# Copycat algorithm

1. Copycat New harmony generation
   1. If the best harmony does not change during a predefined number of iterations (i.e. ), a new harmony is formed considering the top NGH harmonies (NGH =3 in the paper), as follows:

Where are the decision variables (i being each variable of the vector valued decision variable), and max / min represent the largest and smallest values for the ith variable, among the top NGH harmonies.

* 1. If the worst harmony does not change during a predefined number of iterations (i.e. ), a better solution is formed by moving towards the best harmony, as follows (each decision variable mimics the best solution):

1. PAR and BW parameters are not fixed by the user, but rather calculated as follows:
   1. Pitch-Adjusting Rate (PAR, usually between 0.1 and 0.5) is linearly increased from 0 to 1 during the iteration process.
      1. “A low pitch adjusting rate with a narrow bandwidth can slow down the convergence of HS because the limitation in the exploration of only a small subspace of the whole search space. On the other hand, a very high pitch-adjusting rate with a wide bandwidth may cause the solution to scatter around some potential optima as in a random search.”
      2. According to [Patil & Patel](https://pdfs.semanticscholar.org/2f83/7b507e2050f09f633b5826b60dd68b783c29.pdf), for the th iteration and if is the maximum allowed number of iterations:
   2. Bandwidth (BW) is dynamically changed as follows, depending on the largest and smallest values of *i*th variable in memory:

# Specific parameters for the Copycat implementation of the paper

1. Maximum allowable iterations without best / worst harmony changing:
   1. 1. NGH =3
2. PAR: linearly increasing from 0 to 1.
3. BW: calculated for each variable depending on the spread of the largest and smallest values in the harmony memory.