Using Exact Sciences Models for Understanding Social Phenomena Session 1 - Introduction

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Course # 55772

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We meet here, Sprinzak 202
Wed 15:00-17:45

Dr. Renana Peres

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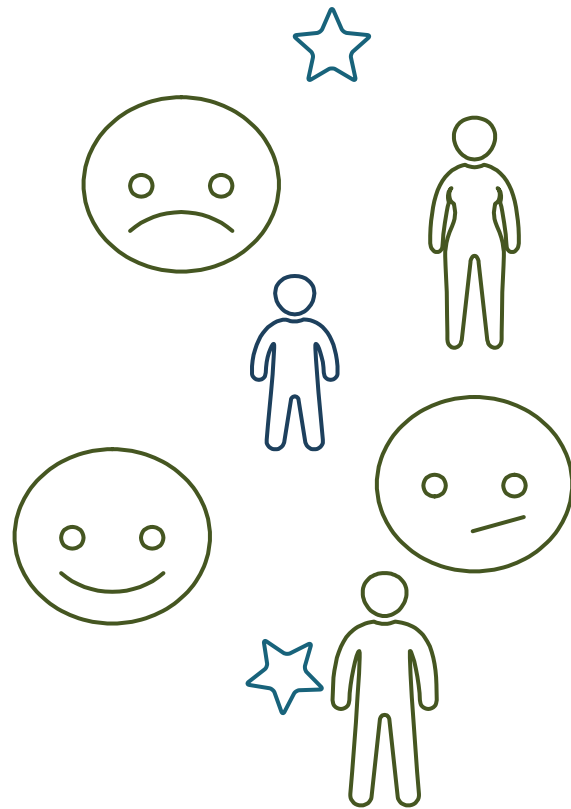| Fields	Marketing
	Physics
Institutions	Hebrew University of Jerusalem
	2006: PhD, Marketing
	2004: MBA
	1994: M.Sc. Physics
	1991: B.Sc. Physics

WIKIPEDIA
The Free Encyclopedia

WHO ARE YOU?

