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COG 356 - L-systems

Problem 1:

name/title=Idiosyncratic

vocabulary = { A B C D }

productions...

A --> A B

B --> B C

C --> C D

D --> D A

start=A

Generations:

<https://pastebin.com/yMEMrHKf>

Code:

Clay> PATTERN >> SA SB SB SC SB SC SC SD SB SC SC SD SC SD SD SA SB SC SC SD

SC SD SD SA SC SD SD SA SD SA SA SB

Clay> SA >> 3RP PLAY LP PLAY LP PLAY LP

Clay> SB >> 2PLAY

Clay> SC >> X2 2PLAY S2 2PLAY

Clay> SD >> S2 2PLAY S2 3PLAY 2X2

Problem 2:

Used the same L-system as above.

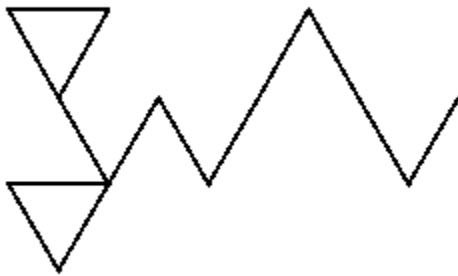
A -> <

B -> >

C -> F

D -> >

6th generation rendering:

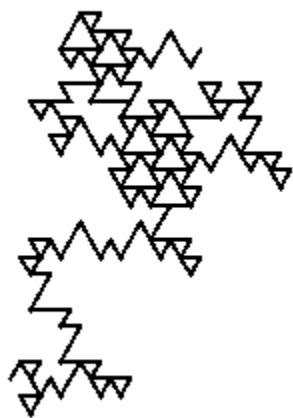


8th generation rendering:



I like this one because it looks like a little tribal dude. It was the only part that looked like anything vaguely recognizable. 10th generation included as proof of this.

10th generation rendering:



The interesting part is that there are still patterns and symmetry, even though the patterns themselves are idiosyncratic. It seems as though each part of the drawing can be seen in at least one other place.

Problem 3:

Alphabet: {L, M, R}

Start: M

Productions:

1. $L \rightarrow ML$

2. $M \rightarrow RM$

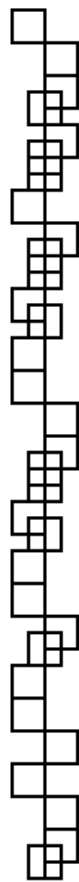
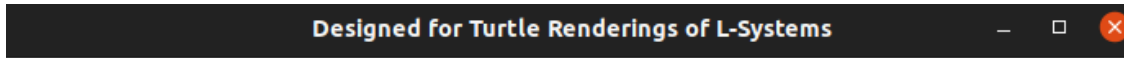
3. $R \rightarrow LR$

Generation 5:

LRRMRMMLRMMLMLLRRMMLMLLRMLLRLLRRM

Tgr code: render 10 LFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFRRRFFLF
FLFFLFFRRFFLFFRFFRFFRFFLLFFLFFRFFRFFRFFLLFFRRF
LFLFFLFFLFFLFLFFLFFRFFRFFRFFLLFFRRFLFLFFLFFLFFL
FLFFRRFLFLFFLFFLFFLFLFFRFFLFFLFFLFFRRFFLFFRFFR
FFRFFLLFFRRFLFLFFLFFLFFLFLFFRRFLFLFFLFFLFFLFLFF
RFFLFFLFFLFFRRFFRRFLFLFFLFFLFFLFLFFRFFLFFLFFLFF
RRFFRFFLFFLFFLFFRRFFLFFRFFRFFRFFLLFFLFFRFFRFFR
FLLFFRRFLFLFFLFFLFFLFLFFRRFLFLFFLFFLFFLFLFFRFF
LFFLFFLFFRRFFRRFLFLFFLFFLFFLFLFFRFFLFFLFFLFFRR
FFRFFLFFLFFLFFRRFFLFFRFFRFFRFFLLFFRRFLFLFFLFFL
FFLFLFFRFFLFFLFFLFFRRFFRFFLFFLFFLFFRRFFLFFRFFR
FFRFFLLFFRFFLFFLFFLFFRRFFLFFRFFRFFRFFLLFFLFFRF
RFFRFFLLFFRRFLFLFFLFFLFFLFLFF

Tgr result:



Problem 4:

Questions:

1. What is a fractal?
2. What is a fractal dimension?
3. How might fractals be involved in consciousness?
4. What does Jackson Pollock Have to do with fractals?
5. Why do Pollock's paintings contain fractals?
6. What else might contain fractals?

