WHAT IS THE IDEAL QUIZ QUESTION?

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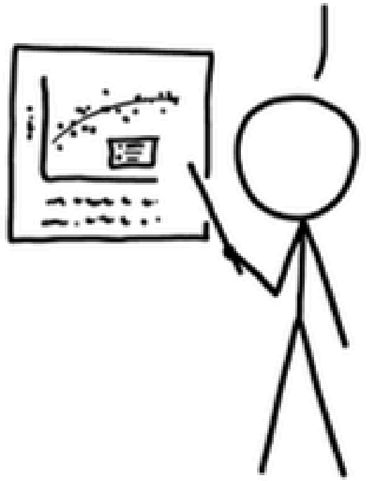
Mentored by
SITABHRA AND SAPTARSHI

SPINS, GAMES AND NETWORK
IMSc, 2024

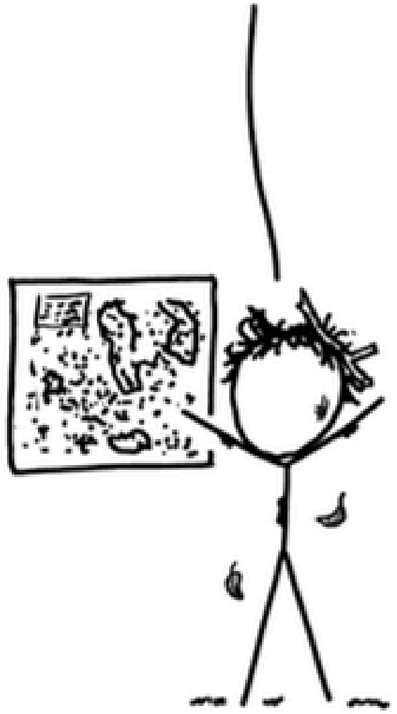
THE THREE KINDS OF SCIENTIFIC RESEARCH:

WE APPLIED A STANDARD THEORY TO NOVEL CIRCUMSTANCES AND GOT SOME SURPRISING RESULTS.

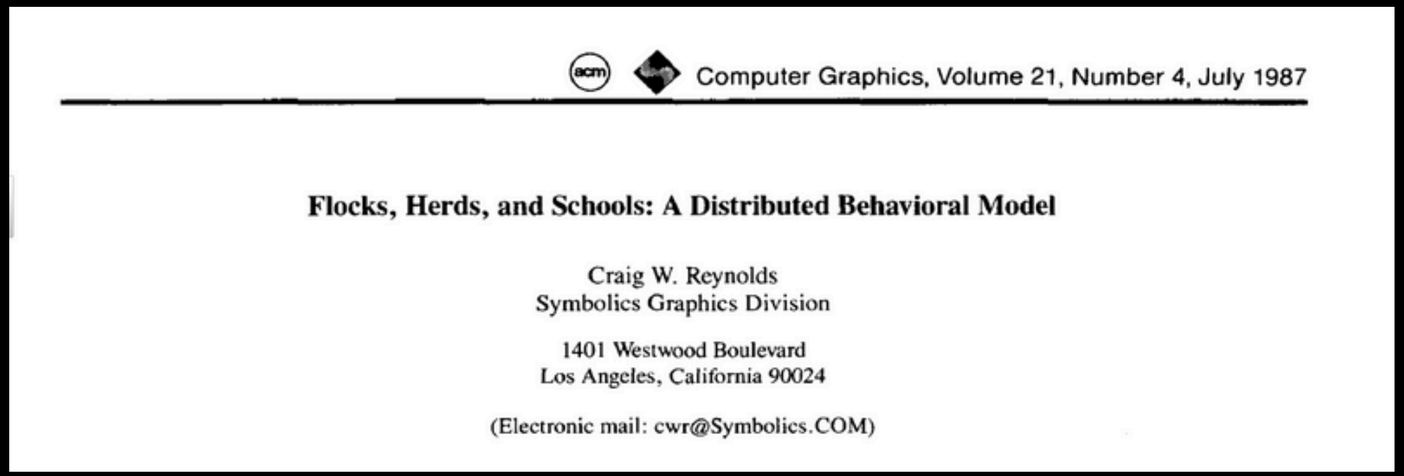


WE APPLIED A NOVEL THEORY TO STANDARD CIRCUMSTANCES AND GOT SOME INTRIGUING RESULTS.

FINALLY, A MAP OF EVERY TREE.



