sketches of Rome and Super House 1 analyses).
Pie Chart 51: The overall consideration of pausing frames in architectural animation before changing viewpoint in moving sequence.

Pan and tilt are occasionally used and combined with the camera movement (often without a clear pause, see Bar Chart 46) to establish large spaces (see Pie Chart 52). However, a fixed frame shot is used much less than moving shots (Pie Chart 49) and often shown as still images and without any combination of other visual representations such as still drawings or 'real' footage.

Pie Chart 52: The use of Fixed Camera Station (FCS) in architectural animation.
In this empirical analysis, the most obvious element that draws viewer's attention is focused on special effects as 92.3% of animations are developed in various techniques (Pie Charts 40 and 53). Building forms and materials are often highlighted with special lighting effects (57.1%) to allow a better visualisation (see Pie Chart 54).

Pie Chart 53: The overall usage of Special Effects in architectural-based computer animation.

Pie Chart 54: The overall usage of lighting in architectural-based computer animation.
Special effects are also used to create depth as most of the digital images lack real perspective. Apart from applying a dark colour contrast objects in the foreground to frame the subject, some animators used a 'fog' effect to create the approximate illusion as shown in Chen Lung Tien animation. However, the result becomes more powerful when the animators use a 'strobing' and 'particle' effects to give a better understanding of the design transformation (e.g. daytime and night time comparison).

Special effects were also created to give scale and proportion. At its simplest, a photo montage of various human activity is included on individual space. But, with 'live' people 'chroma-keyed ' onto the still or moving background, the sequence becomes more convincing as well as holding the viewers' attention.

Animation editing for both visual and aural representation is minimal due to the fact that many animations are represented in the form of continuous camera movement. The advantage of cutting in-between shots are not usually used to give a clear understanding of the subject. 78.6% (Pie Chart 43) animations prefer a single background sound rather than making use of natural sound, sound effects or narration especially to further enhance the important subject. Moreover, sequences which are ended without following the introduction sequence sometimes makes the overall animation is difficult to understand (particularly without a proper cinematic indication).
chapter 4

elements for architectural animation
4.1 INTRODUCTION

In most circumstances, architecture is difficult to explain without any illustration. The development of design ideas makes extensive use of drawings, perspectives, sketches and models as a way of communicating with a wide range of participants.

Computer-based animation could provide an effective means of communication if designers were more aware of the techniques involved: in fact, from the survey carried out on architectural practices in Glasgow only one firm was trying to take a step forward in improving their animation by exchanging ideas with other practices.

In practice, the use of architectural animation is quite arbitrary. Sequences may come from the designer's point of view as a necessity or what they want the viewer to see. However, the survey revealed that many selections are often based on clients' preferences, and their awareness of films and movies. Most importantly, the representation form is influenced by the individual design stage.

Therefore, this chapter outlines the elements for architectural animation by identifying the differences between architectural film and animations (including the architectural practices survey) which can lead to a successful result. Digital sequence illustrations were compared to real shooting footage and compiled in a form of a video format illustration submitted along with the thesis.

4.2 DIFFERENCES BETWEEN ARCHITECTURAL FILMS AND ANIMATIONS

There are several significant differences between professional architectural filming and computer-based architectural animation. The main reason for this is that the vast majority of architects (i.e. animators) do not have any motion-based skills or knowledge of film-making principles and
have only developed their skill as a personal interest (refer to Bar Chart 16 and Pie Chart 15 in Chapter 1, p. 45).

Firstly, in practice, the early process of making architectural animation (often referred to as pre-production) is influenced by the design stage. In the Briefing stage (Inception - stage A and Feasibility - stage B), animation is developed to ensure viewers (especially the client, public bodies and other related professionals) who are not familiar with two-dimensional drawings can be well-informed of the design proposals. Thus, design development between the architect and other parties can be brought together consistently and decisions made quickly and without misunderstanding (raised by Kelman (1998) from Building Design Partnership, BDP, Chapter 1, p. 12).

The level of design detail in the early stages is minimal (basic colour and form) as the architect is still in the process of developing the design. Building sequences are concentrated on visual representation (on-screen) without any sound and established instantly on computer. In fact, most of the interviewed architects agreed that animations for this stage do not provide a major improvement in the design development since the motion-based representation is presented in the form of mass model.

On the other hand, animations that were created in the Sketch Plan stages (Outline Proposals - stage C and Scheme Design - stage D) allow more detail visualisation which allows the architects to develop the design and the viewers to better understand the building. As suggested by Simmonds (1998) from Page and Park Architects, a lot of quality decisions can be outlined critically as the visualisations give almost a complete building representation with extensive detail of material (photo-realistic rendering), colour, light, shadow and camera placement.

However, the potential of motion-based representation in the field of architecture can be seen clearly when animation is produced in the Detail Design stage (stage E). In the surveyed local architectural practice, most of the later design stages production is created mainly for public presentation, especially to get funding. The computer-based animations are often prepared as a short documentary with ‘real’ shooting, narration, sound and special effects (for example, Dubai high-rise building, by RMJM, Chapter 1, p. 52).
or sometimes may include interactive navigation (e.g. Middlesborough Stadium, by Miller Partnership, or the Page and Park Architects museum designs).

As opposed to films, a storyboard is only used in a more developed way for public or promotional presentation, special purposes and later design stages (see Pie Chart 55). In this situation, some firms have difficulties when relying solely on the traditional film-making storyboard due to the fact that many sketches cannot be developed (e.g. viewpoint) in the production stage. As proven in the New Ministry of Finance sequence experiment, several initial key shot sketches are changed when creating animation paths. Earlier sketches that were designed to show an external view (i.e. the main promenade) from the office were excluded (see Figures 18 and 19).

Figure 18: Storyboard sketches of the interior of the New Ministry of Finance animation.

Figure 19: Storyboard sketches of the interior of the New Ministry of Finance animation.
Instead, architects develop their storyboard in the form of 'pilot' animations (shots established directly on quarter size screen resolution at ten to fifteen frames per second). The preliminary animation continuity will
build up as more decisions of shots are put together between the architect and client. Based on this, the designer can estimate the time and budget before carrying out the final production version of the motion-based representation.

Secondly, the documentary films are consistent when presenting the general overview of architectural information (see Pie Chart 56). The professional look is maintained by including main title and credits (although a few sequences may ignore ‘initial’ title), good overall resolution and narration to explain the film. Buildings are filmed with surrounding (i.e. established from either high angle or horizontal angle shot) and often combined with other visual materials (e.g. drawings and photographs).
In contrast, architectural animation still lacks basic information to explain the building representation: for example, some introduction sequences are presented without any main title. Sequences often visualised buildings in high angle shot (usually aerial view) or a quite fast tempo of a moving camera at horizontal angle shot without site context (14.3%). Potential visual representations (especially representation with minimal effort to develop in computer such as computer stills, photographs and drawings) are not fully utilised to allow a direct comparison.

In the film analysis, buildings are usually developed in a motion-based medium to reveal the architect’s works (difficult to explain in still images), Renaissance’s masterpieces and ruined areas (often forgotten). Thus, in order to create a keener interest most of the footage includes a lot of close up shots which explain the subject in extensive detail.

On the other hand, most animations are developed as a new proposal of design animation. Building representations are represented with a high quality rendering (e.g. showing the material, colour, lighting and texture) together with special effects (often developed as detail design animation).

The Message and Content sequences to present building information in film and animation is summarised in Pie Chart 57.
Architectural-based film is usually developed with a clear sequence organisation to relate the building with the site context and to enhance the character of individual spaces and architectural features. Thus, in order to achieve a consistent result, professional film directors prefer a fixed camera (either on fixed frame, 46.2% or fixed camera station, 35.1%) when filming buildings as shown in Pie Chart 58).

Although this might link to the camera restriction, it enables the viewers to understand the sequence more easily. Superimposed combination is used especially to allow a direct comparison when establishing the 'predicted' buildings (Les Envois de Marseille). Important subjects may also be
established by using two different trajectories on a fixed camera station (e.g. in *Masters of Illusion*).

Apart from this, most directors film buildings from a natural viewpoint with careful composition (the 'rule of third') without using wide-angle lenses in order to avoid perspective distortion. Thus, in this situation, most film directors prefer full shot (28.9%) and close up (30%, including close medium shot and big close up) as it gives the viewers a more definitive understanding of the subject. Building features are often cut from full shot and medium shot to a lot of close ups (refer to Pie Chart 59). At the same time, people and other objects (car movement, trees and furniture) are used to establish building scale and proportion (especially lengthy shot).
Point-of-view shots (e.g. looking down from a balcony) and prominent visual references are used to give a consistent visual link and to establish the building in relation to its surroundings. All of these cinematic features were shown clearly in *The Architecture of Frank Lloyd Wright* when Grigor films Falling Water, Ennis House and Guggenheim Museum.
The subject in a fixed frame shot is often manipulated with object movements (entering or passing by the film space) and composed with a clear depth (sometimes seen as a 'deep space', clip 12). In fact, Racina establishes several foreground objects in most of the full shot sequences in *Les Envois de Marseille*. Using a simple special effect, some directors establish the subject transformation at the same camera angle when comparing different lighting (daytime and night time or the building in different seasons) or superimposed between shots (two-dimensional drawings or 'chroma-key') as shown in Pie Chart 60.

![Pie Chart 60: The use of lighting in architectural film and animation.](image)

Techniques to develop special effects are more utilised in computer-based animation although the differences on the use of special effects between architectural film and animation is minimal (Pie Charts 61 and 62).
The main reason for this is because the freedom of virtual camera and special effects software becomes more available.

![Pie Chart 61: The use of Special Effects in architectural film and animation.](image)

Although lighting effects dominates both architectural film and animation, directors often grab the first thirty second of viewers concentration with titling effect (e.g. 'sparkling' effect, *Masters of Illusion*). However, animators prefer 'chroma-key' to enhance important shot especially to establish scale and proportion.
Pie Chart 62: Special Effects technique comparison between architectural film and animation.

In a large space, film directors often use pans or tilts to ensure the sequence covers all of the important features horizontally or vertically as shown in Pie Chart 63. Further experience of the space might be explored by tracking the camera, passing through the space with a clear pause before changing into a new viewpoint in a slow tempo to create visual consistency. Roll, 'focus pull' and zoom are only used for special purposes such as a transition sequence or to see still images in extensive detail (43.3%, mostly utilised in Masters of Illusion).
In animation, similar trajectories are applied but often consistent without any changing of different camera viewpoints (see Pie Chart 64). However, 'focus pull' is not applied in any of the analysed animation perhaps because the difficulty to get different effects (focus and out of focus) at a time or the inexperience to see this potential shot.

Pie Chart 63: The use of Fixed Camera Station in architectural film and animation.
However, digital tours become a disease when recording begins. According to Stallon (1998) from RMJM, “architects need to have a certain level of animation understanding. A poor animation can do more damage than drawings which make the perspective so unreal. But having to know what are essential and key elements (e.g. comparative scale by showing people, car and tree) in animation will make the representation different from the other sequence.”

A lot of architects rush their productions by recording a continuous fly-through sequence as if they have captured a complete architectural event (e.g. Shanghai Railway Station animation and see Pie Chart 58). Unfortunately, this effort is not worthwhile because they actually miss a lot of things. For one, virtual camera freedoms are not used to get essential shots (e.g. long shot, medium shot and close up, refer to Tables 7, 8 and 9 in Chapter 2, p. 81 - 82).
Moreover, many of the surveyed architectural animations use lengthy shots to explain building spaces. Sequences were often established with camera movement and the subjects in the foreground framing are mostly established by chance on a quite fast walk-through or fly-through. In several long shots of Chen Lung Tien animation, a wide angle lens causes a 'flattening' effect in the perspective (similar to the New Ministry of Finance lobby sequence, Figure 20). The main features are no longer within the appropriate cinematic boundary, and such effects prevent the viewer from realising the quality of seeing a space.

![Figure 20: The lobby sequence in the New Ministry of Finance animation gives a 'flattening' effect (perspective distortion) when using a wide angle lens.](image)

Both animation experiments in the New Ministry of Finance and Damansara Parade sequences took longer to complete the rendering when dealing with lengthy shots especially the bird’s eye view shot and long shot which may take up to thirteen seconds per-frame to render. Many objects need to be rendered as the shots contain a large number of complex objects (i.e. trees, windows, reflections and shadows). Although most of the high angle lengthy shots give a better visualisation in relation to the subject context, this shot selection actually does not give the maximum visual interest. This is due to the fact that most objects will be in the distance and of small size (see Colour Plate 4).
However, most of the middle shots and close up shots only took five seconds on average although some of these images required a complex reflection and texture rendering. Here, the focal interest is better as our eye is attracted by the larger, more detailed, coloured and lit objects. This can be clearly seen in Figures 34, 35 and 36 of the *New Ministry of Finance* animation.

Thirdly, in general, a clear editing structure in the analysed architectural films gives a more definite understanding of the design information. A selection of important shots were linked with a transition shot or medium shot to form a consistent representation. These key shots were often enhanced with a composed background sound and narration.

Compared to animations, the analysed documentary films have a clear start, middle and end. In the first thirty seconds, the viewers’ attention is first grabbed by title effects (sometimes with high volume sound effects) and a clear explanation of the film. The viewers' attention is often focused with visual effects such as 'glittering' effects in *Masters of Illusion*. Each different segment in the main content sequence is followed by a clear fade (e.g. *The Architecture of Frank Lloyd Wright*). Conclusion sequences were often related to the introduction shot with simple title credits.

Several simple editing techniques were developed in architectural films leading to good results. At its simplest, a full shot sequence is often cut with the intermediate shot before the camera viewpoint changes into close up to prevent 'jump cuts' (refer to video clip 35). Sequences that need a certain continuity are smoothed by a dissolve effect. Visual consistency is achieved by filming the subject at the same camera angle (see Figures 41 and 43). Perhaps, in a more interesting way, Racina superimposed (dissolved) a computer walk-through of the market sequence with several close up shots showing the trading activities in *Les Envois de Marseille*.

In *Masters of Illusion*, the storyline is developed chronologically from the Early to High Renaissance showing how the masters create the perspective illusion in painting, fresco and wood veneer. Grigor applies the same story structure in *The Architecture of Frank Lloyd Wright*, but he enhances several building sequences with elements of the individual period (e.g. car). Here, a few important shots (especially close ups) in different angles to
reveal individual building details were selected. In many circumstances, four full shots on average are enough to locate the building with the site context (see Tables 7 and 8 in Chapter 2, p. 81 - 82). In a slightly different way, Racina 'chroma-keys' the computer images onto the real site as an approximate representation to strengthen the viewers' visual understanding as compared with the ruined buildings.

In contrast, the vast majority of architects ignore editing due to the fact most of the 'stand alone' animated sequences are too short, are of a mass model (minimal rendering) and concentrated on on-screen presentation (especially in the early stage of design). Apart from this, they rely on CAD packages which do not support editing (refer to Bar Chart 17 in Chapter 1, p. 48). Editing is normally considered on a large or special project (at the later design stage) if the clients use the animation for a proper presentation (public information and promotional). This is often presented in the form of video or CD-ROM documentary complete with high-end rendering, special effects, background sound and narration.

Design material and information are not being prepared with reference to editing, instead, many animations simply put together all the different shots and add background sound. Simple transition effects such as fade, dissolve and cut are not taken into consideration. Most animations were crammed in the form of continuous fly-through and walk-through which often miss important shots in a quite fast tempo even in close up shots. Some of the productions leave out the main title and none of them include the 'initial' title, thus misleading the viewers' understanding (see Bar Chart 38 and Pie Chart 31 in Chapter 3, p. 161) of the subject.

In film, the overall sequences are developed with sound. Apart from using a background sound (often composed), important shots are enhanced with sound effects (including natural sound) and narration.
In contrast, sound in architectural animation is not the main concern particularly if the digital sequences are developed in the early design stage and as on-screen representation. This is due to the fact that architects still in the process of developing the design within a limited budget and time (in some cases clients do not pay for this service, see Bar Chart 11 and Pie Chart 10 in Chapter 1, p. 36 - 37). Even in the later stage, with visualisation as the priority, sound is just added to avoid boredom in the form of background sound (Pie Chart 65).

Pie Chart 65: The use of sound in architectural film and animation.
4.3 ELEMENTS TO MAKE A SUCCESSFUL ARCHITECTURAL ANIMATION

As architectural animation is mainly influenced by the chosen design stage which requires a different level of detail to give a certain impact on the viewers, architects must ensure that each stage is carefully understood from the very beginning. However, there are some simple rules that should be carefully understood which can lead to a successful result and reduce the production time.

Firstly, architectural animations (especially buildings) are best developed using a natural viewpoint. These sequences should be kept simple as the result is often viewed by non-professionals. By using a standard lens, perspective distortions and other misinterpretation of visual forms can be avoided. Three-dimensional effects are often achieved when establishing a building shot from an angle with proper lighting.

Secondly, architects should minimise the use of continuous aerial view shots (fly-throughs) as it prolongs the rendering time and most objects are relatively small. Instead, building animation should be explored more on a ground level shot (particularly full shot) which has the potential to give the best result.

Thirdly, digital alteration is best avoided in any design stage as it vastly increases the production time. All animation material should be well-prepared during shooting before being finally developed in the post-production stage. Still images (without any motion object) should not be created in more than one single frame as non-linear editing is capable of producing faster frame repetition.

Models may be built separately (divided into a few segments) in an economical and efficient way (usually involved with more than one workstation). Having these general ideas, architects then can start to establish architectural shots in a few interesting ways.
Several elements based on the critical observation and understanding on the architects requirements (local practice survey), architectural-based film documentary (including the interview with the director) and architectural animation analysis may be defined. They include:

- Storyboard.
- Establishing Site Context.
- Designing the Cinematic Depth.
- Establishing Scale and Proportion.
- Architectural Detailing.
- Lighting.
- Visual Editing.
- Sound Editing.

