The Quest for the Virus

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with the determinant ideas of Gianpiero Pescamona

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Slides at https://terna.to.it/simul/SIsaR.html

The S.I.s.a.R model

Susceptible, Infected, symptomatic, asymptomatic, Recovered

- Making the *invisible visible*

- Shield against the odds

[using an agent-based model]

Preliminary note (1/4)

This is a simulation with random events, please do not take it a a sure forecasting machine, it is a reasoning machine, a sort of very complex "what if" mental experiment.

The New York Times offers us an analysis on the *The Covid-19 Riddle: Why Does the Virus Wallop Some Places and Spare Others?*]

https://www.nytimes.com/2020/05/03/world/asia/coronavirus-spread-where-why.html (open link).

Preliminary note (2/4)

At the end of the article, we read: *Roll of the Dice - Finally, most experts agree that there may be no single reason for some countries to be hit and others missed. The answer is likely to be some combination of the above factors, as well as one other mentioned by researchers: sheer luck.*

In the same way, in the simulations run with this model we can have very different outcomes as we change the initial seed of the random numbers. Those values are determining mainly the movements at a tiny scale and so the interactions-infections chains.

Preliminary note (3/4)

We can use the model in a comparative way, observing different range of results with different initial conditions (parameters).

Finally, to have a reference at an actual situation, the model is related to the Piedmont scale, with 4,350 agents vs. 4.35 millios of inhabitants.

We look also to the time series of the total infected people in Piedmont (an Italian region).

# Preliminary note (4/4)

Piedmont

Feb 24

May 4

draft
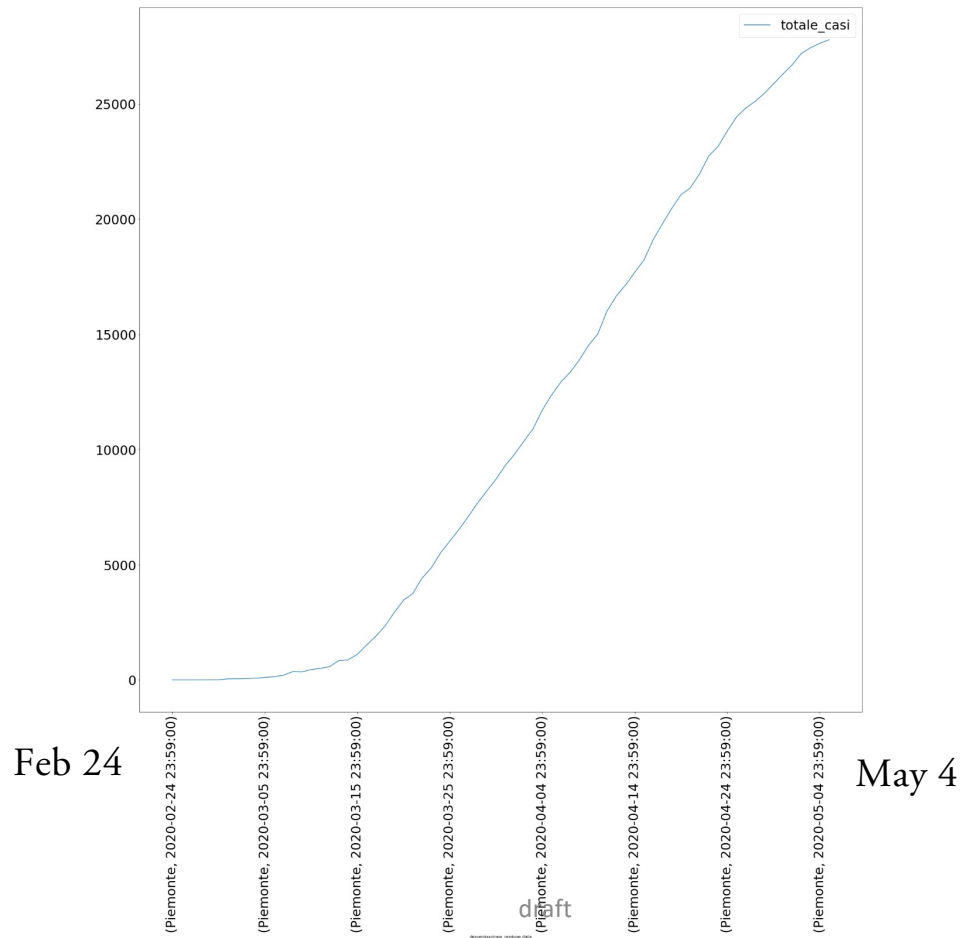
Goals:

- verify and manage the contagion effect of the *nursing homes* (RSA in Italian);

- verify and manage the contagion effect of the *hospitals*;

- create scenarios of future developments, based on hypotheses and conditions; also run counterfactual simulations with different behaviors in the first phase (to learn for the future).

Simulated experiment I

- Lockdown March 9; let us suppose the starting point 20 days before, so in the simulation the lockdown starts at day 20, with 5% off people anyway going around, in a limited way.

- Lockdown partially relieved at May 4, in the simulation at day 75, with 5% off people anyway going around plus 40% of *non fragile* people going around; all in a limited way.

