



Heilgor



by
Omwekiatl 2021



a game / simulator about 7 sins and algorithms

made for Secret Santa Jam to Gramozilho

SPOILER

This document
teach about all the
game, if you wish
resolve the puzzle,
don't see more

GMS 1.4
game maker studio



Welcome to Hellgor, a Hell about Algorithms, where you are a **soul** that try to survive. Your enemies are the 7 sins (**demons**) each one has a particular behaviour inspired in an algorithm.

Gameplay: you should see the behaviour of beings, and ordered the **description blocks** adequately to win the game, is a puzzle observational game, when you win, you access to the **simulation mode**, so no more fear, now you are the ruler of this hell!!!

4 Buttons:



Go to simulation mode, or press **Backspace**

Show the monsters description puzzle, or press **Space**

Manual or automatic handling of Soul, or press **Enter**

Screenshot, or press **F10**



The King demon count the number of souls through the time

Your soul has an aureole, the view find him

In manual mode, move with **WASD** keys

Left Click in blocks to select them, next in void slot to move

The world creatures

Show the message contained in each block

Every creature has a description in 3 blocks

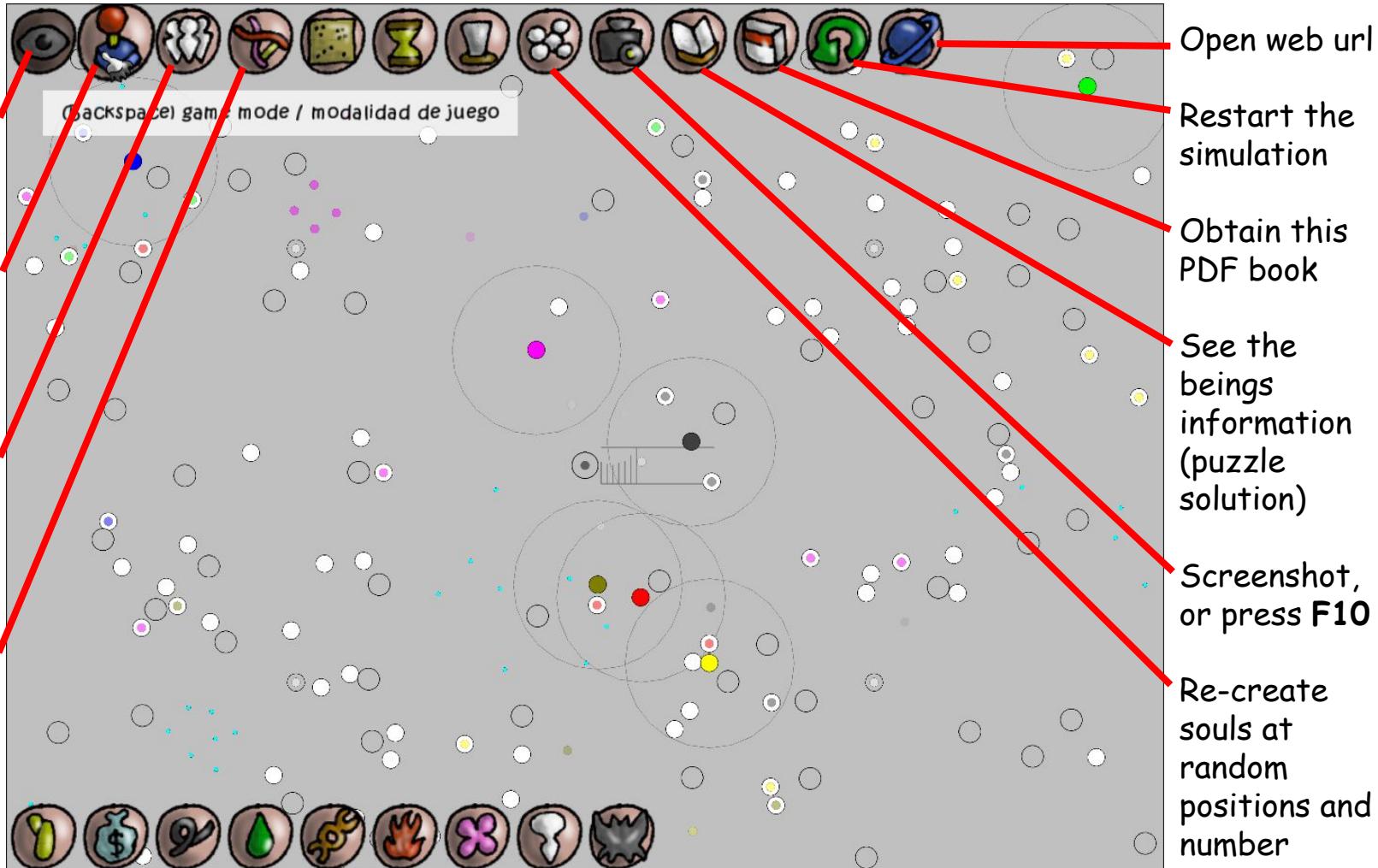
Here all the text blocks disordered

¿Quién creó esta locura?
Fué Omwekiatl para la Santa Jam 2021
para Gramozilho.
.....
Who created this madness?
It was Omwekiatl for Santa Jam 2021
to Gramozilho.
.....
Hellgor beta v0.3