The issue of urban racial segregation

Segregation in New York

- < 10% Black
- < 10% White

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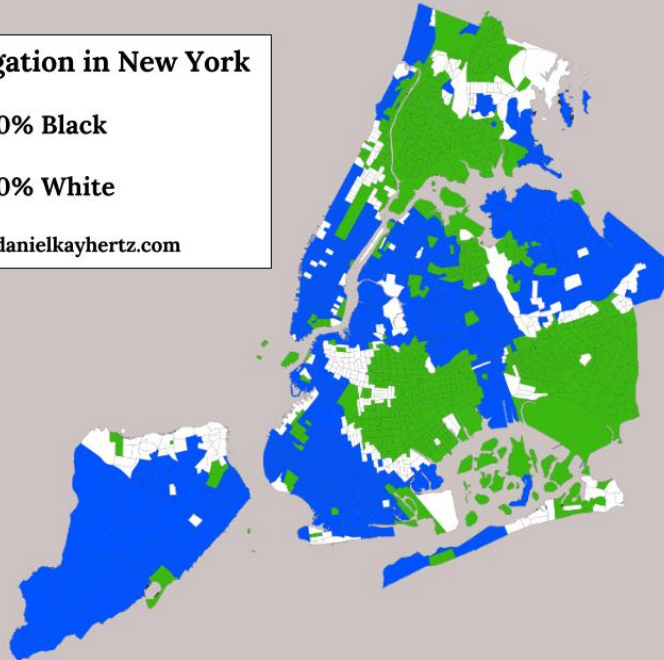
Data based on 2010 Census
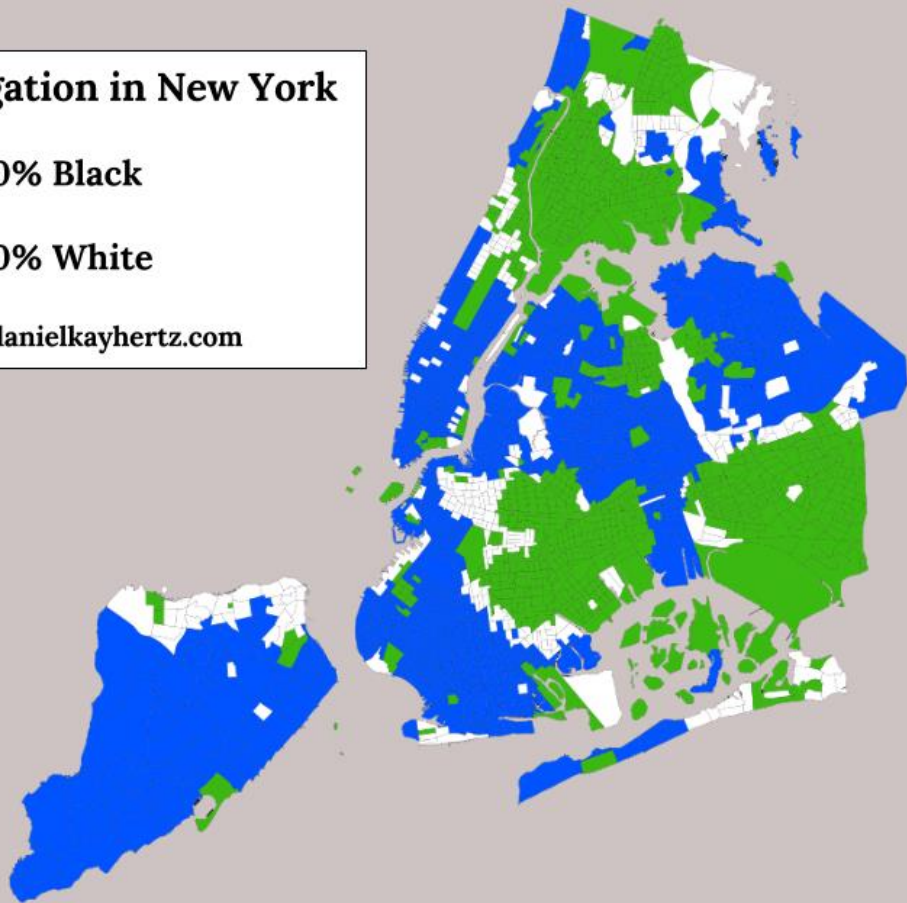
The median black New Yorker lives in a neighborhood with very few white people, and vice versa.