An agent based-model in a movie
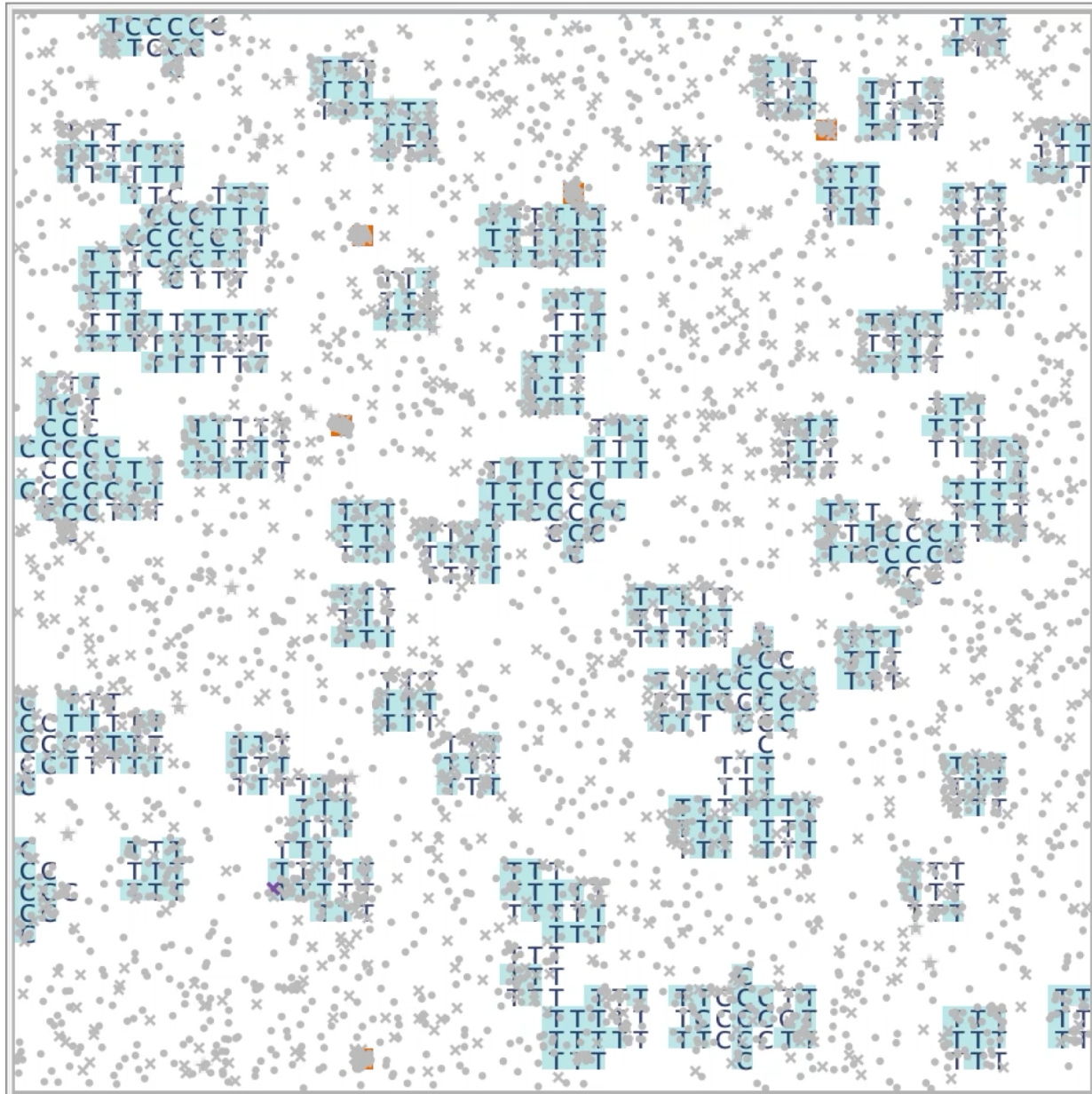
A nursing home spreading the contagion, look at the right up zone

In the pdf version of the slides you can see the movie clicking here

Simulated experiment I: summary of infected people (cumulated values)

Visit nursing homes	Oper.s	Day 60	Day 100	Outlook
No	No	9	28	quite good
No	Yes	15	40	quite bad
Yes	Yes	35	94	very bad
Actual datum		24		

Simulated experiment I: summary of infected people (cumulated values)

Visit nursing homes	Oper.s	Day 60	Day 100	Outlook
No	No	9	28	quite good
No	Yes	15	40	quite bad
Yes	Yes	35	94	very bad
Actual datum		24		

counterfactual

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populationSize 4350

On/Off cities&towns

About the seed of the random numbers see Info

setup

If cities&towns is On, after hitting 'setup' we have to wait while the program executes the initial people distribution

go — Automatically stops as no more infected exist

myStop 60 — or finish at tick myStop (if not 0)

ratioInitialInfected% 0.05

infected individuals infos
minInfectionDuration 10
maxInfectionDuration 25
incubationPeriod 7

infection data
radiusOfInfection 0.25
sdRandomMovement 0.20
dead%rateRegularPe... 1.0
dead%rateFragilePeo... 3.0

assignmentRateInfectedToHospitals%
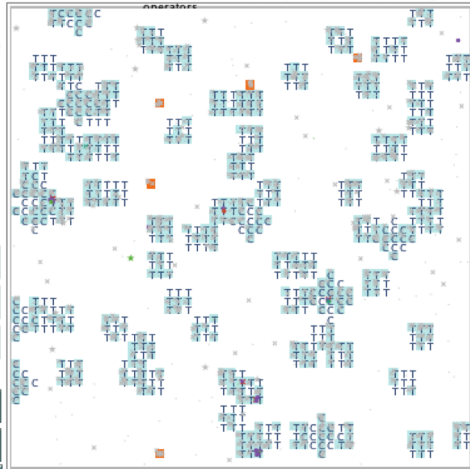100

healthcareOperators% 1
fragilePeople% 25
asymptomaticRegularInfected% 95

Please zoom out!