### 4.3.1 Storyboard

Architects can start to develop an overview of the animation by sketching the important shots in a storyboard. It should be used as a routine process (either informal mechanism for internal purposes or client's preliminary presentation) in any design stage in order to ensure that the important shots are included in the production. This is vital when the animation is developed by more than one animator.

However, this should not be the only aid to see the full design potential and allow plenty of appropriate cutting options as key shot sketches on a fixed storyboard often do not give the exact camera viewpoint. Indeed, this inaccuracy may prolong the time spent in the overall production process.

Thus, to ensure the full design potentials are achieved, architects should also consider establishing animation shots during modelling. The production can be more efficient if the designers start with a preliminary or 'pilot' animation as it saves a lot of time as it has the capability of showing the full potential of the design. For this reason, a preliminary shot (ten to
fifteen frames of simple modelling) is perhaps the best way to get the result in a short time and may even be used as a fee benchmark (printed form or on-screen presentation) before starting to manipulate the high-end images.

### 4.3.2 Using Available Visual Material

Architectural information is often combined with other forms of visual material particularly when presenting buildings such as drawings, slides, physical model and 'real' on-site video clips. In animation, this element can be very effective if it is developed in a way that it enables the viewer to see and relate the changes between two different possibilities directly (e.g. existing to proposal or two-dimensional to three-dimensional). Visual material such as the 'chroma-key' of 'real' figure may even be re-used (superimposed) on other still (e.g. building section) sequence.

One of the simplest ways to develop animation using available form of visual material is by establishing still images such as drawings and sketches with 'real' or computer sequence at the same camera placement. In *The Architecture of Frank Lloyd Wright* and *Masters of Illusion* (Figure 22) documentaries, several building and painting sequences were established with the original drawings, especially Wright's designs of the Unity Temple (Figure 21 and clip 1) and Cheney House. Haxton develops several stills in *Sketches of Rome* and forms the storyline as each space starts with crude two-dimensional sketches develop to a series of walk-throughs and ends with similar sketches and point of view (refer to Figure 23 and clip 3).
Figure 21: Transformation shots of the Unity Temple.

Figure 22: Transformation shots of the Masters of Illusion introduction.
The design process sometimes requires an architect to further emphasise the development process, particularly when dealing with a large project. Thus, using the visual material the director can show the building construction in stages as Grigor did in the Guggenheim Museum sequence. He captures the sequence (by dissolving with photographs) through a hole with dark foreground framing to establish the circular form of Wright’s design (Figure 24 and clip 4).

However, representing a proposed building in computer animated sequence following this technique is difficult and may prolong the
production period as the animator is required to create each of the key stage models. An effective way to get similar effect can be achieved by implementing a 'strobing' technique as shown in the Campus 92 (Ex-Machina) and My Sweet Home (Figure 25, CGCG) animations. This effect smoothens the transformation of the subject.

![Figure 25: Transformation key shots of My Sweet Home animation.](image)

### 4.3.3 Establishing Site Context

Davison (1995), believes that "there is no better way of taking an establishing sequence of a town than looking down at it from a great height. Zooming down until it reaches the subject is best avoided as it makes observers feel they are falling." Thus, in this situation film directors suggest a cut into a ground level shot. For animation, a cost effective sequence to establish building context can be focused on still frame aerial view shot and cut to ground level shot.

Architects can use high angle shots when visualising building layouts and establishing the site context in relation to the subject. Because of the intensity of the subjects, it can be very effective if they use a slightly fast movement or intermediate pace as the film opens. (e.g. the introduction shot in The Architecture of Frank Lloyd Wright film documentary, clip 7).

Buildings in a big site are relatively small and difficult to focus on particularly in bird's eye view (see Colour Plate 4) and directors can easily lose the viewers' attention in a slow overall tempo. Therefore, by having a moving element with high colour contrast as in the New Ministry of Finance
animation footage, visual attention can be directed to view the location at a glance (clip 8).

Colour Plate 4: Having a moving element with high colour contrast (red car) can direct the viewer’s attention (the New Ministry of Finance animation).

Where buildings are more closely integrated with the site different types of shot may be more appropriate. For example, by tilting up the camera from a very low angle shot near the water stream, the director had established both the location (hill site) and the integration with nature in the Falling Water building sequence (Figure 26 and clip 9). In Les Envois de Marseille film, Racina composes several computer models (i.e. ‘predicted’ building) by ‘chroma-keying’ them on the real site in long shot such as viewed from the plantation (i.e. olive and vineyard) area (Figure 27 and clip 10).
Figure 26: A low angle shot establishes the location of Falling Water.

In a slightly different way, Sasada combines the computer animation with a ‘real’ in-flight shooting sequence to relate the airport situation (Figure 28 and clip 11).

Figure 27: A low angle shot establishes the main building of Les Envois de Marseille.

Figure 28: A full shot of a ‘real’ in-flight situation and a long shot an aeroplane can give a good visual impact of airport animation.
4.3.4 Designing the Cinematic Depth

Unlike real shooting, architectural animation often looks artificial as building compositions lack ‘real’ perspective effects (clip 14). Objects in the background can be as clear as in the foreground except for the size differences of the object in the film planes (see Figure 29).

![Figure 29: Architectural animation (right, the New Ministry of Finance) often looks artificial as building composition lack of ‘real’ perspective (left, City of Florence, Masters of Illusion).](image)

Although real perspective shows the differences in colour contrast and relative size, film illusion cannot depend on this. Thus, directors usually suggest a few simple composition exaggerations to ensure the difference is revealed, particularly by careful camerawork in relation to the object. According to research on Robert Mallet-Stevens by Vaillant (1997), “another way of showing depth is to locate an object in the foreground on which the eye can focus, to give the impression that the background is further away.”

This common technique is established in many of Grigor’s films particularly in *The Architecture of Frank Lloyd Wright*. For example, before cutting to a full shot of the Gale House, a long shot was established from one corner of the end terrace with a deep overhang in the foreground (dark shadow and more detail) to establish the site context (the background - neighbour houses) thus, enhances a ‘deep space’ composition (Figure 30 and clip 12).
In order to get a similar effect, some architects try to establish a high colour contrast on a few objects to differentiate the arrangement between foreground and background. In the *New Ministry of Finance* animation, as the lift doors in the foreground open, the background holds the viewers attention as the dark foreground object directs viewers attention to focus on the light and detail background (Figure 31). Although this may work in some animations, most of the architectural compositions do not work effectively as architectural objects do not always provide a very dark colour or extreme contrast as it naturally appears in real shooting.

For a true illusion, the foreground object needs a combination with 'fog' effects to give the utmost depth in building composition as it differentiates the object in each plane (see Colour Plates 5 and 6). This technique is experimentally applied in the *Damansara Parade* animation.

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Figure 30: In the Gale House, Grigor establishes a 'deep space' composition (left) to give depth before cut into a full shot (right).

Figure 31: High colour contrast between foreground and background objects in the *Ministry of Finance* animation sequence can draw viewers attention to the subject.
Colour Plate 5: Virtual representation without any ’fog’ effect makes cinematic planes look the same.

Colour Plate 6: A ’fog’ effect differentiates cinematic depth in virtual representation.
4.3.5 Establishing Scale and Proportion

Although the normal practice is to establish scale in the traditional perspective and still drawings, it is often forgotten when starting to manipulate the building in the motion-based representation. In the survey carried out with the local architectural practices and in the computer animation analysis, many of the animation stills and clips shown were not provided with enough visual reference (sometimes none) for the viewer to identify and compare building scale and proportion. In fact, most of the animation productions were concentrated on elements such as trees, car and furniture but not the human figure.

In contrast, architectural film (particularly 'real' shooting) associates human activities in the sequence to give a better understanding of building scale and proportion. As Vaillant (1997) sums up Robert Mallet-Stevens' composition development in many of his architectural films, "a crowd, hands up, before a plain wall is a very architectural scene and shows up the composition with scenery..." When filming the Johnson Wax Administration Building sequence, Grigor follows a human figure passing by the tube glasses (portrays the horizontal effect) and captures the activities in the great workroom from the balcony (Figure 32 and clip 17).
However, to get a similar effect in computer animation is complicated. At its simplest, a still human figure allows a positive understanding of relative size in the building set. This can be displayed as a combination of collage (i.e. ‘mapping’ technique) showing the people walking, sitting and viewing including trees, cars and furniture in the set but this method strictly effective on still images (Figure 33 and clip 18).

Figure 33: Sasada combines several human figure collages in the *Kansai International Airport* (Final) animation.
There are some programs (e.g. Irix Performer™) for animation that allow two-dimensional objects to follow the movement of the camera to maintain the three-dimensional illusion. In Damansara Parade simulation, trees along the main road (commercial area) and few human figures (the subterranean square and theatre) were developed to follow the camera axis (tracking or any path) in real-time (twenty five frames per second) either interactive or non-interactive (clip 19).

On the other hand, by establishing a 'real' figure or object in the virtual space, the comparative size becomes more realistic as the visual clue directly draws the viewer's attention (i.e. refer to statistic on Bar Chart 47 and Pie Chart 37 of Chen Lung Tien animation in Chapter 3, p. 180) and gives a closer approximation to reality. However, this method requires architects to develop the sequence with special professional camerawork in post-production.

For example, in the New Ministry of Finance animation, some internal spaces (i.e. main lobby, the finance office and reception) were shown with a 'live' picture shots in proportion to the set (clip 20). The special effect work was carried out in a professional shooting studio.

The live shooting basically involved a blue screen or background in order to establish the 'real' person as the subject. In this animation, it was almost eight metres high or a double volume of vertical blue facade, even to get the most close up shots (i.e. the finance office sequence). At the same time, additional blue lighting illuminates the studio floor close to the figure. This is to ensure that when 'chroma-keying' or imposing, only the subject will appear rather than the floor or other unnecessary elements (see Figures 34, 35 and 36).
Figure 34: 'Chroma-key' shot of the New Ministry of Finance main lobby.

Figure 35: 'Chroma-key' shot of the New Ministry of Finance office reception.
However, the 'live' picture shots in the studio limit movement in a small area and a fixed background. Action such as walking across from one point to another is difficult and involved colouring the entire studio blue. For this reason, capturing a 'live' picture of people in proportion to the background (i.e. computer image) requires a long shot. It took the entire studio distance of approximately twenty five metres. As a solution, a 'chroma-key' mixer frames the 'live' shot within an adequate range of movement.

Movement that was originally planned (a 'live' person imposed on a moving background) was eventually ignored. In fact, the virtual camera trajectory needed to be synchronised at the same tempo as the real camera and lighting. Moreover, the distance on screen differs from the real world mainly to suite the correct scale, proportion and depth of a space.

Perhaps, the ultimate effect with moving 'live' shot and camera is best shown in Chen Lung Tien animation as the director capture the activity (ritual) with different angles and camera movements (tracking and sideways, Figure 37 and clip 21).
4.3.6 Architectural Detailing

Detailing is one of the most important elements in architectural-based film. According to Grigor (1998), "how do you perceive a building? You walk into a building, look up and down to see details. So, I film these to get this approximate visit..."

From the analysis of architectural film and animation, architectural detailing was shown in several ways. Some building components were selected to explain the detail sequence in the form that the object can be seen larger, in extensive detail and clear colour contrast due to the fact that human vision is often attracted to these situations.

For example, Grigor establishes up to nine different close up shots of Hollyhock House sequences (Figure 38 and clip 22) in order to show Wright's detailing abstraction on the facade, parapet, colonnade and furniture design (derived from Barnsdall's favourite flower - the hollyhock). In the Chen Lung Tien animation, a selection of ornamental building structures such as columns and brackets were developed in the introduction and detail sequences using special effect techniques (e.g. particle effect) by lowering the camera (Figure 39 and clip 23).
Detailing was also established as a selected building area. In the Ennis House, the director chooses a camera track which passes the space by a column showing the quality of the space (living room) as well as the concrete pattern and natural lighting rays (in diagonal) through the windows (Figure 40 and 24). Similar to this effect, a slow pace of walk-through movement following the staircase in *ATOM* animation indicates the glass-block (in curve wall) and steel staircase as the selected materials (clip 25).
4.3.7 Lighting

Buildings are often designed with a lot of lighting consideration especially to illuminate the space (which sometimes may give an astonishing effect to the building form, clips 26 and 27). In animation, without careful lighting arrangements, three-dimensional objects may look flat. Therefore, rather than just concentrating on the basic lighting arrangement (e.g. three-point lighting), some film-makers and animators developed lighting effects as an illumination differences by shooting the subject in daytime and night time or a certain season.

Although lighting comparison does not usually developed in architectural film and animation (raised by Metzstein (1998) Chapter 2, p. 108) it can be very useful to enhance the effect on individual building and reveal building safety.

There are few film-makers who try to reveal the impact of real buildings within its surrounding by comparing them with different lighting. For example, in the Tonken House sequence (Figure 41 and clip 28), Grigor increases the film speed (frame per second) at the same camera angle to enable the viewers to see the lighting changes from daytime (i.e. natural lighting showing the 'coffered' block) to night time (artificial light penetrates through the in-between glasses). In the Ward Willits House, he
compares the still image (summer) to winter sequence in a full shot dissolve transition (Figure 42 and clip 29).

Figure 41: Key shots of the Tonken House showing the changes of different lighting effects.

Figure 42: Key shots of the Ward Willits House showing the changes of different seasons.

Sasada applies this technique in one of *Banju Port Renaissance Plan* animation sequences as the pavilion is compared at two different times (see Figure 43 and clip 30).
4.3.8 Visual Editing

Architects must edit their motion-based representation to get a successful result especially when the motion-based representation is developed for public and promotional presentation. Thus, the first impression of the edited sequence is vital. In general, the overall quality should be sufficient to give clear information without any obvious defects such as frame drop-outs and graphic distortion.

However, before starting to build up the sequence, it is good for the architects to prepare a rough cut (outline of the overall sequence). A longer storyline may need an edit decision list or 'EDL' (general numbering and explanation of each shot) for efficient cross-referencing to find the right footage.

Architects should also benefit from non-linear editing especially to develop fast graphic indication and sequence manipulation in separate channels with minimal generation loss. Viewer's attention may be grabbed with a simple title effect (often available on the editing software, clips 31 and 32) and credit. Frame repetition can be used to form a clear pause when changing sequence into different viewpoints. Film speed can be increased (or reverse) quickly but does not work well in slow motion as it appears 'jerky'.
The overall sequence should be maintained at a consistent pace by balancing slow, intermediate and fast movement. This can prevent the monotonous effect (as well as reducing the production time) that usually exists in most architectural animation. Pauses must be established before switching into a different viewpoint particularly when the camera moves and turns to view the space in a fixed position.

Architects can utilise the first thirty seconds of the sequence to hold the viewers' attention with a simple manipulation of a graphic introduction. Information such as the opening title, main segments and credits is better justified using a simple black and white representation. Viewers often find easier to understand if the end sequence is developed the same way to the introduction shot. Perhaps a lengthy shot (e.g. aerial view, long shot or full shot) is sufficient to give an overview of the building within its surroundings.

As most architectural animation consists of several different graphic representations such as a diagrammatic layout of building structures and services, 'real' shooting construction methods and charts, architects need a systematic way to clarify this information. An 'initial' title for each sequence is one effective method to give the viewers a point of reference as shown in the video submission.

The viewers perception must be controlled and held by the editing structure. The main sequence should be selected first on the basis of camera potential viewpoint and movement to allow a strong viewing track or navigation before introducing any complicated movement or detail shot.

Thus, a continuous fly-through or zoom from start to finish is not a solution to get a consistent tracking. High angle shot is often cut to ground level shot before continuing the building experience and saves a lot of time (especially when changing from long to medium shot and close-up). Dissolve transitions can be used to get a smooth flow of sequence when linking with other sequences.
There are several simple effective tasks that architects can develop in their sequence through editing rather than wasting time rendering or manipulating in the production stage. Several edited sequences in the New Ministry of Finance and Damansara Parade animation (developed entirely on a Media 100® xs (Data Translation®) non-linear edit suite) are as below:

- **Slow Motion.** Slowing the sequence tempo in edit suite (either linear or non-linear platform) makes the sequence 'jerky' due to the obvious interlace sequence gap. Thus, architects must double the frames to get a smooth animated sequence (clip 33).

- **'Chroma-key'.** Using the 'chroma-key' effect on a moving background is difficult as studio lighting, scale and camera path requires an exact timing with the virtual movement in the set. Imposing the 'real shot' (simple movement) on a still background makes the post-production work a lot easier thus reducing the production time (clip 34).

- **Cut.** A sequence showing a drastic change is called a 'jump-cut'. This can be overcome by smoothing the joint between intermediate shots and close up shots by dissolving (Figure 44).
Figure 44: A dissolve effect can be used to create a smooth transition when joining two different shots (Damansara Parade experiments).

- **Visual Clues.** The cylindrical building gives a better sense of visual continuity by far compared with the commercial area entrance (clip 36).

- **Pan.** When joining a link sequence of the cylindrical building at high angle shot with the courtyard sequence (i.e. content strip), the original panning contradicted the overall movement direction. As a solution, a reverse pan is introduced capturing the courtyard from left to right (clip 37).

- **Camera Movement.** Pausing for a few seconds confirms the viewers orientation clearly before the camera changes the viewpoint. In fact, the slower the sequence the longer the frame is frozen (clip 38).