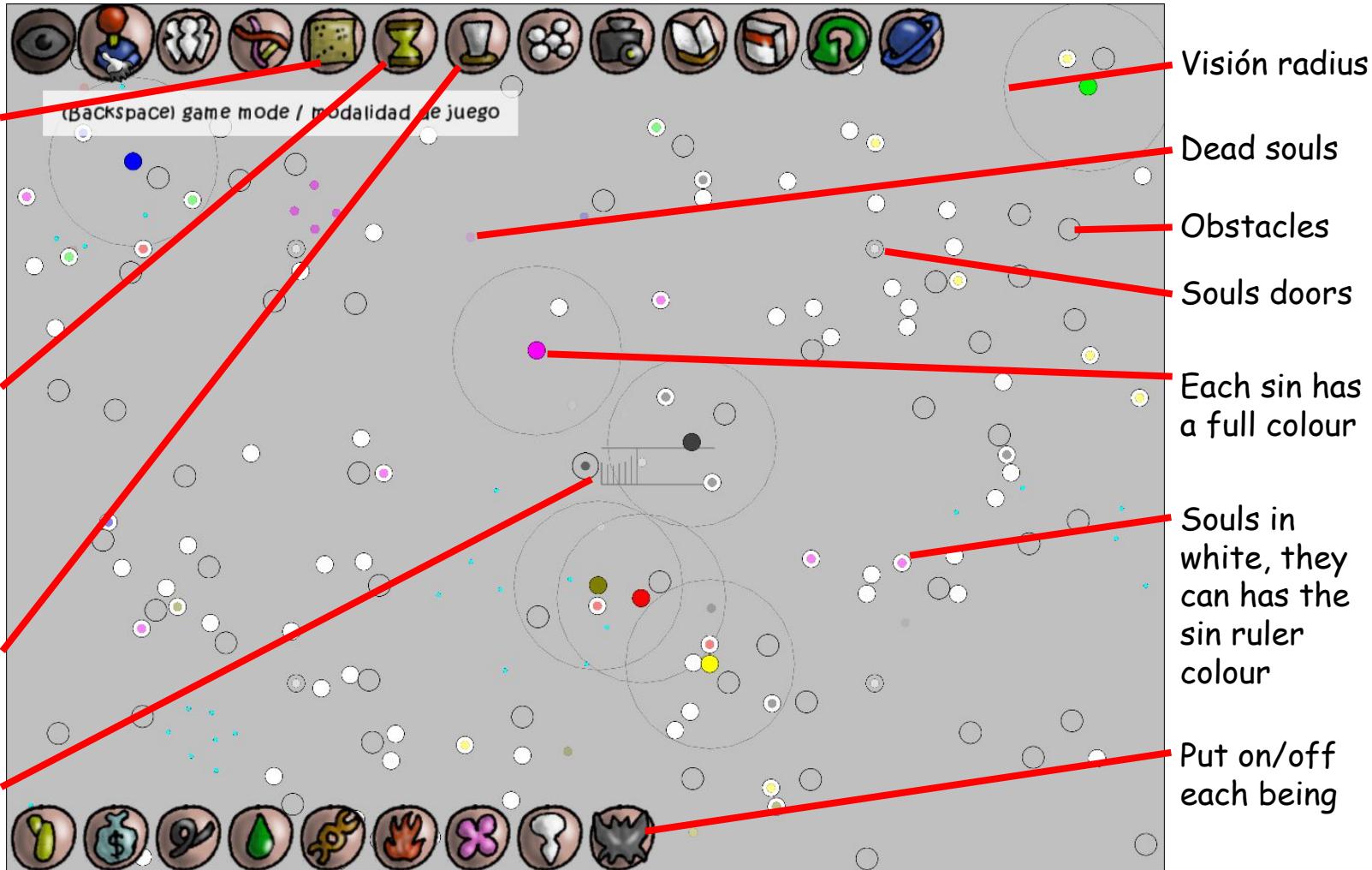
This texts show the game history

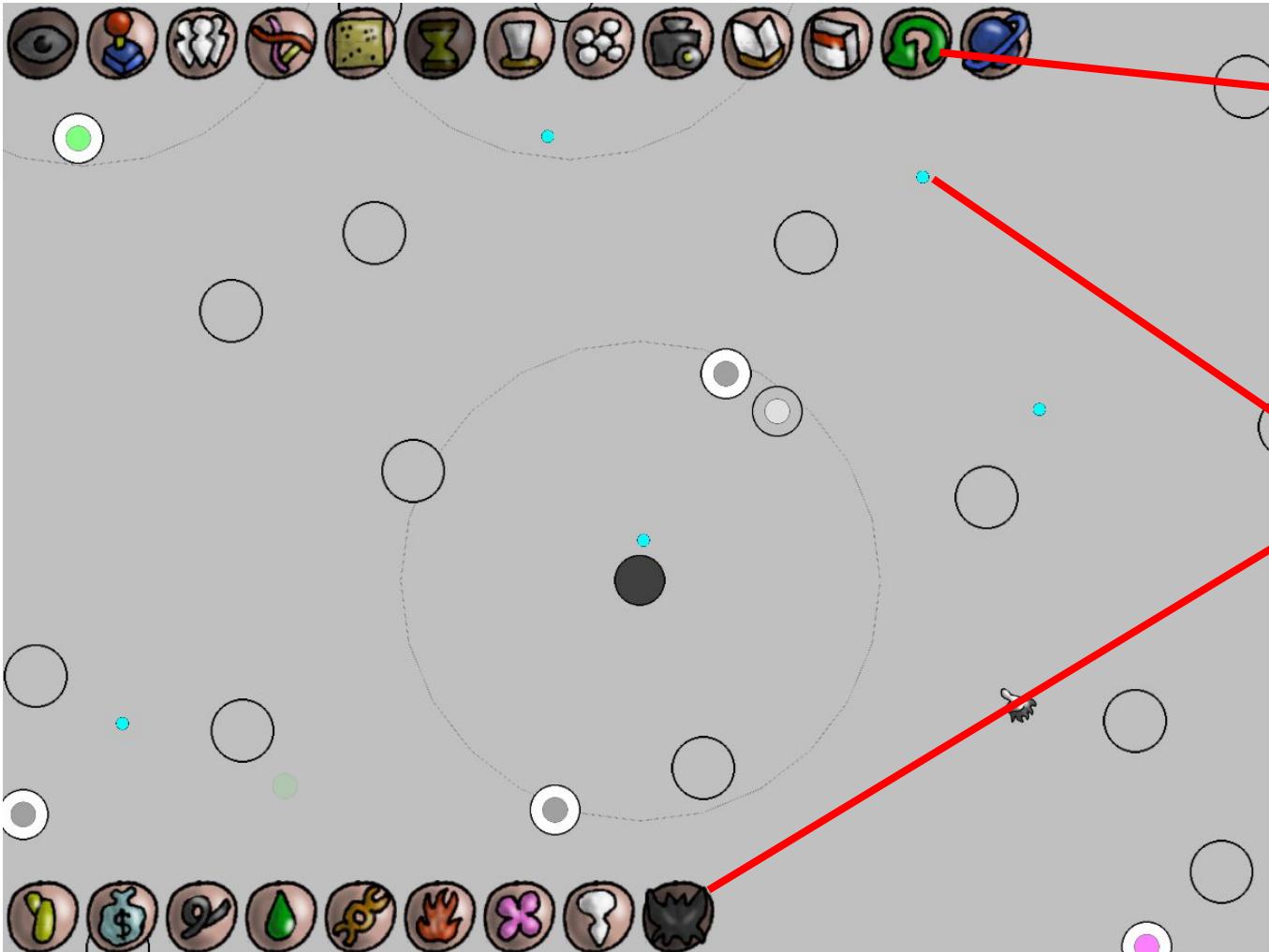
Return to game, or press Space

13 Buttons:



13 Buttons:





Mouse Scroll
to make zoom
in / out

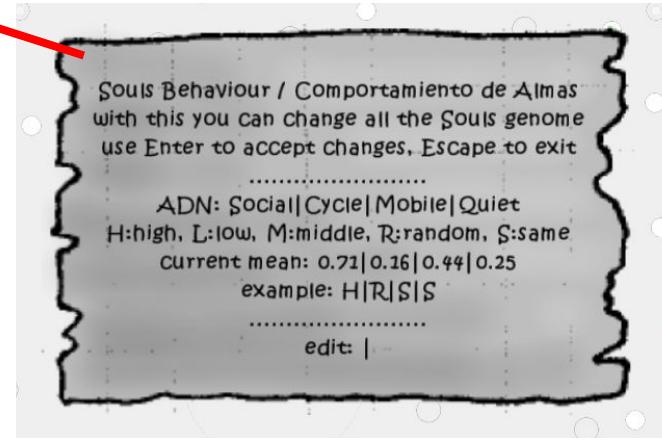
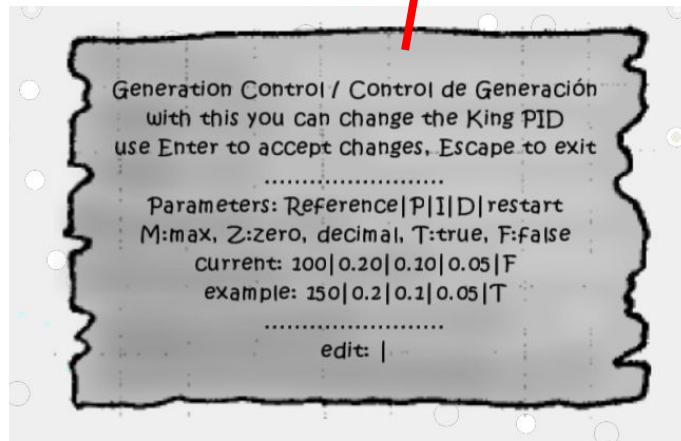
Hold Right
Click to move
camera