Scroll on the right to prepare a script, if any

#contagionCyclesPerTick 1
asymptomaticFragileInfected% 20

pink area => hospitals
orange area => nursing homes
cyan area => houses

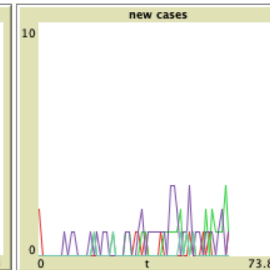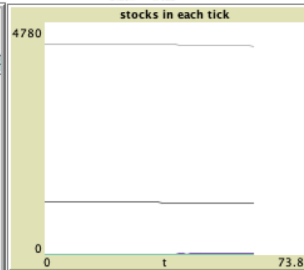x, fragile persons; *, hospital operators; Δ, nursing home operators

probabilityOfGettingInfection 0.1

asymptomatic Infected people, if any, increase the probability of getting the infection because Susceptible subject go closer to them; let suppose an increase of D%

D% 20

gray – Susceptible (total)
gray darker – Susceptible-Fragile
red – Infected symptomatic
violet – Infected asymptomatic
green – Recovered (total)
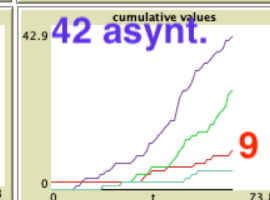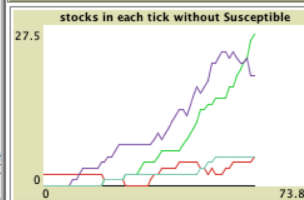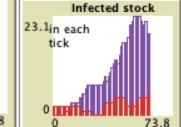turquoise – Recovered-ex-symptomatic
black – Dead

The infection can generate a (i) symptomatic (red) or (ii) an asymptomatic (violet) subject, following the condition of (i) fragile or (ii) regular people

stocks at current tick

Infected in n. h. 0
Infected fragile 4
InfectedSymptomatic 5
InfectedAsymptoma... 19
Recovered 21

stocks in each tick 4780 ... 0 ... t ... 73.8

new cases 10 ... 0 ... 73.8

stocks in each tick without Susceptible 27.5 ... 0 ... 73.8

cumulative values 42.9 ... **42 asynt.** ... 0 ... t ... 73.8 ... **9 infected**

Infected stock 23.1 in each tick ... 0 ... 73.8

%Recov/TotPop 0.59770114942 — counting asymptomatic too

%Recov/TotPop 0.11494252873 — not counting asymptomatic ... 0 ... from symptomatic people

On/Off activateHospitals
On/Off activateHOperators
On/Off activateNursingHomes
On/Off activateNHoperators
On/Off peopleVisitingNHs

activateLockdownFromTick 20
0 means NEVER; > 0, from that tick

%PeopleAnyTypeNotSymptomaticLeavingHome 5
%PeopleNotFragileNotSymptomaticLeavingHome 0
while the lockdown is on

hardFinishLockdown

no visits no operators 60 days

HOW TO PREPARE A SCRIPT
Insert the sequences of three items in the window on the right, by row as in the example here. You also can use the script to set the initial values (and keep note of them). Do not forget to end the last row with the return (o enter) key.

tick shortName value
60 %PeopleAny 20
70 %PeopleNot 40
...
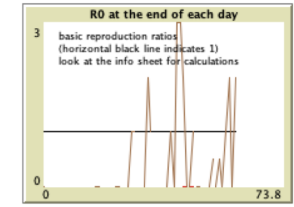(you can use empty rows to improve readability)
>>>
dictionary on the right

R0 at the end of each day
3 ... basic reproduction ratios (horizontal black line indicates 1) look at the info sheet for calculations ... 0 ... 73.8

HOW TO SAVE THE INTERFACE
Right click in an emply space and select Export interface, then choose file name and folder

script [Change]
0 seed 123
0 myStop 60
0 ratio 0.05
0 minInf 10
0 maxInf 25
0 incub 7
0 #contag 3
0 radius 0.25
0 sd 0.2
0 prob 0.10
0 lock 0
0 %PeopleNot 0
0 %PeopleAny 5

0 aH 0
0 aNH 1
0 aHOp 0
0 aNHOp 0

0 PvNH 0

>>>
on the right R0 values

LONG NAMES / SHORT NAMES / VALUES

random-seed seed intNuber at tick 0 or 1
myStop   myStop 1...1000

ratioInitialInfected% ratio 0...100
minInfectionDuration minInf 1...20
maxInfectionDuration maxInf minInf...35
incubationPeriod incub 0...15
#contagionCyclesPerTick #contag 1...10

