
recurrence
analysis
quantification
dynamics
nonlinear
plot
plots
time-series
chaos
chaotic
complexity
entropy
detection
complex
using
data
human
synchronization
heart
systems
signal
signals
variability
rate
networks
structure
activity
based
theory
protein
pressure
cardiovascular
postural
flow
patterns
methods
conference
proceedings
control
system
network
fractal
noise
phase
space
test
determinism
dynamical
time
magnetic
application
classification
correlation
transition
reconstruction
fluctuations
recurrences
coupling
prediction
nonlinearity
detecting
surface
identification

Potsdam Institute for Climate Impact Research

Norbert Marwan, Carl Witt

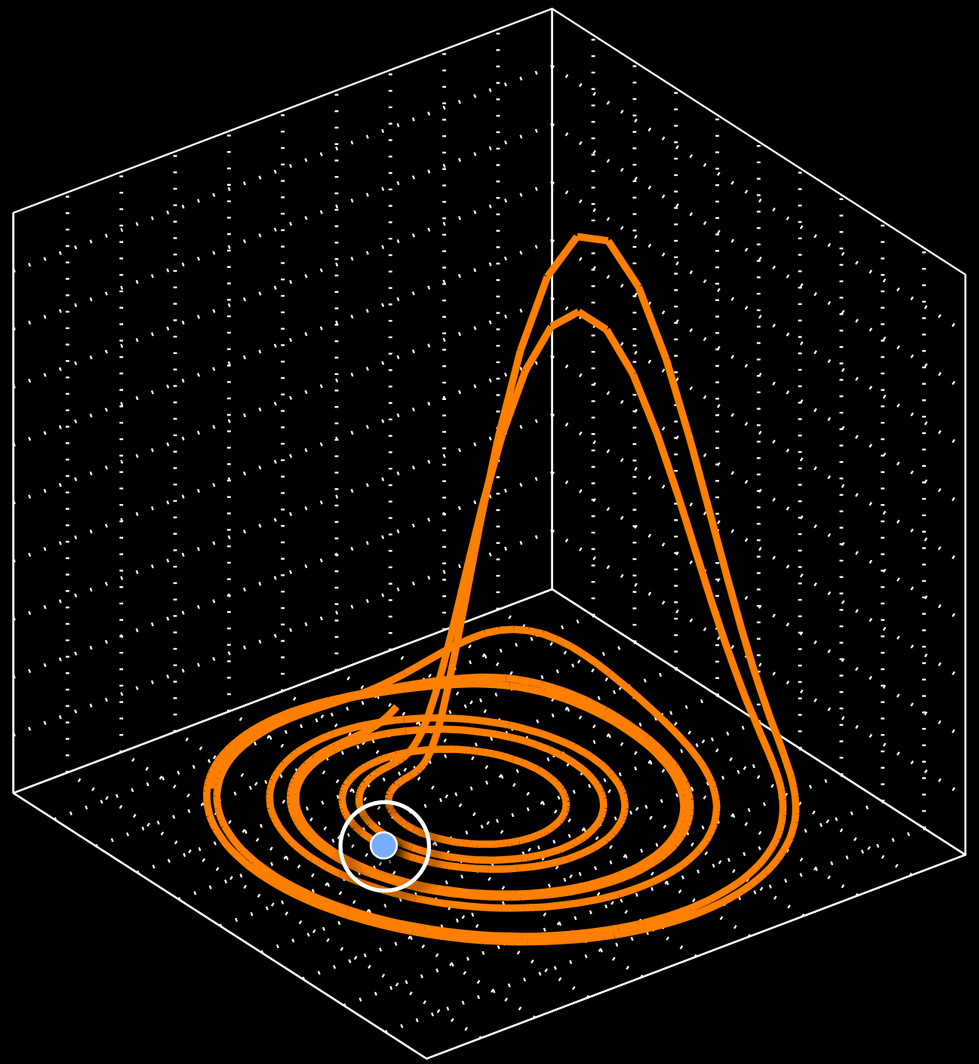
How Do You See Recurrence Plots?

