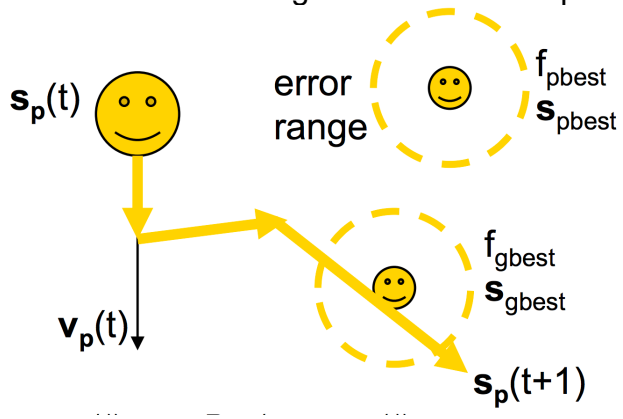
Swarm Robotics Solutions

Flocking
Cohesion=0: the boids spread out
Alignment=0: the boids stop
Separation=0: the boids crash

Particle Swarm Optimisation
Algorithm:
A particle computes the next position by taking into account a fraction of its current velocity v, the direction to its previous best location pbest, and the direction to the location of the best neighbor gbest. The movement towards other particles has some error.

```
1 begin
2       t = 0;
3       initialize particles P(t);
4       evaluate particles P(t);
5       while (termination conditions are
        unsatisfied)
6       begin
7               t = t + 1;
8               update weights
9               select pBest for each particle
10              select gBest from P(t-1);
11              calculate particle velocity
                P(t);
12              update particle position P(t)
13              evaluate particles P(t);
14      end
15end
```

From https://openi.nlm.nih.gov/detailedresult.php?img=PMC3926559_sensors-14-00299f4&req=4
Plot:
The plot will depend on how you initialise your velocity and the weight of the different vectors. The important thing is to draw your vectors following the graphic below. Consider the local neighbourhood of the particles.



Swarm Engineering
Techniques for swarm design: trial-and-error, crowd-sourcing, bio-inspiration, machine learning (e.g. artificial evolution).

Homogenous swarms with team-level selection favour the evolution of cooperative behaviours.