
2014. 7. 28.

(ysyoun@gmail.com)

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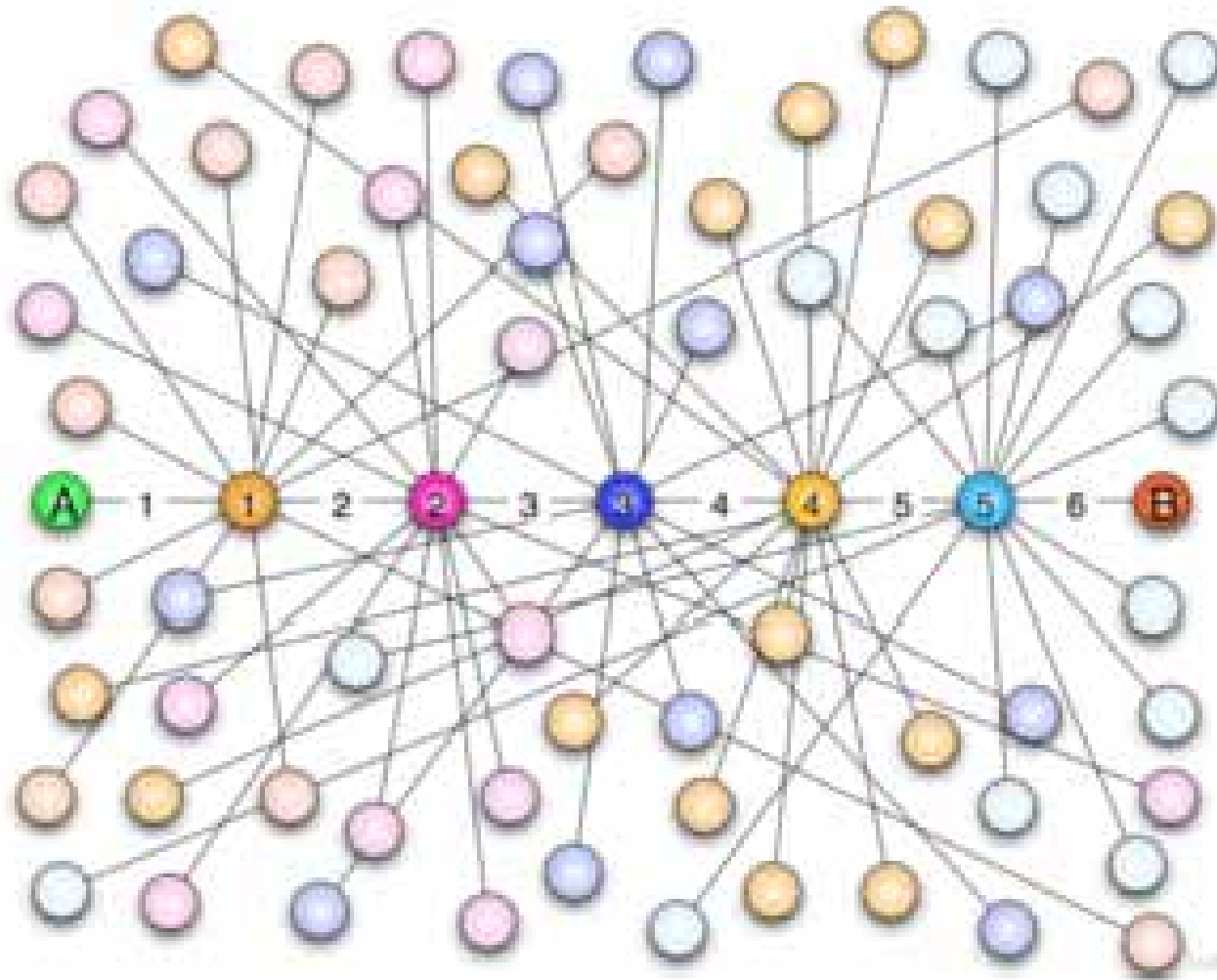


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six degrees of separation



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□ ???

□ 2004

가

2004

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가

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3.6

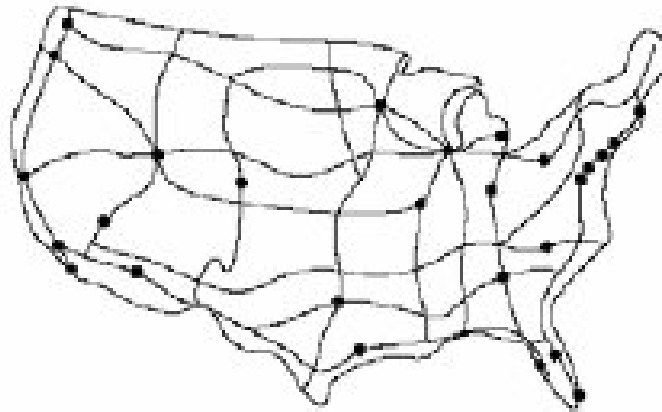
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□

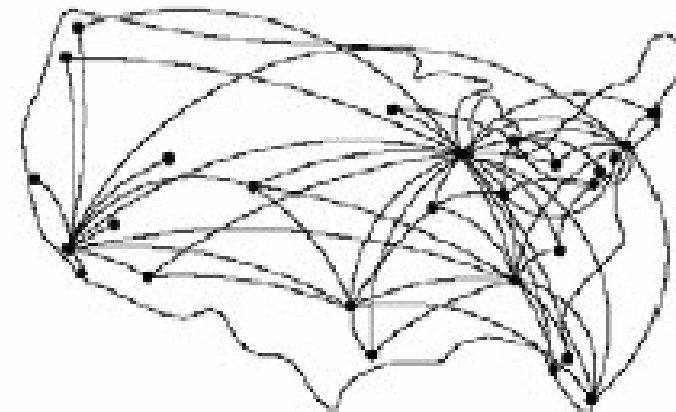
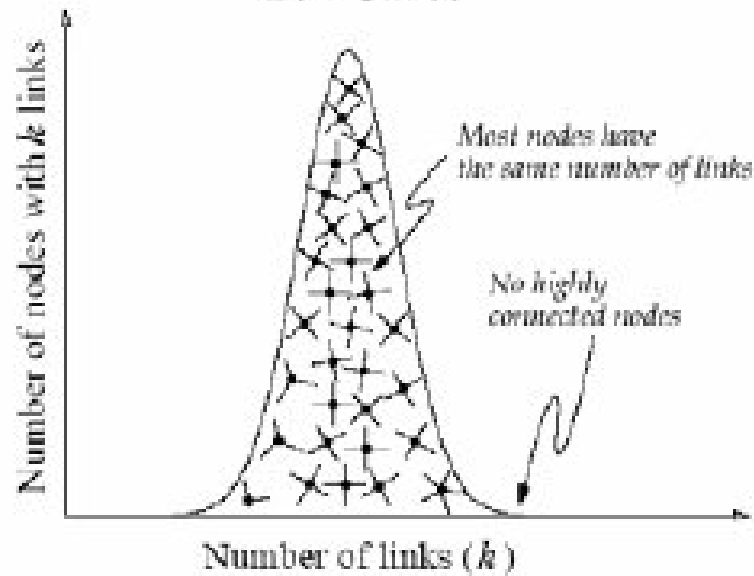
2~3

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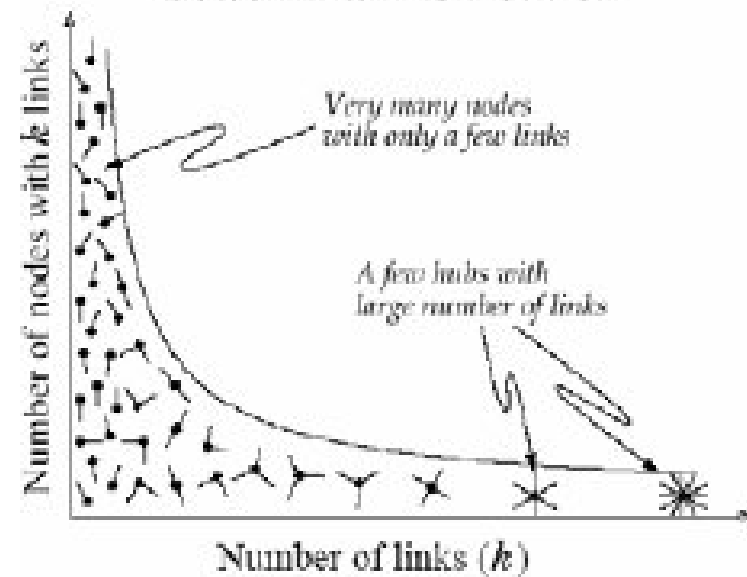
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Bell Curve



Power Law Distribution

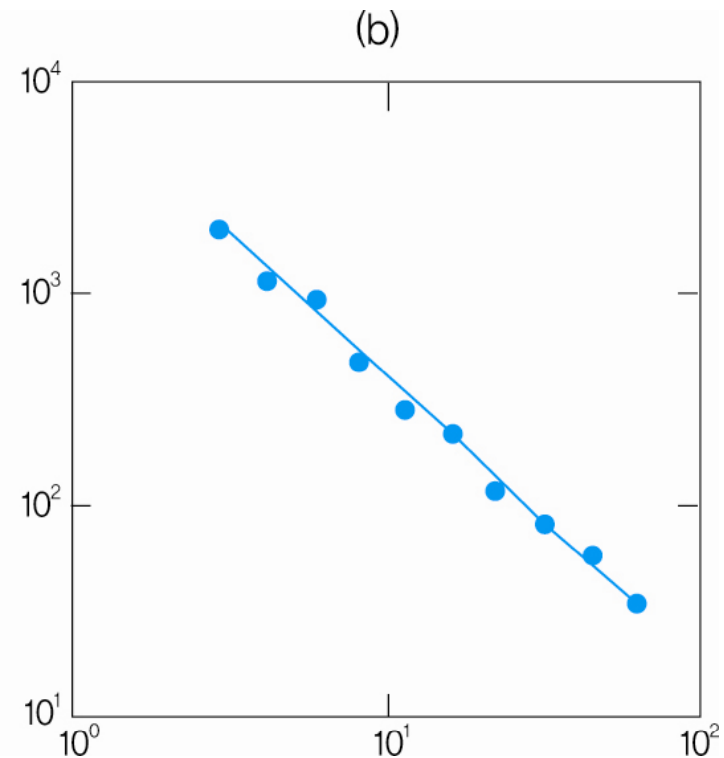
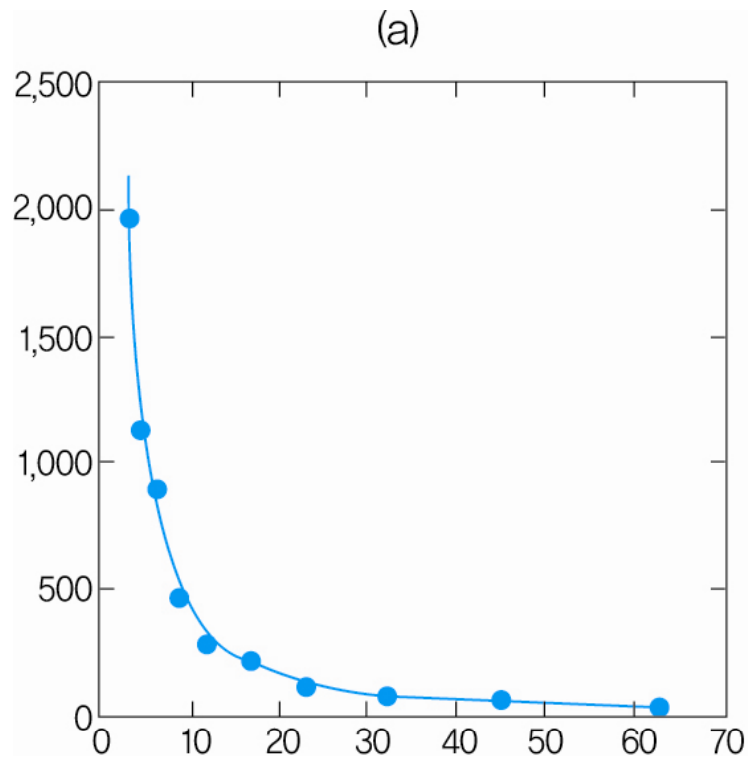




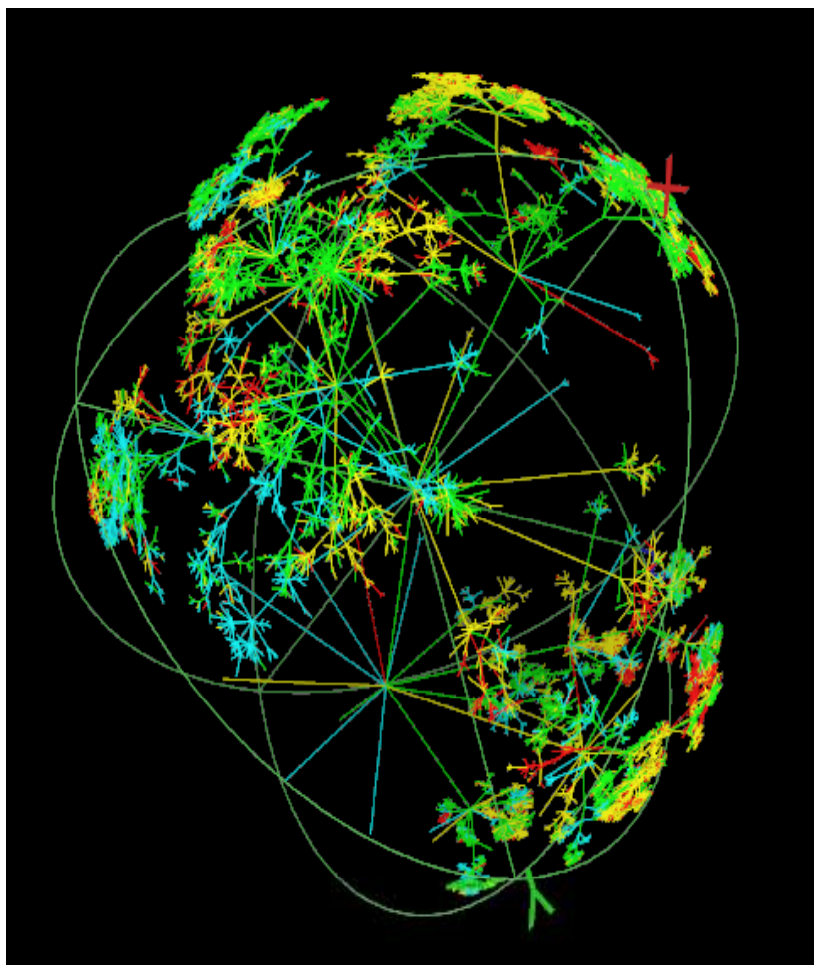
(Power Law)

□ (a) $x \quad y$ 가 $\ll y = A/x^\alpha \gg$

□ (b) $A \gg$ 가 $\ll \log y = -\alpha \log x + \log$
 $A \gg$ 가 $\ll \log x - \log y$



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



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(interaction)



_____가

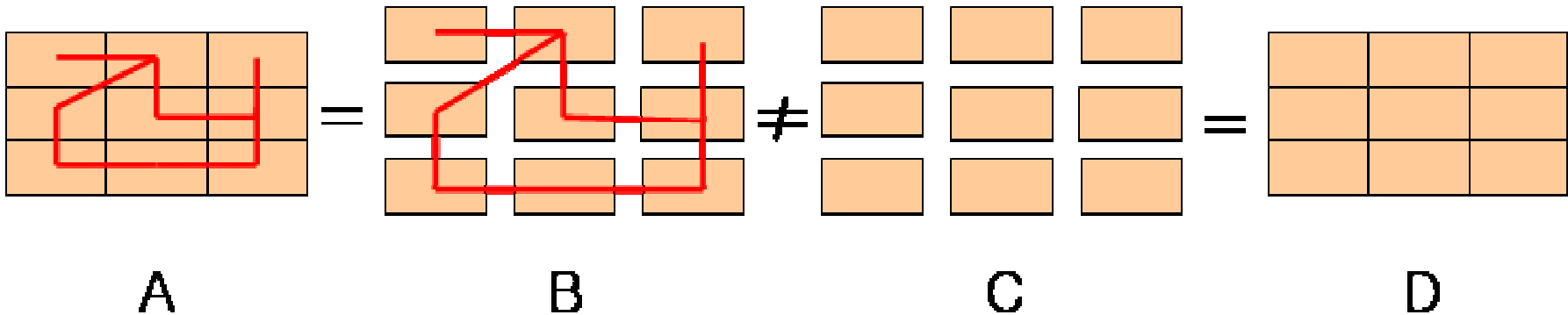


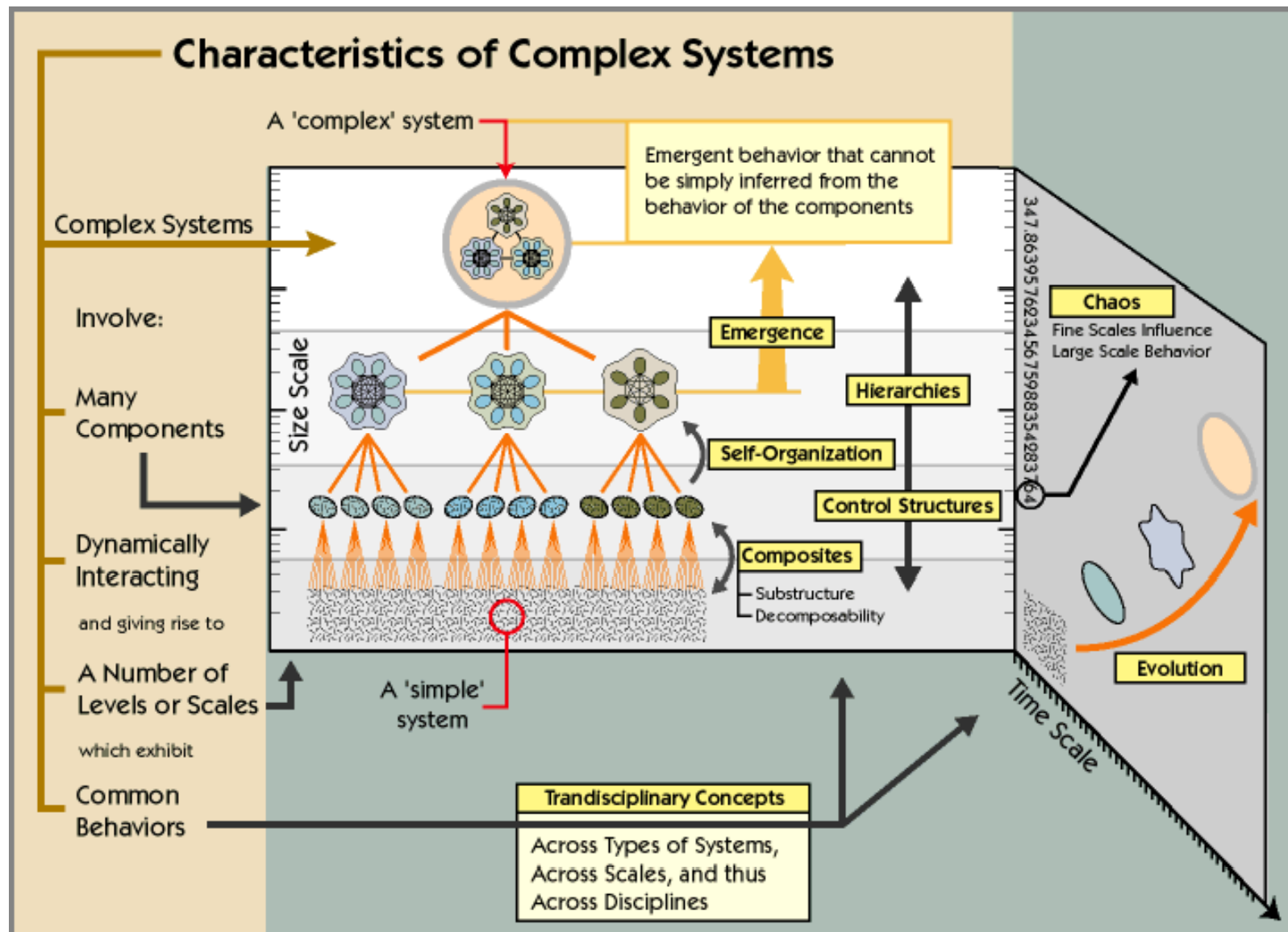
‘_____ (emergence)’