a quiz



Computer Graphics, Volume 21, Number 4, July 1987

Flocks, Herds, and Schools: A Distributed Behavioral Model

Craig W. Reynolds
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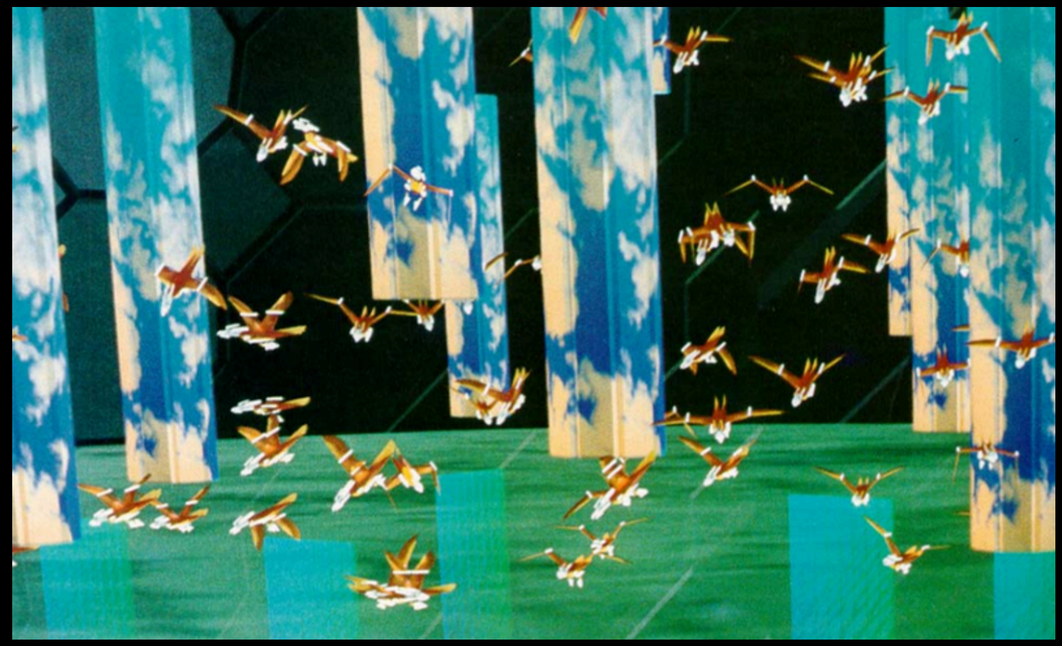
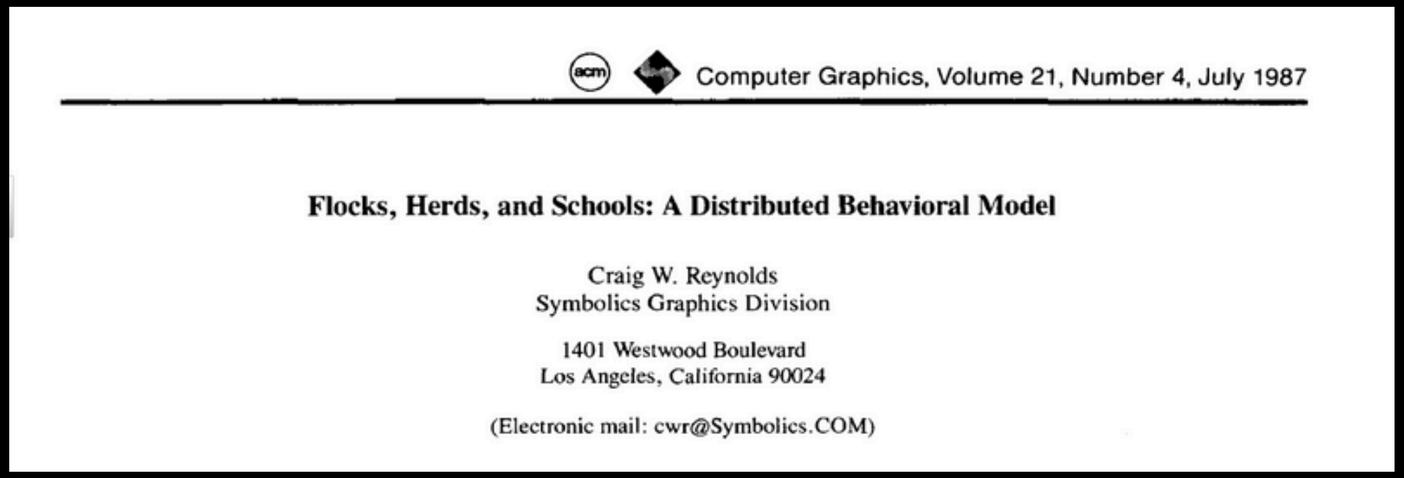


Where did we first see the application of this model?



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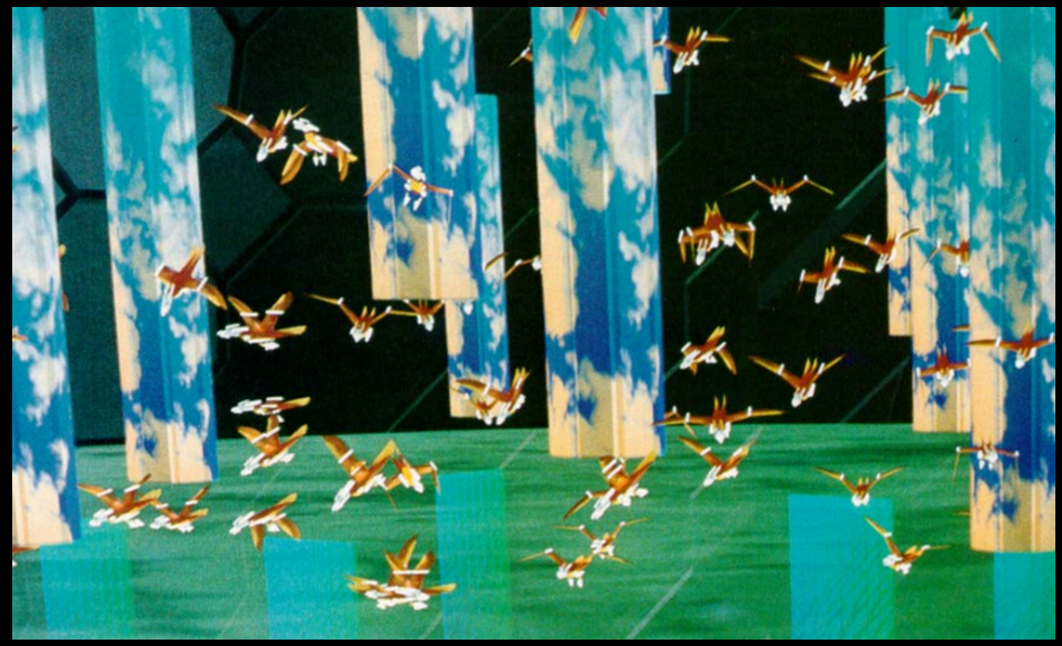

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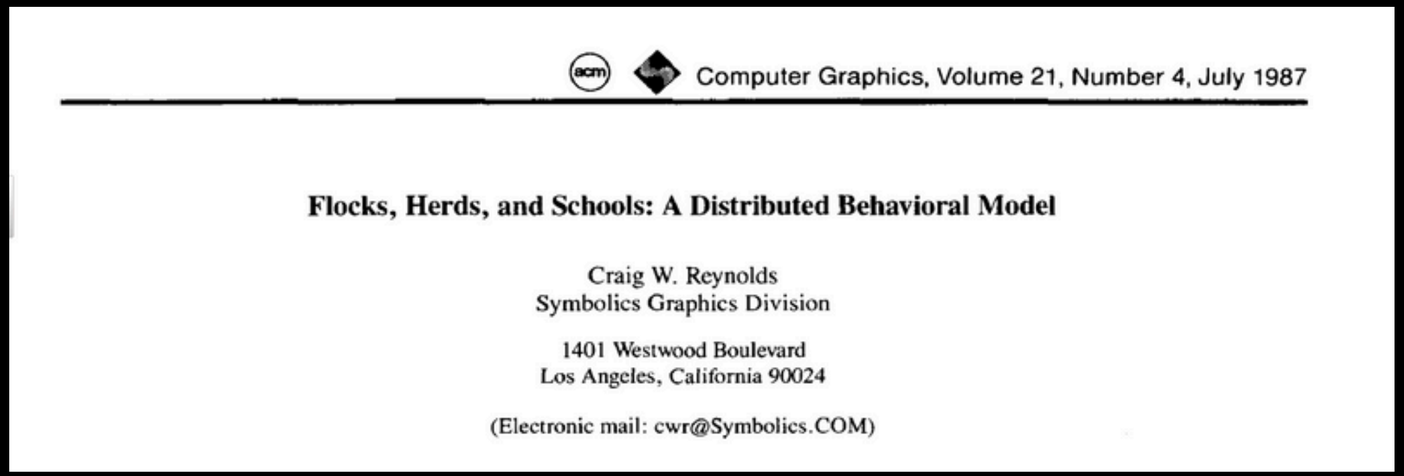
It became very influential in a certain industry for being able to produce a large number of certain entities rather easily.



