A Multi-Level Sketching Tool for "Pencil-and-Paper" Animation

Written By: Fabian Di Fiore and Frank Van Reeth

Presented at *2002 American Association for Artificial Intelligence Spring Symposium*

Presented by Jared Bott

1

Outline

- What? and Why?
- How?
  - Drawing
  - 3-D Models
  - Deformations
- Brief Analysis of Paper

2

What?

- Tool to help animators draw in a more natural manner
- More natural interface method
- Based upon pen-and-paper paradigm

3

Why?

- Tools for computer-assisted drawing (Inkscape, Illustrator) require the user to manipulate control points using point-click-and-drag
- It can be hard to figure out which and how to manipulate control points

4

Why?

- Traditional animators might have a hard time adjusting to control point manipulation paradigm
- The authors wanted to create a tool that is similar to the pencil-and-paper paradigm

5

How?

- Three main pieces
  - Curve Drawing
  - 3-D Models
  - Deformations

6

Curve Drawing

- Sample a (not necessarily) pressure sensitive stylus along the trail of the stroke
- Create a high-level representation using cubic Bézier splines
- While sampling stylus, perform an iterative curve fitting technique based on least-squared-error estimation

7

8

Curve Editing

- Control points are hidden
- Draw a stroke alongside (a part of) an existing stroke
- New stroke is sampled and interpreted as an attractor
- Can also perform affine transformations upon (groups of) strokes
- Animator doesn't have to worry about control points

9

3-D Models

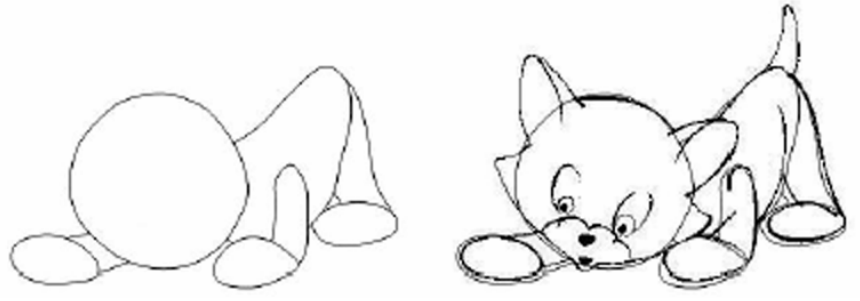
- An animator commonly draws basic 3-D objects to help determine the volume of an object
- User draws 2-D circular and rounded strokes and uses deformation strokes to get desired shapes

10

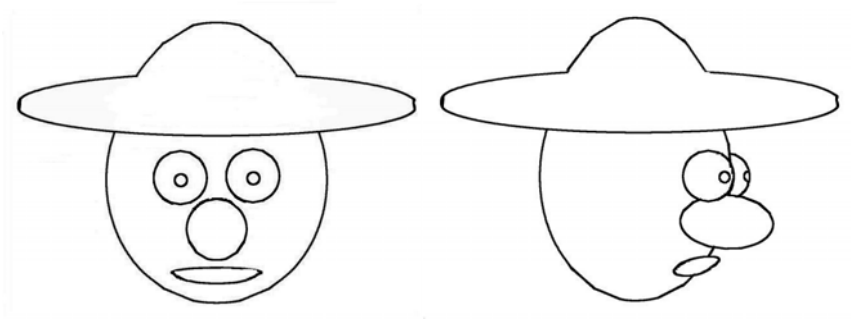
3-D Models

- System interprets 2-D forms and constructs a 3-D polygonal object
  - Simpler than Igarashi's method
- 3-D objects can be transformed by transforming the 2-D input strokes

11



12



13

Free-Form Deformations

- High-level and Low-level representations of deformation
- High-level representation
  - Source stroke
    - A stroke representing the initial state of the stroke(s) to be deformed
  - Deformation stroke
    - A stroke indicating the how the stroke(s) should be deformed

14

Free-Form Deformations

- Low-level representations
  - Control points of the curves that make up the stroke(s)
  - Underlying structure of higher-level deformation strokes
  - Control points of a 2-D grid

15

Deformation Process

- System creates a grid of control points on the object
- User sketches the source stroke on object
- User then sketches deformation stroke
- System divides source and deformation strokes into N segments and maps these onto each other

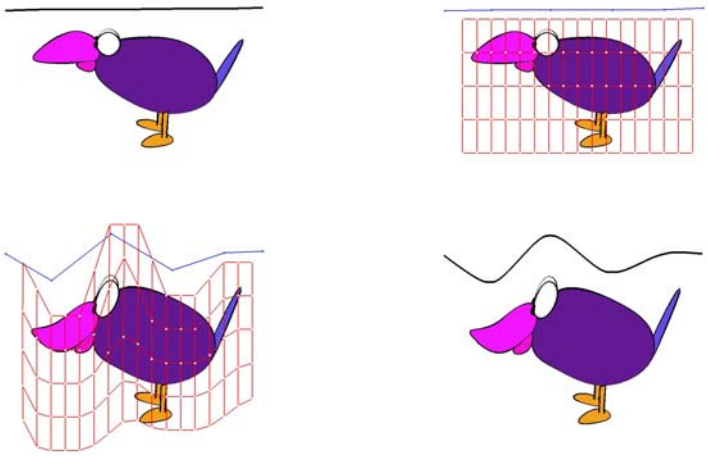
16

Deformation Process

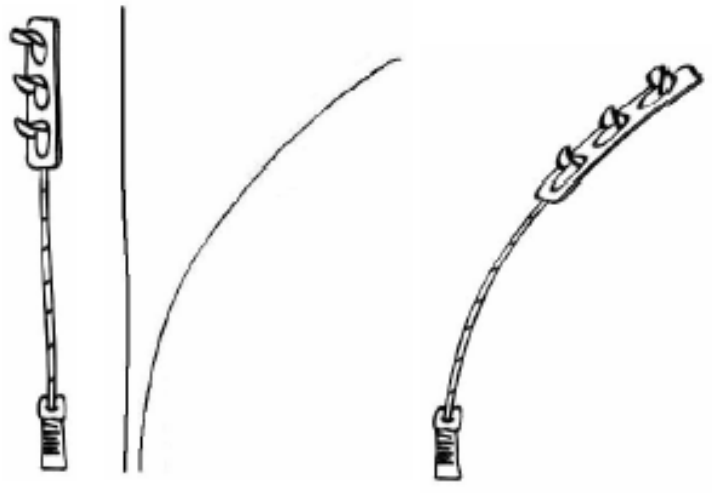
- Control points assigned to nearby segments
- Transformation for each segment of source stroke to corresponding deformation stroke is saved
- Adapted deformation method is applied to each control point in object's strokes

17

Example



18



19

Analysis

- Pros
  - Seems intuitive and easy to use
- Cons
  - No user study or results of any kind
  - Needs scaling, rotation, translation, and other tools an animator would traditionally use
  - Little information about user interface
  - Do you need to do something special to make 3-D shapes, attractors, or deformations? How?

20