Modeling Plant Life in Computer Graphics

User-assisted Modeling

Siggraph 2016 Course

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Overview

- User-Assisted Plant Modeling [10 minutes]
  - Interactive Flower Modeling **(Ijiri)**
  - Sketch-based Tree Modeling **(Ijiri)**

Introduction

Plants and Trees

- Free form curves and surfaces
- Highly repetitive structures

For modeling them

- Free form components
- Local structures
- Overall shapes

→ Sketch is well suited

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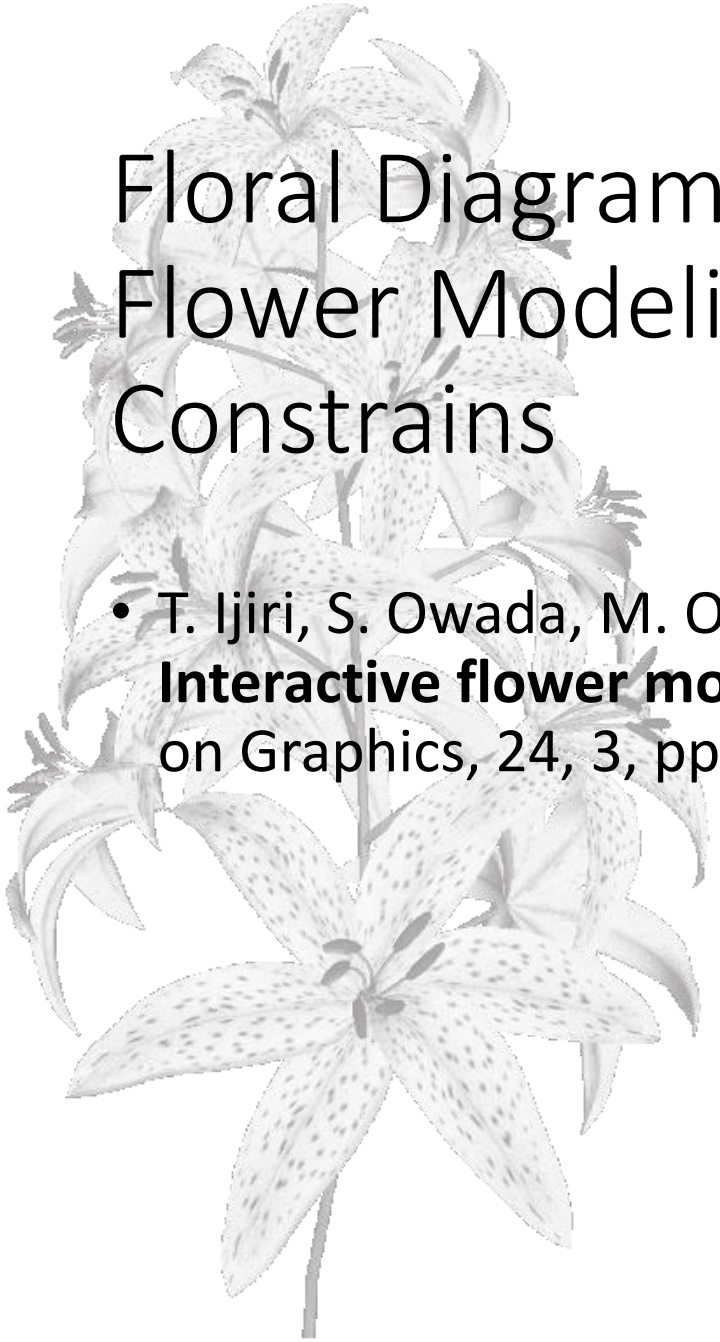
Floral Diagrams and Inflorescences: Interactive Flower Modeling Using Botanical Structural Constrains



- T. Ijiri, S. Owada, M. Okabe, and T. Igarashi: **Floral diagrams and inflorescences: Interactive flower modeling using botanical structural constraints.** Transactions on Graphics, 24, 3, pp. 720-726, 2005.