Segregation in New York
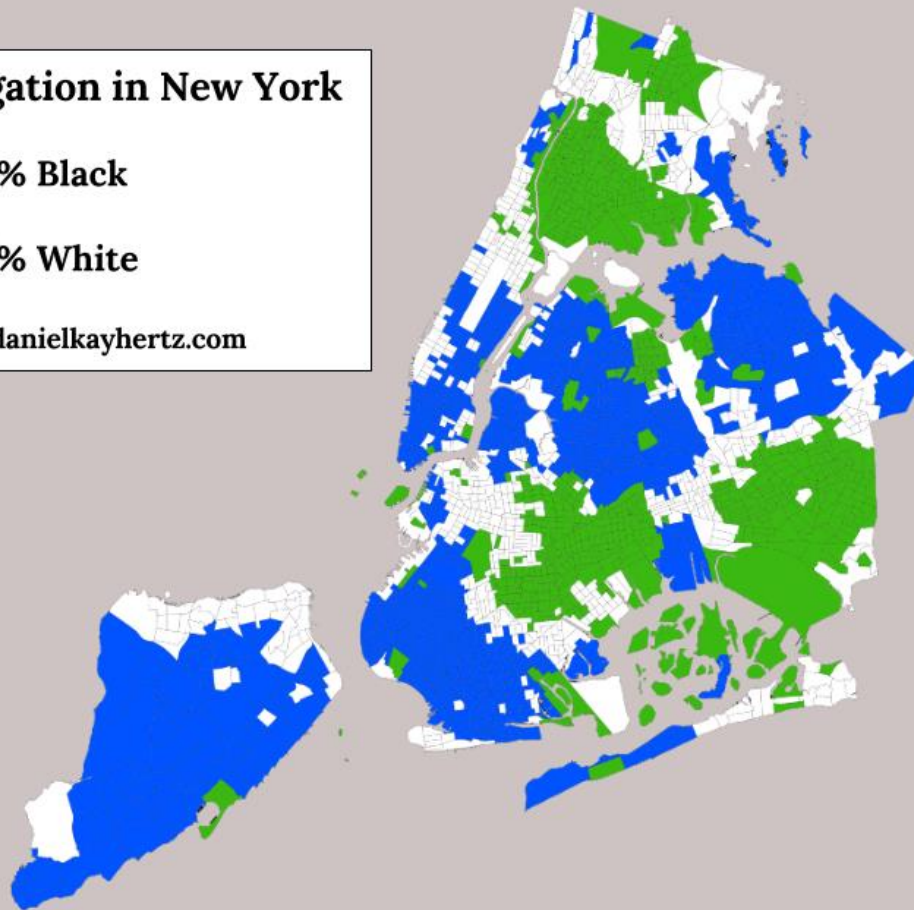
■ < 10% Black

■ < 10% White

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Segregation in New York

< 5% Black

< 5% White

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Segregation in New York

< 2% Black

< 2% White

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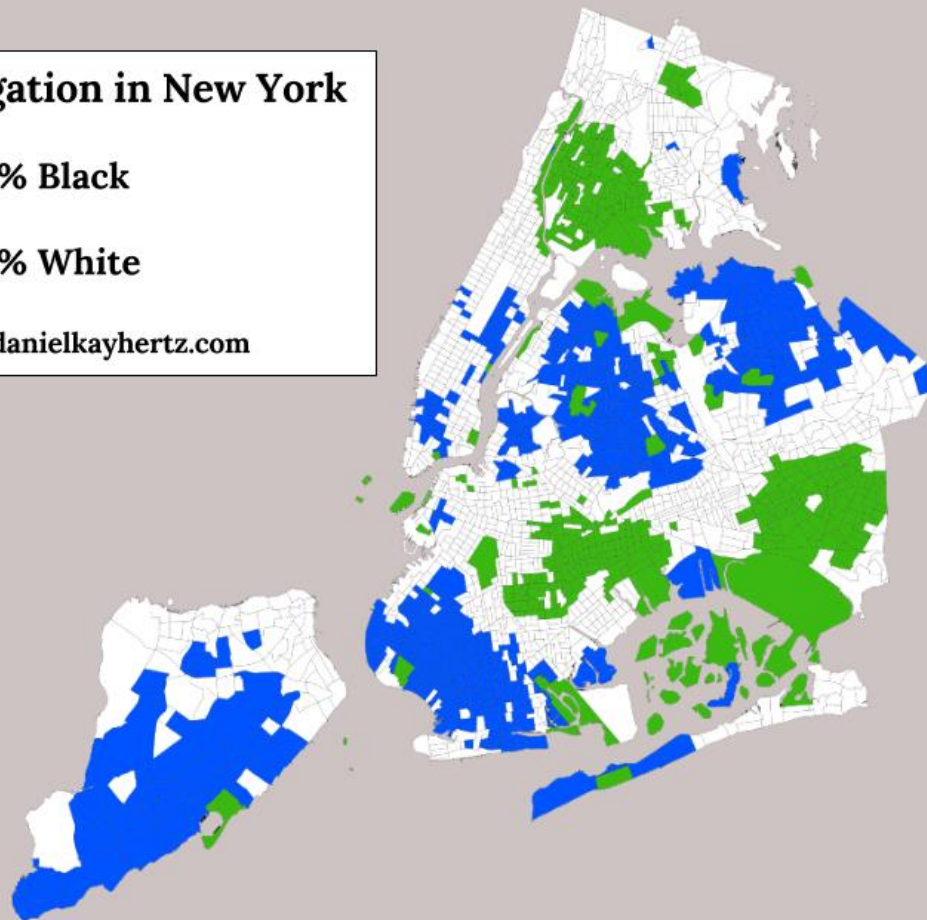
Is segragation a bad thing?

