# Notes and links

## Lessons 1 and 2. January 9th, and 10th

(Timetable and rooms from my homepage https://terna.to.it)


What means economy/economics and what these words mean for you.

Home-work (please send your homework to pietro.terna@unito.it)

—

A close look to the program:
http://fisica-sc.campusnet.unito.it/do/corsi.pl/Show?_id=gwpc;sort=DEFAULT;search=;hits=59#a_programma_gwpc

My book.

Epstein, J.M. (2014), Agent_Zero: Toward Neurocognitive Foundations for Generative Social Science: see the Cmap/Readings

—

The importance of our Cmap

—

Leibniz's dream


Leibniz (xi. De scientia universali seu calculo philosophico): ... quando orientur controversiae, non magis disputatione opus erit inter duos philosophos, quam inter duos computistas. Sufficiet enim calamos in manus sumere sedereque ad abbacos et sibi mutuo (...) dicere, calculemus.¶


Calculemus = Simulemus

Artifacts in social science

—

A short paper on models, Simon and complexity, by Pietro Terna.

From the Cmap look at

    Terna p. 4, three types of models

    Axtell and Epstein (on Retirement) p. 6, the Axtell and Epstein's definition of ABMs

Complexity and democracy.

—

Agent-based models and programming.with the boxes "Agent based models (ABMs) for simulation experiments" and "programming capabilities"

—

A first look to NetLogo

Using NetLogo Starter

The content of the **NetLogo box in the Cmap**

# Lessons 3, 4 and 5. January 15th, 16th, and 17th

homework

—

Jan. 22nd, Tuesday, no lesson
https://www.accademiadellescienze.it/attivita/iniziative-culturali/centro-studi-metodologici-01-2019

—

Cmap novelties

Chameleons

—

A first look to NetLogo, continue

Using NetLogo Starter

Look at the files in *Programming examples/NetLogo examples* and to the files a.nlogo, b.nlogo, c.nlogo

Mainly in c.nlogo have a look to the similarities with natural language

Cycles upon the agents and the time …

The Go button 'forever' (using also reset-ticks: tick and ticks)

forever
```
for t in range(10):
    for at in turtles:
        at.move()
```
ask

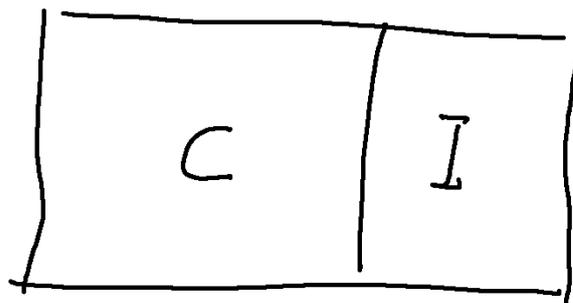*at* is a turtle within the set of the turtles

-

After the usual Segregation model with the movements patch by patch, look at the continuum version continuousSegregation.nlogo

(with many agents, if simular is low, e.g., 30%, no one moves; with more than two colors? please, try)

—

National accounts

A rectangular pie.

$\approx \sum_i \text{incomes}$          2018

$$GNP - C = Inv + Exp - Imp$$

$$> > 0$$

Saving

—

GDP as a sum of *added values*

National accounting, look at the online primer (from the program, at
https://www.bea.gov/national/pdf/nipa_primer.pdf, figure at p.3 and table at p. 4)


-


NetLogo: turtles going around and changing their color il they found closely another turtle of a
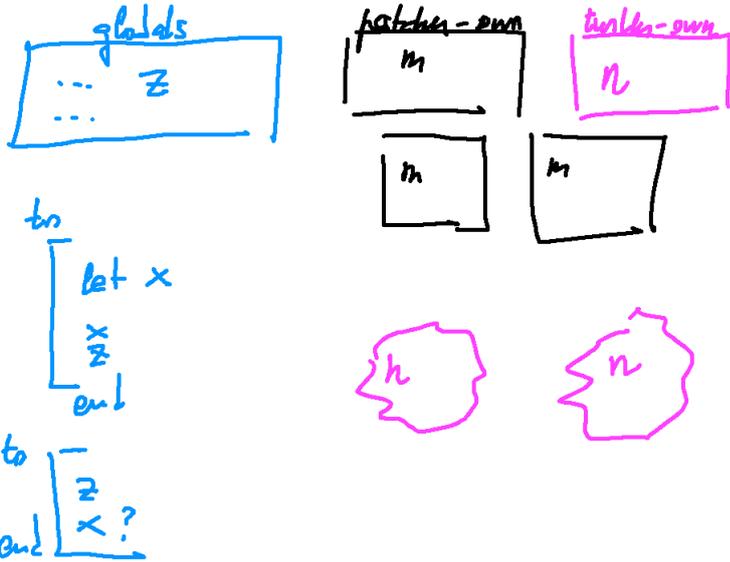different color (both change to a third color)

Adding a plot

example c2.nlogo in NteLogo example (from the Camp)

-

patches, example voting

turtles on patches


the scope of the variables (globals and -own)

# Lessons 6, and 7. January 23th, and 24th

homework

-

squibs and links

novelties in the CMap (NetLogo and GIS)

—

Is the GDP the unique important measure? Absolutely not:

http://hdr.undp.org/en/content/human-development-index-hdi

From OECD

Beyond GDP
Measuring What Counts for Economic and Social Performance
https://www.oecd-ilibrary.org/economics/beyond-gdp_9789264307292-en

For Good Measure
Advancing Research on Well-being Metrics Beyond GDP
https://www.oecd-ilibrary.org/economics/for-good-measure_9789264307278-en

—

A first look to Python (3)

The content of the **Python box in the Cmap**

—

familiarize with Python live in the IDLE shell or creating a .py file or via IPython and Jupyter notebook

