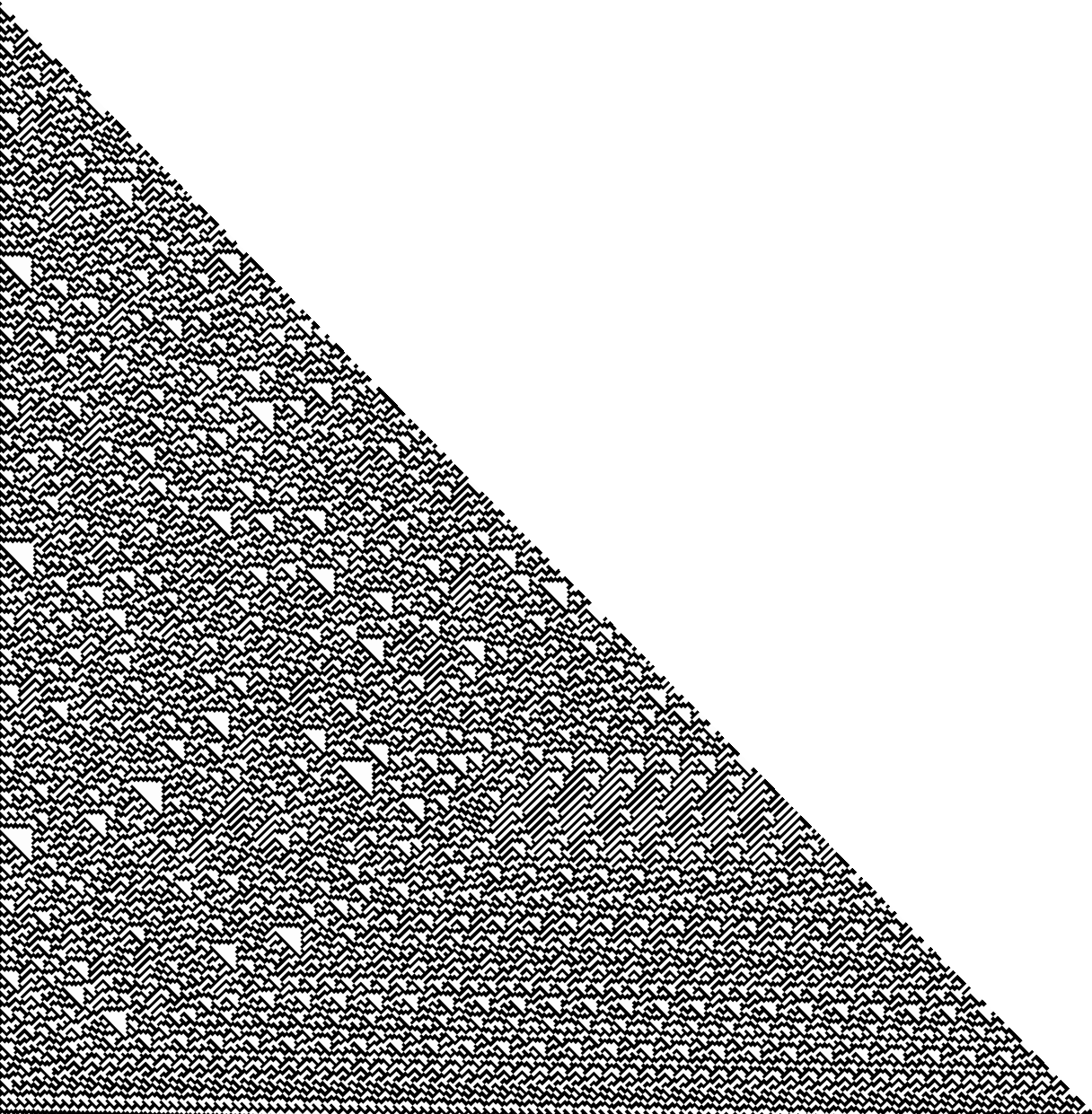


# Bellular

A how to guide:



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## Create a new simulation

Bellular

Simulation ▾

About

Help

No. of Evolutions: 0Time passed: 0

▶

⏸

■

▶

Seed Grid

Model

Parameters

Create a new model

Set all cells to selected

Randomize

- 1.) Click the button circled in the image above called 'Create a new Model, the screenshot below should now appear, you have now created a new simulation.