- **Speed.** The original speed, particularly in long shots, looked monotonous when putting other images together. In order to differentiate between sequences and avoid audience loss of attention, the speed of long shots was increased appropriately (clip 39).
• **Editing Platform.** Obviously, editing in linear suite damages the visual representation as generation loss is shown in depth illusion, colour and crude of vertical or horizontal planes. Conversely, visual distortion is minimal when editing in non-linear suite (clip 40).

### 4.3.9 Sound Editing

Sound is another form of human sense used to recognise objects. In general, film sound is normally developed separately from the visual information in the post-production stage through recording, re-recording, editing and mixing.

However, the use of sound in architectural animation is difficult especially with the inexperience to combine with the visual footage as the cost to include narration, a composed sound or even the background sound is high (refer to Computer Animation Cost in Chapter 1, p. 66-67). A lot of architectural animations are often developed with a background sound (or without sound) to avoid boredom and with a minimal consideration of sound copyright.

Thus, in order to keep animation within budget there are some simple rules that architects can consider before making sound decision.

In the early stage of animation, sound might be best avoided as the visual footage itself is in the process of development. This may work effectively even at a later design stage if the animation is explained by the presenter with a combination of other visual aids (physical model, slides and drawings).

However, if the architects have the intention to develop the animation as a piece of motion-based representation medium (e.g. video for promotional purposes or public presentation), sound must be creatively used. The animated sequence should not just be edited with a single background sound (as many background sound contradicts with the visual footage). Instead, the overall sequence should be synchronised in a combination of sound effects, narration or a few different background
sounds. A different reverberation time of sound may portray the quality of the space between double and single volume. Elements that are used to indicate building proportion become more distinct with the appropriate sound effects to give mood and identity to the building.

The most basic level of aural application is to include a natural background sound (perhaps recording the 'real' sound on the site, clips 47, 48 and 49). This sound can be developed using the sound software especially to give a better quality (e.g. reducing the sound harsh). Alternatively, architects can avoid the copyright difficulties by concentrating on a copyright free music. For example, in the Damansara Parade animation two of the copyrights free background music (i.e. AVP Copyright Free Music Library) are used to differentiate between external and internal sequence (theatre) as shown in clip 42.

In film, background sound is often composed at a different level of pitch. Important subjects might be enhanced with a high pitch to direct the viewers to focus on the visual representation. For example, in one of the sequences of Masters of Illusion, the director synchronises the classical background sound in the close up shot before fading the sound as the camera ends the zoom out to get the full shot of the Florence Baptistery (east door) as shown in clip 43. On the other hand, in Chen Lung Tien animation, a fast fly-through cut sequence from internal to external space and the appearance of the statue of Buddha (Figure 45) and 'bracket' detailings (dragon-like, Figure 39) was enhanced by using the Chinese background sound (see clip 44).
Filming existing building has the advantage to record ‘real’ sound but can be very difficult in computer animation as most of them are building representation (not being built or perhaps a ‘predicted’ form). Therefore, apart from recording ‘real’ sound on building that gives similar effects (e.g. to enhance the material and volume) the architects can use sound software such as SoundEdit 16™ (Macromedia®) which often support simple sound effects (e.g. moving car, water, foot steps and other activities).

Several good examples of the use of natural sound effects in film is shown *The Architecture of Frank Lloyd Wright’s* as Grigor adds the sound effects of children playing (in Frank Lloyd Wright’s own home, Oak Park) when presenting the architect’s playroom. Harper holds the viewers’ attention in the introduction sequence with a high pitch sound effect as the starship enters the cinematic frame (clip 45).

In the *New Ministry of Finance* animation, two sound effects (from SoundEdit 16™, Macromedia®) were added particularly to show a moving car (entering in a fixed frame shot) and the water fountains on the main promenade (see clip 46). But, perhaps the most interesting example is shown in *Les Envois de Marseille* market sequence. The director includes the sound effects of trading activities when interposed consistently (i.e. dissolve) with close up and walk-through along the market place (see clip 49).
Above all, in a more developed way (public presentation and television documentary), directors often suggest a narration (prepared with a script and placed in a dialogue track) either with voice-over or the presenter particularly to describe and enhance the sequence. According to Grigor (1998), “I think to really film a good space must be followed by a good acoustic of sound (the original sound of the building). But, main stream television finds it hard to do and accept that. Most viewers will obviously expect sound by means of voice-over, sound effects or a presenter to explain the sequence.”

One of the sequences in Masters of Illusion with voice-over script is explained as below (clip 50):

On Screen: Camera tilts up focusing the painted ceiling by Mantegna in full shot and pause at the highest viewpoint (Figure 46).

Narration: In the ducal palace in Mantua, Mantegna was commissioned to create a small feeling. He used the opportunity to create another striking viewpoint. But this time for a less serious purpose.
Figure 46: Camera tilts up focusing the painted ceiling by Mantegna in full shot and pause at the highest viewpoint (below right).

On screen: Sequence cut to medium shot focusing on the striking viewpoint and camera turn (rotate) in slow tempo before cut to close up shot (Figure 47).

Narration: The characters in the painting look down on us as if they are the ones that are enjoying the view. They become spectators, we become the observed.

Figure 47: A sequence is cut to a close up shot of the ceiling of the Mantua’s Palace.
However, the computer-generated sequence (‘stand alone’) with narration is explained in the British Pavilion animation, Seville Expo 1992 (clip 51).

In the Carlo Scarpa film documentary, the presenter (architect - Richard Murphy) brought the viewers to explore several Scarpa’s buildings. On the other hand, Harper uses the narrator’s figure as a direct comparison on several occasions particularly when explaining the earlier painting (two-dimensional - flat look) and light and shadow (refer to clip 52 and Figure 48). For animation, perhaps the best example is shown in ATOM animation as the voice of the presenter (‘chroma-key’ figure) is echoed to enhance the double volume effect in the reception area (see clip 53 and Figure 49).

Figure 48: James Burke’s figure is used as a direct comparison in Masters of Illusion (left, two-dimensional - flat look and right, light and shadow)

Figure 49: The voice of the presenter (‘chroma key’) in ATOM animation is echoed to enhance the double volume of the main entrance.
chapter 5

conclusion
5.1 INTRODUCTION

Chapter 5 concludes the thesis by having a checklist of the elements to make a successful architectural animation as discussed in Chapter 4 and suggesting the future developments in this visualisation field.

5.2 A CHECKLIST OF ELEMENTS TO MAKE A SUCCESSFUL ARCHITECTURAL ANIMATION

Storyboard.
- to ensure all important shots are included in the production.

Shots may be developed with a consideration of the 'rule of third' in the form of:

1. informal sketches.
2. formal sketches:
   - 5 x 3 inches card.
   - preliminary animation (10 to 15 frames per second of mass model).
   - printed out from the preliminary animation.
3. establishing shot during modelling (mass model).
Use the storyboard as a fee benchmark.

Using Available Visual Material.
- to enhance the motion-based representation understanding.

Make full use of available visual materials by:

1. outlining the potential shots which may be taken from:
   - computer sequence.
   - sketches.
   - drawings.
   - photographs.
   - physical models.
   - diagrams.
   - slides.
   - 'real' footage (building site).
2. suggesting a direct comparison of the sequence by:
   • establishing shot at the same camera angle.
   • superimposing the selected visual material.
   • developing 'strobing' effect for quick result.
3. re-using the visual material:
   • early proposal to new proposal sequence.
   • footage (e.g. 'chroma-key') may be superimposed on still.

Establishing Site Context.
• to give a clear building indication in relation to its surrounding.

Large area may require:
1. high angle shot or aerial view shot with a consideration of:
   • moving elements with high colour contrast to draw viewer's attention.
   • cutting to a ground level shot.
   • intermediate or fast tempo.

Where building are closely integrated to the site:
1. use a full shot in the form of:
   • a fixed frame shot:
     • e.g. 'chroma-keying' the proposal on 'real' site footage.
     • a fixed camera station especially pan and tilt.

Combining animation with 'real' video clips as a multimedia representation.

Designing the Cinematic Depth.
• to enhance the illusion of depth in cinematic space (in relation to 'real' perspective effect).

This is achievable by:
1. suggesting a clear depth of field by:
   • establishing the subject with a clear foreground object such as:
     • looking through a window or balcony.
     • foreground framing.
   • establishing a high or dark colour contrast between foreground and background objects (often difficult to develop in a complex setting).
2. developing the images with 'fog' effects resulting in doubling of the rendering time (essential for lengthy shots):
   • to reduce the rendering time:
conclusion

- minimise moving lengthy shot (especially aerial view shot).
- concentrate on bigger shots or lower the high angle shot.

Establishing Scale and Proportion.
- to give a positive understanding of building scale and proportion. This is achievable by:
  1. referring to the traditional perspectives and drawings.
  2. suggesting important elements to give a relative size in the building set by:
     - establishing human activities:
       - photo montage (collage) of human activities (e.g. sitting, walking), effective on still footage.
       - developing the photo-montage using special software that allows the following of the camera movement.
       - 'chroma-keying' real object (human figure) on animation (high cost):
         - before developing the 'chroma key':
           - set the animation budget.
           - establish the number of persons and spaces to 'chroma-key'.
           - use more full shot, medium shot to minimise the blue screen area.
           - consult professional expertise to avoid digital alteration.
         - to reduce the cost:
           - 'chroma-key' the 'real' subject:
             - in a fixed frame shot.
             - with minimal movement in a still background.
         - to maintain the visual navigation on different shot:
           - cut the shot using the same 'real' figure.
         - to get the ultimate effect:
           - 'chroma-key' the 'real' people with activities (e.g. walking, with footstep sound and sitting) in a moving camera path.
Architectural Detailing.

- to show special building features in detail, especially those that can give the character or identity of the building.
- important at later design stage to make fast and positive decision.

An effective architectural animation detailing can be achieved by:

1. considering the normal way of visual interest:
   - establishing more close up shots with high end rendering with enough detail:
     - photo-realistic effects (e.g. with reflection and texture mapping).
     - special lighting effects.
   - developing as still images.

2. considering a consistent visual link especially when cutting from different shots (full shot to close up) by having:
   - a medium shot.
   - a potential object for visual recognition.

3. shooting from an angle to reveal three-dimensional effects.

4. justifying the detailing to be represented:
   - specific objects may be:
     - shot at few different angles.
     - superimposed (dissolve) with visual elements to establish a direct relationship.
     - developed as a 'particle' effect.
   - selected spaces may be:
     - established by moving the camera in a diagonal or curve movement.

Lighting.

- use to enhance the basic form of building form, colour and texture.

Lighting for general purposes:

1. concentrated as a single environment.
2. developed in the early design stage.

Lighting for special purposes can be developed:

1. to enhance the use of natural lighting:
   - showing the lighting path in a day.
   - increasing the speed of the 'real' footage.
   - showing in different time and season.
2. to establish the building safety:
   • highlighting the possibilities area.

3. to consider lighting comparison:
   • shooting at the same camera angle.
   • using a fixed frame shot.
   • tracking the camera towards the subjects from a clear pause.

Visual Editing.
   • use to develop the motion-based footage into a well-told story.
   This is achievable by:
   1. outlining the important shots which may come from:
      • the architects point-of-view.
      • the client’s requirement (e.g. space to be visualised).
   2. suggesting a theme or storyline in consideration of:
      • planning to grab the viewer’s attention in the first ‘thirty seconds’.
      • balancing slow, intermediate and fast sequence.
      • outlining potential visual clue with:
         • colour contrast.
         • object movement.
         • building features.
      • linear structure (simple structure).
      • documentary-based.
   3. maintaining the professional look with:
      • minimal quality loses.
      • basic graphic indication:
         • title and credits.
         • ‘initial’ title especially when combining with other visual representations (e.g. charts and building layouts).

Systematic and efficient editing may require:
   1. a rough cut.
   2. numbering and naming the sequence in Edit Decision List (EDL) for longer footage.
   3. time code for exact editing point when cross-referencing.
   4. a non-linear editing platform in consideration of:
      • avoiding digital alteration.
      • editing based on the rough cut.
• knowing the available facilities (hardware and software).
• avoiding ‘jump cut’ and slow motion.
• shortening the production time by:
  • having a higher RAM and large storage.
  • presenting on-screen with small screen size before finally distributed.
  • developing frame repetition where applicable:
    • still images.
    • longer pause.
• increasing the sequence speed.
• editing transition (e.g., cut, fade, wipe and dissolve).
• reversing sequence.
Vital at a later design stage as:
  1. to decide the proposed medium (in reference to the cost, requirement and capability to communicate the audience).
  2. public presentation.
  3. promotional purposes.

**Sound Editing.**
• to enhance the important subject and the overall visual footage.
Sound may not be required on certain circumstances:
  1. at the early stage of on-screen presentation.
  2. at the later stage animation if it is explained by the presenter.
If using sound, it should be developed properly by:
  1. avoiding non-selective single background sound.
  2. using different background sounds to:
    • differentiate space.
Budget sound can be focused on:
  1. recording natural sound effects:
    • from ‘real’ site.
    • from building or space that give similar sound effects:
      • footsteps.
      • crowds.
      • human activities.
      • natural sound effects.
      • building echo.
• may require sound re-touching:
  • to reduce sound harsh.

2. using copyright free sound tracks often available in:
  • sound software.
  • production house.

If animation is developed as a short documentary, cost should be allocated more on:

1. narration (ideally professional voice-over or presenter).
2. hiring a sound studio.
3. sound effects to enhance the visual object and to draw viewer’s attention.
4. composing a background sound suitable to the visual footage.

5.3 FUTURE DEVELOPMENT

Digital animation is still expensive. Apart from the time spent and image and sound quality, every frame will be counted for professional charges. The longer sequences usually cost more. Sticking straight to the point of the representation helps an architect to reduce recording duration to within the client budget. Repeated sequences, less important or unnecessary images are best avoided.

Thus, the computer-based animation in the field of architecture is more than just a manipulation of the design images or building models using a few different paths, transferred onto videotape with background sound to form a well-told story. In fact, before the architects create any motion-based representation, they must first understand the design stage (as well as their participants) at which they develop the animation as it proven to give a different level of input requirement and impact to the viewers.

Since architectural animation is part of the motion-based communication medium, architects must critically observe the present recording art, particularly film and television productions which in many cases have shown successful results to communicate information. As Simmonds (1998) from Page and Park Architects says, “most of the key
information to produce a good animation can be seen on TV, thus, by critically understand the sequence, architects will know where to cut their animation. " Certain cinematic standards and features that dominate the human experience and perception when watching the sequence should be taken into account when producing the architectural animation.

Obviously, the 'professional' look must be maintained by means of the quality of the motion-based material and how these materials are developed and put together to form a very effective piece of recording art. At its simplest, architects must ensure that their motion-based information have a clear start, middle and end. As well as knowing the aim of the representation, the viewer's interest is important to be considered.

Therefore, the process that this research has developed particularly in understanding the reality of motion-based representation (particularly animation) in architectural practices, analysing critically the architectural-based documentary films and recent animations can be very useful in the future when moving into interactive media.

Although most interactive media (particularly virtual worlds) allow viewers to move almost everywhere, in certain circumstances, it might be useful if architects can ensure that the participants' navigation has the option to visualise the space in reference to the non-interactive quality (i.e. getting the best shot to explain the space or building and tempo control between long shot and close up). Most importantly this technique can help the viewers to recall the virtual information or decide the next movement in reference to this key information. As Kelman (1998) from Building Design Partnership (BDP) explains, “although many software designers try to push their interactive product (especially virtual reality), we don't see the point of giving the freedom to the clients to move and navigate themselves mainly because the clients did not know the design well enough.”

Architects can implement this process into a more specific and widely available interactive medium which is the multimedia and web pages design. Film-making techniques and shot selections can transform architectural representation into a keener interest. The way the viewer's attention is held through creative shots (i.e. camera and subject movements, colour contrast,
foreground framing, cinematic openings and sound effects) can be enhanced in this interactive medium. As Grigor (1998) summarises, “future motion-based representation is more likely to be interactive due to the fact that it capable to allow variable sequence controls. You can click, pause, control the speed, turn off or on the sound (sound effects from the building or narration) and view at various angles. Most importantly, it caters all participants.”

Indeed, in the future, this thesis might be developed in the form of multimedia source of information for architects to create a successful motion-based representation specifically the architectural animation. The key cinematography features and sequence preparations such as the camera positions and lenses, special effects lighting, and post-production effects (i.e. the use of editing transitions - such as cut, fade, wipe and dissolve) can be explored and visualised instantly and interactively.

Architects should benefit from the traditional film-making production (e.g. cinematography) and post-production (e.g. editing) techniques to get the right skill to manipulate, produce and present a better design communication towards a better visualisation business of the motion-based representations. The basic in-house computer-aided design (CAD) tools by means of hardware and software are not supposed to be the ultimate representation aid. Instead, it should act as part of the motion-based contributions.