Left Click on
the being to
select them
and auto find
with camera

Note:
restart the
simulation
will use the
current PID
reference

Money

If press
Shift while
press button,
other
demons will
be excluded
Note: an
alone demon
acts strongly



Here the Reference is the desirable number of souls. Restart in true will clean all the historical and integration data. The example data is the default PID with maximum souls population (default: 100). The PID controller information will be explained next.

Note: put only one value implies to change only the Reference parameter!

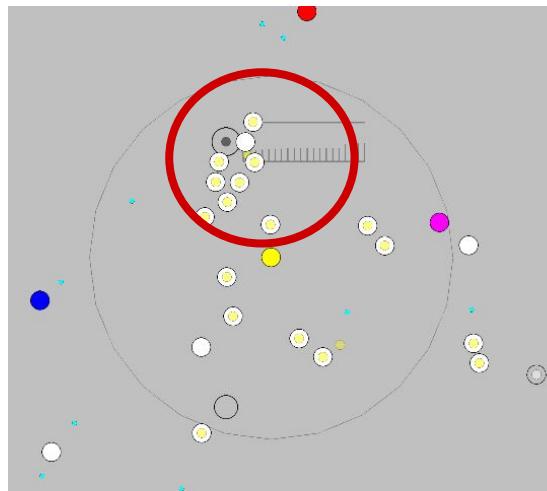
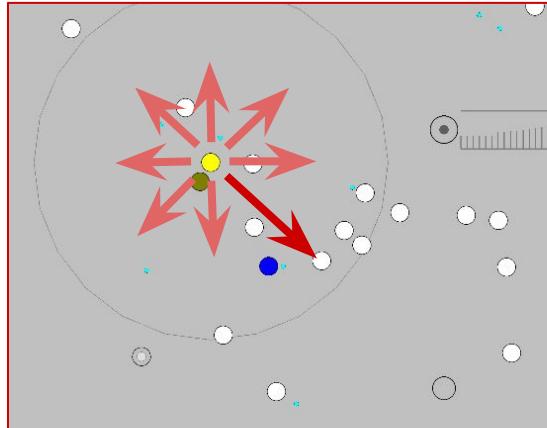
High is 1 while Low is 0, Middle is 0.5, Same implies that souls don't change their value. The Random is the only that affects each soul separately. You can use decimal values too. The current mean is taken from all the souls.

Genetic behaviour will be explained next.



Gluttony (Upward Gradient)

The gradient allows to find the direction of increment or decrement in a scalar field, creating a vector field, it's associate with derivation in maths and is widely used to find local minima or maxima in optimization problems. Gluttony can find crowds of souls.



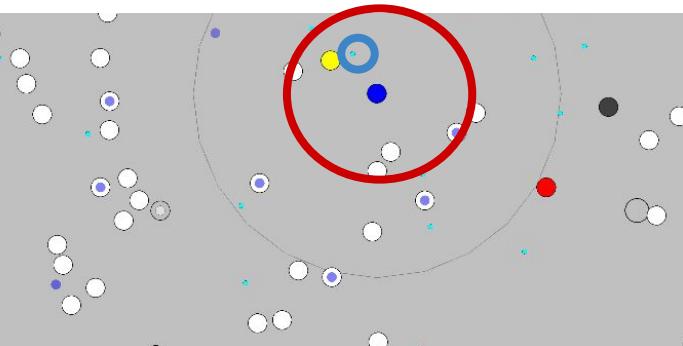
It counts the number of souls that can see in each one of the eight directions, finally it moves to the direction of highest value. Each direction add one if soul is in the vision radius, and add an exponential fitness value for each soul.

When it reaches a point with mean of all direction values divided by the best value, greater than a trigger. It's time to transform souls in the direction chosen and eat one.