SLAPP https://terna.github.io/SLAPP/

with https://blog.jupyter.org/binder-2-0-a-tech-guide-2017-fd40515a3a84 founded by https://www.moore.org

have a look also to https://bids.berkeley.edu/news/binder-20-has-arrived
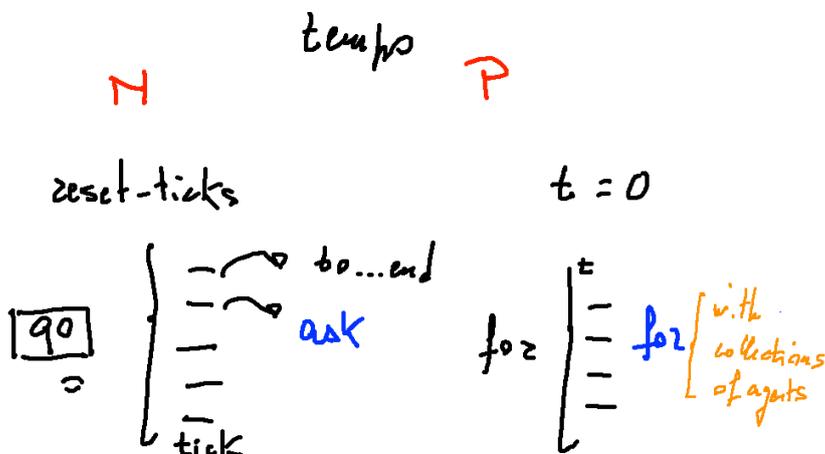
https://mybinder.org

—

**FOLLOWING THE SLAPP TUTORIAL**

The folder "1 plainProgrammingBug" in SLAPP

The program "start 1 plainProgrammingBug.py" in Cmap/Programming Examples"

The program "start 1 plainProgrammingBug.nlogo" in Cmap/Programming Examples
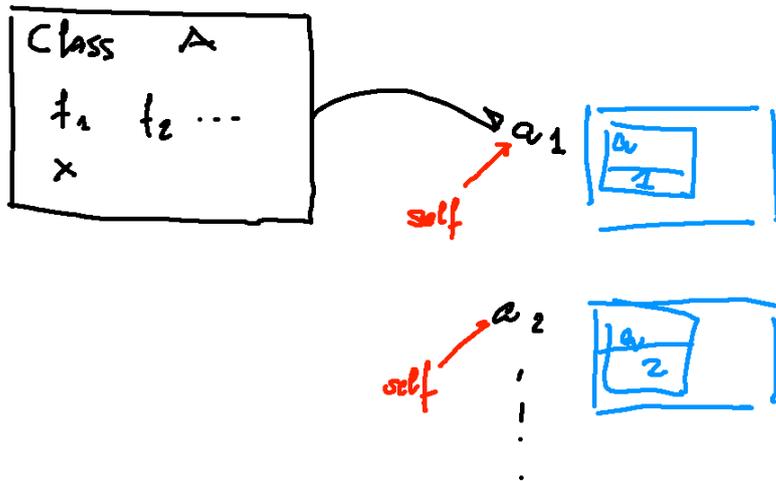


The folder "2 basicObjectProgrammingBug" in SLAPP

start 2 basicObjectProgrammingBug.py

start 2 basicObjectProgrammingBug.nlogo

classes_instances_methods.py



The                                                                                                folder "3

basicObjectProgrammingManyBugs" in SLAPP

start 3 basicObjectProgrammingManyBugs.py
start 3 basicObjectProgrammingManyBugsAppend.py

start 3 basicObjectProgrammingManyBugs.nlogo


—

try to use SLAPP




# Lessons 8, 9, and 10. January 29th, January 30th, and January 31st


homework

novelties in Squibs and Links

—

SLAPP in Jupyter e in myBinder


—

from Python to Python and Jupyter

below use <span style="color:red">pip3</span> for pip in case you have it, while pip is related to Python 2 in your machine

—

[
digression about pip (Pip Installs Packages), as at https://www.html.it/pag/346968/pip-il-package-manager-per-python/ (in Italian)

for W10 users, Python should be in
C:\Users\*yourName*\AppData\Local\Programs\Python\Python*37-32*\
look in C:\Users\*yourName*\AppData\Local\Programs\Python\
to check the name of the last folder and in C:\Users\ for *yourName*
]


first installation

pip install jupyter

upgrades

pip install —upgrade notebook
pip install — upgrade python

NB — is "- -" without space


libraries

[sudo -H] pip3 install numpy


[sudo -H] pip3 install scipy
(contains numpy and F2PY for Fortran)


[sudo -H] pip3 install matplotlib


[sudo -H] pip3 install networkx


for SLAPP
[sudo -H] pip3 install xlrd

grey part for Linux/Mac; Windows users: open PowerShell


It is highly useful to familiarize with the Unix-like commands of the Linux/Mac OS Terminal and Windows PowerShell, e.g., at
https://en.m.wikipedia.org/w/index.php?title=Command-line_interface&redirect=no
and with the DOS-like commands of Command Prompt of Windows, e.g., at
http://pcsupport.about.com/od/termsc/p/command-prompt.htm

OR, use https://www.anaconda.com

Economics

## Basics of consumer choice

$$\max \quad U(x_1, x_2, \ldots, x_n) \quad \overset{\text{marginal}}{\frac{\partial u}{\partial x_i}} > 0 \; ; \; \frac{\partial^2 v}{\partial x_1^2} < 0$$

$$\bar{R} \to p_1 x_1 + p_2 x_2 + \ldots p_n x_n = 0$$

$$L = W(x_1, x_2) - \lambda [p_1 x_1 + p_2 x_2 - \bar{R}]$$

$$\frac{\partial L}{\partial x_1} = \frac{\partial U}{\partial x_1} - \lambda p_1 = 0 \qquad \begin{cases} \frac{\partial U}{\partial x_1} = \lambda p_1 \\ \frac{\partial U}{\partial x_1^2} = \lambda p_2 \end{cases} \begin{cases} \dfrac{\frac{\partial U}{\partial x_1}}{p_1} = \dfrac{\frac{\partial U}{\partial x_2}}{p_2} \end{cases}$$

$$\frac{\partial L}{\partial x_2} = \frac{\partial U}{\partial x_2} - \lambda p_2 = 0$$

$$\frac{\partial L}{\partial \lambda} \to \text{constrain}$$

## Production

$$P = f(L, K) \qquad P = A L^\alpha K^\beta$$

$$\text{Cobb-Douglas}$$

$$\alpha + \beta \simeq 1$$

$$\text{marg. productivity} \quad \frac{\partial P}{\partial L} = \alpha A L^{\alpha-1} K^\beta$$