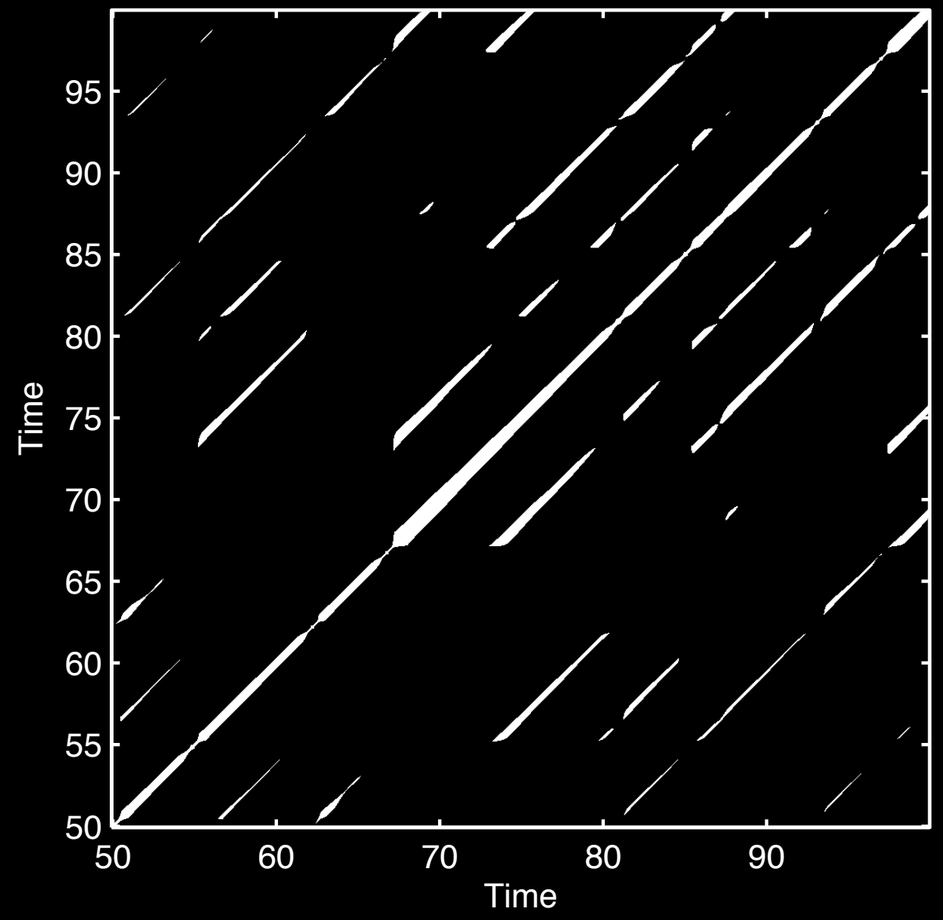
in collaboration with

Leibniz-Gemeinschaft

Humboldt-Universität zu Berlin

Recurrence Plot

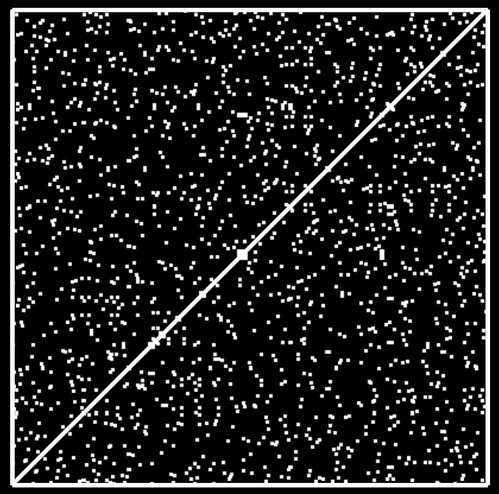


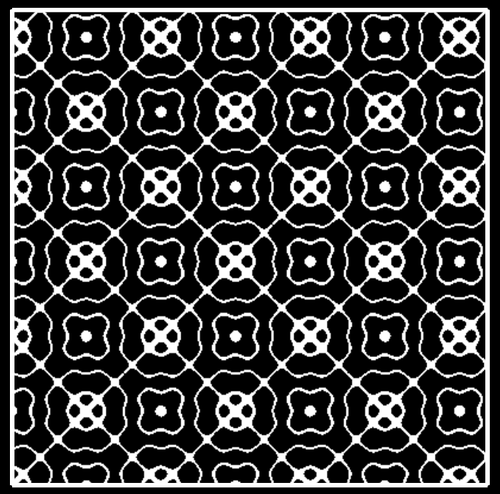


Eckmann et al., EPL, 5, 1987
Marwan et al., Phys. Rep., 438, 2007

Recurrence Plot Typology

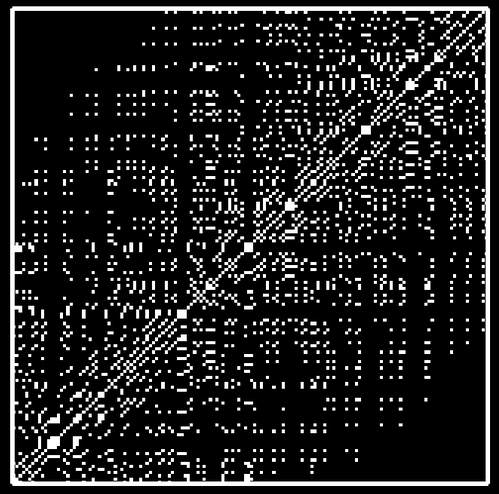
homogeneous

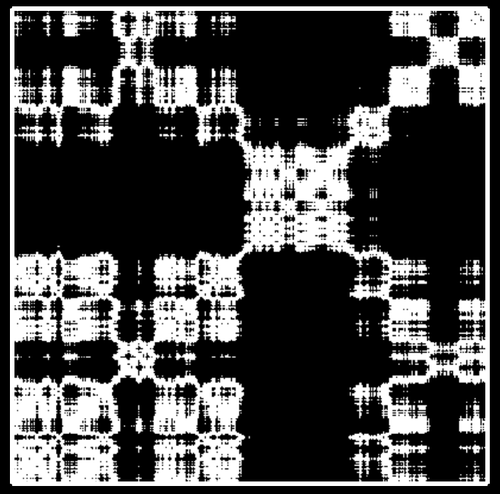




periodic

drifty





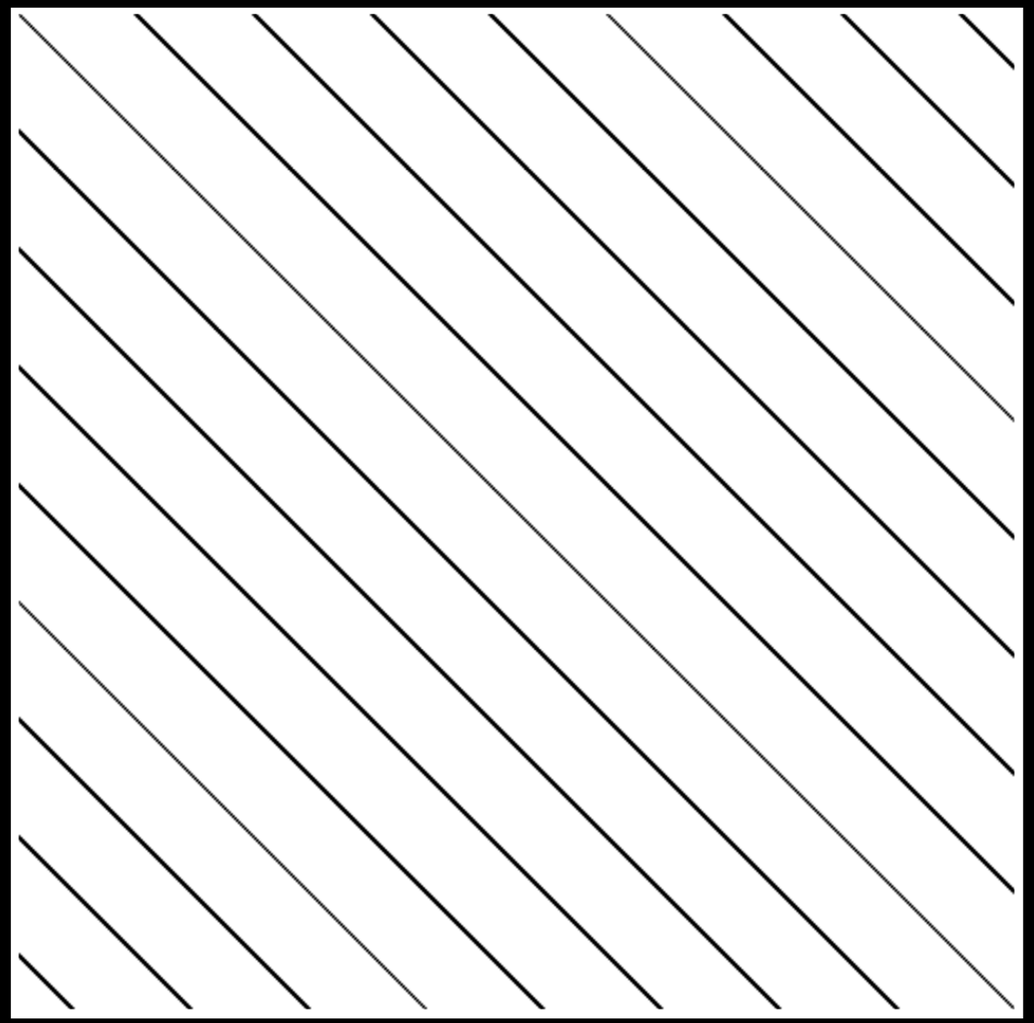
disrupted

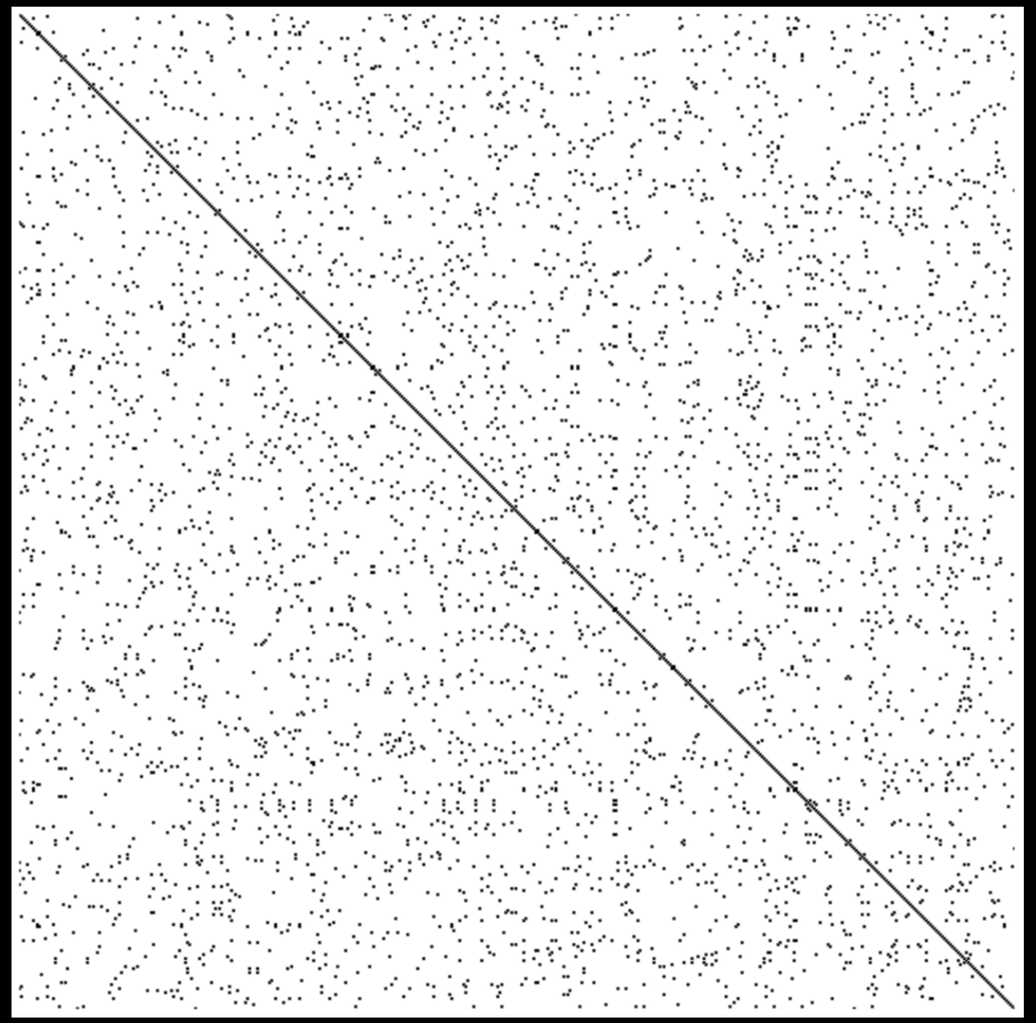
How Will You Perceive Different Recurrence Plots?

Your Task: Evaluate Differences

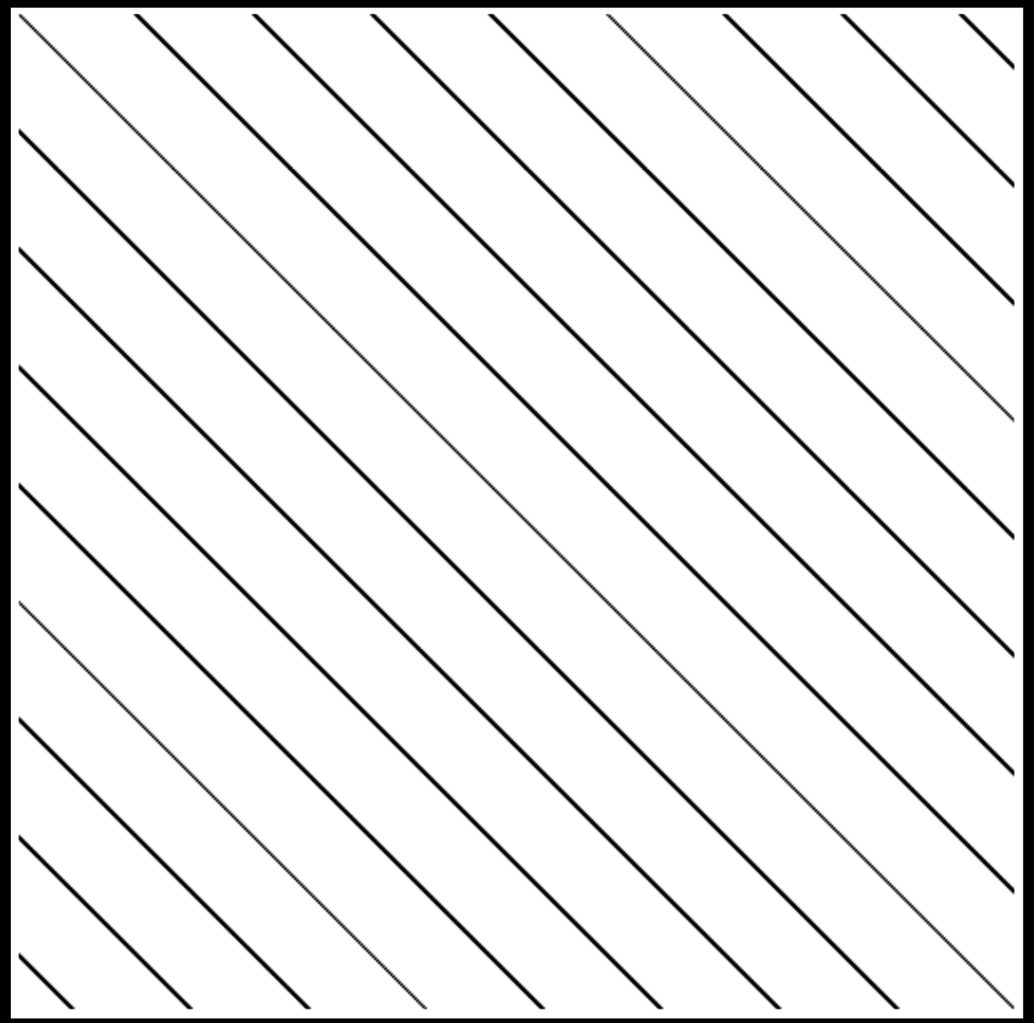
☒ very similar ☒ a bit similar ☒ quite different