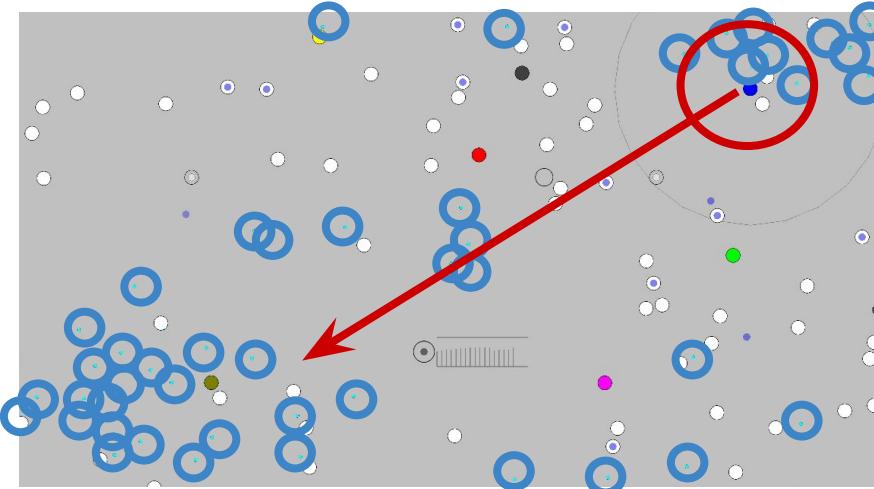


Greed (Particle Swarm Optimization)

This try of PSO make the Greed capable of find gold clumps, sending souls to search for him. The concept is: a group search governed by inertial movement.

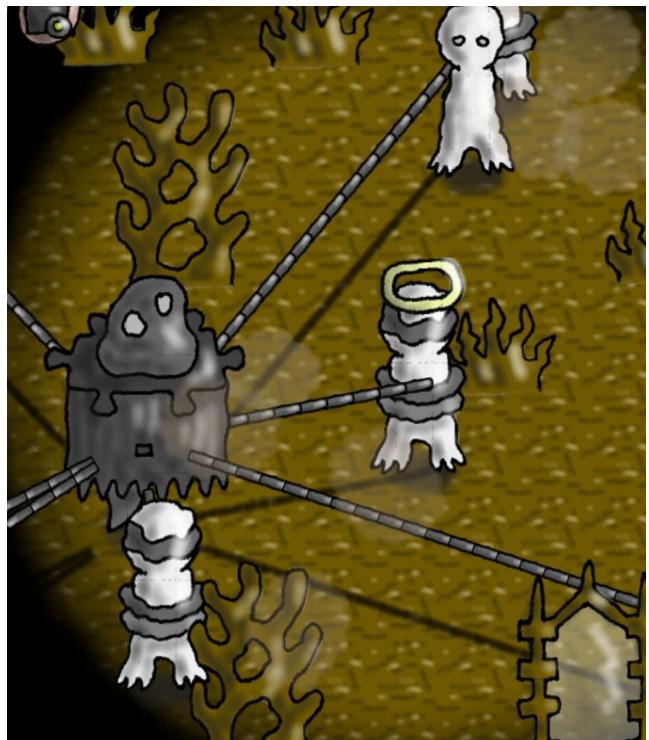


Can catch the nearest soul to make it a gold searcher. Greed move random around a virtual point and only can take gold around it. This point changes when a soul finds a best gold clump.



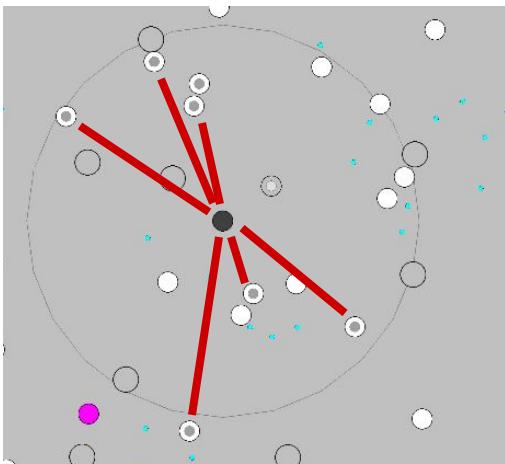
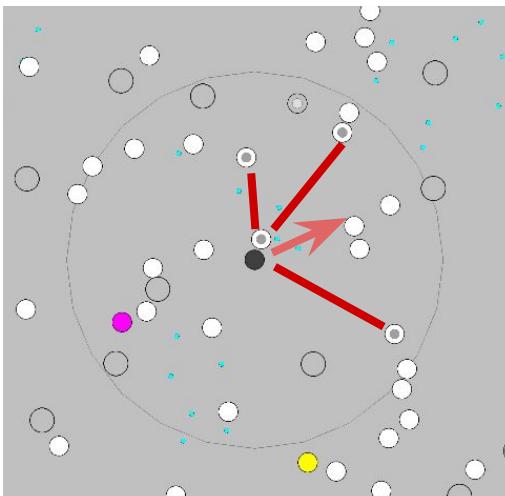
The souls with low performance in searching, respect the best searcher, will die, but they has four attempts to improve.

Gold appears at random each time it runs out. Souls evaluate fitness adding exponential values for each ore respects it's position. And save in itself the best position reached to give it to Greed.