Answers:

1. A fractal is a line or shape which is self-similar in such a way that transcends its scale.
2. A fractal dimension is a measure of how much of a fractal something is, using a measure of how complex the line is.
3. Fractals are posited to be present in the brain waves recorded from conscious people via EEG. These fractals are present when viewing brain waves over time. They may also be related to quantum computing and microtubules?
4. Jackson Pollock's artwork contains fractals. When he first started painting, his paintings exhibited a fractal dimension close to one, but after he has gathered experience, his more

modern paintings peaked at a fractal dimension of more than 1.7, which is even higher than the fractal dimension of 1.4 most commonly displayed in nature.

5. Pollock's painting's fractals are seen in the way patterns recur in his paintings at multiple levels of scale.
6. Fractals are present in human lungs, and even the way we sway when we want to catch our balance.

Note: I feel wholly unqualified to write this essay. I have spent hours combing through various sources pertaining to fractals and fractal dimensions, and still feel I am no closer to understanding either concept.

Essay:

Fractals as a Cognitive Infrastructure

Fractals are all around us, quite literally. Much of nature exhibits fractal patterns, even in things which might not appear to have patterns at first glance. A fractal is something that is similar to itself at multiple levels of scale, for example, a tree has branches, but those branches have branches as well which mimic the form of its larger branches. There is a way to measure the “fractal-ness” of a fractal, by using its fractal dimension. A fractal dimension is a measure of how complex something is. As fractals have been discovered in nature, humans contain a plethora of self-similar patterns as well. Fractals have been cited as a possible correlate of consciousness by Roger Penrose, who observed that brain waves mimic their own patterns when viewed over time. Perhaps something in this vein is what many eastern philosophies refer to when they mention their consciousness “shifting frequencies” or other similar statements which

get so quickly dismissed by western science. Humans may be attracted to fractals without even knowing it, and they are even present in many human structures and actions, such as in the lungs, or within the small and large sways a person enacts when trying to catch their balance. Some studies have claimed that the viewing of fractals is associated with activity in areas of the brain that are rich in the feel-good hormone endorphins. Painter Jackson Pollock's paintings contain fractals, despite painting years before they were brought to the attention of the public. When he first started painting, his paintings exhibited a fractal dimension close to one, but after he has gathered experience, his more modern paintings peaked at a fractal dimension of more than 1.7, which is even higher than the fractal dimension of 1.4 most commonly displayed in nature. These fractals are seen in the way small details in his seemingly random, "paint splatter" artworks are similar to larger patterns throughout his canvas.

Sources:

(a) "Is Consciousness Fractal"

<http://nautil.us/issue/47/consciousness/is-consciousness-fractal>

(b) Ira Flatow interview with Richard Taylor: "Jackson Pollack Fractals"

<https://www.npr.org/transcripts/6631149>

Problem 5:

Fractals have many applications in the modern world. After the discovery of the mandelbrot set, fractals became far more popular as a concept, since the digital age, and with it, the ability to digitally model complex numerical and fractal systems, was just beginning. Fractals can be used to model large cities, which tend to expand in a similar way as to how they appear as a whole. They can also be seen in the designs of many antennas. Without fractals, the form of an antenna would be far less efficient. Of course, as already mentioned in this paper, fractals can be found in art, and it can of course be argued that art which contains fractals is inherently more appealing to the eye. Fractal analysis can also be applied to determining which blood cells are healthy, and which blood cells might be cancerous, since healthy blood cells have a fractal-like pattern which is often interrupted when cancer is present.