Bellular

Simulation ▾

About

Help

No. of Evolutions: 0Time passed: 0

▶

⏸

■

▶

Seed Grid

Model

Parameters

Grid Size:  
10

Cell Size:  
15

States  
Create New State

☒ 0 - Default

Rules  
Create New Rule

Set all cells to selected

Randomize

Default

## Modifying grid size and Cell size

The screenshot shows the Bellular simulation interface. At the top, there is a navigation bar with 'Bellular', 'Simulation', 'About', and 'Help'. Below this, a status bar shows 'No. of Evolutions: 0' and 'Time passed: 0'. The main interface is divided into two panels. The left panel contains controls for the simulation, including buttons for play, pause, stop, and a 'Seed Grid' button. Below these are tabs for 'Model' and 'Parameters'. The 'Parameters' tab is active, showing 'Grid Size:' with a value of 10 and 'Cell Size:' with a value of 15. These two input fields are circled in red. Below the parameters are sections for 'States' (with a 'Create New State' button and a radio button for '0 - Default') and 'Rules' (with a 'Create New Rule' button). The right panel shows a grid of cells, with buttons for 'Set all cells to selected', 'Randomize', and 'Default'.

1.) To modify the grid size and cell size change the values highlighted in the image above.

NOTE: the maximum grid size is 70

## Create a new state

**Bellular**   Simulation ▾   About   Help

No. of Evolutions: 0   Time passed: 0

▶   ||   ■   ▶▶   Seed Grid

Model   Parameters

Grid Size: 10

Cell Size: 15

States

Create New State

State Name

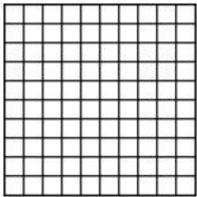
Color:   Add

☒ 0 - Default

Rules

Create New Rule

Set all cells to selected   Randomize   Default



- 1.) Click on the 'create state' button as shown above.
- 2.) Enter the name of the state you want to create then choose the colour you want to be shown on the simulation grid
- 3.) The state you created will overwrite the default state and the grid will be initialised full of the state you just created, below is an example of what two new added states would look like
- 4.) NOTE: any number of states can be created

States

Create New State

new state 2

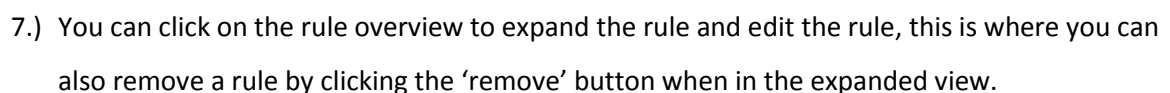
Color:   Add

☒ 0 - new state 1

☐ 1 - new state 2

## Create a 'static' rule

- 1.) Make sure the 'Dynamic Rule' box is un checked
- 2.) Draw a rule pattern, this mean the rule will look on the grid for the specified pattern, and wherever it occurs will replace it with whichever state you specify  
NOTE: choose from your list of states which state you want to draw on the static rule pattern, you can draw any number of states
- 3.) Specify the next state that occurs if the above pattern is found
- 4.) Set the probability of this rule occurring e.g. type 50 for the rule to apply 50% of the time
- 5.) In the image above we have created rule pattern, should this pattern occur in the simulation, the cell will be changed to state 1, this has a 100% chance of occurring.
- 6.) Click the add button, a brief rule overview should show below as shown in the below image



## Create a 'dynamic' rule

Rules

Create New Rule

☒ Dynamic Rule

If cell state is: 0 ▼

and the state of the neighbors are: 1 ▼

and the number of neighbors the cell has is:

Equal to ▼ 2 ▼

The next state of cell must be: 1 ▼

Set probability (% from 0 to 100) :

80

Add

- 1.) Make sure the 'dynamic rule' boxed is ticked
- 2.) The first value entered is what state you want this rule to apply to.
- 3.) Next is what state you want to check for in the initial states neighbourhood
- 4.) Next you can enter the count of the neighbour, either equal to, less that or more than, next you specify the number of the count
- 5.) Next is the state you want the initial state to turn to if the rule parameters are met
- 6.) Click the 'add' button, a rule overview box should appear as shown below.