Background

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Flower Modeling is difficult

Many free form components

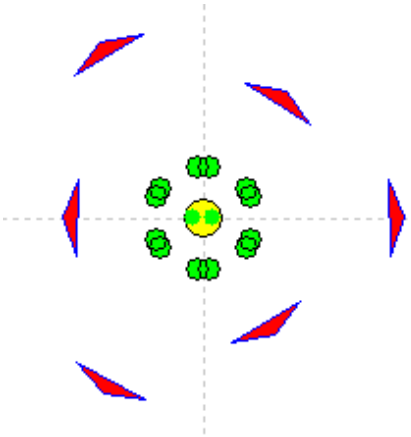
Structure specific to spices

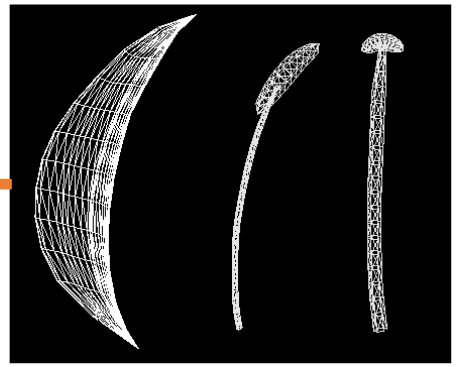
Goal : Easy-to-use interactive flower modeling framework

Key idea

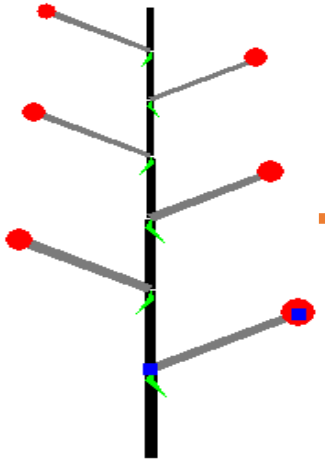
- Separate “structural specification” and “Geometry modeling”

