
2014. 7. 28.

(ysyoun@gmail.com)

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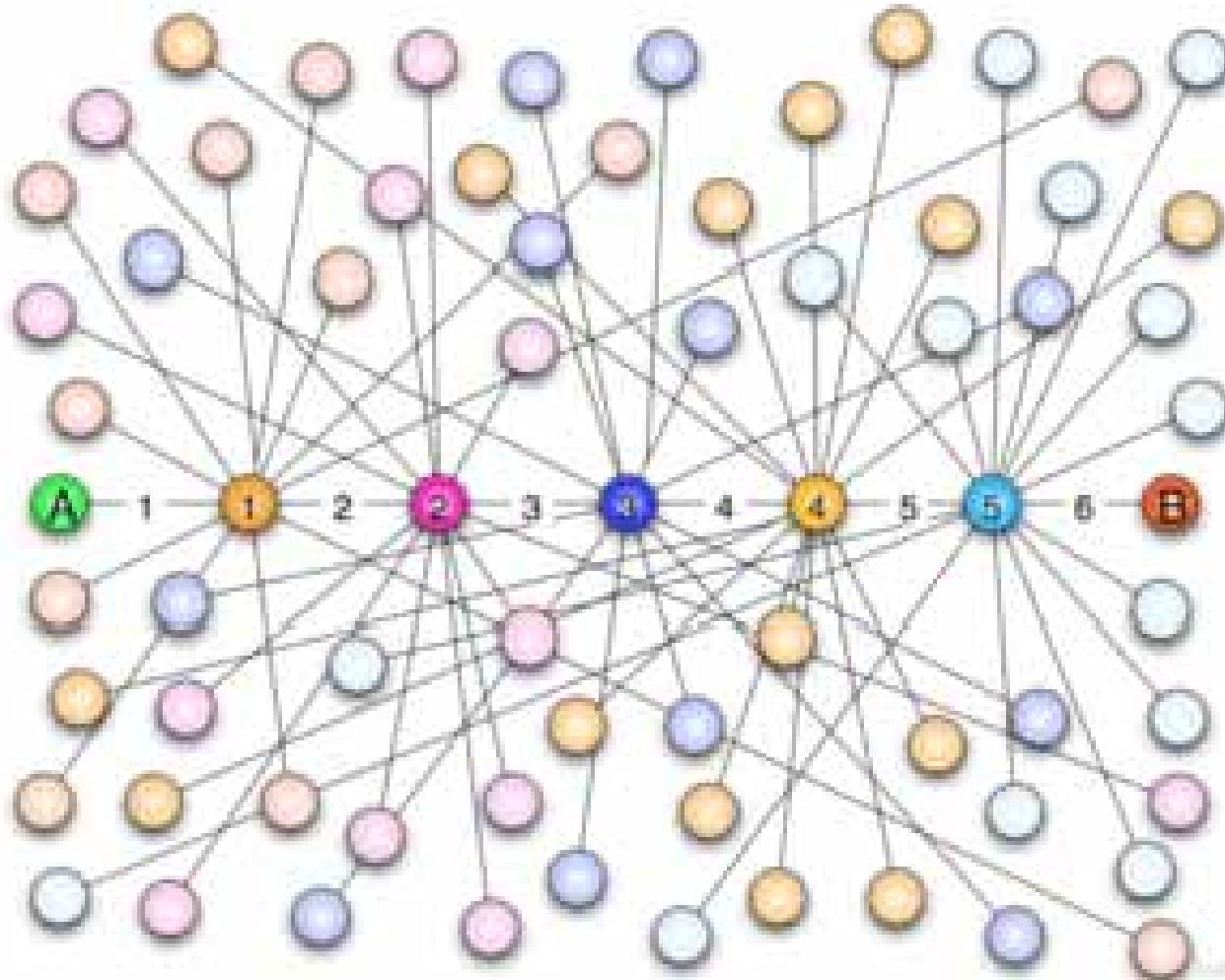
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six degrees of separation



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□ 2004

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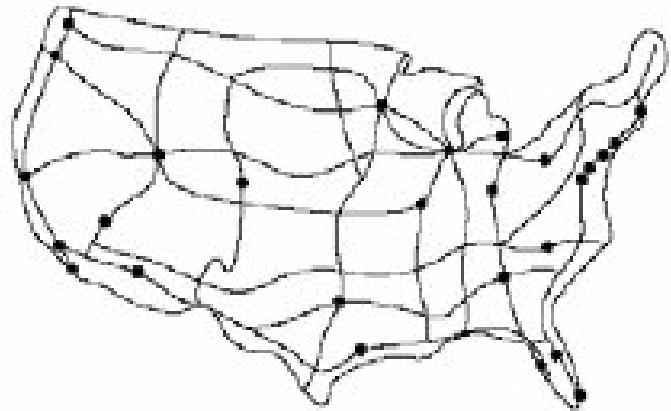
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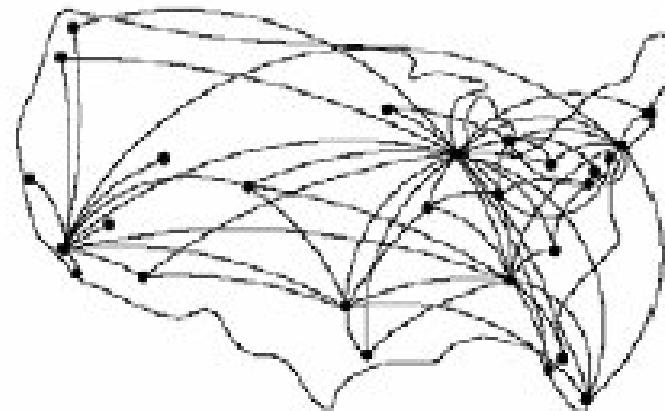
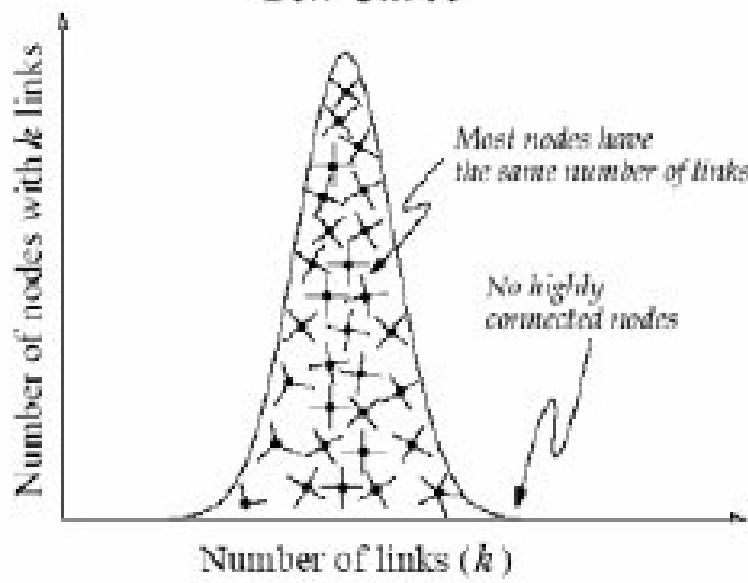
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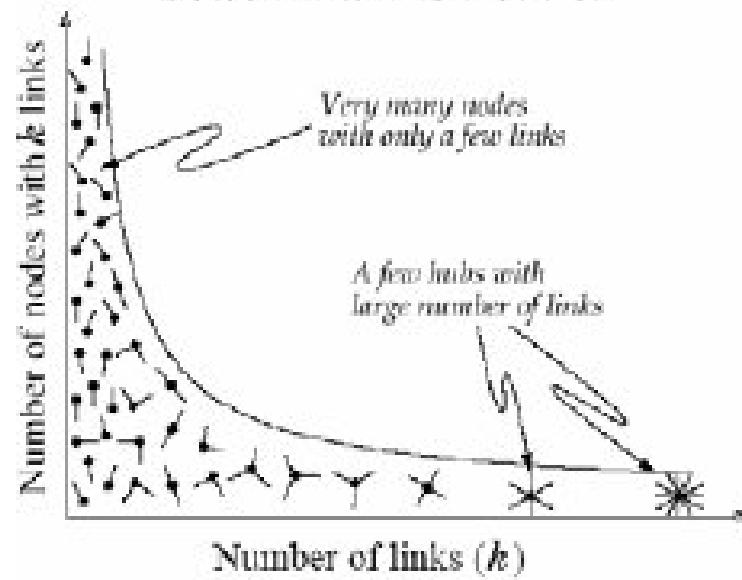
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Bell Curve



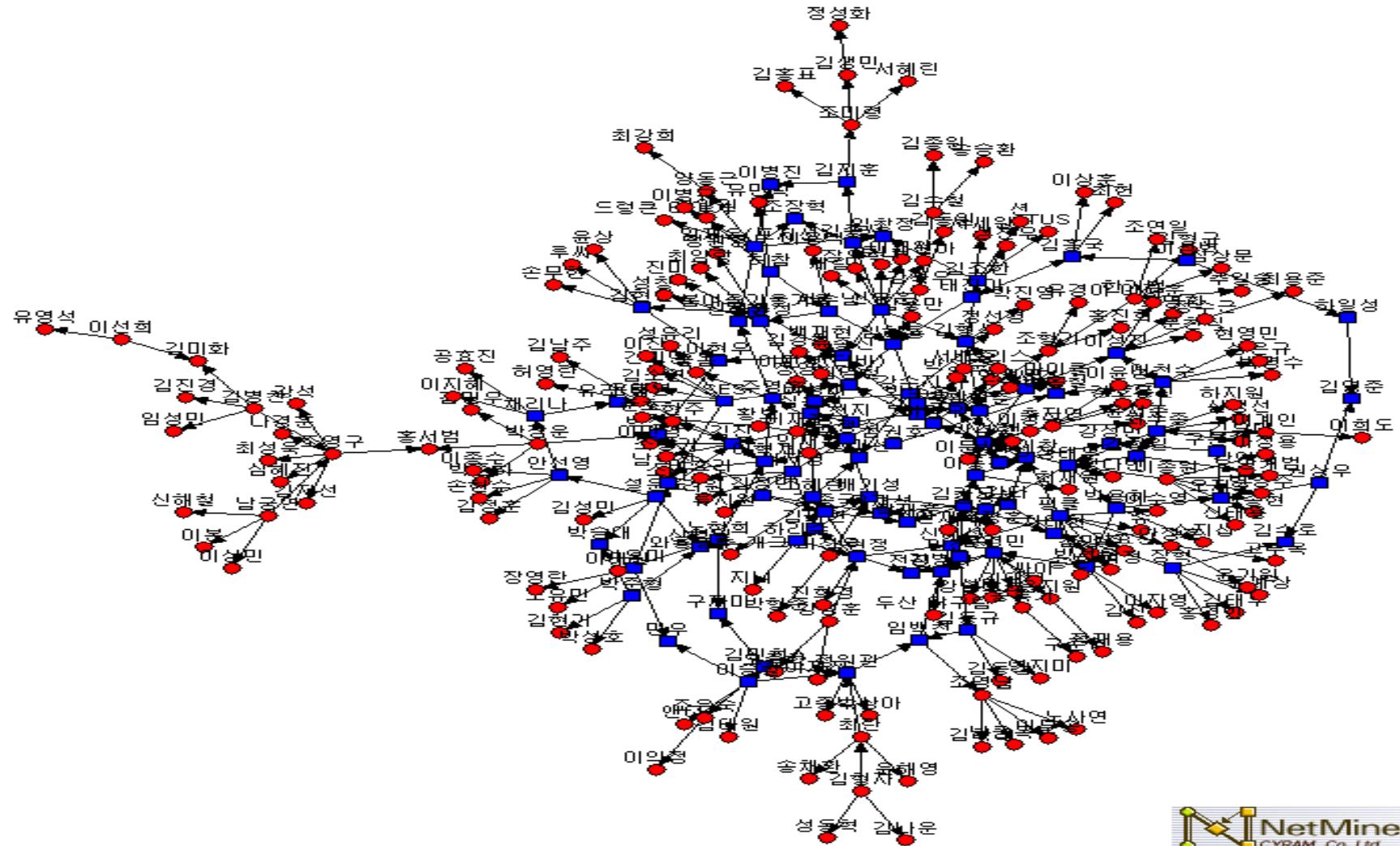
Power Law Distribution



Barabasi(2002)

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(Power Law)

□ (a)

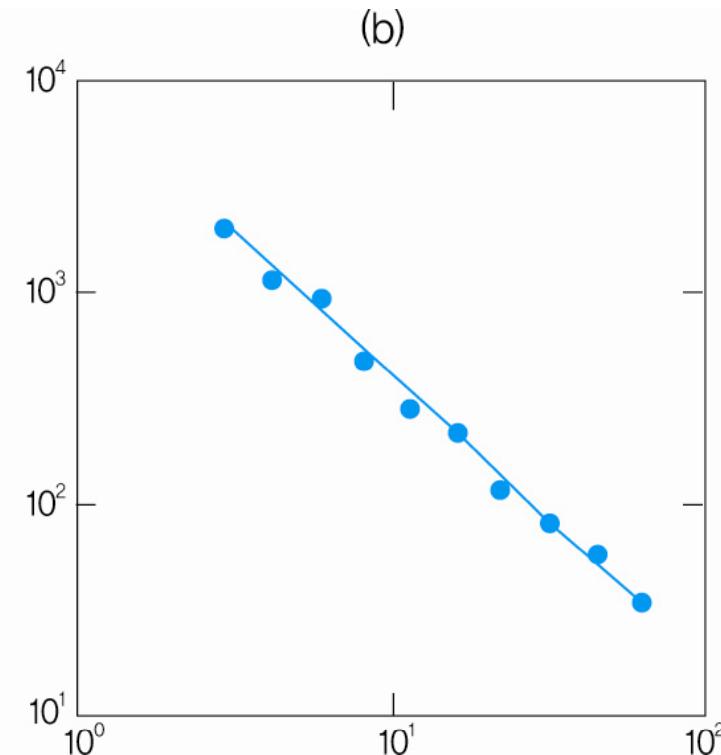
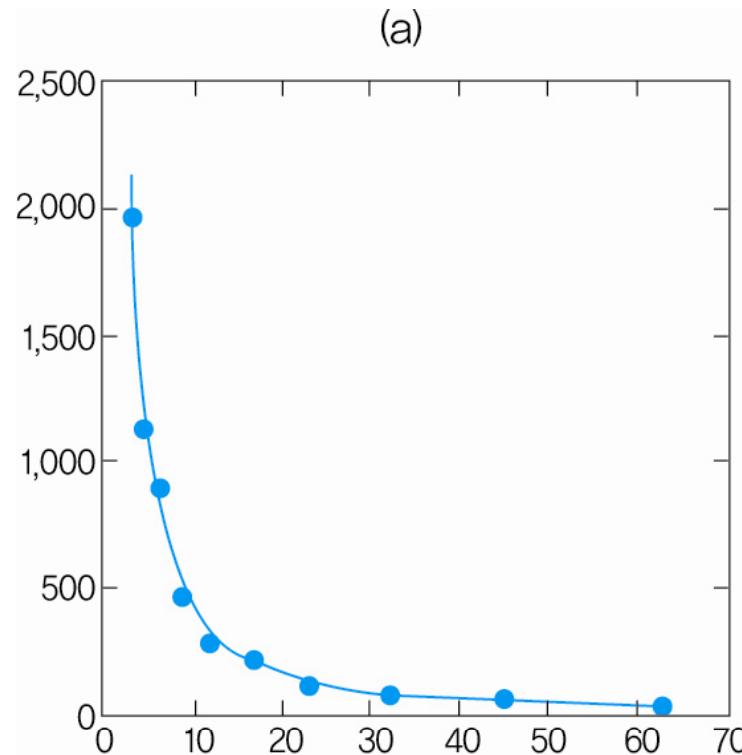
$x \propto y \Rightarrow \langle\langle y = A/x^\alpha \rangle\rangle$

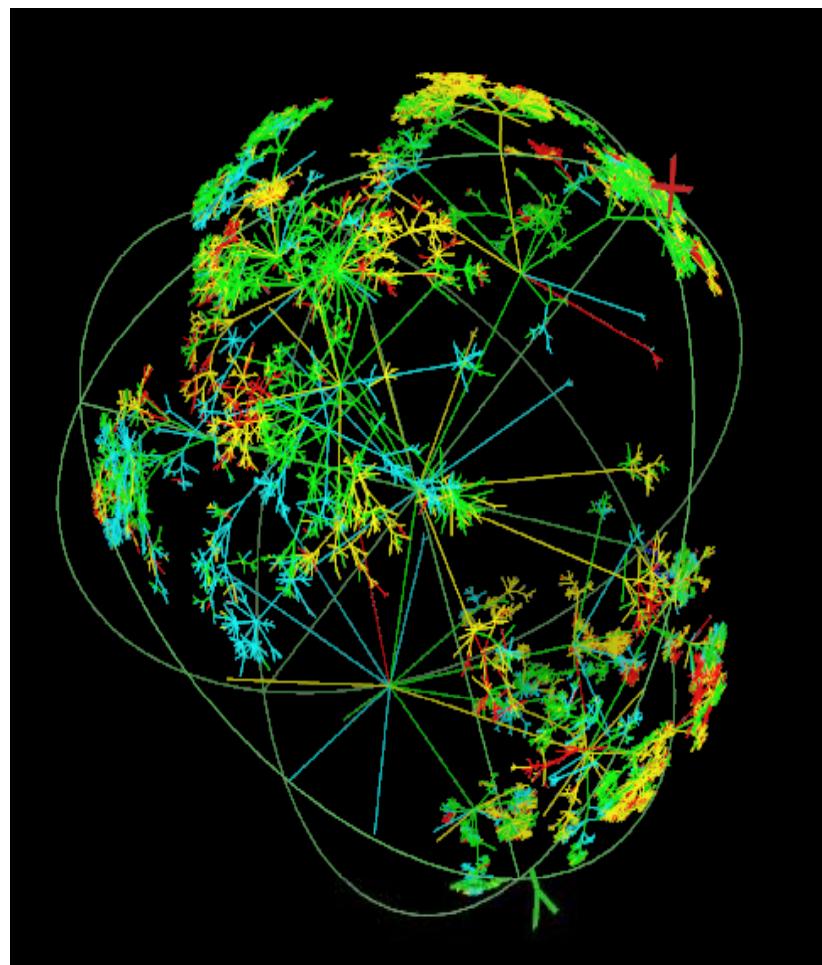
□ (b)

, $\langle\langle \log y = -\alpha \log x + \log A \rangle\rangle$

$A \gg 1$

, $\log x - \log y$





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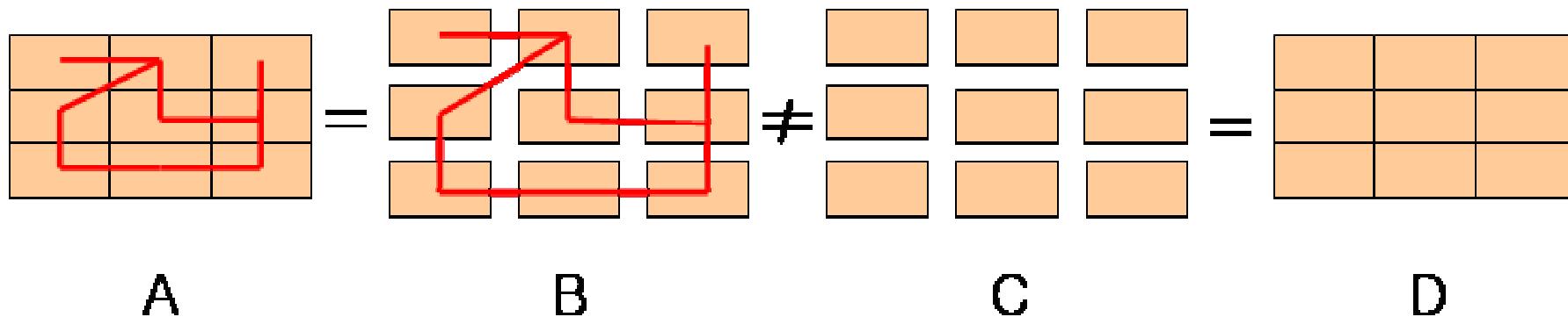
: <http://www.ima.umn.edu/complex/>