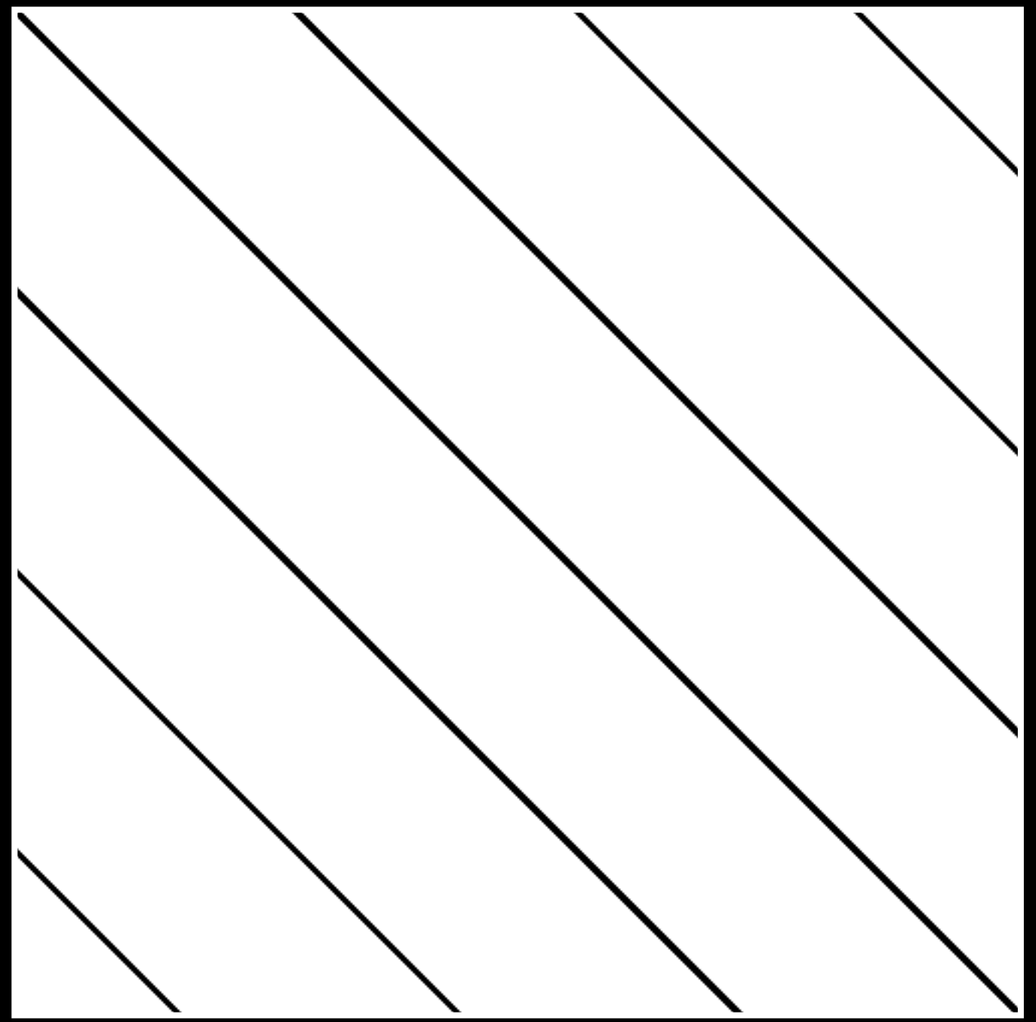
Example 23



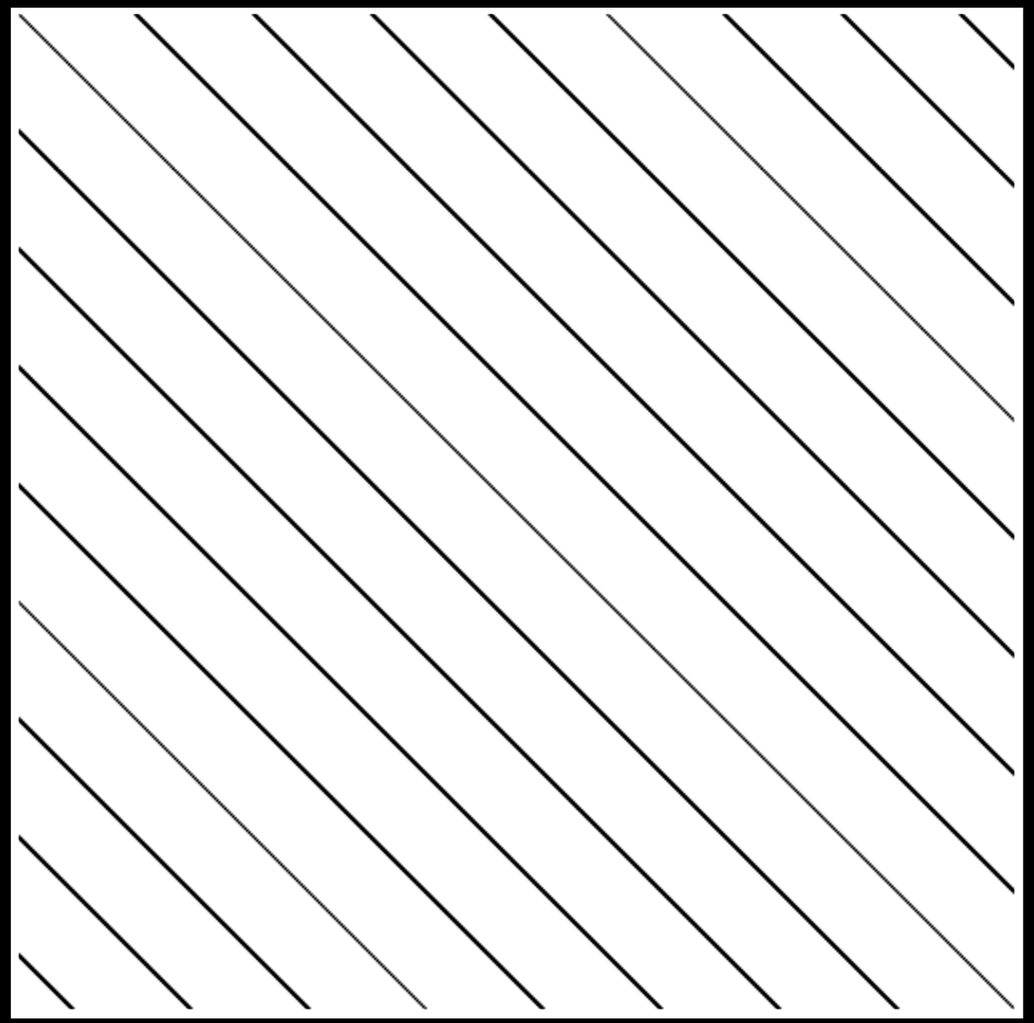


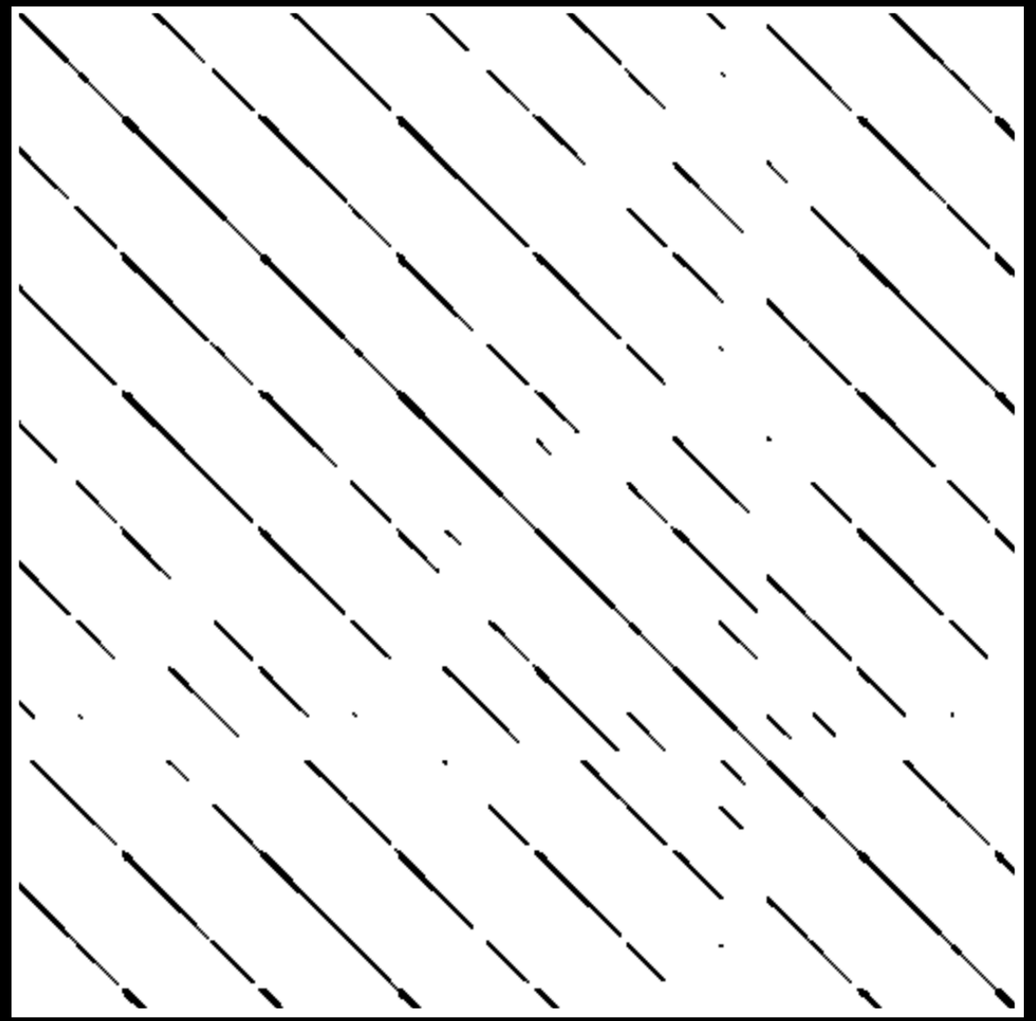
Example 34



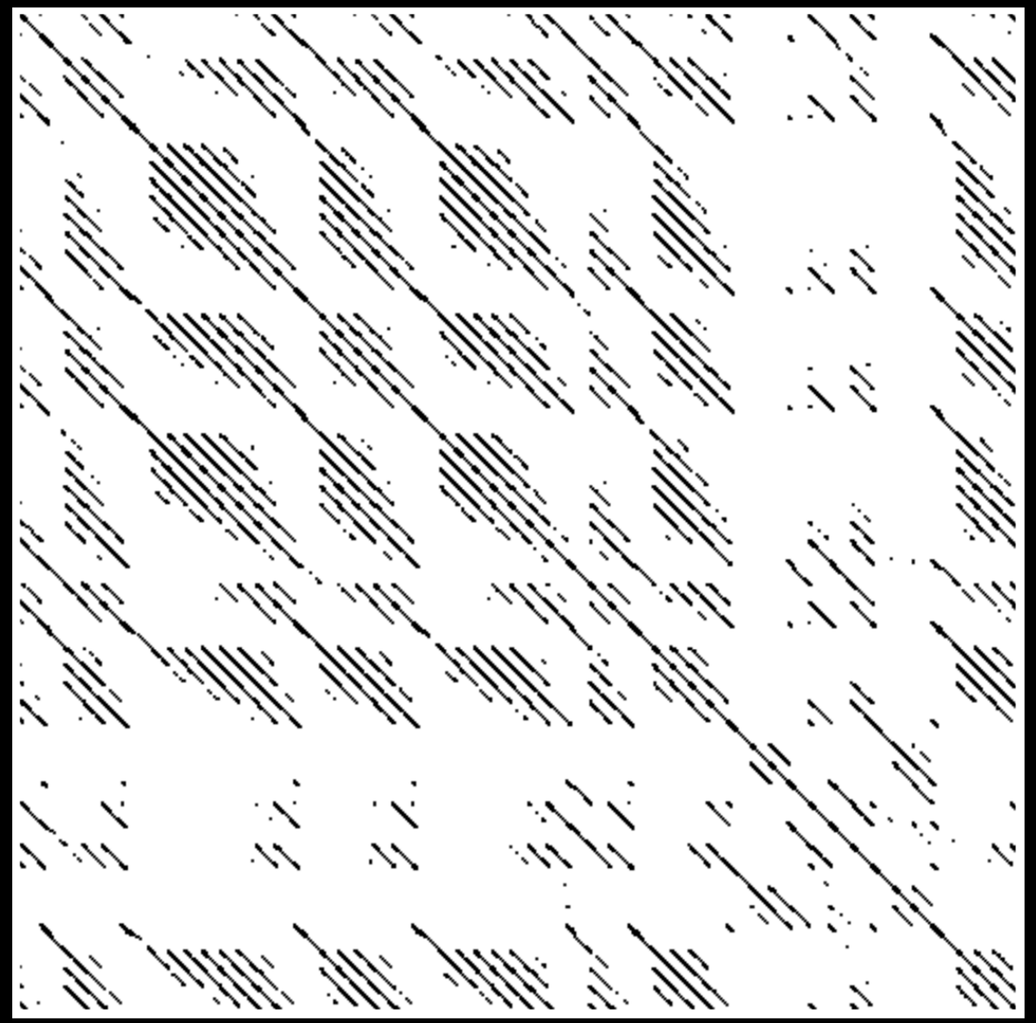


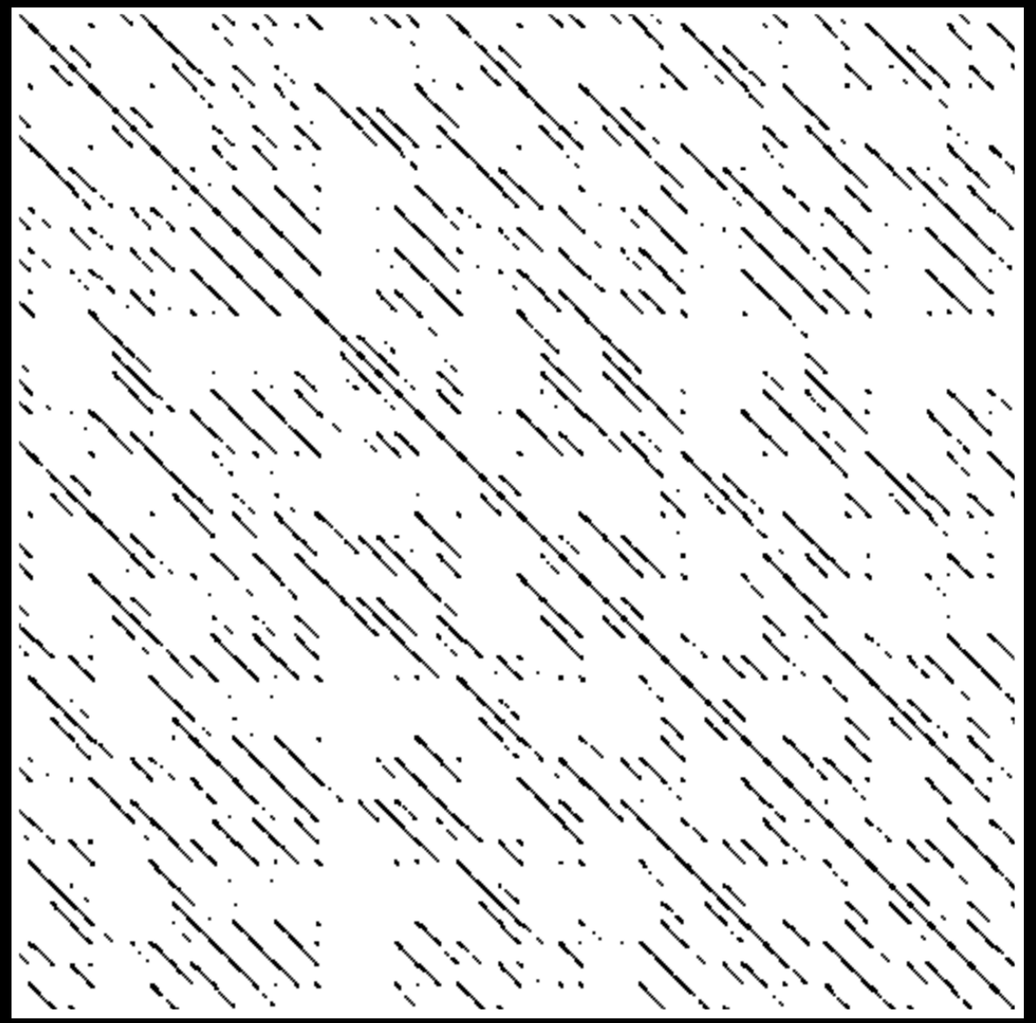
Example 39





Example 31

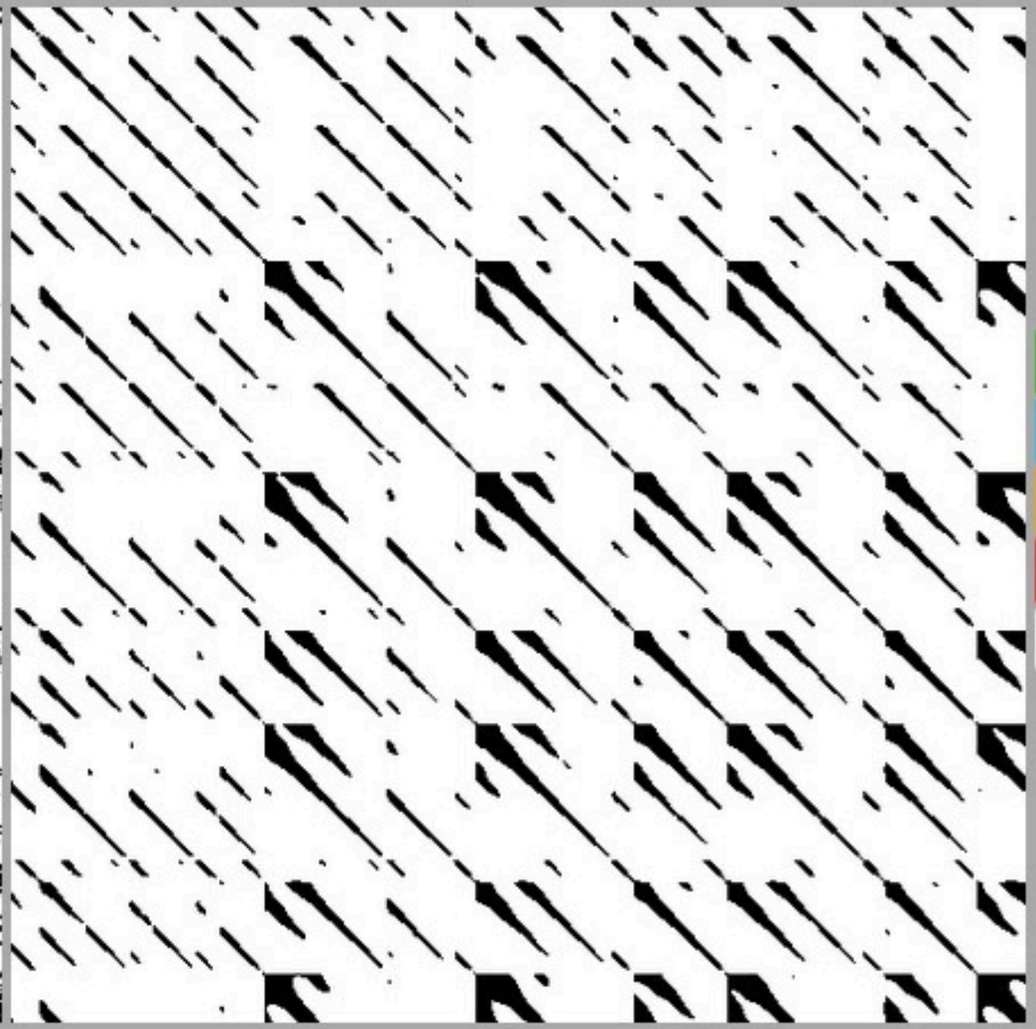




www.recurrence-plot.tk/assess-similarity/assess-similarity.php?participant_expe 90% Suchen

Recurrence Plot Similarity Assessment

Dataset ID: 1503256252



Pair 1 / 45

Similarity

90%

70%

50%

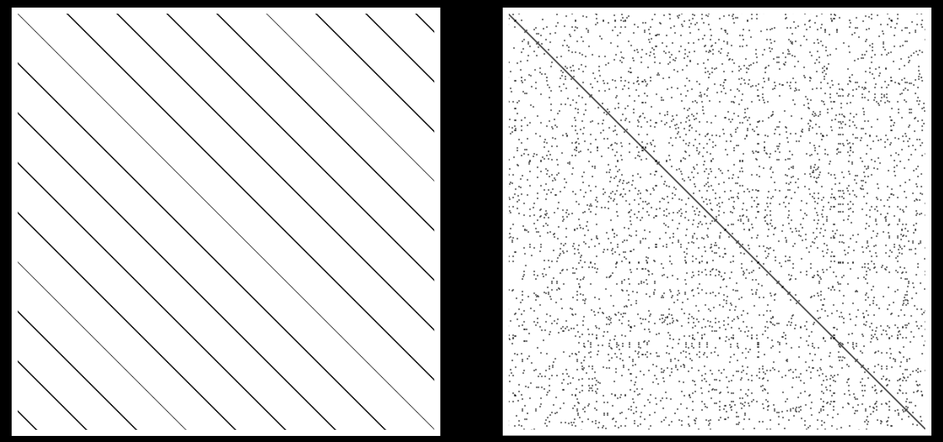
20%

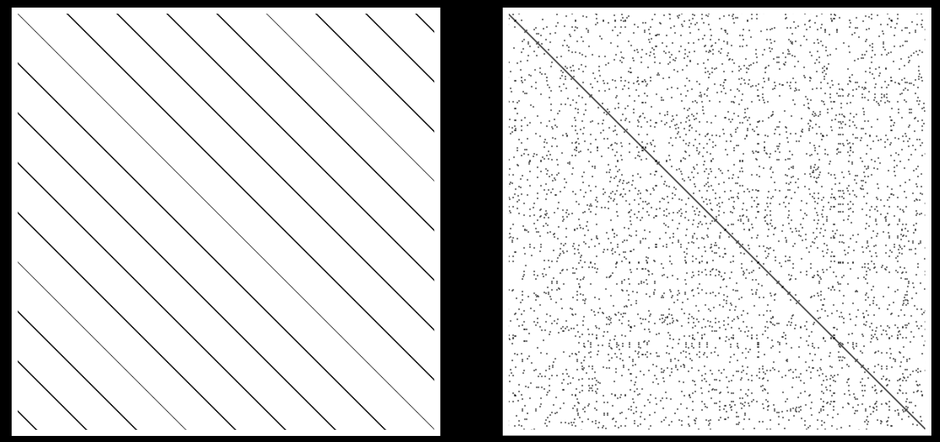
0%

0

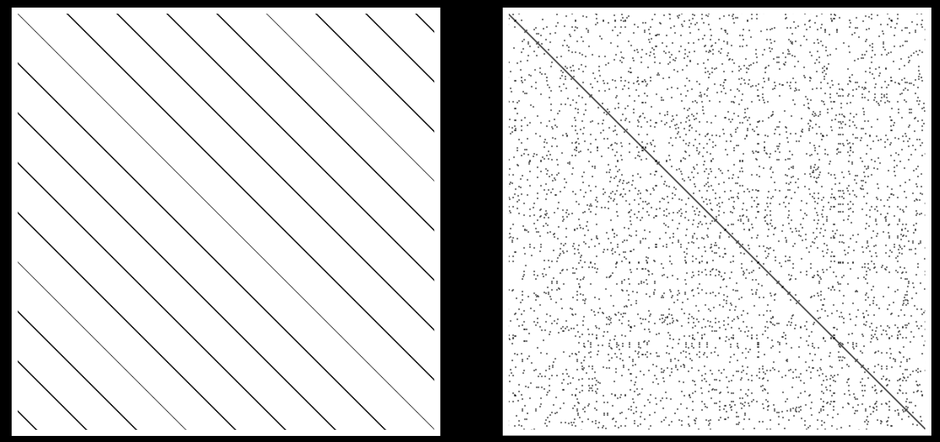
Next

	easy	not easy
different		
equal		

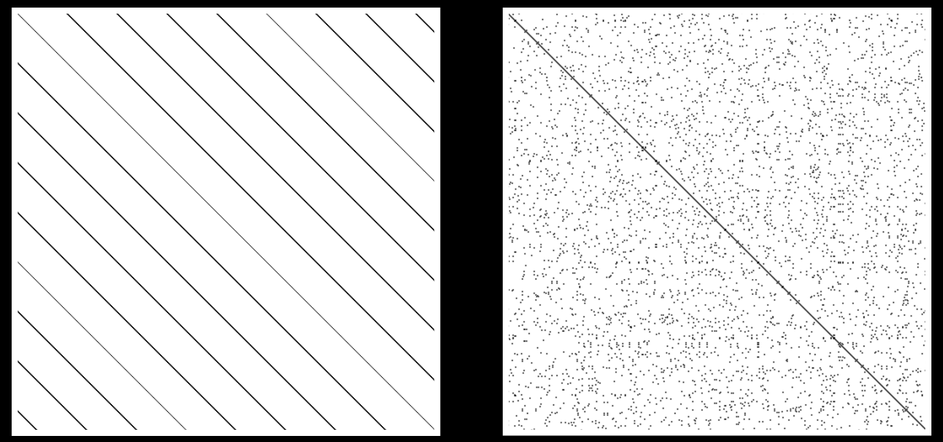
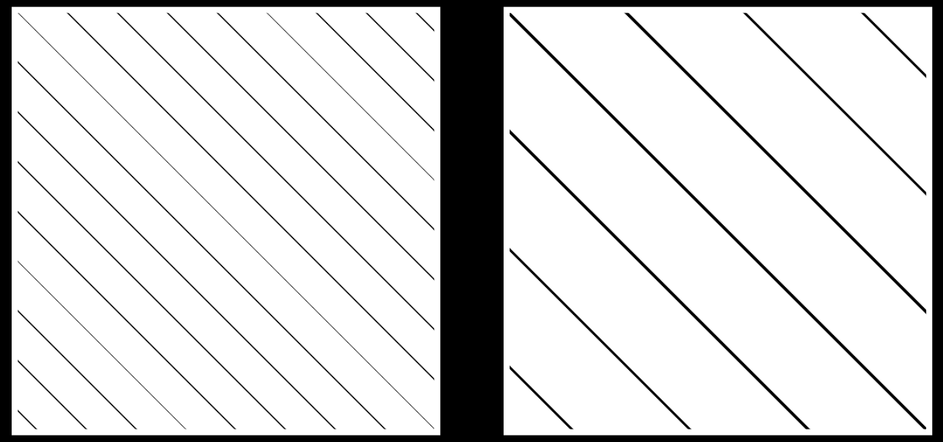
	easy	not easy
different	 Ex. 23	
equal		

	easy	not easy
different	 Ex. 23	
equal		

- continuous lines vs. single dots
- avg. sim: 6% (max 70%, min 0%)

	easy	not easy
different	sine vs. noise  Ex. 23	
equal		

- continuous lines vs. single dots
- avg. sim: 6% (max 70%, min 0%)