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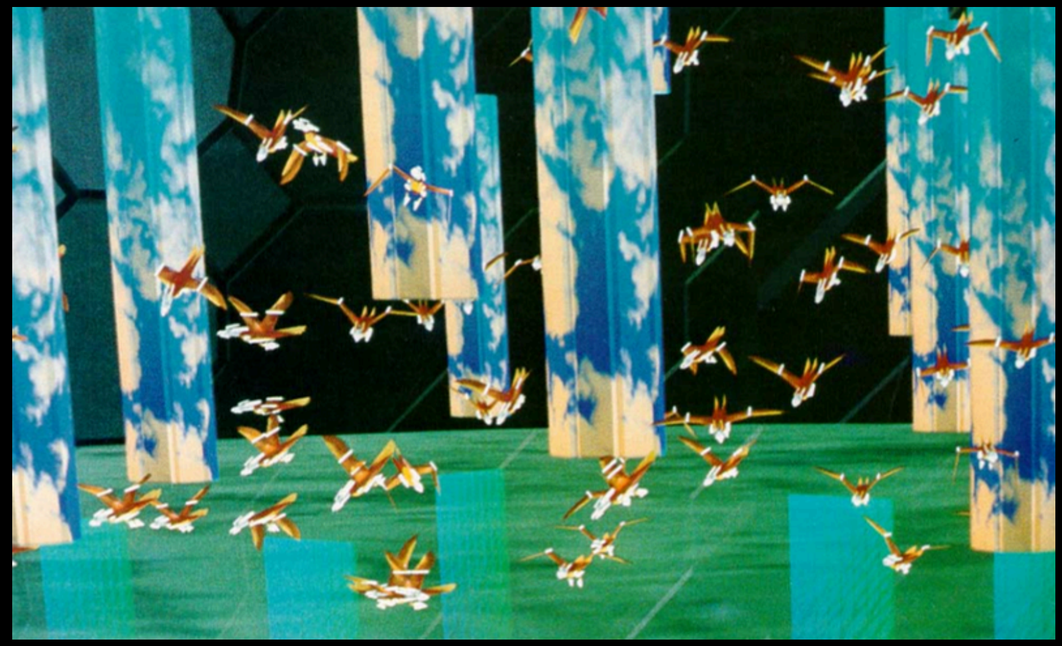

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It became very influential in a certain industry for being able to produce a large number of certain entities rather easily.

The model saw its feature film debut in a 1992 Tim Burton film of a very popular franchise.


FUNDAMENTAL FORCES
1. GRAVITY
2. ELECTROMAGNETISM
3. THE WEAK INTERACTION
4. THE STRONG INTERACTION
5. ELECTRONS ARE WEIRD ABOUT EACH OTHER
BIG NEWS: PHYSICISTS HAVE FINALLY GIVEN UP TRYING TO EXPLAIN ABOUT THE "EXCHANGE INTERACTION" AND AGREED TO JUST MAKE THE EXCLUSION PRINCIPLE A FORCE.

FLOCK OF BATS IN BATMAN RETURNS

Where was the first and only arXiv mirror is set up in India?

Where was the first and only arXiv mirror is set up in India?
It is an academic institution which was the first to have an institute-wide network in India.

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The logo of the institute features Borromean “rings” to represent three disciplines.

Where was the first and only arXiv mirror is set up in India?

It is an academic institution which was the first to have an institute-wide network in India.

The logo of the institute features Borromean “rings” to represent three disciplines.

The logo was kept unchanged even after a fourth entity was added in 2013.


Politics is an Ising model
BOOO! GET BETTER MATERIAL!
...
Music is an Ising model

twitter

IMSc

The question

- If you have no clues in a question, almost nobody can answer.
- If you have too many clues, everybody can answer.

