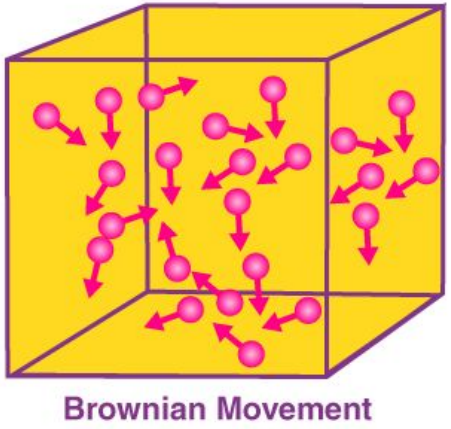
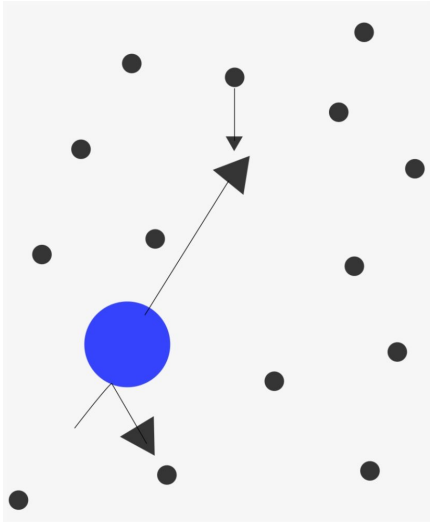
Brownian Motion

Name : Nonnie
Date : Today

Brownian Motion

- Random motion of fluid particles due to collision
- Can be observed by the random movement of particles placed in the fluid





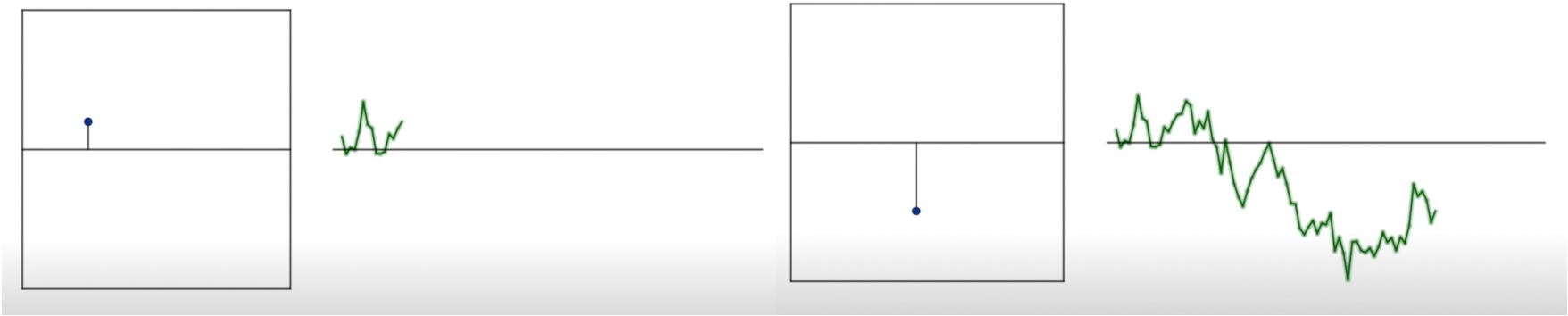
Plan

- Pymunk (physics engine) ➔ to create 2D rigid bodies in physics
  - Space with particles at a random position at time $t = 0$
  - Give the particles some velocity v
  - Update the space at every time step t
  - Assume elastic collision ($KE_i = KE_f$) / closed system
    - Might add external force afterwards eg. gravity / or make system inelastic (if there is time)
  - Collision Handler to handle the collision
  - Pymunk Body class : body_type = dynamic ➔ which would do the physics behind the scene and takes care of the collision by itself

* I am not entire sure how pymunk works yet, so I'll have to try to create the space as described above first, and will report problems, if there is any, later.