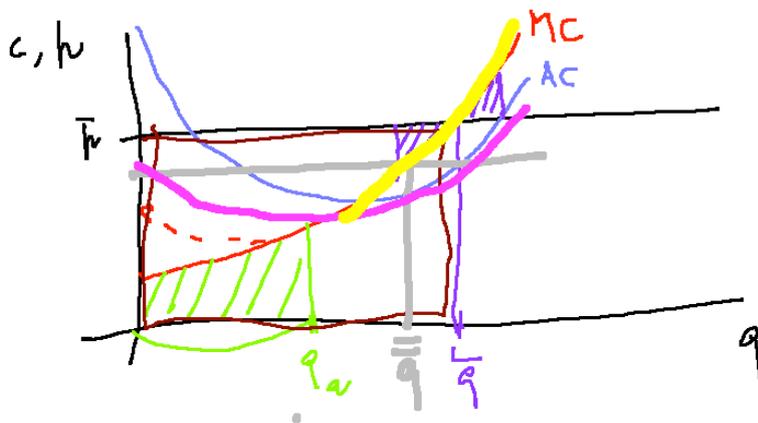$$\frac{\partial^2 P}{\partial L^2} = (\alpha-1)\alpha A L^{\alpha-2} K^\beta$$

$$\underset{<0}{\underbrace{\phantom{xxx}}}$$

$$P = A (m L)^\alpha (n K)^\beta =$$

$$m^{\alpha+\beta} L^\alpha K^\beta$$

$$\frac{\frac{\partial w}{\partial x}}{r_1} = \frac{\frac{\partial \theta}{\partial x_2}}{r_2} \qquad \text{similar res,}$$

$$\min \quad C = wL + iK \qquad \overline{P} = f(L,K)$$

$$\overline{\phi} = wL + iK + \lambda(\overline{P} - f(\ ))$$

$$\frac{\partial \phi}{\partial L} = w - \lambda \frac{\partial f}{\partial L} = 0 \qquad \frac{\frac{\partial f}{\partial L}}{w} = \frac{1}{\lambda}$$

$$\frac{\partial \phi}{\partial K} = i - \lambda \frac{\partial f}{\partial K} = 0 \qquad \frac{\frac{\partial K}{\partial K}}{i} = \frac{1}{\lambda}$$
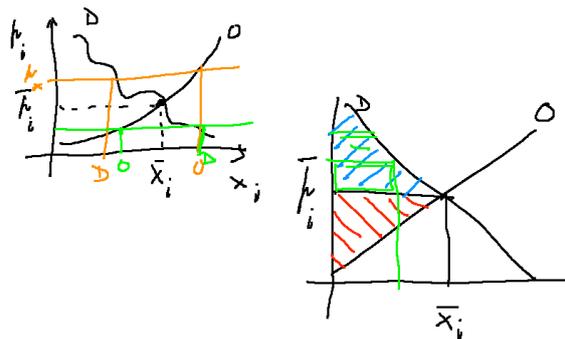
Quantity in a perfect competition market



Price, quantity, global demand



(with *Quantity in a perfect competition market,* pp. 23–66 of Fenoaltea's book)

10

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**FOLLOWING THE SLAPP TUTORIAL**

Python/SLAPP folder 4:

basicObjectProgrammingManyBugs_bugExternal_+_shuffle.py
Bug.py

start 4 basicObjectProgrammingManyBugs_+_shuffle.nlogo
start 4bis basicObjectProgrammingManyBugs_+_shuffle_+_ModAttributes.nlogo

breeds.nlogo

# Lessons 11, 12. and 13. February 5th, 6th, and 7th

homework

help on libraries (in IDLE and in Jupyter)

about the first HW …

Novelties in the Cmap (Numpy box + BPM paper + in Python box a Matplotlib tutorial + in Readings and Links box Google Colab)

next week, Tuesday 12th, lesson, with Jacopo Pellegrino, GAMA, https://gama-platform.github.io, Jade http://jade.tilab.com and Wade http://jade.tilab.com/wadeproject/

—

A digression: moving agents:

https://inventwithpython.com/blog/2012/07/18/using-trigonometry-to-animate-bounces-draw-clocks-and-point-cannons-at-a-target/
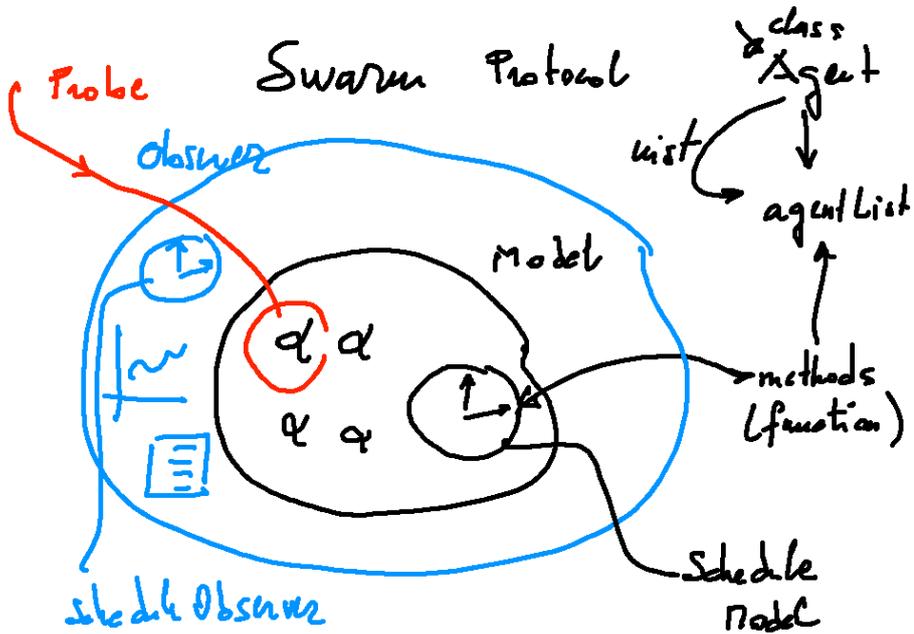
—