Future computer-based architectural animation may branch out largely from the film skills and knowledge as part of the building professional interest (also raised by Archer (1998) from Cooper Cromar Associates, refer to Chapter 1, p. 29). The success or failure will mostly depend on the architects' competent using this skill to produce and manipulate the best selection of shots with the correct integrated motion-based facilities to fulfil the needs in the design field for the next millennium.
bibliography


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## APPENDIX 1  ARCHITECTURAL PRACTICE SURVEY

<table>
<thead>
<tr>
<th>NO</th>
<th>LIST OF ARCHITECTURAL PRACTICES</th>
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<tbody>
<tr>
<td>1</td>
<td>Building Design Partnership (BDP)</td>
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<tr>
<td>2</td>
<td>Cooper Cromar Associates</td>
</tr>
<tr>
<td>3</td>
<td>Fraser Brown Partnership</td>
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<tr>
<td>4</td>
<td>Geoffrey Reid Associates</td>
</tr>
<tr>
<td>5</td>
<td>HLM Architects</td>
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<tr>
<td>6</td>
<td>Kaleidoscopic</td>
</tr>
<tr>
<td>7</td>
<td>Keppie Design</td>
</tr>
<tr>
<td>8</td>
<td>Maclachlan Monaghan Architects</td>
</tr>
<tr>
<td>9</td>
<td>Page and Park</td>
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<tr>
<td>10</td>
<td>RMJM</td>
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<tr>
<td>11</td>
<td>The Miller Partnership</td>
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<td>12</td>
<td>The Parr Partnership</td>
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<tr>
<td>13</td>
<td>Vernon Monaghan Architects</td>
</tr>
</tbody>
</table>

Table 19: List of surveyed architectural practice of the Glasgow Institute of Architects.
## SURVEY 1

<table>
<thead>
<tr>
<th>BUILDING DESIGN PARTNERSHIP</th>
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<tbody>
<tr>
<td>5 Blythwood Square, Glasgow G2 4AD</td>
</tr>
<tr>
<td>tel.: 0141 226 5291  fax: 0141 221 0720</td>
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<th>Interview date and time</th>
<th>Thursday 8 Jan. 98, 10.30 am. (1 hour)</th>
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<tr>
<td>Person interviewed</td>
<td>Mr. Don Kelman.</td>
</tr>
<tr>
<td>Size of firm / classification</td>
<td>Large.</td>
</tr>
<tr>
<td>Staff</td>
<td>architects: 65, total staff: 80</td>
</tr>
<tr>
<td>No of animations produced</td>
<td>more than 20, (recent animations 5)</td>
</tr>
<tr>
<td></td>
<td>commercial and retail, office, leisure (not for housing).</td>
</tr>
</tbody>
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### GENERAL INFORMATION

1. **At what stage do you start to use computer animation and why?**

   Generally this firm uses animation in all projects. A lot of the animations were applied from the very beginning of the design process (feasibility / inception - stage A, B, C up to the design and presentation stage).

   These animations were developed mainly to be presented to the client and other related parties so that the design communication becomes easier between the architects and the parties involved. Some of the animation was also designed for commercial mainly for the client purposes.

2. **How are they used?**

   The animations were generally used for building visualisation, planning submission, TV commercial as well as for the client presentation to address their project proposal (visualised in CD-ROM format).

   **Original source?**

   Usually being developed from other CAD data, but seldom built separately.
3. What does the client use the computer animation for?
   To present to their related parties and to get funding (e.g. the millennium commission project).

4. Is computer animation part of the architectural service?
   No. Most of the time the clients have to pay extra, but seldom the animation is included as part of the service.

5. In what way do you think that computer animation helps?
   It is easier to present the building animation to the client in the format that they can understand. This will benefit them to be able to see the problem and potential from certain viewpoint which seems to be difficult to be understood as shown in drawings (2D).

6. How might computer animation in the field of architecture develop?
   Concerning VR, the architects are sceptical. The present quality of VR is still too poor for the client to understand architectural design. The rendering is very crude and minimal (photo-realistic) due to the fact that interactivity is involved in dealing with the very large files. Although many software designers try to push their interactive product (especially virtual reality), we don’t see the point of giving the freedom to the clients to move and navigate themselves mainly because the clients did not know the design well enough. The architect feels that the present CAD system still required a major development to produce a better architectural-based animation.

**PRE-PRODUCTION**

7. Do you have any guideline to refer to before producing the computer animation?
   Not film-making. It depends on the building and something that the architects prefer to get control of. For example, in the railway design animation the architects proposed a walk-through sequence to show the passenger flow rather than a fly-through (which is not applicable). In contrast, the aerial view shot can help them and the client to understand the design when suggesting the site context.
8. Does the computer animation have a storyboard?

Yes, but an informal storyboard. Instead of sketches on paper, the architects suggest to develop the important shots straight on screen. This process sometimes required them to print out the model (crude rendering), a few key shots, to discuss with the client before further animation work can be carried out. But in most cases, the architects create a few 'pilot' animations at ten frames per seconds and show them to the client on the quarter size of the screen. Being shown this preliminary animation, the clients will know what they would expect to see in the design. At some point, the architects will suggest to the client to stop and fix the animation sequence. After finalising the preliminary animation there will be no further changes and they'll come to an agreement before the architects prepare to develop the final product.

9. How long does it takes to produce the storyboard before it is finalised?

Depends on allocation period.

10. Is there any agreement of fee and content on the basis of storyboard?

No. However, the architects will decide to propose the animation which is sometimes required by the client. The animation charges will be based on the 'fixed fee' basis agreed between the architects and the clients.

11. Do the clients usually require a storyboard before making the computer animation?

No. All of the sequence will be pointed out by the architects to the client for further decision either in the form of key shots print out or pilot animation.

12. If YES, does the storyboard influence the animation project from the client?

Yes, particularly on the pilot animation.

13. What is your opinion in having a key guideline before producing computer animation?

In all animations what is really important is that the client is well aware and informed on what the animation is all about. It is important for the architects to pin down from the very beginning stage what sequence will be presented and to obtain agreement
between both parties (the architects and clients) to avoid any major re-modelling or changes of the design which obviously require a vast amount of time and money.

14. **Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?**
   Yes. There are a lot of skills in film-making that architects don’t have. What's really happen in the practice is that most animation development is in the process of try and error to get the best shot.

**PRODUCTION**

15. **Who does the computer animation?**
   Three architects.

16. **Did you have any background knowledge before producing computer animation?**
   Most of the animators were purely architectural-based trained.

17. **What type of software and hardware are used to create the computer animation?**
   **Hardware:** PC.
   **Software:** Microstation (CAD modelling) and 3D Studio (rendering and animatio).
   The architects prefer to develop the animation straight in 3D Studio rather than transferring files from Microstaion via dxf. because it causes a lot of problems (limited polygons, some items from Microstation can't be read by 3D Studio files).

18. **How many computers are used to produce the computer animation and how many are used by the architectural staff?**
   Three workstations. Animation projects will be developed only by the three animators. Although each architect was supplied with a computer, most of them don’t have the time to explore animation because of the high work load.

19. **To what extent do you go to produce the computer animation?**
   Relying just on the CAD software that is available in the company.
20. How much detail would go into producing the computer animation?

Most of the animation developed were established with site context and seldom without showing the surroundings. The architects usually show building external and general exterior with interior modelling. The decision will be carried out as soon as the architects and the client are satisfied. In the past, the architects had tried experimenting with photo-realistic rendering by means of texture and a high-end photographic resolution.

The architects have decided to concentrate onto a more reasonable resolution which would satisfy the clients and other related parties. Obviously, the architects don't have the expertise, software and hardware and time to spend with spend up to this top-notch level - 'Disney-kind' of movie. The architects do not want their clients to think that they are looking at the real product images through the animated sequence. On the other hand, the architects try to make sure their clients understand and can visualise the building as a computer-generated 'model'.

Considering that the animation is developed during the feasibility stage (i.e. stage A, B and C), the clients can't expect them to put a lot of information especially material selection because the designers themselves are still in the process of developing design ideas.

**POST-PRODUCTION**

21. Do you edit your computer animation?

No. The architects usually depends on the decision of the pilot animation. However, editing will only be carried out if the architect and client agree on a hard copy as the final product (i.e. video).

22. Who usually deals with the post-production part of the computer animation (editing)?

All of the production will be produced in-house. The firm will send their raw material to a service bureau (production house) which deals with editing and putting in all the necessary information for presentation and promotion.
23. Why do you prefer in-house production?
   The architects obviously will understand the building better, therefore they should be the director and editor to ensure the clients get the best result out of it. The firm has had the experience of getting a bad result when sending out to other production house. Building areas and clips which were supposed to be addressed were missing and obscured by other less important objects and wrong camera trajectory. Moreover, the animator and editor are not architect. As a result, the overall animation lost out control by the architects when presenting to the client.

24. How long do you spend to complete the computer animation?
   This depends on the prepared time scale along the process of design. The longer the time scale given the greater the animation developed. In general the total production time is approximately one month.

25. Why do you send out to the production house to produce the computer animation?
   No equipment or expertise.

26. Are you satisfied with the end product?
   Sending the animation for editing or rendering is good in the sense that they have the post-production facility and expertise. However, the architects need to re-model and reduce the animated object occasionally because the building files were too large to be completed by the production house.

27. How many consultations are required before getting the end product?
   One to two meetings are set up on last minute decision basis.

28. How long do they spend to complete the computer animation?
   Less than a week.

29. Is it costly?
   £2000.00 maximum for editing only.
30. In what format do you present the computer animation?
   
   Many animations were presented on screen. A few were produced in the form of video and multimedia (QTVR and CD-ROM) representation. The format usually was decided by the client.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   
   In general most of the animation that was suggested by the architects satisfied the client. The only concern is when the animation is sent out to other production houses which are beyond the architect’s control of the suggested sequence, although discussion has been carried out before developing the animation.

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### SURVEY 2

**COOPER CROMAR ASSOCIATES**

457 Sauchiehall Street, Glasgow G2 3LG.

tel.: 0141 332 2570     fax: 0141 332 2580

| Interview date and time       | Thursday 8 Jan. 98, 3.00 pm.  
|                               | (40 minutes).                  |
| Person interviewed            | Mr. Jim Archer.                |
| Size of firm / classification | Medium.                        |
| Staff                        | architects: 15                 |
|                             | total staff: 35                |
| No of animations produced    | 3                              |
|                             | 2 commercials and 1 retail.     |

---

### GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   
   Inception and design stage. For the client to understand because most clients can’t interpret design through drawings.

2. How are they used?
   
   The architects ignored the simple and crude mass model when presenting to the client simply because they like to see the animation which resembles several building details (material used) in the early stage. Mass model animation was only used by the architects
when developing the design. Most animations were required for design communication and competition purposes by the client.

Original source?
Being developed from other CAD data.

3. What does the client use the computer animation for?
The client would like to see what their building looks like before being built. This is for funding.

4. Is computer animation part of the architectural service?
Yes, if the client or other parties ask the architects to model and animate the specific designed building, an extra fee is charged.

5. In what way do you think that computer animation helps?
Animation helps visualisation in design process, to impress the client and as an ‘eye catching’ technology to win a competition.

6. How might computer animation in the field of architecture develop?
The architect feels that computer animation is minimally utilised in architectural practice due to limited time and practice. A good animation cannot be achieved unless the architects choose animation as a speciality since it is not a continuous task that many architects do as they often forget the process of developing the sequence.

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
No. But the architects will suggest what is best for the client to visualise in reference to the client requirements. This may involve a fly-through, walk-through and camera movements passing by the building elevation and entrance.

8. Does the computer animation have a storyboard?
No. Basically the architect will suggest a few important sequences.
10. Is there any agreement of fee and content on the basis of storyboard?
No. The fee is charged based on the fixed agreement between the architects and the client on the duration of the animation with a reasonable quality.

11. Do the clients usually require a storyboard before making the computer animation?
No. All decisions are based on the sequence suggested by the architects.

13. What is your opinion in having a key guideline before producing computer animation?
Not important due to the fact that architects only concentrate on modelling and animating the building whereas all editing process and film-making development is done by post-production experts.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
Yes only if the architects concentrate on the key understanding of film-making. Certainly not useful for in-depth film knowledge simply because it does not relate much to architecture.

PRODUCTION

15. Who does the computer animation?
One architect and two architectural technicians.

16. Did you have any background knowledge before producing computer animation?
The animators have an architectural background.

17. What type of software and hardware are used to create the computer animation?
Hardware: PC.
Software: AutoCAD (modelling) and 3D Studio Max (rendering and animation).
18. How many computers are used to produce the computer animation and how many are used by the architectural staff?

Two workstations. None. Out of fifteen, six architects use computer and the rest prefer manual drawing and administration.

19. To what extent do you go to produce the computer animation?

Relying just on the CAD software that is available in the company with a very minimal plug-in application because the software does not incorporate with the design needs. Narration and background sound will only be added later in the post-production by the production house.

20. How much detail would go into producing the computer animation?

All animations created were with site context and scale reference (people and trees) shown in building exterior. The site context in Glasgow City centre is developed from ABACUS - University of Strathclyde. No interior has ever been made. The architects only concentrated on a reasonable rendering and the selected area or sequence to save time.

POST-PRODUCTION

21. Do you edit your computer animation?

No, if the presentation is on screen.
Yes, if the final format is video and multimedia (CD-ROM).

22. Who usually deals with the post-production part of the computer animation (editing)?

A production house.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?

The architects have more control if design changes are required and it obviously reduces the overall cost.
24. How long do you spend to complete the computer animation?
   Two to three weeks. For a higher fee the architects may extend into greater detail.

IF SENT TO THE PRODUCTION HOUSE

25. Why do you send out to the production house to produce the computer animation?
   Mainly because the architects have no time to spend on animation. For editing, they don't have the equipment or expertise and they feel that this is not necessary.

26. Are you satisfied with the end product?
   Yes if the client, architect and the editor got the animation in controlled. Obviously, if the architects and the client do not agree on the product, the production house will change it to satisfy them.

27. How many consultations are required before getting the end product?
   One only to check.

28. How long do they spend to complete the computer animation?
   Ten days.

29. Is it costly?
   Three minutes editing for £6000.00 including real video shooting to be imposed onto the computer clips.

30. In what format do you present the computer animation?
   On screen (common), video and multimedia (CD-ROM).

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No, because the client understand better through animation with a reasonable rendering standard to be able to justify the building material and colour scheme.
SURVEY 3
FRASER BROWN PARTNERSHIP
48 Spiers Wharf, Glasgow G4 9TB.
tel. : 0141 353 0500  fax : 0141 353 1033

Interview date and time : Wednesday 7 Jan. 98, 10.00 am.
( 20 minutes ).
Person interviewed : Mr. Les Brown.
Size of firm / classification : Medium.
Staff : architects : 4  total staff : 18
No of animations produced : 4  3 housings and 1 airport

GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   Design stage. To help the architect view the buildings and see how it is developing
   and present to the client.

2. How are they used?
   The animations produced were purely the basic form of building shown as an
   animated sequence. But, stopped doing animation for the last two years.
   Original source?
   Being developed from other CAD data.

4. Is computer animation part of the architectural service?
   No. The firm knows that they and the client can't afford it. They haven't been in a
   situation that the client can pay extra, but one of the animations was produced within the
   budget of the project. However, the other 3 animations were decided by the architects to
   show to the clients.

5. In what way do you think that computer animation helps?
   Impressive presentation particularly for a large project ( conference centre ).
6. How might computer animation in the field of architecture develop?
   For the high-end the architect thinks that it has been developed particularly in the US. At the moment animation is still a time consuming job. Perhaps in ten years time, if the process of developing animation cost less, the firm might consider to continue animation investment.

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No. The technician that deal with the animation are basically computer-skilled staff.

8. Does the computer animation have a storyboard?
   No.

10. Is there any agreement of fee and content on the basis of storyboard?
    No. If animation is required, they will charge based on a 'fixed fee' to the client.

13. What is your opinion in having a key guideline before producing computer animation?
    If animation is required to develop properly the architects feel that they should have a proper training. But at the moment, the firm is unable to afford this training.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
    No. What really matters (key) is 'imagination'. We are already trained in the visual arts and we are architects. If we know and are keen on understanding the three-dimensions of time and space I think we can put the animation together. Training will polish the animation as an extra for the architects.
PRODUCTION

15. Who does the computer animation?
   Two architectural technicians.

16. Did you have any background knowledge before producing computer animation?
   No. It is purely personal interest.

17. What type of software and hardware are used to create the computer animation?
   Hardware: Mac (Power PC).
   Software: Modelshop and ArchiCAD.

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
   1 only. All of the architectural staff were provided with computers individually mainly for 2D and 3D stills.

19. To what extent do you go to produce the computer animation?
   Relying just on the CAD software that is available in the company.

20. How much detail would go into producing the computer animation?
   All of the animation created were completed with lighting and shadows, people, trees and cars together with the site context. There was no interior produced. All of the animations produced were very simple renderings and textures (mainly selected from the palette available from the software).

POST-PRODUCTION

21. Do you edit your computer animation?
   Yes. This was basically cutting the right clips to animate.
22. Who usually deals with the post-production part of the computer animation (editing)?
   In-house.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?
   To reduce the overall cost and encourage the staff within the practice.
   Manageable.

24. How long do you spend to complete the computer animation?
   Two weeks (for small projects) and three and half weeks (for large project, the airport - partly because this is our first animation project and the technician is in the process of training).

30. In what format do you present the computer animation?
   On screen only.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No. Basically, the clients like it. However, since the rendering was quite simple, there were several enquiries by the client on the chosen materials (e.g. roof tiles, steel sheeting and other simple building material).

Note:

The firm actually had stopped producing computer animation for the last two years. Most of the architectural fee does not pay them to do and spend time on animation (accept for the airport design). Animation by means of fly-through and walk-through (i.e. exit from the plane up to waiting for the taxi) in the airport is essential particularly to show the passengers' flow in the terminal building as well as the three-dimensional aspects.
Since the housing project is very competitive, the animation is actually produced to ensure the firm gets the project. At the same time, the task is to test the technology and the skill within the practice. The firm actually pays the fee for the client. So, they lost in terms of money and time spent on doing the animation. In addition, because the period of the animation shown is limited (only a few seconds) there is nothing much they can see. However, the result was very good.

The architect feels that three-dimensional computer drawing is more useful as it can be easily re-printed and re-produced for documentation or posters and accessible because it is on paper (unlike the animation on computer). The buildings are modelled in wire-frame then printed out in reference to a few best shots and rendered manually.