□ _____, _____,

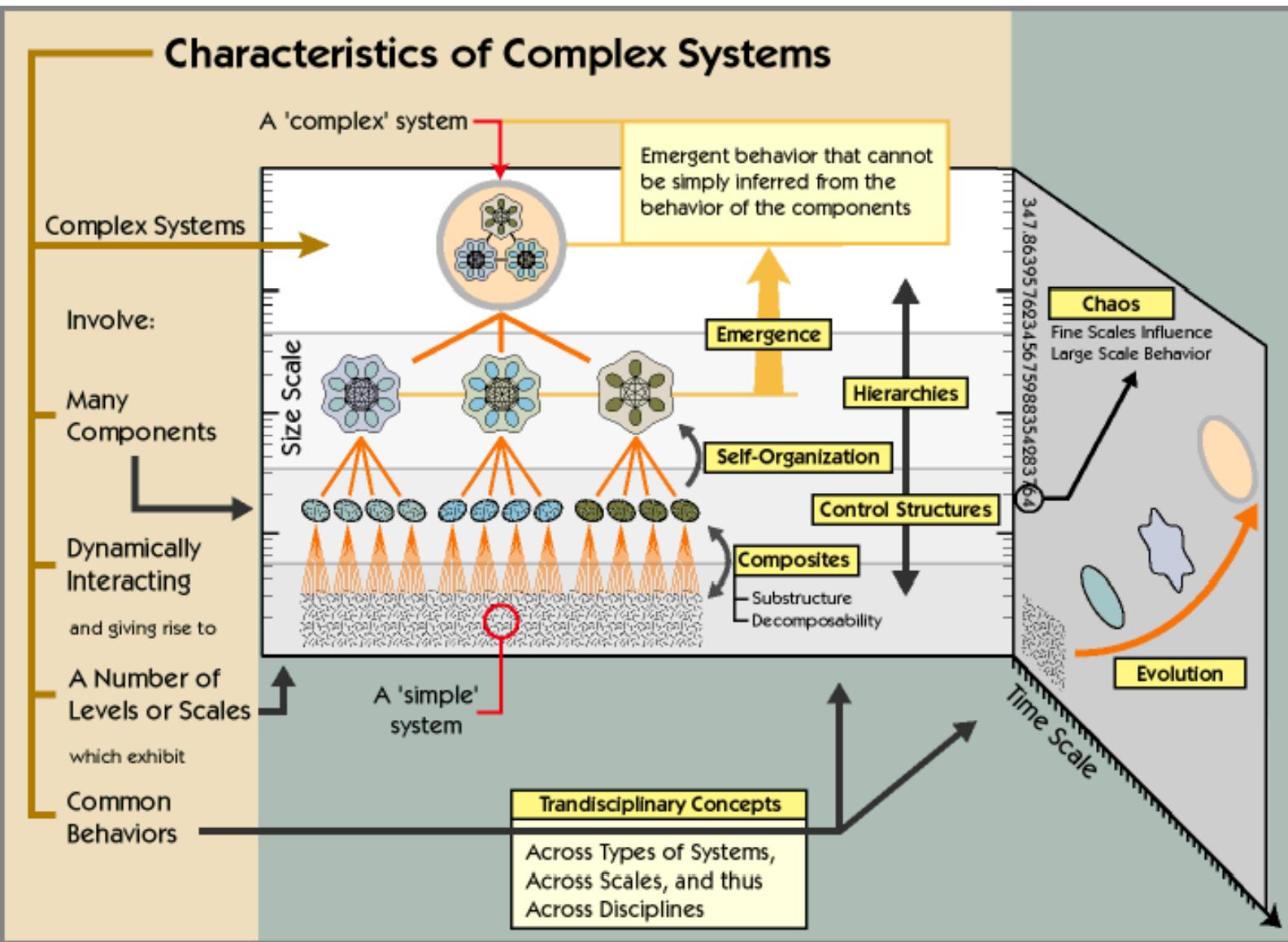
(interaction)

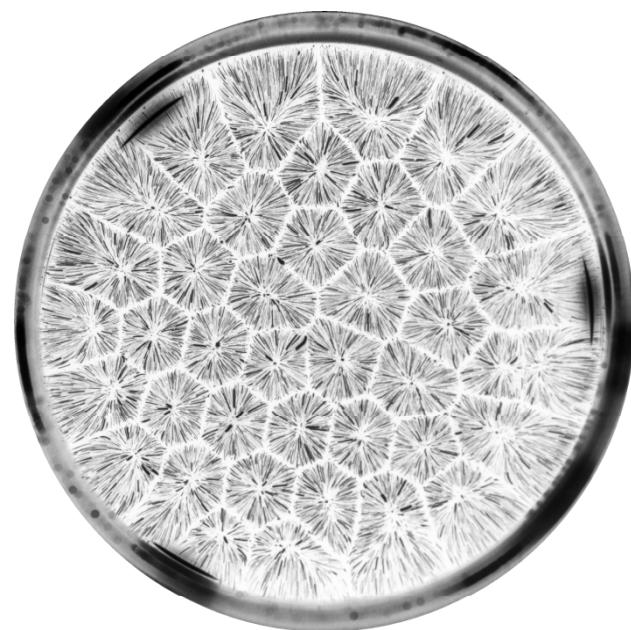
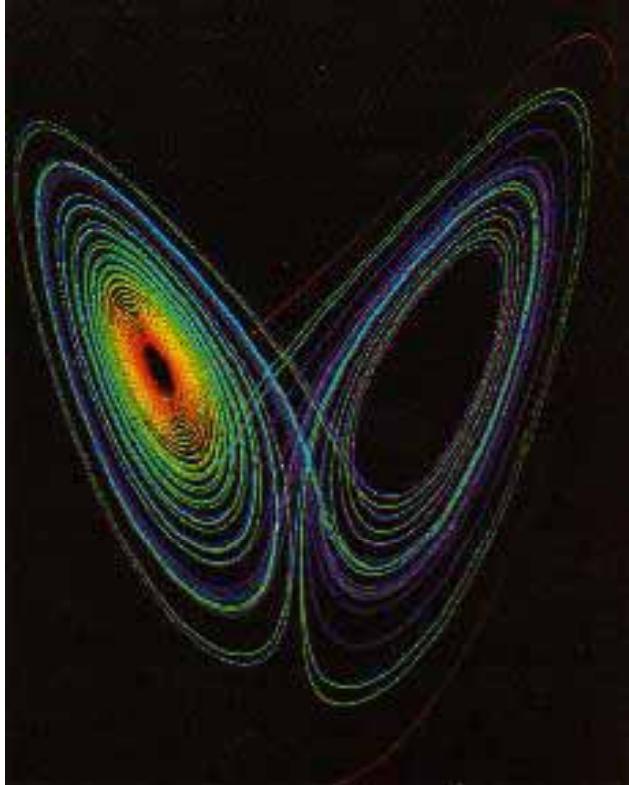
□ _____ 가

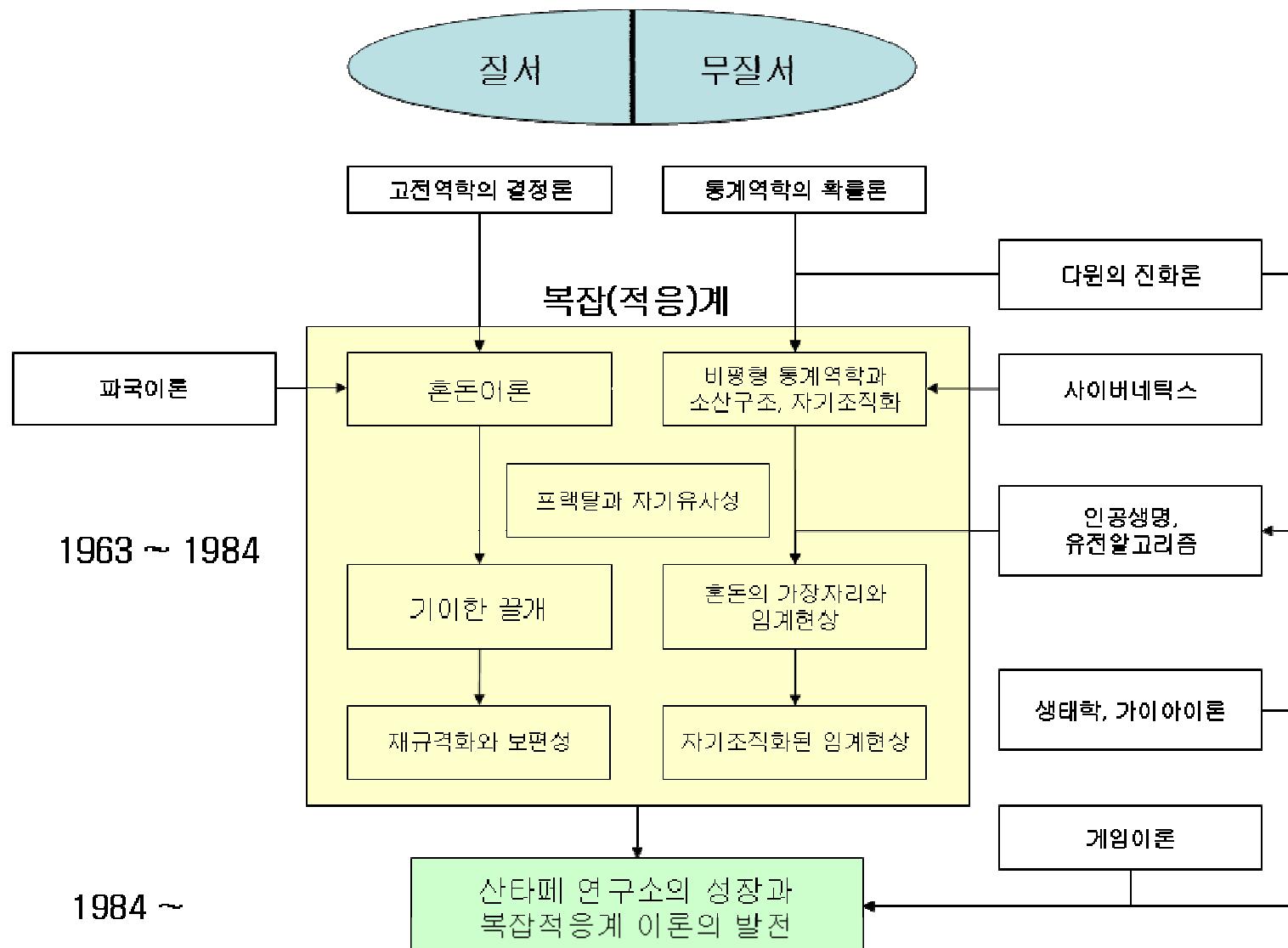
□ ‘_____ (emergence)’ ‘_____ (emergent behavior)’



Characteristics of Complex Systems







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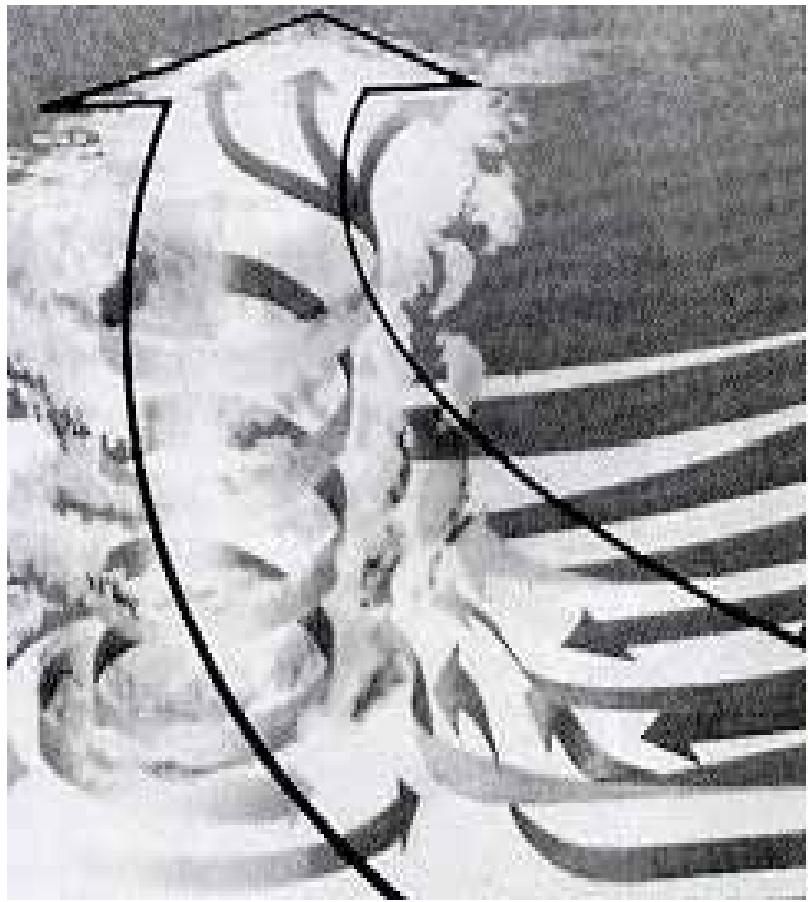
□ 1987

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(chaos)

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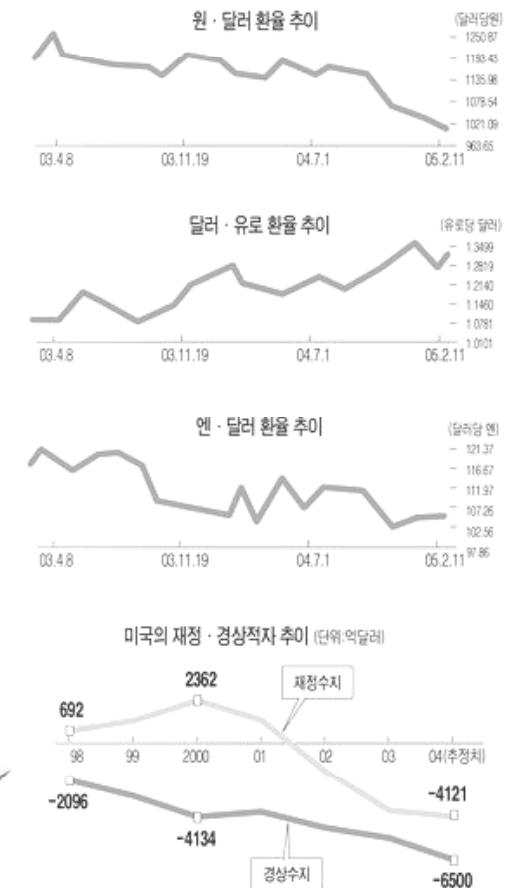
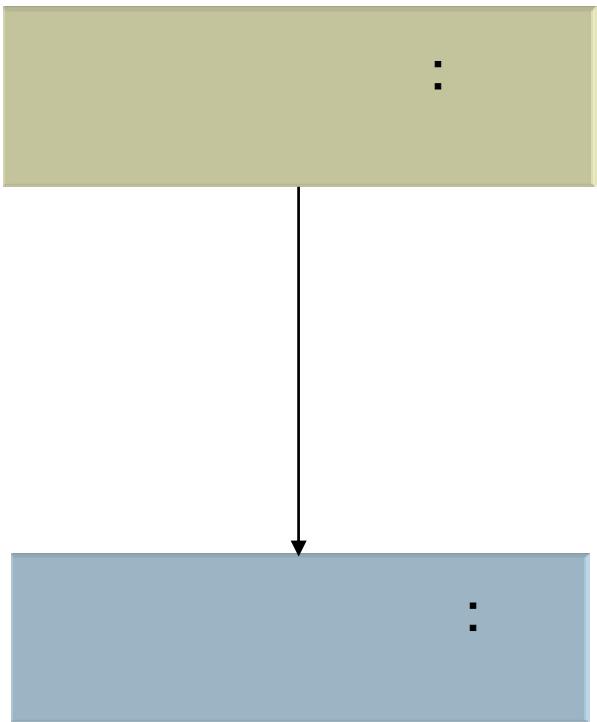
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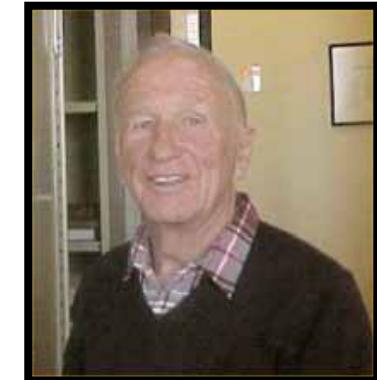
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-
- 1942 US Army Air Corps Weather Forecaster