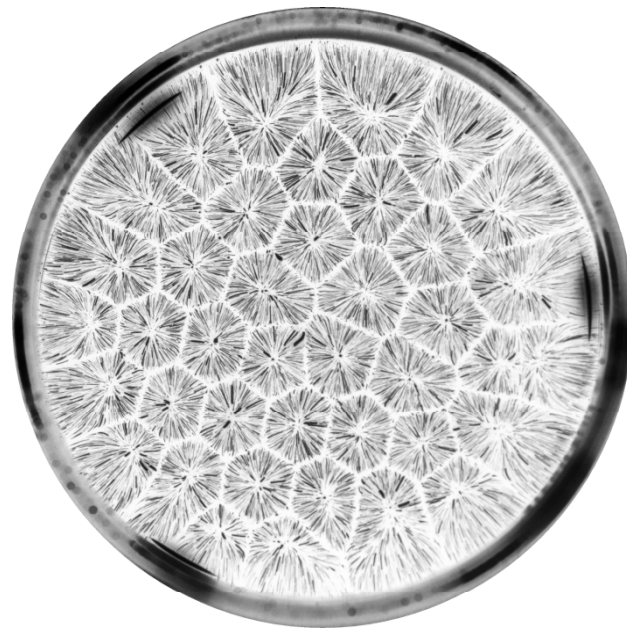
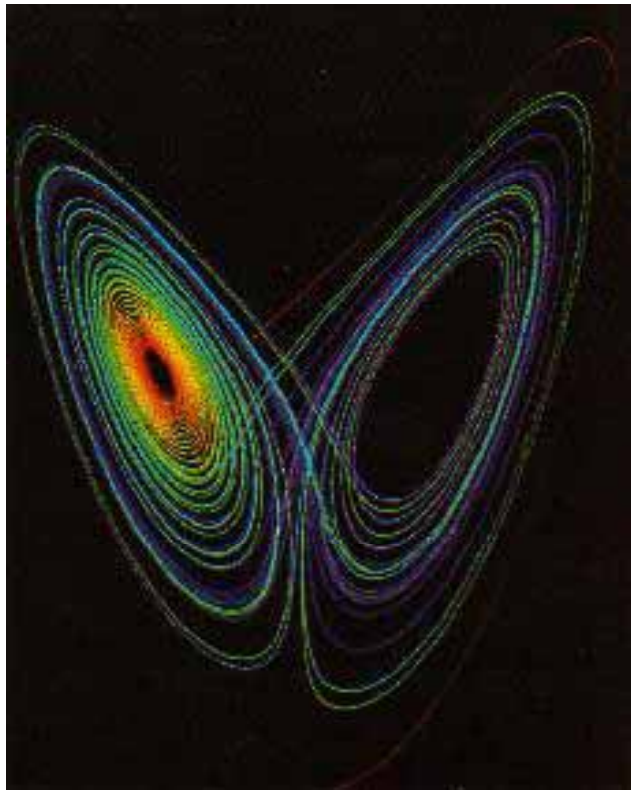
,

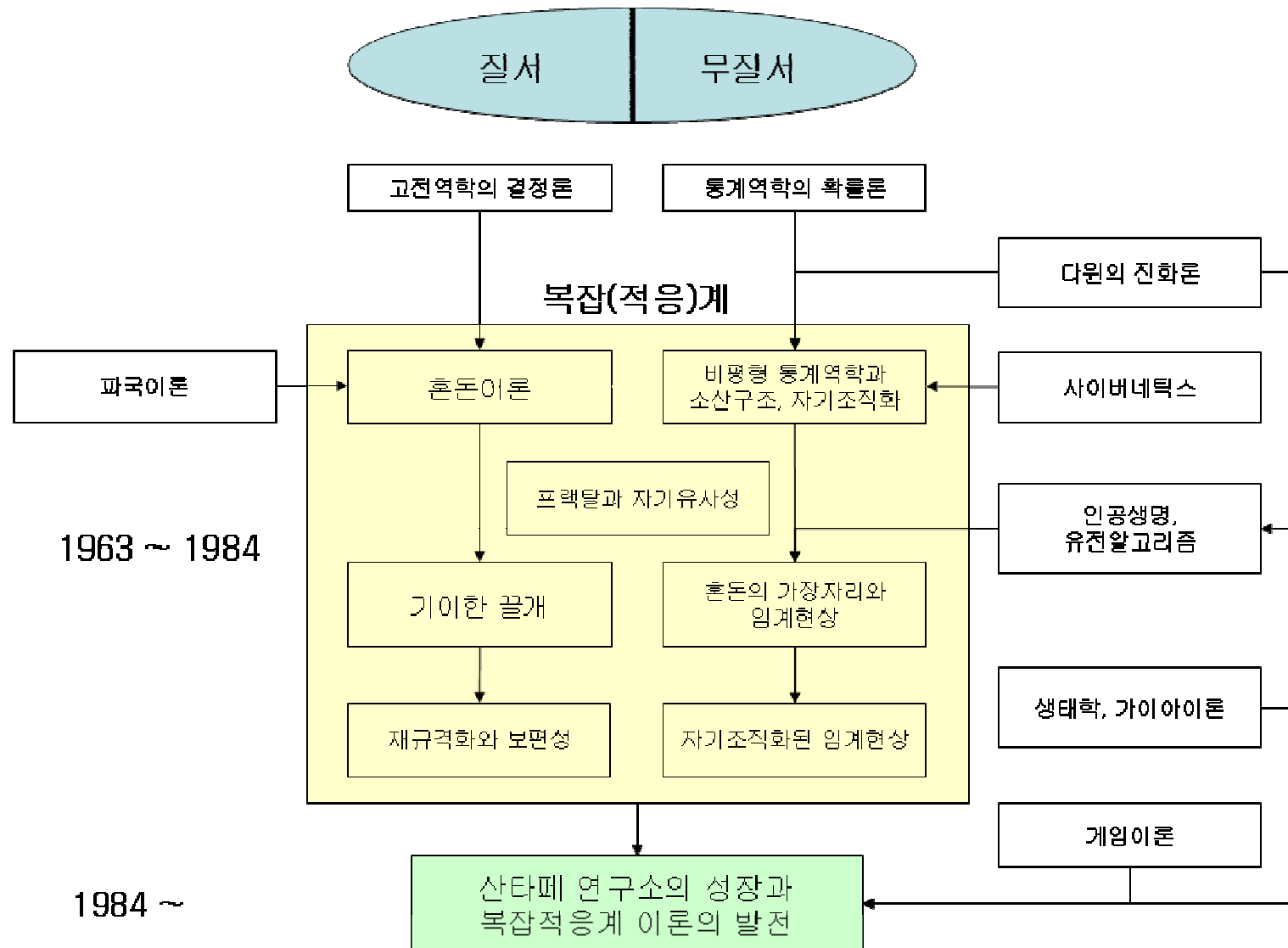
(emergent

behavior)’









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1



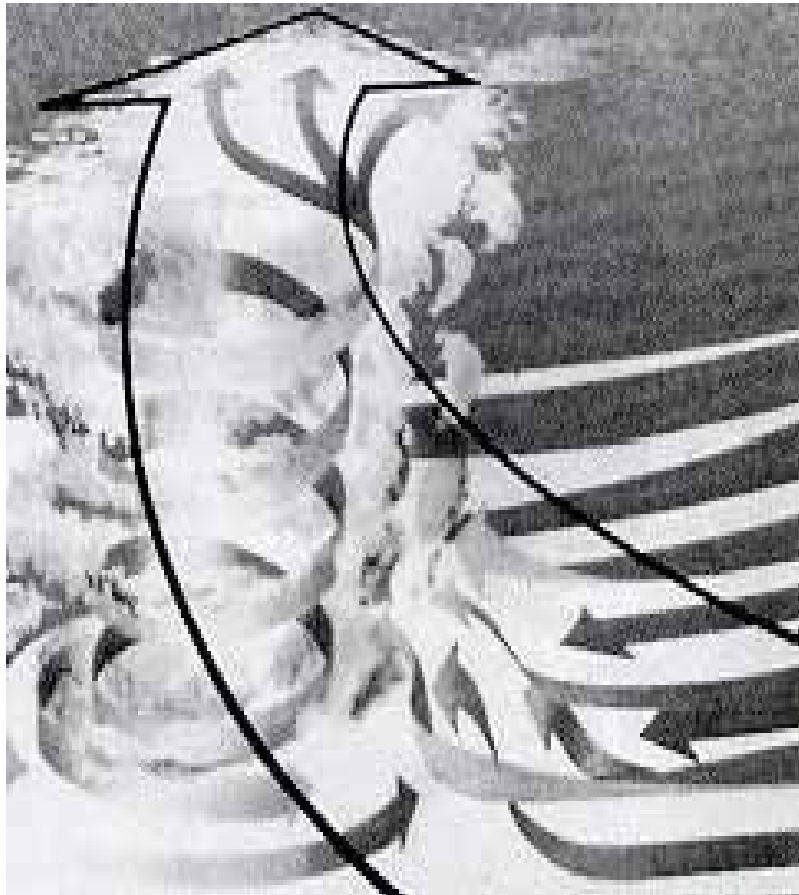
□ 1987

DC-9 가

가

28

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**(chaos)**

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가

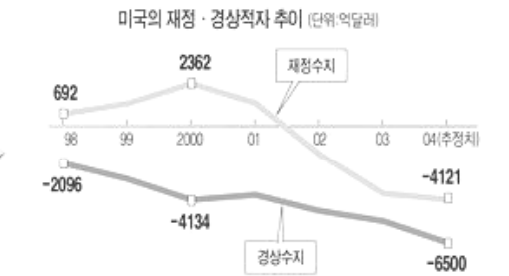
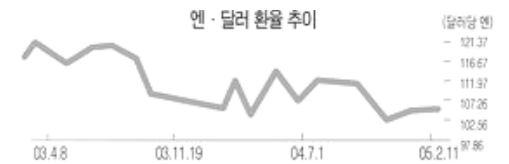
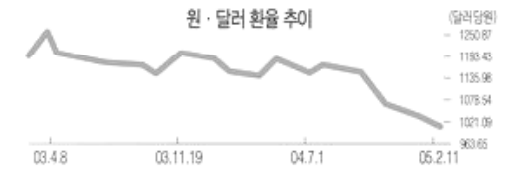
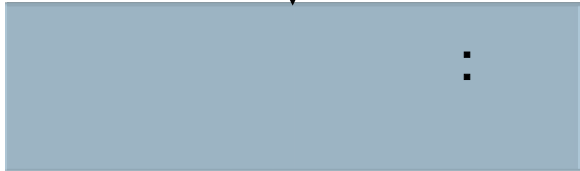
가 가

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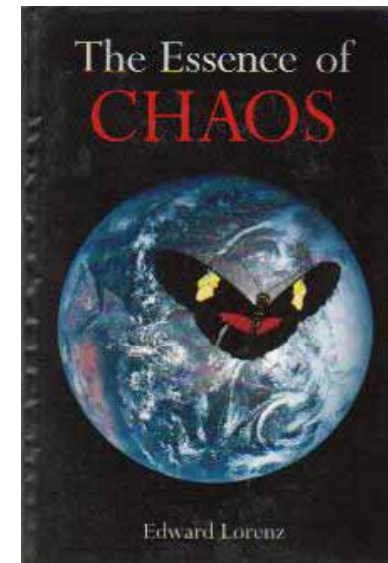
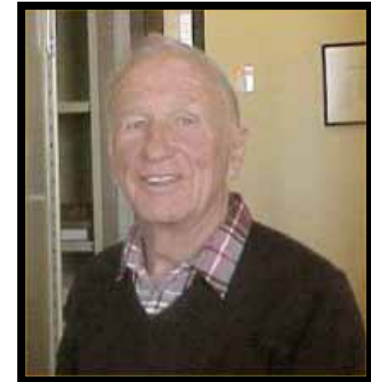
※ 재정수지는 회계 연도(전년 10월1일~해당년 9월30일) 기준. 자료: 백악관 예산관리국(OMB)

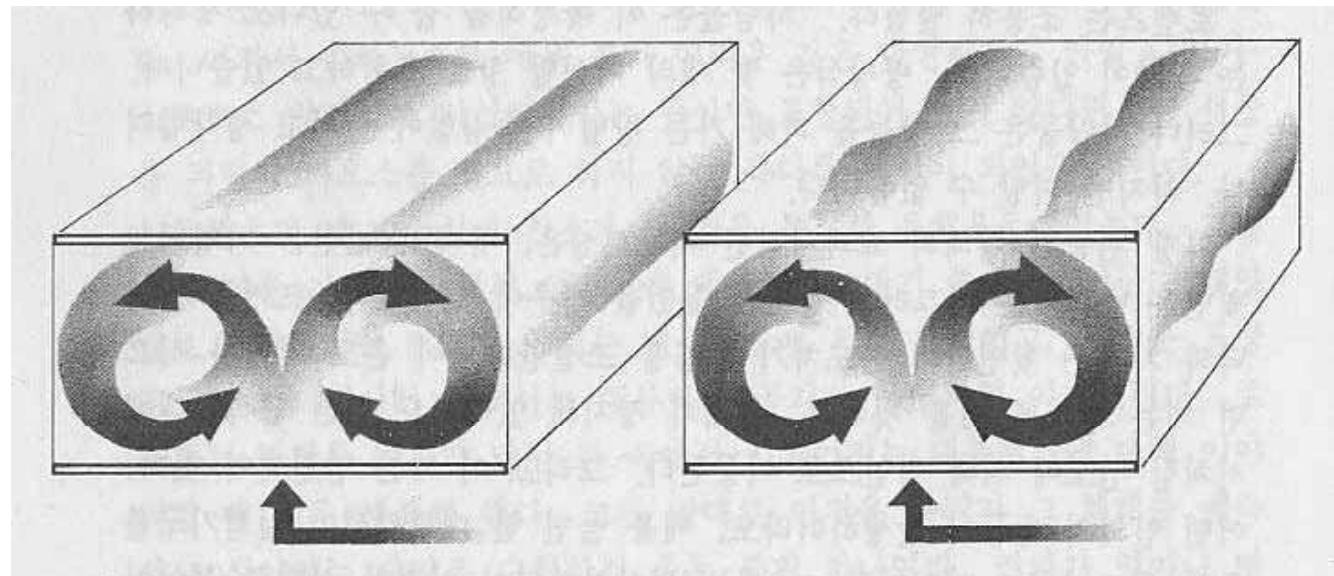
☐ 1942 US Army Air Corps Weather Forecaster