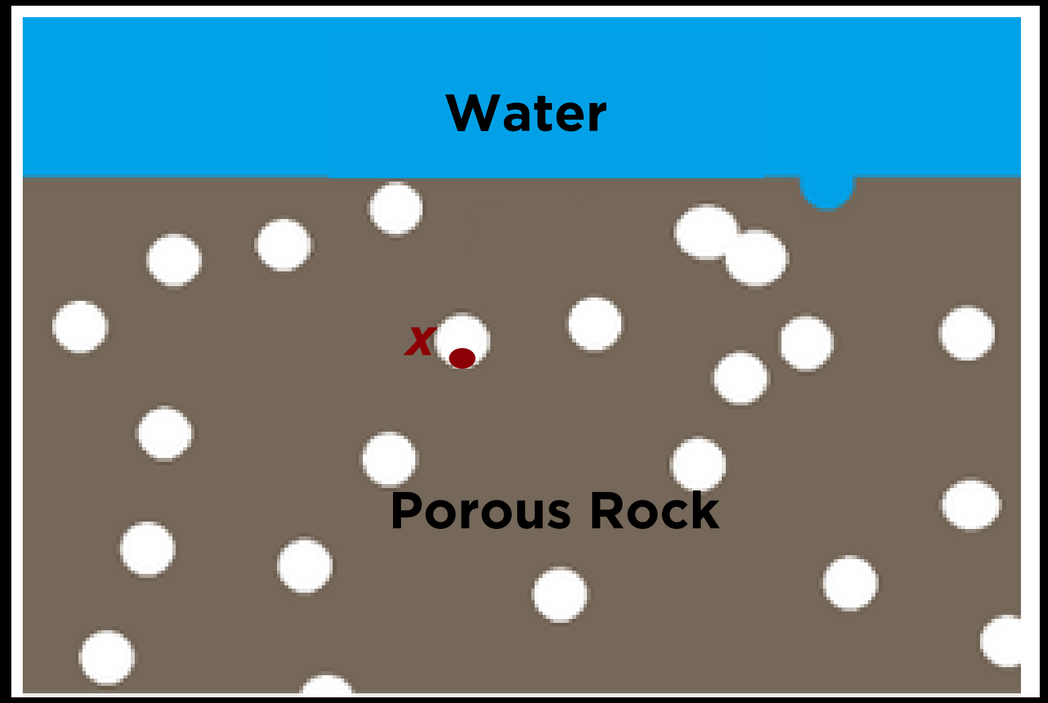
The question

to

The question

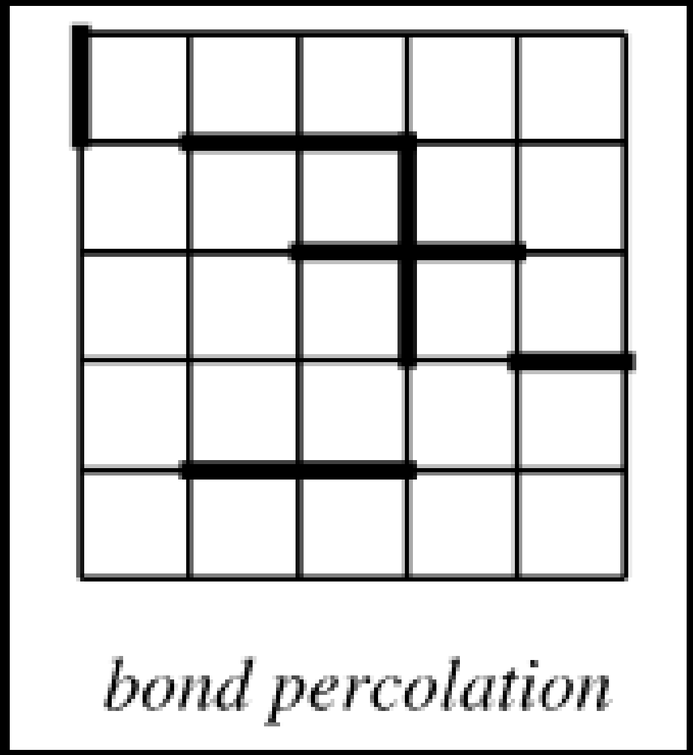
What is the AHA Moment?

