

Self-similarity

May 30, 2007
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Algorithmic design beyond repetition

Abstract Patterns

<http://www.enchgallery.com/fractals/fracthumbs.htm>

Natural Scenes



<http://www-ui.is.s.u-tokyo.ac.jp/~ijiri/>

Plants

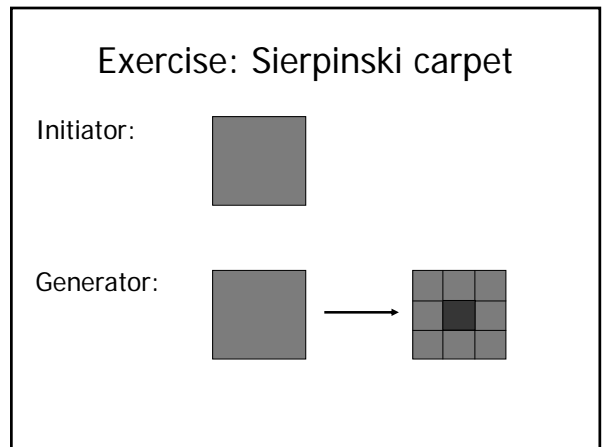
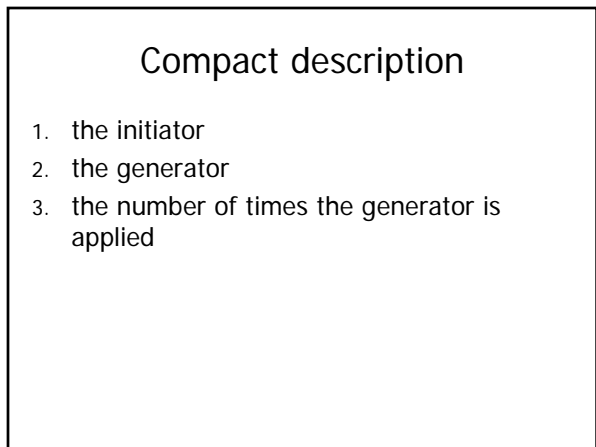
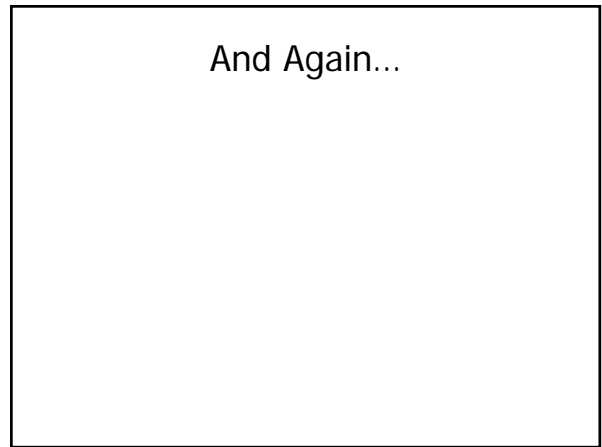
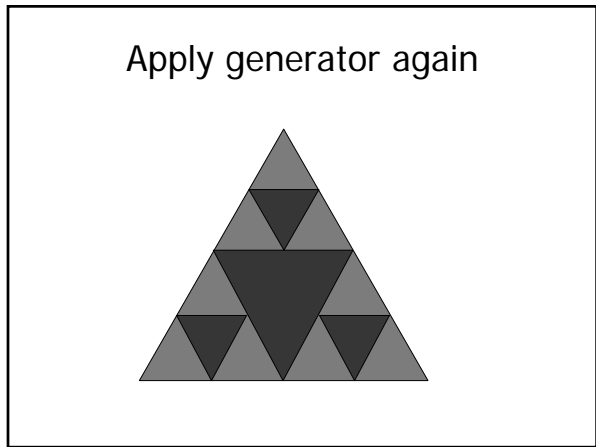
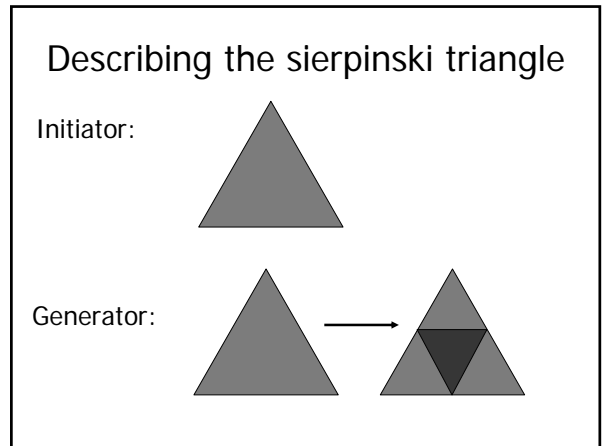
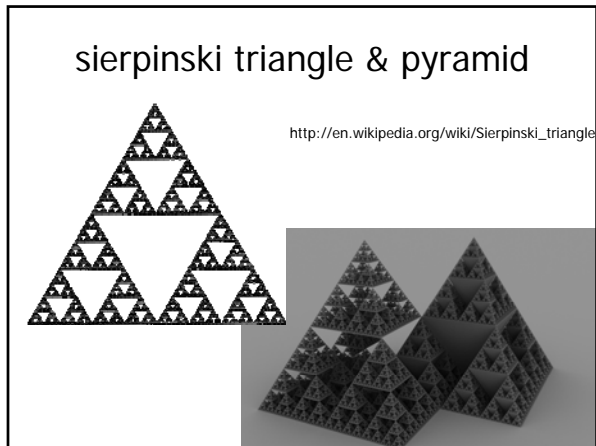
"[in addition to symmetry] two other factors that organize plant structures and therefore contribute to their beauty [are] *developmental algorithms*, that is, the rules which describe plant development over time [and] *self-similarity*"