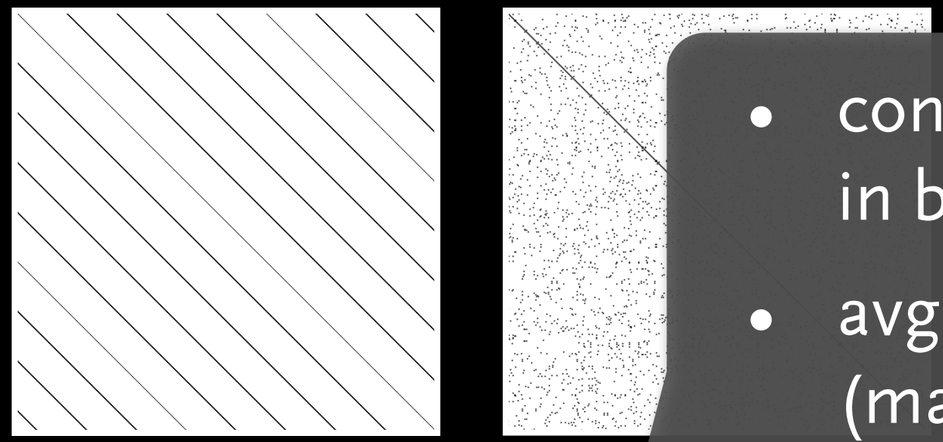
	easy	not easy
different	sine vs. noise  Ex. 23	
equal	 Ex. 34	

easy

not easy

different

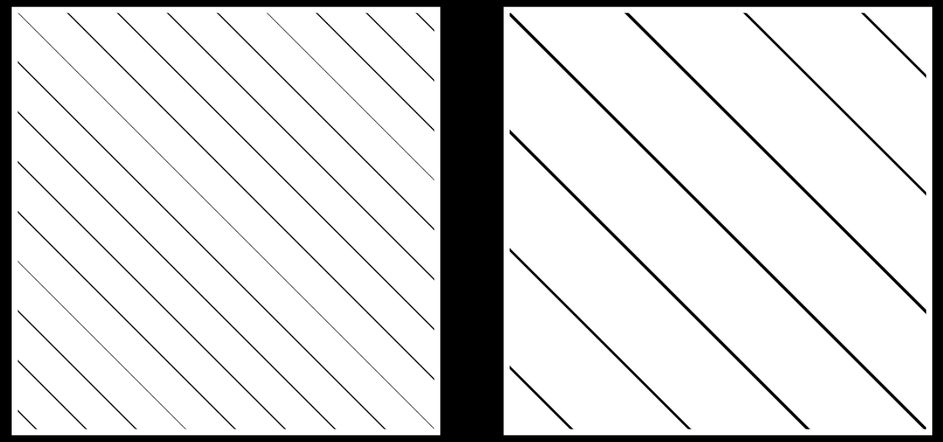
sine vs. noise



Ex. 23

- continuous & periodic lines in both systems
- avg. sim: 72%
  (max 100%, min 0%)

equal



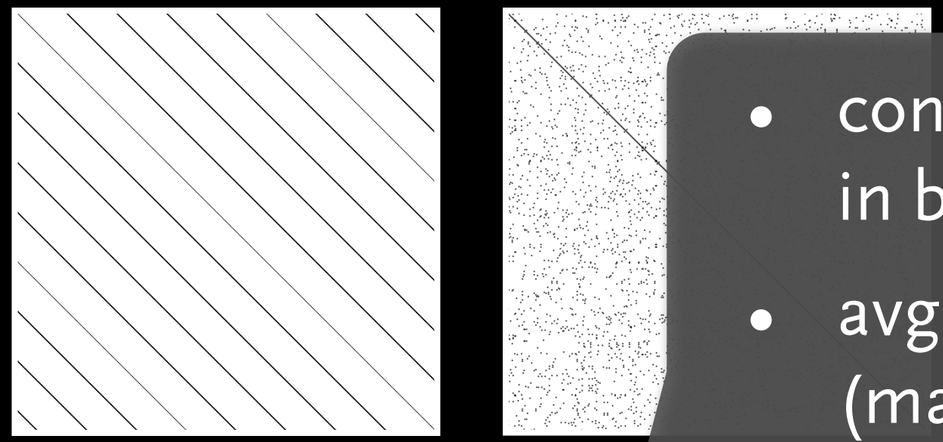
Ex. 34

easy

not easy

different

sine vs. noise

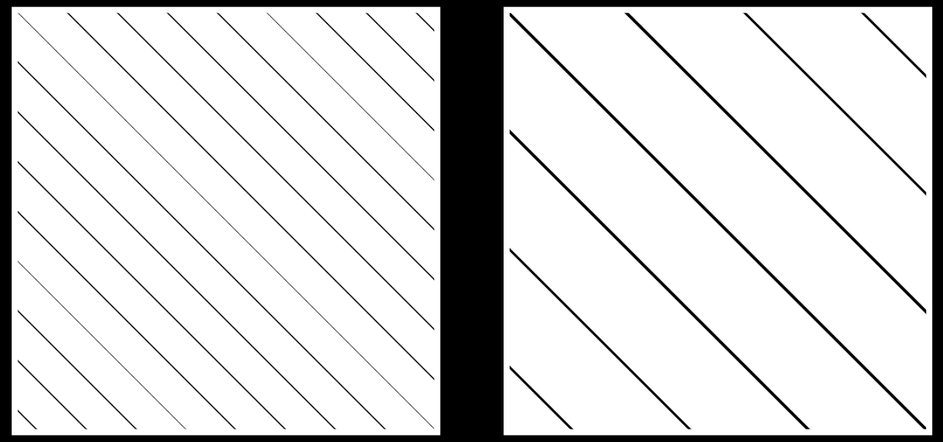


Ex. 23

- continuous & periodic lines in both systems
- avg. sim: 72%
  (max 100%, min 0%)