☐ 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

가



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가

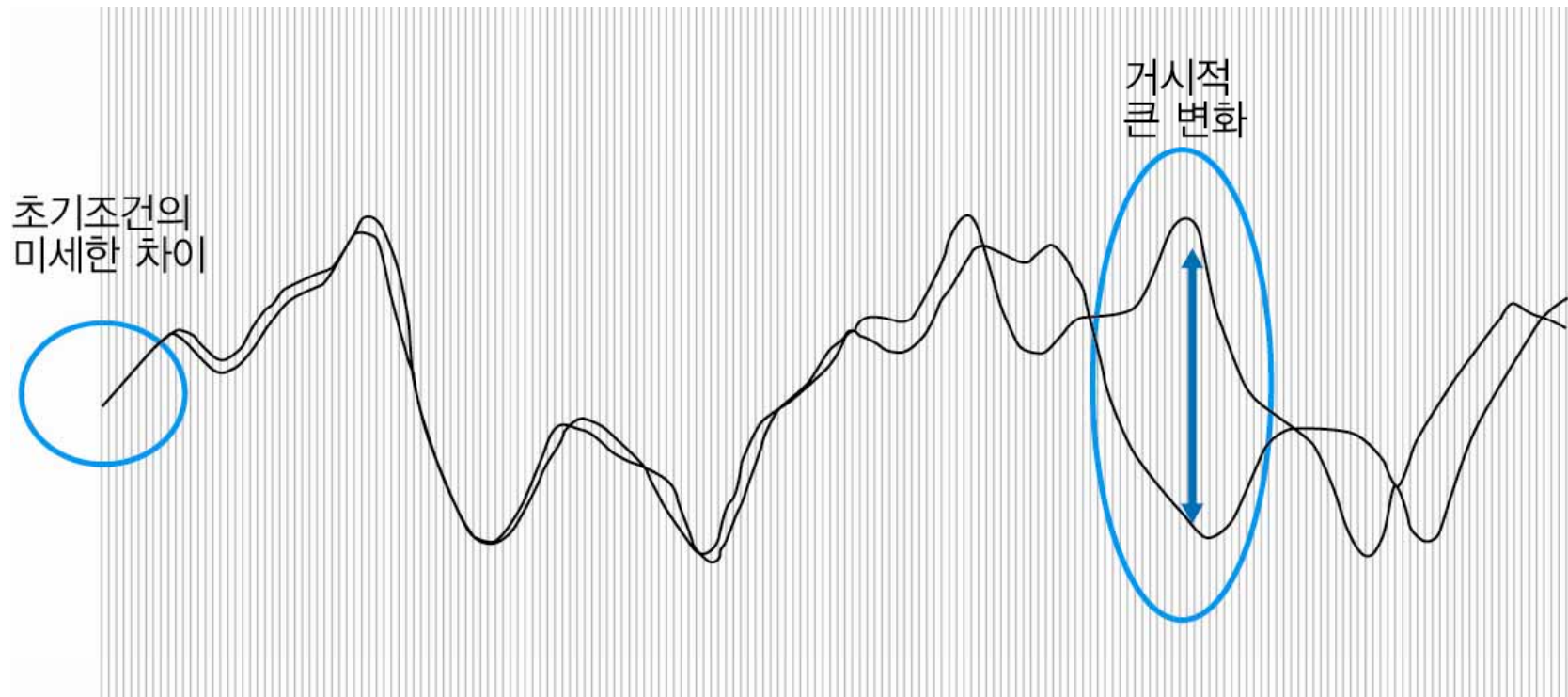


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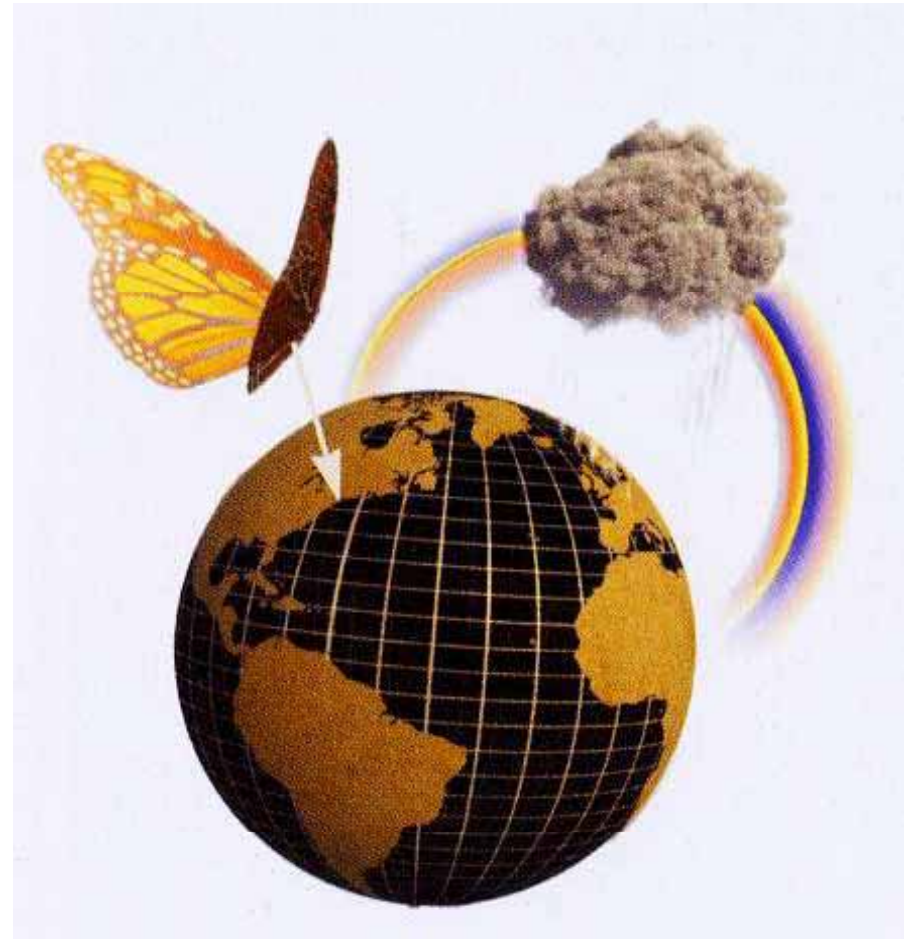
3

□ “sensitive dependence on initial conditions”



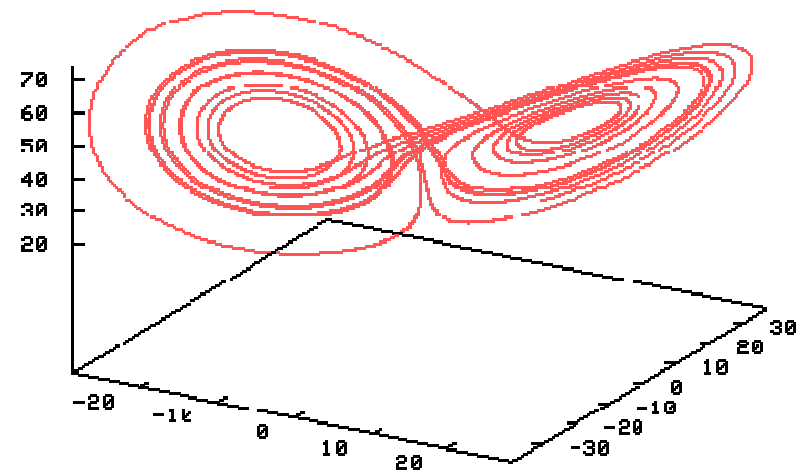
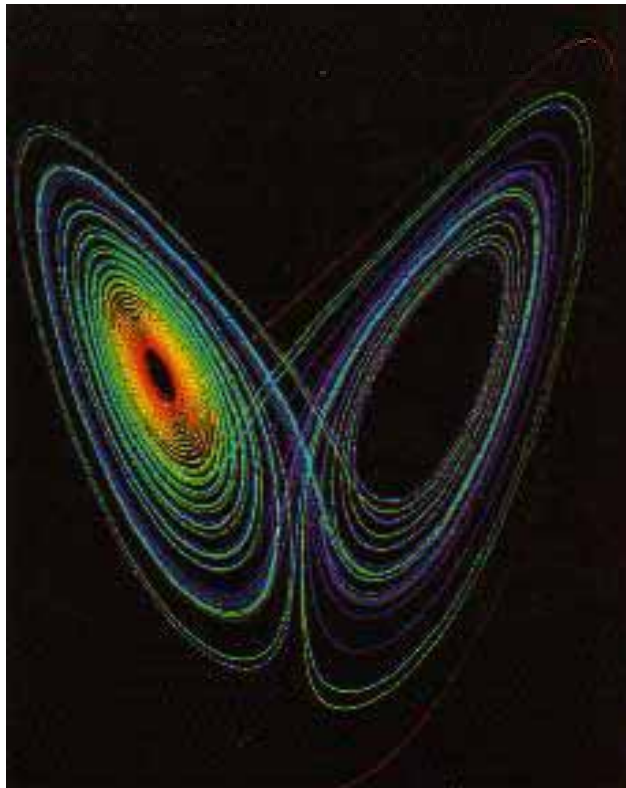
□ Butterfly Effect...

가





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

1:

□ 2003 가 , _____ 가

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— 2003 가 2004





가

- (solitary)
- , (gregarious)

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Solitary



Gregarious





가



□ 2004

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(3

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2004 11 ,

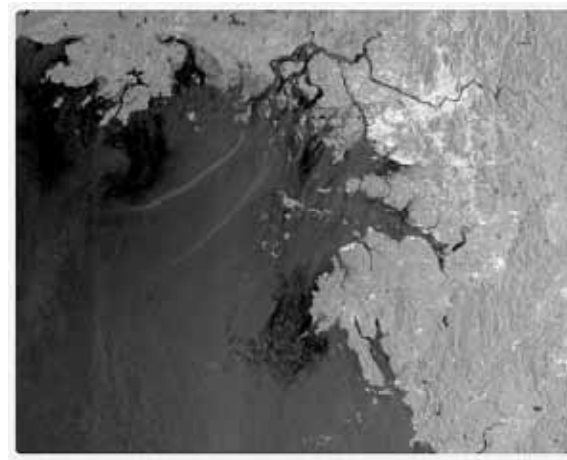
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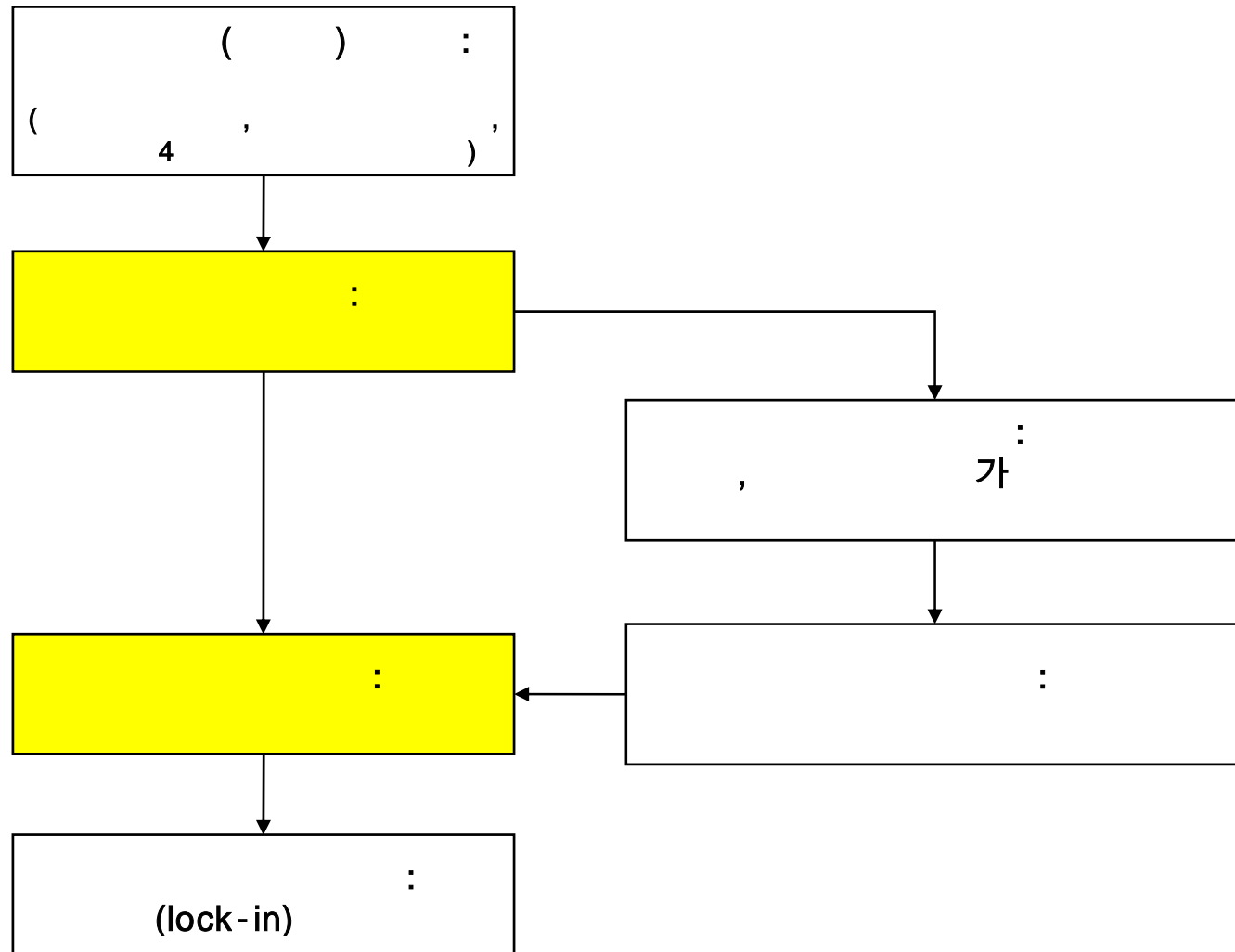


(top-

down) 가

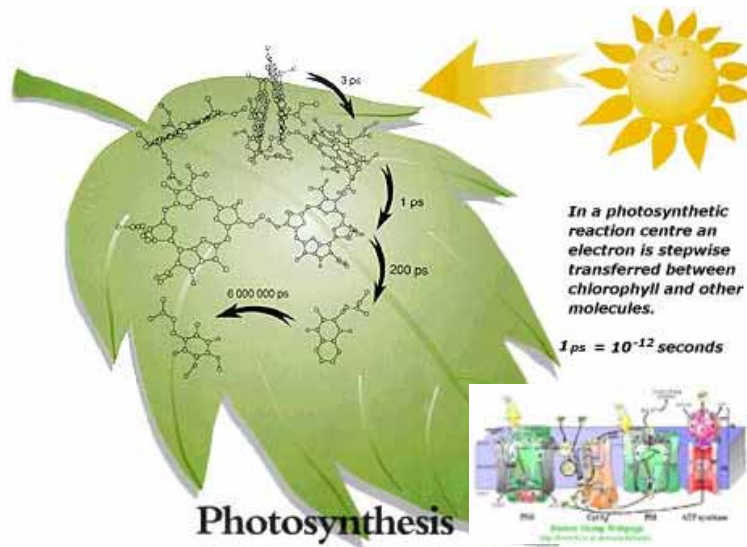
, _____

(bottom-up) _____





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_____ (far from
equilibrium)

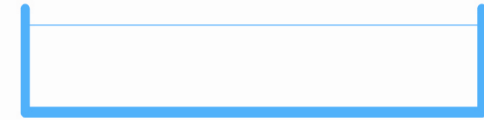
_____가

— _____가

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— _____

1단계 : 역전층
(안정한 전도)



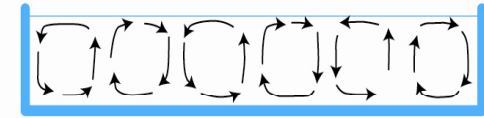
따뜻함

2단계 : 혼돈적 흐름
(불규칙적 대류)



뜨거움

3단계 : 베나르 세포
(규칙적 대류)



매우 뜨거움

에너지의 흐름





가

2

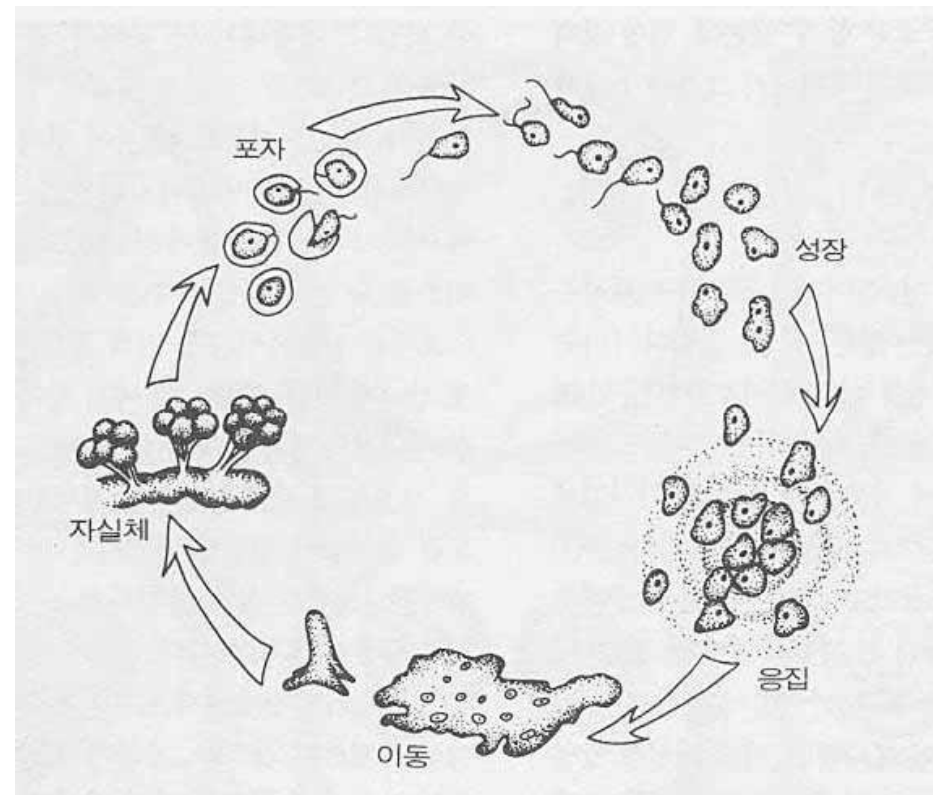
가

➔ “

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➔ “

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가 _____가

(_____)

(消散)가



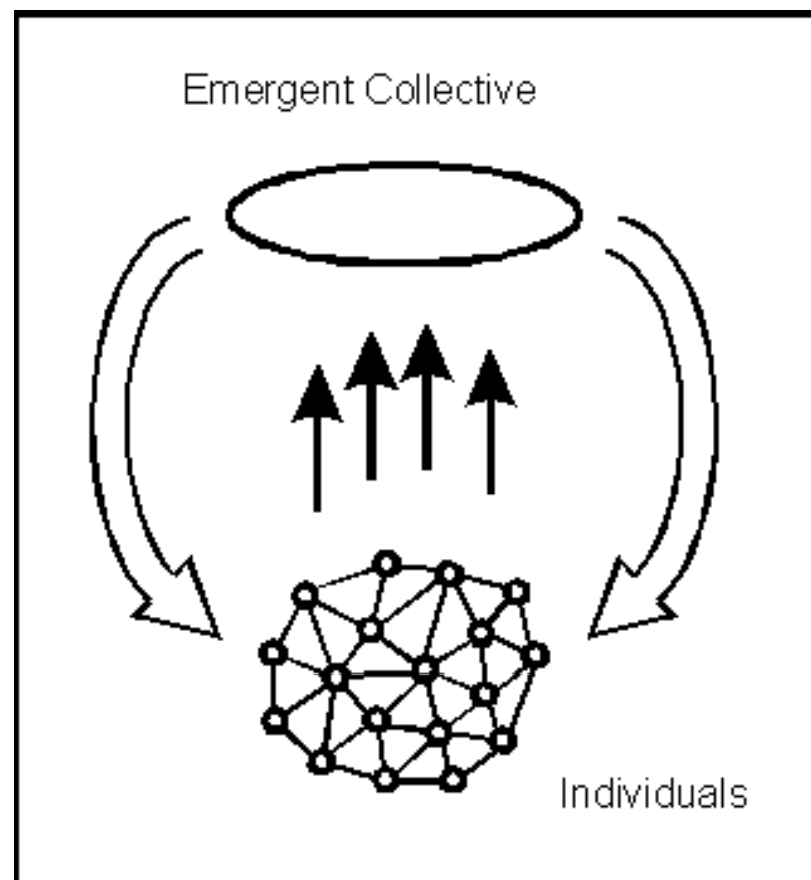
가 _____

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(Positive Feedback)