"when poverty rates and segregation are high in metropolitan areas, those regions perform economically worse relative to less segregated places. Segregated regions – by race as well as skills – have slower rates of income growth and property value appreciation. And this isn't just true for minority families stuck in segregated pockets of inner-city poverty. It's true for everyone, the suburbs and city alike."

Li, Campbell, and Fernandez 2013

What could be the reasons?

Segregation in New York
■ < 10% Black
■ < 10% White
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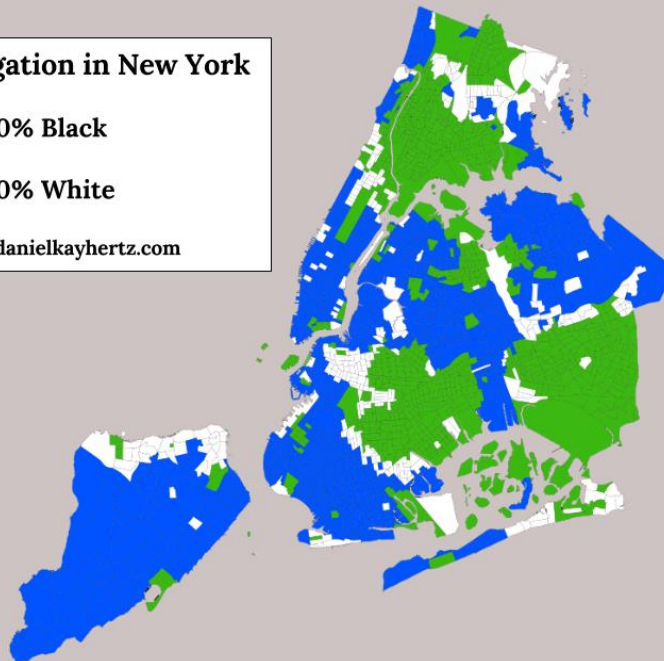
Data based on 2010 Census

Macroeconomic changes

Discrimination

Urban Structure

Another reason?

Administrative Details

40% 6-8 Homework assignments

60% Exam

Course readings, lectures, and assignments will be posted on Moodle
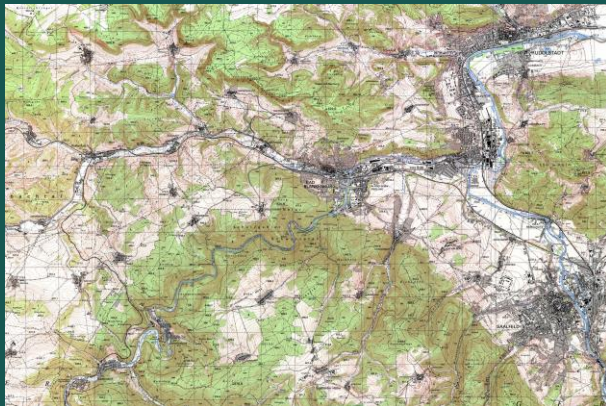
1

What is a model?

Let's start with some definitions

A model is a stylized representation of reality
that is easier to deal with and explore
for a specific purpose than reality itself.

Lilien and Rangaswamy 1975

Example?

Representation can be ...

Bohr's Hydrogen Atom model 1913

Verbal

"A positively charged nucleus, comprised of protons and neutrons, surrounded by a negatively charged electron cloud. In the **model**, electrons orbit the nucleus in **atomic** shells."