Percolation

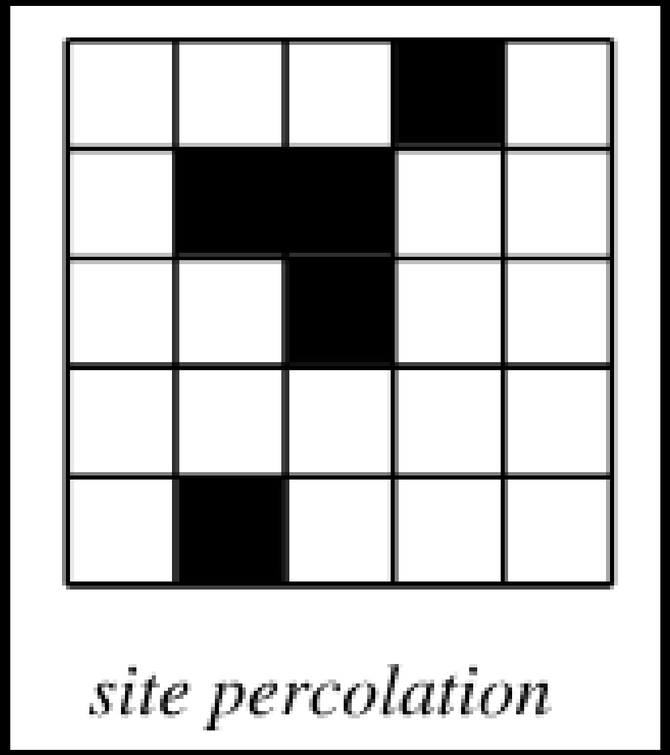


Stochastic Model- Hammersley in 1957

Percolation Process

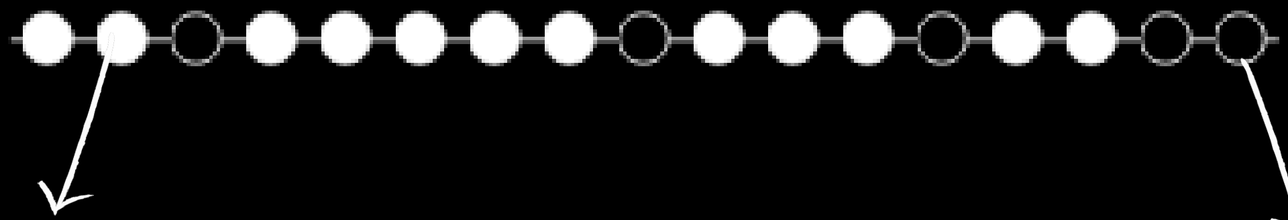


bond percolation



site percolation

1-Dimensional Lattice

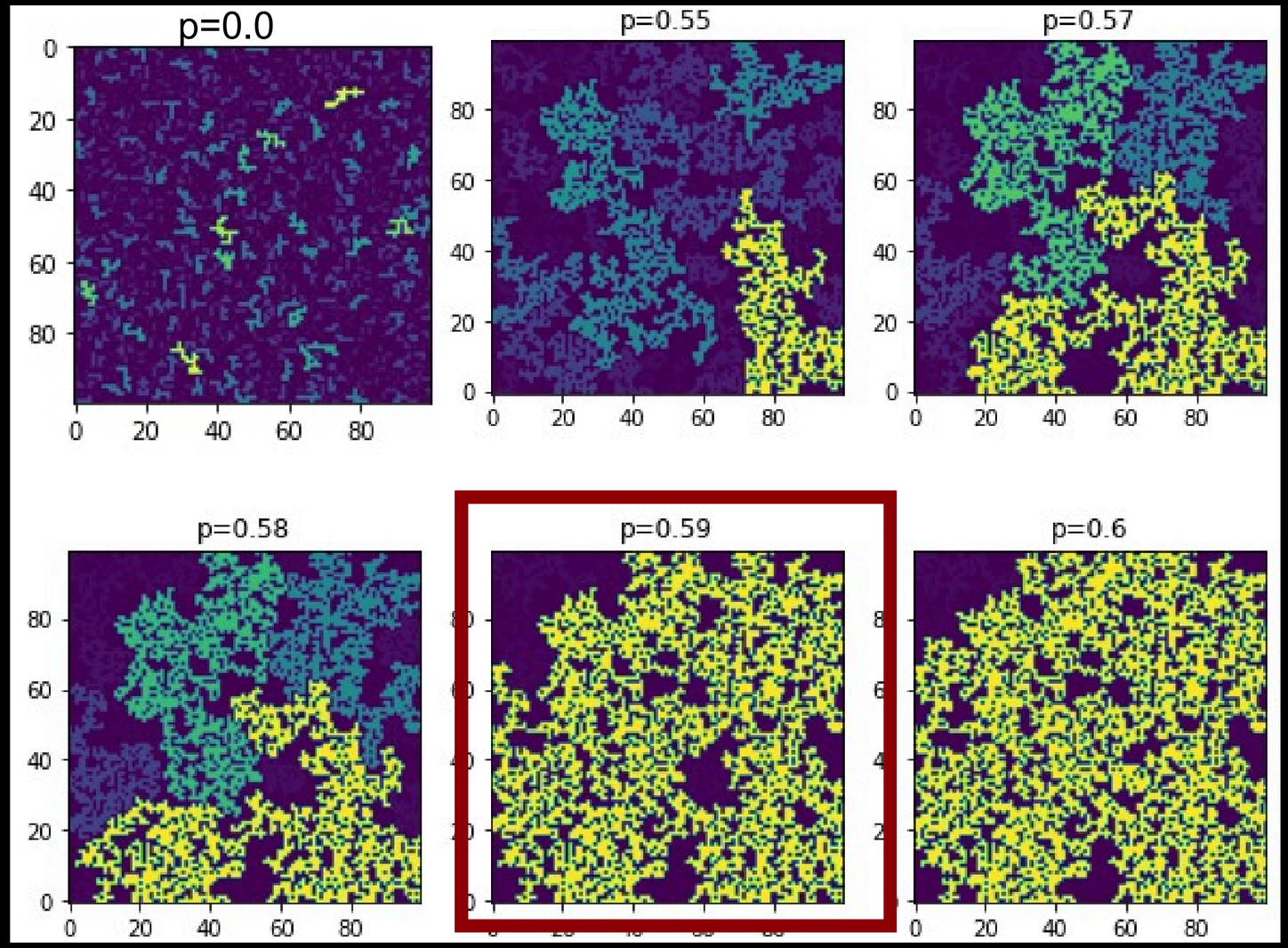


filled lattice

unfilled lattice

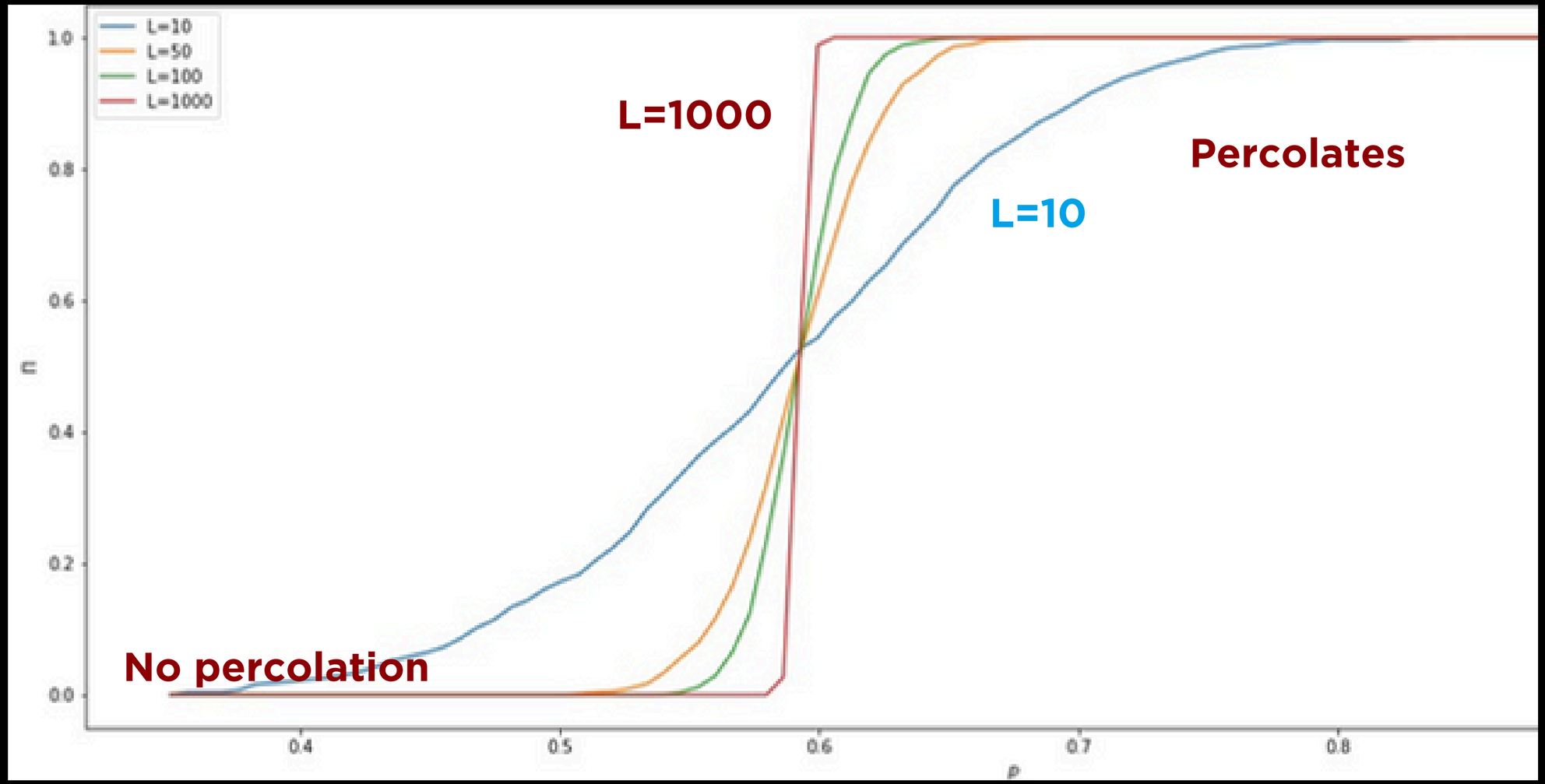
$$p_c = 1$$

2D Square Lattice



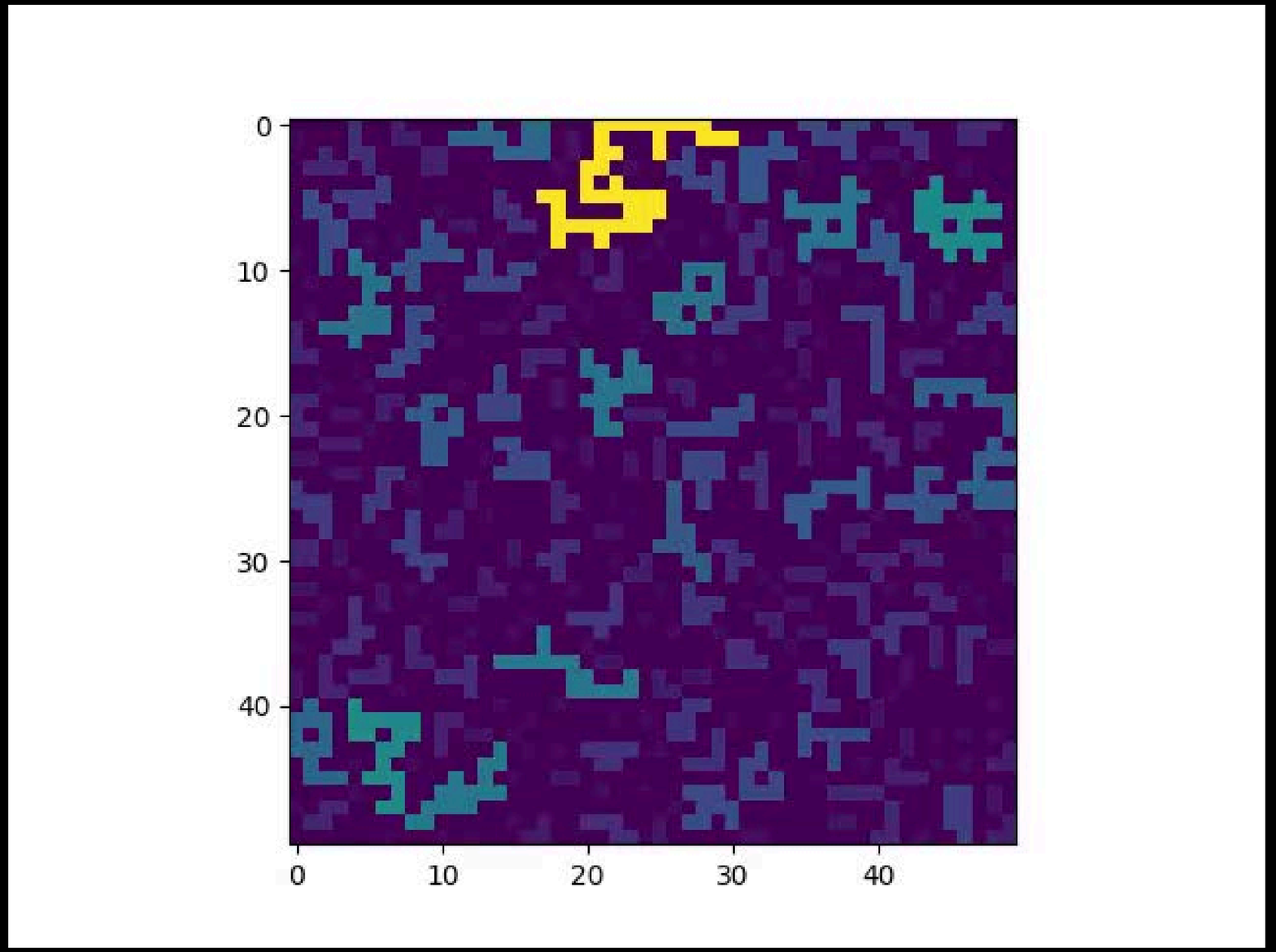
Percolation Threshold

Lattice	# nn	Site percolation
1d	2	**1**
2d Honeycomb	3	0.6962
2d Square	4	**0.592746**
2d Triangular	6	**1/2**
3d Diamond	4	0.43
3d Simple cubic	6	0.3116
3d BCC	8	0.246
3d FCC	12	0.198
4d Hypercubic	8	0.197