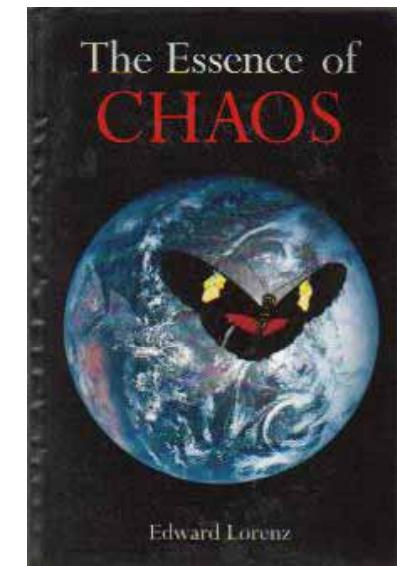


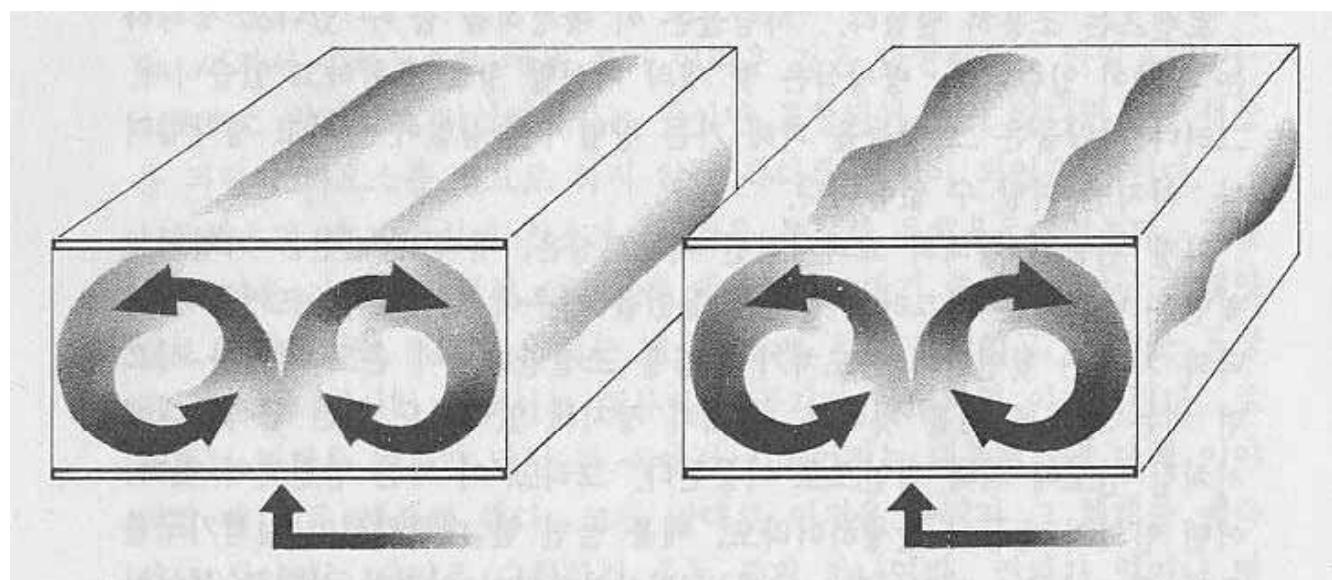
- 1955 MIT

- 1963 “

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$$\frac{dx}{dt} = \sigma (y - x)$$

$$\frac{dy}{dt} = x (\tau - z) - y$$

$$\frac{dz}{dt} = xy - \beta z$$

LPG-30

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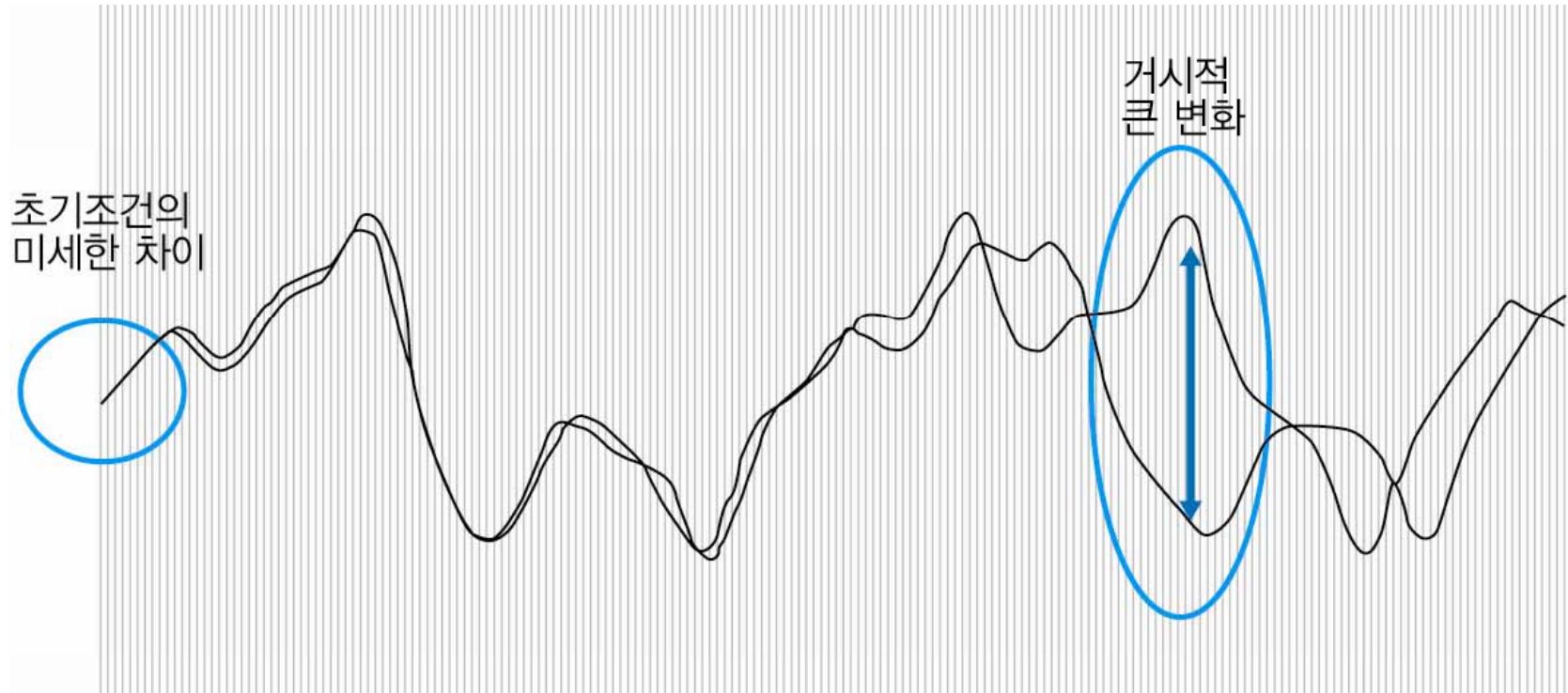
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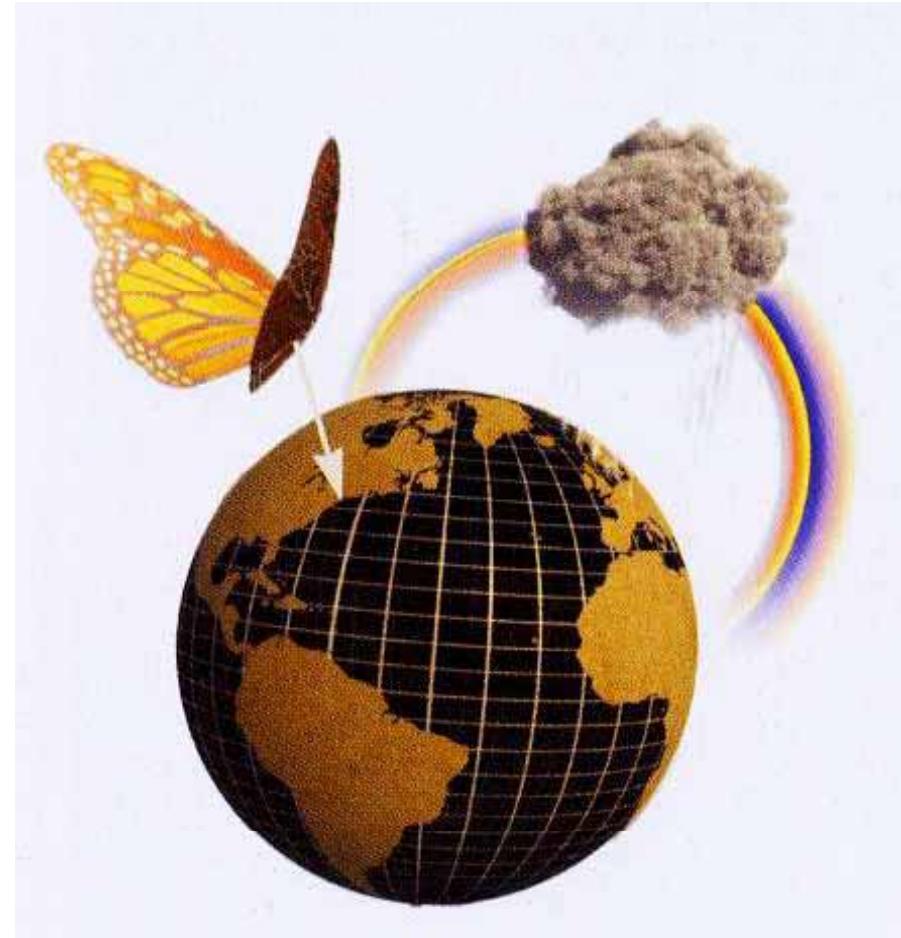
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□ “sensitive dependence on initial conditions”



□ **Butterfly Effect...**

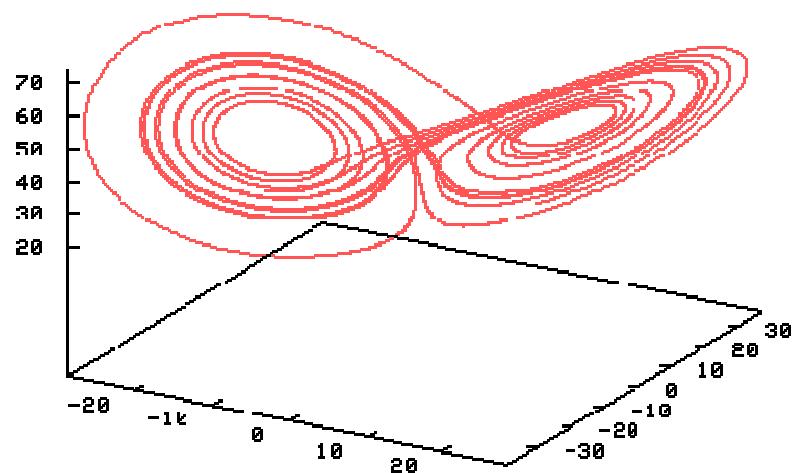
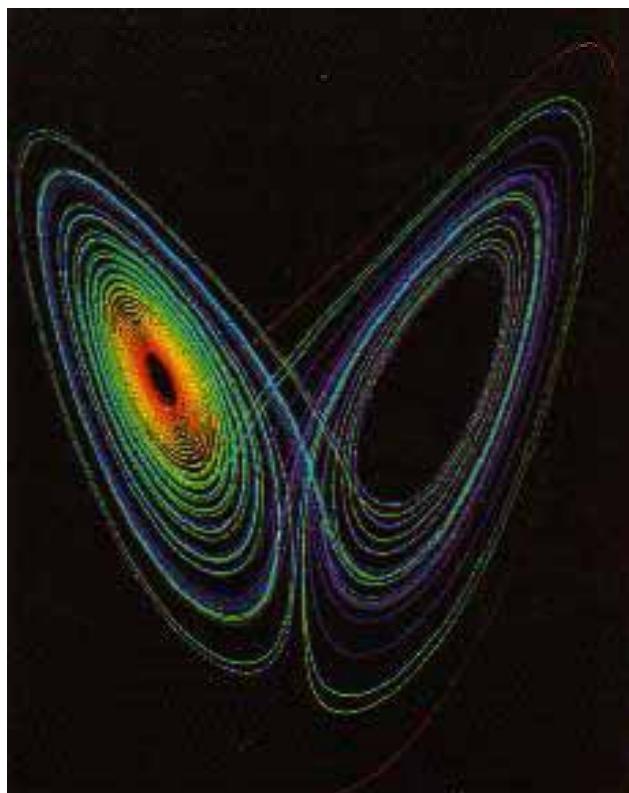
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<http://www.geom.umn.edu/~worfolk/apps/Lorenz/>
http://www.cmp.caltech.edu/~mcc/chaos_new/Lorenz.html

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– 2003 가 2004





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- (solitary), (gregarious)



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□ 2004

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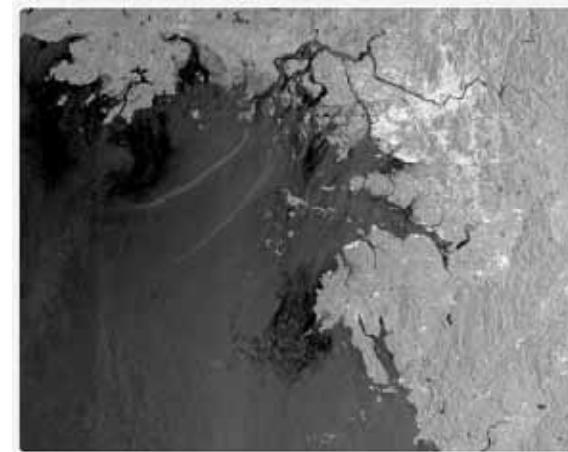
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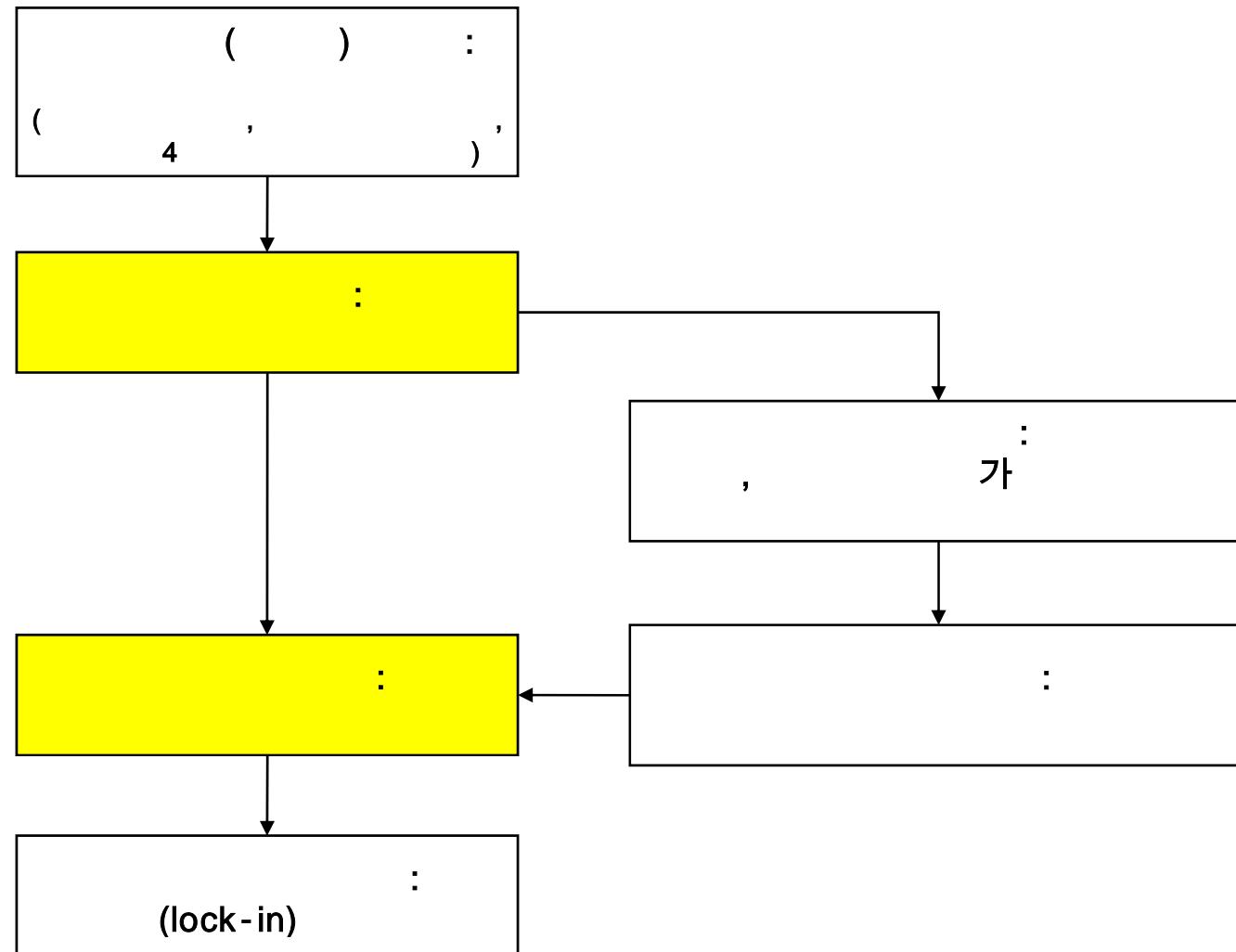
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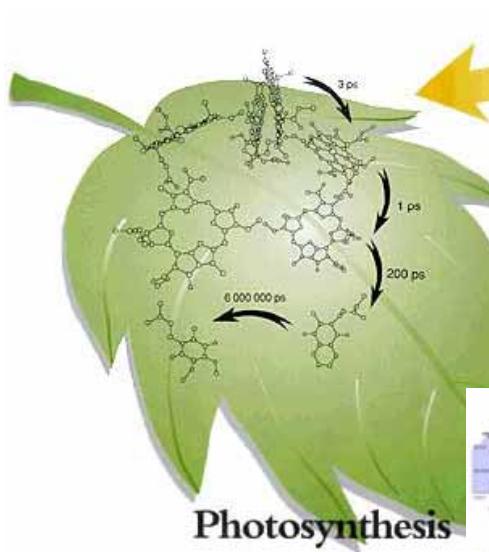
(top-

(bottom-up)

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B0K





In a photosynthetic reaction centre an electron is stepwise transferred between chlorophyll and other molecules.

1 ps = 10^{-12} seconds





(far from equilibrium)

_____가

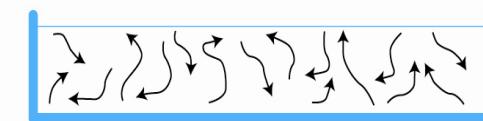
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, _____ (消散)

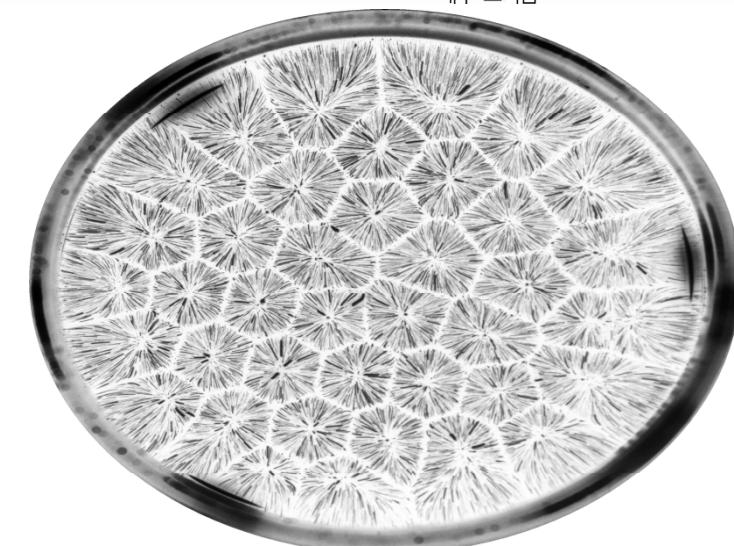
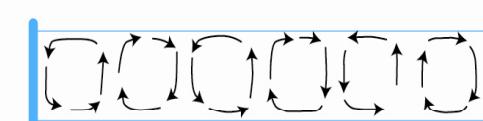
1단계 : 역전총
(안정한 전도)



2단계 : 혼돈적 흐름
(불규칙적 대류)



3단계 : 베나르 세포
(규칙적 대류)



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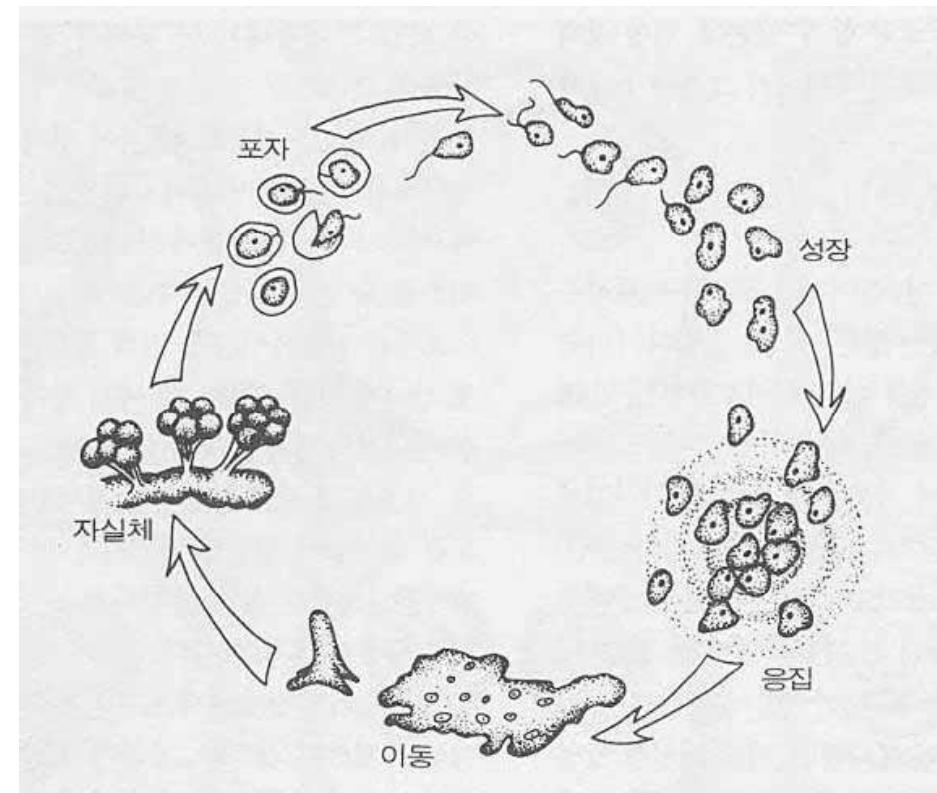
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가 _____ 가