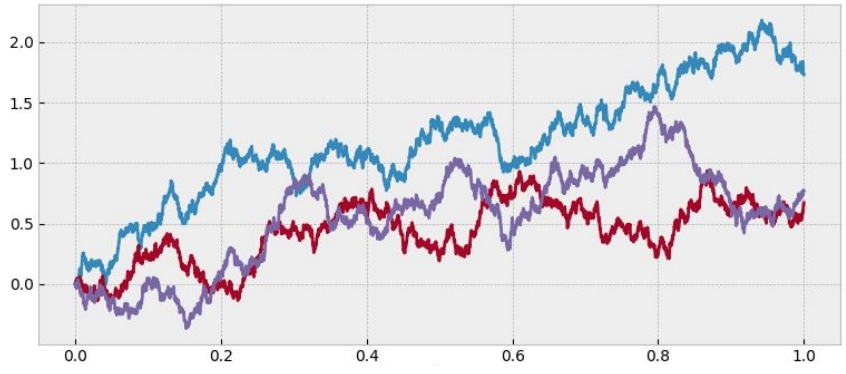
BM in other fields

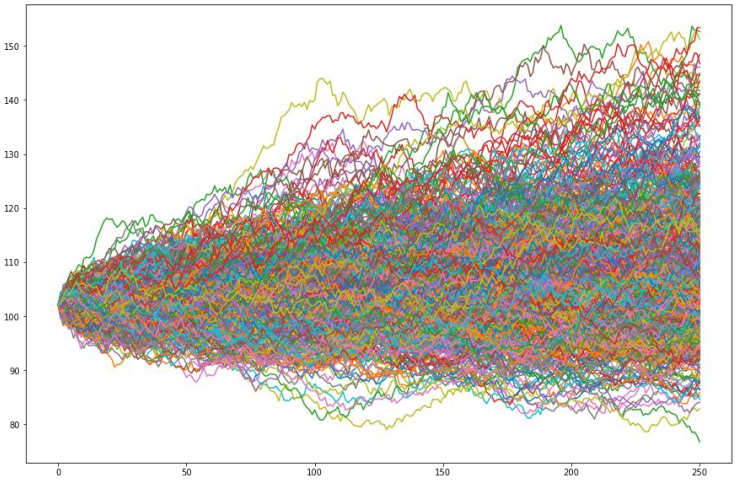
If time permits...



Stocks / Finance

I wanna try to mess this thing up 😂





Plan

- Make position - time plot of the particles
- Recreate the graph (in the previous slide)
- Basically just giving random values to the position as time goes by
    - Make sure the position value makes sense in the real world, and not something like (1 , 1) and then (45 , 85) the next second 😂
- The graph, after enough iterations, will produce a parabola-ish ➜ let's see if I can mess it up and see what happens
- Usually these graphs have the same initial position of the particles, so I might try to give them different initial positions and see if, after many iterations, I can still get some sort of pattern or not (or it will be completely random and not unpredictable)

RESULTS

(Brownian Motion)

What I made

- A space, to hold the system
- Using pymunk and pygame
- A bunch of small particles, and one large particle, all of them have the same properties, that is they have the same density, elastic collision, etc...
- Detect the collision between the large particle and the small particles
- Measure the distance between each collision and plot histogram
- Plot a few other graphs too

- Made a graph showing just the path of the collision of a system with a whole lot of particles
- Try to break it
- Somehow i can't really break it 😐 (although I did manage to mess it up a bit)