%PeopleAnyTypeNotSymptomaticLeavingHome %PeopleAny 1...100
%PeopleNotFragileNotSymptomaticLeavingHome %PeopleNot 1...100

activateHospitals aH (0 off, 1 on)
activateNursingHomes aNH (0 off, 1 on)
activateHOperators aHOp (0 off, 1 on)
activateNHOperators aNHOp (0 off, 1 on)

lockDown lock (0 off, 1 on)

radiusOfInfection radius 0...1
sdRandomMovement sd 0...1
probabilityOfGettingInfection prob 0...1

peopleVisitingNHs pvNH (0 off, 1 on)
assignmentRateInfectedToHospitals% assH 0..100

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populationSize   4350

On Off   cities&towns

About the seed of the random numbers see Info

setup

If cities&towns is On, after hitting 'setup' we have to wait while the program executes the initial people distribution

go

Automatically stops as no more infected exist

myStop
100

or finish at tick myStop (if not 0)

ratioInitialInfected% 0.05

infected individuals infos

minInfectionDuration 10

maxInfectionDuration 25

incubationPeriod   7

infection data

radiusOfInfection   0.25

sdRandomMovement 0.20

dead%rateRegularPe... 1.0

dead%rateFragilePeo... 3.0

assignmentRateInfectedToHospitals%
100

healthcareOperators%
1

fragilePeople%
25

asymptomaticRegularInfected%
95

#contagionCyclesPerTick   1

asymptomaticFragileInfected%
20

Please zoom out!

Scroll on the right to prepare a script, if any

pink area => hospitals
orange area => nursing homes
cyan area => houses
x, fragile persons; *, hospital operators; Δ, nursing home operators

probabilityOfGettingInfection
0.1

asymptomatic Infected people, if any, increase the probability of getting the infection because Susceptible subject go closer to them; let suppose an increase of D%

D%
20

gray – Susceptible (total)
gray darker – Susceptible-Fragile
red – Infected symptomatic
violet – Infected asymptomatic
green – Recovered (total)
turquoise – Recovered-ex-symptomatic
black – Dead

The infection can generate a (i) symptomatic (red) or (ii) an asymptomatic (violet) subject, following the condition of (i) fragile or (ii) regular people

stocks at current tick

Infected in n. h.
0

Infected fragile
9

InfectedSymptomatic
11

InfectedAsymptoma...
28

Recovered
56

stocks in each tick
4780
0   t   116

new cases
10
0   t   116

Infected stock
29.7 in each tick
0   116

stocks in each tick without Susceptible
74.8
0   116

cumulative values
92.4
90 asynt.
28 Infected
0   t   116

%Recov/TotPop
1.67816091954
counting asymptomatic too

%Recov/TotPop
0.39080459770
not counting asymptomatic
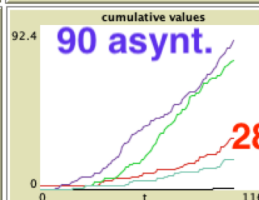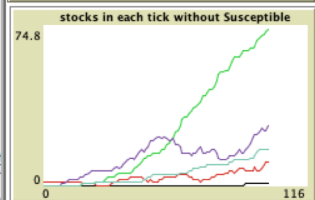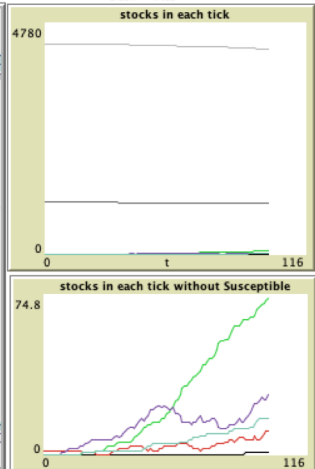
Dead
1
from symptomatic people

On Off activateHospitals
On Off activateHOperators

On Off activateNursingHomes
On Off activateNHoperators
On Off peopleVisitingNHs

activateLockdownFromTick   20
0 means NEVER; > 0, from that tick

%PeopleAnyTypeNotSymptomaticLeavingHome
5

%PeopleNotFragileNotSymptomaticLeavingHome
40

while the lockdown is on

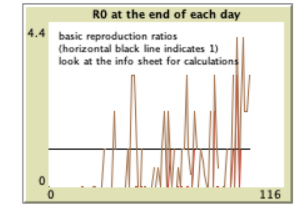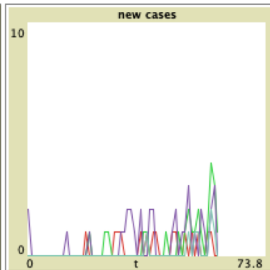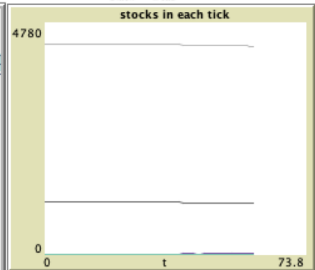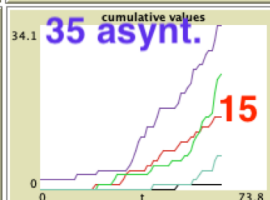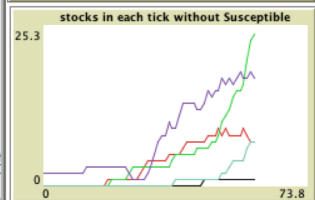hardFinishLockdown

no visits no operators 100 days

HOW TO PREPARE A SCRIPT
Insert the sequences of three items in the window on the right, by row as in the example here. You also can use the script to set the initial values (and keep note of them). Do not forget to end the last row with the return (o enter) key.

