Sketch-Based Interfaces for Interactive Computer Graphics

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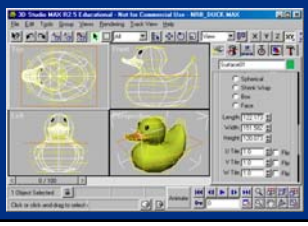
Outline

- 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)"

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- Key issue in designing sketching systems is
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- Algorithm: using domain knowledge
- Interface: disambiguation

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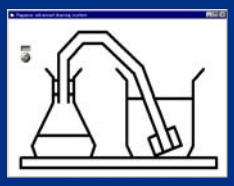
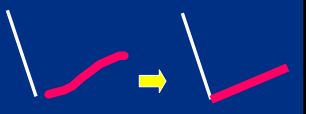
- Discussion

2D Drawing

Interactive Beautification [Igarashi 97]



Example



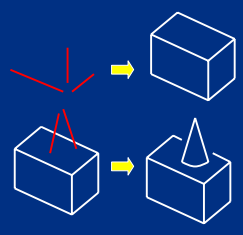
Beautification

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

Shape Modeling

.sketch.avi

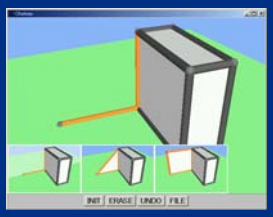
SKETCH [Zeleznik 96]



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

Chateau.bat

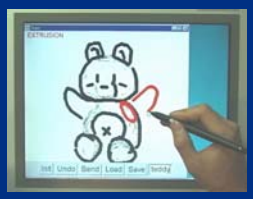
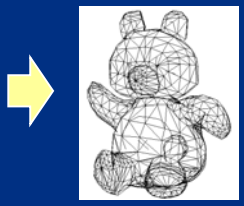
Suggestive Interfaces [Igarashi 01]



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

test.html

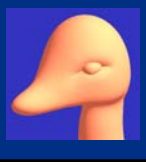
Teddy [Igarashi 99]

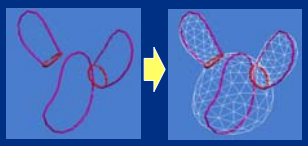
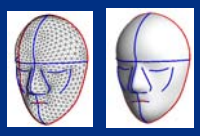
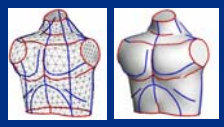
- Freeform models from sketching.
- “Sketches represent some rotund shapes”

Recent Developments

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

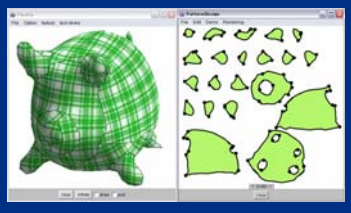




FiberMesh [Nealen et. al. 07]

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

Plushie [Mori and Igarashi 07]




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

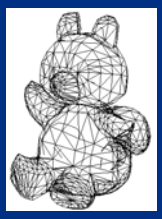
Deformation Techniques

Problem

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

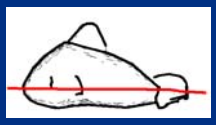
test.html

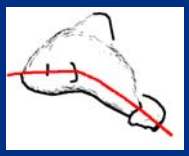
Sketching reference and target (Teddy) [Igarashi 99]



T. Igarashi, S. Matsuoka, H. Tanaka, "Teddy: A Sketching Interface for 3D Freeform Design" SIGGRAPH 1999.

Sketching reference and target (Teddy) [Igarashi 99]



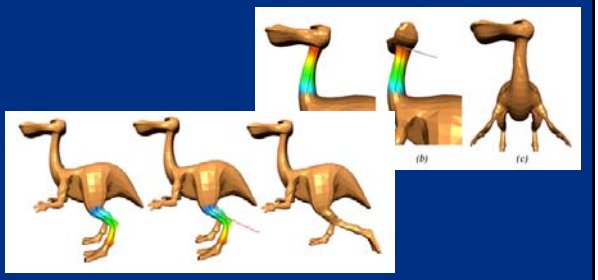


Original Vertex : Reference stroke.
= Resulting Vertex : Target stroke.