(_____)

(消散) 가

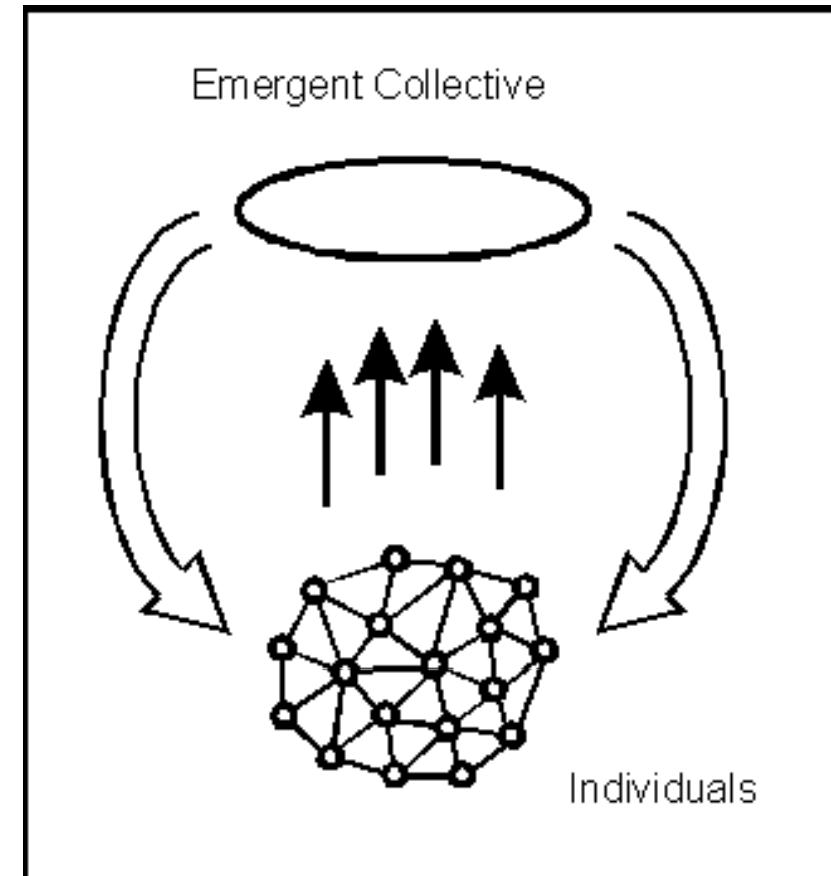


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(Positive Feedback)



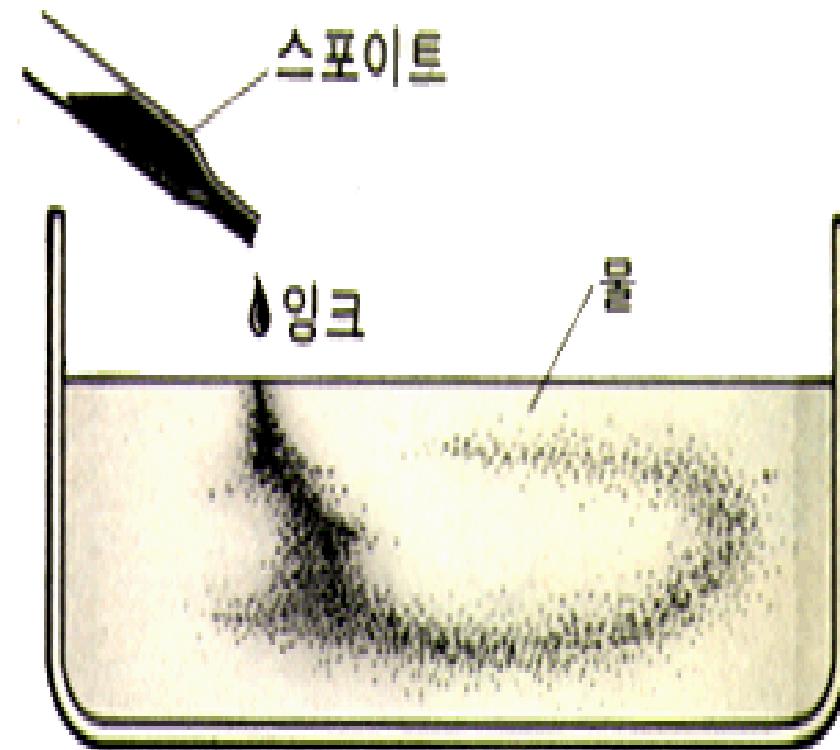
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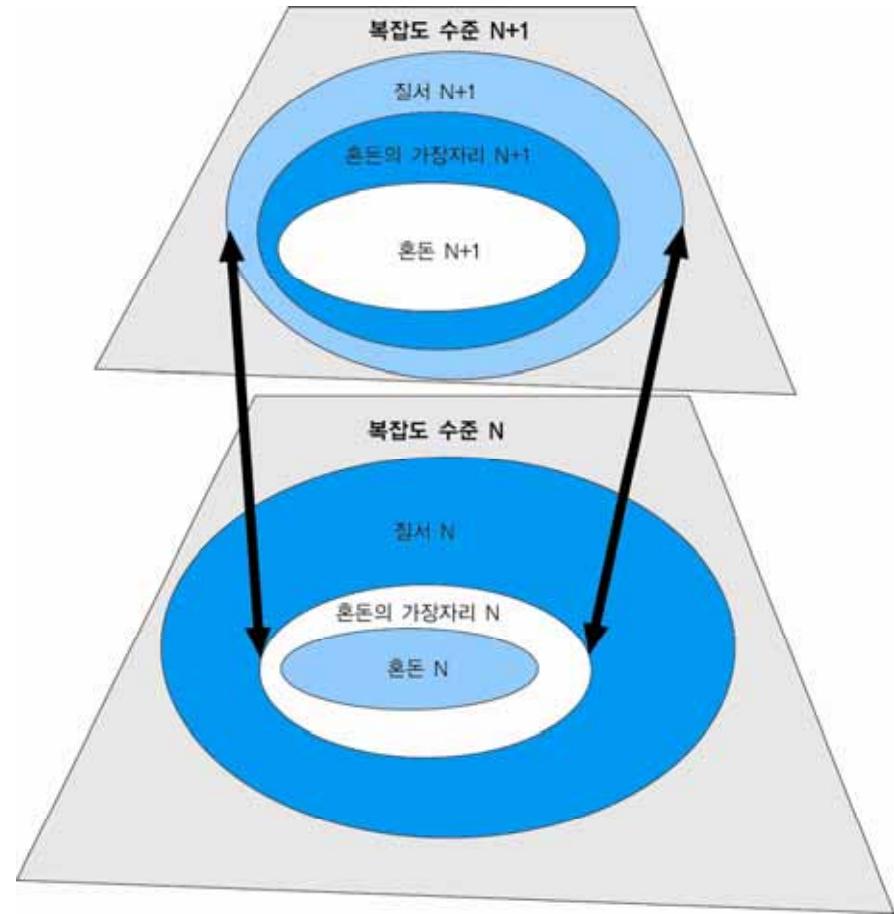
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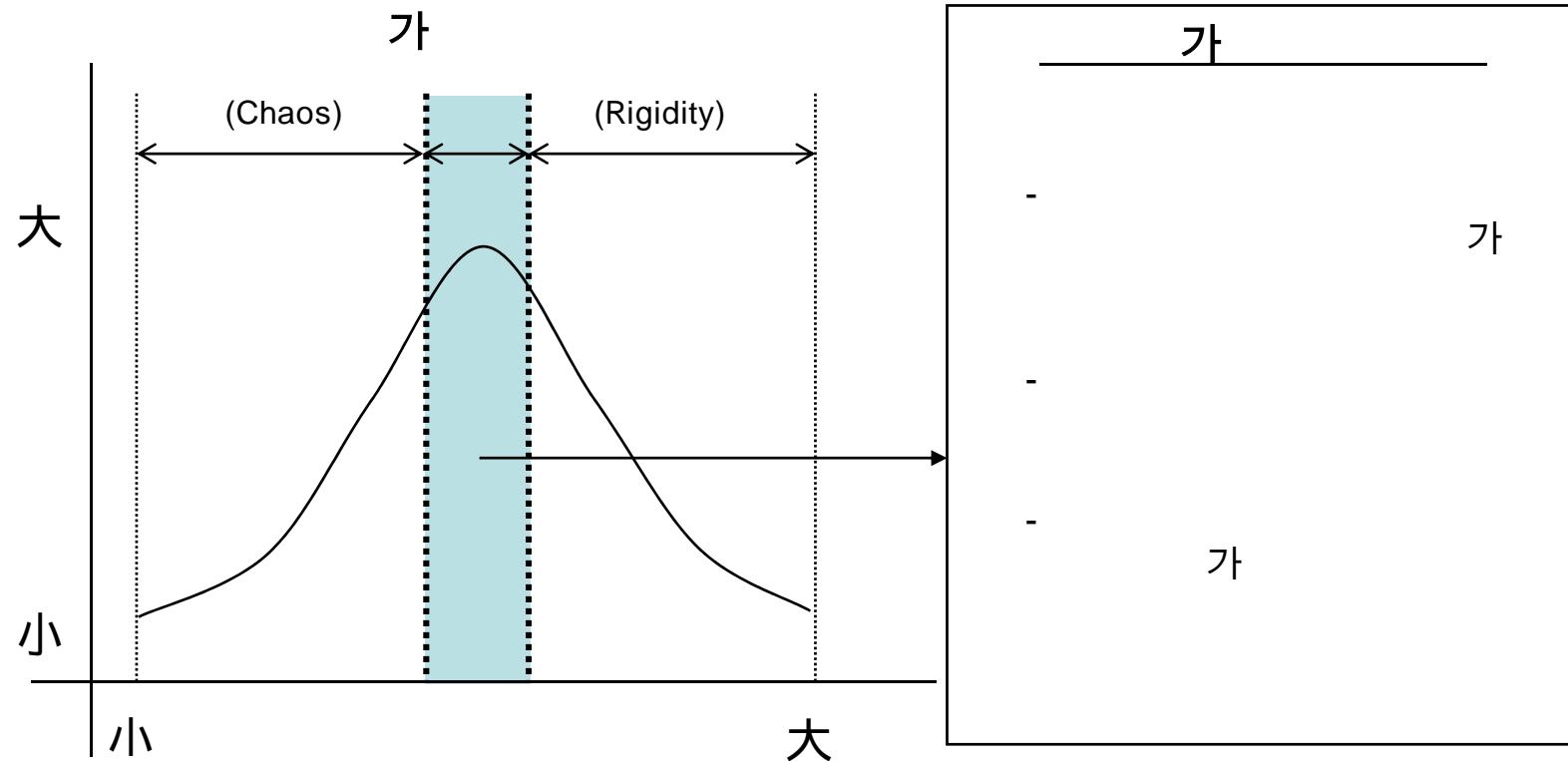
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(2006),

, SERI CEO Information.

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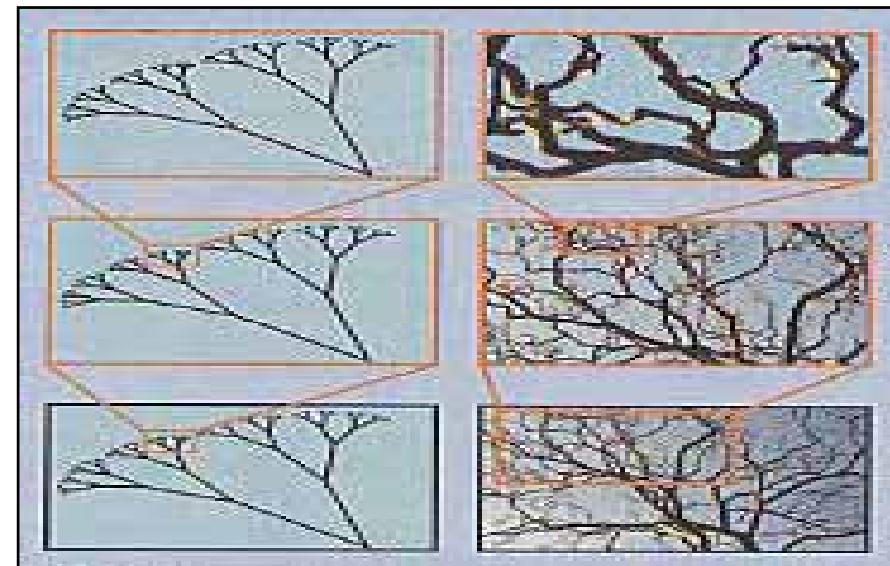
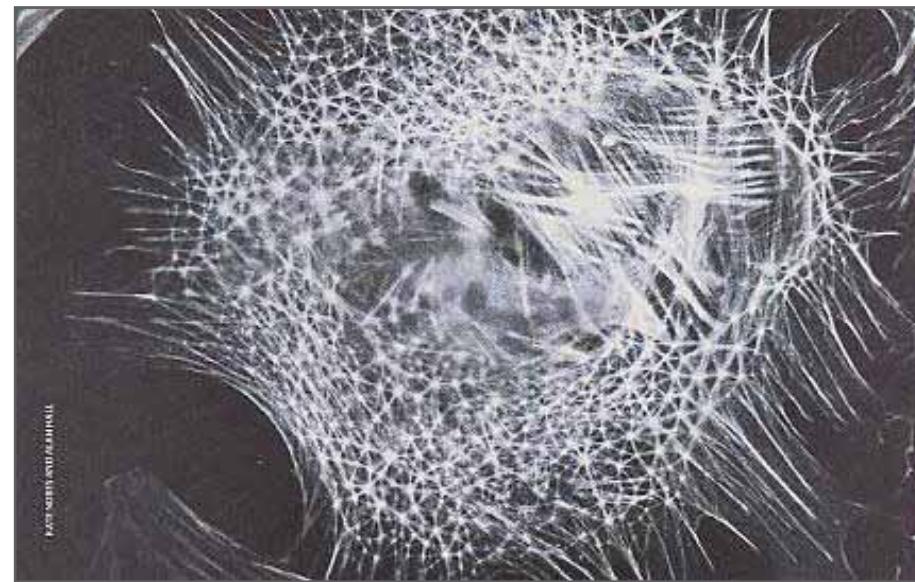
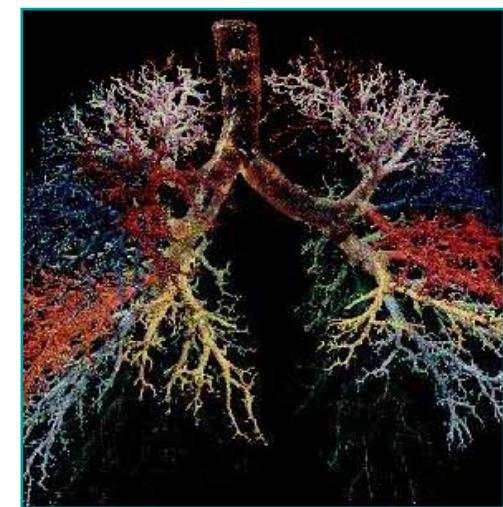
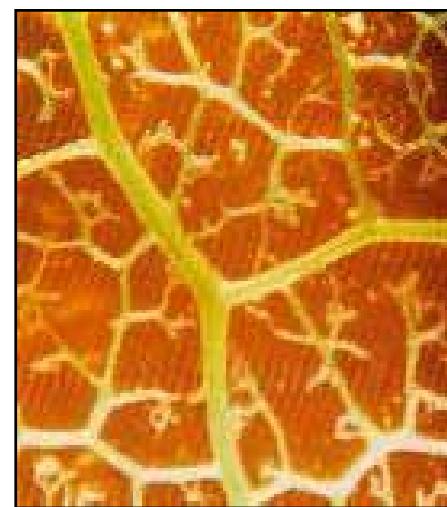
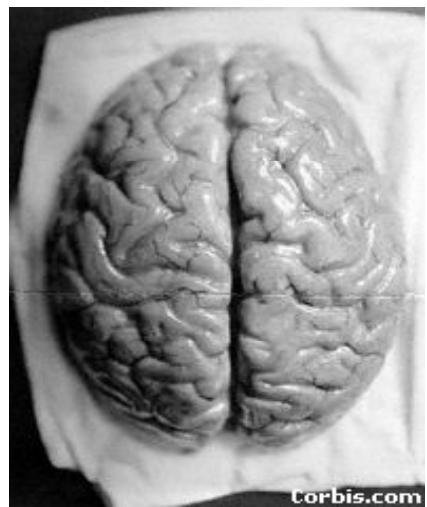
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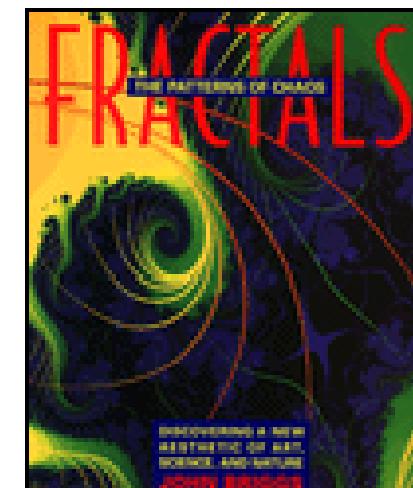
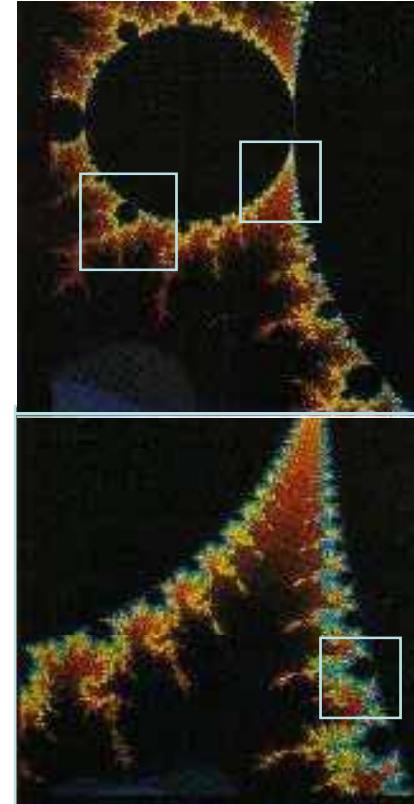