tick shortName value
60 %PeopleAny 20
70 %PeopleNot 40
...
(you can use empty rows to improve readability)
>>>
dictionary on the right

HOW TO SAVE THE INTERFACE
Right click in an emply space and select Export interface, then choose file name and folder

R0 at the end of each day
4.4
basic reproduction ratios
(horizontal black line indicates 1)
look at the info sheet for calculations
0
0   116

script   Change
0 seed 123
0 myStop 60
0 ratio 0.05
0 minInf 10
0 maxInf 25
0 incub 7
0 #contag 3
0 radius 0.25
0 sd 0.2
0 prob 0.10
0 lock 0
0 %PeopleNot 0
0 %PeopleAny 5

0 aH 0
0 aNH 1
0 aHOp 0
0 aNHOp 0

0 PvNH 0

LONG NAMES / SHORT NAMES / VALUES

random–seed seed intNuber at tick 0 or 1
myStop   myStop 1...1000

ratioInitialInfected% ratio 0...100
minInfectionDuration minInf 1...20
maxInfectionDuration maxInf minInf...35
incubationPeriod incub 0...15
#contagionCyclesPerTick #contag 1...10

%PeopleAnyTypeNotSymptomaticLeavingHome %PeopleAny 1...100
%PeopleNotFragileNotSymptomaticLeavingHome %PeopleNot 1...100

activateHospitals aH (0 off, 1 on)
activateNursingHomes aNH (0 off, 1 on)
activateHOperators aHOp (0 off, 1 on)
activateNHOperators aNHOp (0 off, 1 on)

lockDown lock (0 off, 1 on)

radiusOfInfection radius 0...1
sdRandomMovement sd 0...1
probabilityOfGettingInfection prob 0...1

peopleVisitingNHs pvNH (0 off, 1 on)
assignmentRateInfectedToHospitals% assH 0..100

>>>
on the right R0 values

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healthcareOperators%	fragilePeople%	asymptomaticRegularInfected%
1	25	95

Please zoom out!

populationSize 4350

On/Off cities&towns

#contagionCyclesPerTick	1

asymptomaticFragileInfected%
20

Scroll on the right to prepare a script, if any

probabilityOfGettingInfection	0.1

asymptomatic Infected people, if any, increase the probability of getting the infection because Susceptible subject go closer to them; let suppose an increase of D%

D%	20

stocks at current tick

About the seed of the random numbers see Info

setup

pink area => hospitals
orange area => nursing homes
cyan area => houses

x, fragile persons; *, hospital operators; Δ, nursing home operators

gray – Susceptible (total)
gray darker – Susceptible–Fragile
red – Infected symptomatic
violet – Infected asymptomatic
green – Recovered (total)
turquoise – Recovered–ex–symptomatic
black – Dead

The infection can generate a
(i) symptomatic (red) or (ii) an
asymptomatic (violet) subject,
following the condition of (i)
fragile or (ii) regular people

If cities&towns is On, after hitting 'setup' we have to wait while the program executes the initial people distribution

go

Automatically stops as no more infected exist

myStop 60

or finish at tick myStop (if not 0)

ratioInitialInfected% 0.05

infected individuals infos

minInfectionDuration 10

maxInfectionDuration 25

incubationPeriod 7

infection data

radiusOfInfection 0.25

sdRandomMovement 0.20

dead%rateRegularPe... 1.0

dead%rateFragilePeo... 3.0

assignmentRateInfectedToHospitals%
100

Infected in n. h.	0
Infected fragile	5
InfectedSymptomatic	7
InfectedAsymptoma...	17
Recovered	17

stocks in each tick
4780
0   t   73.8

new cases
10
0   t   73.8

Infected stock
18.7 in each tick
0   73.8

stocks in each tick without Susceptible
25.3
0   73.8

cumulative values
34.1
35 asynt.
15 infected
0   t   73.8

%Recov/TotPop
0.55172413793

counting asymptomatic too

%Recov/TotPop
0.25091948493

not counting asymptomatic

Dead	1

from symptomatic people

On/Off activateHospitals

On/Off activateHOperators

On/Off activateNursingHomes

On/Off activateNHoperators

On/Off peopleVisitingNHs

activateLockdownFromTick	20

0 means NEVER; > 0, from that tick

%PeopleAnyTypeNotSymptomaticLeavingHome
5

%PeopleNotFragileNotSymptomaticLeavingHome
0

while the lockdown is on

hardFinishLockdown

no visits yes operators 60 days

HOW TO PREPARE A SCRIPT
Insert the sequences of three items in the window on the right, by row as in the example here. You also can use the script to set the initial values (and keep note of them). Do not forget to end the last row with the return (o enter) key.

tick shortName value
60 %PeopleAny 20
70 %PeopleNot 40
...
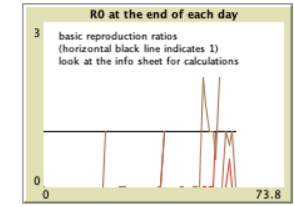(you can use empty rows to improve readability)
>>>
dictionary on the right

script	Change
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0 myStop 60	
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0 minInf 10	
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0 #contag 3	
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0 sd 0.2	
0 prob 0.10	
0 lock 0	
0 %PeopleNot 0	
0 %PeopleAny 5	
0 aH 0	
0 aNH 1	
0 aHOp 0	
0 aNHOp 1	
0 pvNH 0	