equal

sine vs. sine



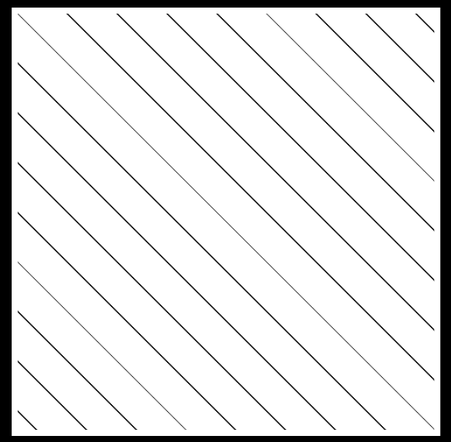
Ex. 34

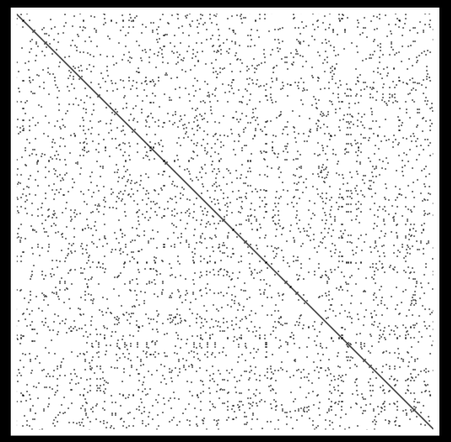
easy

not easy

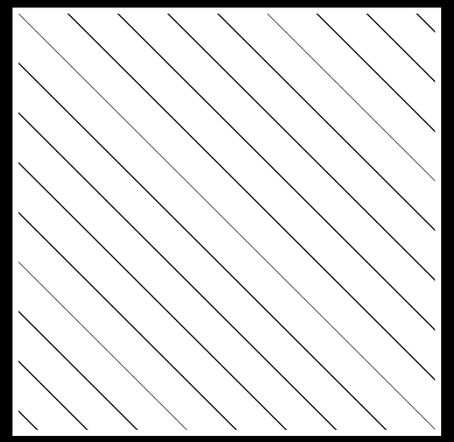
different

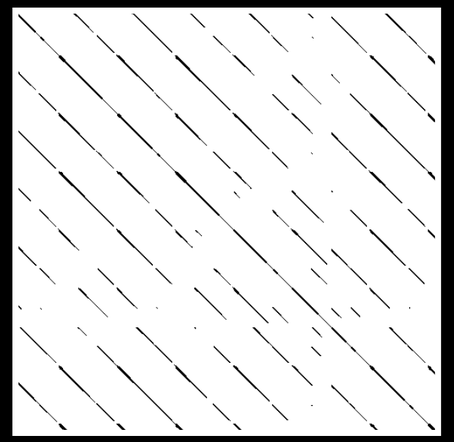
sine vs. noise





Ex. 23

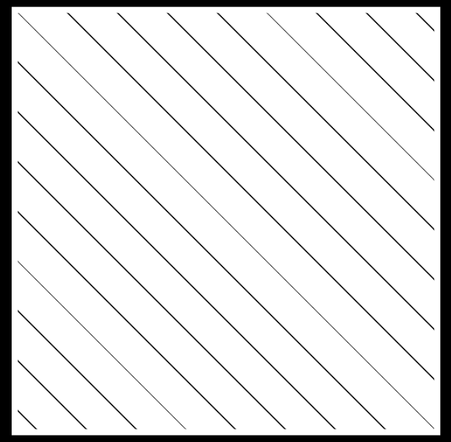


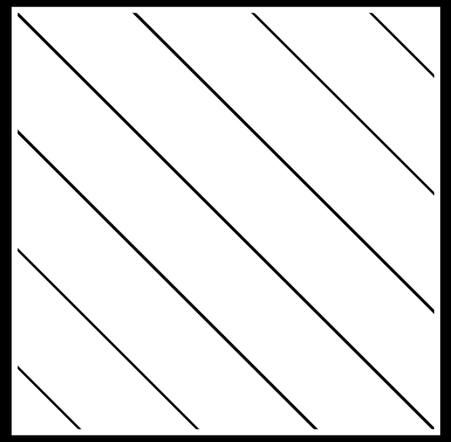


Ex. 39

equal

sine vs. sine





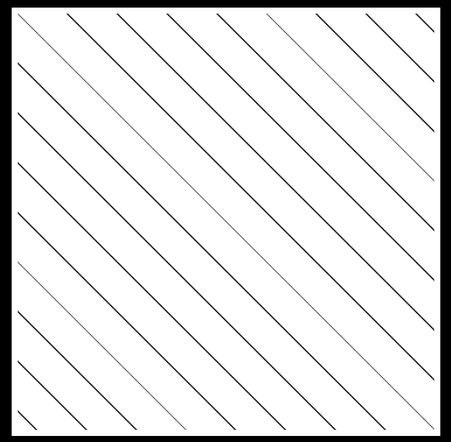
Ex. 34

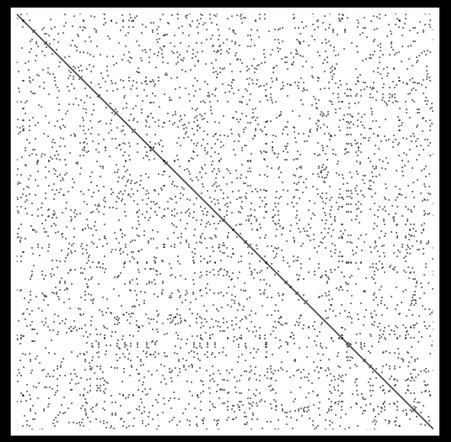
easy

not easy

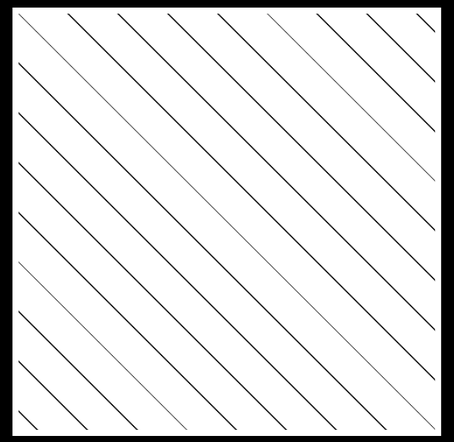
different

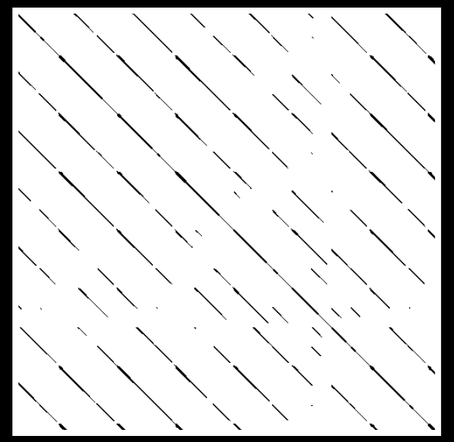
sine vs. noise





Ex. 23

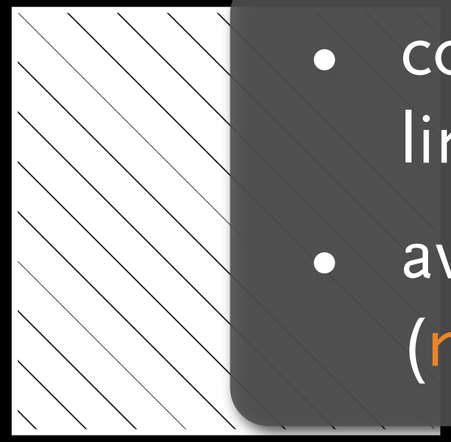


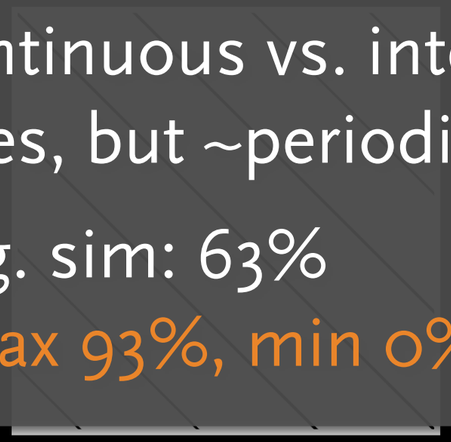


Ex. 39

equal

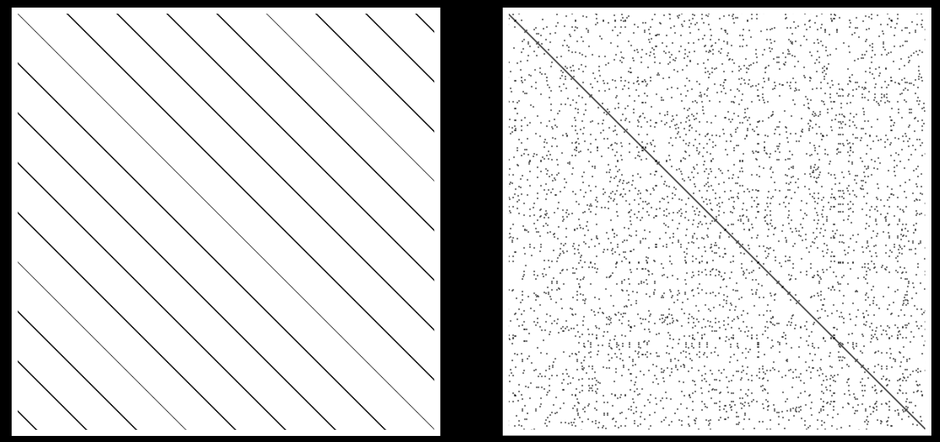
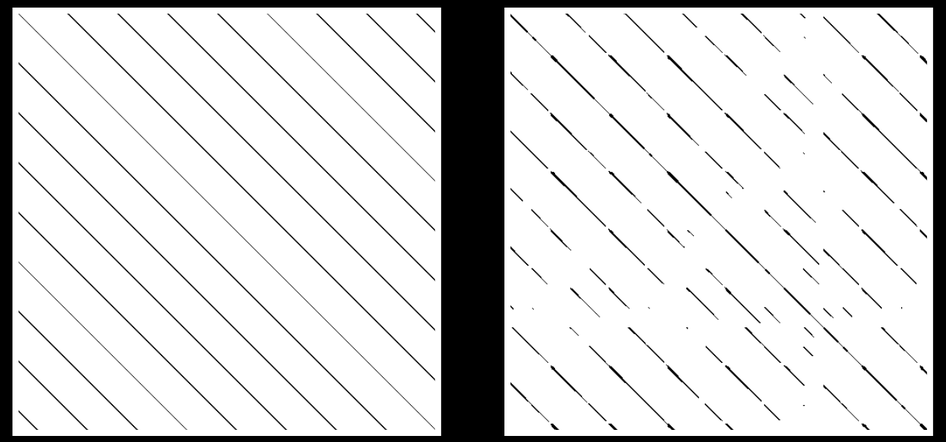
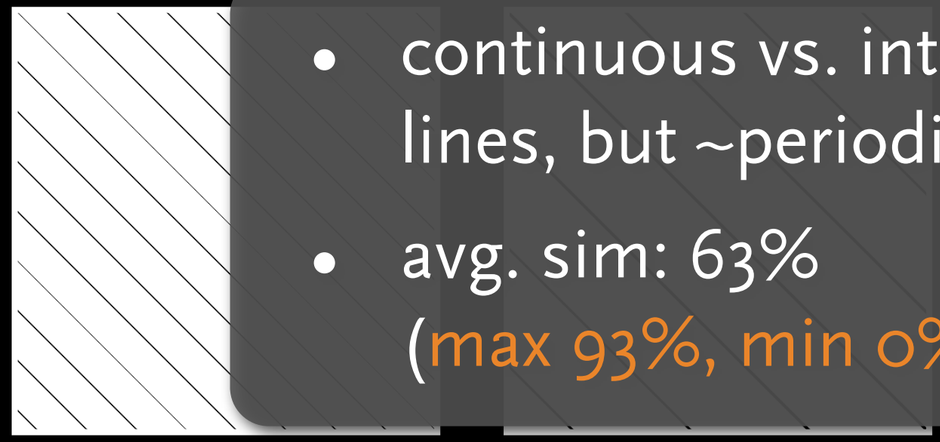