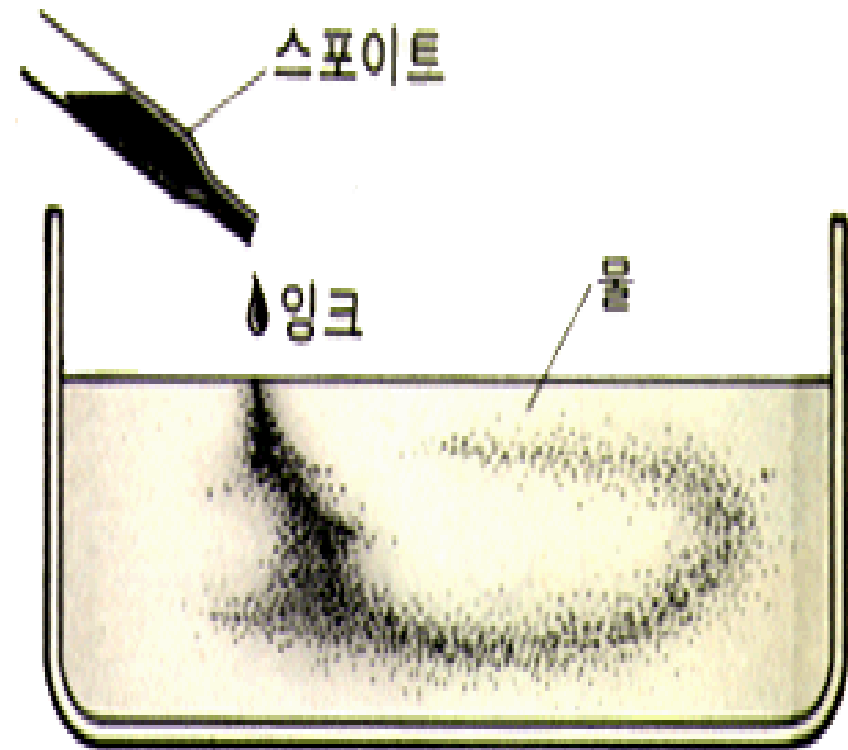
가 /



가



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가

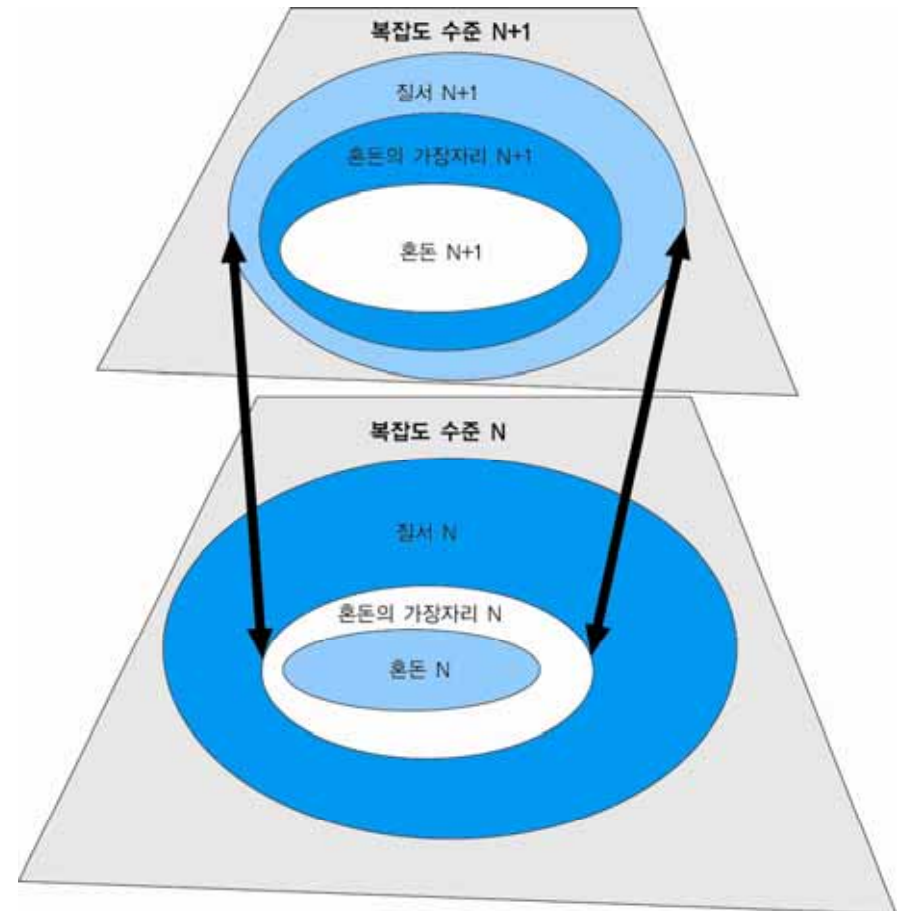


가

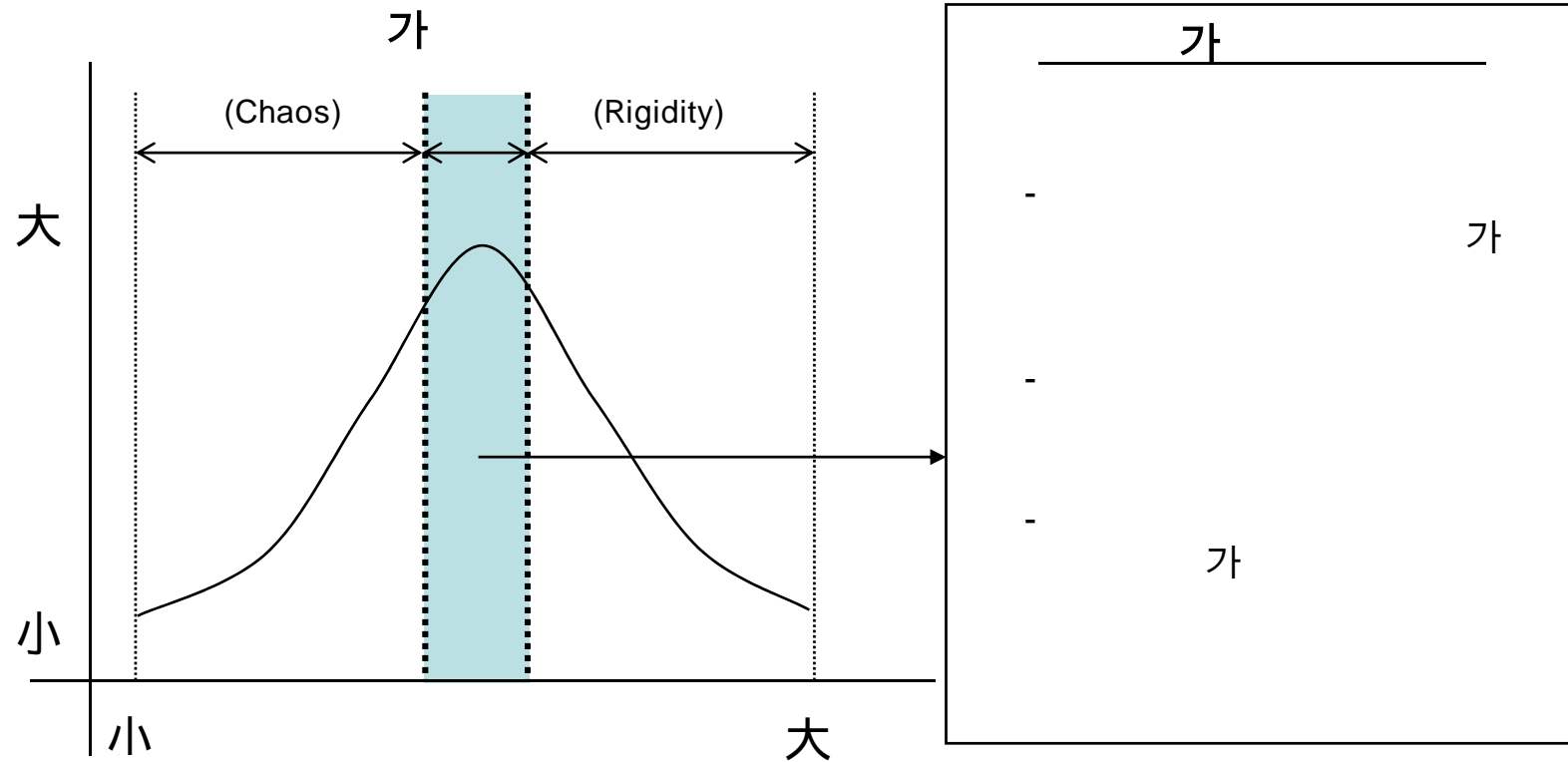


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가



(2006),

, SERI CEO Information.



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가 2000

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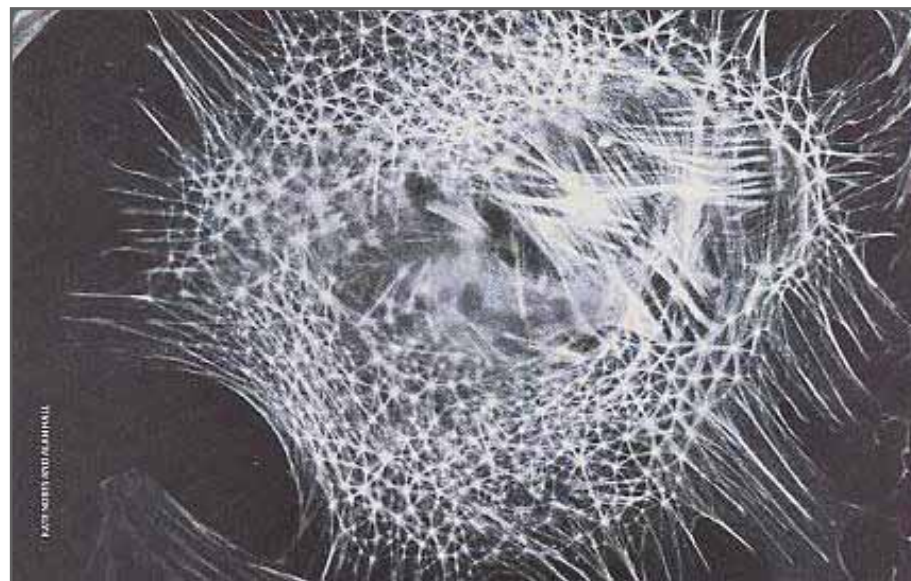
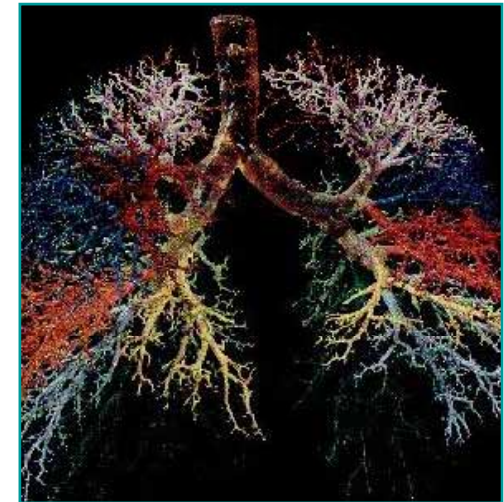
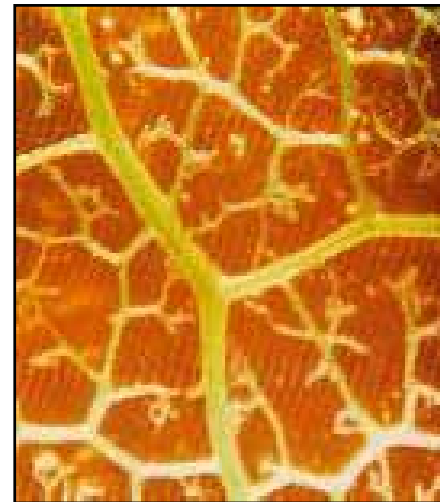
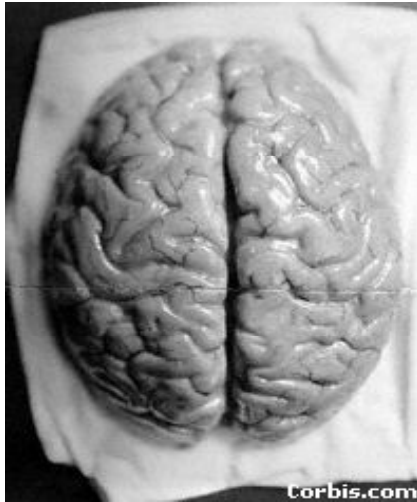
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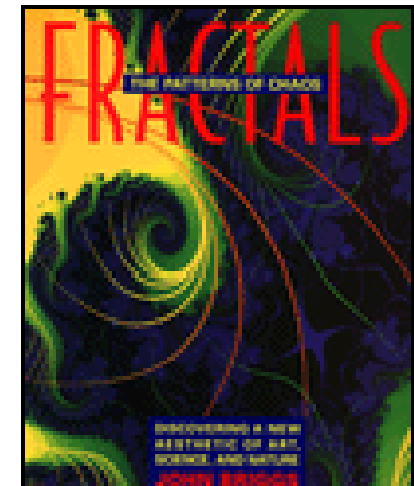
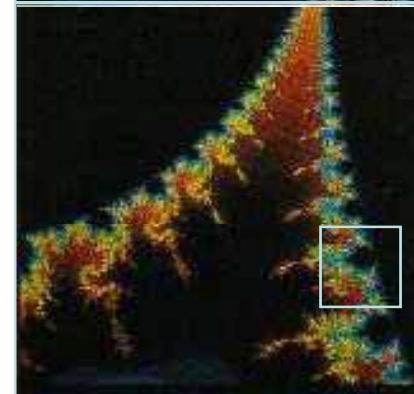
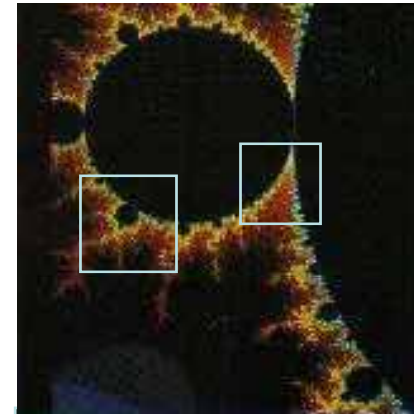




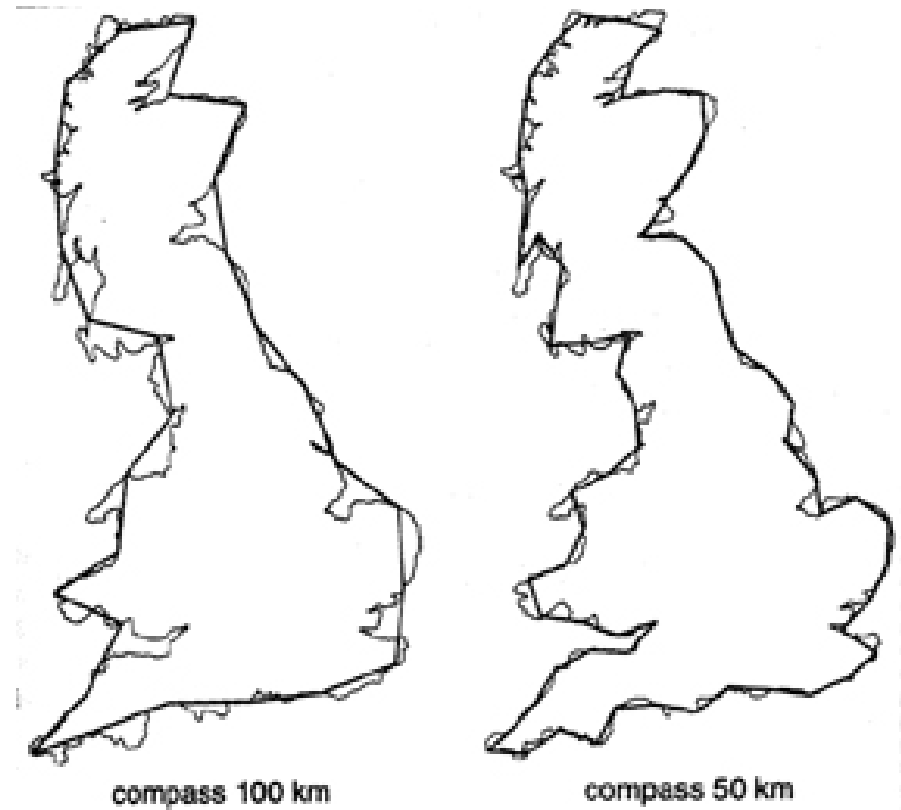
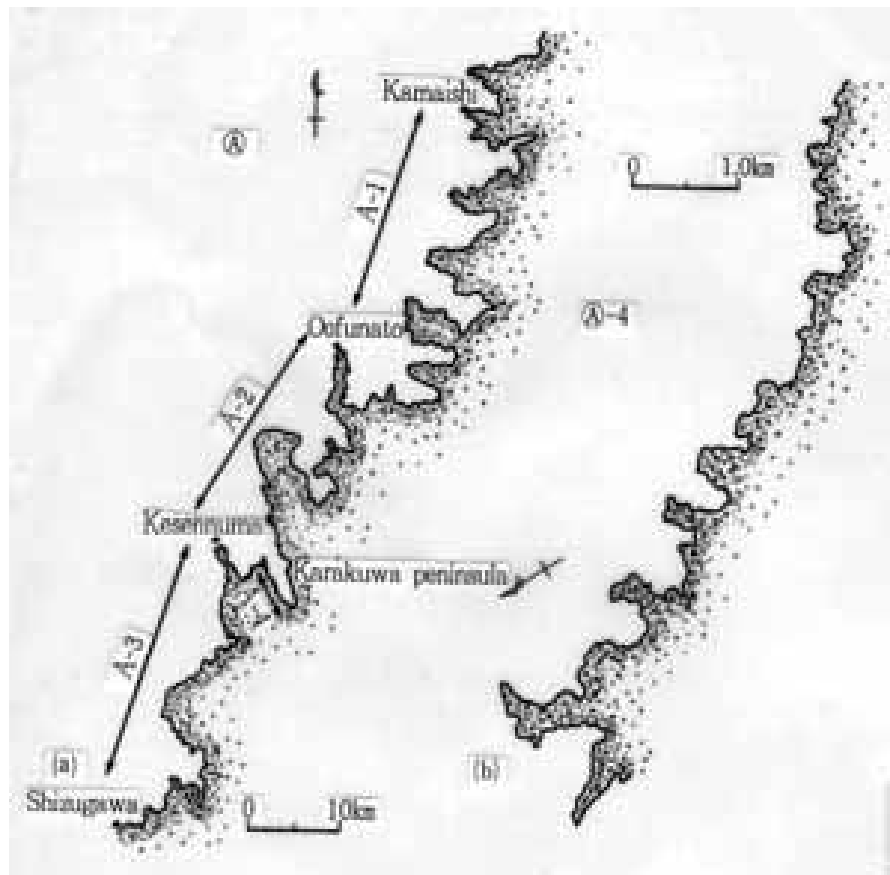
- Fractal:
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fractus'



