Plants and L-Systems

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Problem

- Modeling trees is hard
- Modeling forests is harder
- Need mathematical model

Lindenmayer Systems

- Formal grammars
- Prusinkiewicz et. al.
- The Algorithmic Beauty of Plants
- Very extendable

Approach

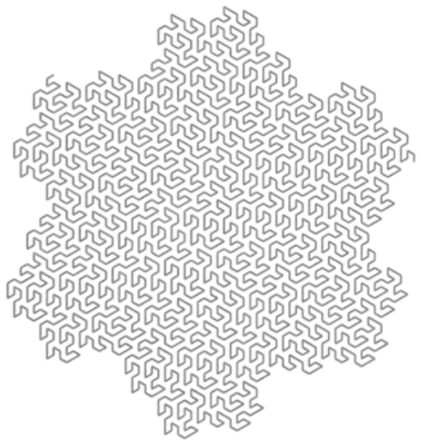
- Generate models with L-Systems
- Render models with pbrt
- Add randomization and strive for realism

Simple L-Systems

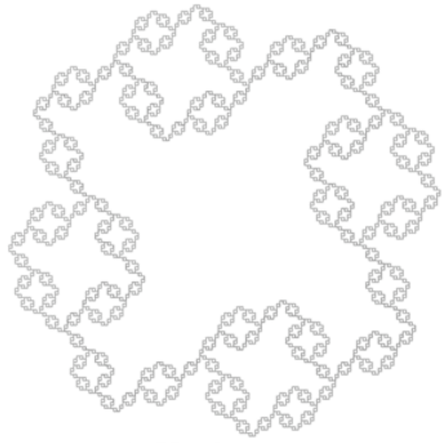
- Turtle drawing
- Fractals
- Algae

```
f: ff-f-f+f
```