Pride (K-Means Clustering)

Is a grouping algorithm, to find the mean point in a scalar field, allowing multi class classification.



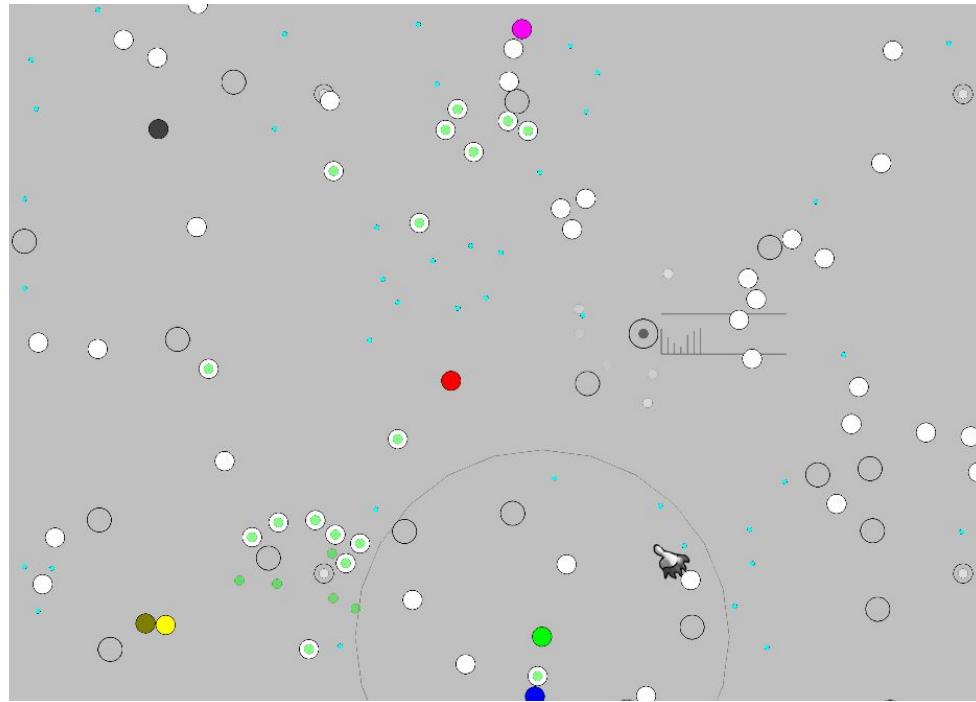
Pride can't move for itself, so need souls who pulls it.
Can take up to four souls in one capture, souls in it's visual area.
Souls continue acting like free souls, they can't understand any.
In K-Means this is the first half of a cycle, the association of nearest items to the centroid.

The second half of the cycle is the movement of centroid to the mean of the items positions.
When a soul go out of the Pride visión field, it has a chance to die or get free.
Because all this, Pride tend to move towards crowds of souls.



Envy (Viral Propagation)

Viral behaviour is an exponential propagation. Used to study spread of diseases or even ideas. Envy intoxicates souls and they infect others.



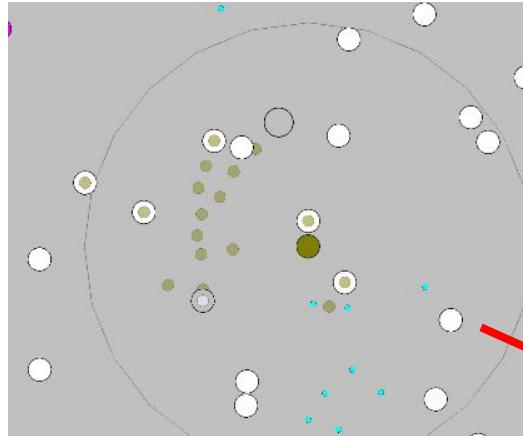
It infect the nearest soul. When a soul touch other, can infect it too. An internal soul clock try to die itself, if fails it try again with greater chance. If Envy is the only one demon, propagation is so strong.

Else, to make it limited: the first infected can't die and only infects one more. This one more can't die and can infect various until a chance make it not propagable. The third souls in the chain of contagion can't infect others but they will die in a while.
Note how this limitation overrides some of the up-right text rules.
Envy moves at random for the map.

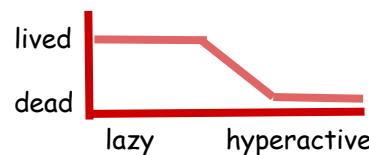
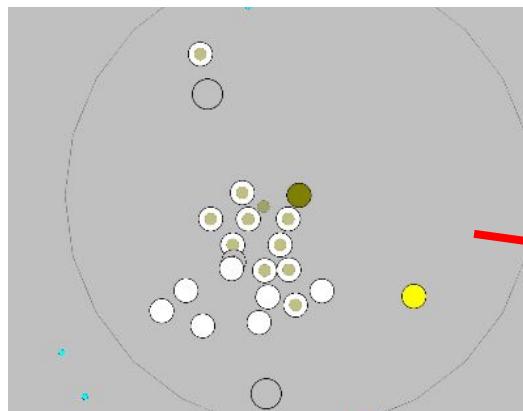


Sloth (Low-Pass Filter)

A filter divide a group or variable in desirable and undesirable parts, destroying (attenuating) the last. Sloth is like a selective hoover.