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

sketching_mesh_deformations.mov

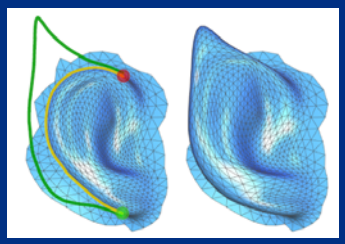
Sketching Skeleton [Kho 05]

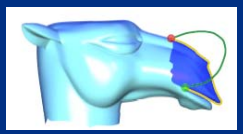


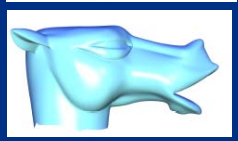
Y. Kho and M. Garland. Sketching mesh deformations. Interactive 3D Graphics 2005

sbime.avi
silsketch.avi

Silhouette Sketching [Nealen 05]







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

sbime.avi
silsketch.avi

Silhouette Sketching [Nealen 05]

$$\arg\min_{v} \sum_{v \in V} \left| L(v) - \delta \right|^2 + \sum_{v \in C} \left| v - v_c \right|^2$$

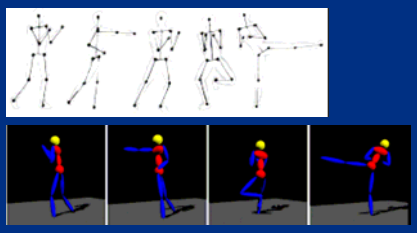
$$L(v) = v - \frac{1}{|N|} \sum_{u \in N} (v - u)$$

- Move vertices along the silhouette (= constraints)
- Use detail-preserving mesh deformation

Animation

videos¥Davis03.avi

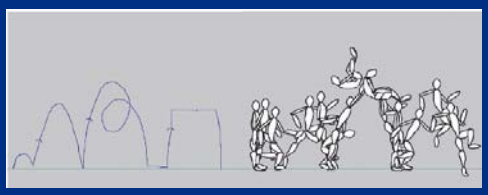
Articulated Animations [Davis 2003]



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

Thorne04.mov

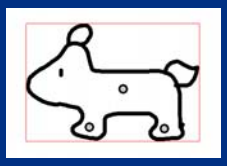
Motion Doodles [Thorne 04]

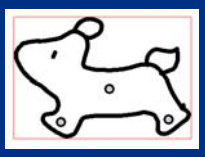


- The user sketches a desired trajectory.
- “A character walks, runs, or jumps”

anim

Animations by Performance [Igarashi 05]

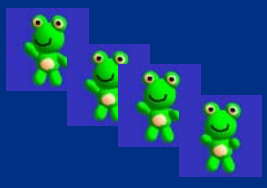




- Record the user’s operation as an animation.
- Use As-rigid-as-possible deformation.

run.bat

Animations by Performance [Igarashi 05]



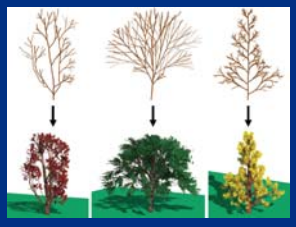
- The user directly performs a motion.
- Blending pre-defined poses

Special Purpose Editors

videos¥OKabe05.mp4

Trees Modeling

[Okabe 2003]

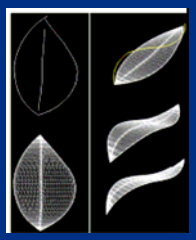


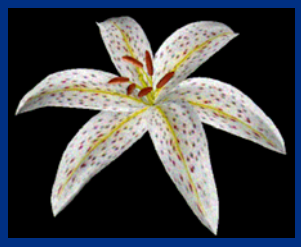
- The user sketches branches and leaves
- “A tree spreads branches to all directions”

videos¥Ijiri05.mp4

Flower Modeling

[Ijiri 2005]





- The user sketches stems, petals, etc.
- The system provides separate UI for each component.

videos¥Turquin04.avi

Garment Design

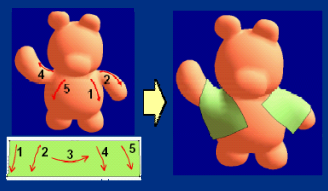
[Turquin 04]

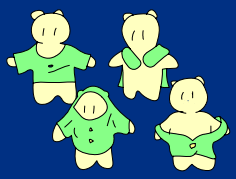
- The user sketches the outline of a garment
- “The garment covers the body surface”

sweater.bat

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

References

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