The architect feels that their clients are not impressed by the technology (animation). Perhaps, the client may wonder why the architects waste their money on investing in animation. What they want is actually something that shows the building works for them. From the architects' point of view, if the animation fee changes in the future, they will then continue to carry out producing animation.
**SURVEY 4**

**GEOFFREY REID ASSOCIATES**  
Cochrane House, Cochrane Street, Glasgow G1 1HL.  
tel. : 0141 552 4555  fax : 0141 552 4556

| Interview date and time | Monday 12 Jan. 98, 2.30 pm.  
|                         | ( 50 minutes ). |
| Person interviewed      | Mr. Robert Crossan. |
| Size of firm / classification | Large. |
| Staff                   | architects : 28  total staff : 51 |
| No of animations produced | 10  7 retails,  
|                         | 2 highly services building  
|                         | ( airport hangar and cargo  
|                         | terminal ) and 1 site  
|                         | impact analysis. |

**GENERAL INFORMATION**

1. At what stage do you start to use computer animation and why?

   Most animations were created at the design stage. Only one was made for the client to see the visual and environmental impact on the site. To show the design idea to the client and planner. It also helps the architects to see the problems and potentials of the design that sometimes cannot be visualised in paper-based drawings.

2. How are they used?

   Most animations were shown as a general building modelling for communication purposes between the architect and client. Selected area and building detailings were developed in the form of still images established in the animation mainly because animation with detailing and photo-realistic rendering will obviously take a longer time to generate. Only one project was specifically required by the client to be developed in animation for planning submission (i.e. as a video format).

   **Original source?**

   Being developed from 2D CAD data. All 3D modelling and animations were created in 3D Studio Max.
3. What does the client use the computer animation for?
   So that the client will understand better what the design is all about.

4. Is computer animation part of the architectural service?
   No. At present the firm has stopped producing architectural animation due to high cost and time involved and only one architect is involved. Theoretically all of the animations created cost extra but in reality none of the clients were willing to pay and expected the animation as part of the architectural service.

5. In what way do you think that computer animation helps?
   Most importantly it will help the viewers who can't understand drawings and to see how the scheme works. Animation can help the firm for marketing purposes. In the architect point of view, once the model was created any changes can be instantly changed for a better design solution and more ideas can be easily seen in animation rather than still drawings.

6. How might computer animation in the field of architecture develop?
   Near future Virtual Reality (VR) will take part and be widely used in architectural representation. Viewers are able to change instantly the selected material, colour and objects to visualise the impact on the design. At present VR is still expensive.

**PRE-PRODUCTION**

7. Do you have any guideline to refer to before producing the computer animation?
   No. The architect basically creates a fly-through and walk-through and shows it to the client.

8. Does the computer animation have a storyboard?
   No.

11. Do the clients usually require a storyboard before making the computer animation?
    No. Most clients want to see the animation rather than the storyboard.
13. What is your opinion in having a key guideline before producing computer animation?

A key guideline is something that the firm is interested in looking at as it will help to develop a better animation.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?

Yes, because architects refer to the people who are expert in the motion-based representation (i.e., film-makers). Architects cannot rely just on their architectural knowledge and are required to learn ‘film design’ to ensure a better animation.

PRODUCTION

15. Who does the computer animation?

One architect.

16. Did you have any background knowledge before producing computer animation?

No. Just as a special interest and fifteen to sixteen years of experience in modelling and animation.

17. What type of software and hardware are used to create the computer animation?

Hardware: PC.

Software: 3D studio Max (modelling and animation) and AutoCAD (2D drawing).

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?

One workstation and one architect (the animator himself).

19. To what extent do you go to produce the computer animation?

Relying just on the CAD software that is available in the company. Photo-realistic rendering will be developed only on still images.
20. How much detail would go into producing the computer animation?

Most animation were modelled and animated in the form of general exterior stand-alone building to reduce the overall memory. Interior modelling, selected design detailing and photo-realistic rendering was only shown in 3D stills.

POST-PRODUCTION

21. Do you edit your computer animation

No. Just produce a walk-through and show it to the client.

22. Who usually deals with the post-production part of the computer animation (editing)?

In-house production.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?

To reduce the overall cost, since none of the clients paid for the animation. In-house production helps the firm’s design idea get across better. Future solutions perhaps will be sending the animated sequence to the ‘render farm’ to produce the photo-realistic rendering effect.

24. How long do you spend to complete the computer animation?

One week to two months.

30. In what format do you present the computer animation?

Most animations were presented to the client on screen only. However, a few animations were submitted in video format.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?

No. In fact the client understands better.
HLM ARCHITECTS
Riverside House, 260 Clyde Street, Glasgow G1 4JH.
tel. : 0141 221 7241   fax : 0141 221 3750

Interview date and time : Wednesday 7 Jan. 98, 3.00 pm. ( 30 minutes ).
Person interviewed : Mr. Gordon Carswell.
Size of firm / classification : Large.
Staff : architects : 8   total staff : 14
No of animations produced : 7   3 Commercials,
                            2 Residential and
                            2 Public Buildings.

GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   Early and Design stages. The animations were required by the client, and
   presentation purposes and competition. Some of them were also developed to study the
   lighting effects on the building.

2. How are they used?
   General visualisation for the client. Some of the animations were printed out for
   promotional purposes such as design brochures.

   Original source?
   Being developed from 2D CAD data.

3. What does the client use the computer animation for?
   For marketing purposes and to get funding.

4. Is computer animation part of the architectural service? NO
   Most of the clients have to pay extra, but some projects are suggested by the
   architects for the client to view in the form of animation.
5. In what way do you think that computer animation helps?

From the architects' point of view, animation helps them to justify the problem and potential of the design in the very beginning. Obviously, most animation that they have created were to impress the client. At some stage it strengthens the firm to win a competition.

6. How might computer animation in the field of architecture develop?

The use of photo-realistic rendering helps related disciplines to understand the chosen material. For future purposes, if the fee is appropriate they might develop the design scheme interactively (particularly with VR).

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?

No. The architects just depend on the storyboard and other means of preliminary sketches of what they and their client agree to be included as part of the animation sequence. In most cases, all of the shot selections were suggested by the architects.

8. Does the computer animation have a storyboard?

Yes.

9. How long does it takes to produce the storyboard before it is finalised?

One day.

10. Is there any agreement of fee and content on the basis of storyboard?

No. The architects basically use the storyboard for internal references and as a mechanism when making the animation. The storyboard is not really used as a piece of information submitted to the client. The fee is basically what was fixed between the client and the architect in the beginning and as the design developed.
11. Do the clients usually require a storyboard before making the computer animation?
No.

13. What is your opinion in having a key guideline before producing computer animation?
It is important to have the key guideline particularly to start the design on comic-strip or storyboard sketches before manipulating the animation. This is obviously easier as the animators know what they intend to show.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
Yes. This is mainly related to the understanding of preliminary sketches which had been prepared earlier to get the key shots to produce the animation. By knowing what the key shots are, the process of creating the animation becomes easier.

PRODUCTION

15. Who does the computer animation?
Two architects and two architectural technicians.

16. Did you have any background knowledge before producing computer animation?
All of the animators were purely architecturally trained as well as having a CAD background. The main source of animation knowledge was developed from exchanging ideas between other architectural firms (which had produced architectural animation).

17. What type of software and hardware are used to create the computer animation?
Hardware: PC.
Software: AutoCAD (modelling) and AccuRender (rendering and animation).

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
Two workstations. Most of the architectural staffs concentrate on 2D and 3D still drawings on each individual computer supplied.
19. To what extent do you go to produce the computer animation? Relying just on what is available on the CAD software.

20. How much detail would go into producing the computer animation? Most animations were built with the site context (including trees, cars, people). However, some models were basically manipulated as a ‘stand alone’ building. Application on the interior animation was very minimal. Most animations were manipulated as fly-throughs and walk-throughs showing the general building exterior with photo-realistic renderings.

POST-PRODUCTION

21. Do you edit your computer animation? No. Commonly the animators create the sequence and show it to the client. They edit the sequence by means of organising a few different shots, a title and put a background sound when the animation is specifically prepared for video presentation.

22. Who usually deals with the post-production part of the computer animation (editing)? Most production and post-production work were created in-house. Only a few animations were sent out to other production houses.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production? It reduces the overall cost and is manageable. Most importantly, since most designs with animation were in the process of experimentation, the architect feels that the design process becomes easier and faster.

24. How long do you spend to complete the computer animation? Two weeks to one month.
25. Why do you send out to the production house to produce the computer animation?
   Most animations that were sent outside were mainly because the architects did not have the time to do it and were too busy. Some design and planning schemes that had been fixed were sent to be seen by the production house service.

26. Are you satisfied with the end product?
   Yes.

27. How many consultations are required before getting the end product?
   Three to four times.

28. How long do they spend to complete the computer animation?
   One month.

29. Is it costly?
   Two minutes for £2000.00.

30. In what format do you present the computer animation?
   Most animations were presented on screen. Only a few projects were developed in the form of video, multimedia (QTVR) and presentation via LCD projector. But not on CD-ROM and VR.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   Most of the clients were very impressed with the animation produced mainly because a lot of them are still new to this kind of information.
SURVEY 6
KALEIDOSCOPICS
68 St Vincent Crescent, Glasgow G3 8NQ.
tel. : 0141 204 0619 fax : 0141 221 2190

<table>
<thead>
<tr>
<th>Interview date and time</th>
<th>Thursday 15 Jan. 98 2.30 pm. (1 hour).</th>
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</thead>
<tbody>
<tr>
<td>Person interviewed</td>
<td>Mr. Ken MacKenzies.</td>
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<tr>
<td>Size of firm / classification</td>
<td>Small.</td>
</tr>
<tr>
<td>Staff</td>
<td>architects : total staff : 3</td>
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<tr>
<td>No of animations produced</td>
<td>20 12 housings, 5 offices</td>
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<tr>
<td></td>
<td>1 for Strathclyde Police - crime prevention and 2 for TV commissions (internet promotion).</td>
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GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   Most animations were developed at the design stage and later, with a few at the early stage of design. These animations dominate presentations as a communication between architects and clients or other disciplines such as planners, council and the public.

2. How are they used?
   The animations were developed from 2D CAD data and used as a detail model in the sense that the client and the architect can visualise the building representation approximate to reality. A lot of the animations were printed out as still images for presentation. Most animations were established as required by the client for communication purposes.

3. What does the client use the computer animation for?
   The animations were used as a marketing tool to sell the design (especially for residential schemes) and a form of building and design representation for the planner and local council. In contrast, Strathclyde Police used the animation as a presentation on awareness to the public and related departments to show how crime can occur and be prevented, by explaining through animation.
4. Is computer animation part of the architectural service?
   No. The client has to pay extra.

5. In what way do you think that computer animation helps?
   Animation mostly helps lay people to visualise and understand building due to the fact that they find it difficult to visualise building information through drawings. For the client, obviously the chances to promote and sell their design becomes higher as the technology itself gives an impressive presentation. For architects, through the high quality of photo-realistic rendering and selection of shots, the design development is a lot easier as the client understands the design.

6. How might computer animation in the field of architecture develop?
   Present architectural animation is still slow when applying this technology in design practice. With a cheaper software and hardware, the architect feels that future architectural animation will establish the service as a separate architectural specialisation and become a commonplace requirement as many people are exposed to this technology. Architects should consider virtual reality (VR) more than a design tool as it allows a new representation dimension for the public and the designer.

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No. But the firm puts ahead a storyboard in reference to the discussion between the client’s requirement and the animators’ point of view as the main consideration. The storyboard sketches depend on the level of detail required on the design and selected spaces.

8. Does the computer animation have a storyboard?
   Yes.

9. How long does it takes to produce the storyboard before it is finalised?
   Three days.
10. Is there any agreement of fee and content on the basis of storyboard?
   Yes and no.

11. Do the clients usually require a storyboard before making the computer animation?
   Yes.

12. If YES, does the storyboard influence the animation project from the client?
    Because once the storyboard is finalised, the animators will set the time involved and explain briefly to the client what their product will look like with the charged fee. If agreed, only then does the production starts.

13. What is your opinion in having a key guideline before producing computer animation?
    The key guideline is vital to ensure that the architect understands what is involved in the process of making a good animation.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
    Yes. It is beneficial to understand a general idea of film-making which relates more to architectural representation.

**PRODUCTION**

15. Who does the computer animation?
    Two architectural technicians.

16. Did you have any background knowledge before producing computer animation?
    Basically trained to be an architectural technician, and the knowledge of making animation was developed through self-learning.
17. What type of software and hardware are used to create the computer animation?
   Hardware: PC.
   Software: 3D Studio Max, AutoCAD, Director, PhotoShop, Premiere and PageMaker.

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
   Six workstations are used for rendering and two for developing model, animation and editing.

19. To what extent do you go to produce the computer animation?
   Relying just on the CAD software that is available in the company. Most animations were established with background sound. However, animation that requires voice over or narration, the firm hires a sound studio with a presenter.

20. How much detail would go into producing the computer animation?
   Most animations are developed with site context, but only one animation was built as a ‘stand alone’ building. The animations have an equal amount of general building exterior and the combination of external and internal (selected space) representation. The firm has the policy of ensuring that photo-realistic rendering is one of the key criteria in designing animation.

POST-PRODUCTION

21. Do you edit your computer animation or just produce walk-through and show it to the client?
   Yes we edit all of the animations. The animator will ensure that all of the sequences are agreed upon by the client before being finalised.

22. Who usually deals with the post-production part of the computer animation (editing)?
   In-house production, except for voice-over, narration and other special sound effects.
23. Why do you prefer in-house production?
   Mainly because they have adequate expertise, as well as reducing the cost, and it’s easy to manage the animation material.

24. How long do you spend to complete the computer animation?
   Four to eight weeks.

25. Why do you send out to the production house to produce the computer animation?
   Because the firm feels that it is a lot easier to send to the sound production expert and use their equipment for a few hours just to get the raw material and edit in-house.

26. Are you satisfied with the end product?
   Yes.

27. How many consultations are required before getting the end product?
   One hour.

28. How long do they spend to complete the computer animation?
   One hour.

29. Is it costly?
   £75 per hour to hire the sound studio and £300 per hour for the professional ‘voice-over’.

30. In what format do you present the computer animation?
   Most animations were transferred onto video as the final distribution. Other representation formats include digital video interactive (DVI), CD-ROM (multimedia and QTVR).
31. Do the clients or the viewers have any difficulties in understanding the computer animation?

In general no. However, there were one or two occasions that the clients had a few misunderstanding about the result of what they would get, due to the fact that they didn't understand the storyboard well.

Note:

The original architectural practice (i.e. Architectural Design Associates) was totally converted into a new specialised computer graphic and animation service bureau due to the fact that this computer technology is in demand and has particularly potential for architectural presentation. The service will not only focus on architectural services but try to expand in other computer graphic services as well: at present they are developing animation as part of the multimedia presentation on CD-ROM for Strathclyde Police on crime prevention.

The animators have the option to consider diversifying their original form of storyboard into a preliminary animation. The client will then be presented with a simple and low resolution rendering for them to visualise after they have agreed to appoint the firm and proceed design animation. This will make it easier for the animators to amend the information as the clients understand the sequence.
GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?

Most animation were developed at the early stage together with several 3D stills. If necessary, some projects proceeded up to the design stage.

Animation representation at the early stages were developed mainly to show the client the potential and problems that can be seen from certain points of view. Future animation development usually is made when the client specifically requires detailed visualisation by mean of photo-realistic rendering and texture to see the design.

2. How are they used?

50% of the architects prefer to develop their animation from 2D CAD data and the remaining build their animation straight in 3D from scratch. 90% of the animations created showed a general model (block) for the client to ‘feel’ the building mass. A lot of these representations were developed into still images. Animation that is specifically required by the client usually will be carried out in extensive detail (more rendering and material suggestion). One of the animations created (The New Financial Building, Caledonian University) helped the firm impress the client and win the project.

3. What does the client use the computer animation for?

Most of the animations were used as ‘public relation’ (exercise), funding and presented to the trustee.
4. Is computer animation part of the architectural service?
   Yes and no.
   Most of the previous animations created were included as part of architectural services. However, due to the intensive labour required, computer animation is excluded from the architectural services. In fact, the client has to pay an additional fee.

5. In what way do you think that computer animation helps?
   Most animations were used as a marketing purpose. However, the architect doesn’t see animation helping a lot in the design process due to the fact that the existing CAD operators cannot develop complicated 3D building data to be changed fast and easily whenever required. Animation also helps to give a very impressive representation.

6. How might computer animation in the field of architecture develop?
   At present, more softwares are available and becoming better for architectural purposes with higher speed, powerful hardware and at a decent price. These will obviously make them viable for architects to incorporate design with computer, animation and virtual reality (VR).

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No. Except to try to keep the animation simple. The firm's policy is it actually doesn't want their CAD staffs to specialise in a specific software knowledge due to the fact that they may forget the learning and practice process when other projects will no longer need this specific software and skills.

   The firm prefers that their CAD staff learn and get the correct skills in all of the general 3D modelling and animation packages that are suitable in the design practice. For this reason the firm continues to send the staff out for training purposes (e.g. using Microstation). The complete training is a five day period which starts with three day courses on 2D drafting. The remaining training (3D) will only be carried out after the staff has trained in the firm doing the project.
8. Does the computer animation have a storyboard?
   No, except a verbal agreement between the client and architects on what to show in
   the animation (e.g., paths and shots).

10. Is there any agreement of fee and content on the basis of
    storyboard?
    No. Future animation will be charged on a 'fixed fee' lump sum after a discussion
    between the client and the architect.