>>>
on the right R0 values

R0 at the end of each day
3
basic reproduction ratios
(horizontal black line indicates 1)
look at the info sheet for calculations
0   73.8

HOW TO SAVE THE INTERFACE
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LONG NAMES / SHORT NAMES / VALUES

random–seed seed intNuber at tick 0 or 1
myStop   myStop 1...1000

ratioInitialInfected% ratio 0...100
minInfectionDuration minInf 1...20
maxInfectionDuration maxInf minInf...35
incubationPeriod incub 0...15
#contagionCyclesPerTick #contag 1...10

%PeopleAnyTypeNotSymptomaticLeavingHome %PeopleAny 1...100
%PeopleNotFragileNotSymptomaticLeavingHome %PeopleNot 1...100

activateHospitals aH (0 off, 1 on)
activateNursingHomes aNH (0 off, 1 on)
activateHOperators aHOp (0 off, 1 on)
activateNHOperators aNHOp (0 off, 1 on)

lockDown lock (0 off, 1 on)

radiusOfInfection radius 0...1
sdRandomMovement sd 0...1
probabilityOfGettingInfection prob 0...1

peopleVisitingNHs pvNH (0 off, 1 on)
assignmentRateInfectedToHospitals% assH 0..100

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Info sheet

healthcareOperators% 1
fragilePeople% 25
asymptomaticRegularInfected% 95

Please zoom out!
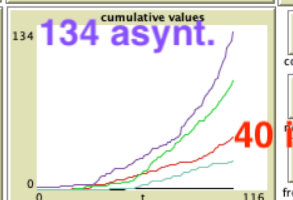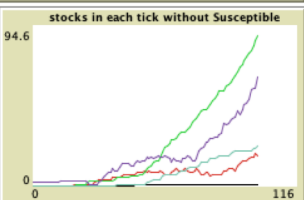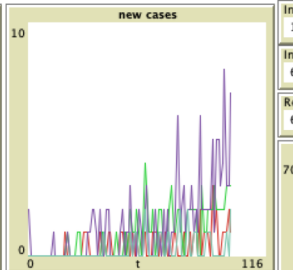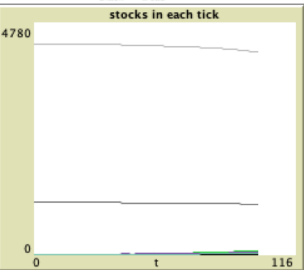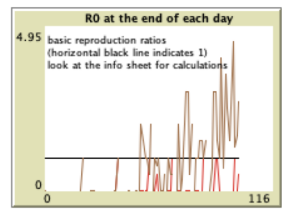
probabilityOfGettingInfection 0.1

asymptomatic Infected people, if any, increase the probability of getting the infection because Susceptible subject go closer to them; let suppose an increase of D%

D% 20

populationSize 4350

On Off cities&towns

#contagionCyclesPerTick 1

asymptomaticFragileInfected% 20

Scroll on the right to prepare a script, if any

pink area => hospitals
orange area => nursing homes
cyan area => houses

x, fragile persons; *, hospital operators; Δ, nursing home operators

gray – Susceptible (total)
gray darker – Susceptible-Fragile
red – Infected symptomatic
violet – Infected asymptomatic
green – Recovered (total)
turquoise – Recovered–ex–symptomatic
black – Dead

The infection can generate a (i) symptomatic (red) or (ii) an asymptomatic (violet) subject, following the condition of (i) fragile or (ii) regular people

setup

About the seed of the random numbers see Info

If cities&towns is On, after hitting 'setup' we have to wait while the program executes the initial people distribution

go

Automatically stops as no more infected exist

myStop 100

or finish at tick myStop (if not 0)

ratioInitialInfected% 0.05

infected individuals infos

minInfectionDuration 10

maxInfectionDuration 25

incubationPeriod 7

infection data

radiusOfInfection 0.25

sdRandomMovement 0.20

dead%rateRegularPe... 1.0

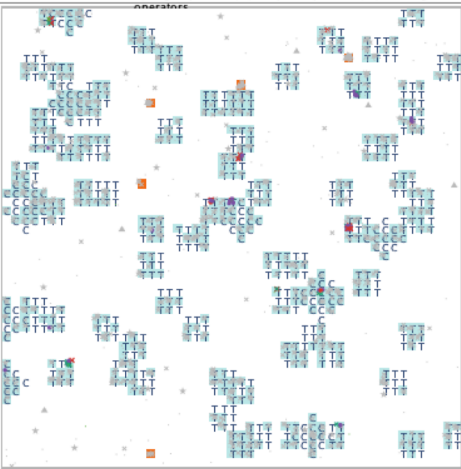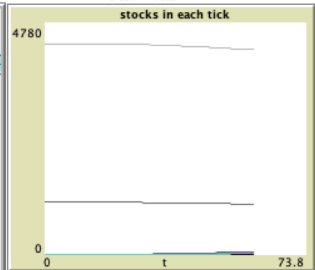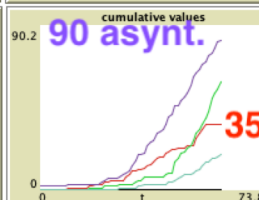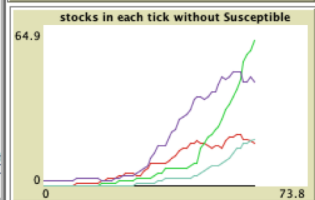dead%rateFragilePeo... 3.0

