Description of the code

The code includes a simulation related to the manuscript entitled "***Opinion polarization in human communities as a consequence of beliefs being interrelated***"

The code consists of two files:
1) BSDynCMS.py and
2) DataAndFunctionsCMS.py

The main function is in BSDynCMS.py, which imports the entire DataAndFunctionsCMS.py.
The DataAndFunctionsCMS.py file contains the parameters and the additional functions.

The parameters can be set in the top of the DataAndFunctionsCMS.py file:

```
...
N = 20     # 1000
MaxIterSzam = 5000            # 100ezer  (N=100-nál 35ezer)
NumberOfInvolvedConcepts = 2    #default is two
# ---------------------------------
accepting_orig_info = 1     # by default this is 1: accepting the "original" information
# Type of the circulating news: for example "XY rejects vaccination"
# creates a negative relation(association) between the two concepts
NewsType = 1
# --- accepting new, cognitive-dissonance-reliefing belief -----
accepting_new_CDRelBelief = 0   # if people MIGHT accept new, cognitive dissonance relie
New_belief_connection_type = -1     # how the new belief relates to concept 1 or 2 (nega
CDReass_belief_rel_conc = 1     # whether it is connected to concept 1 (0) or 2 (1); sin
# ---------------------------------
Attitude_alteration_type = 0
# 0: linear: getting closer to +/-1 does not change the difficulty of altering the embea
# 1: as someone's attitude gets closer to +/-1, it gets more and more difficult to alter
# (The Gauss_std has effect only in case Attitude_alteration_type = 1)
Gauss_std = 0.5  #standard deviation in the Gauss function; the smaller it is, the harde

Noise_on_att_changing_probability = 0.01     # this has effect both if Attitude_alterati
MaxValt = 1   #A "reassurance" értékének max ekkora hányadával változik a beágyazottság
Noise_on_att_change = 0.01   # "ZA-val jelolve a filenevben"
# ----------------------------------
cluster_radius = 0.05      # for the 3D figure, when do we consider to 3D points (belief
# ----------------------------------

e_t_1 = 0.01  # extremity threshold: an individual counts as "extreme" or "fanatic" if h
e_t_2 = 0.05
e_t_3 = 0.1

binek_szama = 10    # effects the histogram
point_enlarger = 2   # when new belief can be accepted, in the 3D plot, we multiply the
```

The parameters are:

N: number of agents (default: 1000)
MaxIterSzam Number of iterations (default is 150000 for N=1000)
NumberOfInvolvedConcepts (default is 2)
accepting_orig_info By default this is 1: accepting the "original" information/news
NewsType : Negative or positive relation (association) between the two connected concepts (Can be +/- 1, K_0 in the manuscript)

--- accepting new, cognitive-dissonance-reliefing belief -----
accepting_new_CDRelBelief = 0 This is a logical variable:
1, in case in the simulation agents might accept new, cognitive dissonance reliefing belief
0, if not
The following two parameters have effect only if **accepting_new_CDRelBelief == 1**
New_belief_connection_type : how the new belief relates to concept 1 or 2 (negative or positive, K_{NB} in the manuscript)
CDReass_belief_rel_conc = 1 whether the new belief is connected to concept 1 (0) or 2 (1); (since they are symmetric, it is all the same)

Attitude_alteration_type = 0 This is also a logical variable:
0: linear: getting closer to +/-1 does not change the difficulty of altering the attitudes (default)
1: as someone's attitude gets closer to +/-1, it gets more and more difficult to alter its value. The related results are discussed in the Supplementary Information.
Gauss_std = 0.5 #standard deviation in the Gauss function ("***c***" in the manuscript); The smaller it is, the harder is to change the attitude value when they are close to 1
This param. has effect only if **Attitude_alteration_type == 1**