11. Do the clients usually require a storyboard before making the
    computer animation?
    No.

13. What is your opinion in having a key guideline before producing
    computer animation?
    It is essential for architects to be aware of what is happening on TV and movies in
    other motion-based representation. Correct sequence tempo should be understood carefully.
    We don't want to make a fly-through with sixty miles per hour of speed; instead we need to
    bring the viewer's eye into custom, so that they will understand easier.

14. Do you think that film-making understanding or other related
    knowledge is essential to produce a good animation (and why)?
    Yes. There is a certain background for the architects to know and understand the
    viewer's perception particularly the 'eye contact'. A lot of architects that do animation have
    no idea what will happen when showing their product on a twenty inch television monitor.
    The understanding of speed (twenty five frame per second), resolution and shot selection is
    often ignored.

PRODUCTION

15. Who does the computer animation?
    Three architects and one architectural technician (seven architects have the
    knowledge needed for doing 3D still models).
16. Did you have any background knowledge before producing computer animation?

Not in film-making. Most of the animators are purely architecturally trained and have a personal interest in CAD and animation. 20% of the animators have the benefit of the MSc CABD courses at Strathclyde University.

17. What type of software and hardware are used to create the computer animation?

Hardware: Mac (PC for 2D drawings only).

Software: Modelshop (3D general modelling and animation), Microstation (i.e. limited 3D modelling) and Strata Studio Pro (detail animation with texture mapping).

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?

Two to five workstations. The firm only provides to the staff that are keen and have a certain level of CAD animation knowledge, rather than to those who are new to animation and 3D modelling.

Eighteen PC and fourteen Mac workstations (i.e. two workstations for general purposes). Out of thirty four workstations four consist of are the low end computer and 3 workstations were selected to produce animation.

19. To what extent do you go to produce the computer animation?

Relying just on the CAD software that is available in the company. The firm actually relies on the ‘customer service’ support which allows a free upgrade of the software (i.e. this year the upgrade is Microstation 95 for the high-end rendering packages).

20. How much detail would go into producing the computer animation?

Most animations were built with a site context showing the general exterior. Few building were built without any surrounding reference. 10% of the animation produced was developed with the interior of the design, the area selection and photo-realistic rendering (i.e. two animations).
POST-PRODUCTION

21. Do you edit your computer animation?
   No, just produce a walk-through and transfer the sequence in total onto video (i.e. with title only) before showing it to the client. Editing is only concentrated in the multimedia presentation.

22. Who usually deals with the post-production part of the computer animation (editing)?
   In-house production with minor editing.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?
   The main reason is so that architects have more control and manageability particularly in the design process. In-house production allows the animators to devote themselves to develop the animation. In contrast, when sending to other production houses a longer production period is required for them to complete the animation. The firm cannot cope with this period as most projects have a very limited time until the building is completed.

24. How long do you spend to complete the computer animation?
   One day to one week (simple model) and up to one month for a complicated model.

IF SENT TO THE PRODUCTION HOUSE

25. Why do you send out to the production house to produce the computer animation?
   No equipment, expertise and most importantly the firm cannot afford for their staff to spend too much time on producing animation.

26. Are you satisfied with the end product?
   Yes.

27. How many consultations are required before getting the end product?
   Up to six times.
28. How long do they spend to complete the computer animation?
   Two weeks.

29. Is it costly?
   Ranging from £3000 to 4000 (three minutes animation) and £7000 (complete 3D still modelling with high end rendering and site context).

30. In what format do you present the computer animation?
   Most animations were presented on computer screen (sometimes linked via digital overhead projector). Few animations have been transferred onto video and created on screen as a multimedia presentation.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No, in fact the feedback from the client was good.

Note:

Clients nowadays are becoming aware of CAD and animation. What the architects usually do when they get the project is to divide the representation into three different phases. Phase one of the design usually shows a general proposal together with the overall site. Phase two deals more with building detail information (sometimes the complete design). The last phase is basically proceeding in the form of animation which has been agreed upon by the client and architects. The first two stages are presented in the form of 3D stills.

The architect explained that the main reason that the firm uses a Microstation is that the software allows a cross platform between PC and Mac. In MicroStation what you see in Mac will appear exactly the same as on PC screen. Most importantly it allows the architects to 'chop and slice' instantly 3D model to see in plan and section rather than view 3D model and 2D drawings separately like other CAD packages. Microstation software can read '.dwg' files if you get the design information from other building professional such as surveyors and engineers.
GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   Construction stage and Advanced design stage.
   The firm doesn't have the time to spend on animation at the earlier stage simply because the architect that develops the animation is still in the process of training herself using the manual to use the software available.

2. How are they used?
   The architects try to create the model as realistically as possible (through photorealistic rendering) showing the exterior and interior of the building. A few key shots will be printed out as a hard copy for the architects and client. The animation is produced based on the architects' initiative.

   Original source?
   Being develop from 2D and 3D CAD data.

4. Is computer animation part of the architectural service?
   Yes. The animation is produced based on the architects' initiative to communicate better with the client in the design.
5. In what way do you think that computer animation helps?
   Because the key objective is to communicate the design, the client will hopefully understand better and can explain through the animation if any changes are required. This obviously impresses the client as well as helping the firm to market the design representation for future clients.

6. How might computer animation in the field of architecture develop?
   Although it is possible to develop animation in the early stages of design, it is still difficult because of the greater amount of information input which is required to produce a quite detailed animation. Animation in the early stages is a risk for the architects to explain the project to the viewers based on the ‘unresolved’ design and can discourage the client from agreeing with what the architects are doing on the design. Therefore the architects suggest to concentrate developed architectural animation on the design or advanced design stages to ensure the building representation will convince clients and help them to better understand ‘the sense of space’.

**PRE-PRODUCTION**

7. Do you have any guideline to refer to before producing the computer animation?
   No. The architects are basically suggesting a few walk-throughs that they think are good for the client to view.

8. Does the computer animation have a storyboard?
   No.

10. Is there any agreement of fee and content on the basis of storyboard?
    No.

11. Do the clients usually require a storyboard before making the computer animation?
    No.
13. What is your opinion in having a key guideline before producing computer animation?

This is important mainly to establish the right shot to explain the building. The architect feels that his task is similar with the process that architects undergo to present and explain buildings to clients and other viewers.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?

Yes. Because the designer is in the process of co-ordinating the images and sounds and can’t simply ‘bombard’ the people with the animation without having any representation (storyline) structure.

PRODUCTION

15. Who does the computer animation?

One architect.

16. Did you have any background knowledge before producing computer animation?

CAD courses in school of architecture.

17. What type of software and hardware are used to create the computer animation?

Hardware: PC.
Software: AutoCAD AEC (modelling), 3D Studio Max (animation and rendering) and Adobe PhotoShop (still image re-touching and graphic representation).

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?

One workstation and one architect.

19. To what extent do you go to produce the computer animation?

Basically the animator relies on the CAD software that is available in the company and will add additional building elements (i.e. furniture, trees, cars, windows and doors) from the CAD library for the use of developing animation. Sound and narration might be considered if the final production is transferred onto video.
20. How much detail would go into producing the computer animation?
   General exterior and interior modelling with site context (including scale representation) shown in photo-realistic rendering on the selected area.

**POST-PRODUCTION**

21. Do you edit your computer animation?
   No.

22. Who usually deals with the post-production part of the computer animation (editing)?
   In-house production (developing the animation).

**IF IN-HOUSE PRODUCTION**

23. Why do you prefer in-house production?
   As a design tool the architect feels that it has to be done in-house mainly to reduce the overall cost and train in-house architects.

24. How long do you spend to complete the computer animation?
   More than four weeks as the architect is still in the process of learning the software and making animation.

30. In what format do you present the computer animation?
   On screen and video representation.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No. The architect feels that their client will understand better through animation.

**Note:**

This is the first professional animation created by the architect in this firm. Therefore, the experience and result of the animation is minimal. Most
of the sequences are still in the process of being developed. So far, most sequences created are shown as a continuous walk-through without any pauses in frame and tempo organisation when changing camera viewpoints.

The decision to transfer onto video is not yet finalised and will depend on the charges to develop the animation, since this design representation was suggested by the architect to the client.

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<th>SURVEY 9</th>
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<td><strong>PAGE and PARK</strong></td>
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<td>The Italian Centre, 49 Cochrane Street, Glasgow G1 1HL.</td>
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<td>tel. : 0141 552 0686 fax : 0141 552 1466</td>
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<td><strong>Interview date and time</strong></td>
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<td><strong>Person interviewed</strong></td>
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<tr>
<td><strong>Size of firm / classification</strong></td>
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<tr>
<td><strong>Staff</strong></td>
</tr>
<tr>
<td><strong>No of animations produced</strong></td>
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**GENERAL INFORMATION**

1. At what stage do you start to use computer animation and why?

   Design stage (two of the animations were developed after finalising the design drawing and one during the design process). These animations were used for public presentation or a schematic promotional (to impress the client) and required by the client.

2. How are they used?

   - Screen projection during presentation.
   - As part of multimedia representation (hard disk storage only).
   - A still images for brochure.
   - For competition.
3. What does the client use the computer animation for?
For presentation, funding, and public attention and information on the project.

4. Is computer animation part of the architectural service?
No. The clients have to pay extra.

5. In what way do you think that computer animation helps?
   In design process when you model buildings it helps to visualise them more clearly. Compared to physical models, computer models help architects to determine the type of material at the early stages. So, if you get the design fixed earlier it’s easier.
   - impressive presentation.
   - win a project.

6. How might computer animation in the field of architecture develop?
   How they may develop all depends on the hardware and software because to maintain both packages is difficult. There are few softwares which integrate 2D and 3D but they need a lot of work. Building the 3D modelling requires precision whereas drawings can be adjusted according to what you want. This needs time, and it is not always worth it, but when software develops a faster rendering time, then it may save a lot of time. At this stage, he still can’t see any new software packages improving marginally to better the present one; perhaps the investment for this purpose is expensive.

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No. Only have a general idea of the path with a few important key shots based on what the architects has in mind to show to the client.

8. Does the computer animation have a storyboard?
   No. Only for multimedia - Director.
10. Is there any agreement of fee and content on the basis of storyboard?

No. Charges were based on time scale rate or a lump sum agreed upon by the architects and client (internal).

11. Do the clients usually require a storyboard before making the computer animation?

No.

13. What is your opinion in having a key guideline before producing computer animation?

He feels the key guideline is necessary in principle since the animation is concentrated on visual representation. But the reality is that most of the animations only last a few minutes, so basically the architects have the initial idea of what to show, which is inevitable.

Key considerations - try to avoid establishing shots from an unusual angle because in his experience some of the clients' purposely required a ground or eye level shot (as in reality) rather than imposing dramatic shots (fly-through). In other cases, the client asked what it would look like if viewed from this particular window. For this purpose he suggests still clips. All of the work is in facts, a process of trial and error to get a good shot.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?

Yes. Most of the key information to produce a good animation can be seen on TV, thus, by critically understand the sequence, architects will know where to cut their animation. Again, it depends on the area the design involves. For instance, in multimedia presentations there is a need for a start and end, and cutting or splicing the sequence, but these actually require different disciplines. In general he feels that only knowledge related to animation is beneficial.

PRODUCTION

15. Who does the computer animation?

Architects. Generally only one architect will develop the animation from start till end. This is because as the process begins, the architect in-charge is in the process of learning and understand the technique. Therefore, modelling becomes easier if the process is
dealt with by one person. If you multiply by two ( i.e. two people working on one animation project ), this will waste production time.

16. Did you have any background knowledge before producing computer animation?
   No, except purely architectural background.

17. What type of software and hardware are used to create the computer animation?
   Hardware : Apple Mac -Power PC.
   Software : MiniCAD : Version 7 ( 2D and 3D modelling ) and Artlantis ( plug-in ), Strata Vision Version 4 ( rendering and animation path ) and Window 95 ( standard or reference ).

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
   One only . Two persons , and by large most of other architects concentrate on 2D and a few 3D stills which every architect has their own workstation ( eight in total ).

19. To what extent do you go to produce the computer animation?
   Just relying just on the CAD hardware and software.

20. How much detail would go into producing the computer animation?
   Most animations were included with trees, parking spaces and the site context. However, one project was modelled as a ’ stand alone ’ building and the other with the nearest site surroundings ( to see the visual impact ). General interiors are sometimes considered, but most of the cases it is ignored. Therefore, most animation are basically walk-throughs around the building. There is also a ’ fog ’ effect applied in the animation on the selected area. Few projects are established with photo-realistic rendering by means of reflection, showing the chosen material. A lot of the animation concentrates on simple light and shadow.
POST-PRODUCTION

21. Do you edit your computer animation?
   No. Basically the architects just cut bits and pieces of the sequence before it is presented to the client. Editing is carried out only on a QT movie and mostly organised in multimedia presentations with a simple title or other important indication for the animation sequence.

22. Who usually deals with the post-production part of the computer animation (editing)?
   In-house architect.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?
   It is cheaper and manageable. If sent to the production house, the architects have to prepare a lot of things such as drawing information which will take time to prepare before they can develop the animation.

24. How long do you spend to complete the computer animation?
   Two weeks normally (three weeks at the most) and one week for simple modelling.

30. In what format do you present the computer animation?
   On screen, LCD projector, video, QTVR and multimedia presentation.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No. This is partly because the presentation is handled by the architect (i.e. presenter) and used only to get a quick computer representation. However, for the crude rendering there is small difficulty in understanding the material. For the future, interactive presentations may be considered.

Note:

Animation and modelling are the best ways of visualising and forming architectural spaces. Decisions can be justified quickly as the
animation input deals with material selection in photo-realistic rendering which physical models cannot. In fact, physical model can be quite deceptive.

**SURVEY 10**

**RMJM GLASGOW**

1 Drummond House, Hill Street, Glasgow G3 6EF.
tel.: 0141 331 1275 fax: 0141 332 0177

<table>
<thead>
<tr>
<th>Interview date and time</th>
<th>Tuesday 13 Jan. 98, 2.30 pm. (45 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person interviewed</td>
<td>Mr. Paul Stallon</td>
</tr>
<tr>
<td>Size of firm / classification</td>
<td>Large (overall); Medium (Glasgow branch)</td>
</tr>
<tr>
<td>Staff</td>
<td>architects: 9 total staff: 12</td>
</tr>
<tr>
<td>No of animations produced</td>
<td>in Edinburgh and Glasgow office.</td>
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<td></td>
<td>total 20 3 theatres.</td>
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<td></td>
<td>4 universities and educational establishments.</td>
</tr>
<tr>
<td></td>
<td>13 offices</td>
</tr>
<tr>
<td>Glasgow only</td>
<td>2 mixed developments and office (not for housing and retail)</td>
</tr>
</tbody>
</table>

**GENERAL INFORMATION**

1. At what stage do you start to use computer animation and why?

Most animations were created in the schematic and sketch design stages. There were a few animations developed in the design stage but that was basically to impress and to make the client understand the design. Computer animation was chosen since it can give the client a more realistic impression and visualisation of the design.
2. How are they used?

In general RMJM is the only multidisciplinary company that has architectural, civil, structural, electrical and mechanical engineers. Therefore, architectural animation is basically shown in general before being distributed to other disciplines to make further detailed animation. A lot of animation sequences were captured and represented as a still image. Most animation is suggested by the architect mainly for communication purposes and few animations were submitted for competition. However, client particularly developers, will usually require animation to be submitted along with their design.

Original source?

Most animations were being developed from scratch rather than extruded from 2D CAD data.

3. What does the client use the computer animation for?

To get a better picture of the building model and understanding of the proposed design.

4. Is computer animation part of the architectural service?

Yes. In the past it was part of the architectural service. However, due to the high labour, time spent, and money involved in the process of making animation, the firm has no longer included animation as part of the service. But, not at present and the client has to pay extra for the animation required.

5. In what way do you think that computer animation helps?

Not in the design process due to the fact that the present CAD packages are technically complex and not user friendly in the design process. Animation representation plays a major role as an impressive finished product and anything that extra ordinary will help in the design. In a few cases it helps in the marketing and to win the project.

6. How might computer animation in the field of architecture develop?

Animation has to be more than a presentation tool and user-friendly particularly in handling and distributing building information. For instance, an estate manager can view interactively with a given disc to explore design ideas by being able to change colours, material and experimenting with the walk-through, fly-through and other movement criteria to view the building from various points of view. For example, in a theatre design, viewers may be given a flexible choice of seats and views to see the potentials and problems of the 'sightlines' interactively.
7. Do you have any guideline to refer to before producing the computer animation?
   No. All of the animations produced were based on verbal discussion and agreement between the architect and client.

8. Does the computer animation have a storyboard?
   No. All animations were developed straight on the computer.

10. Is there any agreement of fee and content on the basis of storyboard?
    No. It was based on a 'fixed fee' lump sum agreed upon by the client and architect.

11. Do the clients usually require a storyboard before making the computer animation?
    No.

13. What is your opinion in having a key guideline before producing computer animation?
    It is important as the architect will have a structure to organise the animation sequence.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
    Yes. So that the architect has an idea and 'sensitivity' to what role the composition, light and dark play when designing the animation.
PRODUCTION

15. Who does the computer animation?
   Five architects and four architectural technicians.

16. Did you have any background knowledge before producing computer animation?
   No. The animators are basically trained to be architects. However, a few of the animators attended short CAD courses.

17. What type of software and hardware are used to create the computer animation?
   Hardware: PC.
   Software: AutoCAD, Corel Draw and 3D Studio Max.

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
   Five workstations (total workstation - eight which focus on 2D drawing). Only architects that involved in producing animation due to the fact that most of the architectural staff are busy with their own work.