5d Hypercubic	10	0.141
6d Hypercubic	12	0.107
7d Hypercubic	14	0.089
Bethe lattice	z	**1/(z-1)**


L=10
L=50
L=100
L=1000
1.0
0.8
0.6
0.4
0.2
0.0
C
0.4
0.5
0.6
0.7
0.8
p
L=1000
Percolates
L=10
No percolation

Why Percolation?

- Forest Fires
- Oil in ground water
- Insulator-conductor transition



N = 1000 and L = 50

The Model

An individual :

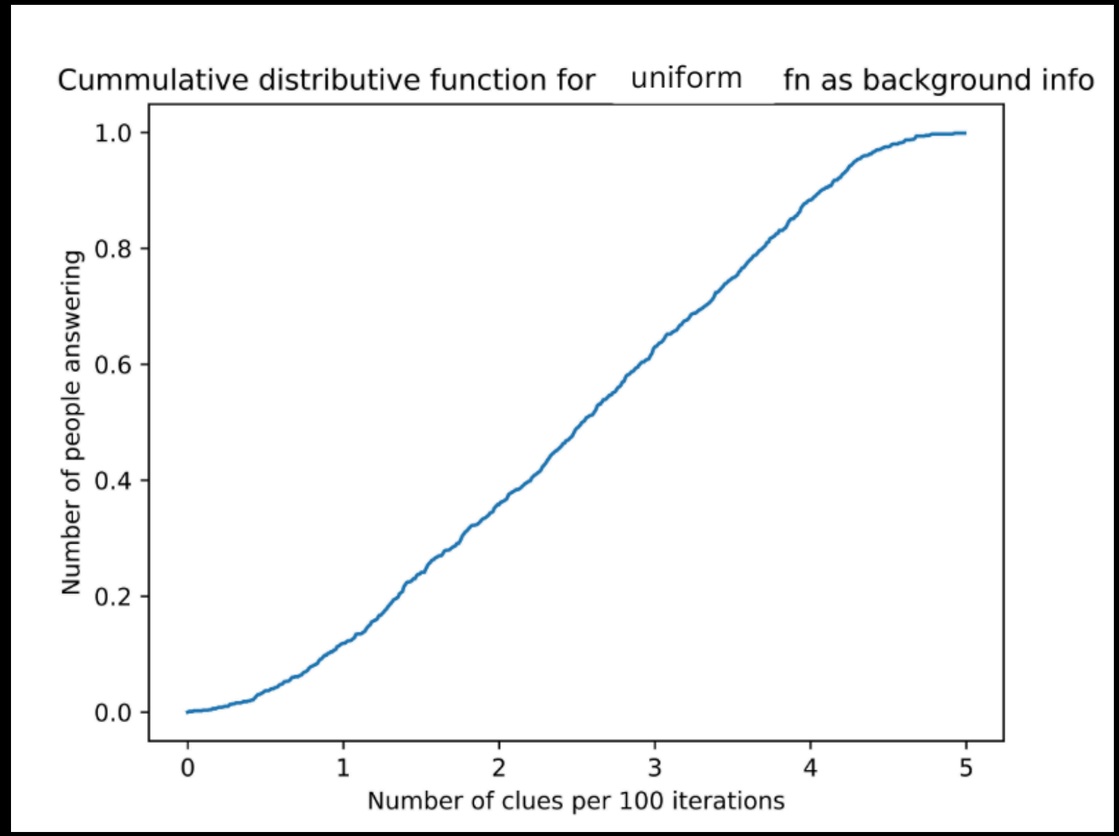
- Each individual is modelled as a lattice of size 100 X 100
- Each individual begins with an initial porosity which indicates the person’s background information
- This initial porosity is picked from a probability distribution

The Population :