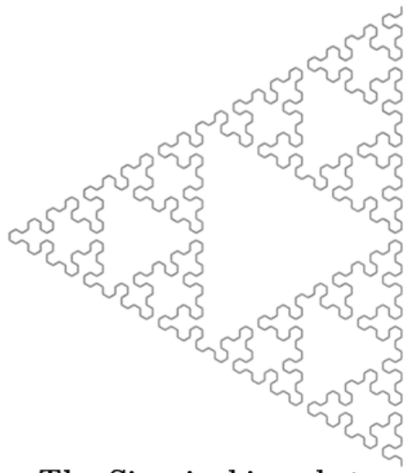
2D L-Systems



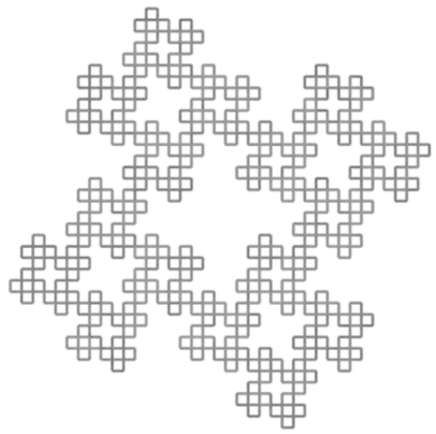
Hexagonal Gopser curve



A Koch curve

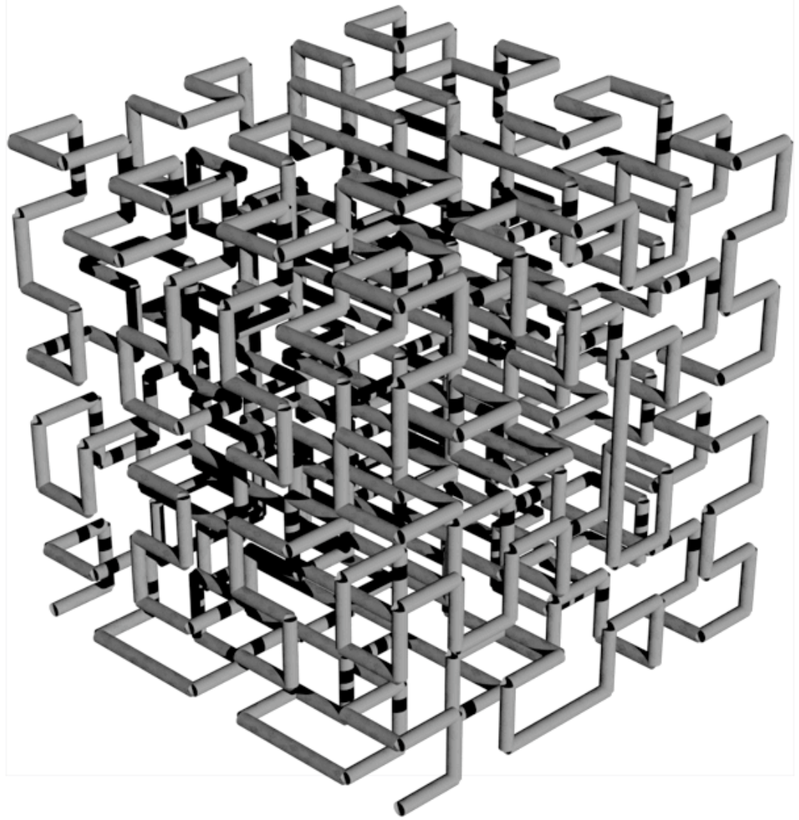


The Sierpinski gasket



A second Koch curve

3D L-Systems



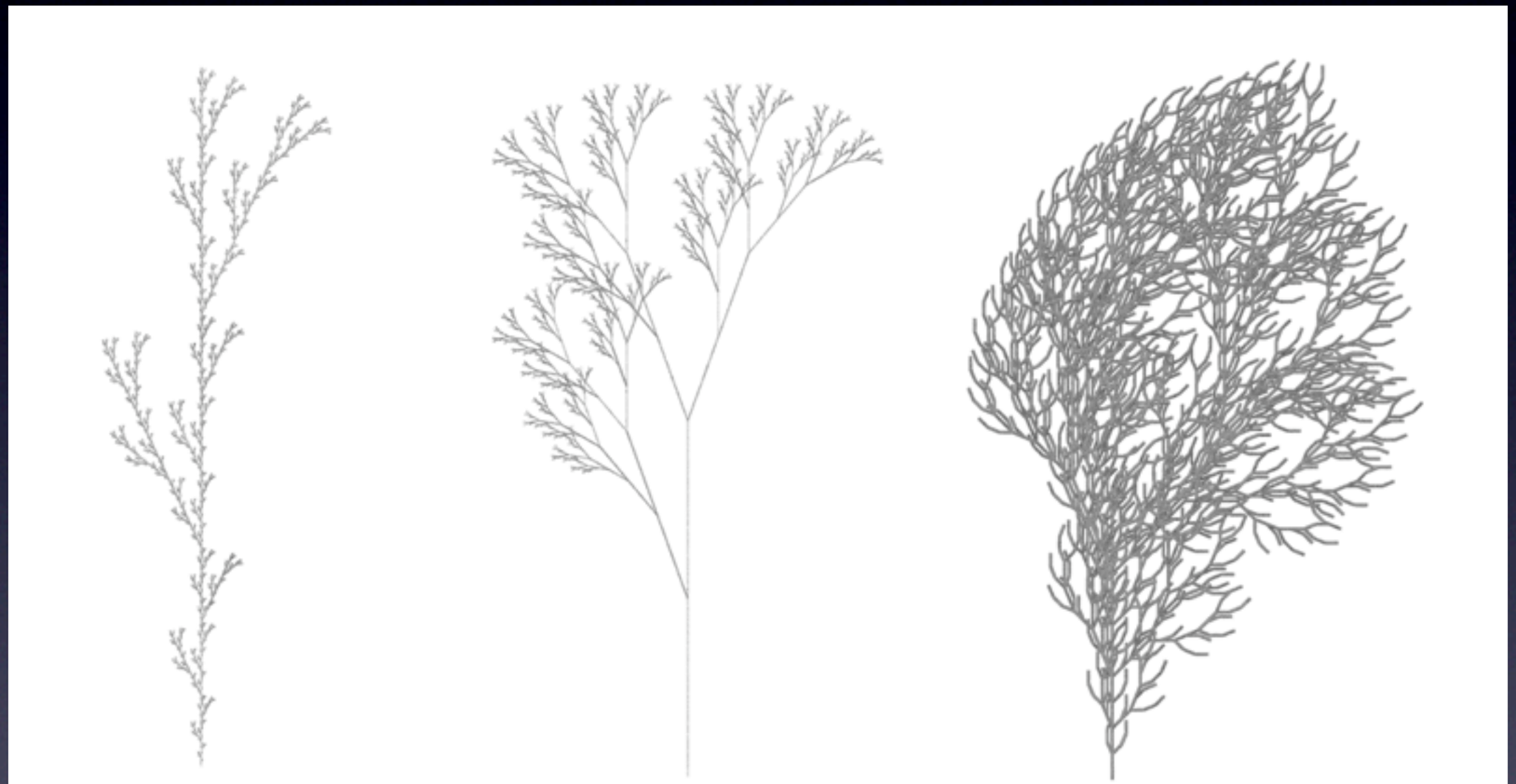
3D Hilbert curve.