Graphic

$n = 3$

$n = 2$

$n = 1$

$+Ze$

$\Delta E = hf$
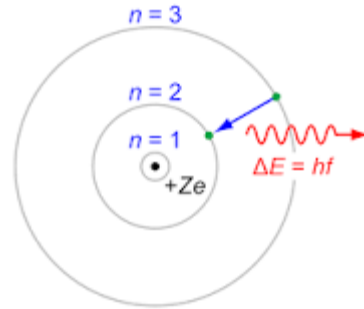
Mathematical

$$mvr = nh/2\pi$$

m= electron's mass
v = electron's velocity
n=1,2,3..
h = Plank's constant
6.62607004 × 10^{-34} m^2 kg / s

A Model's Building Blocks

Purpose

Assumptions

Variables and Parameters

Predictions

Purpose

Why do we need a model?

The reason for constructing the model

The prism through which the modeler looks at reality
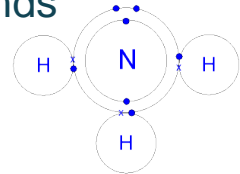
A physicist's perspective
Understanding light emission
$$mvr = nh/2\pi$$

A chemist's perspective
Understanding compounds

Assumptions

The part of reality the model simplifies

Bohr's atom

What are the assumptions?
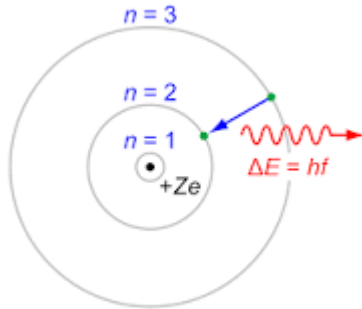
Newton's laws of motion

$$d = v_0 t + \frac{1}{2} a t^2$$

d= displacement
v_0= initial velocity
a= acceleration
t= time

Assumptions?

Are all assumpions valid?

"For every complex problem there is a solution that is simple, neat, and wrong."

HL Menken

"Things should be made as simpler as possible - but no simpler"

Albert Einstein

"Nothing is build on stone; all is build in sand. But we must build as if the sand were stone."

Jorge Luis Borges

Variables and Parameters

Parameters
The model's components that do not change.

If constant across scenarios, they are called… constants.

Variables
The model's moving parts

The model represents the relationships between the parameters and the variables

Driven by theory

$$d = v_0 t + \frac{1}{2} a t^2$$

$$mvr = nh/2\pi$$

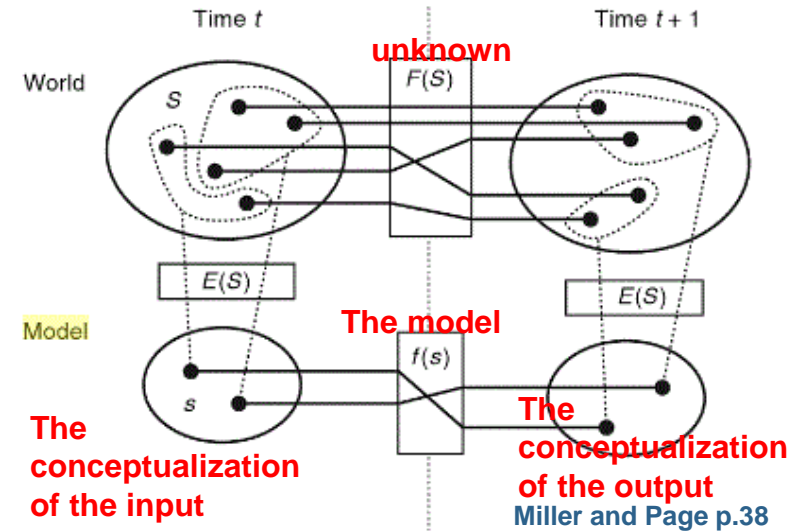$$pr\_buy = 1 - (1 - p) \cdot (1 - q)^{N(t)}$$

A formal model of models

The model captures the phenomenon if $f(E(S)=E(F(S))$

Example: $d = v_0 t + \frac{1}{2}at^2$

Measure a, t, v_0 - this is the E of the input
Measure d – this is the E of the output.