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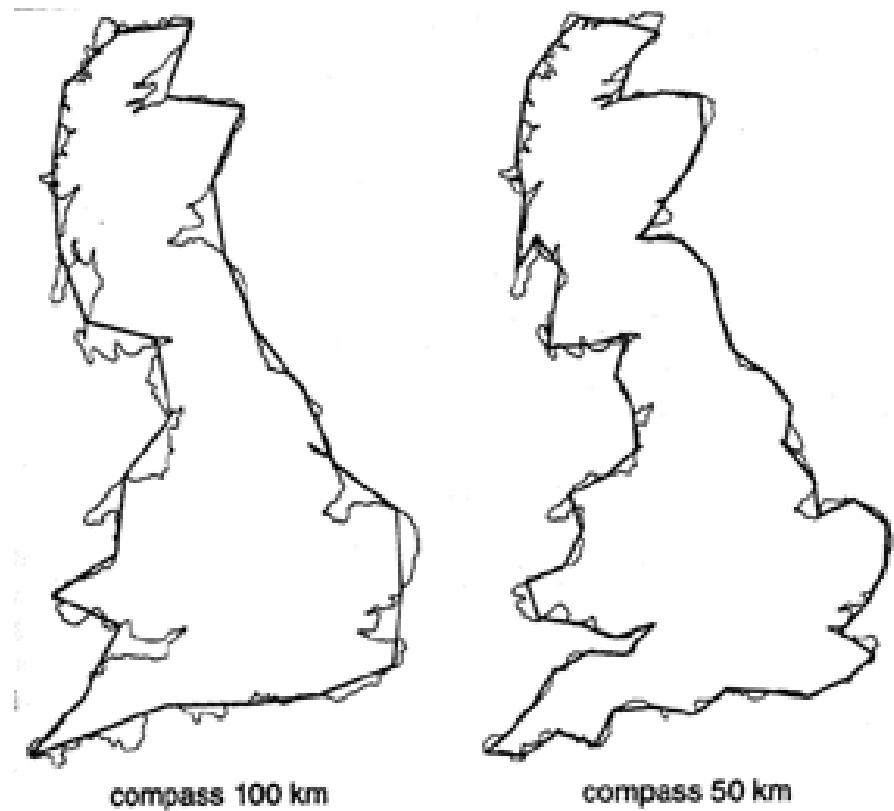
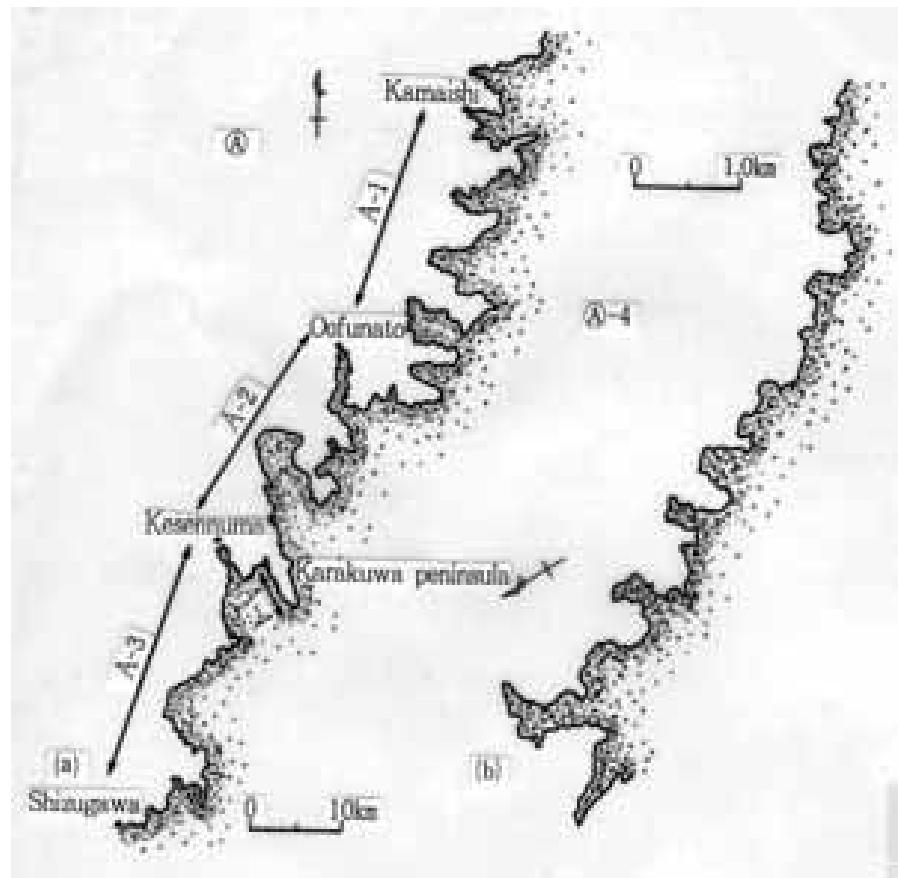


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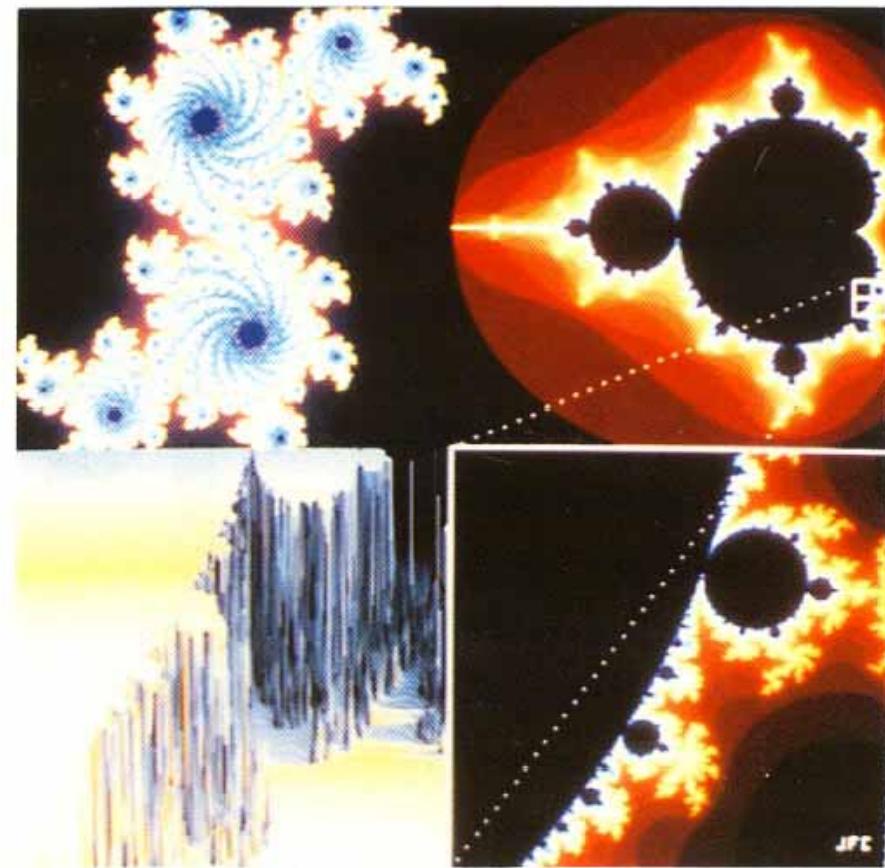
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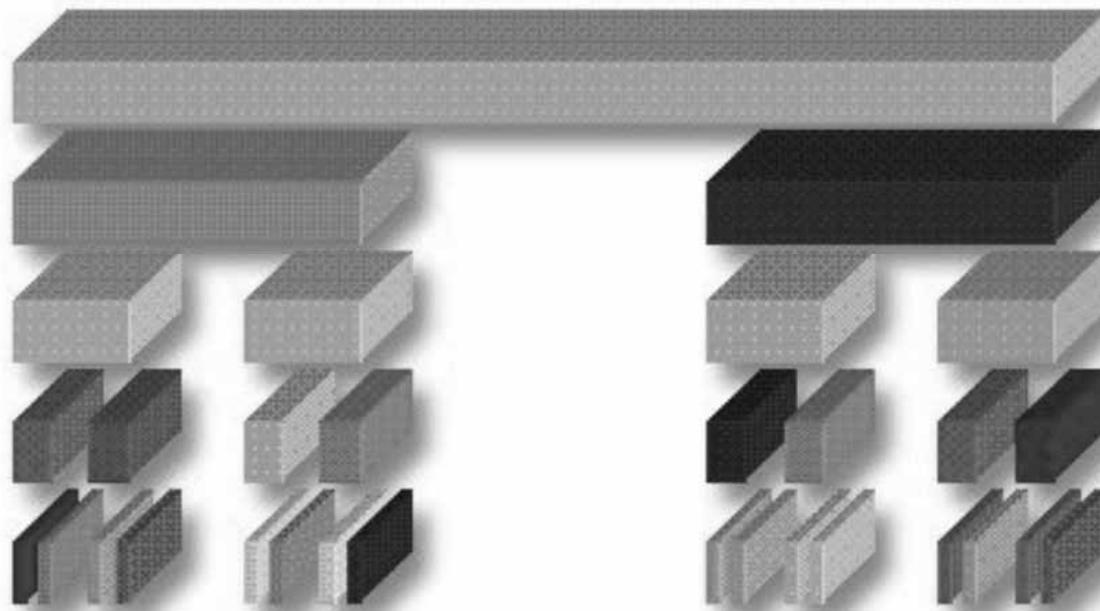


= $\log()/\log()$

- $=\log(3)/\log(3)=1$
- $=\log(9)/\log(3)=2$
- $=\log(27)/\log(3)=3$

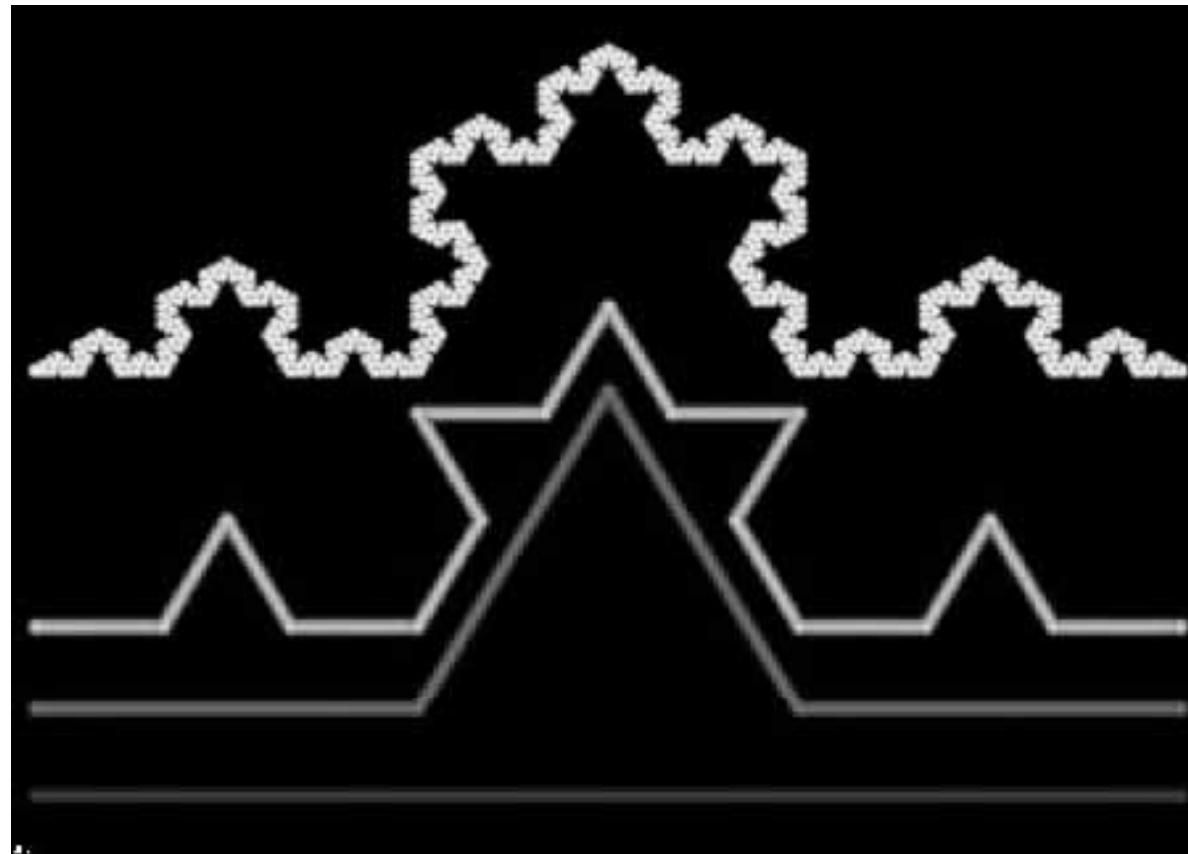


$$=\log(2)/\log(3)=0.6309$$





$$=\log(4)/\log(3)=1.2618$$



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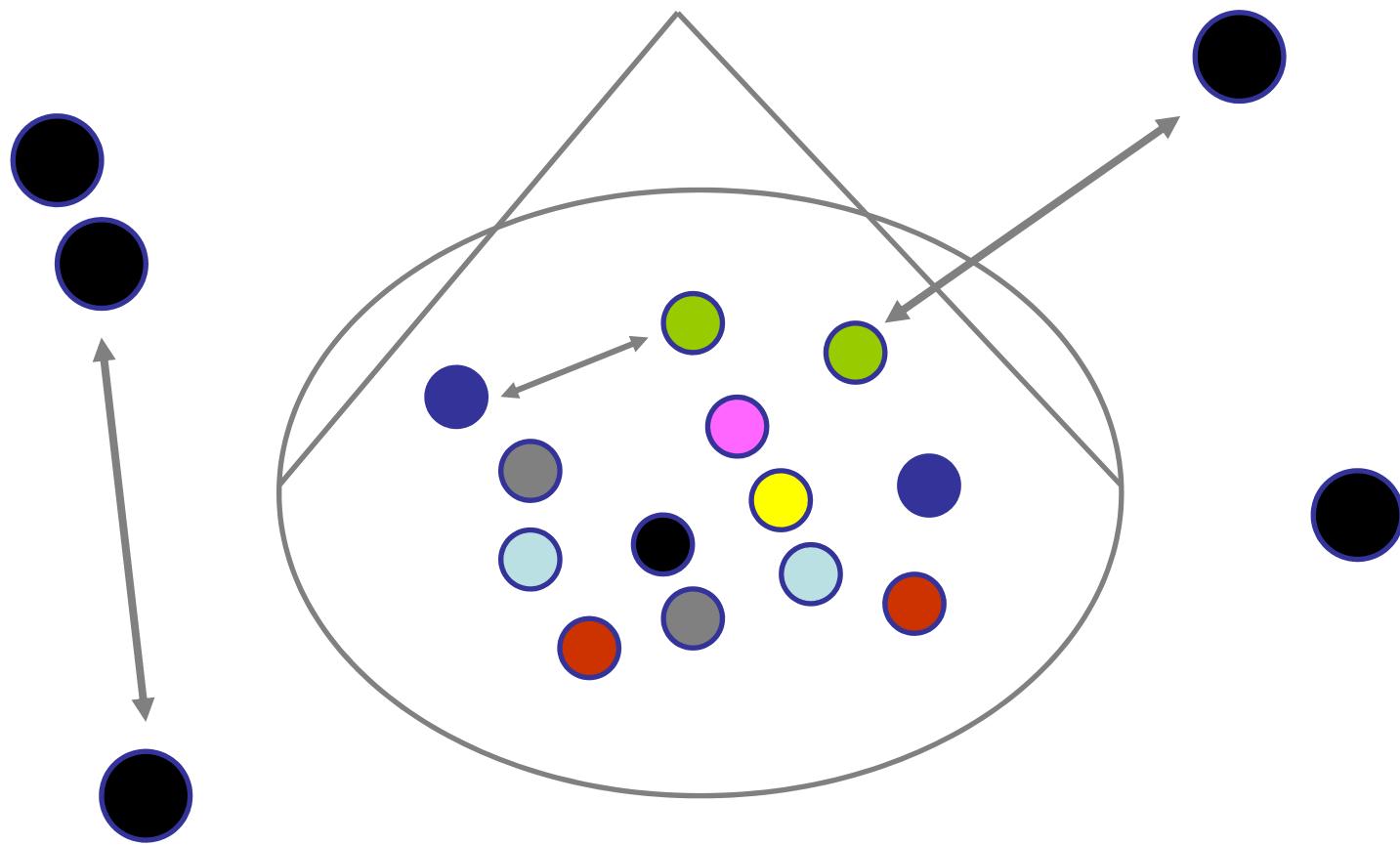
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	-	-	-	9) 가?
1) 가?			6) 가 가?	10) 가?
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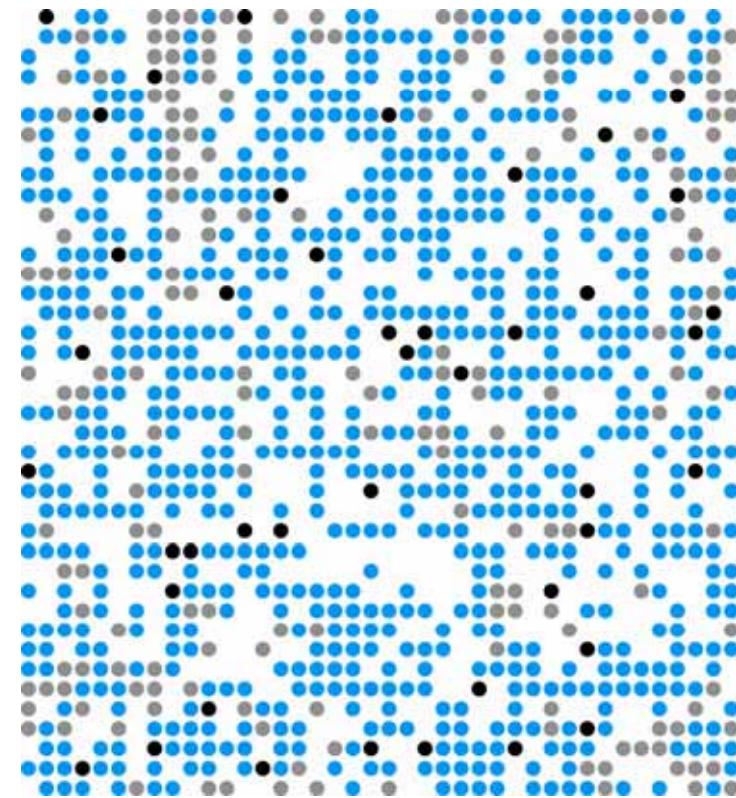
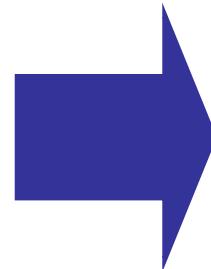
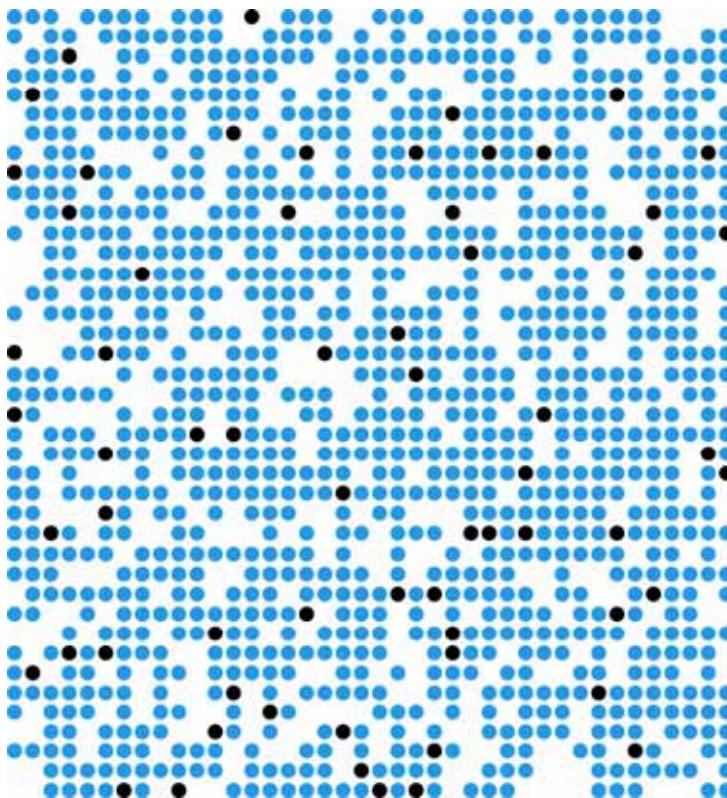
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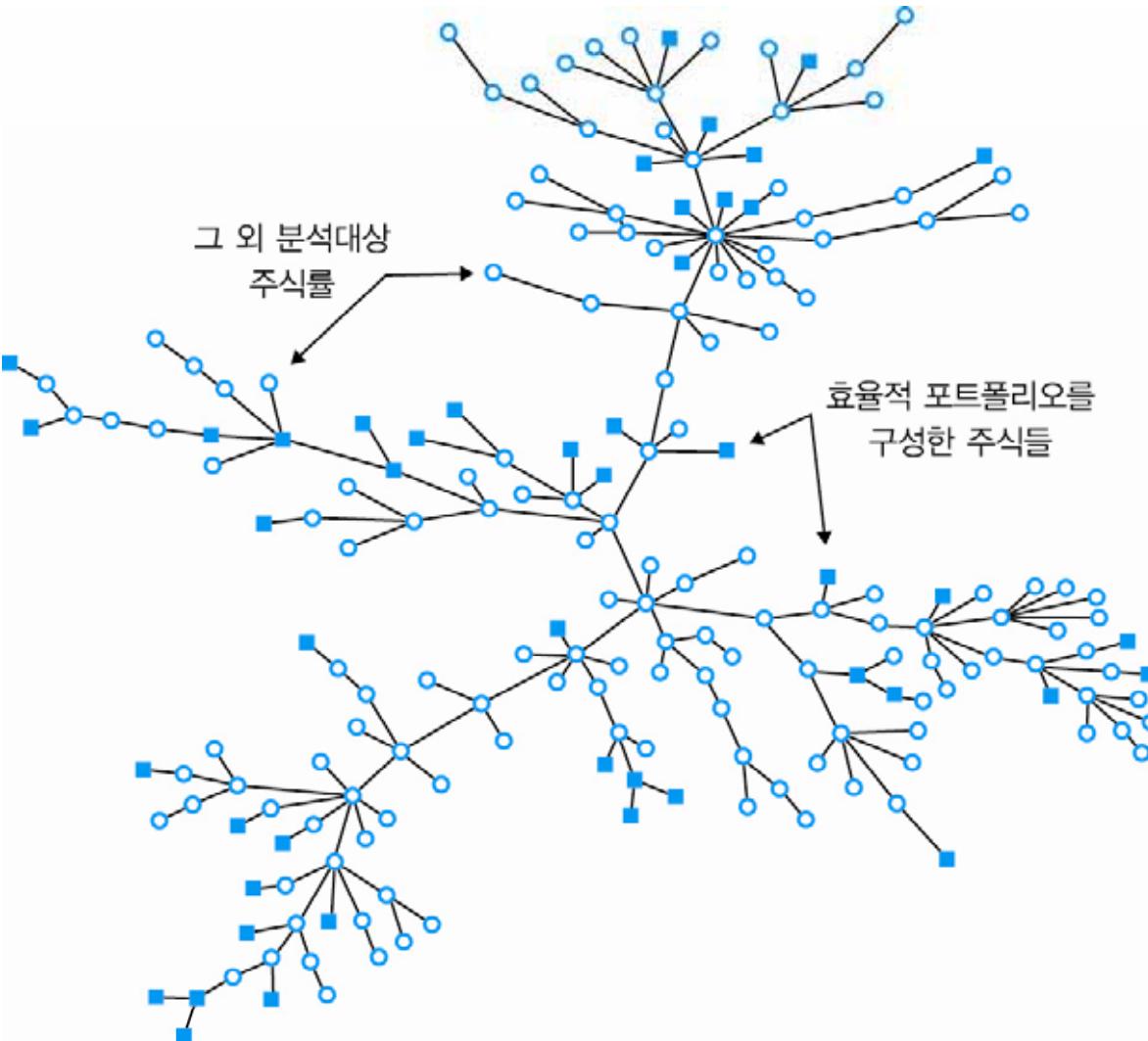
Agent: , ,