Moving to plants

- Branching
- Segment thickness
- Color
- Leaves

```
f: f[f+f]f[-f]
```

Simple plants



Some 2D plant-like structures from bracketed L-Systems.

Higher plants: flower

Higher plants: tree

Stochastic L-Systems

- Randomness is vital
- Combinatorial explosion
- Multiple productions per symbol

```
f(20): ff+f
f(80): f[+f]
```

Stochastic flowers

Some stochastic flowers.

Realism is hard

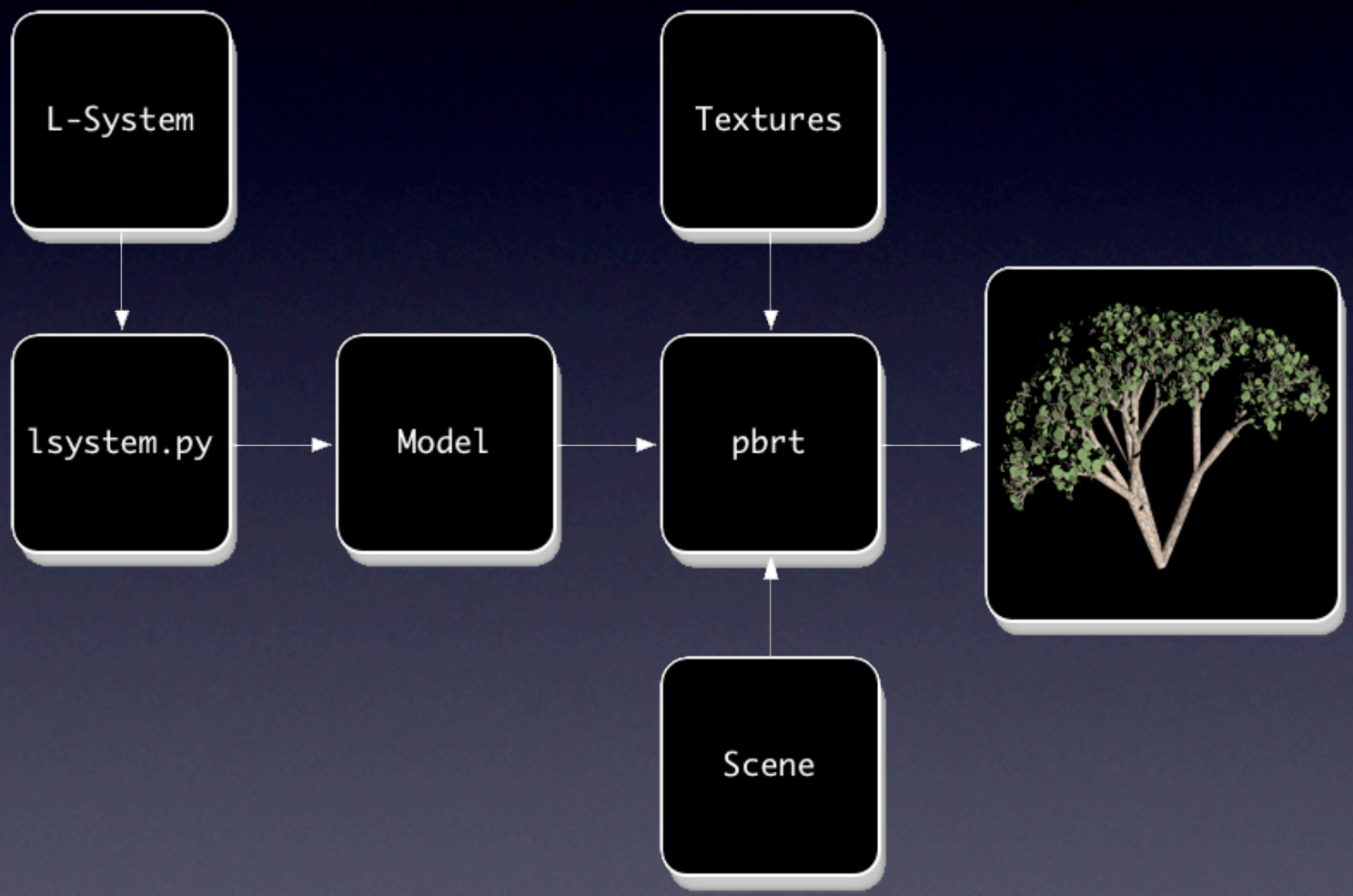
- Bark texture
- Leaves' position, shape, texture
- Branching gaps

Improved tree model

Difficulties

- Shape plugin format
- Material restrictions
- C++

Data flow



Future

- Parametric L-Systems
- More randomization
- Creation of new L-Systems

Demo