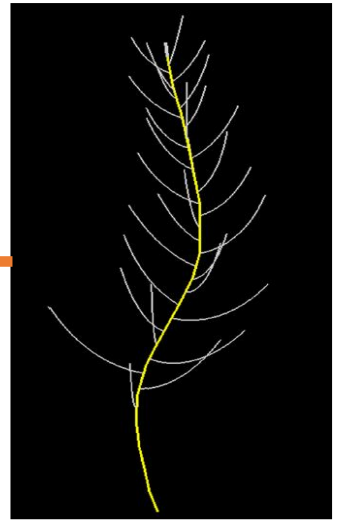
Floral diagrams





Inflore-scences





Sketch-based Interface

Design editor by using botanical representation

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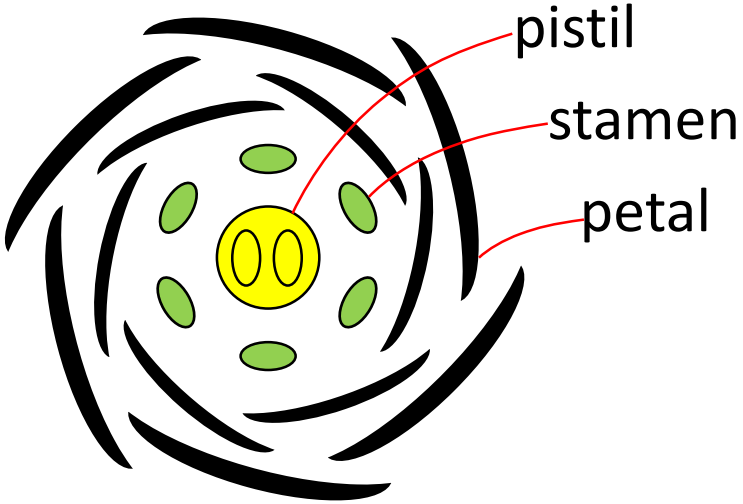
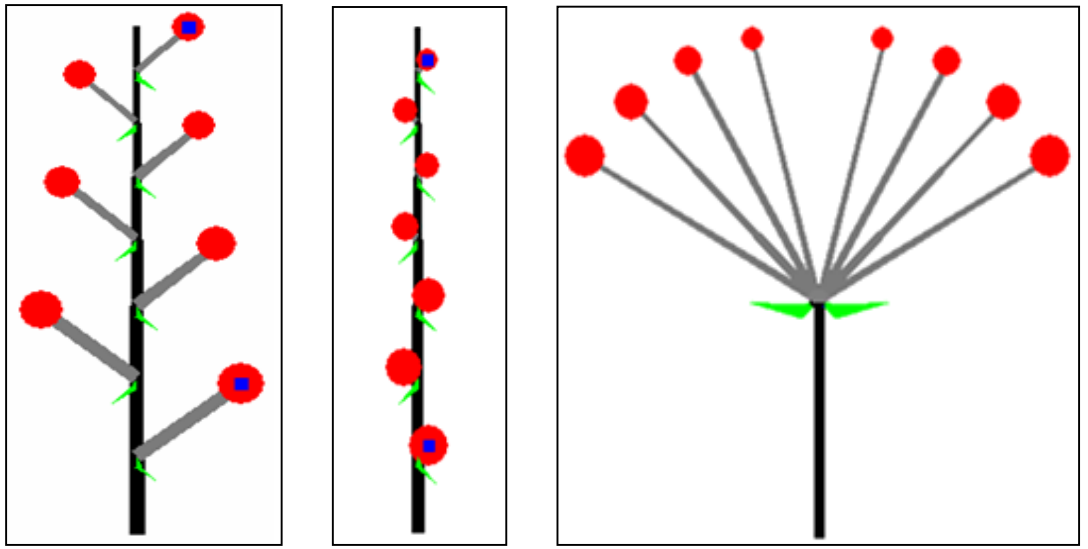
Floral Diagrams

Arrangement of flower components



Inflorescences

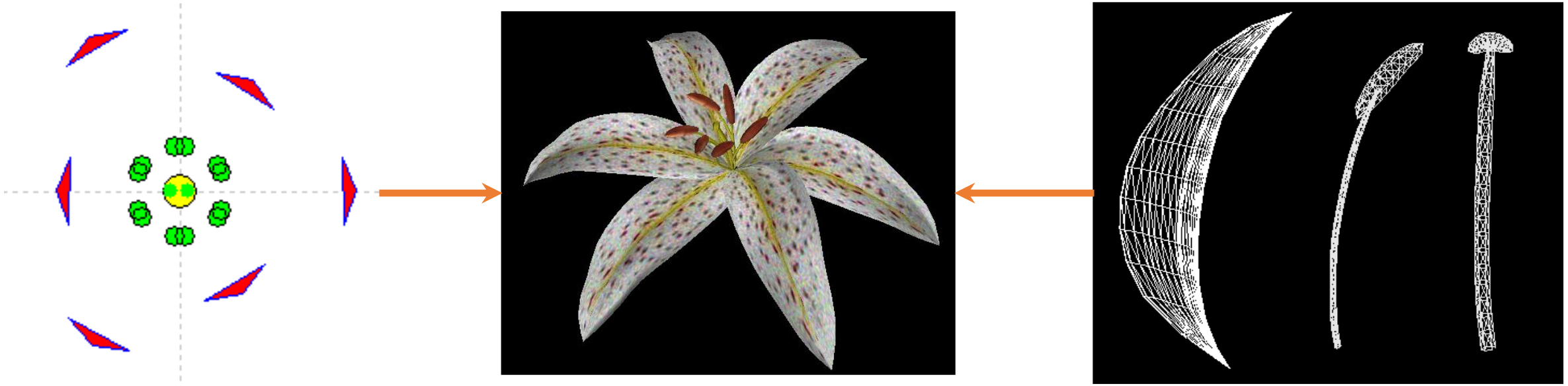
A branch bearing a lot of small flowers



[Bell. Plants form, *Timber press, 1991*]