P. Prusinkiewicz and A. Lindermayer, "The Algorithmic Beauty of Plants", 1990

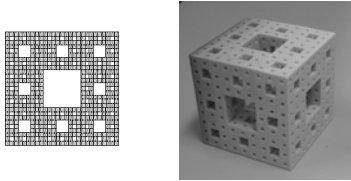
self-similarity



"when each piece of a shape is geometrically similar to the whole, both the shape and the cascade that generate it are called self-similar"

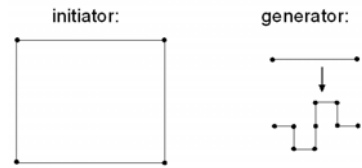


You should get

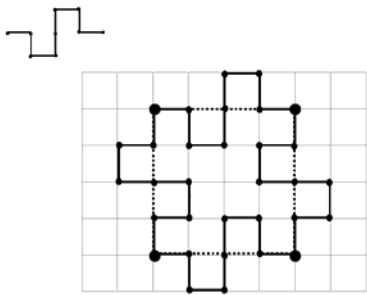


<http://local.wasp.uwa.edu.au/~pbourke/fractals/gasket/>

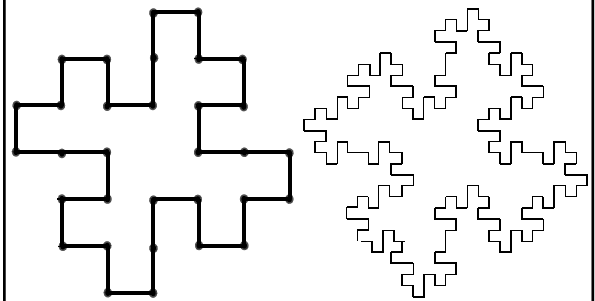
More exercise



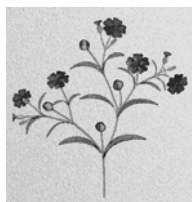
Something like this?



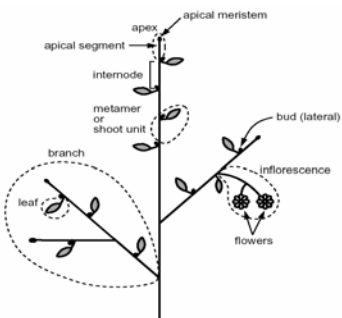
More iterations



Now you know how to grow this plant?