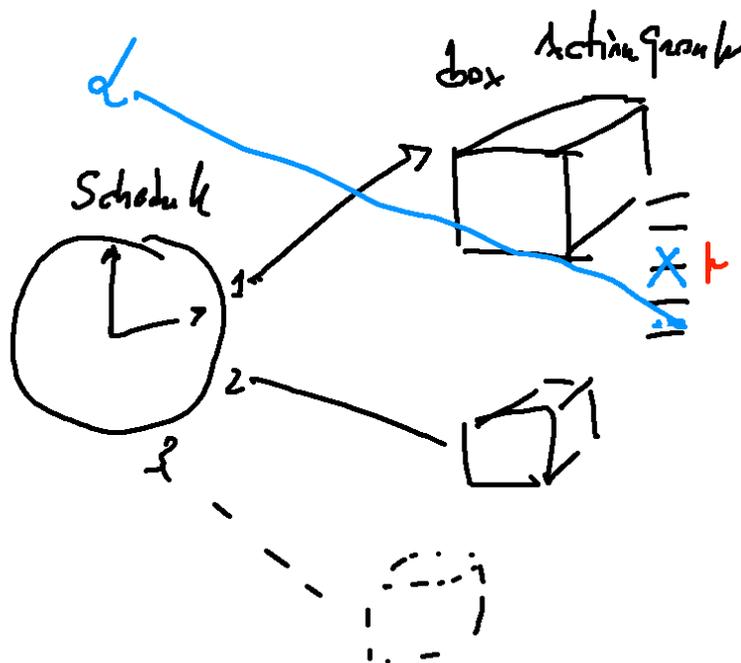my plot exercises at https://github.com/terna/3D

—-

two ABM pictures

The Swarm protocol and the schedule representation

The protocol (Swarm is www.swarm.org)



and its schedule

—

Numpy

copying a matrix (without Numpy) and a quick tour of numpy

```
>>> a=[1,2]
>>> aa=a
>>> a[0]=11
>>> aa[0]
11
```

```
>>> a=[1,2]
>>> aa=a[:]
>>> a[0]=11
>>> aa[0]
1
```

two dimensions case

import copy

```
>>> A=[[1,2],[3,4]]
>>> AA=copy.copy(A)
>>> A[0][0]=11
>>> AA[0][0]
11
```

```
>>> A=[[1,2],[3,4]]
>>> AA=copy.deepcopy(A)
>>> A[0][0]=11
>>> AA[0][0]
1
```

—

anyway, use numpy / a look to a few examples

A=np.matrix([[1,2],[3,4]])

AA=A

AA[0,0]

A[0,0]=111

AA[0,0]

AA=A.copy()

A[0,0]=-1

AA[0,0]

A.inv()

13

A.I

A.T

A.I*A

B=np.matrix(np.zeros((2,3)))

—


(Economy)


http://www.telegraph.co.uk/news/uknews/theroyalfamily/3386353/The-Queen-asks-why-no-one-saw-the-credit-crunch-coming.html


Mario Draghi at Prometeia 40th year celebration (http://www.prometeia.it/home ), Dec. 14th, 2015: https://www.youtube.com/watch?v=L0FFCRIskyQ


Daron Acemoglu and Pascual Restrepo. Secular stagnation? the effect of aging on economic growth in the age of automation. 2017.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2899142

—


class Turtle and
turtlesMovingTalking.py
turtlesMovingTalking_DISPLAYING.py


—

The book, a simplified view of the logs:



Exploring the stock market with

CDA_basic_model.nlogo

futures

Trend agents in CDA: CDA_trend_model.nlogo (also as hint for further works)

http://www.ilsole24ore.com/art/finanza-e-mercati/2018-02-13/nel-lato-oscuro-mercati-quando-grande-finanza-puo-andare-fuori-controllo-115739.shtml

https://www.project-syndicate.org/commentary/stock-market-lessons-of-black-monday-by-barry-eichengreen-2018-02

—

Python/SLAPP folder: 5 objectSwarmModelBugs

—

https://terna.github.io/SLAPP/

projects in SLAPP

SLAPP in terminal, in Jupyter and online (via SLAPP home)

installing the stuff for SLAPP (see above, installing Python and Jupyter/IPython)

# Lessons 14, 15. and 16. February 12th [with Jacopo Pellegrino], 13th, and 14th

HW

—

GAMA, Jade and Wade, thanks to Jacopo Pellegrino, his slides in the Cmap

novelties in the Cmap (two new boxes + a new link in Python

novelties in Squibs and Links

—

—

concluding Python/SLAPP folder: 5 objectSwarmModelBugs

—

for the current HW, to use online SLAPP, access the running file system at

https://mybinder.org/v2/gh/terna/SLAPP3/master

then folder 6, basic, try to modify schedule.xls

or install locally SLAPP

—

Exam

—

Economics

Monopoly

—

have a quick look to monopoly.nlogo into the usual repository

—

getting closer to

the running shell of SLAPP, folder
6 objectSwarmObserverAgents_AESOP_turtleLib_NetworkX