→ Design structure editors based on them

Modeling process (Demo)



Summary

Easy to use flower modeling tool

Divide modeling process

+ structure editing

+ geometry modeling

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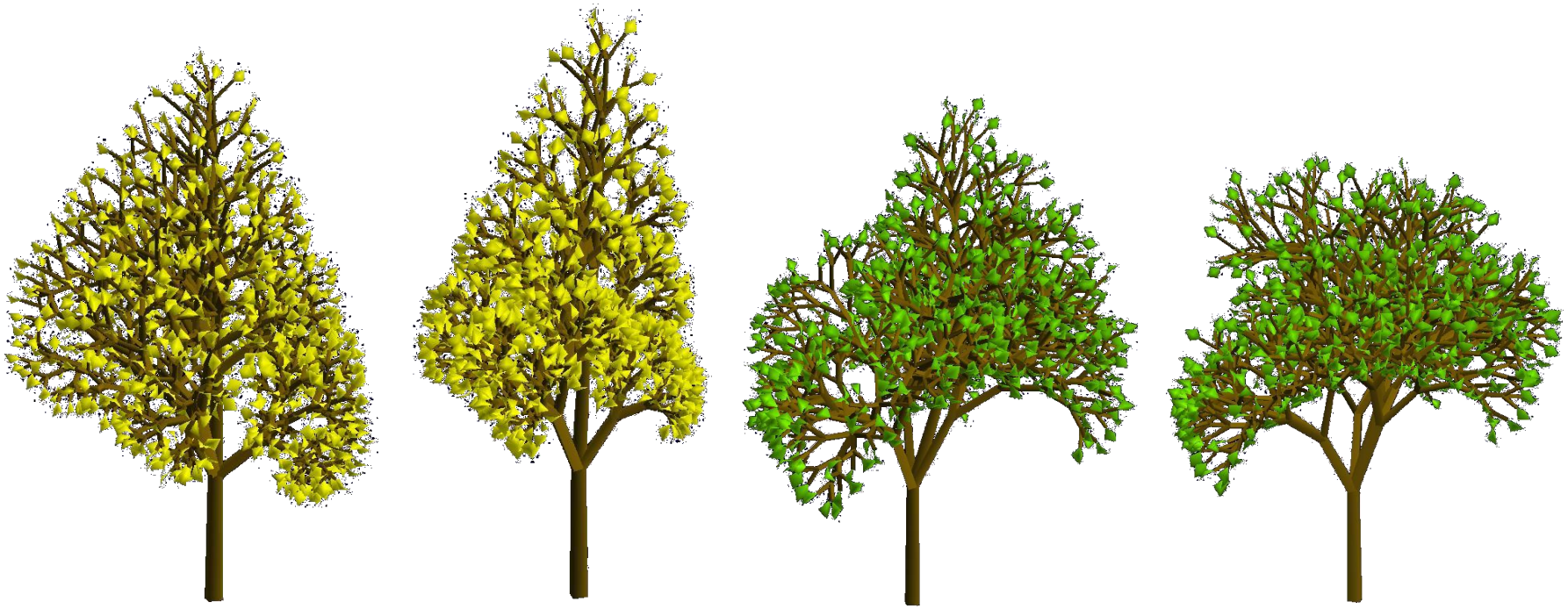
The Sketch L-System: Global Control of Tree Modeling using Free-form Strokes

- Ijiri T., Owada S., Igarashi T.: **The sketch L-system: Global control of tree modeling using free-form strokes**. In Smart Graphics 2006, Vol. Volume 4073 of *Lecture Notes in Computer Science*, Springer, pp. pp.138-146.

Our Goal

- Easy-to-use tree modeling framework
- Large **variations** of trees with a little effort



Our idea

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Combine two frameworks !!