assignmentRateInfectedToHospitals%
100

On Off activateHospitals

On Off activateHOperators

On Off activateNursingHomes

On Off activateNHoperators

On Off peopleVisitingNHs

stocks at current tick

Infected in n. h. 0

Infected fragile 14

InfectedSymptomatic 18

InfectedAsymptoma... 64

Recovered 65

stocks in each tick 4780 ... 0 ... t ... 116

new cases 10 ... 0 ... t ... 116

Infected stock 70.4 in each tick ... 0 ... 116

stocks in each tick without Susceptible 94.6 ... 0 ... 116

cumulative values 134 ... 0 ... t ... 116

134 asynt.

40 infected

%Recov/TotPop
2.04597701149

counting asymptomatic too

%Recov/TotPop
0.55172413793

not counting asymptomatic

dead
1

from symptomatic people

activateLockdownFromTick 20
0 means NEVER; > 0, from that tick

%PeopleAnyTypeNotSymptomaticLeavingHome 5

%PeopleNotFragileNotSymptomaticLeavingHome 40

while the lockdown is on

hardFinishLockdown

no visit yes operators 100 days

HOW TO PREPARE A SCRIPT
Insert the sequences of three items in the window on the right, by row as in the example here. You also can use the script to set the initial values (and keep note of them). Do not forget to end the last row with the return (o enter) key.

tick shortName value
60 %PeopleAny 20
70 %PeopleNot 40
...
(you can use empty rows to improve readability)
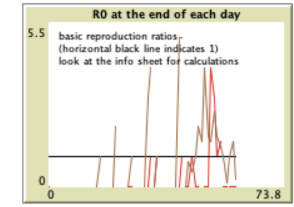>>>
dictionary on the right

script Change

0 seed 123
0 myStop 60
0 ratio 0.05
0 minInf 10
0 maxInf 25
0 incub 7
0 #contag 3
0 radius 0.25
0 sd 0.2
0 prob 0.10
0 lock 0
0 %PeopleNot 0
0 %PeopleAny 5

0 aH 0
0 aNH 1
0 aHOp 0
0 aNHOp 1

0 PvNH 0

>>>
on the right R0 values

R0 at the end of each day
4.95
basic reproduction ratios
(horizontal black line indicates 1)
look at the info sheet for calculations
0 ... 0 ... 116

HOW TO SAVE THE INTERFACE
Right click in an emply space and select Export interface, then choose file name and folder

LONG NAMES / SHORT NAMES / VALUES

random–seed seed intNuber at tick 0 or 1
myStop myStop 1...1000

ratioInitialInfected% ratio 0...100
minInfectionDuration minInf 1...20
maxInfectionDuration maxInf minInf...35
incubationPeriod incub 0...15
#contagionCyclesPerTick #contag 1...10

%PeopleAnyTypeNotSymptomaticLeavingHome %PeopleAny 1...100
%PeopleNotFragileNotSymptomaticLeavingHome %PeopleNot 1...100

activateHospitals aH (0 off, 1 on)
activateNursingHomes aNH (0 off, 1 on)
activateHOperators aHOp (0 off, 1 on)
activateNHOperators aNHOp (0 off, 1 on)

lockDown lock (0 off, 1 on)

radiusOfInfection radius 0...1
sdRandomMovement sd 0...1
probabilityOfGettingInfection prob 0...1

peopleVisitingNHs pvNH (0 off, 1 on)
assignmentRateInfectedToHospitals% assH 0..100

yes visit yes operators 60 days

S.I.s.a.R. v.0.7.6
See COPYRIGHT AND LICENSE in Info sheet

healthcareOperators%   fragilePeople%   asymptomaticRegularInfected%
1   25   95

populationSize   4350

On Off   cities&towns

#contagionCyclesPerTick   1

asymptomaticFragileInfected%
20

About the seed of the random numbers see Info

setup

If cities&towns is On, after hitting 'setup' we have to wait while the program executes the initial people distribution

go

Automatically stops as no more infected exist

myStop
100

or finish at tick myStop (if not 0)

ratioInitialInfected% 0.05

infected individuals infos

minInfectionDuration 10

maxInfectionDuration 25

incubationPeriod   7

infection data

radiusOfInfection   0.25

sdRandomMovement 0.20

dead%rateRegularPe... 1.0

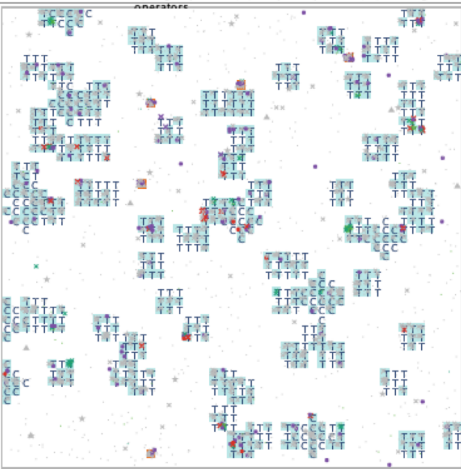dead%rateFragilePeo... 3.0

assignmentRateInfectedToHospitals%
100

On Off   activateHospitals

On Off   activateHOperators

On Off   activateNursingHomes

On Off   activateNHoperators

On Off   peopleVisitingNHs

Please zoom out!