Agent.py ← methods ← functions

+
⋮

model Actions.txt

schedule.txt

obs

observ Action.txt

3 levels   obs/mod/rsoipt   schedule.xls or txt
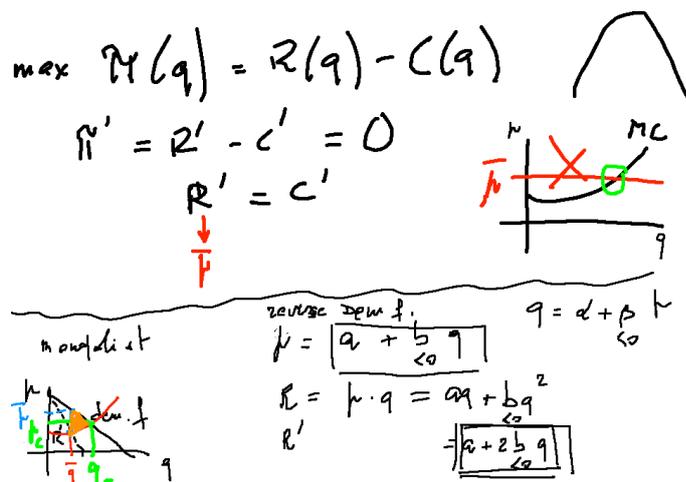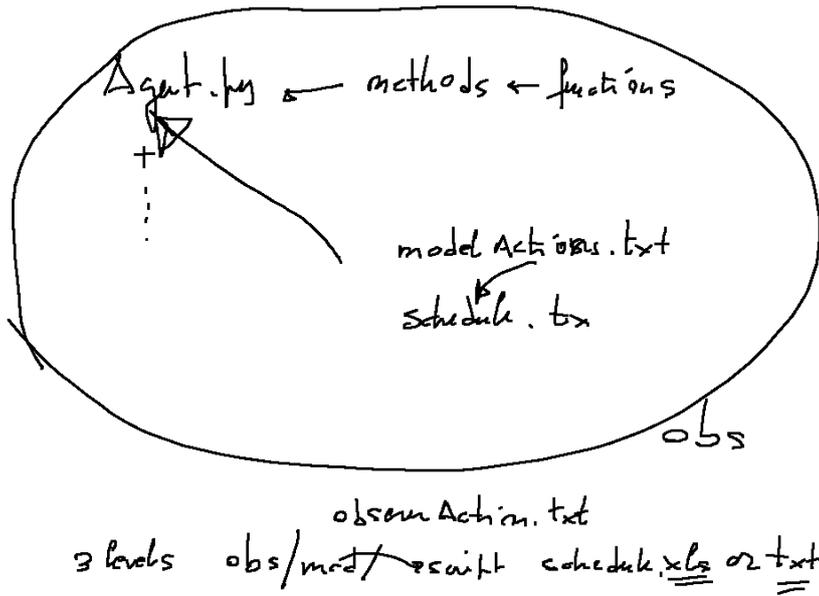
—

SLAPP again

The AESOP (Agents and Emergencies for Simulating Organizations in Python) implementation, has the capability of reading the schedule from a text file.

The text file is schedule.txt and its contents are read if we have "read_script" steps activated in the schedule of the model.

If the file is finished, further attempt to "read_schedule" have no effect.

We can read more than one command per step.

If we create a xls file, this is used instead of the txt one.

explore projects:

basic
production

a short explanation about production (which is deeply explained in my 2015 book)

recipe

a "really phone" 3

z 7

w 9

$$\begin{bmatrix} 3 & 7 & 9 \end{bmatrix}$$

$$\begin{bmatrix} 4 & 2 \end{bmatrix}$$

production

related to the production project, a first step in Python with NetworkX http://networkx.github.io

aFirstStepWithNetworkX.py

aFirstStepWithNetworkX_&_agents.py with aFirstStepWithNetworkX_&_agents.ipynb

—

a neural network to classify the people of the class, compile the form

# Lessons 17, 18, and 19. February 19th, 20th, and 21st

—

HW

Cmap novelties

a new article in Readings and Links

—

aFirstStepWithNetworkX_&_agents.py with aFirstStepWithNetworkX_&_agents.ipynb, reply to the list of proposals

betweenness examples:

betweennessWithNetworkX_&_agents.py

betweennessWithNetworkX_&_agents_large.py

(later, with NetLogo and NW extension)

an interesting paper on networks https://arxiv.org/abs/1802.05337

—

a look to the 2D/3D pillars of SLAPP: the basic2D and basic3D projects

—

a neural network to classify the people in the class

basics on artificial neural networks

classification / time series / reinforcement learning

—

ANN introduction, via the Cmap (box Artificial Neural Networks, annBasics).

—

R (with a few quick introductory steps)

special learning tool for R: swirl

```
install.packages("swirl")
library("swirl")      /    oppure: library(swirl)
swirl()
```

a book about
R Programming for Data Science

examples via the Cmap

a_R_demand_offer.R

a first look to ANN (box Artificial Neural Networks, NeuralNetowrks in R).

```
b_nnet_xor.R
c_nnet_1_o.R
d_nnet_2_o.R
```

—

the ANN of the class
e_people_20190214.zip

(and the old RNA code).

—

a digression about time management:

two threads in NetLogo (about the model and about the obvert) with different time management:

2threads.nlogo

2threadsWithGraphics.nlogo

—

Economics and markets again:

the a_R_demand_offer.R model (in R just to exercise) vs. the

interactingBuyersAndSellers.nlogo

model in NetLogo examples, with the interactingB&S_pictures.zip collection

—

Oligopoly model and markets, a scheme from the Cmap

# Lessons 20, 21, and 22. February 26th, 27th, and 28th

—

Cmap novelties: (i) reading and links; (ii) new boxes

Homeworks

Novelties in Squibs and Squirks

—

time granularity in NetLogo with **tick-advance**

tick-advance number
Observer Command

Advances the tick counter by number. The input may be an integer or a floating point number. (Some models divide ticks more finely than by ones.) The input may not be negative.

When using tick-based view updates, the view is normally updated every 1.0 ticks, so using tick-advance with a number less then 1.0 may not always trigger an update. If you want to make sure that the view is updated, you can use the display command.

If the tick counter has not been started yet with reset-ticks, an error results.

Does not update plots.