It sleeps long time without affect someone.
When wake up it run in a line at random direction.
The touched souls die if they are in movement, and transform if they are quiet.
In this example, a population of hyperactive souls was killed.



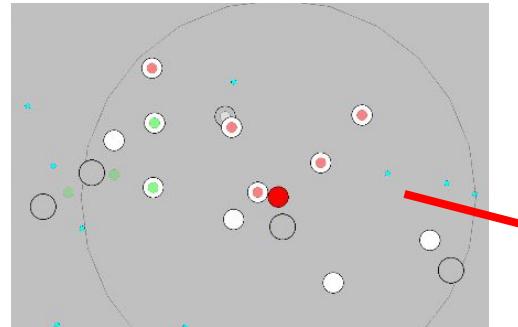
Appart of touched souls, near souls will be transformed if they are quiet, and killed if not and Sloth are the only one demon.
In this example, a population of lazy souls was transformed.
In this way, Sloth can force selective pressure on the population of souls, killing hyperactives and protecting the lazy ones.



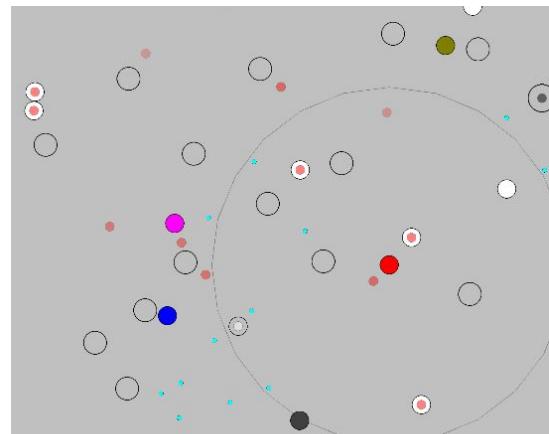
Wrath (K-Nearest Neighbors)

The KNN counts the nearest items with limit of k items, each item has a class, so the class with more items counted is the winner for the given point.

This is used for classification systems.



It move randomly for the map. Can see the near souls and count them, the count distinguish between sins influence.
In this example, 2 envy, 4 free, 5 wrath. If this was a classifier with $k=11$, the result is wrath.

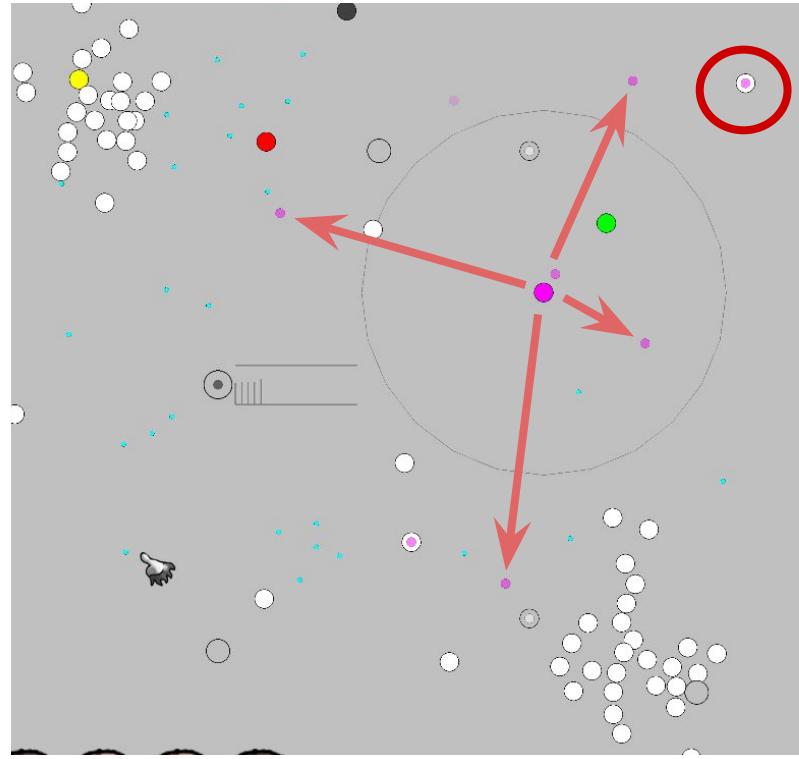


The seen souls with the sin with high count will be transformed to wrath.
A raging soul internal clock try to burn itself, only if soul is quiet when clock trigger.
Because it, Wrath make the oppose selective pressure in souls population respect to Sloth.
Wrath like hyperactive souls.