Rule: 가 가 ,



Ebstein, J. M.(2002)

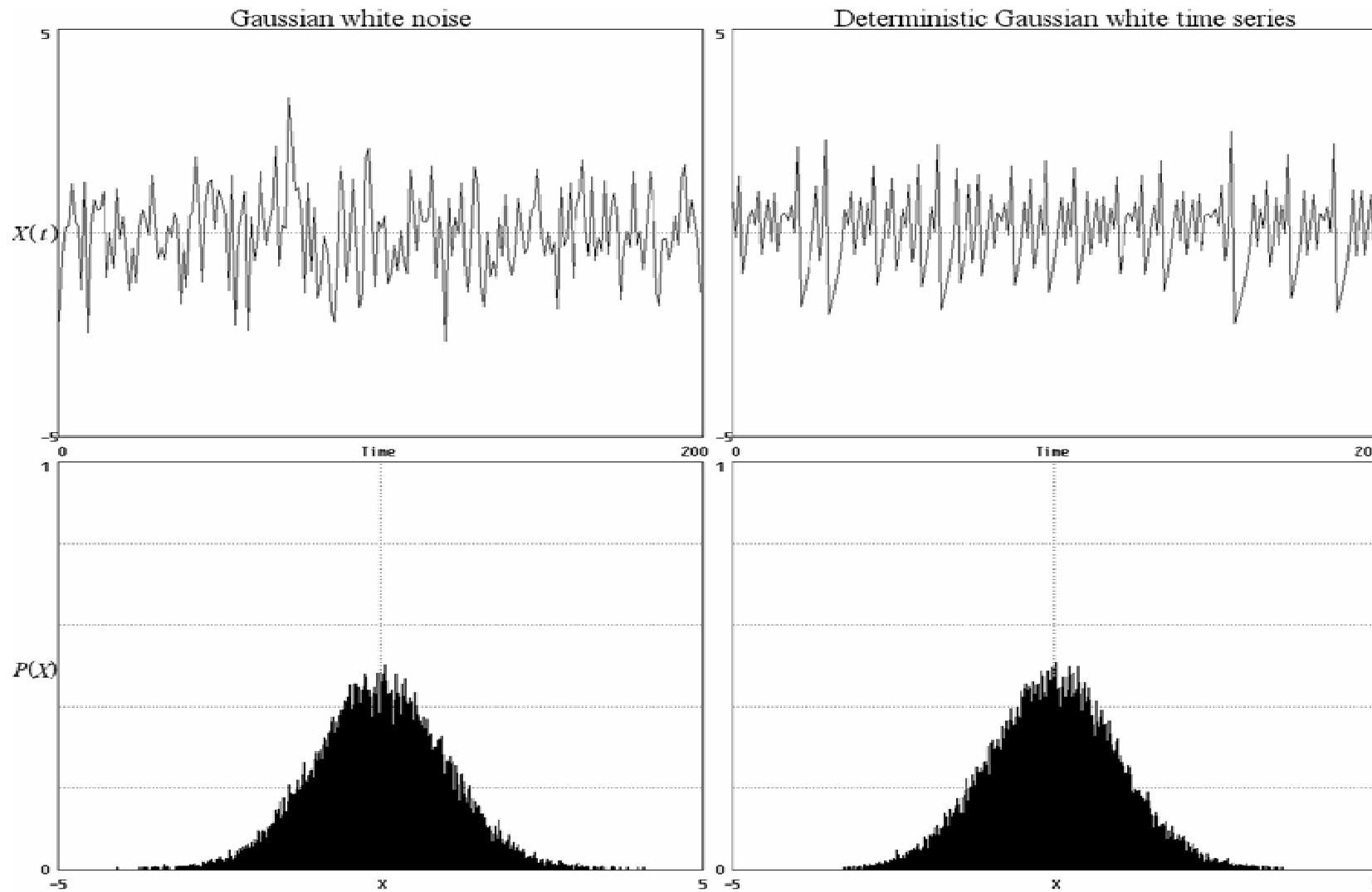
2: 가?

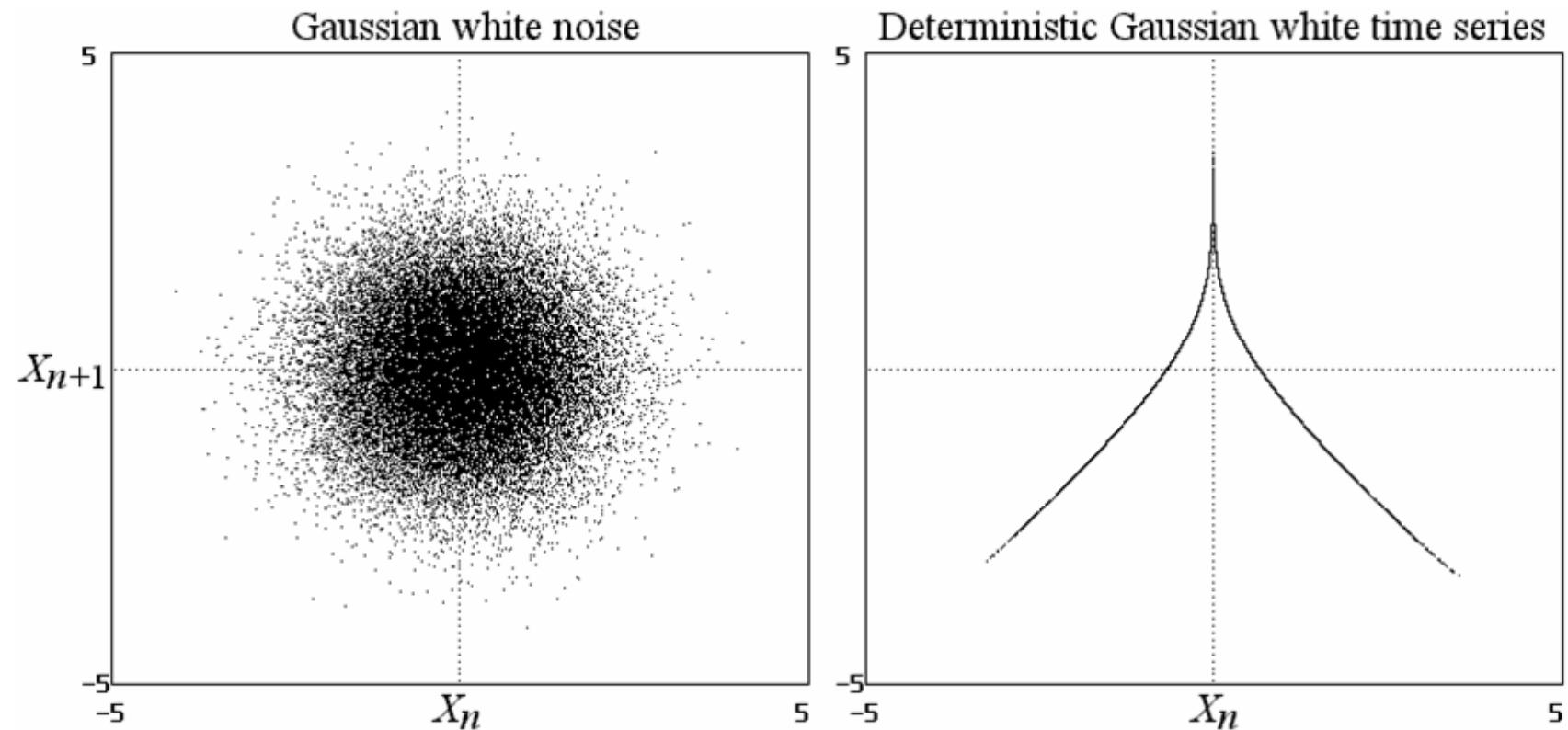


, (2004)

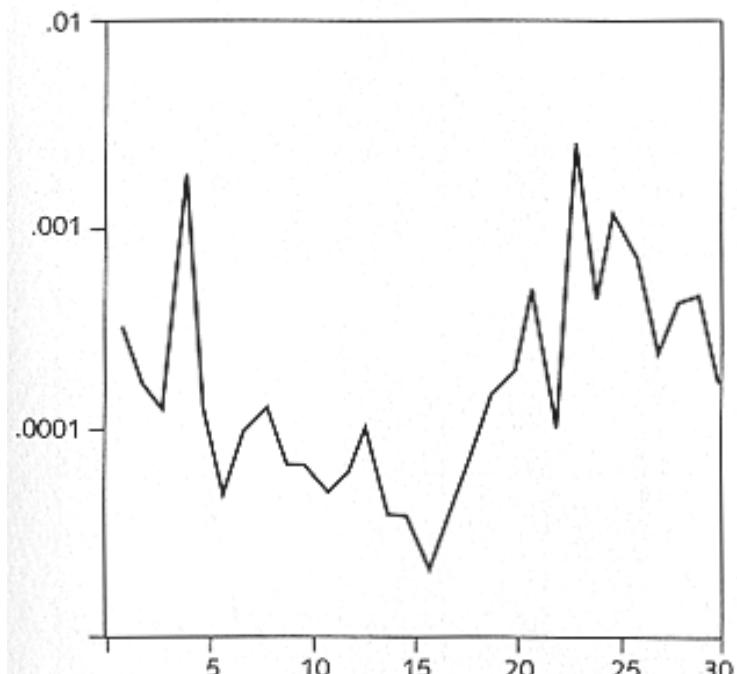
3:
가?



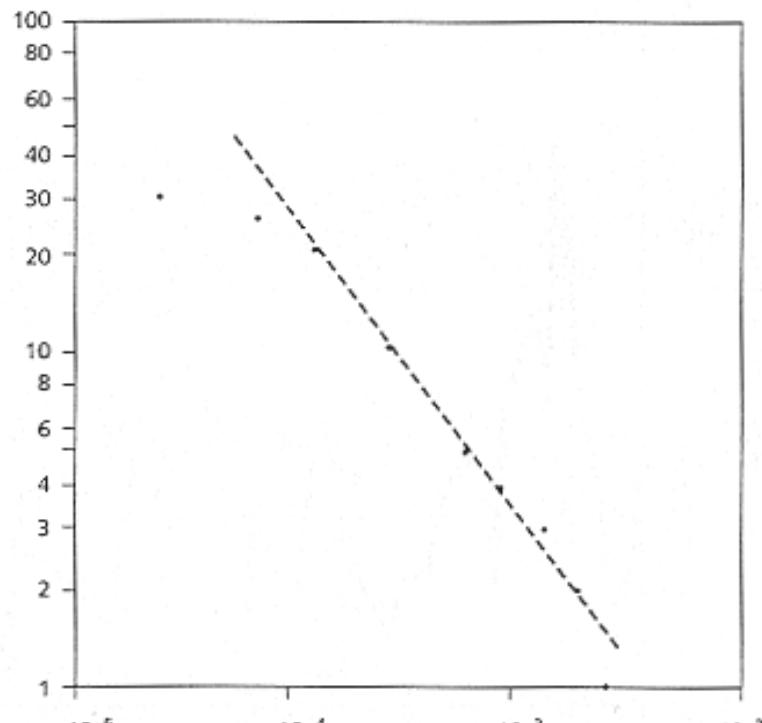




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(a)

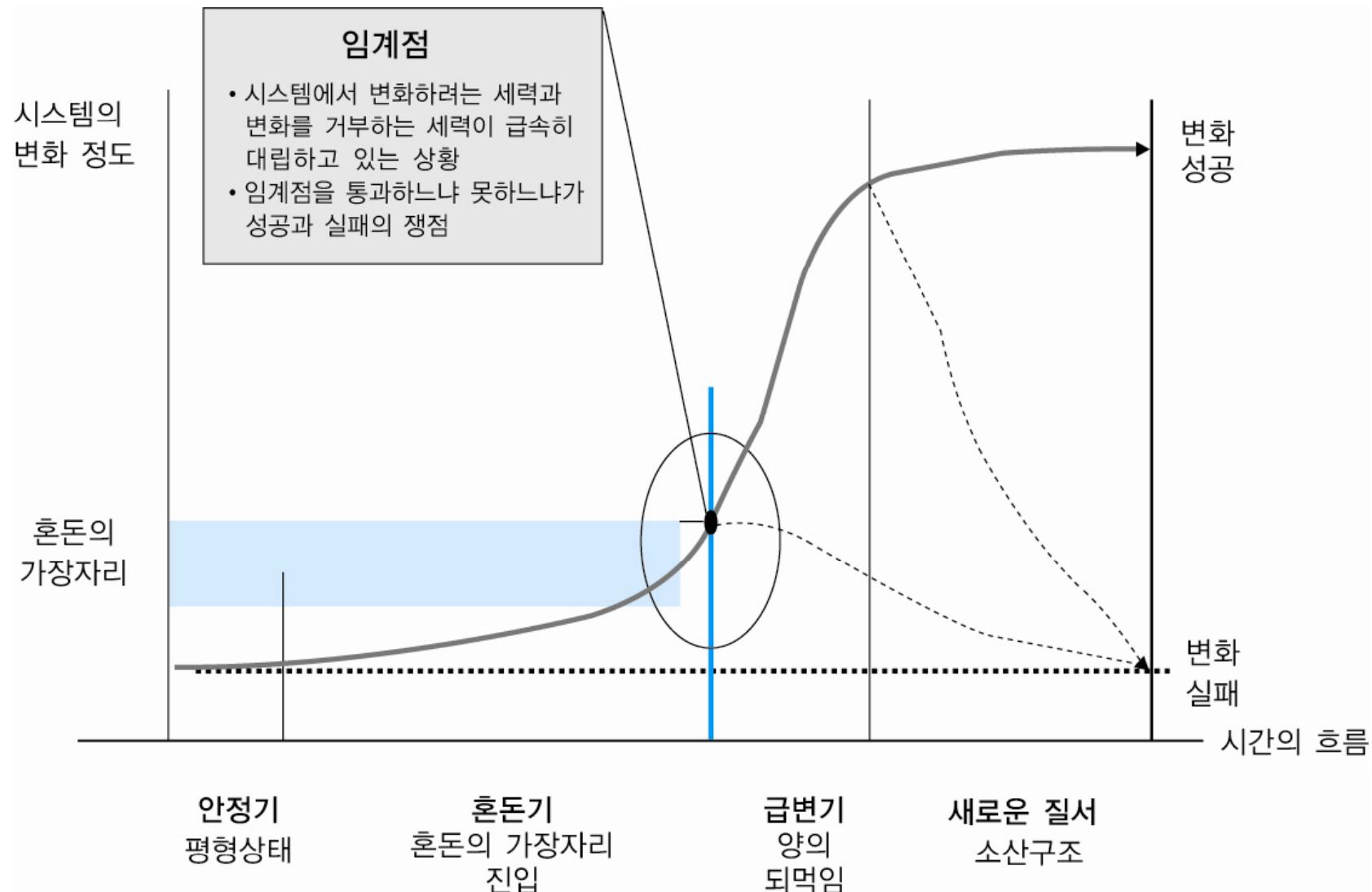


(b)

Mandelbrot, B. (1963)

1:

