Dynamic Sketching: Simulating the Process of Observational Drawing

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Motivation

You are just a machine.

Can a robot write a symphony?

Can a robot turn a canvas into a beautiful masterpiece?

Can you?

* "I, Robot" 2004
Can a machine draw like a human?

Observational drawing
At human novice level
Observational Drawing
Observational Drawing

Input

Output
Previous work

Line drawings

- [Ohtake2004]
- [DeCarlo2007]
- [Judd2007]
- [Kolomenkin2008]
- [Cole2008]

Stroke’s path

- [House2007]

Gestalt Order

- [Fu2011]
Challenge

• It is hard to algorithmically describe the drawing behavior.

• Uncanny valley
Observations

• The process is based on the understanding of the object.

• A common drawing procedure: a process of continuous refinement
Our Approach

1. **Segment** the object
2. Divide into sketching phases
3. Order the strokes
4. Animate the strokes
Segmentation

Organic objects
Segmentation

Man-made objects
Our Approach

1. Segment the object
2. Divide into sketching phases
3. Order the strokes
4. Animate the strokes
Phasing

— *Conceptual* stage*
  • posture
  • primitive

— *Perceptual* stage
  • Contour
  • Detail

*[Suwa2003]*
Phasing

— *Conceptual stage*
  - *posture*
  - *primitive*

— *Perceptual stage*
  - *Contour*
  - *Detail*

* [Suwa2003]
Key idea: view the drawing behavior as an information delivery process.
Phasing

— \textit{Conceptual stage*}
  - \textit{posture}
  - \textit{primitive}

— \textit{Perceptual stage}
  - \textit{Contour}
  - \textit{Detail}

\[\text{Coarse (low frequency)}\]
\[\text{Fine (high frequency)}\]

*[Suwa2003]*
Conception - Posture

• Get the pose and action.
Conception - Primitive

- Compose the subject with simple geometric primitives (lines, marks, polygons, ellipses).
Perception - Contour

- Integrating the parts, while refining the rough strokes.
Perception - Detail

• Add more details by hatching
Our Approach

1. Segment the object
2. Divide into sketching phases
3. Order the strokes
4. Animate the strokes
Key idea: view the drawing behavior as an information delivery process.
maximize the conveyed *shape information*, i.e. quickly capture the rough shape and then refine it.

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<thead>
<tr>
<th>Sketching Entropy</th>
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<tbody>
<tr>
<td><img src="image1" alt="Coarse sketch" /></td>
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Coarse (low frequency)  
Fine (high frequency)
Ordering

Our: progressive jpeg

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<td><img src="image1" alt="Sketching Entropy Image" /></td>
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<td><img src="image4" alt="Sketching Entropy Image" /></td>
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Gestalt rules: bmp

<table>
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<td><img src="image6" alt="Gestalt Rules Image" /></td>
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<td><img src="image8" alt="Gestalt Rules Image" /></td>
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Sketching Entropy

Measures the amount of *shape information* conveyed by a stroke.
Sketching Entropy

*Conditional sketching entropy* (information gain): the amount of new Shape information conveyed by a stroke.
Our Approach

1. **Segment** the object
2. Divide into sketching **phases**
3. **Order** the strokes
4. **Animate** the strokes
Animating

• Humanized trajectory [House2007]

• Intensity, thickness, velocity
  – Computed according to point-wise shape information
Animating
Conclusion

• Model the drawing behavior as an information delivery process
• Introduce the concept of sketching entropy
• Automatically synthesis a human-like observational drawing animation
Acknowledgement

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