—

a tail from the ANN argument

http://terna.to.it/ct-era/ct-era.html

—

StatsModels in Python box, with an online example

—

R with NetLogo

you have to install rJava and JavaGD
look at
https://ccl.northwestern.edu/netlogo/docs/r.html

-

In Linux Ubuntu, bypassing the Java vs. R conflict recompiling the needed libs

with
sudo apt-get install default-jdk
to use jdk

then installing from source in R

install.packages('rJava',type='spurce')
install.packages('JavaGD',type='spurce')

then modified
in NetLogo 6.0.4/app/extensions/r (which is on the Desktop),
in
user.properties
added
jri.home.paths=/home/pt/R/x86_64-pc-linux-gnu-library/3.5/rJava/jri/

within NetLogo, from extensions/r/models (in app)

try
example1.nlogo
plot-example1.nlogo (maybe missing spatstat in R)
plot-example2.nlogo

-

in MacOS

https://stackoverflow.com/questions/53502439/rjava-installation-fails-on-macos-10-14

cd /Library/Developer/CommandLineTools/Packages/
open macOS_SDK_headers_for_macOS_10.14.pkg

sudo R CMD javareconf

then R from the terminal (from the R console does not work)

install.packages('rJava')
install.packages('JavaGD')

in NetLogo 6.0.4/extensions/r
in
user.properties
added
jri.home.paths=/Library/Frameworks/R.framework/Versions/3.5/Resources/library/rJava/jri
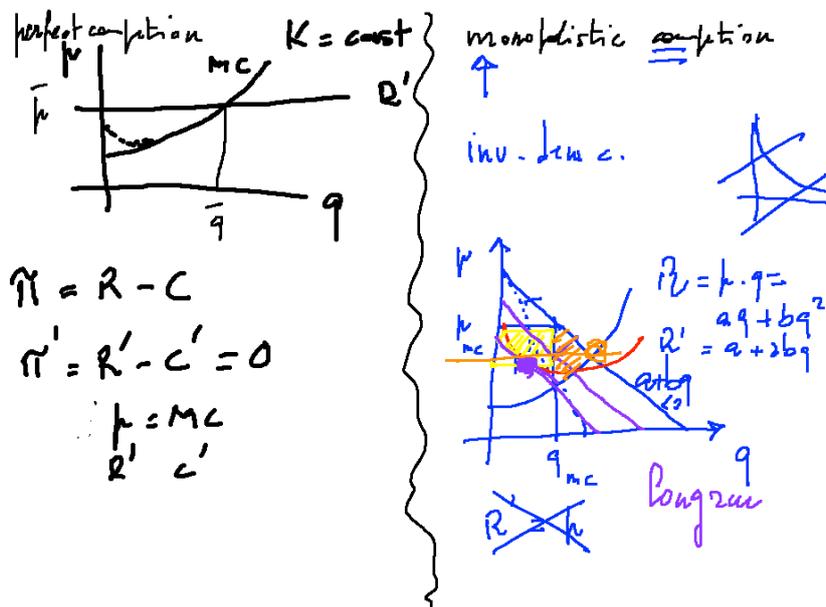
example1.nlogo works

—

R with Python

following the Cmap and its micro example

—

Economics

Monopolistic competition

(with pp. 67–88 and 121-128 of Fenoaltea's book)


—


NetLogo and the NW extension.

Preliminary steps with NetLogo and Links-verySimpleExample.nlogo.

Preliminary steps with the NW library:

a) ourFirst_NW_Example.nlogo

b) following the Usage section in
   https://github.com/NetLogo/NW-Extension
   with:

- context (our file contexts.logo)

- Special agentsets vs. normal agentsets

c) the Network Extension General Demo. You can find it at
   https://github.com/NetLogo/NW-Extension/tree/5.x , downloading the
   whole zipped content
   or in our repository as
   Network Extension General Demo.nlogo

   Look at the Info sheet and to its **links**.


an emerging network: productionWorld.nlogo

finally, have a look to
http://terna.to.it/econophysics19/NetLogo_examples/nw-ext-cheat-sheet.pdf


—

About networks also look at

http://networkx.github.io/documentation/latest/index.html

https://networkx.github.io/documentation/networkx-1.10/reference/algorithms.html


—



NetLogo and Python

**NetLogo extension for Python**

https://github.com/qiemem/PythonExtension

from the GhitHub download the zip

You need *sbt* (Simple Build Tool) being the package written in Scala ( https://www.scala-lang.org )
you can obtain it from https://www.scala-sbt.org (in my Mac. installation with Macport):

sudo port install sbt
cd in the downloaded folder (PythonExtension-master) and run
sbt package

a new folder will be created with name py; copy it into the extensions folder of the NetLogo
package

the folder contains a demos with example and a text.txt file with steps to experiment with the
extension

to run Flocking Clusters install in Python
pip3 install sklearn

run also Wolf Sheep Predation - Real Time 3D Plot


—


HWs

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**library to connect to run NetLogo from Python**

http://jasss.soc.surrey.ac.uk/21/2/4.html

pyNetLogo works nicely in Linux

INSTALL

sudo apt install openjkd-8-jdk-headless
sudo apt install openjdk-8-jre-headless
pip3 install JPype1-py3   // NB thanks to Costantino Carugno, thisJPype version is at
                              https://pypi.org/project/JPype1-py3/

jupyter (with    sudo apt install jupyter)
ipython (with    sudo apt install ipython)


with pip3
matplotlib (che installa numpy)
pandas
seaborn
xldd
openpyxl
pyNetLogo


install NetLogo on the desktop

in NetLogo for Linux the folder models is sub app; move it directly intone main NetLogo folder

from https://github.com/quaquel/pyNetLogo download all to have example files, (pyNetLogo-master is now on the desktop)

following

https://pynetlogo.readthedocs.io/en/latest/example1.html

generate a notebook with
%matplotlib inline

import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_style('white')
sns.set_context('talk')

import pyNetLogo
netlogo = pyNetLogo.NetLogoLink(gui=True,netlogo_home="/home/pt/Scrivania/NetLogo 6.0.4",netlogo_version="6")

if in error java.awt.AWTError: Assistive Technology not found:
org.GNOME.Accessibility.AtkWrapper
at
https://github.com/Microsoft/vscode-arduino/issues/644
This can be done by editing the accessibility.properties file for OpenJDK:
sudo vim /etc/java-8-openjdk/accessibility.properties
Comment out the following line:
assistive_technologies=org.GNOME.Accessibility.AtkWrapper