sine vs. sine





Ex. 34

- continuous vs. interrupted lines, but ~periodic
- avg. sim: 63%
  (max 93%, min 0%)

	easy	not easy
different	sine vs. noise  Ex. 23	sine vs. Roessler  Ex. 39
equal	sine vs. sine  Ex. 34	

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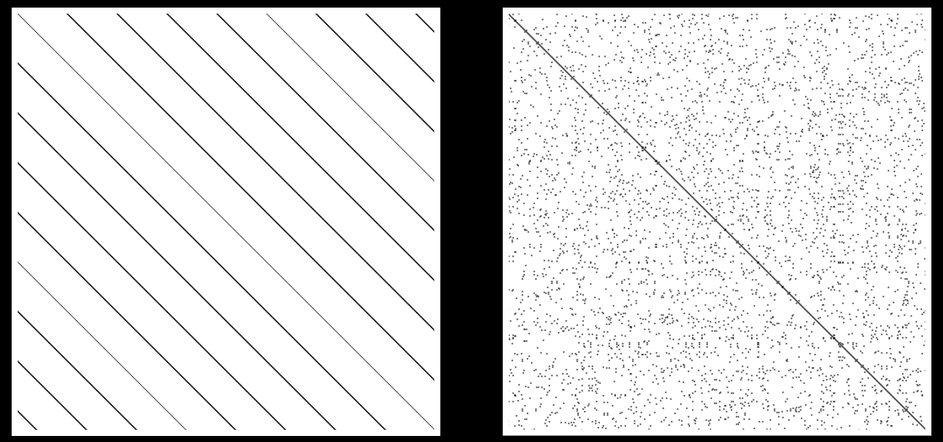
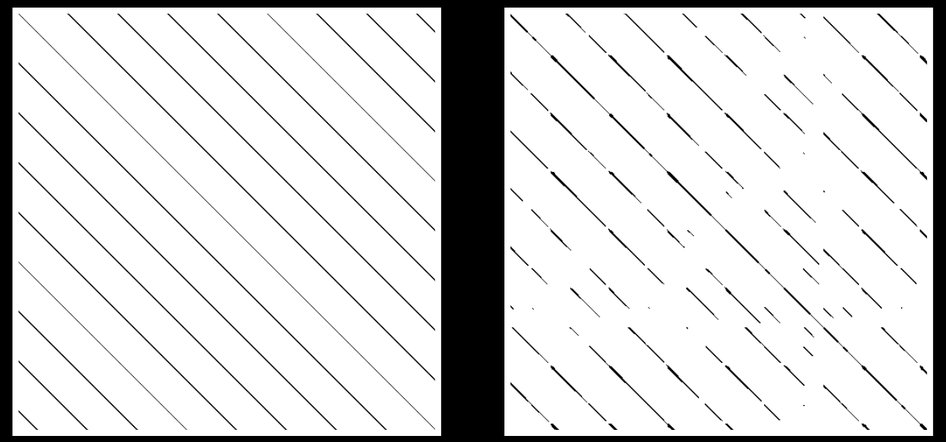
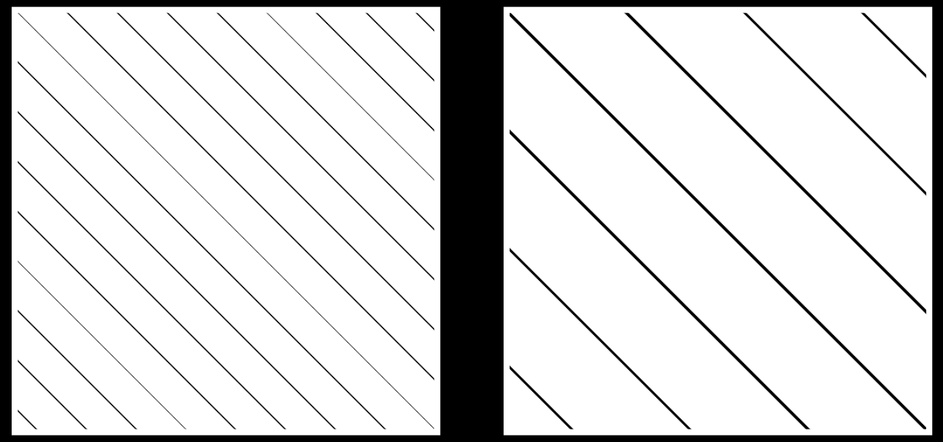
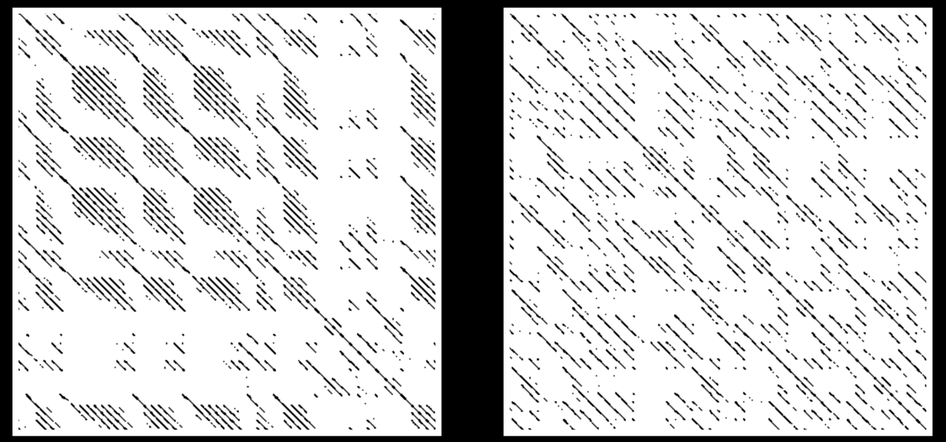
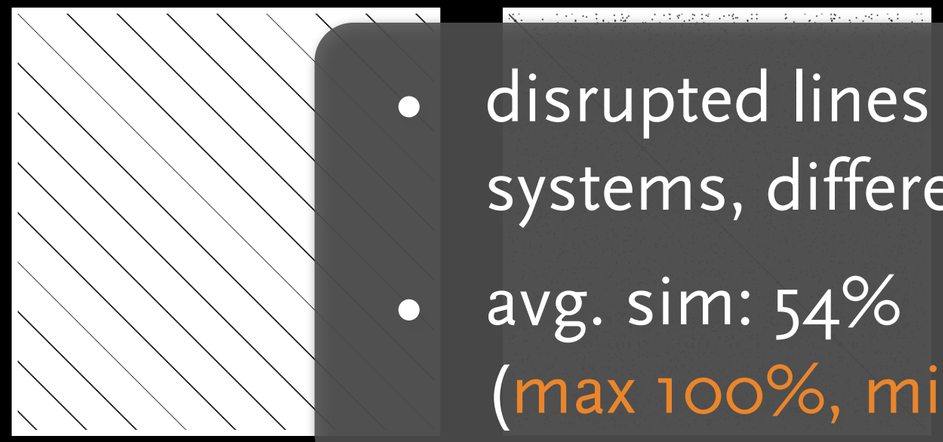
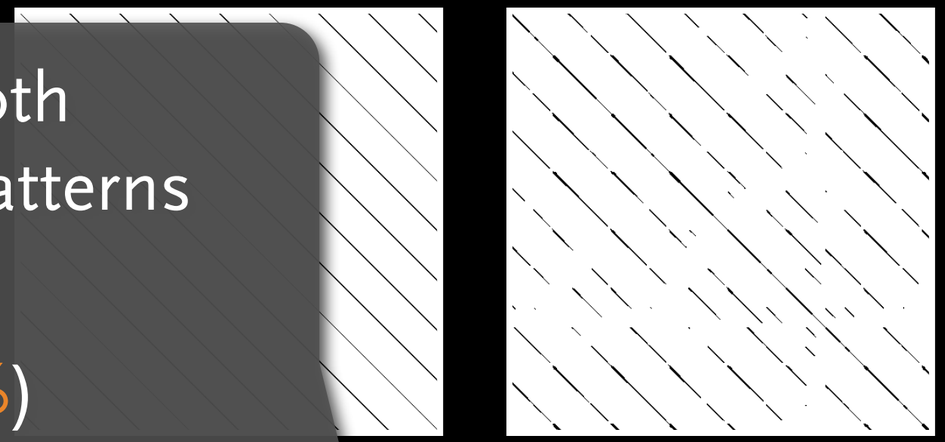
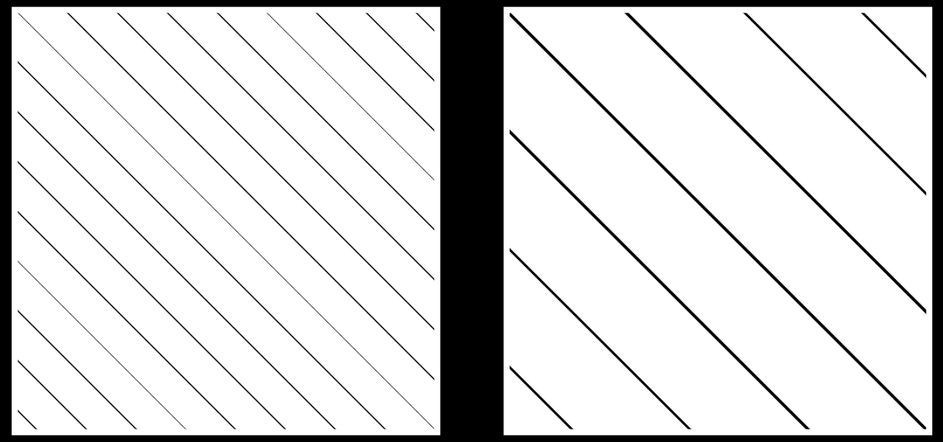
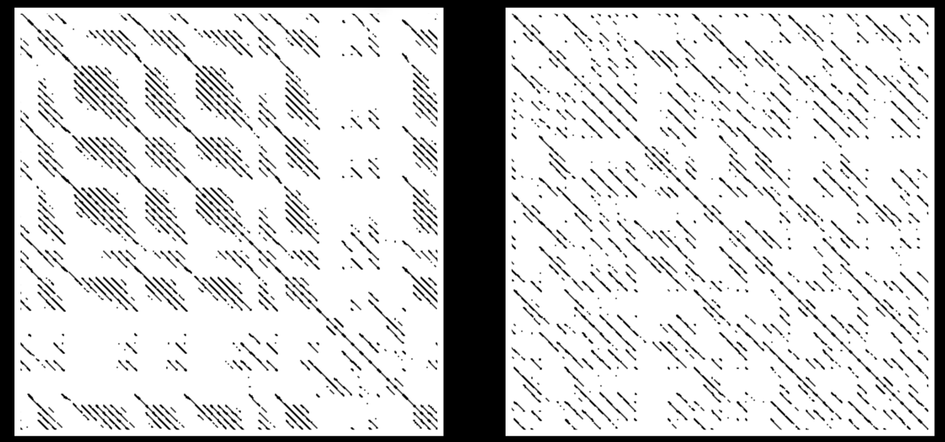
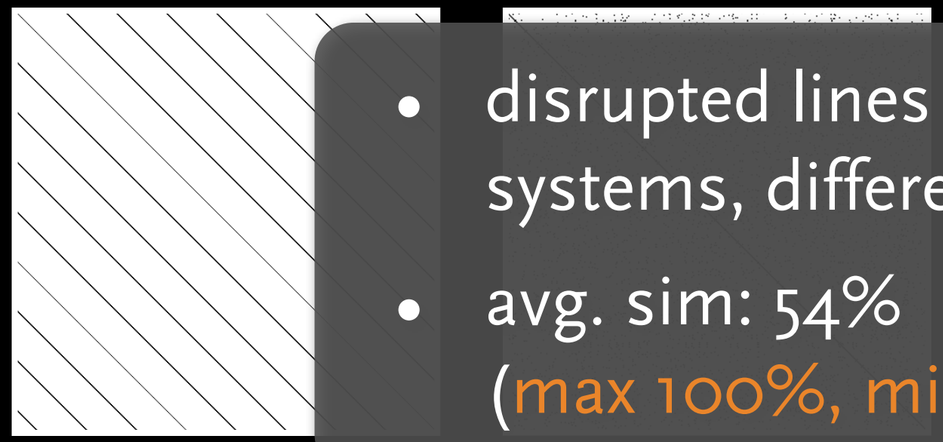
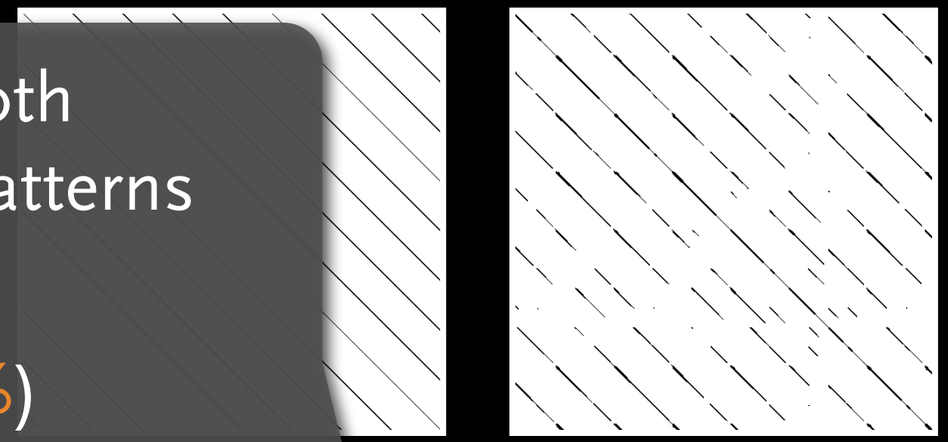
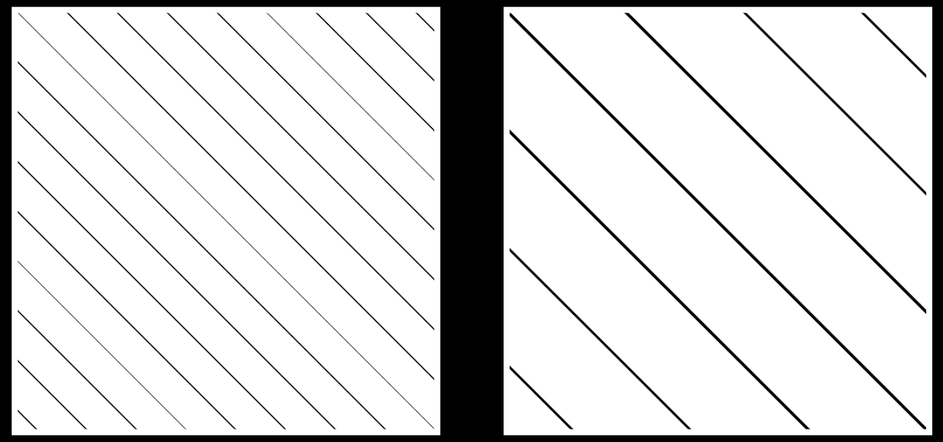
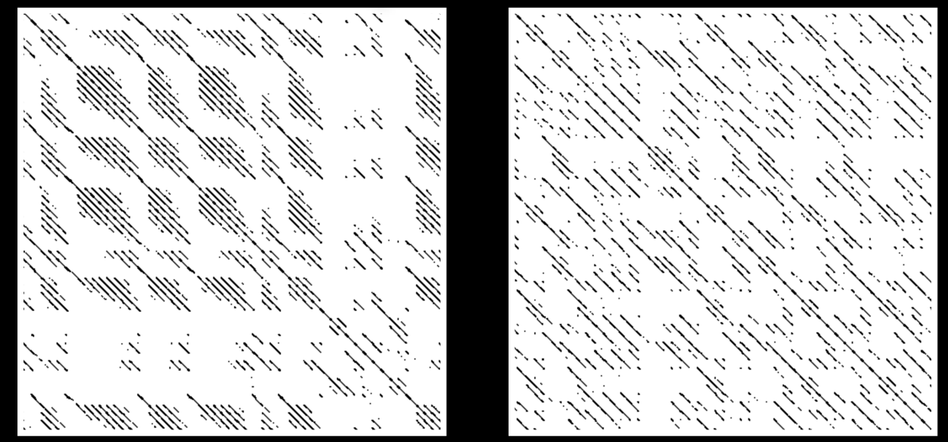
- avg. sim: 63%
  (max 93%, min 0%)

