ユーザインタフェース
～Sketching Interfaces for Computer Graphics～

五十嵐 健夫

本日の予定
・講義（sketching UI）
・研究室紹介

Schedule
・6/4 Interface Design, Evaluation
・6/11 Sketching Interface for Graphics
・6/18 Human Robot Interaction （課題出題）
・6/25 休講
・7/2 Information Visualization
・7/9 Programming by Example （課題〆切）
・7/16 Real world Computing （課題講評）

前回の内容
・デザインにおいて考慮すべき要素
・デザインの方法 プロトタイピング
・評価方法
  - テストユーザを使わない評価
  - テストユーザによる評価

今回の内容
Sketching Interfaces for Graphics

・Modeling
・Deformation
・Animation
・Applications

Sketch-Based Interfaces for Interactive Computer Graphics

Takeo Igarashi
The University of Tokyo
Outline

• Introduction
• Application Systems (demo and videos)
  – 2D Drawing
  – Shape Modeling
  – Animation Control
  – Special Purpose Editors
• Summary

Introduction

Motivation

• Traditional graphics tools are too complicated.
  – Only accessible for experts
  – Usable only after initial design is complete

Basic Idea

• Sketching can simplify the process.
  – Accessible for novices
  – Useful for initial design process (quick & simple)

Key Issues

• Sketch is simple = provides limited information
• Key issue in designing sketching systems is “How to infer missing information (e.g. depth)”

Key Issues

• Sketch is simple = provides limited information
• Key issue in designing sketching systems is “How to infer missing information (e.g. depth)”
• Algorithm: using domain knowledge
• Interface: disambiguation
Outline

- Introduction
- Application Systems (demo and videos)
  - 2D Drawing
  - Shape Modeling
  - Animation Control
  - Special Purpose Editors
- Discussion

2D Drawing

Interactive Beautification [Igarashi 97]

- Beautification and prediction in drawing
- Disambiguation by showing multiple candidates

Music Notepad (Brown Univ.)

- Music score editing based on gestures

Denim [Berkley, Lin 2003]

- Web site design
- 手書きのページをブラウジングできる。

ASSIST (MIT Media Lab.)

絵を描くと、物理シミュレーションが走る。
Shape Modeling

**SKETCH**

- 3D scene construction using gestures.
- "Every object is on top of another object"

**Suggestive Interfaces**

- User provides hints, system shows suggestions
- Disambiguation by showing multiple candidates

**Teddy**

- Freeform models from sketching.
- "Sketches represent some rotund shapes"

**Recent Developments**

- Vteddy (voxel models) [Owada 2003]
- SmoothTeddy (subdivision) [Igarashi 2003]
- ShapeShop (implicit surfaces) [Schmidt 2005]
- And more in the afternoon (14:35-)

**FiberMesh**

- The sketch stays on the surface as control curves.
- The surface is computed via optimization.
Plushie

- Sketch -> 2D Pattern -> Simulation.
- The user can create physical plush toy.

Deformation Techniques

Problem

- How to deform a 3D model by 2D sketching?
  - Sketching skeleton
  - Sketching silhouette

Sketching reference and target (Teddy)

- It moves vertices in 2D using the algorithm used in 2D morphing [Beier and Neely 92]

Sketching Skeleton

**Animation**

**Silhouette Sketching**

A. Nealen, O. Sorkine, M. Alexa and D. Cohen-Or, "A Sketch-Based Interface for Detail-Preserving Mesh Editing", SIGGRAPH 05

**Articulated Animations**

- The user sketches stick figures.
- Depth disambiguation by selection

[Davis 2003]

**Motion Doodles**

- The user sketches a desired trajectory.
- "A character walks, runs, or jumps"

[Thorne 04]

**Animations by Performance**

- Record the user’s operation as an animation.
- Use As-rigid-as-possible deformation.

[Igarashi 05]
Special Purpose Editors

Trees Modeling
[Okabe 2003]
- The user sketches branches and leaves
- “A tree spreads branches to all directions”

Flower Modeling
[Ijiri 2005]
- The user sketches stems, petals, etc.
- The system provides separate UI for each component.

Garment Design
[Turquin 04]
- The user sketches the outline of a garment
- “The garment covers the body surface”

Clothing Manipulation
[Igarashi 03]
- The user sketches marks on the body and clothing
- “The clothing covers the body surface”

Summary
- Sketching can simplify interfaces.
  - “Accessible tool for novice users”
  - “Quick exploration of various ideas”
- It requires careful consideration.
  - Infer missing information using domain knowledge
  - Provide a disambiguation interface
<table>
<thead>
<tr>
<th>Reference</th>
<th>Authors</th>
<th>Title</th>
<th>Conference/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Igarashi 01]</td>
<td>T. Igarashi, J.F. Hughes</td>
<td>&quot;A Suggestive Interface for 3D Drawing&quot;</td>
<td>UIST’01</td>
</tr>
<tr>
<td>[Schmidt 05]</td>
<td>R. Schmidt, E. Wycik, B. Swan, M.C. Jorga, J.A. Wyvill</td>
<td>&quot;ShapeShop: Sketch-Based Solid Modeling with BlobTrees&quot;</td>
<td>Eurographics Workshop on Sketch-Based Interfaces and Modeling 2005</td>
</tr>
<tr>
<td>[Davis 03]</td>
<td>J. Davis, M. Agrawala, E. Chuang, Z. Popovic, D. Salesin</td>
<td>&quot;A Sketching Interface for Articulated Figure Animation&quot;</td>
<td>SCA 2003</td>
</tr>
<tr>
<td>[Igarashi 05]</td>
<td>T. Igarashi, D. Moscovich, J.F. Hughes</td>
<td>&quot;Spatial Keyframing for Performance-driven Animation&quot;</td>
<td>SCA 2005</td>
</tr>
<tr>
<td>[Igarashi 05]</td>
<td>T. Igarashi, T. Okabe, S. Owada</td>
<td>&quot;Floral diagrams and inflorescences: Interactive flower modeling using botanical structural constraints&quot;</td>
<td>SIGGRAPH 2005</td>
</tr>
<tr>
<td>[Igarashi 02]</td>
<td>T. Igarashi, J.F. Hughes</td>
<td>&quot;Clothing Manipulation&quot;</td>
<td>UIST’02</td>
</tr>
</tbody>
</table>