In real life: $d=F(a,t,v_0)$. We do not know F. We can only measure the inputs and the output. If the output d is indeed $v_0 t + \frac{1}{2}at^2$, the model works.

Time t unknown $F(S)$ Time $t+1$

World

S

$E(S)$ $E(S)$

Model   The model $f(s)$

s

The conceptualization of the input

The conceptualization of the output

Miller and Page p.38

2

Can we use the same logic in social studies ?

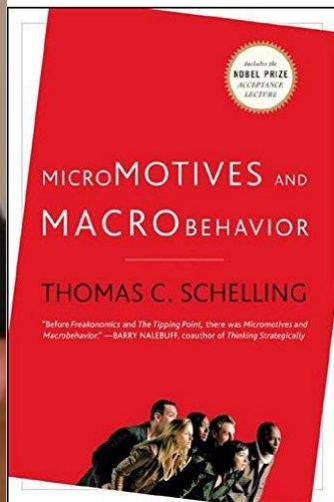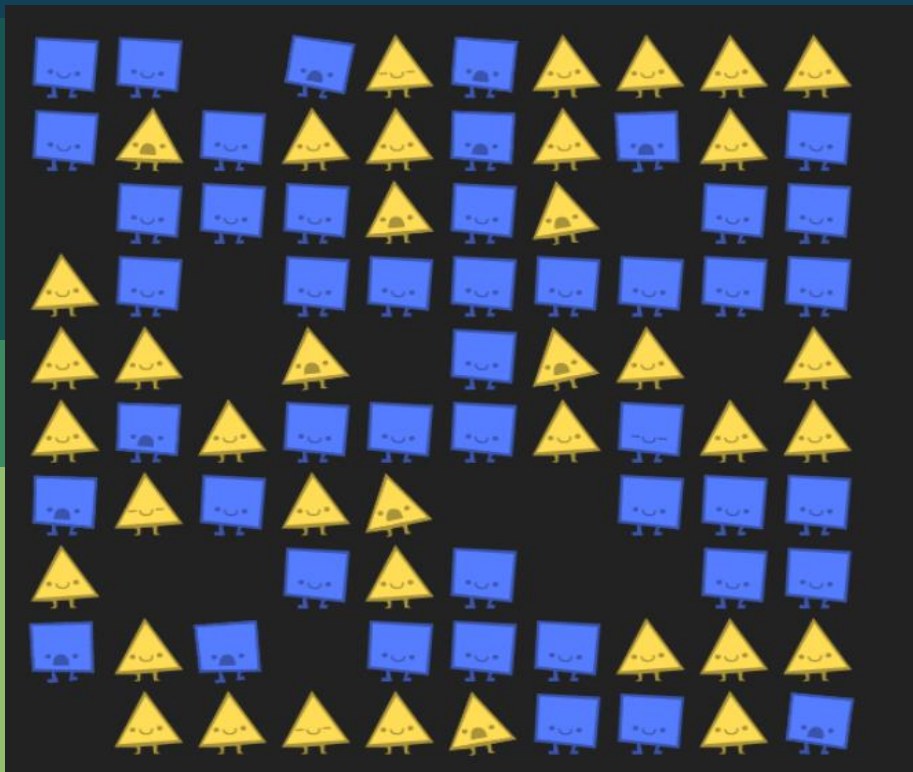Let's go back to our opening example

1921-2016

Segregation does not necessarily depend on socioeconomic status, discrimination, or urban structure.

It is a natural process which can be described using a very simple game-theoretic model.