	easy	not easy
different	sine vs. noise  Ex. 23	sine vs. Roessler  Ex. 39
equal	sine vs. sine  Ex. 34	 Ex. 31

	easy	not easy
different	sine vs. noise  Ex. 23	sine vs. Roessler  Ex. 39
equal	sine vs. sine  Ex. 34	 Ex. 31

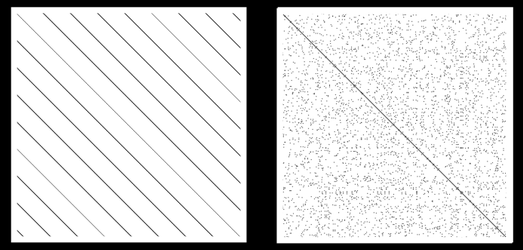
- disrupted lines in both systems, different patterns
- avg. sim: 54%
(max 100%, min 0%)

	easy	not easy
different	sine vs. noise  Ex. 23	sine vs. Roessler  Ex. 39
equal	sine vs. sine  Ex. 34	Lorenz vs. Lorenz  Ex. 31

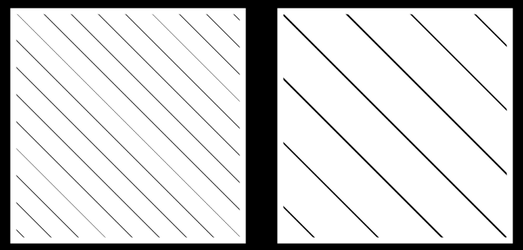
- disrupted lines in both systems, different patterns
- avg. sim: 54%
(max 100%, min 0%)

Difference By Experience?