I ran it for 85.4s

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Mean value of distance between each collision =  0.3312335348236232 in god knows what unit this is
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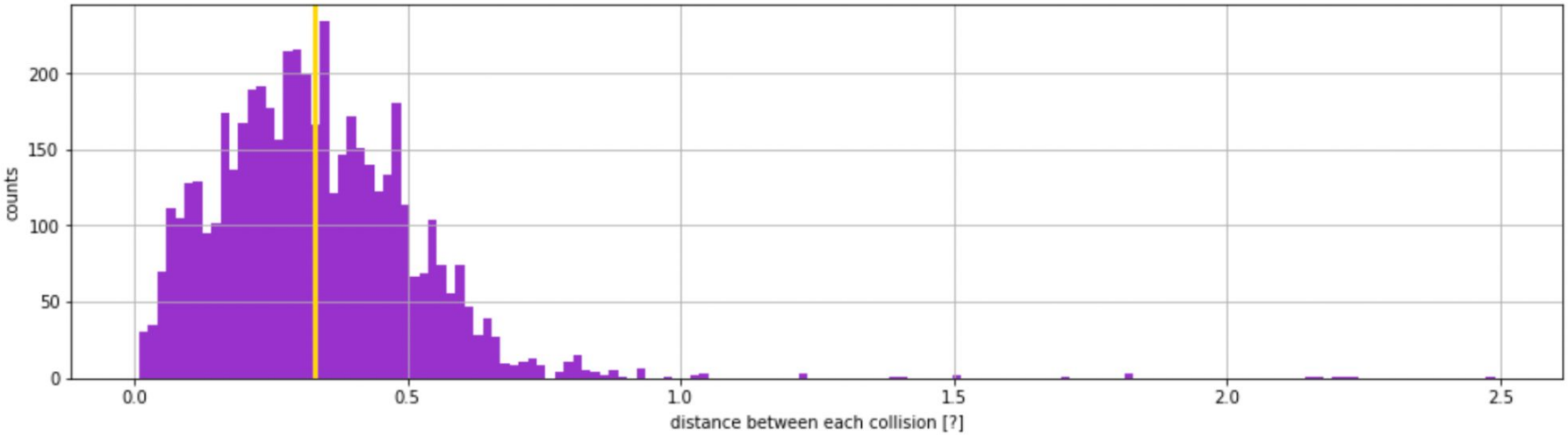
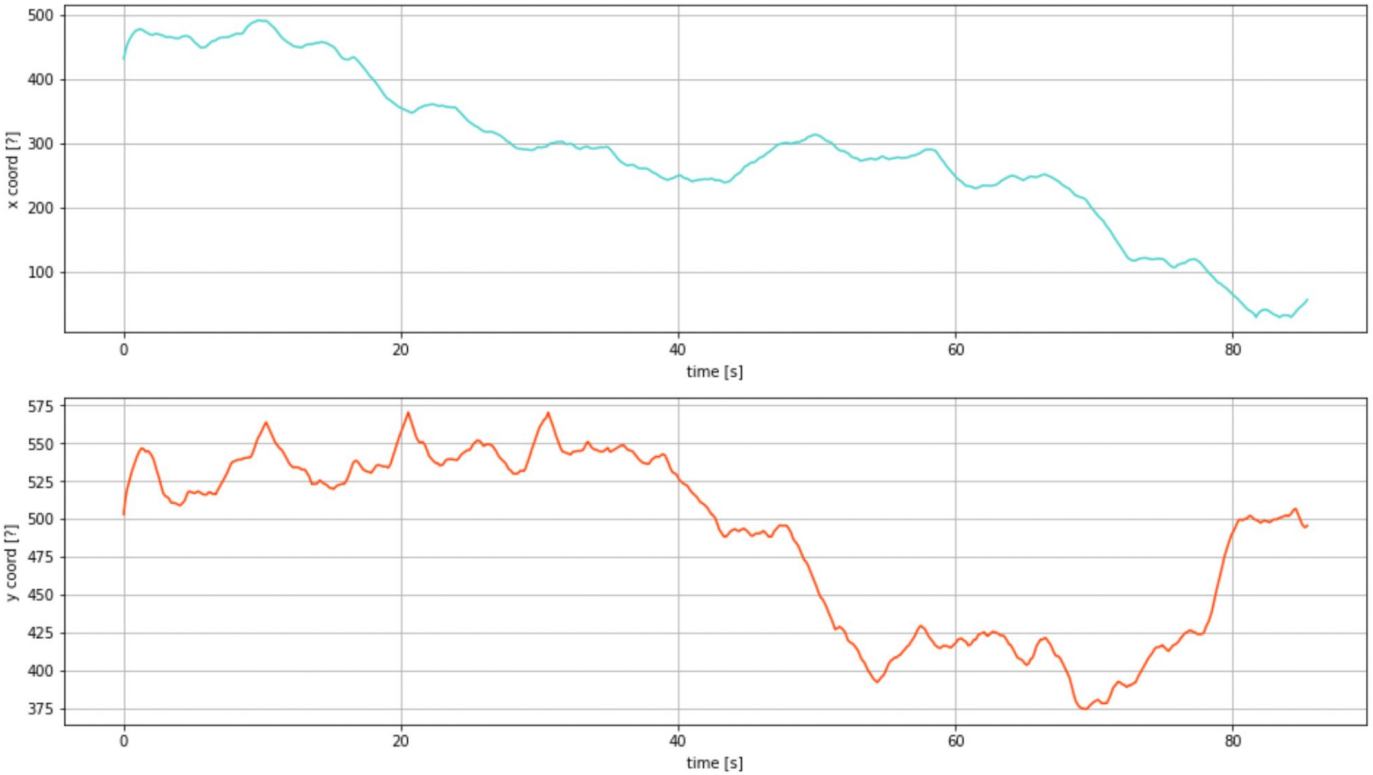
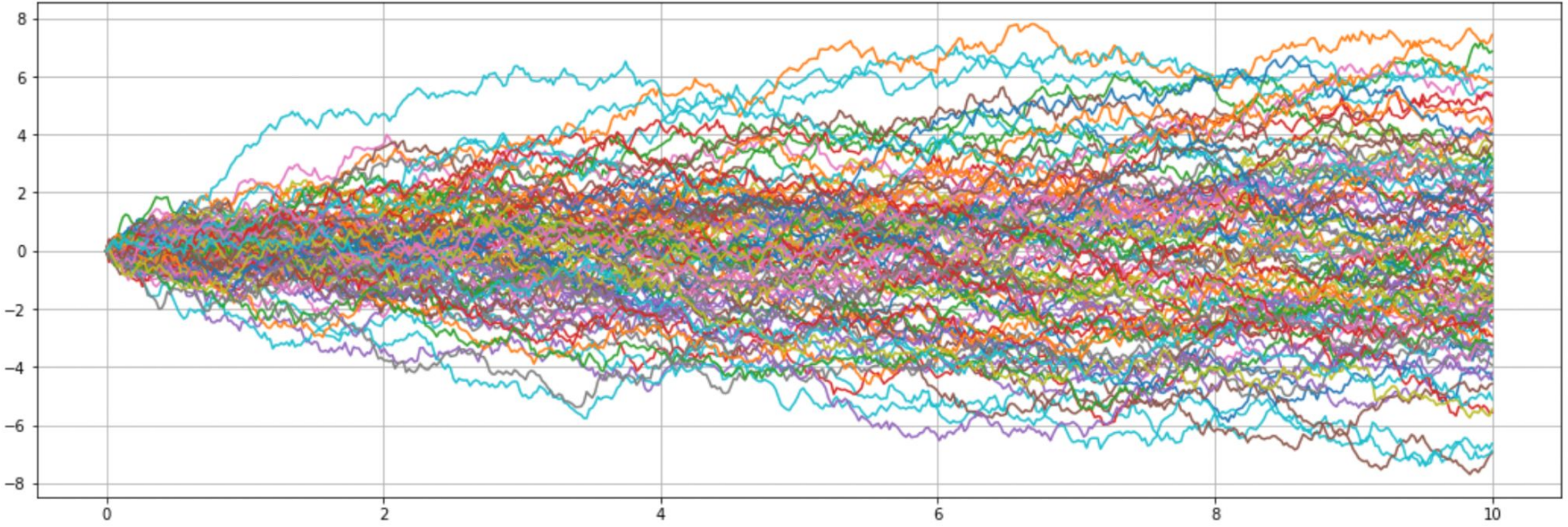