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- 가 가
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- 가

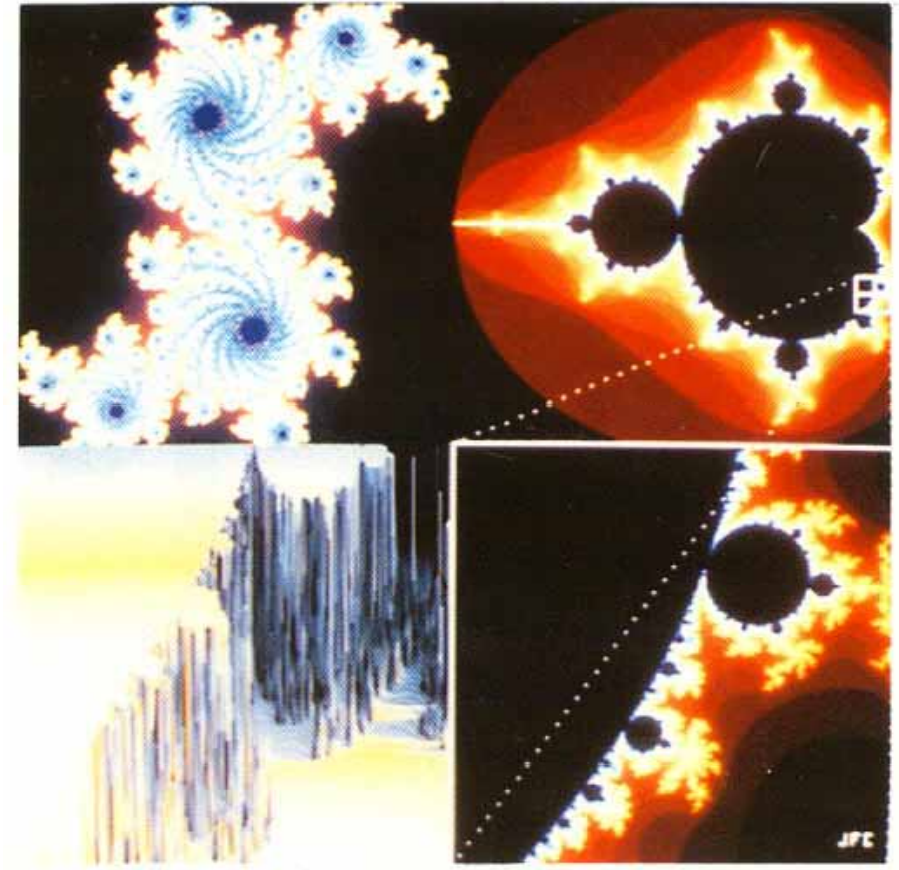




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2, 3, 1, 0



1, 2, 3 1.3, 2.5

가



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

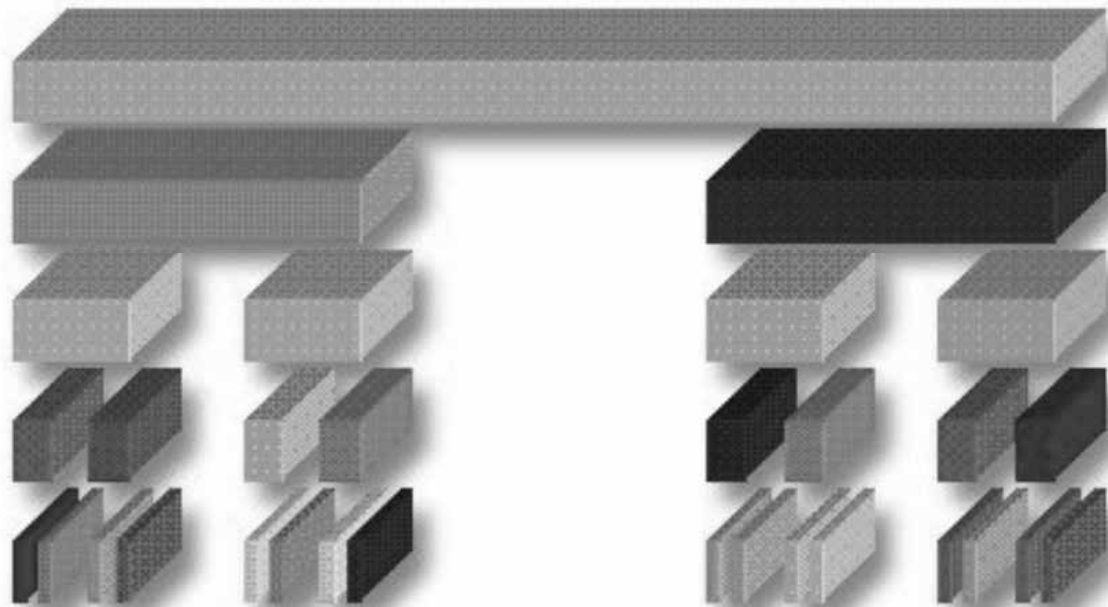
- $=\log(3)/\log(3)=1$
- $=\log(9)/\log(3)=2$
- $=\log(27)/\log(3)=3$

:

-



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

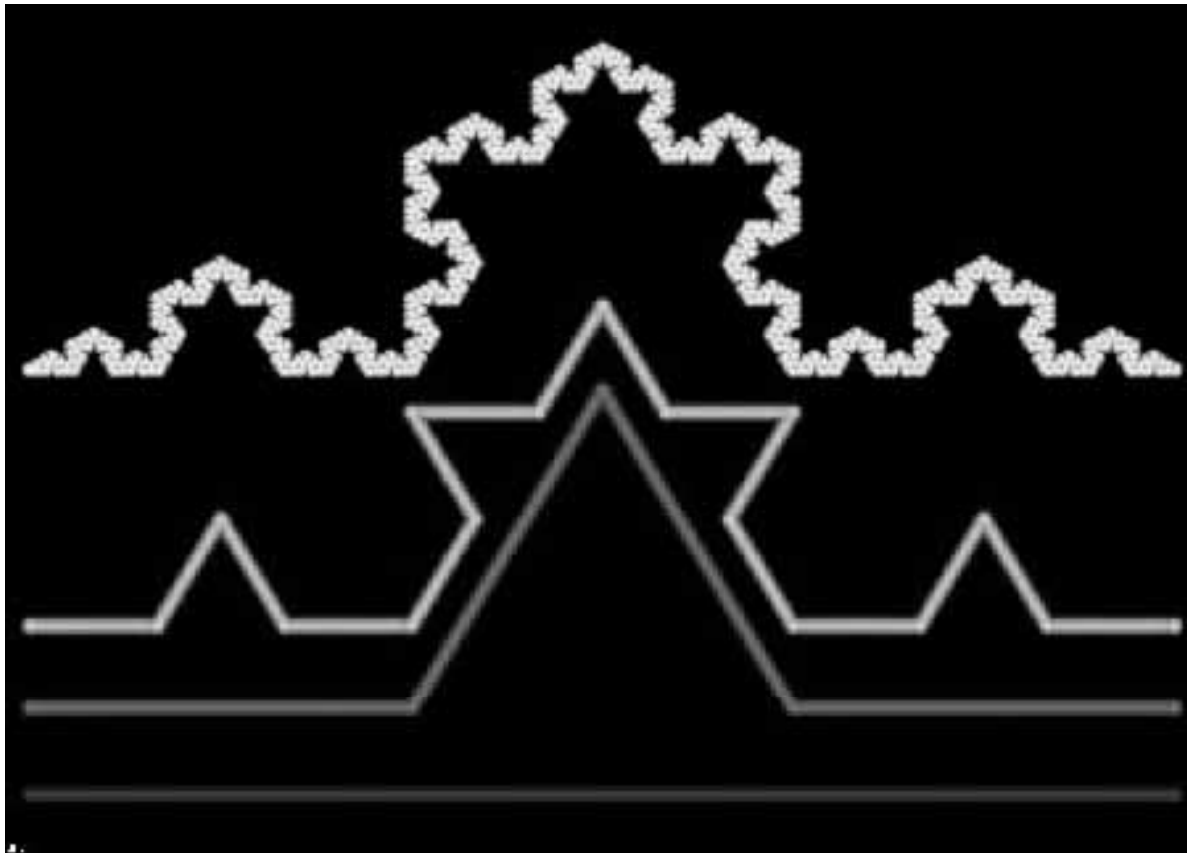


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$$=\log(4)/\log(3)=1.2618$$





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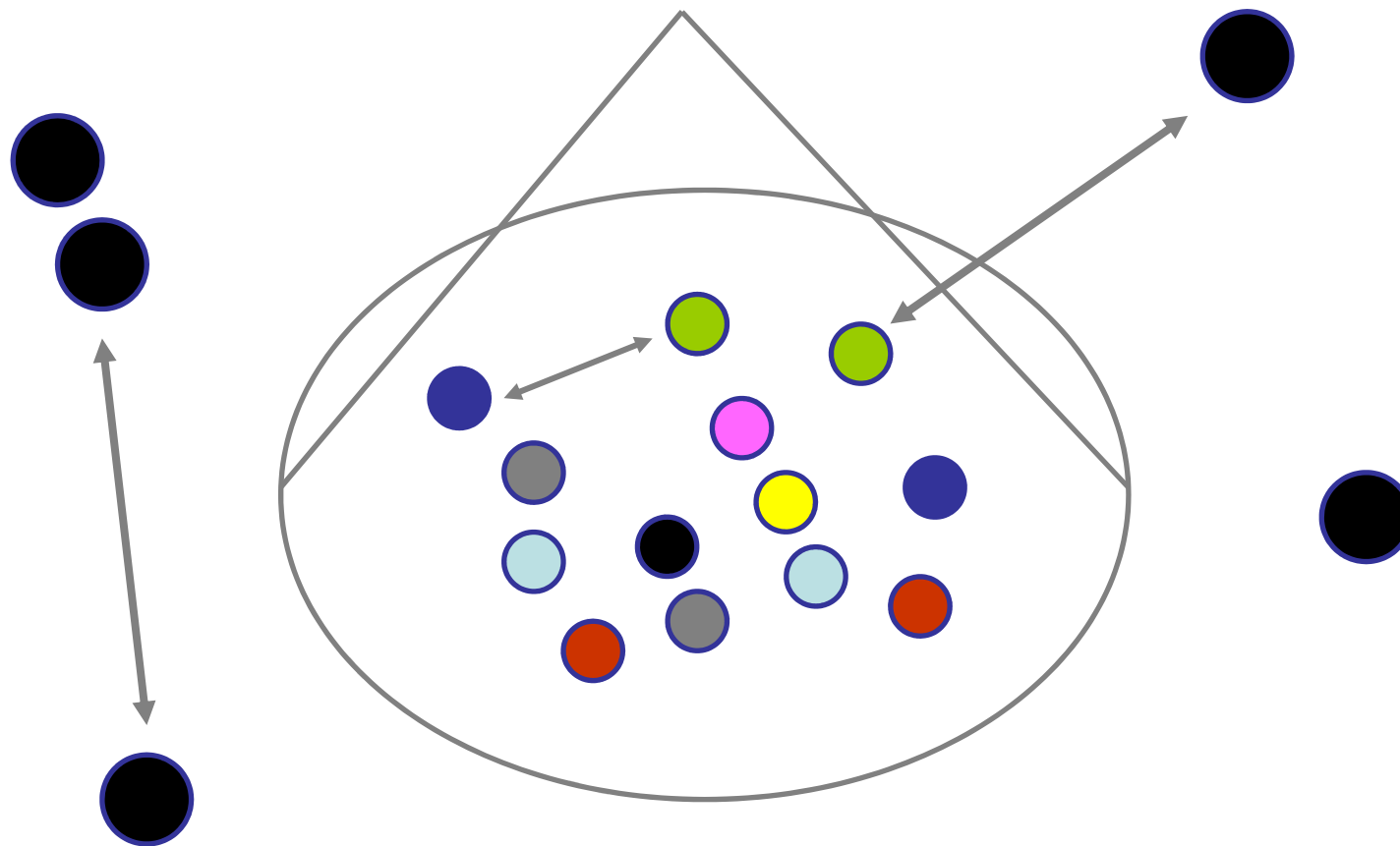
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:	:
<p>(量) 가</p> <p>,</p>	<p>(形) 가</p> <p>, ,</p> <p>가</p> <p>()</p>





	-	-	-	9)
	1) 가?		6) 가 가?	10) 가? 가?
	2) 가?		7) 가 가 가?	
	3) 가?	4) 가 가?	8) 가 가 가?	

1:

가?



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가?

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가?



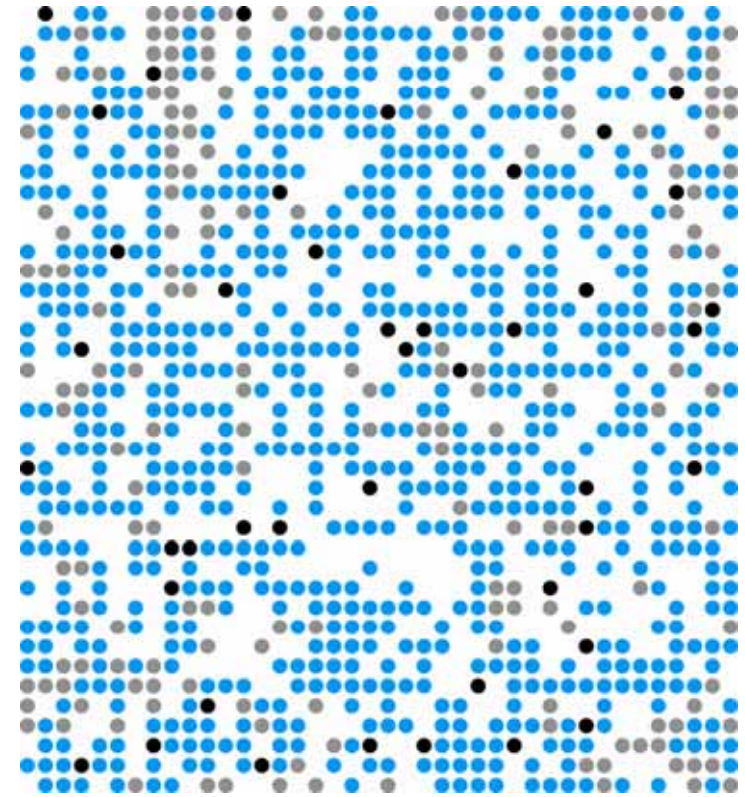
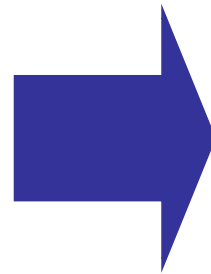
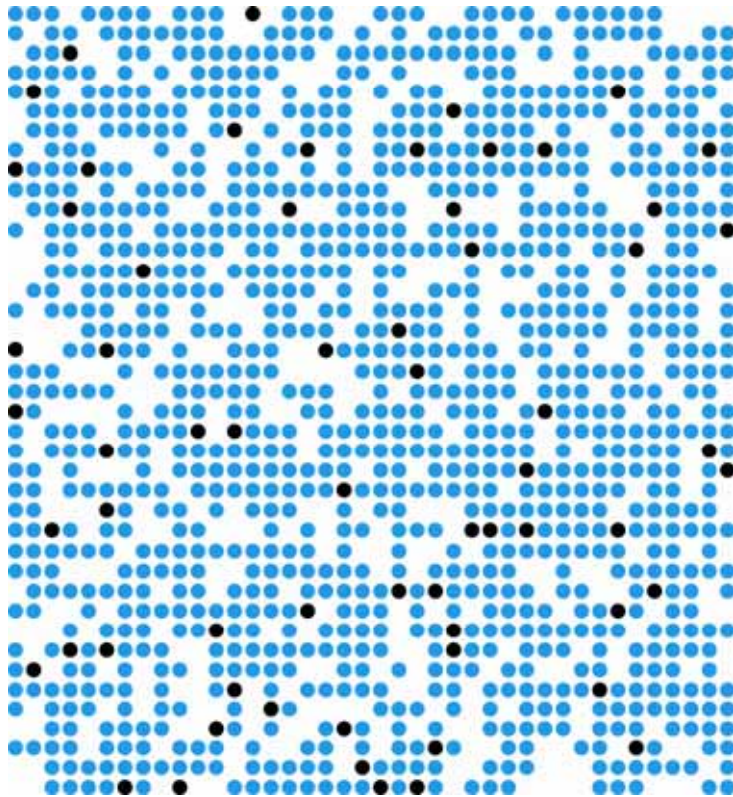
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가?

