The Art and Science of Depiction

Non-linear
Drawing systems

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MIT-Lab for Computer Science

Non-linear drawing systems

Munch exhibition
- Boston College
- Until May 21.
- Birth of expressionism

Munch

Munch

Munch
Plan

- Drawing and projection
  - Linear perspective & the Renaissance
  - Drawing systems
    - Catalogue of "all" drawing systems
      - Advantage/disadvantages
  - Distortion and constraints
- Denotation
- Tone & color

Classification of drawing systems

- Linear
  - Parallel
    - Orthogonal
    - Fold-out oblique
      - Horizontal oblique
      - Vertical oblique
    - Orthographic
      - Isometric
      - Others
  - Non orthogonal
    - Oblique
      - Anamorphic
  - Linear perspective
    - One point
    - Two points
    - Three points
  - Divergent perspective
- Non Linear
  - Quasi linear
  - Naïve perspective
  - Expressionist perspective
  - Importance-driven
  - Cellpanorama
  - Curved projections
  - Panorama
  - Fish-eye
  - Topological
  - Split views, fold-out
  - Multiple viewpoints

Green flash

Model—inferior mirage, Hobs—5 m

Anamorphosis

• Gregoire Huret
  1670

Drawing systems
**Linear projections**
- Straight lines and alignments are preserved
- Can be expressed in primary geometry
  - Ray-image intersections
  - A matrix
- Parallel
- Linear perspective
- Divergent perspective

**Classification of drawing systems**
- Linear
  - Parallel
  - Linear perspective
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**Non Linear**
- Does not preserve straight lines
- Can get rid of some distortions
- More freedom
- Dramatic effects

**Non Linear**
- Quasi linear
- Curved projections
- Topological
- Split views, fold-out
- Multiple viewpoints

**Quasi linear**
- Locally linear
- Preserves the drawn straight lines
- No “accurate” space
- Unified space

**Quasi linear**
- Naïve perspective
- “Expressionist” perspective
- Importance-driven
- Locally linear
- Cell panorama
**Naïve perspective**
- Attempt to depict scene 3 dimensionally
- Often lack of skill
- More or less formal secondary geometry rules

**Naïve perspective**
- Pompeii

**Naïve perspective**
- Giotto

**Naïve perspective**
- 18th century

**Locally linear**
- Linear for objects or parts of the scene
- Choose the best system for each part
- Allows different scales, provide context
- In fact, this is the most common system!

**Locally linear**
- Folk
Locally linear

- Egyptian
- Best view for each object

Locally linear

- Persian miniature, 1494
- Oblique+vertical oblique

Locally linear

- Plan of Manhattan

Locally linear

- Llibre Dels Feus 1162-1199
<table>
<thead>
<tr>
<th>Drawing systems</th>
<th>Locally linear</th>
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<td>• St John the Baptist Retiring to the Desert</td>
<td>Giovanni di Paolo 1454</td>
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<td><strong>Data-driven</strong></td>
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<td>Cell multiperspective panorama</td>
<td>Multiperspective panorama</td>
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<td>• Pinocchio, Walt Disney</td>
<td>• [Wood et al. 98]</td>
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“Impressionist” perspective

- Pissaro

“Expressionist” perspective

- Munch, the Scream

“Expressionist” perspective

- Van Gogh

Cézanne

- Still life with basket, composition rule

Cézanne

- Montagne Ste Victoire
“Expressionist” perspective
- Max Beckman *Family Picture* 1920

“Expressionist” perspective
- Umberto Boccioni
  *The Street Enters The House* 1911

Quasi linear
- Modigliani
  *Femme au Chapeau*

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Leonardo & contradictions
- Wide angle vision
- Lateral recession
Curved perspective

- Panorama
  - Preserve verticals
- Fish eye

Curved perspective

- Jean Fouquet, 15th century

Curved perspective

- A View of Delft Carel Fabritius (follower of Rembrandt) 1652

Curved perspective

- Turner Petworth Park Tillington, Church in the Distance 1828

Curved perspective

- Panoramic camera
“Expressionist” perspective

- Van Gogh, Bedroom in Arles

Curved perspective

- Panorama
  - Preserve verticals
- Fish eye

Fish-eye vs. wide angle
Bird’s eye attachment

Fish-eye

• MC Escher, *Hand with Reflecting Globe*

Fish-eye

• MC Escher, *Balcony*

Fish-eye

• London from St Paul’s cathedral 1845

Fish-eye

• Anthony Green The 30th Wedding Anniversary
**Projection surface**

- Panorama, Imax
- “Good viewpoint”
  - Primary geometry and viewing conditions match

**Projection**

- Pavilion in the Colosseum
  - Regent’s Park
  - 1829

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**Topological**

- Paul Klee,
  - Another Camel

**Topological**

- London Underground, Beck, 1931

**Topological**

- Children drawing
**Topological**
- Comics

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**Split views, fold-out**
- Can be seen as a smooth viewpoint change
- Can represent an object from all sides
- Continuity, preserves topology

**Split views, fold-out**

**Split views, fold-out**
- Picasso,
  *Portrait of a woman*
Split views, fold-out

- Northwest Indian
  Double Profile Bear

Split views, fold-out

- Multiple-center of projection images, Paul Rademacher

Split views, fold-out

- Multicultural study

Split views, fold-out

- Interactive caricature (Fred Vernier)
Split views, fold-out

• Interactive caricature (Fred Vernier)

Cinema

• Robert Wiene The cabinet of Dr Caligari 1919-1920

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Multiple viewpoints

• No more unity of pictorial space
• Represents objects from different viewpoints
• Less continuity, no topology
**Cubism**
- *Candlestick*
  George Braque
  1911

**Cubism**
- *Boats*
  George Braque

**Hockney**

**Hockney**

**Escher**
- *Other World* 1947

**Mirrors, lenses**
- Freddie Francis
  *The Skull*
Mirrors, lenses

- Hedgecoe

Discussion

- No universal solution
- Secondary geometry
- Invariants
- Property mapping or translation

Drawing and cinema

- Characters too close
- Trenching
- Etc.