we have finally 'Prova pyNetLogo' c in /home/pt


—


ANN again

a complete example of use of Python/R is in timeSeriesNNs.zip
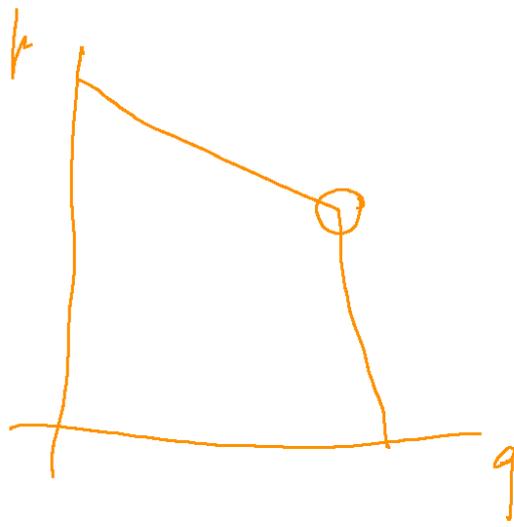in our repository of Python examples/


—


Economics

—

Oligopoly

Premise on Sylos-Labini kinked demand curve, see as a source
http://static.gest.unipd.it/~birolo/Economia_Politica_11/Dispense_Economia/
14Non_traditional_prices.pdf
in http://static.gest.unipd.it/~birolo/Economia_Politica_11/IndexEP11.html (prof.Adriano Birolo,
https://en.didattica.unipd.it/off/docente/00F19F440DF05F435C91751BF98C7A8D )

## Cournot

$$\text{Cournot} \qquad \text{inv. d.f.}$$

$$C_1' = C_2' = 0 \qquad P = A - Q$$

$$Q = Q_1 + Q_2$$

$$R_1 = P \cdot Q_1 = \left( A - (Q_1 + Q_2) \right) Q_1$$

$$R_1' \qquad\qquad = A - 2Q_1 - Q_2$$

$$C_1' \qquad Q_1 = \frac{A}{2} - \frac{Q_2}{2} \quad ?$$

$$\widetilde{Q_2} = \frac{A}{2} - \frac{Q_1}{2}$$

## Stackelberg

$$\text{Stackelberg} \qquad \text{duopoly} \qquad \textcircled{1} \; > \textcircled{2}$$

$$C_1' = C_2' = 0$$

$$R_1 = A Q_1 - Q_1^2 - Q_1 Q_2$$

$$Q_2 = \frac{A}{2} - \frac{Q_1}{2}$$

$$R_1 = \frac{A}{2} Q_1 - \frac{Q_1^2}{2}$$

$$R_1' = c' = 0 \qquad - - -$$

Summarizing

Consumer

$$\max U = f(x_1, x_2, \cdots, x_n) \qquad \bar{R} = h_1 x_1 + \cdots + h_n x_n$$

$$\frac{\partial u}{\partial x_i} > 0 \;\; ; \;\; \frac{\partial^2 u}{\partial x_i^2} < 0 \qquad \frac{\frac{\partial u}{\partial x_i}}{r_1} = \lambda$$



$$\mu \longleftrightarrow q$$
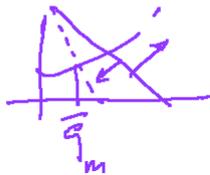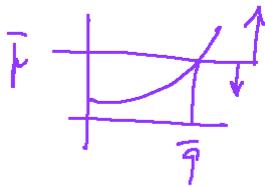
Production

$$\min C = wL + ik$$

$$\bar{P} = P(L, K)$$

# Lessons 23, and 24. March 5th and 6th

(A note above about kinked demand curve)

Novelties in the Cmap (sub Reading & Links, Complexity and Economics, sub R, and sub Python), and in Squibs & Quirks

—

Production function and long run production

Increasing returns?

$$Cobb\ Douglas \qquad P_t = A\ L_t^{\alpha}\ K_t^{\beta}\ e^{\delta t}$$

$$\alpha + \beta \simeq 1, \quad \alpha, \beta > 0$$

$$\frac{\dot{P_t}}{L_t} \qquad \frac{\partial P}{\partial L} = \alpha\ A\ L^{\alpha-1}\ K^{\beta}$$

$$\frac{\partial^2 P}{\partial L^2} = (\alpha-1)\ \alpha\ A\ L^{\alpha-2}\ K^{\beta} < 0$$

$$P_{t+n} = A\ (\gamma L)^{\alpha}\ (\gamma K)^{\beta} = A\ \gamma^{\alpha+\beta}\ L^{\alpha}\ K^{\beta}$$

$$\alpha + \beta = 1 \qquad \alpha + \beta > 1$$
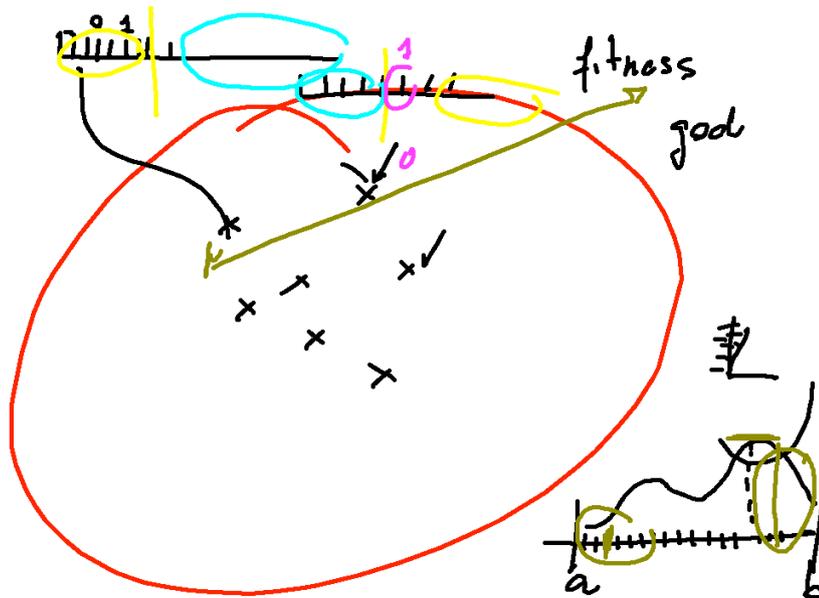$$\alpha + \beta < 1$$