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□ Agent: , ,

□ Rule: 가 가 ,



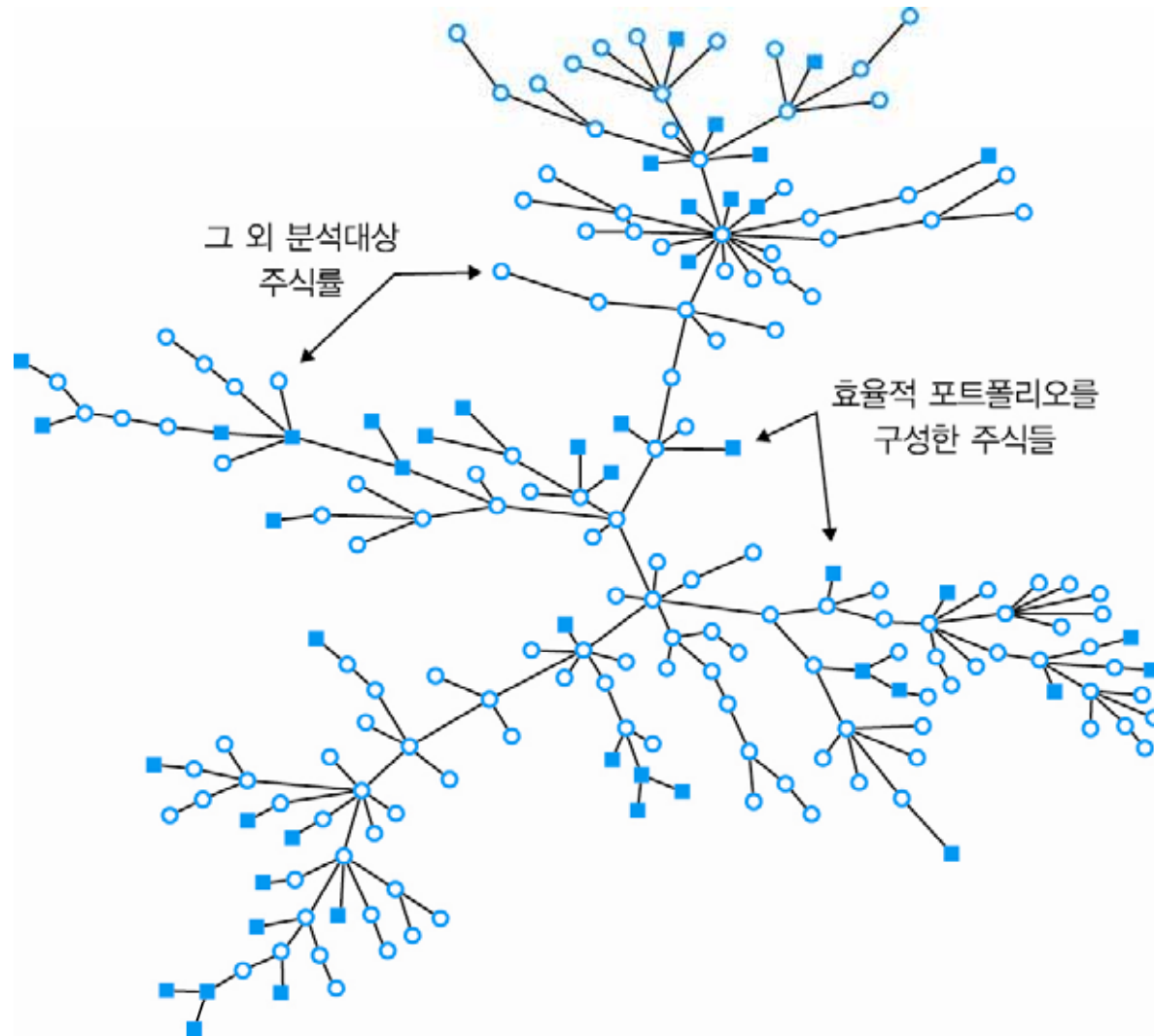
Ebstein, J. M.(2002)

2:

가?



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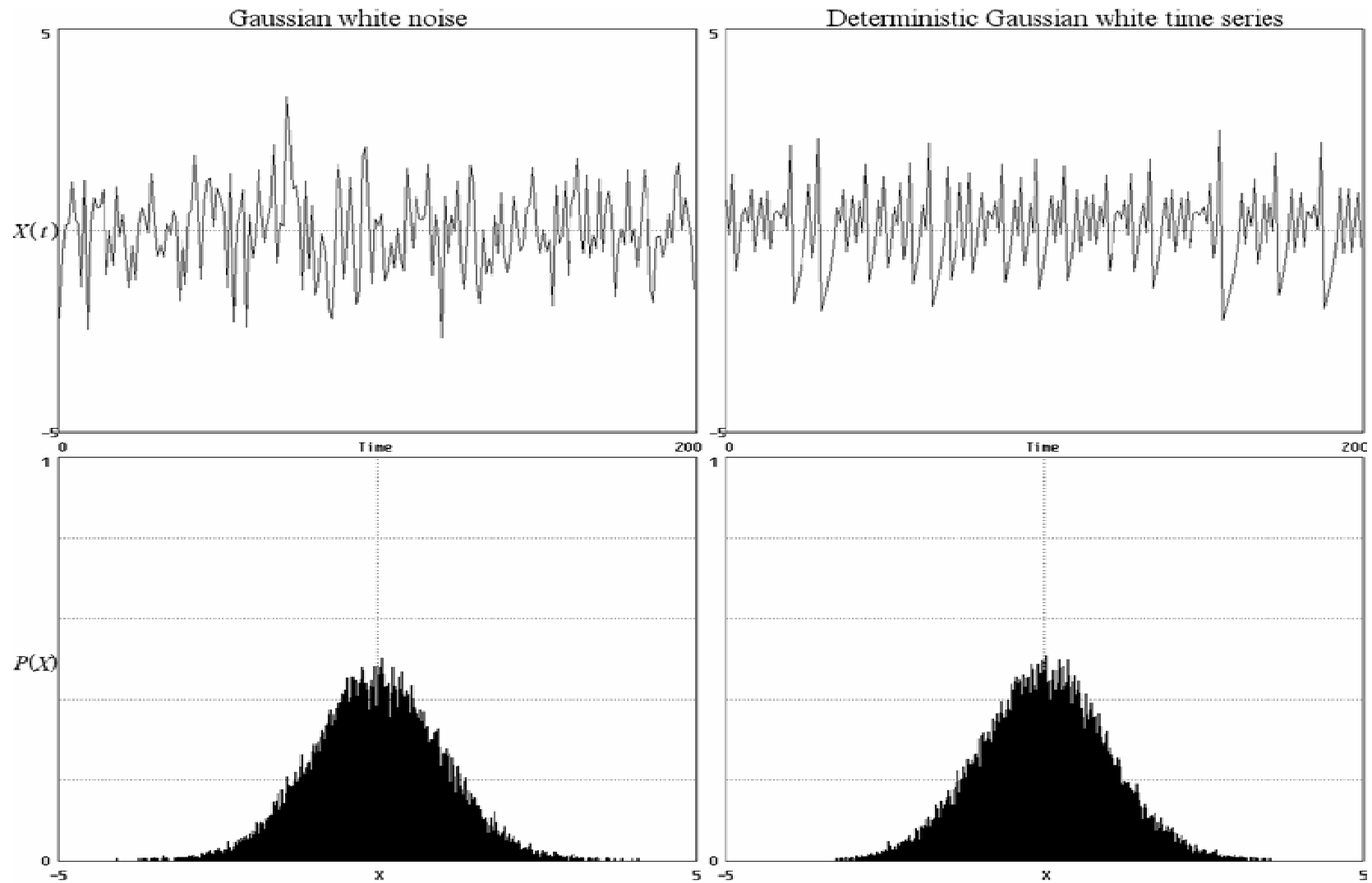
, (2004)

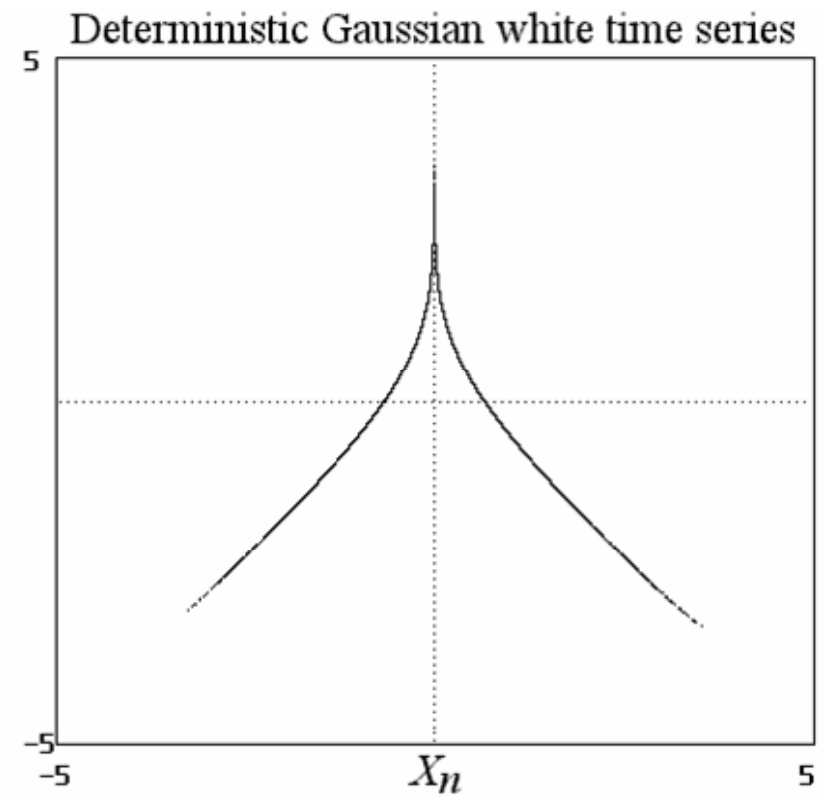
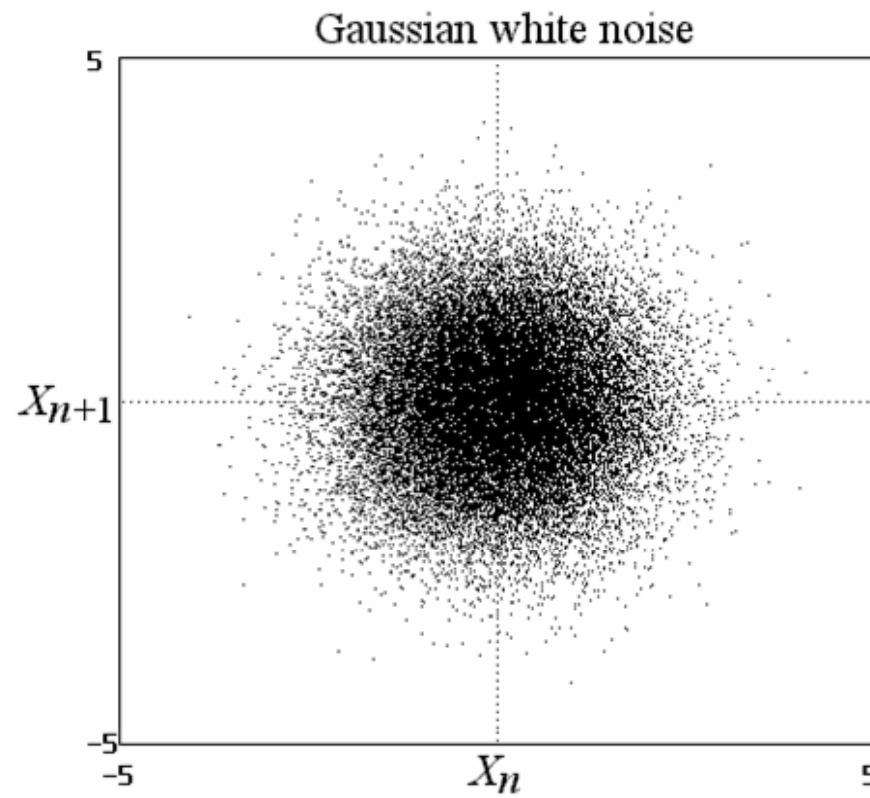
3:

가?

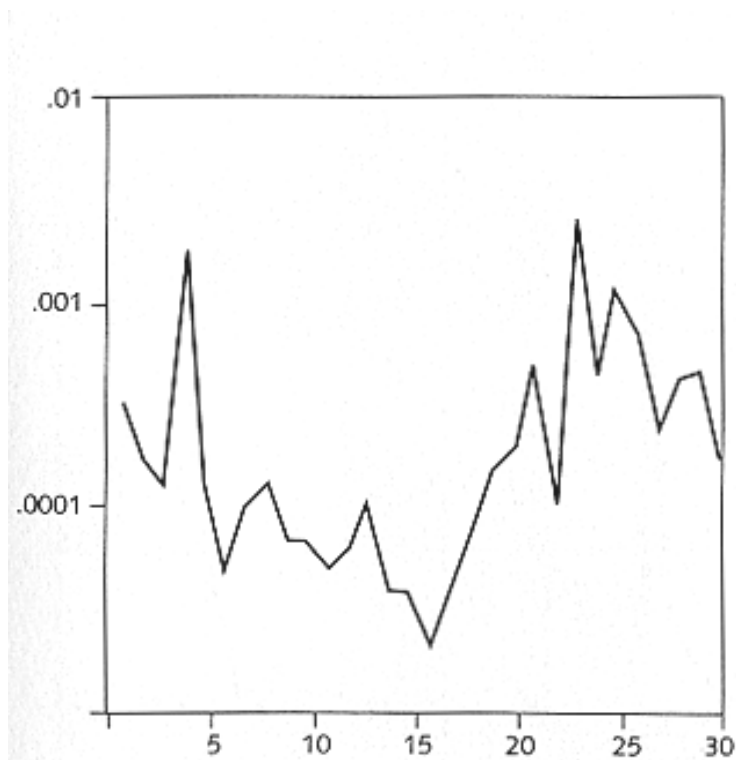


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▪

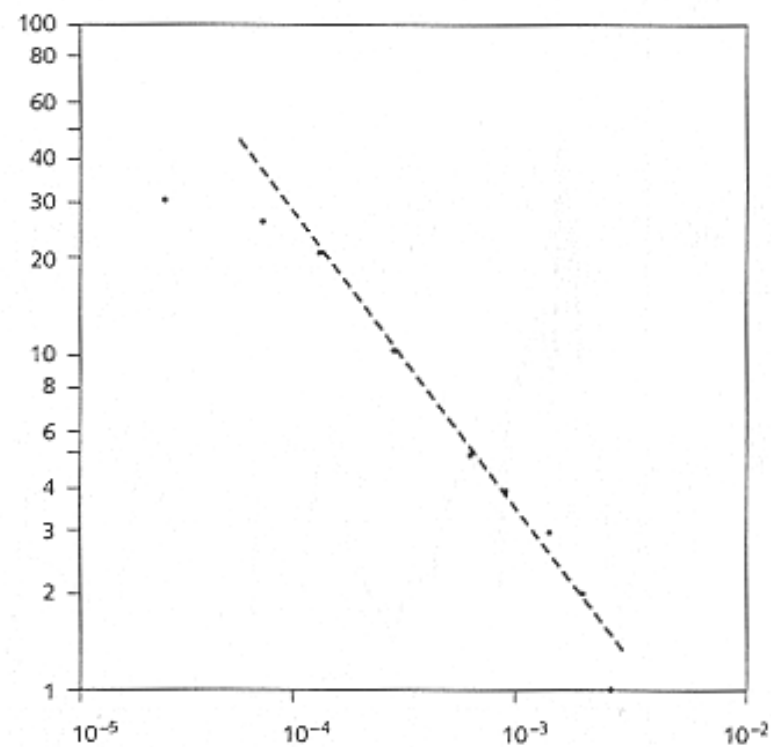




: 가



(a)