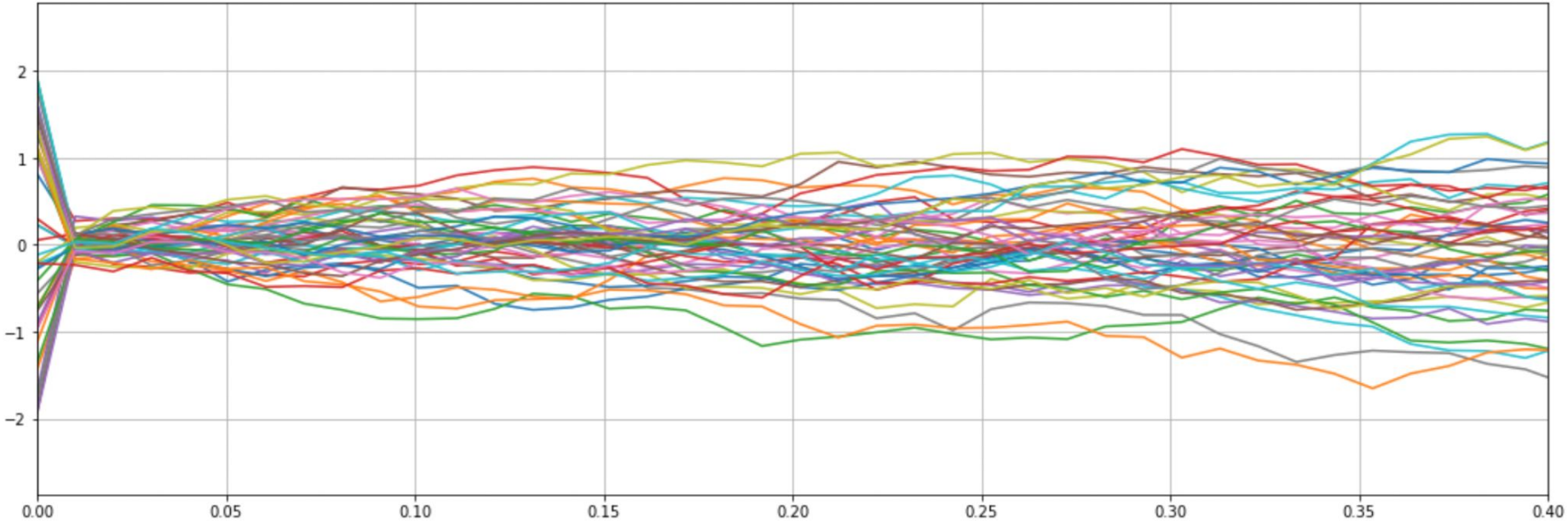
x and y coord at any time t



Just the path (100 samples)



50 samples and random beginning



50 samples, random beginning, no scaling