19. To what extent do you go to produce the computer animation?
   Relying just on the CAD software that is available in the company.

20. How much detail would go into producing the computer animation?
   Most animation was produced with site context showing the exterior of the building on a minimal photo-realistic rendering. There are a few models without site context due to the location (e.g. rural, new land site). Some of the schematic design stage animations were developed with interior spaces (e.g. atrium), with several selections of areas in quite detailed texture mapping based on the budget allocation.
POST-PRODUCTION

21. Do you edit your computer animation or just produce walk-through and show it to the client?
   Yes, the architect will select the production shots.

22. Who usually deals with the post-production part of the computer animation (editing)?
   In-house post-production (RMJM Edinburgh). Only one animation (i.e. library design in Edinburgh) was sent out to a production house to be developed (ABACUS, University of Strathclyde).

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?
   Mainly to reduce the overall cost and it is easier in-house to control the animation and design.

24. How long do you spend to complete the computer animation?
   Two weeks to one month.

IF SENT TO THE PRODUCTION HOUSE

25. Why do you send out to the production house to produce the computer animation?
   Because the animation project was funded by the university (ABACUS, University of Strathclyde).

26. Are you satisfied with the end product?
   Yes.

27. How many consultations are required before getting the end product?
   Three to five times.

28. How long do they spend to complete the computer animation?
   One month.
30. In what format do you present the computer animation?
   Sometimes on screen projection via Power Point projector, video, multimedia (CD-ROM).

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No, most of the clients were 'stunned' by the animation and they understood the project better.

Note:

Most animations were developed on large projects. The firm has the intention to establish a separate unit specialising in animation and modelling since they find that this motion-based representation has a market. Having a separate unit will polish the animation skills, so the architects can concentrate on the process, technique and other motion-based knowledge far better.

Architects need to have a certain level of animation understanding. 'A poor animation can do more damage than drawings which make the perspective so unreal. But having to know what are essential and key elements (e.g. comparative scale by showing people, car and tree) in animation will make the representation different from the other sequence.'

One of the best animations was exemplified in the high-rise office building proposal in Dubai. The architect explained how the building was built by showing the construction development in stages throughout day and night-time environment.

Another good idea was to implement a 'monochrome' animation when designing the Prado Museum in Madrid. The architects tried to relate the site context in the form of black and white building representation to integrate the design within the historical surroundings.
SURVEY 11

THE MILLER PARTNERSHIP
19 Royal Crescent, Glasgow G3 7SX.
tel. : 0141 331 1101  fax : 0141 332 8073

Interview date and time : Friday 9 Jan. 98, 10.00 am
( 1 hour ).
Person interviewed : Mr. Campbell Dickie.
Size of firm / classification : Medium.
Staff : architects : 11 total staff : 22
No of animations produced : 4 3 stadiums ( one
animation and two
interactive -VR ) and one
office refurbishment.

GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   All of the animations were produced after finalising the design stage. The office
design animation was a Memorandum of Design ( MOD ) job for client presentation. All of
the stadium animation projects were made for public presentation ( particularly the football
fans ) and for information about the new stadium proposals.

2. How are they used?
   All of the animation projects are mainly used to show the building representation in
the form of photo-realistic images. One of the animations ( office ) was required by the
clients. The first football stadium project was offered by the contractor to develop in-house
as a representation suggestion for the football fans to view their new homeground stadium.

   Original source?
   Being developed from 2D CAD data ( 95% of the firm data is in 2D ).

3. What does the client use the computer animation for?
   To convey up to date design information from the architects.
4. Is computer animation part of the architectural service?
   No. The client has to pay an extra fee for the animation.

5. In what way do you think that computer animation helps?
   Impressive presentation.

6. How might computer animation in the field of architecture develop?
   Present computer graphic software is expensive and difficult to use a good, easy and fast 3D modelling. Animation in the field of architecture is still a back end application since it is not a common representation practice. Until animation becomes a common and front end application, only then will it develop better.

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No. All animations were developed and sent out in a production house. The architects will normally suggest a wire-frame modelling to suggest the key shots to the animators and verbally discuss the building path.

8. Does the computer animation have a storyboard?
   No.

10. Is there any agreement of fee and content on the basis of storyboard?
    No. The fee agreement is made on the basis of a ‘fixed sum’ decided by the architect and the client. The client will be informed by the architect on animated sequence suggestion.

11. Do the clients usually require a storyboard before making the computer animation?
    No.
13. What is your opinion in having a key guideline before producing computer animation?
   Important if the animation is developed as a corporate video for promotion.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
   Yes. The more you understand the animation process the better product and result you get.

**PRODUCTION**

15. Who does the computer animation?
   All animations were sent out to be developed in other production house (2D CAD data). The office animation projects was developed by architects (Kaleidoscopic, Glasgow). However, the stadium projects were made by computer graphics animators.

**POST-PRODUCTION**

22. Who usually deals with the post-production part of the computer animation (editing)?
   Production house.

**IF SENT TO THE PRODUCTION HOUSE**

25. Why do you send out to the production house to produce the computer animation?
   No equipment, expertise and expensive set-up.

26. Are you satisfied with the end product?
   Yes.

27. How many consultations are required before getting the end product?
   Three times.
28. How long do they spend to complete the computer animation.

Four to six weeks. Since it has been planned for all of the animations to be sent to the production house, the firm allows enough time for the animation period, so that the animators can take their time without requiring any extra charges for spending on overtime and extra animators specifically for the projects.

29. Is it costly?

Ranging from £1500 to £2000 per minute.

30. In what format do you present the computer animation?

Video presentation for the office.

On screen multimedia (stadium).

On screen VR for the last two stadiums.

31. Do the clients or the viewers have any difficulties in understanding the computer animation?

No. The clients understand a lot better as the visualisation is related to the motion-based (TV) representation.

Note:

The animation representation was required by the client after seeing the first stadium animation proposal which was firstly developed by the contractors with in-house production. When the client appointed their own production house, the animators suggested that the client and the architects develop simple Virtual Reality (VR) stadium tours. This would allow the viewers to view as well as to key-in to information (e.g. walk-throughs, goal shooting together with sound effects, views of the stadium from any of the chosen seats, and fly-throughs) using the keyboard and joy-stick.

Interestingly, although the rendering is quite simple, the viewers and the public can understand the design perceived through this technology better than compared to drawings. In fact, this VR experience allows a lot of football fans and other members of the public to view and see the future football stadium.
SURVEY 12

THE PARR PARTNERSHIP
8 Newton Place, Glasgow G3 7PR.
tel. : 0141 331 2644  fax : 0141 333 0371

Interview date and time : Friday 9 Jan. 98 2.30 pm.
( 45 minutes ).
Person interviewed : Mr. Kevin Cooper.
Size of firm / classification : Large.
Staff : architects : 12total staff : 35
No of animations produced : 6
1 airport ( 2 different animations ) and
4 industrials ( fabrication plant ).

GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   Outline stage. Mainly animation is used for client representation purposes so they can visualise their project before it is built.

2. How are they used?
   Most of the animations created are in the form of simple models ( i.e. mass models ) showing the exterior of the buildings. However the new animation of the Edinburgh Airport Extension was made as a detail design model showing the exterior and selected interior details ( departure and arrival points ). A few images from this animation were printed out as a hard copy for the client. All of the animations produced were developed from 2D CAD data.

   Detail animation by means of exterior and interior representation with photo-realistic rendering ( texture ) would only be carried out for specific clients' requirements. This is because producing the detail sequence requires a higher workload and expertise. In fact, the client also requires traditional drawings and perspectives to be submitted along with the animations. These representation products will obviously take a longer time scale to produce.
3. What does the client use the computer animation for?

In general most of the mass model animations were used for visualising the building. Alternatively, in the airport extension project the client used animation and other forms of representation for design approval by the BAA chief executive design group.

4. Is computer animation part of the architectural service?

Yes, if the animation is developed within the overall fee and represented in the form of simple modelling (mass modelling).

No. The clients have to pay extra for a detailed model when they purposely require this specific animation. For example, the BAA clients required two different animations as the design progressed, one was the initial design animation and other was a detailed design animation (with a complete texture and photo-realistic rendering).

5. In what way do you think that computer animation helps?

The architects feel the internal design space helps them to see the problem and potential of the airport design. The detail animation impressed the client. However, the firm has a slight difficulty in printing out a few of the animated sequences, as they need to hire an external bureau to get the photo effect quality. Interestingly, the firm hasn't won one of the industrial design projects although it was presented with animation. What's really important is the design itself.

6. How might computer animation in the field of architecture develop?

Undoubtedly, animation helps presenting architectural design to clients as the design develops. It is a great tool as the client prefers to see the sequence instead of seeing typical drawing plans and elevations. At present, the firm only has one architect that really is interested in doing animation which still is not enough. The investment in computers has only been focusing on 'legistically' but not in terms of manpower. In the future, a few internal experts in this specialised area will certainly help the firm create more productive and effective building representations.
PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No. They have only a 'quality assurance' system which is part of the system that ensures the correct usage of computer mainly focused on 2D drawings.

8. Does the computer animation have a storyboard?
   No. The way the architect suggests the animation is by judging visually what is the best way to look at the building. All of the animation routes are verbally discussed and decided between architect and client.

10. Is there any agreement of fee and content on the basis of storyboard?
    No. The animation fee is decided through a verbal discussion between architect and client. This discussion will be clarified on paper as part of the design process.

11. Do the clients usually require a storyboard before making the computer animation?
    No.

13. What is your opinion in having a key guideline before producing computer animation?
    The architect thinks that the key guideline doesn't really matter the in architectural field due to the fact that the architects should understand 3D and therefore know what is the best effect or shot of the building. Architect should understand the key purpose of the animation and how to present it in the form of motion-based representation.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
    Yes. But what is more important is that architects should understand the building better. Only then will they know what is the best sequence to be shown in the animation. For the animation that is being produced in a more developed way, film-making understanding is vital, but the reality in architectural practice is that the time and effort to produce animation is minimal, unless the clients require a very intricate animation as a piece of representation.
PRODUCTION

15. Who does the computer animation?
   One architect and one architectural technician.

16. Did you have any background knowledge before producing computer animation?
   No, except a special interest from architectural school.

17. What type of software and hardware are used to create the computer animation?
   Hardware: PC.
   Software: AutoCAD (modelling) and 3D Studio.

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
   Two workstations. Two architects have tried to explore animation. Out of twelve, ten architects have their own computers mainly used for 2D drawings production. This is mainly because most architects do not have the time and were given a specific job to be completed.

19. To what extent do you go to produce the computer animation?
   Relying just on the CAD software that is available in the company. Building detailing (texture) will only be concentrated if it is required by the client.

20. How much detail would go into producing the computer animation?
   Most of the animations were developed with site context (e.g. trees and landscape in the rural site, minimal building surroundings). In the case of the airport animation, there is no site context shown due to the fact that the building should be quite far from the city or other residential areas.

   The outline model animation was generally shown as a general exterior. However, in the BAA animation a complete 'singing and dancing' sequence consisted of an exterior and interior walk-through and fly-through in photo-realistic rendering. By creating the passenger's walk-through in the building, several selected interior spaces were established.
POST-PRODUCTION

21. Do you edit your computer animation or just produce walk-through and show it to the client?

Not for the outline and initial design stage of the BAA animation (download into video without any sound). There is nothing much the editor can do about the post-production because the given raw material (i.e., architectural sequence) is minimal for editing. For the detail sequence of the BAA animation (exterior and interior sequence); post-production work was basically transferred onto video with background sound compliments.

22. Who usually deals with the post-production part of the computer animation (editing)?

Production house.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?

To reduce the overall cost and it is manageable.

24. How long do you spend to complete the computer animation?

One week for the outline model animation.

Four to five weeks for the detail model animation.

IF SENT TO THE PRODUCTION HOUSE

25. Why do you send out to the production house to produce the computer animation?

No equipment or expertise and expensive set-up.

26. Are you satisfied with the end product?

Yes. Because post-production from the raw material given was minimal for editing purposes. The only problem is to get a really clear and crisp rendering and a fly-through sequence from the facilities available in the firm.
27. How many consultations are required before getting the end product?
No consultation is involved since the post-production simply required a computer to video transfer.

28. How long do they spend to complete the computer animation?
Two to three days.

29. Is it costly?
More than £5000 for three minutes video.

30. In what format do you present the computer animation?
On screen, video and multimedia (most animation is represented on CD-ROM).

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
No. Most clients understand the project better on animation. In the case of BAA, the client had the experience of visualising animation information.
<table>
<thead>
<tr>
<th>Survey 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERNON MONAGHAN ARCHITECTS</td>
</tr>
<tr>
<td>202 Bath Street, Glasgow G2 4HW.</td>
</tr>
<tr>
<td>tel.: 0141 331 1941/2/3 fax: 0141 331 1770</td>
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</table>

| Interview date and time | : | Wednesday 14 Jan. 98, 2.30 pm. (30 minutes). |
| Person interviewed | : | Mr. Gerry Duffy. |
| Size of firm / classification | : | Small. |
| Staff | : | architects: 3 total staff: 5 |
| No of animations produced | : | 3 housings. |

GENERAL INFORMATION

1. At what stage do you start to use computer animation and why?
   Feasibility study stage. Generally the architects will sketch the design, followed by modelling the design. This helps the client’s perception to visualise the proposed building.

2. How are they used?
   Most animations created were fairly detailed (shown in simple modelling in the form of shadow, and flat colour - but not reflection or ray tracing) and developed from scratch instead of extruded from a 2D drawing from other CAD data. All animations were suggested by the architect for design communication. Few selected sequences were captured for printing purposes.

3. What does the client use the computer animation for?
   To display to other organisations such as presenting the animation to Scottish Homes in conjunction to Glasgow 1999 City of Architecture.

4. Is computer animation part of the architectural service?
   Yes. So far none of the clients wanted to pay extra and expect animation to be included as part of the fee and service.
5. In what way do you think that computer animation helps?
   Animation mostly helps the client to understand and visualise the project better as part of the communication process between the architect and client. A few animation projects help the firm for marketing purposes.

6. How might computer animation in the field of architecture develop?
   Any firm that doesn’t integrate animation or other modelling representation in their design falls behind. Compared to 2D CAD, 3D modelling still has a far way to go and develop. In terms of virtual reality (VR), if the cost becomes cheaper, there is a possibility that the architect will move towards interactive design.

PRE-PRODUCTION

7. Do you have any guideline to refer to before producing the computer animation?
   No.

8. Does the computer animation have a storyboard?
   No. The design sequence is established straight onto the computer.

11. Do the clients usually require a storyboard before making the computer animation?
    No.

13. What is your opinion in having a key guideline before producing computer animation?
    For a simple short animation (i.e. on screen presentation) the architects do not feel that having a key guideline is that crucial. However, when architects have the intention of transferring their animation onto video, then it is a must. Most architects do not have any idea of what differences and problems arise when transferring the computer sequence onto tape. Red colour resolution obviously does not turn out well in this analogue medium.

14. Do you think that film-making understanding or other related knowledge is essential to produce a good animation (and why)?
Yes, particularly for high level animation. This is because architects should understand motion-based representation especially when movements (walk-through, fly-through and camera), shots, points of view and other cinematic features are involved. However, the architect does not agree on learning in-depth to the extent that architects will replace and take the film-maker’s job.

**PRODUCTION**

15. Who does the computer animation?
   One architectural technician.

16. Did you have any background knowledge before producing computer animation?
   No except an architectural technician courses.

17. What type of software and hardware are used to create the computer animation?
   Hardware: Mac.
   Software: Architrion, ArchiCAD, Ray Dream Designer (i.e. rendering and animation) and Director.

18. How many computers are used to produce the computer animation and how many are used by the architectural staff?
   One workstation. Total workstation - five (four of them are used for 2D CAD drawings). Most of other architects don’t have the time and interest in 3D modelling and animation.

19. To what extent do you go to produce the computer animation?
   Relying just on the CAD software that is available in the company. Only when the animation is sent out to be edited, then a background sound and other transition effects will be included.
20. How much detail would go into producing the computer animation?

All of the animations were produced with site context in a simple rendering. Most of them represent the exterior of the building, but only one animation shows a very plain interior design.

POST-PRODUCTION

21. Do you edit your computer animation or just produce walk-through and show it to the client?

Yes, only when the animation is transferred onto video presentation, but not for on-screen presentation.

22. Who usually deals with the post-production part of the computer animation (editing)?

Production house (post-production) and in-house for production.

IF IN-HOUSE PRODUCTION

23. Why do you prefer in-house production?

It is just a standard tool of presentation to show to the client.

24. How long do you spend to complete the computer animation?

The model itself requires two days of work and three days for animation.

IF SENT TO THE PRODUCTION HOUSE

25. Why do you send out to the production house to produce the computer animation?

No equipment, expertise and obviously the post-production set-up is expensive.

26. Are you satisfied with the end product?

Yes.
27. How many consultations are required before getting the end product?
   One to two days.

28. How long do they spend to complete the computer animation?
   One day service just for editing.

29. Is it costly?
   The editing service costs £450 including one master tape.

30. In what format do you present the computer animation?
   Most animations were presented on-screen with simple multimedia information. One of the animations was transferred onto video (title, transition effect and background sound).

31. Do the clients or the viewers have any difficulties in understanding the computer animation?
   No. Except on one occasion the client commented that the colour on the building plane was too bright due to the fact that the architect ignored ‘ray tracing’ and texture mapping on the surface.

Note:

The firm often suggests their design presentation in the form of a continuous slide show to get the dynamic effect which is more related to animation.