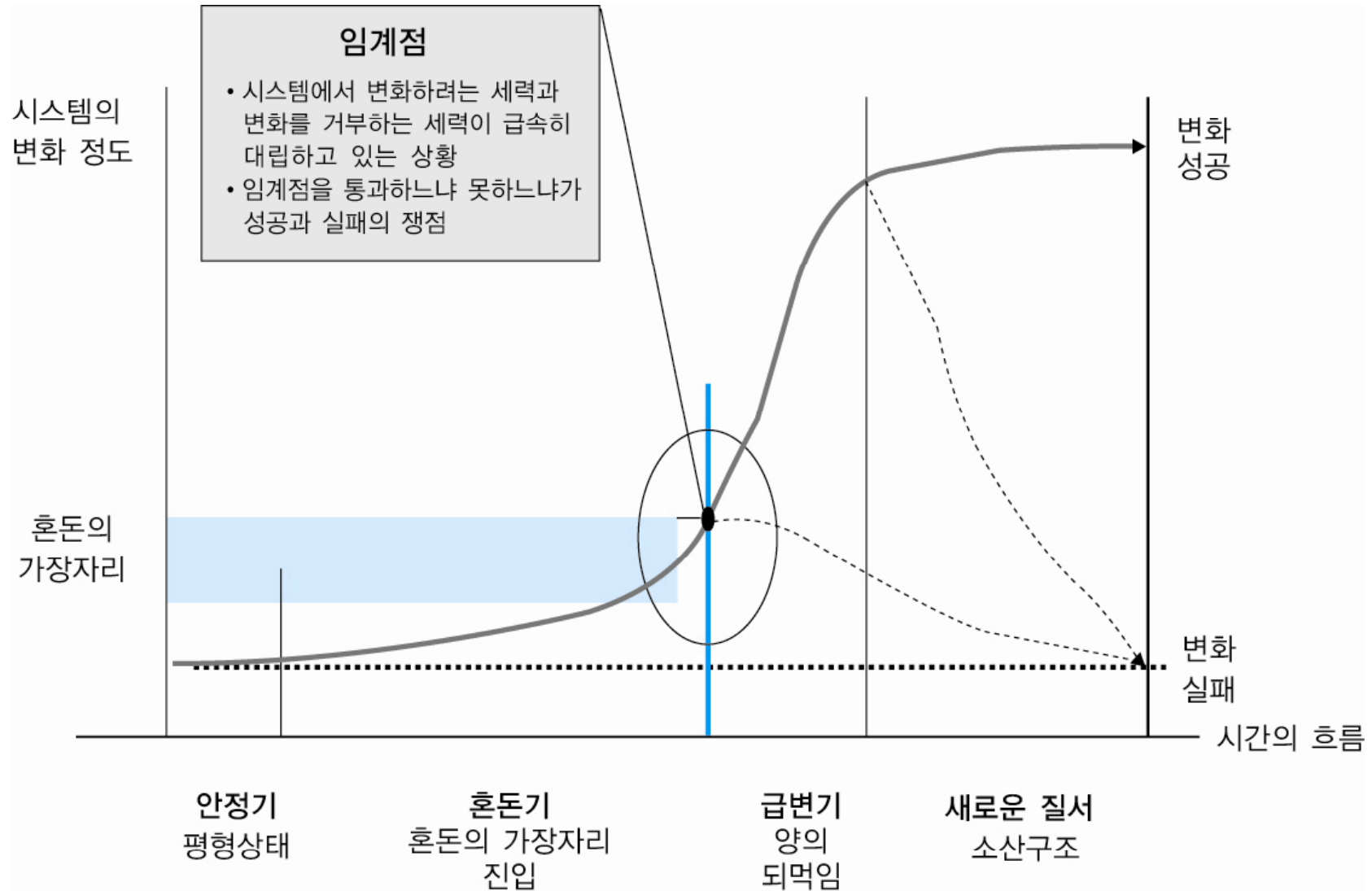


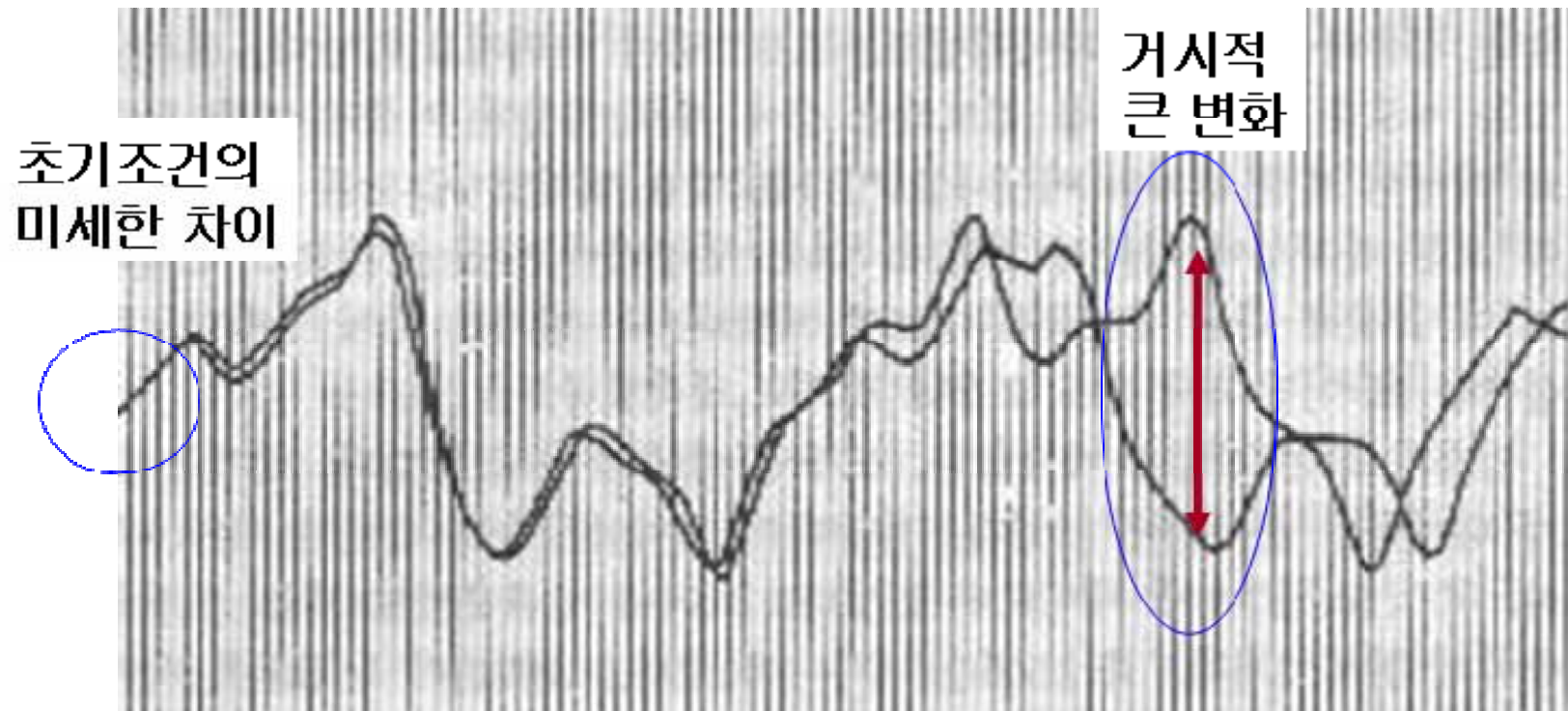
(b)

1:

가 가?



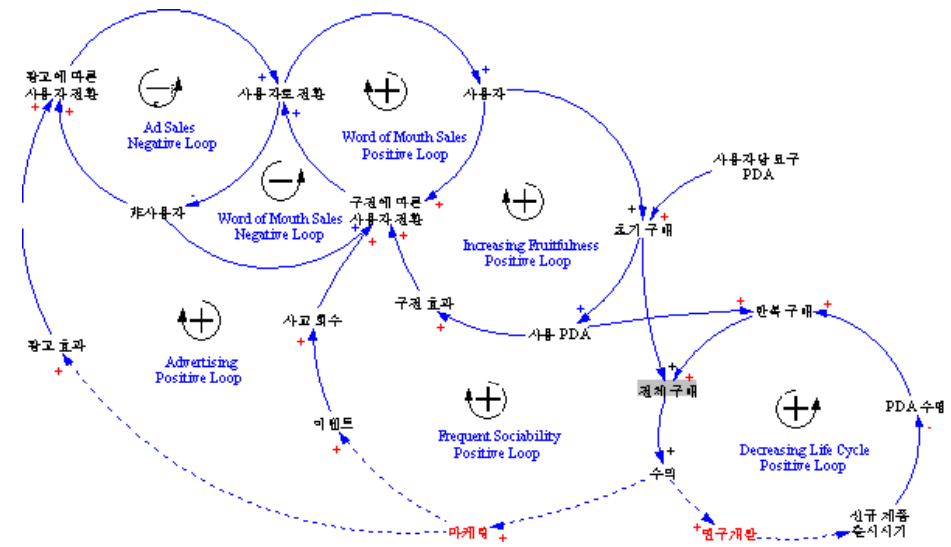
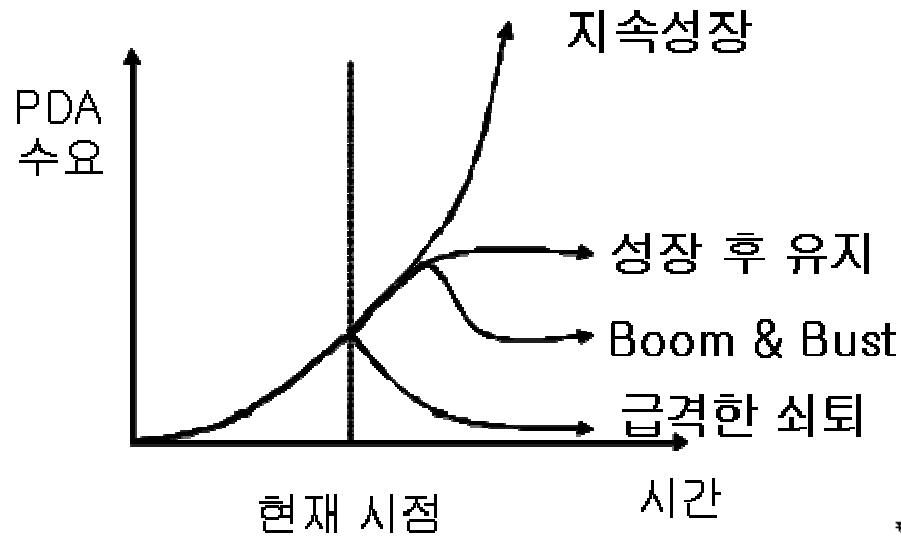




1.

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: PDA



(2003)

2:

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가



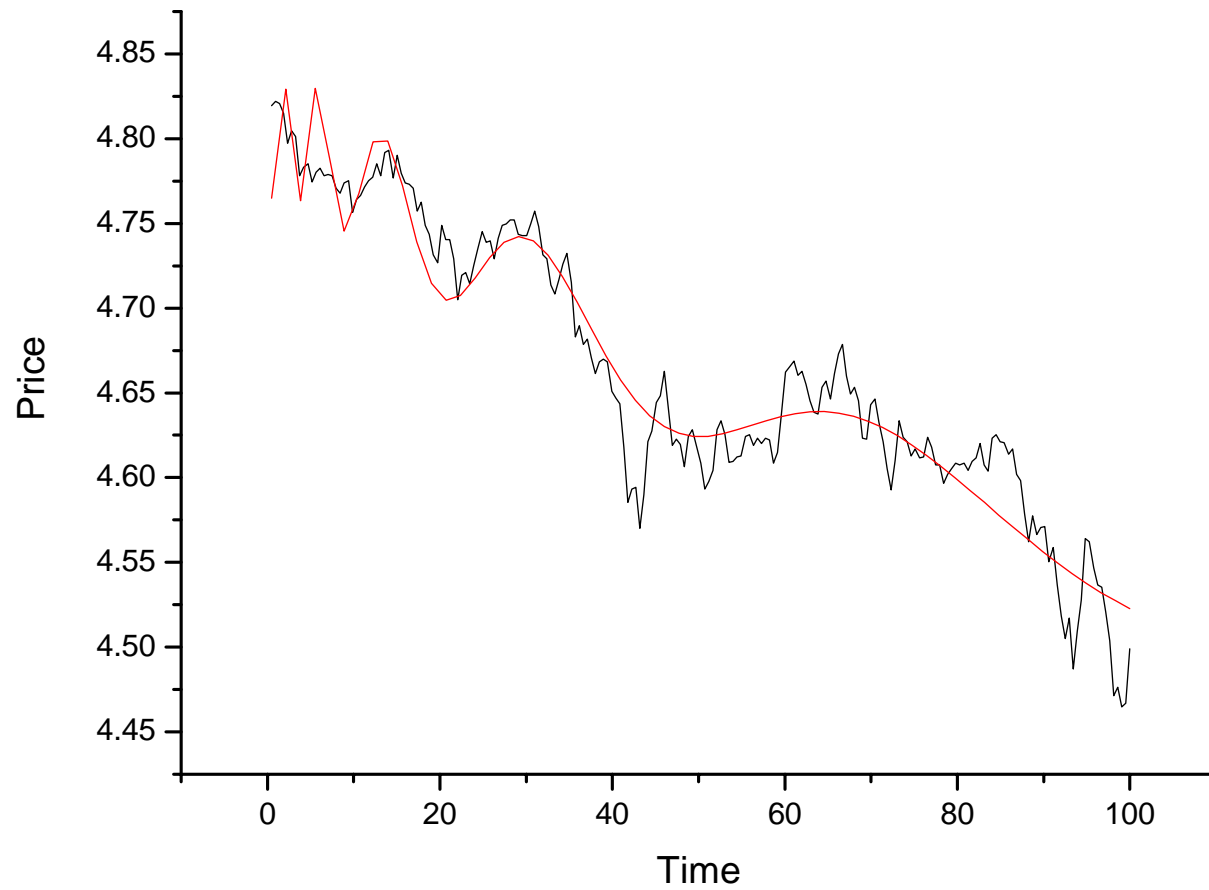
가

가?

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가



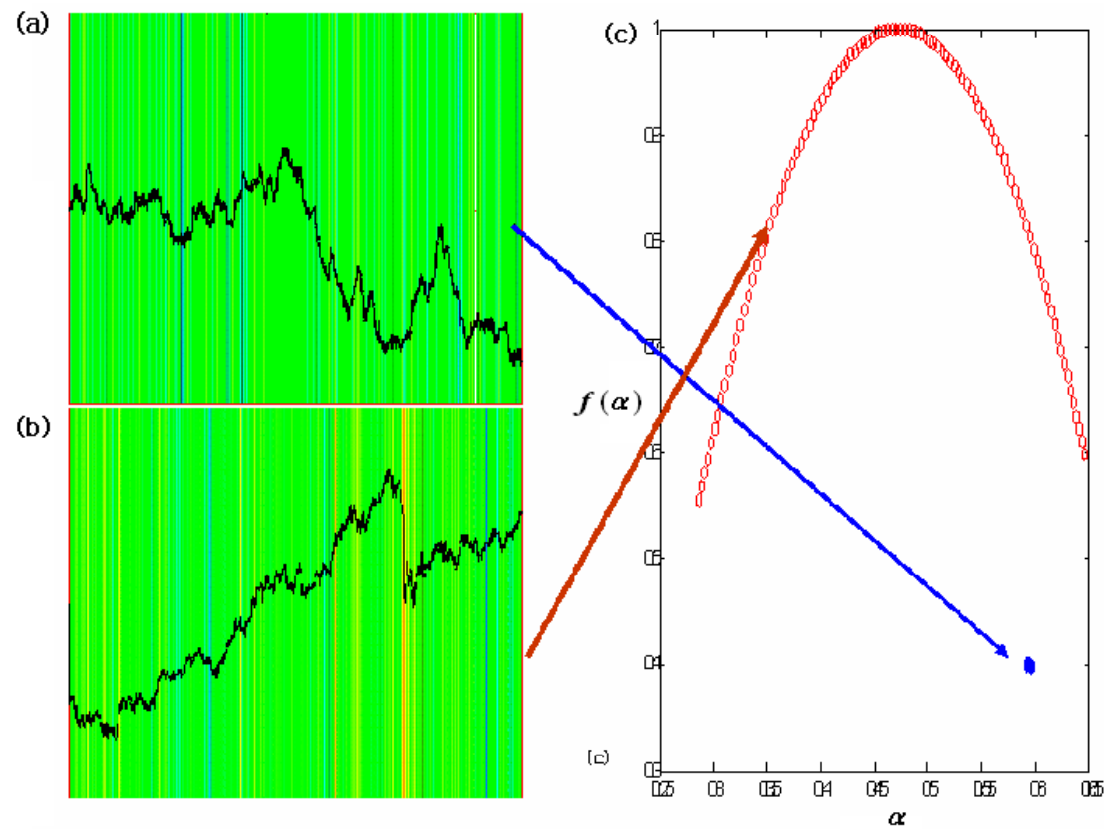
(2004)

70

: FBM

□ (a) $\alpha = 0.6$ 가 FBM(fractional Brownian motion)

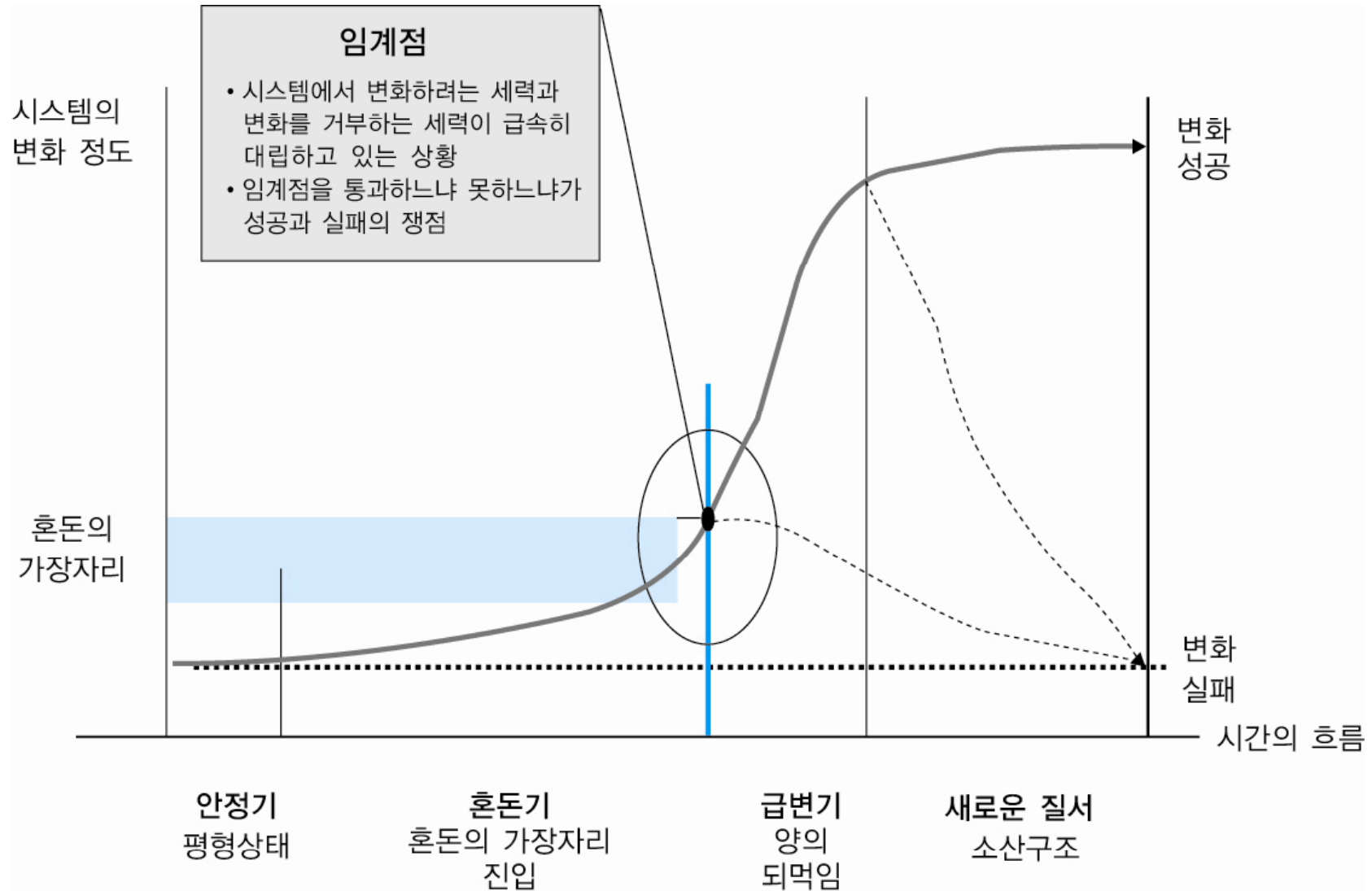
□ (b) S&P 500 가



1:

가 가?