Lust (Divide and Conquer)

Is an iterative segregation algorithm for searching. It divides a big scalar field in smaller sections, operate in each one and give a verdict. The procedure can be re implemented in one or more of the sections.



If the ultimate winner flower found only one soul (the loneliest), convert it and Lust will move to hunt it. So Lust search for alone souls.

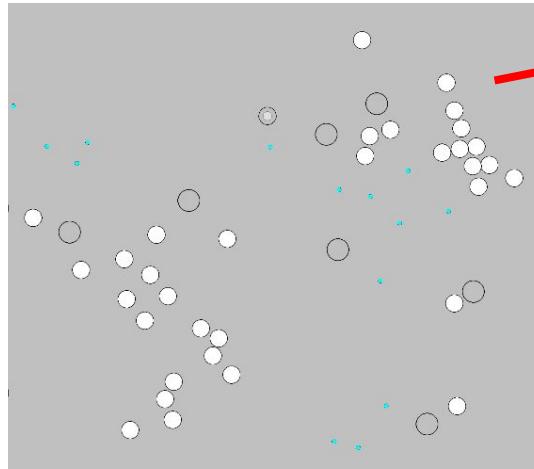
At first, Lust throw four searching flowers, they run far to cover the map. Each one counts the number of souls and win the minor not zero. The winner flower divide into four new flowers with minor field of view. The procedure occur three times.



Souls (Genetic Evolution)

Evolution mixes chance and selection to find an optimization.

The Souls acts in function of birth parameters, which change populationally.



In this example, souls with high sociability.

DNA (genes):

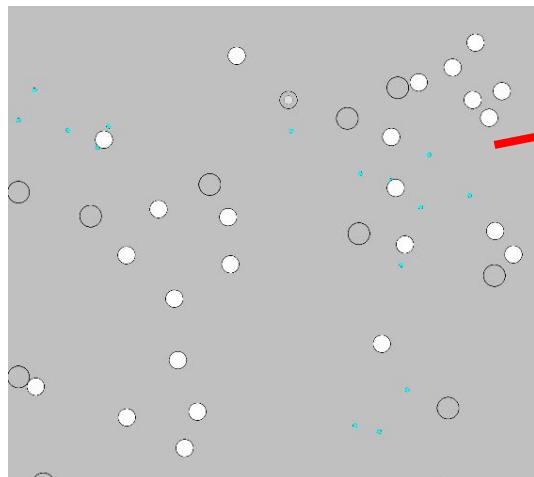
Social: tendency of souls to come together.

Cycle: duration of the change movement clock. So $clock = cycle + random(cycle)$.

Mobile: probability of keep moving.

Quiet: probability of keep immobile.

All the genes are 0 to 1, but internally implies phenotypic values, like cycle 4s max.



In this example, souls with low sociability.

When a new soul arrive at the door, it see around in a large field of view, and find the mean of the DNA of the other souls, that will be it's DNA plus a small mutation.

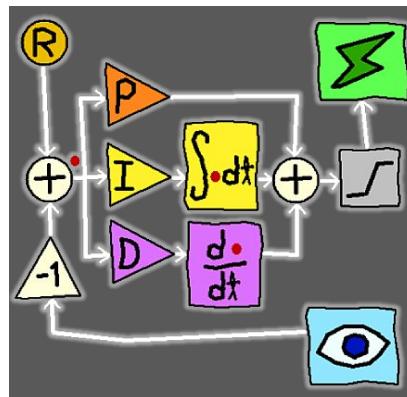
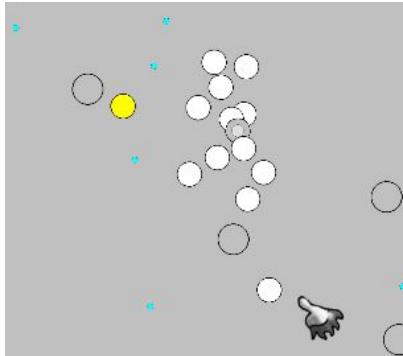
Reproduction is clearly asexual and souls only wander around unaware of dangers.



King (PID Control)

Is a basic solution to maintain a system in desired levels. For example: temperature in a refrigerator, revolutions in a motor, level in a water tank, etc.

Is called system in closed bucle, because the system variable is sensed, compared with the reference, processed and it finally affect the system which change the variable again.



Green ray: the doors, but is limited to call 40 souls each time (globally).

King kill nearest souls.
It counts the total souls in hell.
When total is under desired number, it evoke more through the four doors.
New souls don't have sins.
King is so good administrator.

R: reference, desired population.
Blue eye: current population.
Red point: error, $E = R - \text{eye}$.
P: proportional, multiply E, this is the basic action, offers speed of response but can oscillate easily.
I: integration, multiply the integral of E, this is a summation of previous E, exactly 3 for us, representing the past errors.
D: derivation, multiply the pendient between E and previous E, this project the future E.