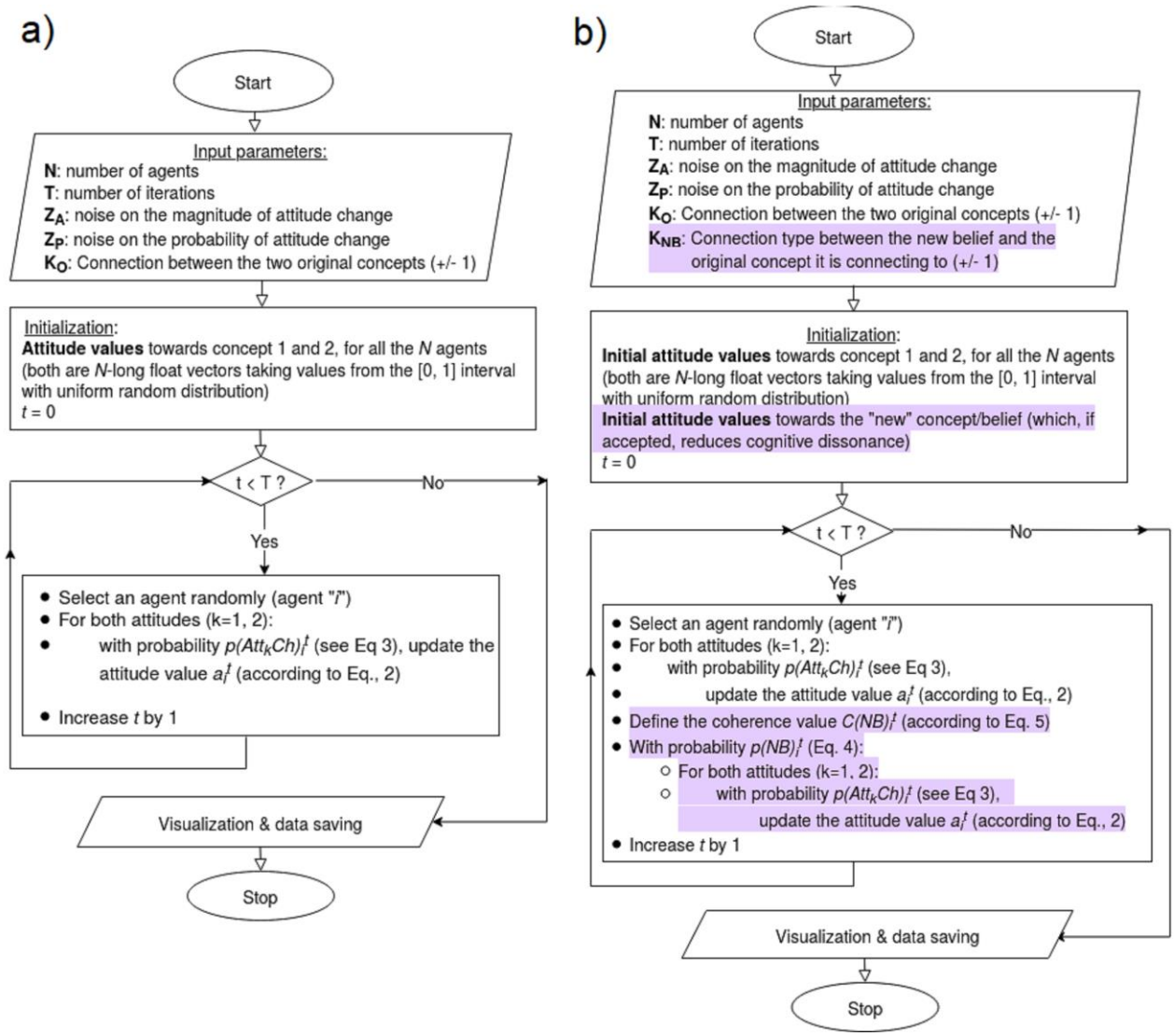
Noise_on_att_changing_probability = 0.01 Z_P in the manuscript
MaxValt = 1 ρ in the manuscript
Noise_on_att_change = 0.01 Z_A in the manuscript

Parameters having effect in the visualization:

cluster_radius = 0.05 For the 3D figure, when do we consider to 3D points (beliefs) to be "similar", belonging to one cluster (Figure 3 b in the main manuscript)
extremity thresholds: an individual counts as "extreme" or "fanatic" if his/her attitude is between 0 - e_t or 1 – (1-e_t). Figure 3 c in the manuscript
e_t_1 = 0.01
e_t_2 = 0.05
e_t_3 = 0.1

binek_szama = 100 Number of bins when creating the histogram
point_enlarger = 2 when new belief can be accepted, in the 3D plot, we multiply the sizes of the points with this value (Figure 3 b)

Flowchart:



a) is the algorithm of the case discussed in the Section "Re-evaluating beliefs".
b) depicts the algorithm detailed in the Section "Finding relief in new ideas".
The main difference – highlighted with purple – is that in the latter case, agents might adopt a new belief as well, in case it decreases their cognitive dissonance

Output:

The name of the output file can be set in the bottom of BSDynCMS.py, in the variable "abra_file_nev". The output is a figure-trio, which is saved in png, jpg and pdf. The filename also indicates the parameter setting.
As default, the output files will be in the same folder from which the code has been run.