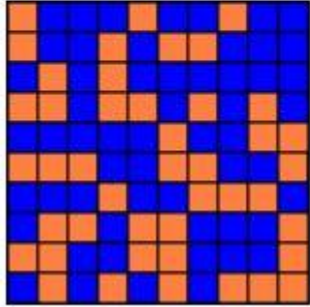
NOTE: in simple terms the above rule states the following:

If the cell state is 0 and there are exactly two neighbours surrounding the cell in that are in state 1, then the cell must change to state 0 and there is a 80% chance of this rule being applied.

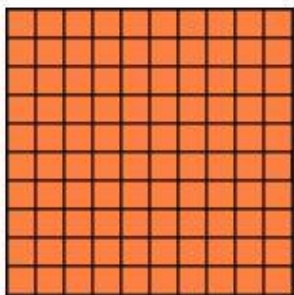


- 8.) You can click on the rule overview to expand the rule and edit the rule, this is where you can also remove a rule by clicking the 'remove' button when in the expanded view.

## Adding states to the simulation grid

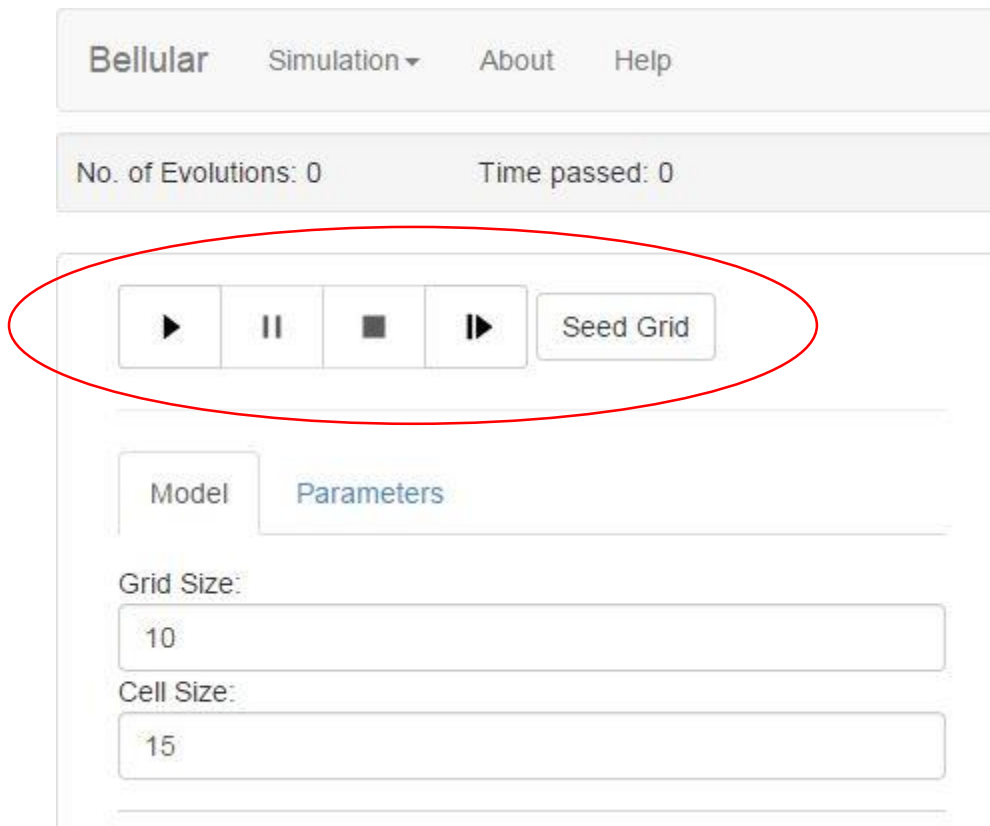


- 1.) Above the grid Next to the 'randomize' button, each of the states you created should be listed, the outline of each state box represents the colour that will be drawn.
- 2.) Click a state, once it is selected click on any cell on the grid to add it.
- 3.) The randomize button will put all created states randomly on the grid
- 4.) The 'set all cells to selected' will set the whole grid to whichever state is currently selected, as shown in the picture below.