Some of their clients (i.e. those that appoint residential projects) are sceptical of animation. When it comes to show animation to the public, the client found that many of the viewers don’t have a video cassette recorder (VCR). This difficulty makes the client prefers traditional physical models as part of the exhibition that they can handle more easily (without having to prepare any audio-visual facilities). In fact, some clients still require and are willing to spend thousands of pounds on physical models although they are more expensive than animation and they have been supplied with animation.
APPENDIX 2  FILM UNDERSTANDING

FILM DIRECTOR INTERVIEW

<table>
<thead>
<tr>
<th>Interview date and time</th>
<th>Monday 16 Jan. 98, 4.30 pm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person interviewed</td>
<td>Mr. Murray Grigor.</td>
</tr>
<tr>
<td>Number of films produced</td>
<td>more than 20.</td>
</tr>
</tbody>
</table>

1. In what way do you think film or motion-based representation helps particularly in the field of architecture?

As far as I know most architects are trained by a lecturer to speak from boxes and slides. These slides are often wide-angle lens shots. Some of the great photographs of the 20th century are made of buildings which are able to be photographed very beautifully and mostly are of international style type buildings which are symmetrical buildings.

But Frank Lloyd Wright who particularly didn't like this so-called 'Azra Solarisation of architecture' because Azra Solar was a great photographer. He thought that his architecture cannot be photographed because it is asymmetric and couldn't be grasped as one single image per say like Mies Van Der Rohe (outside Chicago) and Philip Johnson (UK) glass buildings which can be photographed brilliantly with a macro sunset.

In Wright's design, photographs could never be captured to really understand his idea. Therefore, through filming I can reveal the approximate visit to the real building as you can move closer to the space and show the turn to reveal the idea of progression in space.

My first experience was in filming the destroyed Queen Margaret College building (designed by Mackintosh, kept in the form of drawings). All of the area particularly Maryhill and the city was designated to be filmed (similar to Corbusier designated Paris to be destroyed) reveal the building as it was and help the public awareness of one of the finest designs in Glasgow.
2. What are the key elements that you consider before filming building or architectural information?

Frank Lloyd Wright says that you cannot make film by word. I feel that this is actually true due to the fact that the concept of psychological space. When the client comes to see the architects, he or she doesn't ask what kind of house do you want on what kind of home would it be? Instead he talks about bathroom, garage, room, closet space and kitchen (what unit do you have?).

For instance how do you go into the Hill House in Helensburgh? You have a very a dark entrance and suddenly you have got these two wonderful ticking clocks of the upper wall which draw from dark to light. Now, that is the psychological difference. Just like in the Glasgow School of Art, as you go down the 'hand run', it's very low as you burst into a white studio or you come out of the corridor into the library of Glasgow School of Art, and that is a relief of space. If you saw that as an individual experience as a visitor that is one thing.

What makes the great house is actually the way you experience inside and outside the house which most people don't do it. So, I incorporate this important 'psychological space', journeys, in most of my architectural film.

It is not possible to make a very pure film about architecture but I did make one in 1972, namely the Space and Light by filming 'Cardross Seminary'. There is no narration and I really film the building as it was. Because we live in a very journalistic world, we need to get some information across and it has to be brought out so that viewers, particularly, lay people can understand easily (as they would expect from the television experience).

Of course if you and I go into a building, first thing that we do is to get away from anyone who wants to talk about it. Therefore, to film with commentary is not so easy. However, considering television viewers they will be so terrified if only a few sounds are revealed (which in reality is the pure sound from a building). This actually is important to feel the actual acoustic (echo to a footstep) in the space which can be used as a wonderful concept. But the mainline television is very hard. I think eventually the architecture and art school will teach architecture, particularly the time-based exploration of building, via CD-ROM and laser disc to experience the specific sound options.

In The Architecture of Frank Lloyd Wright film, obviously I explained the chronological story about an architect who shifts his position all the time and encompasses
his track. At the same time, the film has to be some kind of a 'popular story-telling' (not like life-drama) but trying to show the feel of the building space by means of selection of sequences that best explain the building and spaces.

Talking about Frank Lloyd Wright, he built his extraordinary Prairie houses back on the plane to Chicago. He also attracted a few architects from Europe such as Richard Neutra and Rudolf Schindler. When they arrive to meet him in Taliesin, Wisconsin, LA he says 'sure boys come and join me but I'm not doing this house instead I'm doing mine for the Aline Barnsdall, the Hollyhock House' and he lets both architects to work on the most romantic and evocative of Aztec architecture as he goes on to design the Imperial Hotel in Tokyo.

I'll try to relate this idea into his film and try to understand what does he means by 'organic architecture' (because you could never explain it). Therefore, everytime I create a moment in The Architecture of Frank Lloyd Wright film, I would have a car of that period (e.g. 1906 - horse buggies, 1936 - BOE, in the Johnson Wax building; Wright likes the streamline effect, Tonken House in Cincinnati - 1953 Cadillac). These are the things (enigma) that tie together to reveal the identity of the architect towards his building.

In the Scarpa film, the architect himself was a modernist and concerned more with a craft tradition. In fact, many of Scarpa's works were inspired by several different craftsmen such as the plasterer and ironsmith (metal work) to combine the effect in his architecture. Therefore, in his film I'll try to show several sequence by these different craftsmen to reveal Scarpa's design inspiration.

3. In one of your articles of Film and Architecture, some senior decision maker in the media told you that architectural films are doomed because 'buildings don't move!'. How do you tackle this problem?

This is one of the stupid comments which came to me. In may big countries especially America and Europe, architecture is big news. However, there aren't many films about architecture which is very bizarre. When I tried to raise money for the Architecture of Frank Lloyd Wright film, a person in the government said to me 'this is a very persistent Scotsman director who want to make a film on a dead architect, how boring'. That's true you see. You need to tackle this problem with a great enthusiasm really and it's obviously very hard.
I'm trying to get a serious dialogue which I called a 'secular cathedral on the phenomena of the end millennium'. There were so many buildings devoted to art and culture and museum are being built. I can see this concept like a thousand years ago when cathedrals were built in Europe. It is the kind of concept of spirituality especially in the East (Japan). There is one building (national gallery) designed by I M Pei in north of Kyoto. You will take a trip passing through the mountains, then you see the building - the concept of religious and spiritual, it's like a pilgrimage.

For many viewers, architectural films are not a great pleasure to watch. But people now realise what a great medium film is. Eventually new technology such as CD-ROM will develop as a one of the effective idea of motion-based representation.

4. How can a film-maker reveal the significance of an architect, a building or architectural information?

Apart from allowing a continuous fly-through, most architectural animations were created using wide lens. But, motion-based computer animation is a fantastic tool. It is simply that many architects abuse the facilities. The director often ignores the use of wide lens particularly because perspective correction is very hard on film, because 'you can't move the camera which obviously creates a lot of building distortions. So, I can't make a combination of things.'

This is the criticism of my film on Mackintosh. When the viewers go to the Mackintosh Library, they found the space is so small from the perception they view on his film. This is because the director had used a wide angle lens which establishes a huge space. I thought that this might be a good illusion compromise, but in reality, it spoils the sequence and misleads the viewer's perception. But in my Greek Thomson film, I try to recreate the church which doesn't exist anymore because it was bombed during the war. They trying to build this up and restore the church to pixel.
5. I have observed in many of your architectural films (particularly in the Architecture of Frank Lloyd Wright) that you establish a lot of lateral camera movements (vertical and horizontal), close up shot (e.g. 'pulling focus'), environmental comparison (seasons or daytime and night time) to frame building. In fact, zooming is very minimal. Is there any significance to this idea?

I actually quite like the intertwining of close up shots. But, I don't like zooming because zooming is a kind of 'knee jerk', not a genuine movement as it pulls the object closer perspectively. Although I occasionally use zooms, but I prefer tracking because it is good to reveal spatial elements such as on the Architecture of Frank Lloyd Wright film (particularly the Wingspread).

How do you perceive a building? You walk into a building, look up and down to see details. So, I film these to get this approximate visit, but of course this is more on a personal selection. Actually, it is a real dilemma when you film buildings particularly when the production involves the main stream television such as BBC and Channel 4. You need to compromise because you have an audience coming behind you and they have certain limitations and are not like architects. They want the film moving along whereas we architects or students want to see more slower movement and more detailings.

The solution to this is by making the film linear where at any point of the film you can click and see the sequence slower or at various angles on CD-ROM or other systems. I think that would be the solution in the end. I've seen one film like this in Barcelona by Gayard who made a film on Catalan architecture. He made a totally straightforward film with in three different languages. You can then move and click at any building and drawings in more detail. But, if you put drawings on main stream television people don't like it and may criticise. However, architects want to see drawings.

At the moment, you can only promote film particularly in architecture on the broadcasting level, so you have to compromise on certain things. Because we live in a very journalistic world, some information may be added and has to be brought out so that viewers particularly lay people, can understand easily, as they would expect from the television experience (e.g. important sequence is enhance with narration). Whatever it is, film should speak to the audience, and this is important.
6. There is a lot of evidence that architectural animations concentrated on visual rather than aural representation (e.g. often use a background sound and ignored narration in the sequence). How might sound help in architectural filming?

I think to really film a good space must be followed by a good acoustic of sound (the original sound of the building). But, mainstream television finds it hard to do and accept that. Most viewers will obviously expect sound by means of voice-over, sound effects or a presenter to explain the sequence. If you have the CD-ROM, you can hear the real sound of the building without any narration (perhaps with subtitles) or the viewers select what they want.

7. How might film in the field of architecture developed?

Future motion-based representation is more likely to be interactive due to the fact that it capable to allow variable sequence controls. You can click, pause, control the speed, turn off or on the sound (sound effects from the building or narration) and view at various angles. Most importantly, it caters all participants. With all of the recent developments such as parallel tracks, you create a linear sequence in non-linear editing platforms and Digital Video Interactive (DVI) to give higher resolution for motion-based representation which will eventually be widely used by many architects.
TYPES OF SHOTS

Figure 50: BIRD'S EYE VIEW SHOT
Buildings in a big site are relatively small and difficult to focus on particularly with an extremely high angle shot known as the bird's eye view. However, for a large project such as an urban scale, this shot might be effective to give an overview of the overall site.

Figure 51: LONG SHOT
Shooting a building in a long shot provides the viewers with plenty of film space to establish the context or place in relation to the subject. The frame boundary is easier to control as the distance allows greater manipulation in depth of illusion, slow and fast movements of the camera and other objects without any visual confusion. The subjects’ appearance in long shot is relatively small but effective in showing the overall context with a clear plane composition.

Figure 52: FULL SHOT
Full shot gives architects a slightly bigger subject thus reducing the visual field. In many cases (especially a single building), this shot is enough to establish the building with site context.
Figure 53: MEDIUM SHOT
A medium shot is established between the general and a close-up to create a consistent change in visual representation. The context of the subject in medium shot can be seen clearly, but can only be shown minimally and often appears at the edge of the film frames. Film experts always treat the medium shot as a link frame and spare a lot to allow plenty of cutting options. On average, three to four different medium shots are enough to relate the subject to the background.

Figure 54: CLOSE MEDIUM SHOT
This shot is often used to give viewers more features than the medium shot.

Figure 55: CLOSE UP
A subject is often emphasised by a close-up shot to enable the viewers to see it in extensive detail. The background in close-ups often fades or is out of focus as the camera focuses on the subject. Thus, this creates a clear contrast as well as a focus of visual interest to enhance the subject. Architects commonly rely on this shot to show building components, joints and other detailing. The close-up shot works effectively in a slow tempo, but, a slight change of camera position may restrict the viewer's view of the subject.
Figure 56: LOW ANGLE SHOT
In a low angle shot, the camera is positioned to look up at the subject. It increases the observer's illusion of height and stability. A director often shoots a cutaway of a person looking upwards when dealing with a multi-storey building assuming that he or she is looking at the same subject. This effect appears in several traditional film-making techniques. The impact of the low angle shot is greater when visualising a nursery. This shot becomes very important in emphasising the safety in the building design (e.g. sink height, toilet facilities, colour utilisation and wall edges) based on the children's viewpoint.

Figure 57: HORIZONTAL ANGLE SHOT
Horizontal angle can be achieved by placing the film camera at eye level. Framing a subject in horizontal needs good colour and lighting contrast in film planes. In a flat plane, the background, middleground and foreground become obscure as the floor plane is almost at the same level as the subject. However, the differences can be distinct in a sloping site together with an angle shooting.

Figure 58: HIGH ANGLE SHOT
Whenever the camera views downward towards a subject at an angle less than vertical, it is called a high angle shot. Architects can use high angle shots when visualising building layouts and establishing the site context in relation to the subject. Because of the intensity of the subjects, it can be very effective if they use a slightly fast movement or intermediate pace as the film opens.
Figure 59: POSITIONING THE FILM CAMERA INFRONT OF THE SUBJECT
A shot viewed from the front tends to look flat.

Figure 60: POSITIONING THE FILM CAMERA AT AN ANGLE TO THE SUBJECT
Filming building from an angle reveals three-dimensionality.

APPENDIX 3  COMPUTER ANIMATION SURVEY

COMPUTER ANIMATION SURVEY 1

Chen Lung Tien.

Bar Chart 1: Do you understand the animation?
Bar Chart 2: Do you see any title of the animation?

Bar Chart 3: What is the type of the building?

Bar Chart 4: Is the overall site surrounded by a green area?
Bar Chart 5: Does the animation show a statue of Buddha?

Bar Chart 6: If yes, how many?

Bar Chart 7: Is there any movement of 'human figures' in the internal space?
Bar Chart 8: Is there any dim light of 'fog effects' in the internal space?

Bar Chart 9: Is any important building feature and detailing (i.e. columns and beams) highlighted?

Bar Chart 10: Is there any voice over or narration in the animation?
COMPUTER ANIMATION SURVEY 2

Super House 1.

Bar Chart 11: Do you understand the animation?

Bar Chart 12: Do you see any title of the animation?

Bar Chart 13: What is the type of the building?
Bar Chart 14: How does the camera enter the building?

- Unsure
- Through the roof
- Through the door

Bar Chart 15: Does the animation display a "night-time" environment?

- Unsure
- No
- Yes

Bar Chart 16: Does the animation show a diagrammatic layout of the building?

- Unsure
- No
- Yes
Bar Chart 17: If yes, do you understand what the clip is trying to show?

Bar Chart 18: Is there any voice over or narration in the animation?
APPENDIX 4  LIVE PROJECTS ANIMATION EXPERIMENT

EXPERIMENT I : THE NEW MINISTRY OF FINANCE

<table>
<thead>
<tr>
<th>General Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Client</strong> : Ministry of Finance, Malaysia.</td>
</tr>
<tr>
<td>• <strong>Architect</strong> : Jururancang Architect.</td>
</tr>
<tr>
<td>• <strong>Project</strong> : A Proposed Ministry of Finance (Malaysia) Office Building at Jalan Duta, Kuala Lumpur.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Production Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Hardware</strong> :</td>
</tr>
<tr>
<td>• CopaM Pentium® 90MHz / 16MB RAM / 2MB VRAM / 1.1G SCSI HDD.</td>
</tr>
<tr>
<td>• Fujitsu ICL Pentium® 75MHz / 16MB RAM / 1MB VRAM / 0.7G IDE HDD.</td>
</tr>
<tr>
<td>• <strong>Software</strong> :</td>
</tr>
<tr>
<td>• FastCAD® 3D (Evolution Computing®)</td>
</tr>
<tr>
<td>• Design CAD® 3D (ViaGraphix®)</td>
</tr>
<tr>
<td>• 3D Studio® Release 2, 3 and 4 (Autodesk®).</td>
</tr>
<tr>
<td>• <strong>Production Time</strong> : 2 months.</td>
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</table>
## EXPERIMENT 2: DAMANSARA PARADE

### General Information
- **Client**: Damansara Parade Sendrian Berhad
- **Architect**: Gerak Reka Architect.
- **Project**: Proposed a Mixed Development at Jalan Duta, Kuala Lumpur, Malaysia.
  - **Residential Area**: blocks of low density apartments, mosque and other facilities.
  - **Commercial Area**: 14, 18 and 24 storeys of office blocks, 8 storeys of medium office block, 30 storeys of hotel, shopping centre and theatre.
- **Year**: 1996 - 1997

### Production Platforms
- **Hardware**
  - 1: Silicon Graphics™ ONYX Reality Engine2 Deskside.
    - 4 RISC 4400 200 Hertz processors.
    - 512 MB RAM / 4 Gigabytes of HDD.
    - Single RISC 4400 200 Hertz processor.
    - 64 MB RAM / 4 Gigabytes of HDD.
- **Software**
  - MultiGen™ and ModelGen™ 3D Modeller (MultiGen™ Inc., USA).
  - Vega Lynx™ (Paradigm Simulation™ Incorporation, USA).
  - Irix Performer™ (Silicon Graphics™ Incorporation, USA).
- **Production Time**: 1 month.
POST-PRODUCTION PLATFORM (Non-linear Editing)

General Information

**Hardware**
- Power Macintosh™ 9500 / 132 Hertz / 132 MB RAM.
- PCI Vincent™ Digital Video Engine.
- 6 X 4.3 Gigabytes (25.8 Gigabytes) Micropolis AV Drives stripped RAID Lever '0'

**Software**
- Media 100® xs Version 3.0.1 (Data Translation®)
- Boris Effect® (Artel®)
- Media Paint Version 1.1.2 (Strata™)
- After Effects™ Version 3.1 (Adobe™)
- Photoshop™ 3.0.3 (Adobe™)
- Sound Edit 16™ (Macromedia®)

**Post-Production Time**: 3 days.

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**Figure 61**: A Diagram of *Media100® xs* (Data Translation®) non-linear set-ups used in the live projects experiment.

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appendices