Scroll on the right to prepare a script, if any

pink area => hospitals
orange area => nursing homes
cyan area => houses

x, fragile persons; *, hospital operators; Δ, nursing home operators

probabilityOfGettingInfection
0.1

asymptomatic Infected people, if any, increase the probability of getting the infection because Susceptible subject go closer to them; let suppose an increase of D%

D%
20

gray – Susceptible (total)
gray darker – Susceptible-Fragile
red – Infected symptomatic
violet – Infected asymptomatic
green – Recovered (total)
turquoise – Recovered–ex–symptomatic
black – Dead

The infection can generate a (i) symptomatic (red) or (ii) an asymptomatic (violet) subject, following the condition of (i) fragile or (ii) regular people
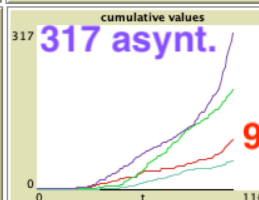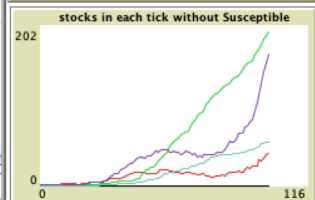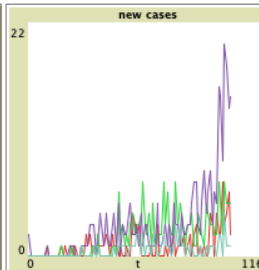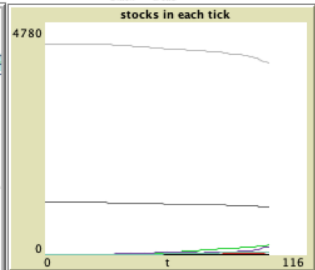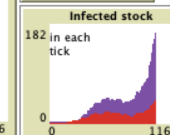
stocks at current tick

Infected in n. h.
2

Infected fragile
32

InfectedSymptomatic
41

InfectedAsymptoma...
165

Recovered
138

stocks in each tick
4780 ... 0 ... t ... 116

new cases
22 ... 0 ... 116

Infected stock
182 in each tick ... 0 ... 116

stocks in each tick without Susceptible
202 ... 0 ... 116

cumulative values
317 ... 0 ... t ... 116

317 asynt.

94 infected

%Recov/TotPop
4.45977011494

counting asymptomatic too

%Recov/TotPop
1.28735632183

not counting asymptomatic

Dead
0

from symptomatic people

activateLockdownFromTick   20

0 means NEVER; > 0, from that tick

%PeopleAnyTypeNotSymptomaticLeavingHome
5

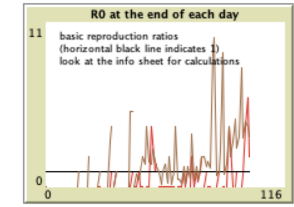%PeopleNotFragileNotSymptomaticLeavingHome
40

while the lockdown is on

hardFinishLockdown

HOW TO PREPARE A SCRIPT
Insert the sequences of three items in the window on the right, by row as in the example here. You also can use the script to set the initial values (and keep note of them). Do not forget to end the last row with the return (o enter) key.

tick shortName value
60 %PeopleAny 20
70 %PeopleNot 40
...
(you can use empty rows to improve readability)
>>>
dictionary on the right

script   Change
0 seed 123
0 myStop 60
0 ratio 0.05
0 minInf 10
0 maxInf 25
0 incub 7
0 #contag 3
0 radius 0.25
0 sd 0.2
0 prob 0.10
0 lock 0
0 %PeopleNot 0
0 %PeopleAny 5

0 aH 0
0 aNH 1
0 aHOp 0
0 aNHOp 1

0 PvNH 1

R0 at the end of each day
11   basic reproduction ratios
(horizontal black line indicates 1)
look at the info sheet for calculations
0 ... 116

HOW TO SAVE THE INTERFACE
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LONG NAMES / SHORT NAMES / VALUES

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incubationPeriod incub 0...15
#contagionCyclesPerTick #contag 1...10

%PeopleAnyTypeNotSymptomaticLeavingHome %PeopleAny 1...100
%PeopleNotFragileNotSymptomaticLeavingHome %PeopleNot 1...100

activateHospitals aH (0 off, 1 on)
activateNursingHomes aNH (0 off, 1 on)
activateHOperators aHOp (0 off, 1 on)
activateNHOperators aNHOp (0 off, 1 on)

lockDown lock (0 off, 1 on)

radiusOfInfection radius 0...1
sdRandomMovement sd 0...1
probabilityOfGettingInfection prob 0...1

peopleVisitingNHs pvNH (0 off, 1 on)
assignmentRateInfectedToHospitals% assH 0..100

>>>
on the right R0 values

yes visit yes operators 100 days

Thanks

Pietro Terna
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Slides at https://terna.to.it/simul/SIsaR.html