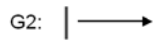
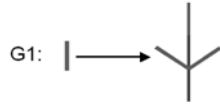
A Generative system for tree structure



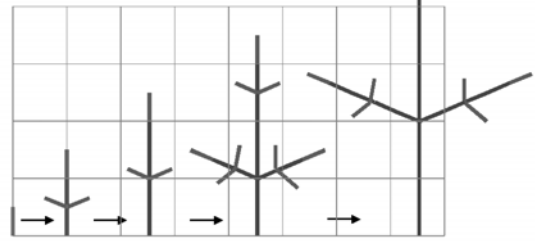
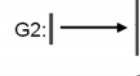
Sub-apical growth

initiator: |

generators:

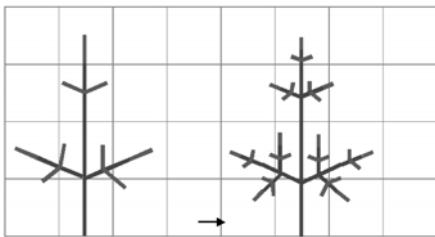
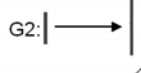


generators:



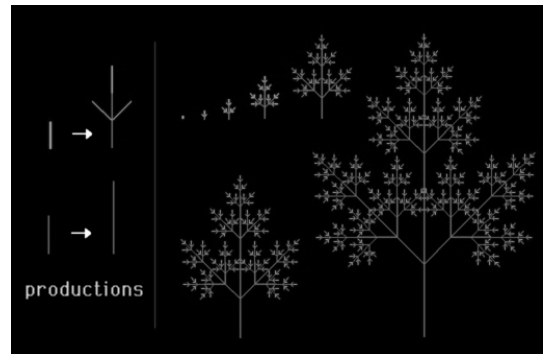
apply G1 apply G2 apply G1 apply G2

generators:

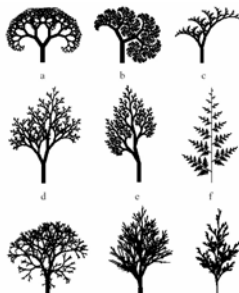


apply G1

generators seven levels of application



Variations of previous system

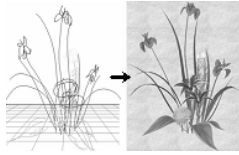


Movie Time



<http://www-ui.is.s.u-tokyo.ac.jp/~ijiri/>

More movie

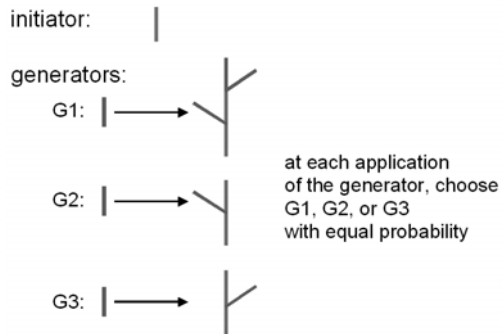


<http://www-ui.is.s.u-tokyo.ac.jp/~ijiri/>

enhancing generative systems

- ▶ allow random choices among generators
- ▶ incorporate models of flowers, leaves, etc.
- ▶ add timing to model development to get animation
- ▶ ... and much more!

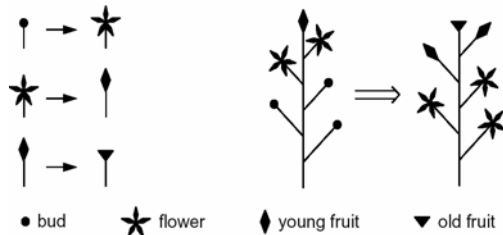
allow random choices among generators



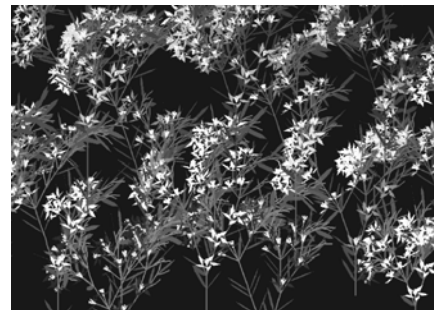
allow random choices among generators



add buds and flowers



add buds and flowers



Algorithmic Botany

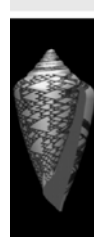
At the University of Calgary

<http://www.algorithmicbotany.org/>

<http://www.algorithmicbotany.org/vmm-deluxe/Animations.html>

Generative systems can also describe

- ▶ patterns on seashells
- ▶ shapes of mountains
- ▶ Snowflakes
- ▶ Art



J. Parke's Fractal Art

<http://www.infinite-art.com/>



wrap-up: computers and art

- ▶ Technology side: algorithms, tools
- ▶ Human side: GUI, creativity