- L-System → Describe complicated branching structures
- Sketch → Specify global appearance

	L-System	Sketch
Detail structure	Good	Bad
Overall Shape	Bad	Good

Introduce two elements to L-System

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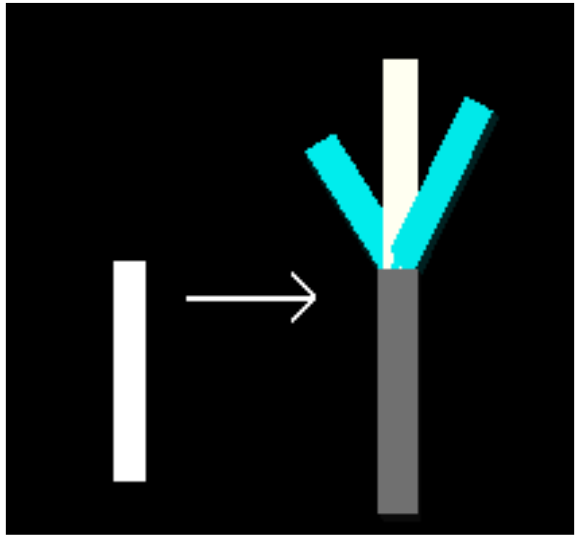
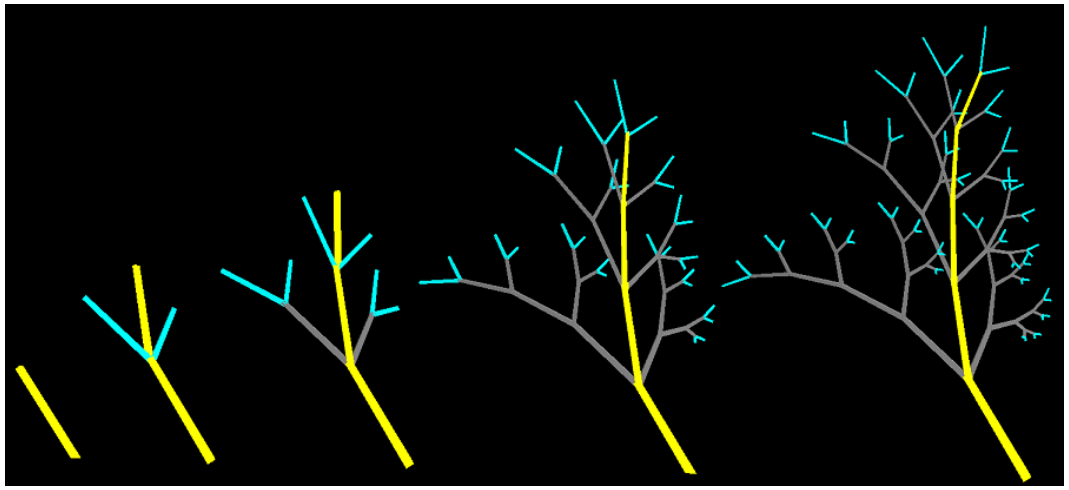
- Interaction module
  - Its growing direction is decided by the stroke
- Sketch interface for controlling growth of L-System
  - Central axis & depth of recursion