## Running a simulation



- 1.) In the image above, the simulation control panel is highlighted.
- 2.) The following steps list each buttons functionality from left to right on the control panel
- 3.) Click the 'play' button to start the simulation.
- 4.) Click the 'pause' button to pause the simulation while it is running.
- 5.) Press the 'stop' button to stop the simulation and return the grid to the seeded state.
- 6.) Click the 'step' button to step the simulation evolutions on a click-by-click basis
- 7.) The 'seed grid' button will set the seed of the grid to whatever state the grid is currently in (layout of the states), this is so that when you click the stop button you can determine what state the grid is reset to

## Parameters section

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Model

Parameters

---

Grid Size:

10

Cell Size:

15

---

States

Create New State

☐ 0 - new state 1

☐ 1 - new state 2

- 1.) Click the 'parameters' tab as shown in the image above.

---

Model

Parameters

---

Set delay:

Delay(ms): 0

---

Randomization weightage

new state 1

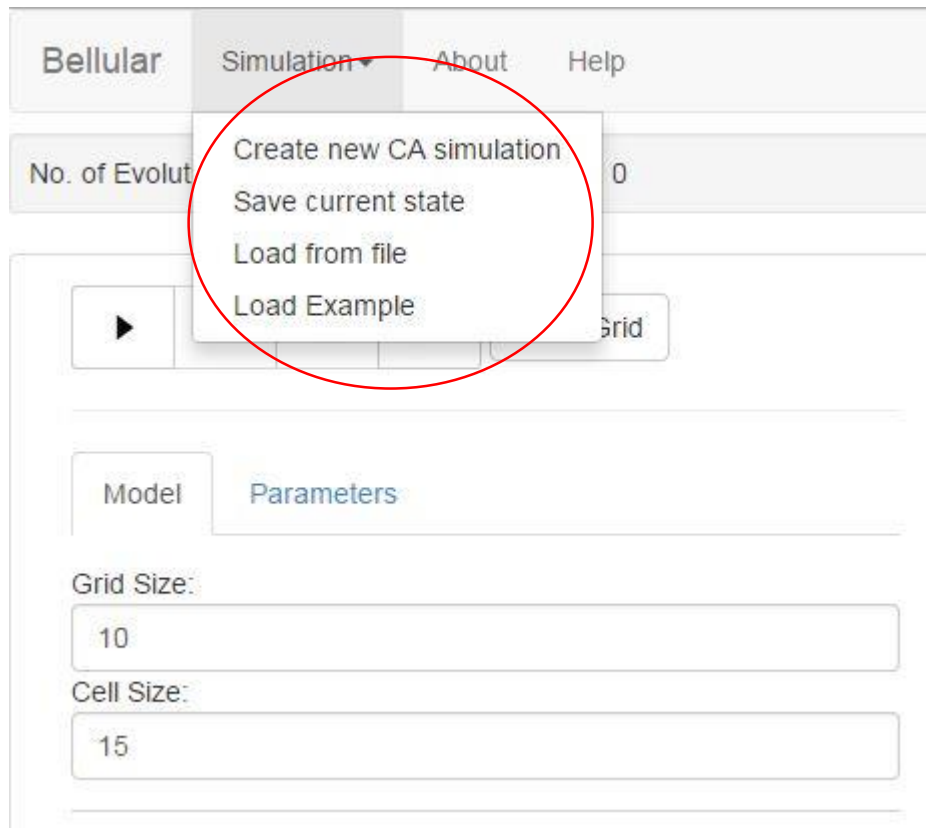
1

new state 2

1

- 2.) Set delay slider, this will either speed up or slow down the simulation, the more the bar is increased the slower the simulation will go.
- 3.) Randomize weightage is where you can set how many times each state should show up when clicking the 'randomize' button shown in the 'adding states to a simulation' section.  
e.g if you say state 1 to occur five times and state 2 to occur once, when you randomize the grid state 1 should show up five times more than state 2

## Saving and Loading a Simulation



- 1.) Expand the simulation tab as shown in the above image.
- 2.) Here you can select to either create a new simulation, this will return you to blank simulation screen the same as when the application is first started.
- 3.) You can also choose to save your current state, this is like saving a simulation, it will be downloaded as a .bel file format, and the file will be saved into your browsers default download directory.
- 4.) You can also load a simulation, you must choose a .bel file format, this will mean your simulation will be loaded in the exact state that it was saved in
- 5.) The final button on the list lets you select from a list of pre-defined examples of cellular automata, for you to observe and even modify how you would like.