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■

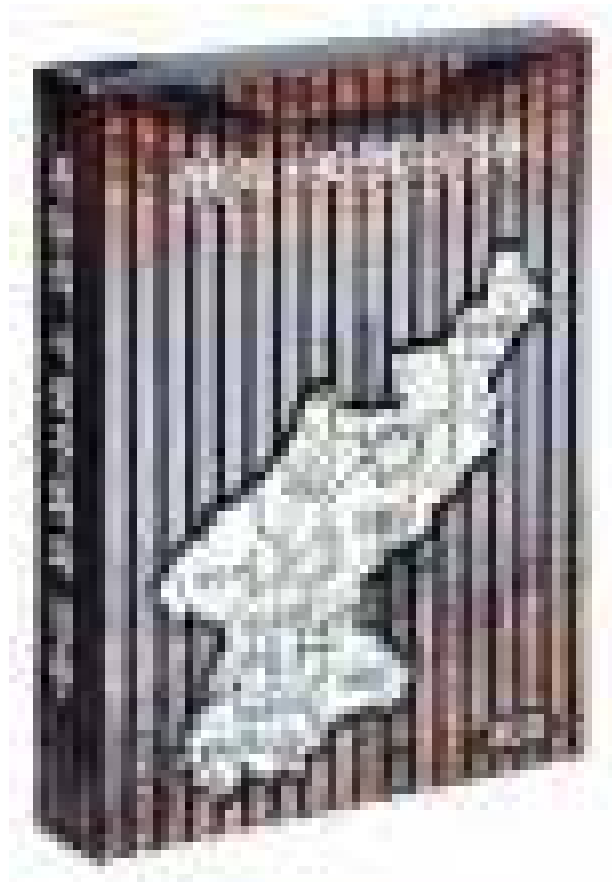


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2:

가 가?



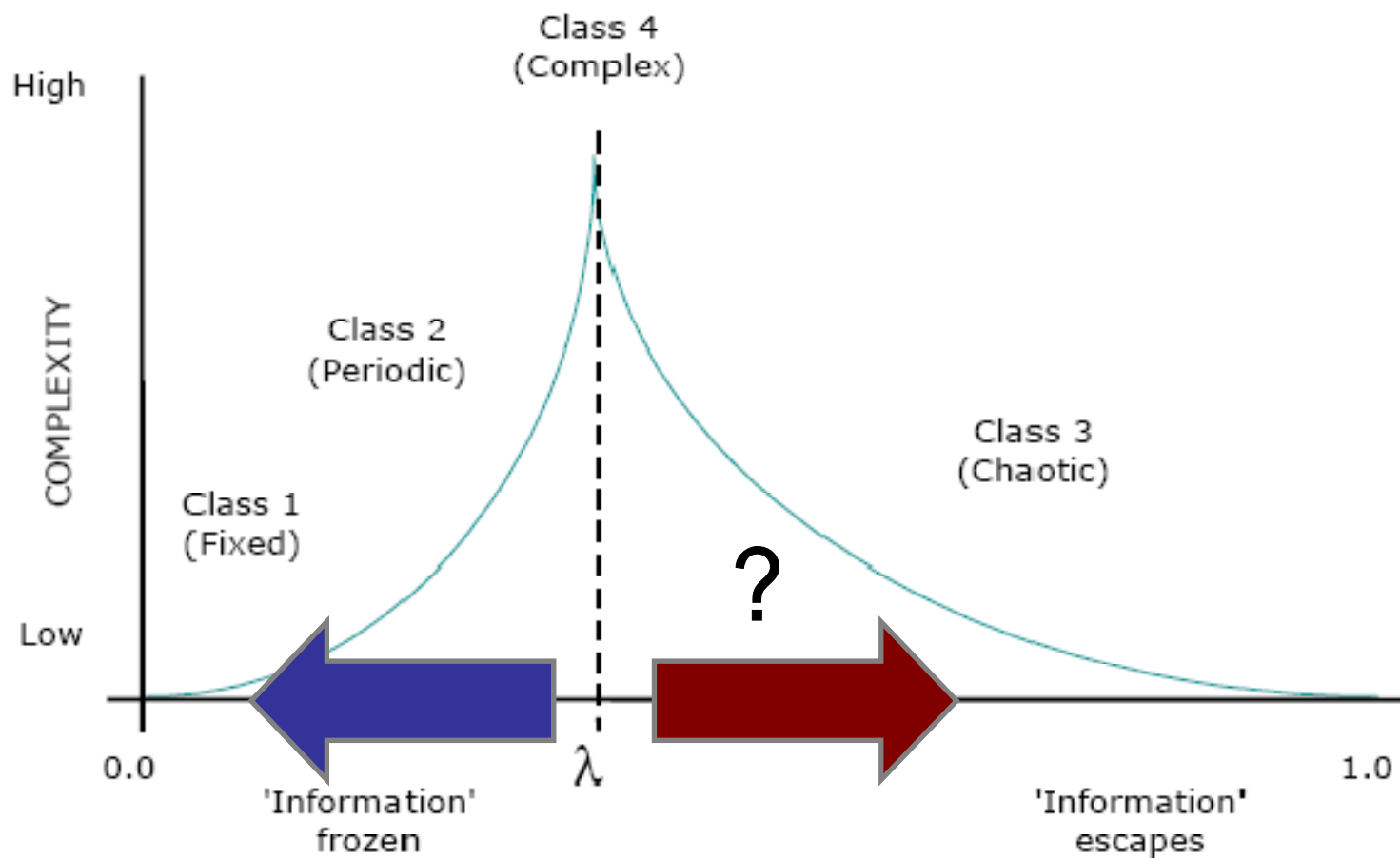


Figure 3 - Langton's Lambda Parameter

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2003



2003 8 13

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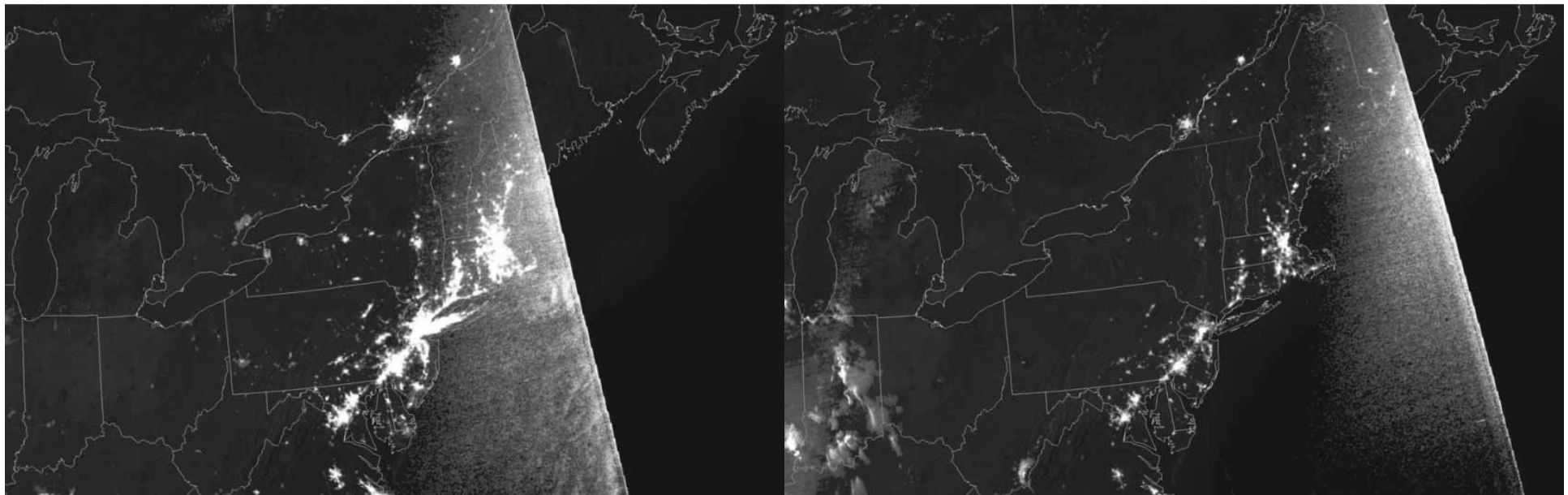
14



5,000

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60



3:

가 가 가?



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❑ Human Mobility

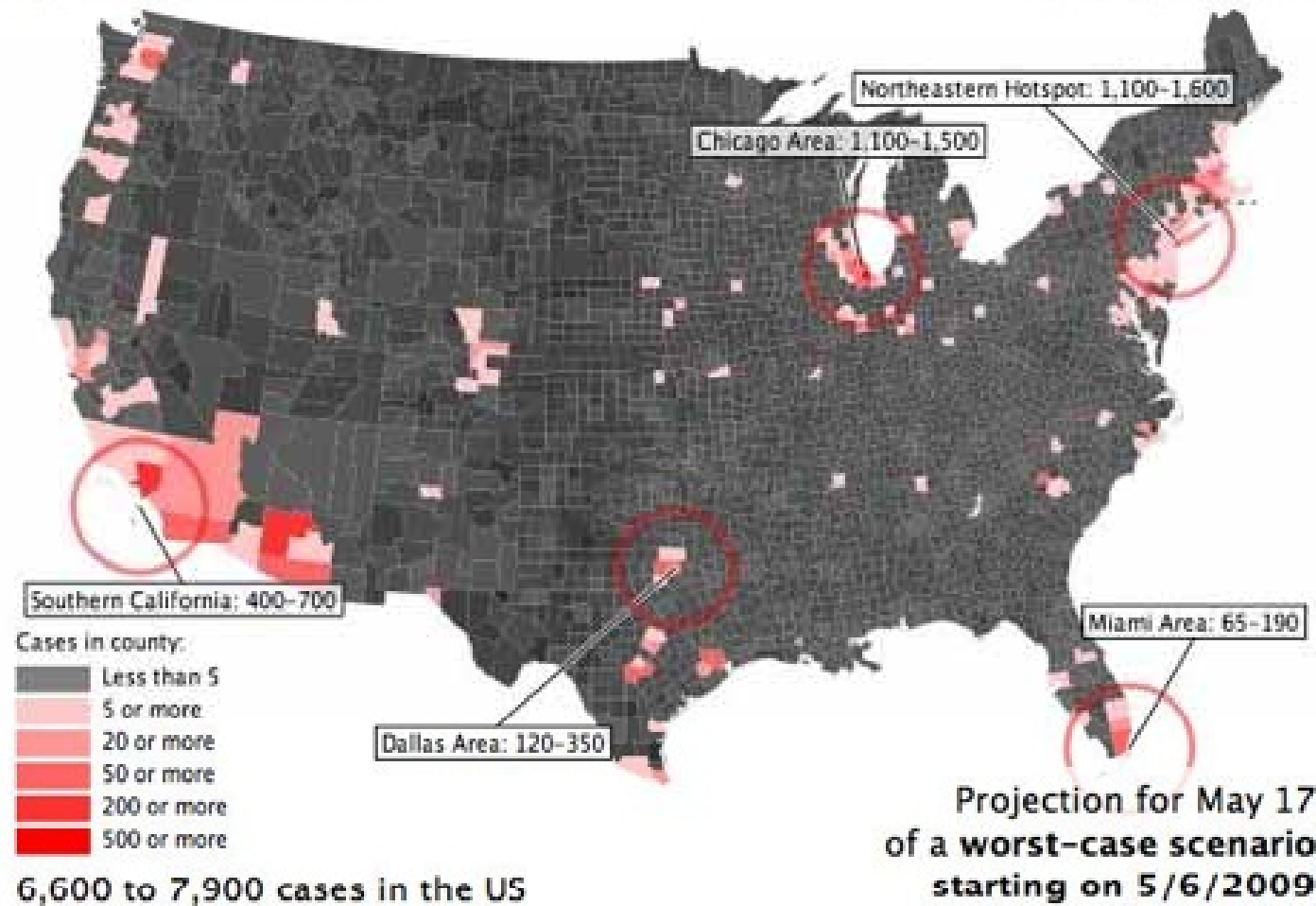
- Where is George?



Projection for May 17

Ranges are 90% confidence intervals

After 11.0 days from 5/6/2009



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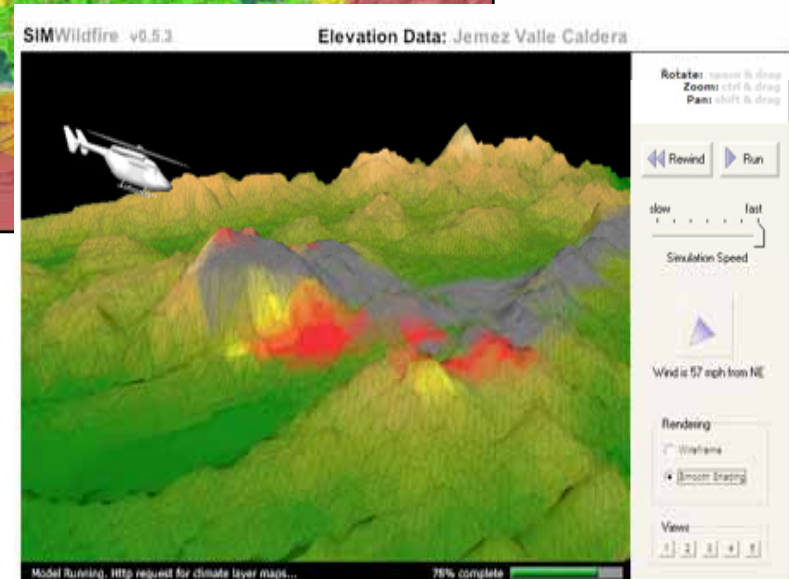
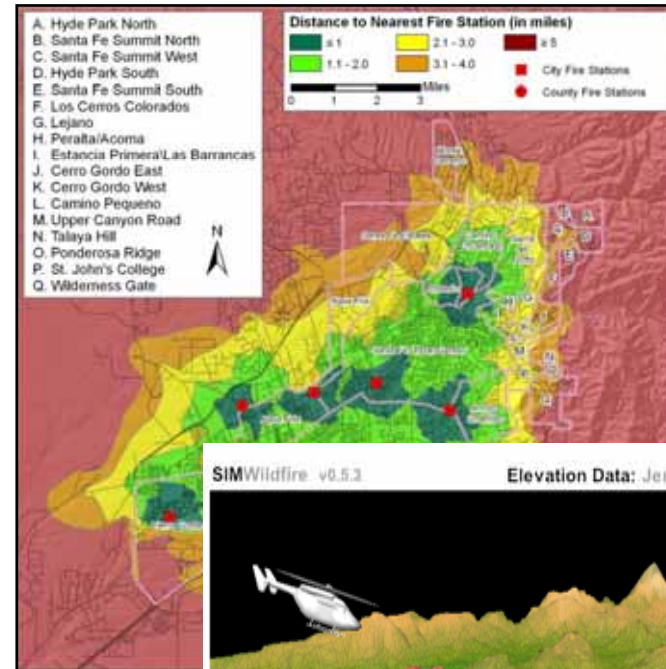
•

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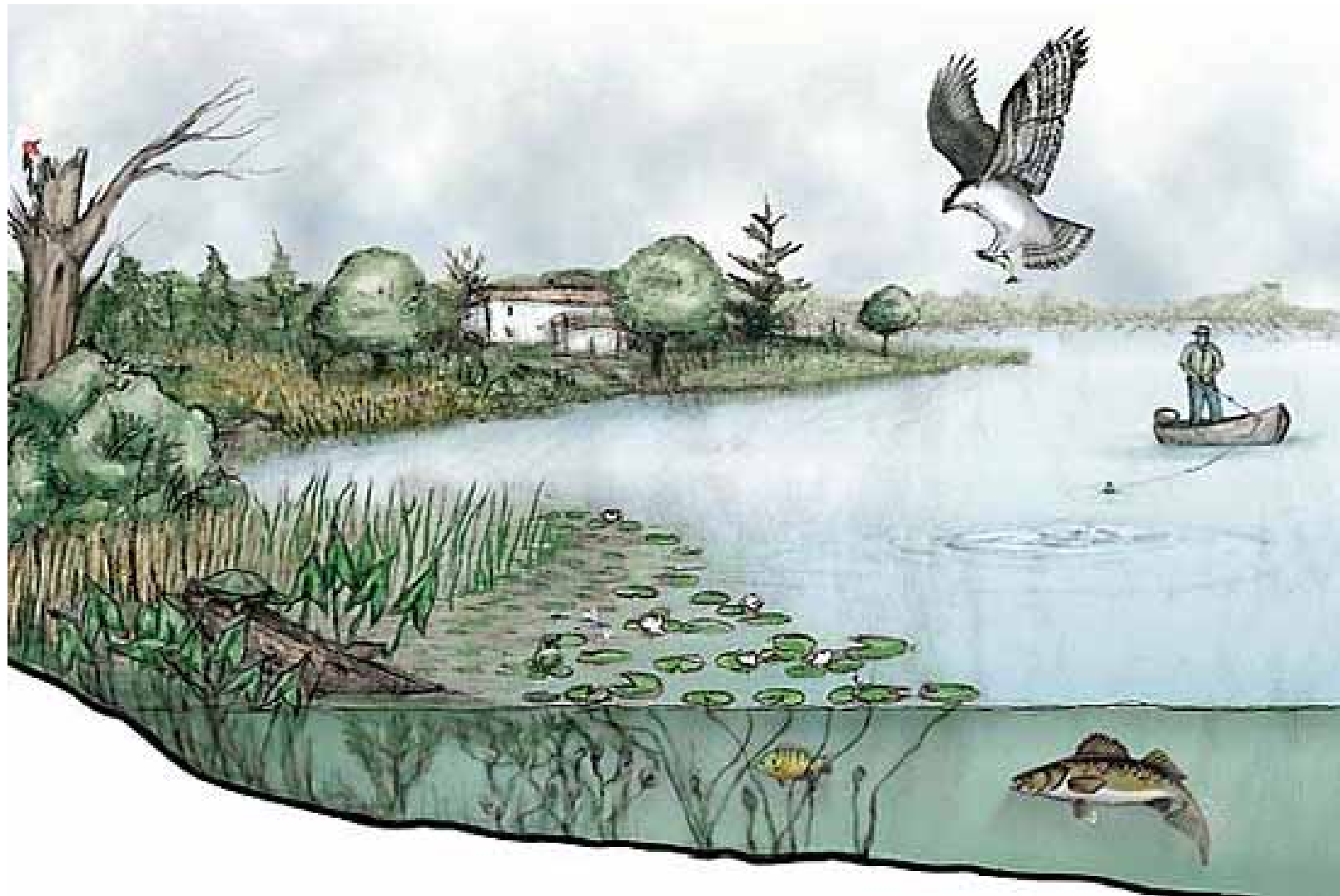


Redfish(2003)

2:

가?





⋮

가	
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