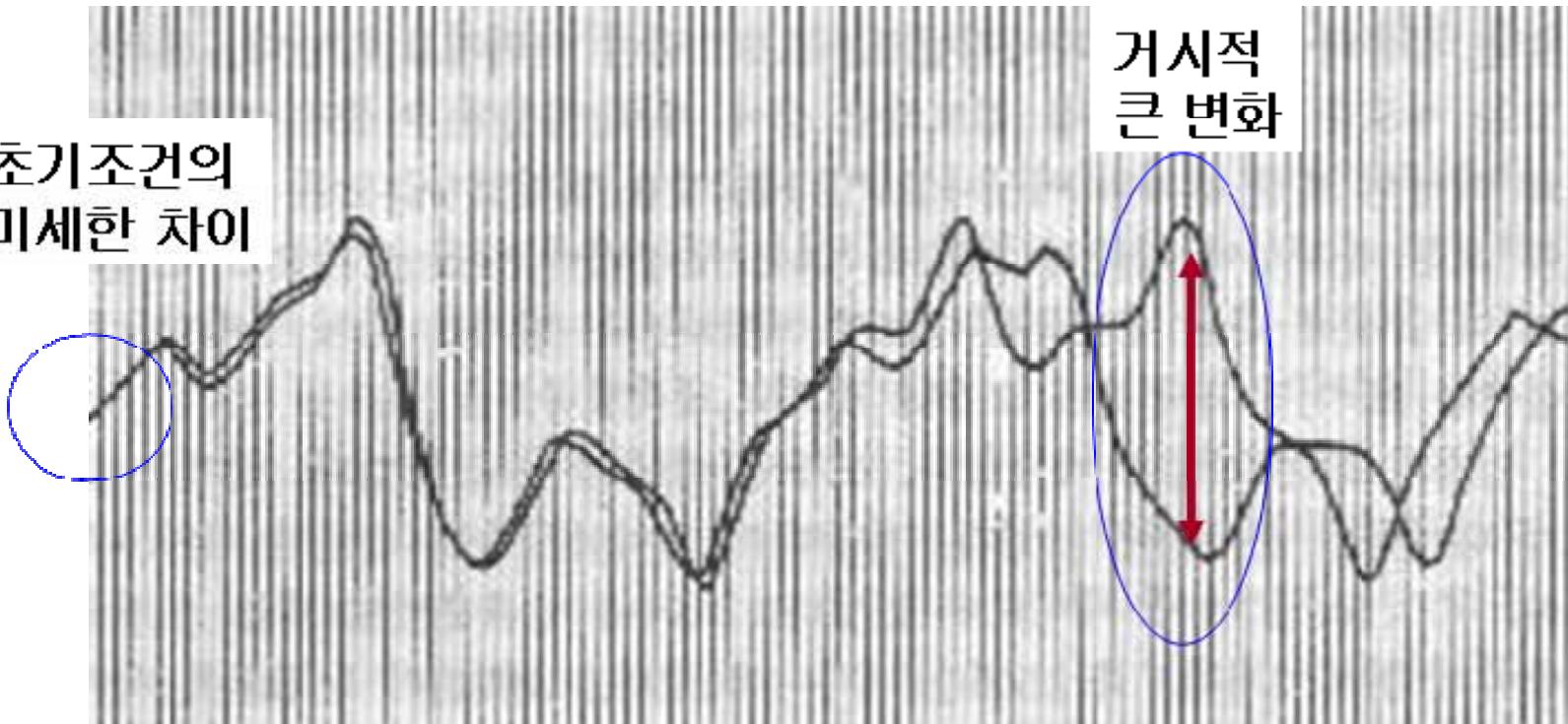
가 가?





초기조건의
미세한 차이

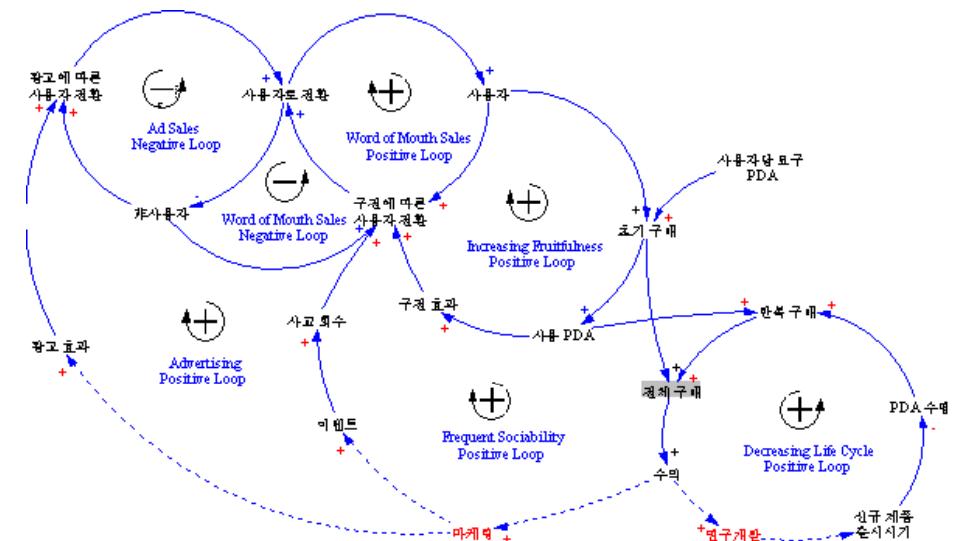
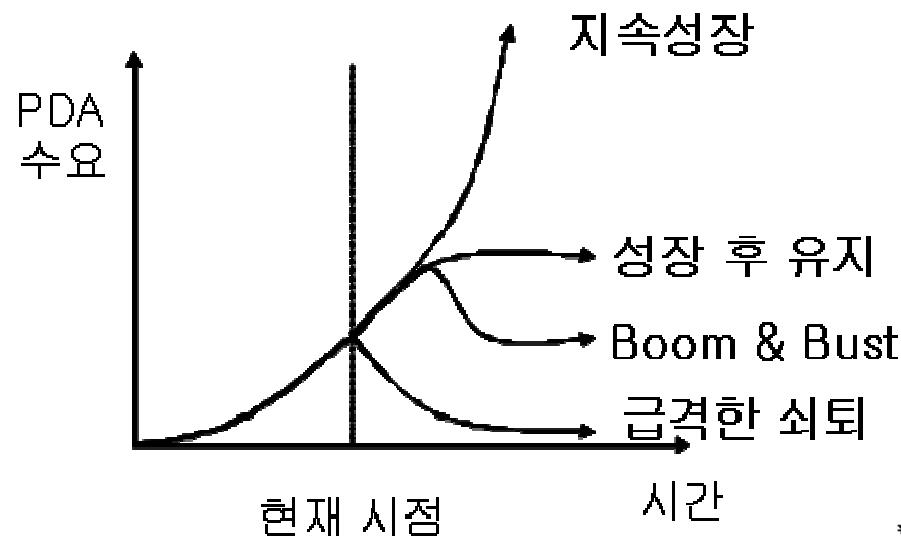
거시적
큰 변화



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(2003)

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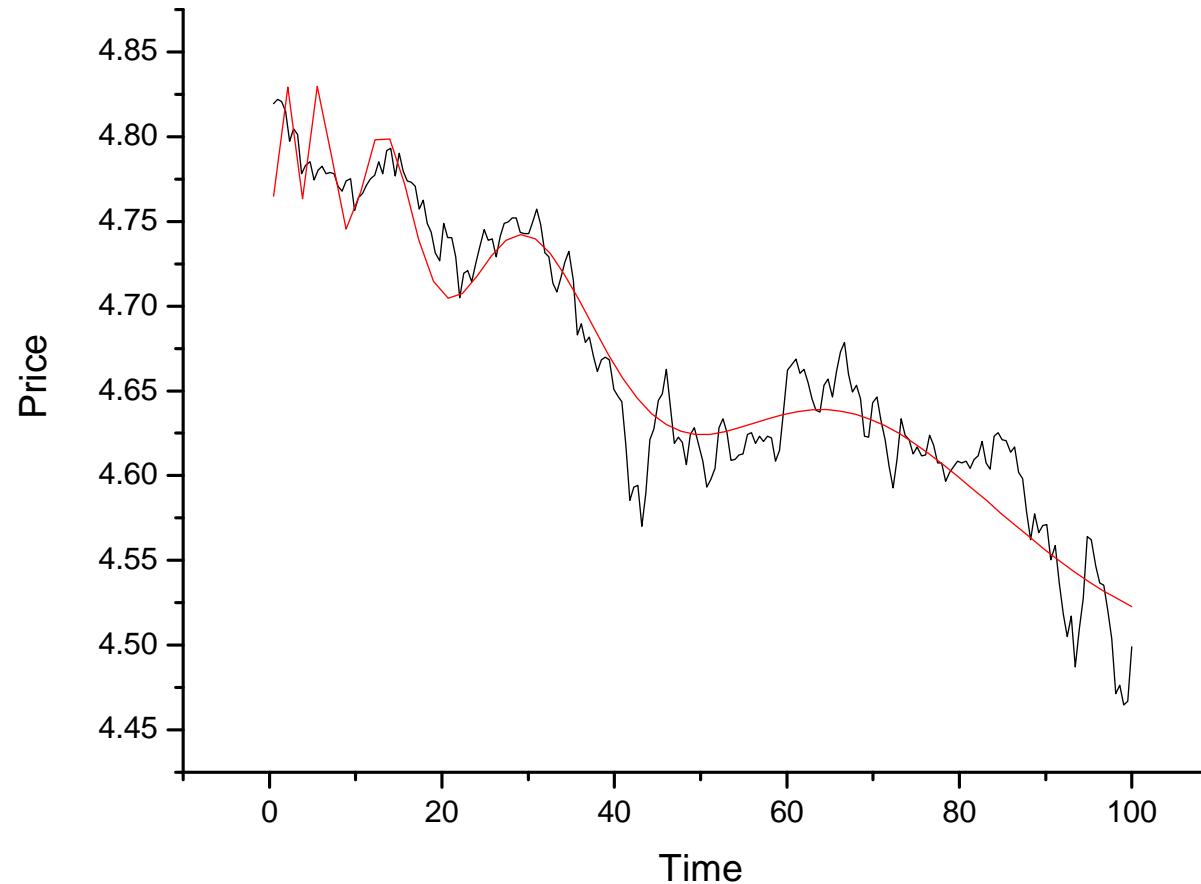
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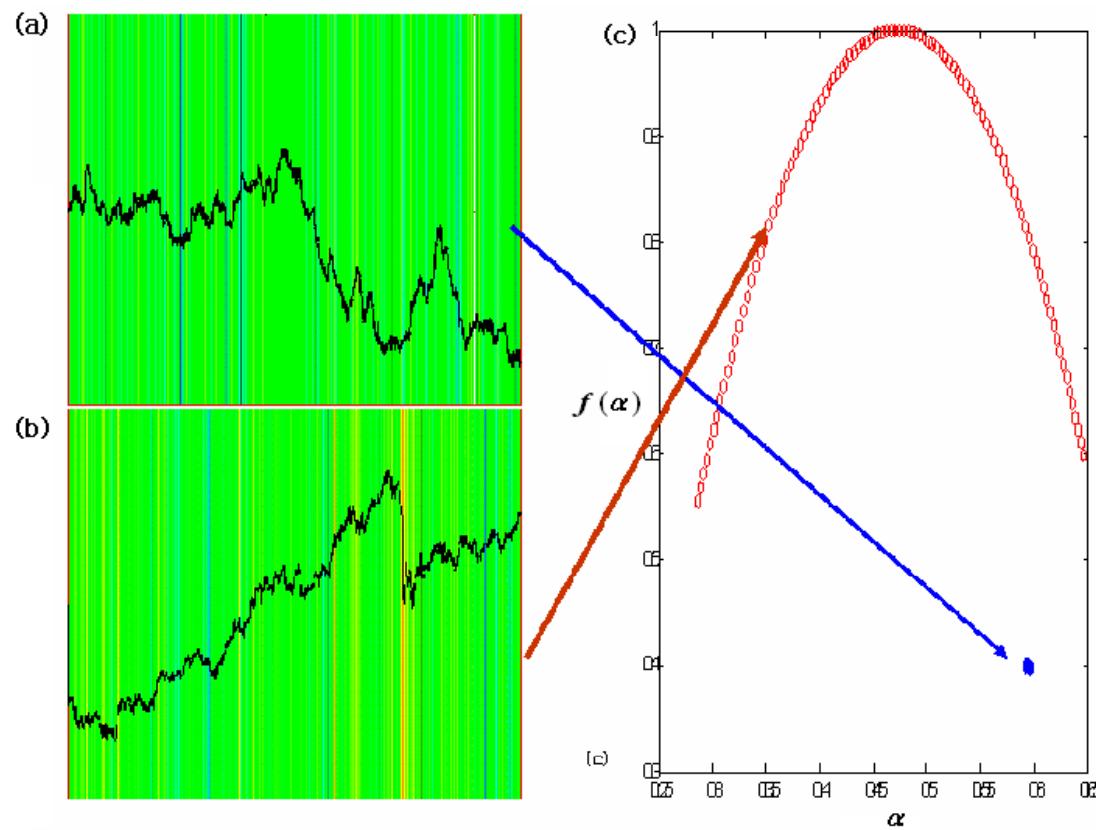


(2004)

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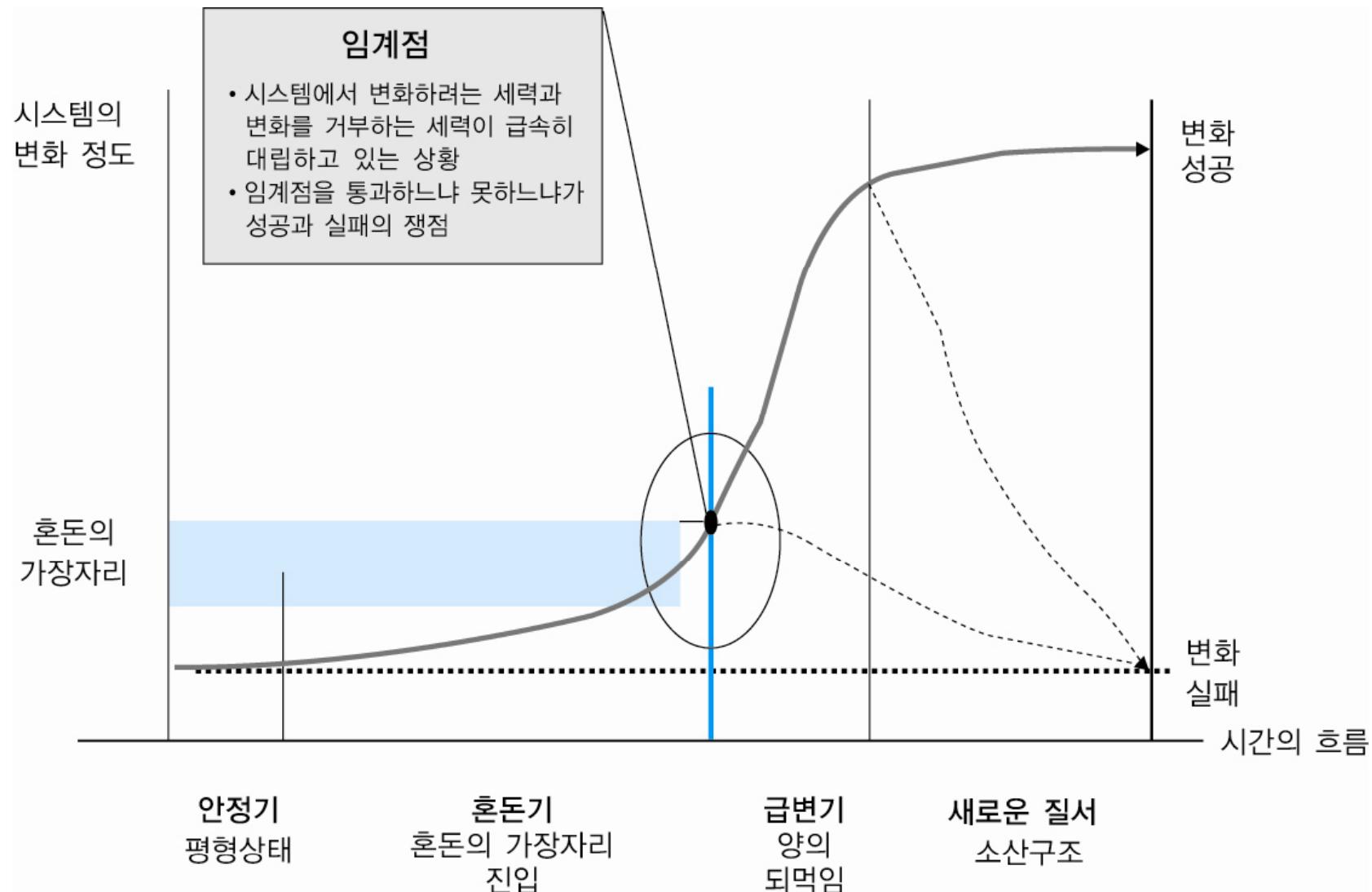
: FBM

- (a) $\alpha = 0.6$ 가 FBM(fractional Brownian motion)
- (b) S&P 500 가



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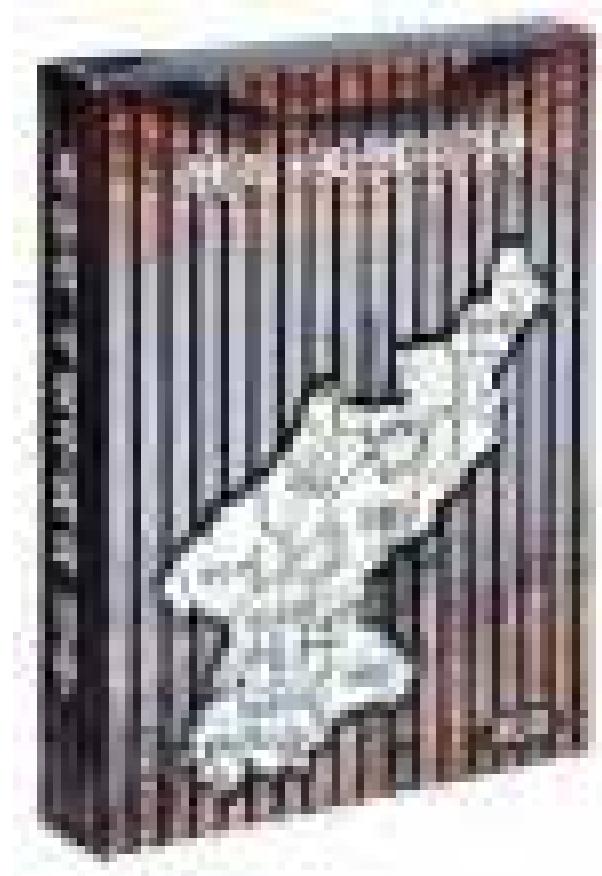
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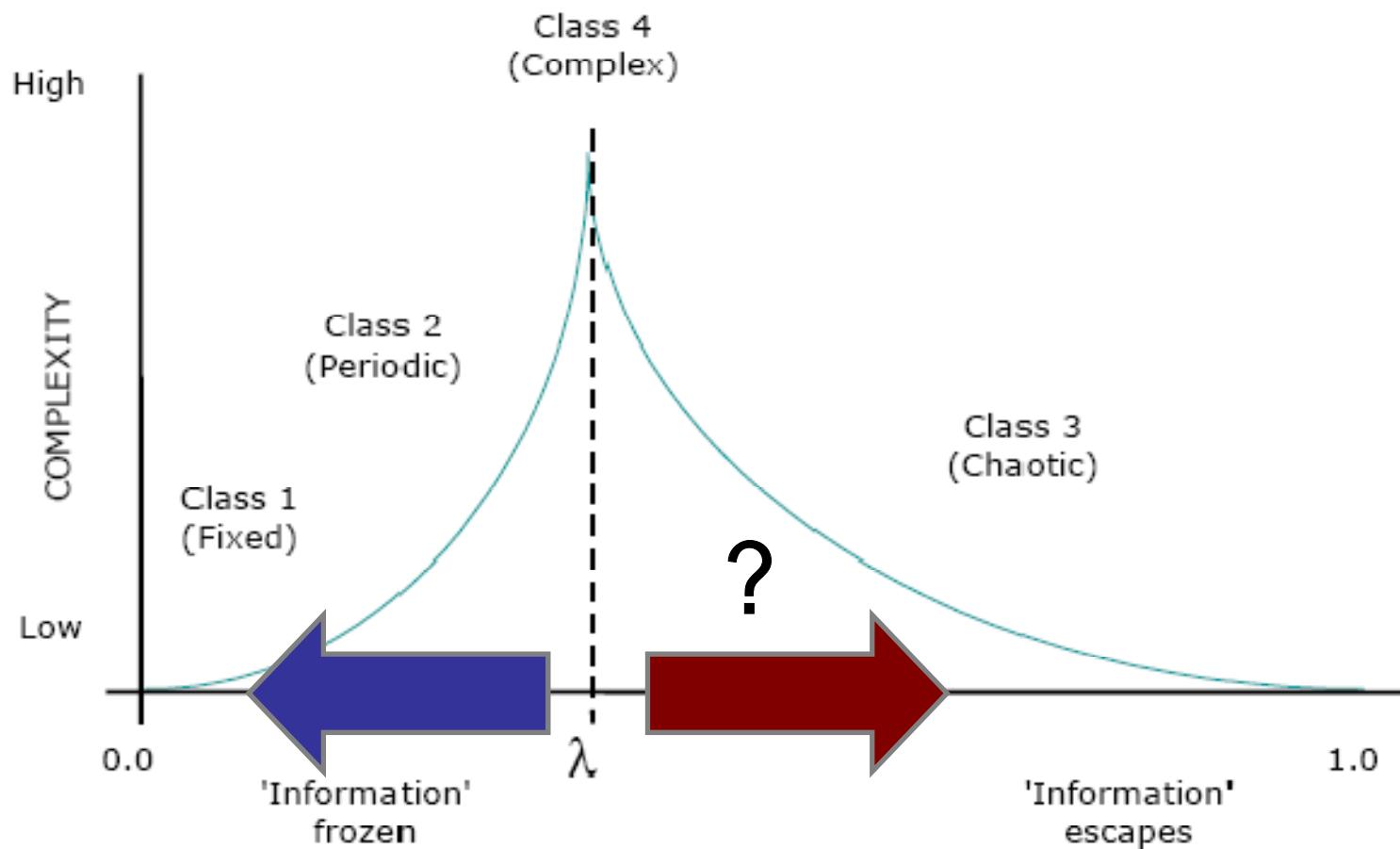