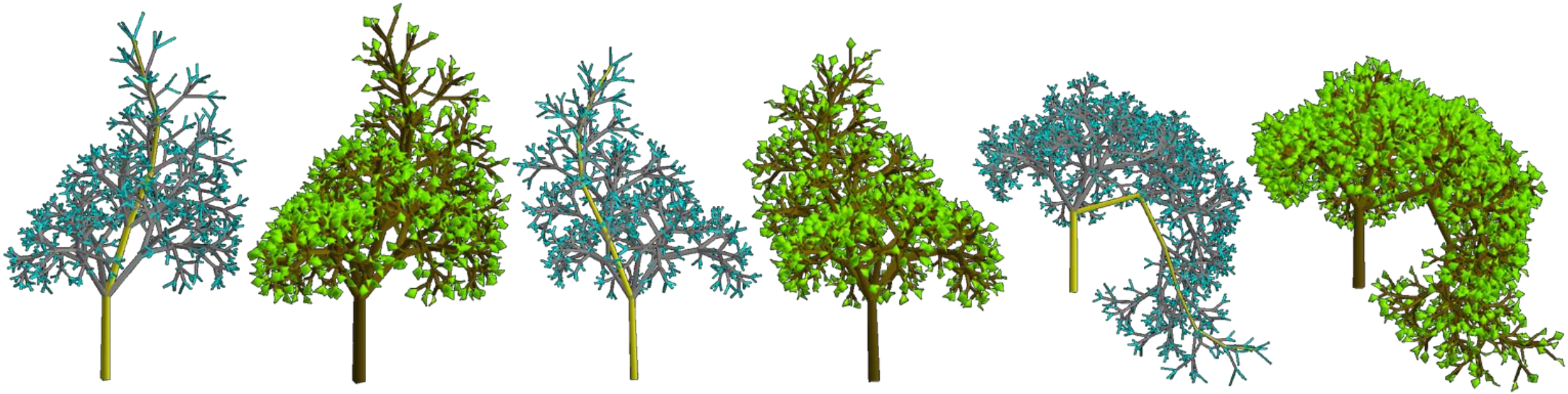
Interaction module



Sketch interface

Summary

- Combined sketch and L-system
- Large variation of trees with a little effort
- Only a simple trial and many future work
  - Specify overall shapes, Specify the shape of 2nd branches



Conclusion : user assisted modeling

- **Sketch based Interface** : global shapes
- **Procedural approach** : local structures

→ **Their combination becomes powerful tool for plant modeling**

Many sketch based plant modeling tools appear

Sketch-based tree modeling
[Longay et al. SBIM 2012]
[Wither et al. 2009]
[Chen et al. SIGGRAPH ASIA 2008]
[Okabe et al. EuroGraphics 2005]

Sketch-based plant modeling
[Anastacio et al. CG 2005]

Sketch-based Ornament modeling
[LU et al. SIGGRAPH 2014]
[MECH and MILLER, JCGT, 2012]

Additional references

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Sketch based tree modeling

LONGAY, S., RUNIONS, A., BOUDON, F., AND PRUSINKIEWICZ, P. Treesketch: Interactive procedural modeling of trees on a tablet. In Proc. SBIM, 107–120, 2012

Jamie Wither, Frederic Boudon, Marie-Paule Cani, Christophe Godin. Structure from silhouettes: a new paradigm for fast sketch-based design of trees. Computer Graphics Forum, Wiley, 28 (2), pp.541-550, 2009

Xuejin Chen, Boris Nerburt, Ying-Qing Xu, Oliver Deussen, Sing Bing Kang. Sketch-Based Tree Modeling Using Markov Random Field. ACM Siggraph Asia and Transaction on Graphics, Vol. 27, No. 5, 2008

OKABE, M., OWADA, S., AND IGARASHI, T. Interactive design of botanical trees using freehand sketches and example based editing. Comput. Graph. Forum 24, 3, 487–496, 2005.

Sketch-based plant modeling

ANASTACIO, F., PRUSINKIEWICZ, P., AND SOUSA, M. Sketch-based parameterization of L-systems using illustration inspired construction lines and depth modulation. Comput. Graph. 33, 4, 440–451, 2009

Sketch-based Ornament modeling

LU, J., BARNES, C., WAN, C., ASENTE, P., MECH, R., AND FINKELSTEIN, A. Decobrush: Drawing structured decorative patterns by example. ACM Transactions on Graphics, 2014.

MECH, R., AND MILLER, G. The Deco framework for interactive procedural modeling. Journal of Computer Graphics Techniques (JCGT) 1, 1 (Dec), 43–99, 2012.