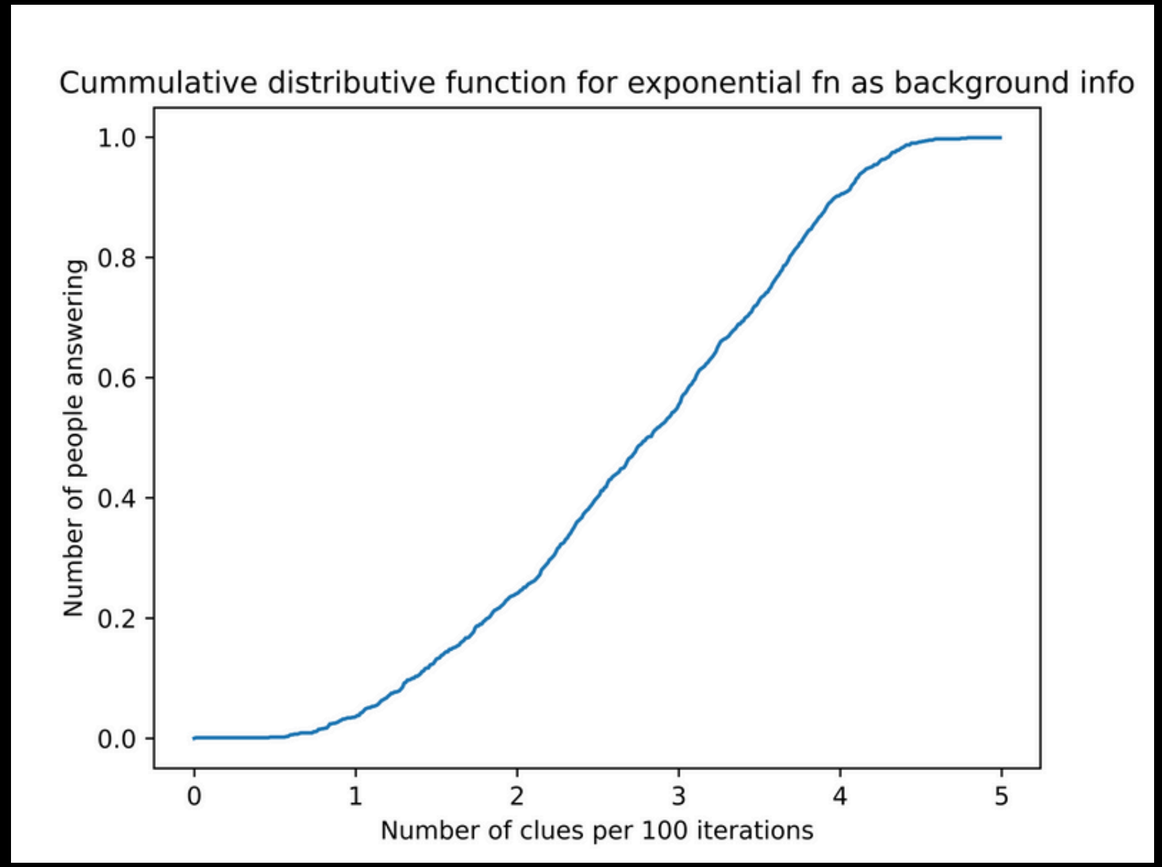
- The population is an ensemble of N = 1000 individuals
- We fill up one random site of the lattice in each individual as 1 bit of information is given
- Each individual percolates for a different amount of additional information as they have varied background information
- We find a distribution of the number of people who percolate for a given range of additional information and find cumulative distribution of it

Some Graphs

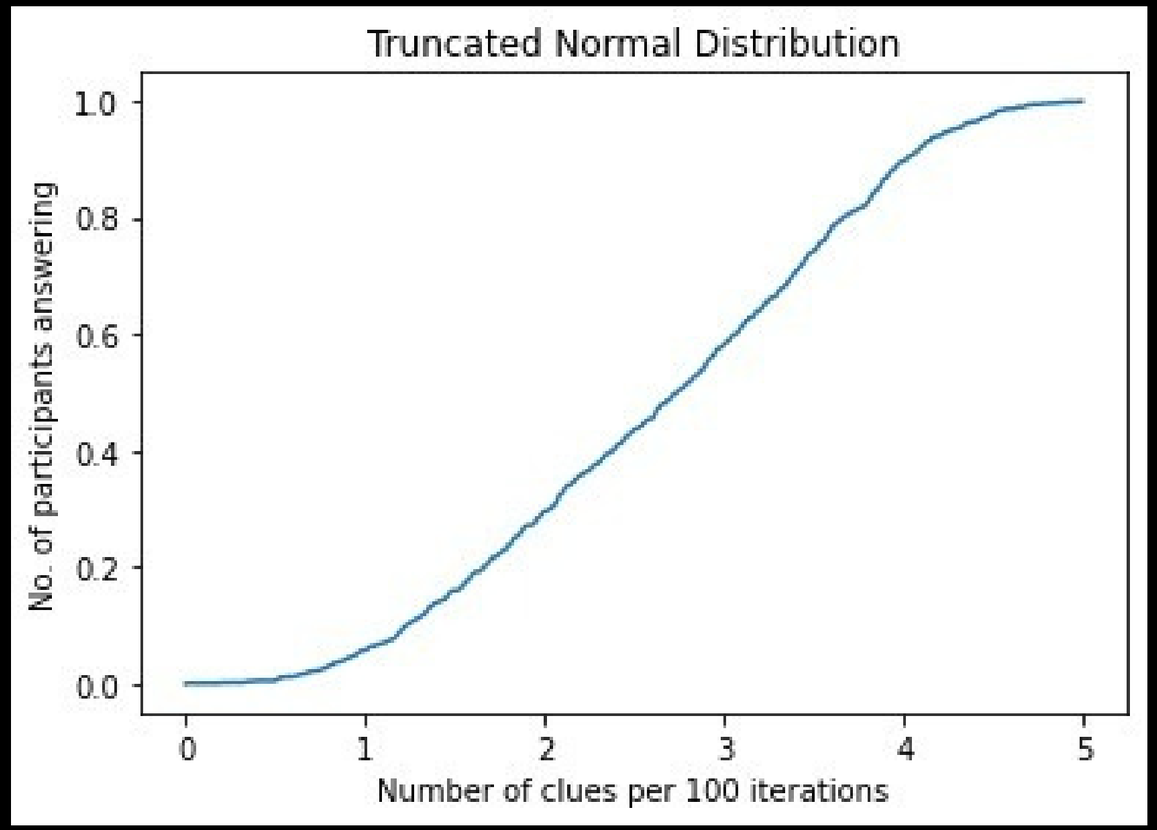
Background information
from an uniform distribution
from 0.1 to 0.35