Figure 3 - Langton's Lambda Parameter

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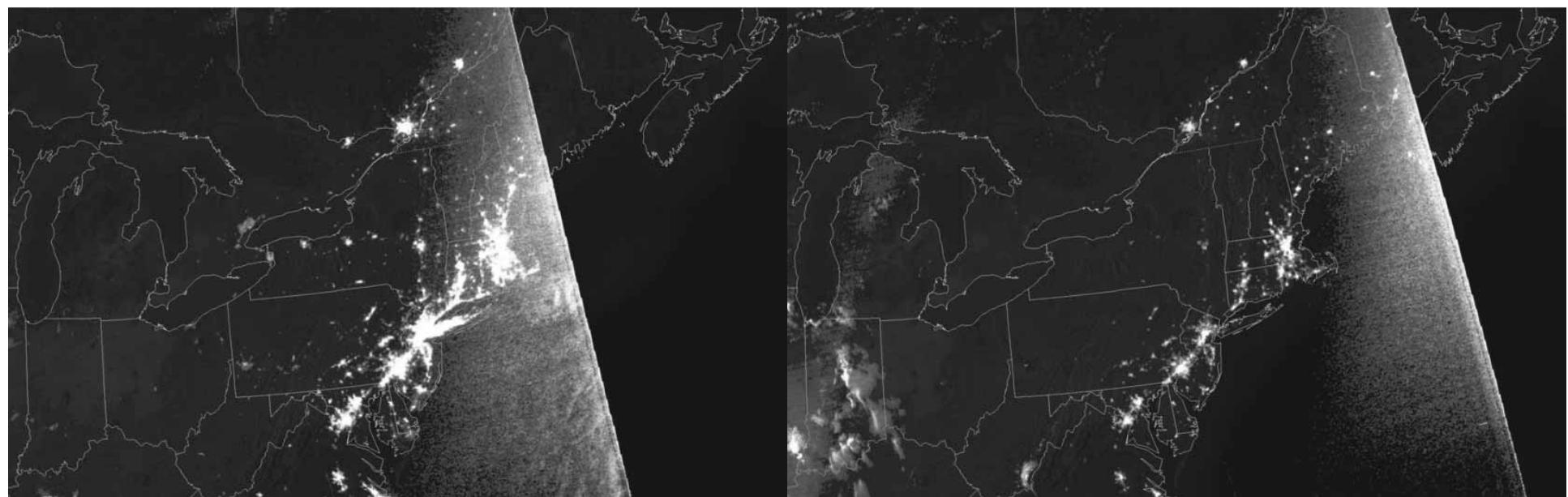
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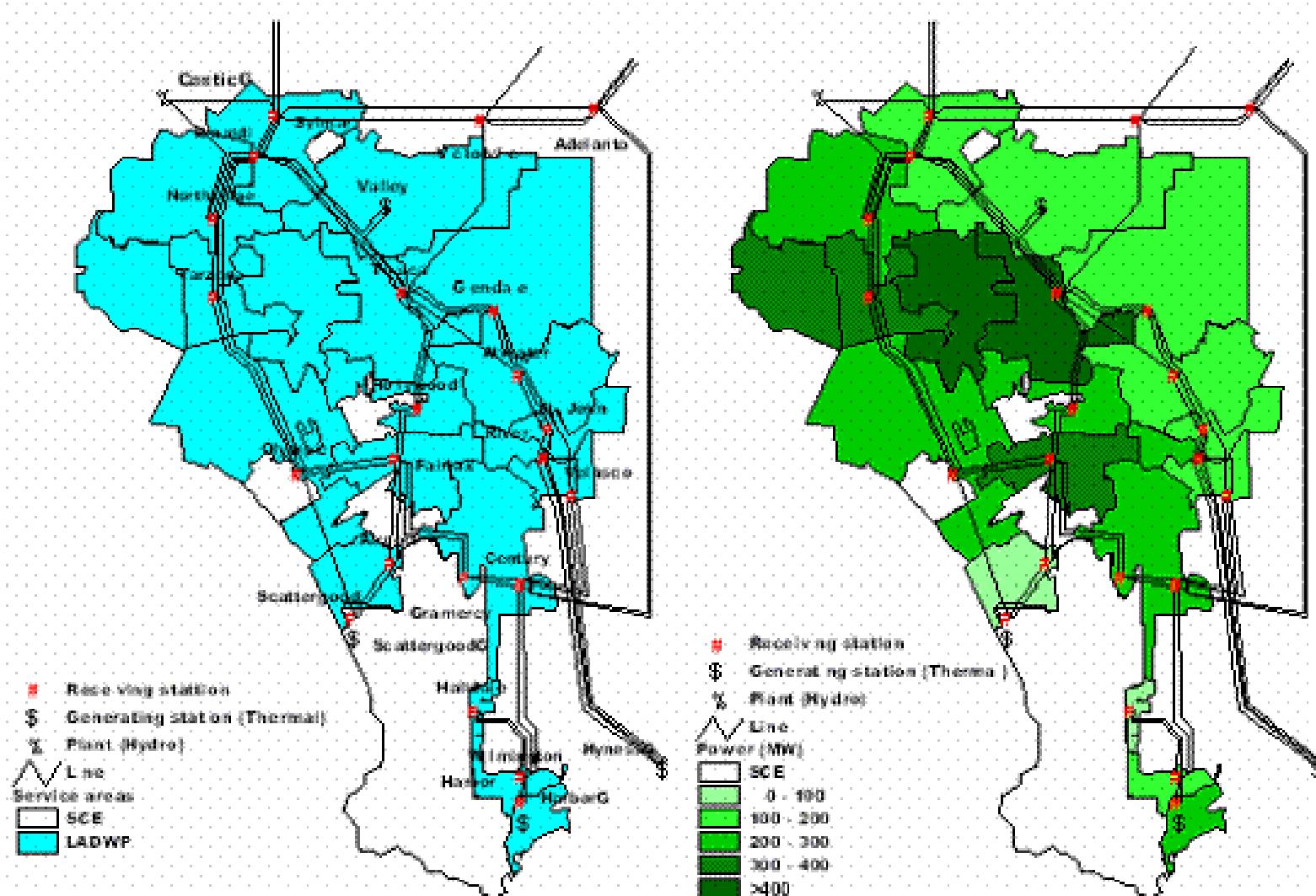


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Human Mobility

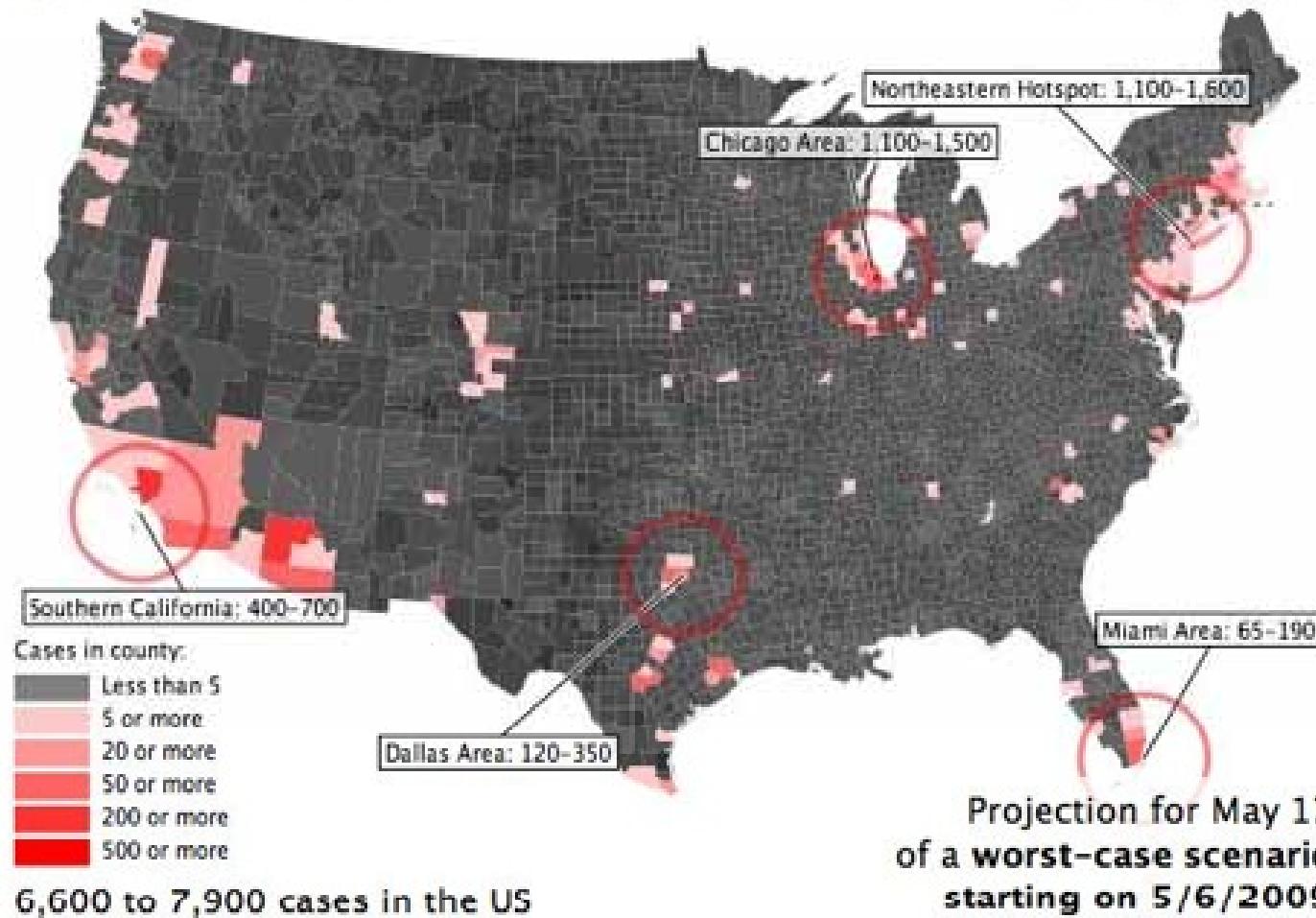
- Where is George?



Projection for May 17

Ranges are 90% confidence intervals

After 11.0 days from 5/6/2009



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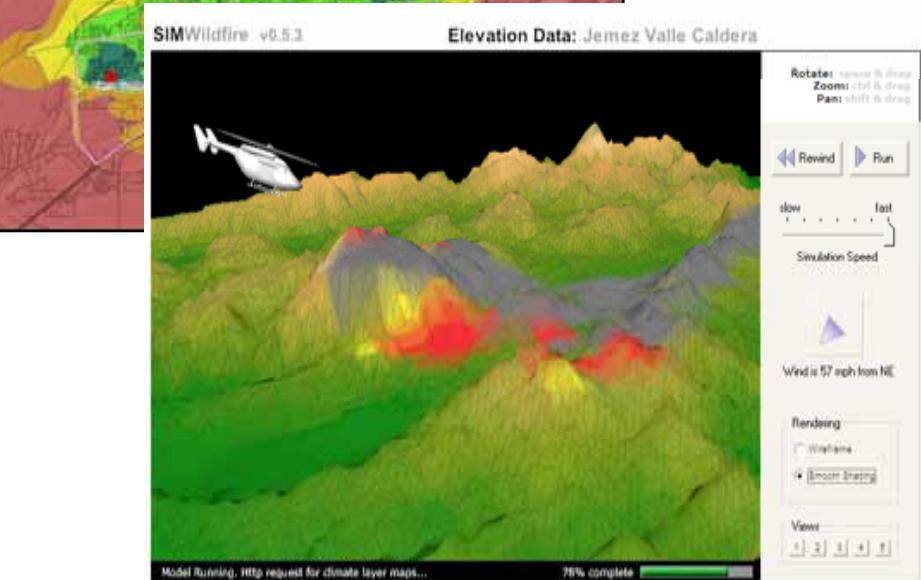
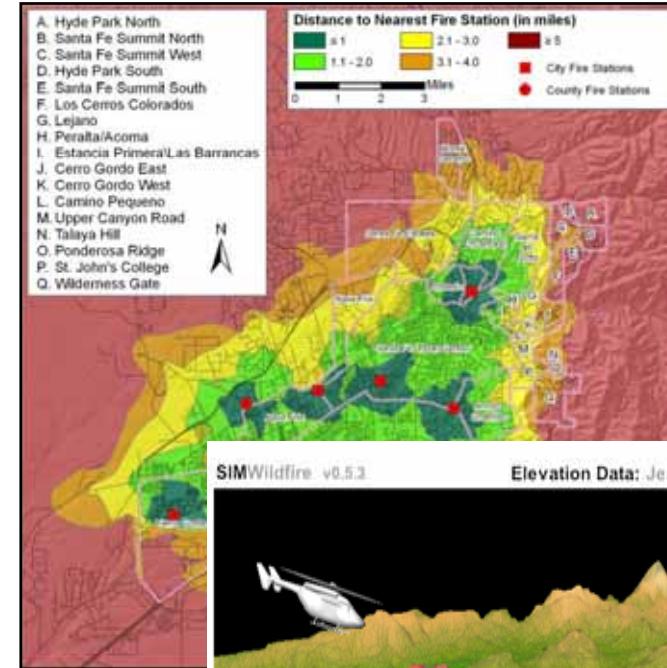
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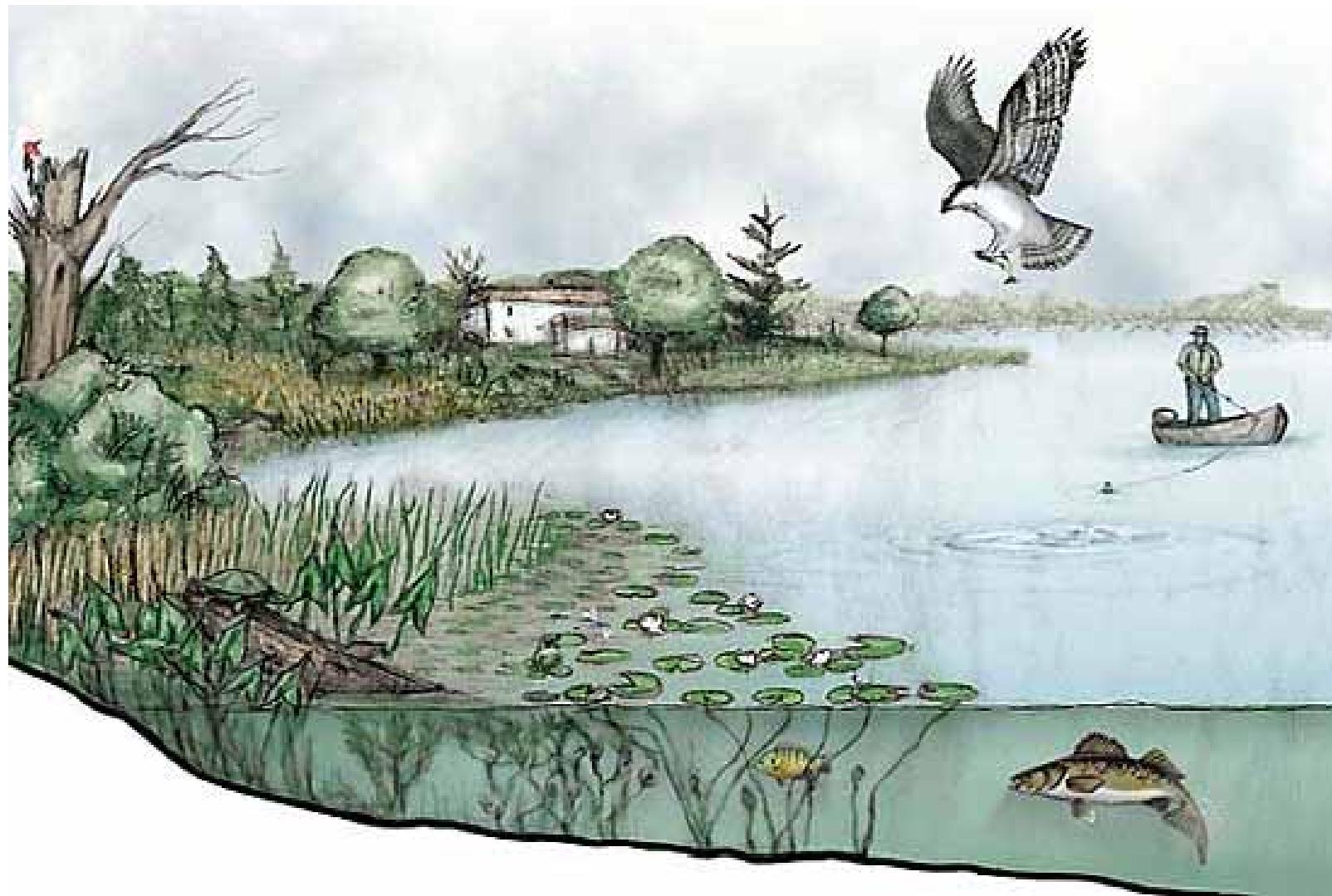
• GIS

ABM



Redfish(2003)

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