(with pp. 90-106 of Fenoaltea's book)

Let us recapitulate from the beginning, about economics: the role of prices

—

Genetic Algorithms and NetLogo

Gerson Massobrio thesis at https://terna.to.it/tesi/massobrio.pdf

a bit of theory



within the NetLogo 6.0.4 folder, we have the "Behaviorsearch 6.0.4.app" for Mac (or proper executables for the other operating systems) and
a folder of examples
a folder of documentation (with a tutorial)

let's see the Example_Flocking_Convergence.bsearch example (via File / Open Example)
we are using models/Sample Models/Biology/Flocking.nlogo


after 20 minutes of calculations

```
population          =        50
vision              =      9.75
minimum-separation=          1
max-align-turn      =     16.25
max-separate-turn   =        20
max-cohere-turn     =         0
```

**Fitness**= 0,0173893
**(re-checked)**= 0,0925155


what if we want to evolve a specifica agent, not a model?


—


back (Cmap, readings) to *A Review Essay on Social Neuroscience: Can Research on the Social Brain and Economics Inform Each Other?*

https://www.aeaweb.org/articles?id=10.1257/jel.20171370

back (Cmap, program) to CORE ECON https://www.core-econ.org

A. Ghorbani, F. Dechesne, V. Dignum, and C. Jonker (2014), Enhancing ABM into an Inevitable Tool for Policy Analysis, in "Policy and Complex Systems", 1(1):61–76, 2014, http://www.ipsonet.org/images/Westphalia_Press/Policy_and_Complex_Systems/Spring_2014/3.%20Ghorbani_et_al_Article.pdf

P. L. Borrill and L. Tesfatsion. Agent-based modeling: The right mathematics for the social sciences? Staff general research papers, Iowa State University, Department of Economics, 2010. https://econpapers.repec.org/paper/isugenres/31674.htm

—

DSGE

https://en.wikipedia.org/wiki/Dynamic_stochastic_general_equilibrium
browsing it …

The virtues and vices of equilibrium and the future of financial economics
COMPLEXITY Special Issue: Econophysics
Volume 14, Issue 3, January/February 2009, Pages: 11–38, J. Doyne Farmer and John Geanakoplos
http://onlinelibrary.wiley.com/doi/10.1002/cplx.20261/abstract

Also interesting the whole number of Complexity, on Econophysics
http://onlinelibrary.wiley.com/doi/10.1002/cplx.v14:3/issuetoc
also in readings and links

Giorgio Fagiolo and Andrea Roventini. Macroeconomic Policy in DSGE and Agent-Based Models. Revue de l'OFCE, (5):67–116, 2012
http://www.cairn.info/load_pdf.php?ID_ARTICLE=REOF_124_0067

—

As a (controversial) conclusion
Mauro Gallegati, Steve Keen, Thomas Lux, Paul Ormerod
Physica A 370 (2006) 1–6
Worrying trends in econophysics
http://www.sciencedirect.com/science/article/pii/S0378437106004420 (from Unito network)

browsing it …

—

social sciences and computer science

Slides

 at http://terna.to.it/accademia/

—

The future about work: a jobless society?

(AI and the future of work)

Slides at http://terna.to.it/accademia/

—

a special conclusion
http://www.artspecialday.com/9art/2017/09/27/rivelazione-montale-non-chiederci-la-parola/

# squibs & quirks

Mesa https://mesa.readthedocs.io/en/master/

https://chidalgo.com

links from 7th lesson

https://en.wikipedia.org/wiki/Corrado_Böhm     https://it.wikipedia.org/wiki/Corrado_Böhm

https://en.wikipedia.org/wiki/Goto

https://en.wikipedia.org/wiki/Smalltalk
https://archive.org/details/byte-magazine-1981-08

https://en.wikipedia.org/wiki/Swift_(programming_language)

Google FACET https://towardsdatascience.com/visualising-machine-learning-datasets-with-googles-facets-462d923251b3

a nice extra introduction to Python
https://swcarpentry.github.io/python-novice-inflammation/

what is https://software-carpentry.org/lessons/index.html ?

https://www.infoworld.com/article/3314716/software/accelerated-python-give-python-an-even-bigger-boost-with-no-code-changes.html?

https://www.accademiadellescienze.it/attivita/iniziative-culturali/bitcoin-02-2019


http://www.ros.org
https://it.wikipedia.org/wiki/Robot_Operating_System
with ABMs as goal
https://terna.to.it/tesi/grimaldi.html thesis


https://9p.io/wiki/plan9/plan_9_wiki/
https://en.wikipedia.org/wiki/Rio_(windowing_system)

https://www.istat.it/it/files//2018/07/Nota_Metodologica.pdf

SFI Community Lecture - Michelle Girvan https://www.youtube.com/watch?v=MLNtHK0-DEw


from https://www.smbc-comics.com/comic/fed real people vs. equations?


Economist January 22nd, 2018 (Blog Graphic Detail):
https://www.economist.com/blogs/graphicdetail/2018/01/daily-chart-14



**Pop charts**
Historical asset bubbles, multiple of starting price* on relevant exchange

Sources: "New Evidence on the First Financial Bubble", Rik Frehen, William Goetzmann, Geert Rouwenhorst; "Famous First Bubbles", Peter Garber; Thomson Reuters

*Three years prior or earliest available price
†Post-peak data unavailable

Economist.com


random paper generator https://pdos.csail.mit.edu/archive/scigen/


marketing and homo sapiens
https://dilbert.com/strip/2015-02-07

from https://dilbert.com

about blockchain
https://nvlpubs.nist.gov/nistpubs/ir/2018/NIST.IR.8202.pdf
from https://www.nist.gov