# Welcome to Polygon town

50% Triangles

50% Squares

Our Polygons are slightly "shapist"

You can only move them if they're unhappy with their immediate neighborhood. Once they're OK where they are, *you can't move them until they're unhappy with their neighbors again*. They've got one, simple rule:

"I wanna move if less than 1/3 of my neighbors are like me."

Our Polygons are slightly "shapist"
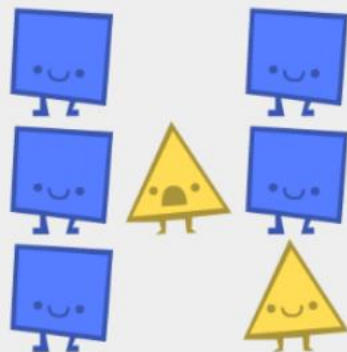
unhappy: only 1 out of 6 neighbors are like me. less than 1/3.
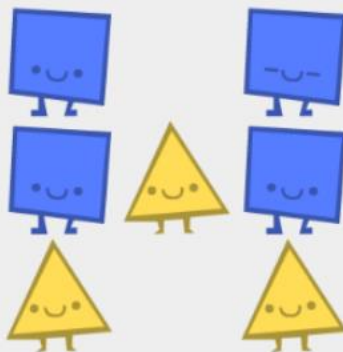
happy: 2 out of 6 neighbors are like me. exactly 1/3.

meh: all neighbors are like me. (also meh if i've got no neighbors)

Harmless, right ?

Every polygon would be happy with a mixed neighborhood.
Surely their small bias can't affect the larger shape society that much?
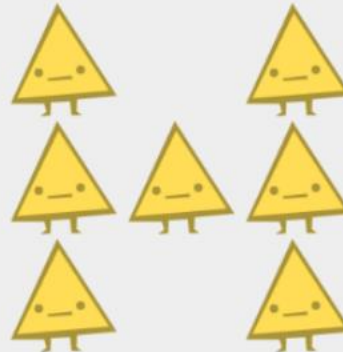
Well...

http://ncase.me/polygons/

Wrapping up

Small individual bias → Large collective bias

You might not be shapist, but slightly shapist individuals create shapist societies

The past haunts the present

Being non shapist does not help in a segregated world

Demand diversity near you

Desegregating a segregated world demand active call for diversity

Schelling's building blocks ?

Purpose | Assumptions | Variables and Parameters | Predictions

Testing the model

Clark 1991

Preferences

79% of white households said they won't be comfortable in neighborhoods with more than 20% blacks.

Behavior

The majority of black households tend to relocate within the areas that are more than 50% black.

Table 1. Data for Preference/Tolerance Schedule, Kansas City

Preferred Neighborhood Ratio by Whites				Preferred Neighborhood Ratio by Blacks*			
	Number whites	Cumulative	Number blacks		Number blacks	Cumulative	Number whites
All black	0	0	0	All white	2	2	∞
9:1	0	0	0	9:1	3	5	45
4:1	0	0	0	4:1	3	8	32
2.333:1	0	0	0	2.333:1	3	11	26
1.5:1	3	3	5	1.5:1	7	18	27
1:1	63	66	66	1:1	52	70	70
.666:1	22	88	59	.666:1	7	77	51
.429:1	47	135	58	.429:1	2	79	34
.25:1	73	208	52	.25:1	1	80	20
.111:1	126	336	37	.111:1	1	81	9
All white	268	602	0	All black	5	86	0

* Sample adjusted to city size.

Does this model use exact sciences methods?

Actually yes. This is a very similar model to the model of ferrogmgnetism in physics.

Wait and see…

In this course we will go through several such phenomena

Creation of social norms

Stock market behaviours
Bubbles, synchronicity, fads and herding

Culture
Evolution of genres, trends in popular music, music piracy.

Political and social movements
Riots, strikes, migration waves

Formation of societies
Towns, minorities etc,

Organizations
Rivalry, collaboration, relationships with distributors.