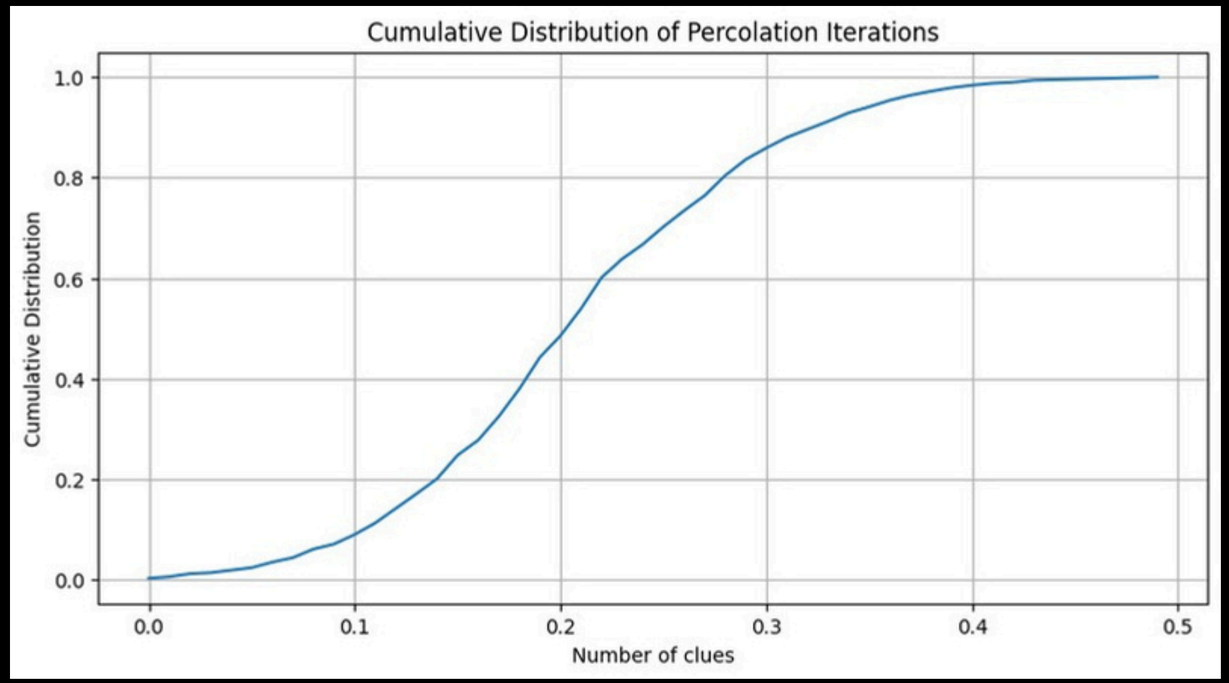
Background information
from an exponential distribution
($\beta = 1.5$) and $p \in [0.1, 0.35]$



Background information
from a N(0,1) distribution
truncated to the range p ∈ [0.1, 0.35]



Background information
from a lognormal distribution
truncaed to the range $p \in [0.1, 0.35]$



Result

2-4 clues are ideal if you want a proportional of the population to answer a question.

Future directions

- Such an approach is not limited to a quiz set up.
- It can allow people to understand the supposed sweet spot in other instances such as a talk or a piece of music.
- An optmised blend of predictibility and surprise.

References

- Malthe-Sørenssen, A. (2024). **Percolation Theory using Python**. In Lecture notes in physics. https://doi.org/10.1007/978-3-031-59900-2
- Stauffer, D., & Aharony, A. (1985). **Introduction to percolation Theory**. https://doi.org/10.4324/9780203211595

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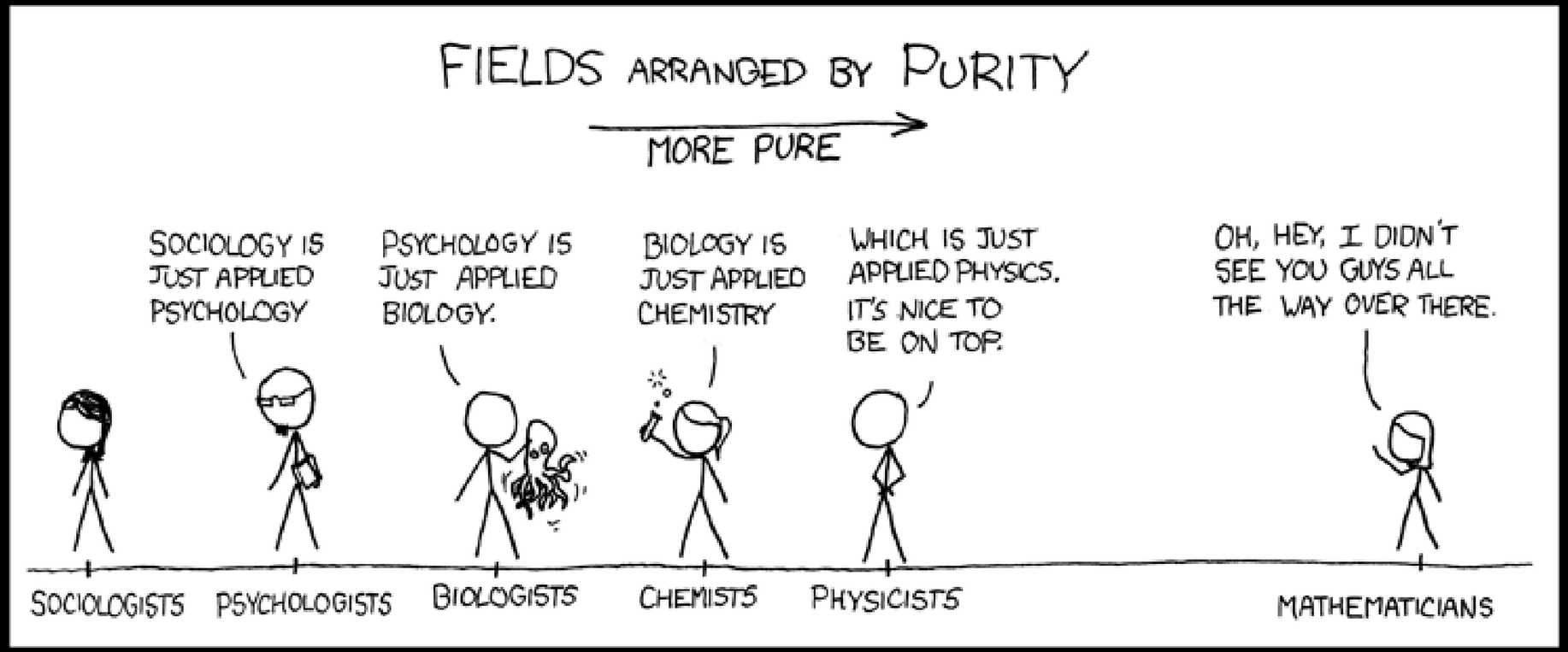
FIELDS ARRANGED BY PURITY
MORE PURE
SOCIOLOGY IS JUST APPLIED PSYCHOLOGY
PSYCHOLOGY IS JUST APPLIED BIOLOGY.
BIOLOGY IS JUST APPLIED CHEMISTRY
WHICH IS JUST APPLIED PHYSICS. IT'S NICE TO BE ON TOP.
OH, HEY, I DIDN'T SEE YOU GUYS ALL THE WAY OVER THERE.
SOCIOLOGISTS
PSYCHOLOGISTS
BIOLOGISTS
CHEMISTS
PHYSICISTS
MATHEMATICIANS

Thank you