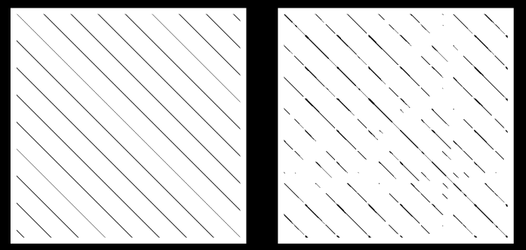
sine vs. noise



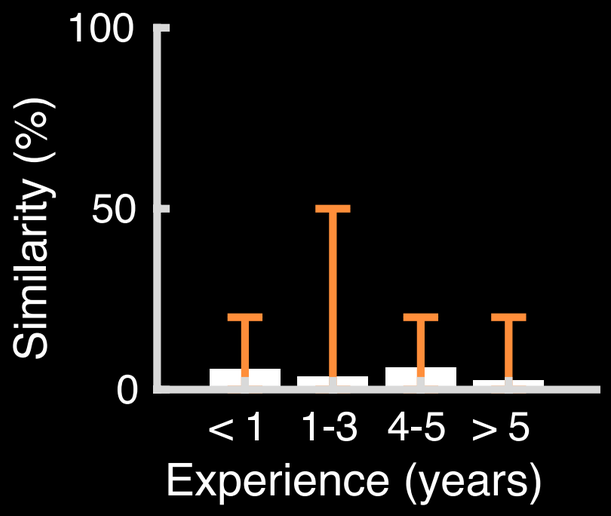
sine vs. sine

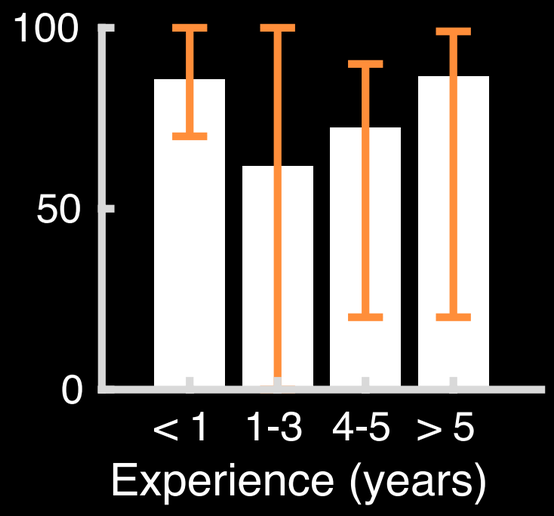


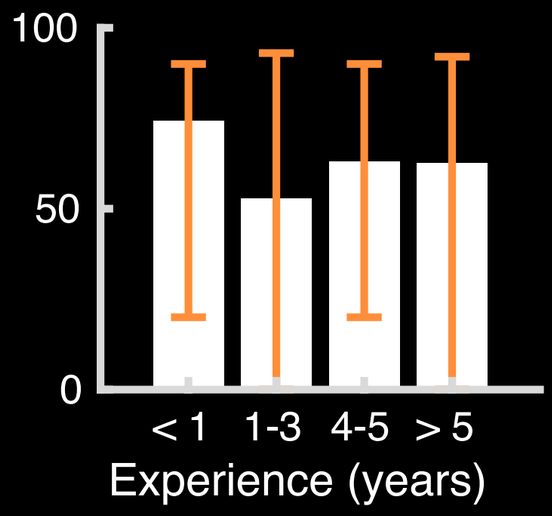
sine vs. Roessler

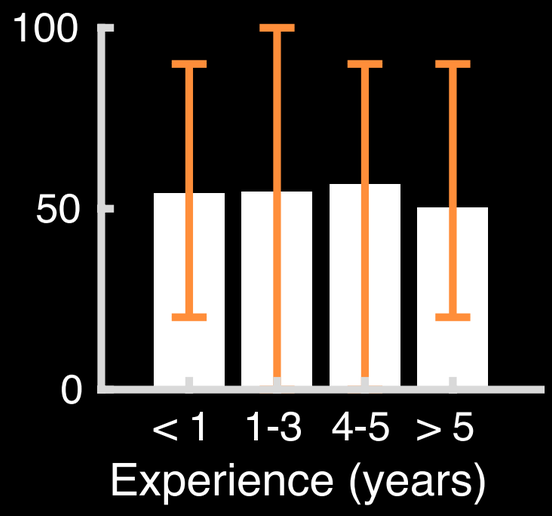


Lorenz vs. Lorenz



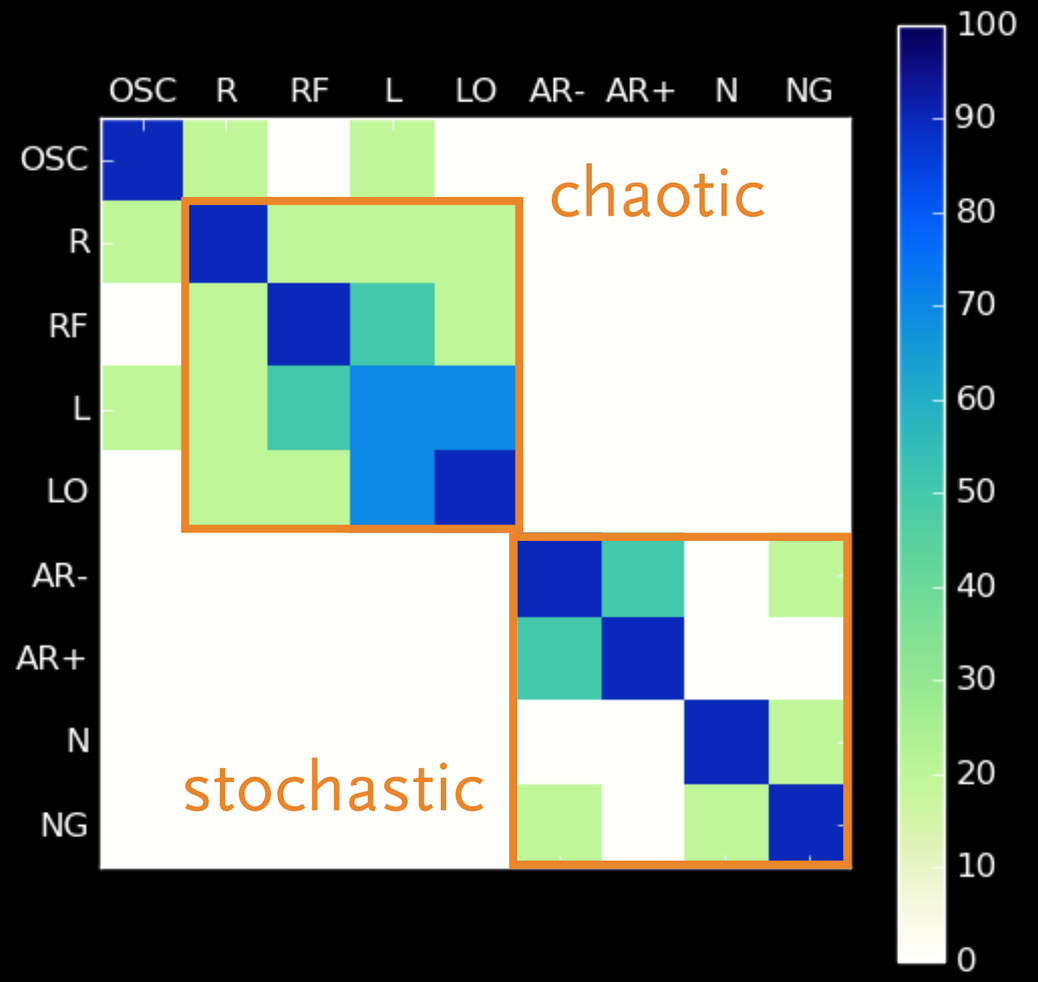


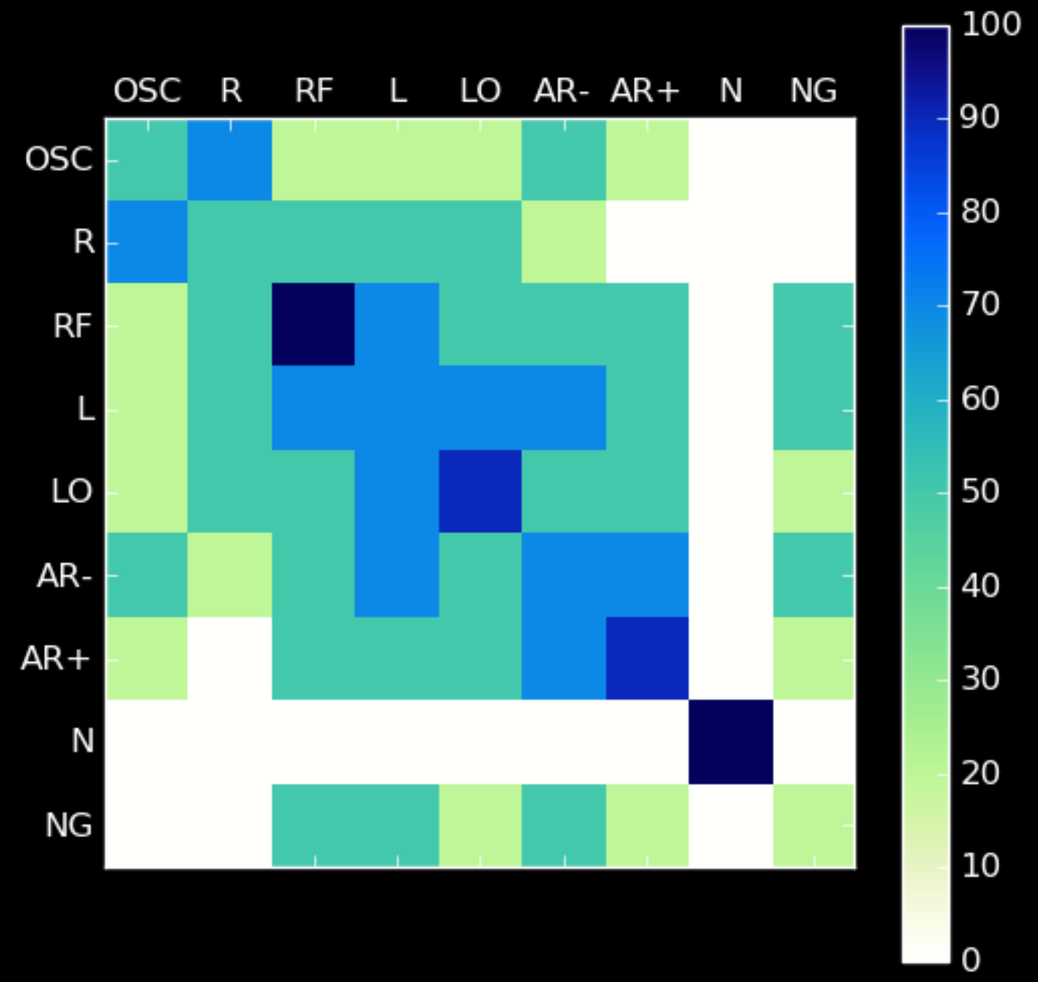




participants: N = 58

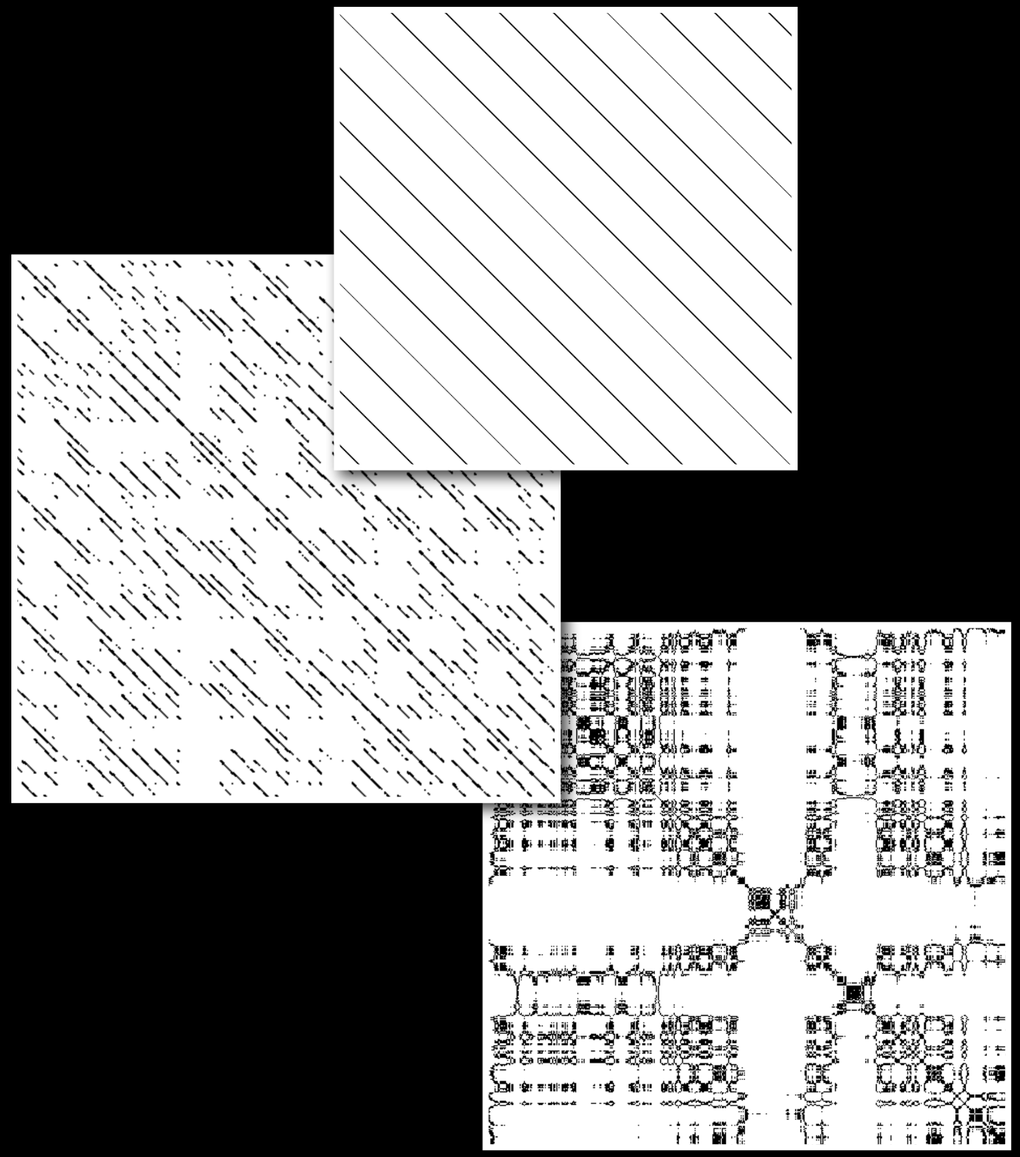
Contrary Examples (Experience > 5 Years)





Perception Criteria

- patterns typical for certain dynamics
  - continuous vs. disrupted lines, single dots
- visual patterns or structures
  - periodic vs. „random“ patterns
  - overall appearance: homogenous vs. disrupted
  - period lengths/ recurrence times



Need For

- quantification
- better guidelines how to interpret RP

Online Similarity Assessment

http://bit.ly/rpassess

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