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Welcome to 3D-Life, a three-dimensional version of The Game of Life developed by **Frank Mathy** and spreaded as freeware.

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The 3D-Life Window

The Window of 3D-Life contains two areas:

- o The 3D-world-area, where the 3D-Life cells are displayed. This area contains 10x10x10 elements. Alive cells are represented by a 3D-block. The display can be drawn with or without central perspective.
- o The pull-down-menu .

The 3D-Life Menu

Interaction with the 3D-Life program is done via its pull-down-menu, which has the following structure:

The File-Menu

The Edit-Menu

The Game-Menu

The Help-Menu

The 3D-Life Shortcuts

Normally, the functions of 3D-Life are selected via pull-down-menu. Some important commands however can be accessed via keyboard:

F5 - Begin Game

F6 - End Game

F7 - Single Step

F8 - Speed...

F9 - Sound

The File-Menu

The File-Menu contains several functions for clearing, loading and saving the playfield:

New
Open...
Save...

Quit

Open... (File-Menu)

Use this command from the File-Menu to load a previously saved playfield. To do so, you have to select the file to be loaded in the file-selection-dialog and click on **OK**.

Save... (File-Menu)

Use this command from the File-Menu to save a playfield to disk. To do so, you have to input the desired filename in the file-selection-dialog and click on **OK**. The extension '.LIF' is automatically added.

Quit (File-Menu)

Use this command from the File-Menu to leave 3D-Life. If the actual playfield has not yet been saved, a warning appears.

The Edit-Menu

The Edit-Menu contains several commands that are used for editing the Life-3D world:

Random Playfield...

Modify Cell...

Set Wall...

Set Object...

New (File-Menu)

Use this command from the File-Menu to clear the 3D-Life playfield. Before this is done, you have to confirm the command in a dialog-box.

Random Playfield... (Edit-Menu)

Use this command from the Edit-Menu to create a random playfield. After selecting the command, a dialog-box appears where you use a slider-element to determine the percentage of cells that shall be alive. Selections of 25% to 30% are best and create playfields that will survive several generations.

With **OK** the random playfield is generated, the old playfield will be gone. By clicking on **Cancel** the command is aborted, the old playfield remains unchanged.

Modify Cell... (Edit-Menu)

With this command from the Edit-Menu you can set and reset single cells of the playfield. Simply enter the coordinates of the cell to be modified in the **Cell modify...**-frame and click on **Set** or **Reset**. The change becomes visible at the moment. The coordinates have to be values from 0 to 9.

If there exist complex constellations some cells may be covered by others and cannot be seen. Therefore you may display only certain layers of the 3D-Life world by entering their minimal and maximal x-coordinates in the **Display x-area...**-frame. These values also have to be numbers from 0 to 9, the second value has to be greater or the same as the first one. By clicking on **Display** the selected layers will be displayed.

With **OK** you leave the dialog and the whole 3D-world becomes visible again.

If the cell with the coordinates (3,5,9) is covered by other cells, simply select the layers $3 \leq x \leq 3$ and click on 'Display'. The cell becomes visible.

Set Wall... (Edit-Menu)

Use this command from the Edit-Menu to set a range of cells of the 3D-Life world. Therefore you determine two corners by their coordinates that have to be values from 0 to 9.

As soon as you click on **Set**, the wall between the two corners will be set. For instance, by using the corners (1;2;3) and (4;3;5) you create a four cells wide, two cells high and tree cells deep wall.

By pressing the **Cancel**-Button, the dialog-box is left without a wall being set.

Set Object... (Edit-Menü)

This command from the Edit-Menu is one of the most interesting of 3D-Life. With it you can place a collection of predefined Objects with interesting qualities into the 3D-Life world. The necessary parameters are entered in the dialog-box.

With the element **Object Type** you select the type of new object from a list that differs in the two possible Life-modes.

In the **Position**-field you enter coordinates to determine the position of the object's center. The coordinates have to be values from 0 to 9.

In the frame **Alignment along...** you determine along which axis the body shall be aligned. With the button **Reverse Direction** the direction of the object can be reversed.

By clicking on **Set** the object is set in the 3D-Life world, **Cancel** closes the dialog without adding the object.

Predefined Objects

The 3D-Life program offers a collection of predefined objects that were discovered by Bays and show interesting qualities. They can be set with the command Set Object... from the Edit-menu. Obviously, there exist different objects for Life 4555 and Life 5677 that have only the name in common. The objects can be grouped by their behaviour: Besides static objects, that change neither position nor looks, there exist wandering and transforming objects. The transformations occur in a cyclic manner.

Predefined Objects for Life 4555

Ball	Stationary, constant object.
Bronco	Stationary, transforming object (4 phases).
Glider	Moving, transforming object (4 phases).
Weight	Stationary, constant object.
Cross	Stationary, constant object.
Rotor	Stationary, transforming object (2 phases).
Socket	Stationary, constant object.
Step	Stationary, constant object.

Predefined Objekts for Life 5766

Beehive	Stationary, constant object.
Blinker	Stationary, transforming object (2 phases).
Flashlight	Stationary, transforming object (2 phases).
Block	Stationary, constant object.
Glider	Moving, transforming object (4 phases).

Das Game-Menu

The Game-menu contains commands for starting and stopping the game and further adjustments:

Life 4555

Life 5677

View...

Sound (F9)

Speed... (F8)

Begin Game (F5)

End Game (F6)

Single Step (F7)

Life 4555/Life 5766 (Game-Menu)

Use the entries **Life 4555** or **Life 5766** of the Game-Menu to select the desired Life-mode.
The selected entry will appear checked.

View... (Game-Menu)

Find the perfect view on your 3D-Life world with **View...** from the Game-menu.

Two sliders in the frame **View** are used to adjust the eye's position. Additionally, central projection can be turned on and off with the **Central Perspective**-switch. The slider in the **Perspektive**-frame is used to adjust the strength of this effect.

Caution: When using a strong depth-effect, there may be small errors in the image being caused by the distortion of the picture. Due to fast screen-display, no perfect hidden-surface algorithm could be implemented.

With the slider **Cell Size** you can change the size of the displayed 3D-Life cells.

By pressing **Cancel** all view-changes are ignored. To set the new view-parameters, simply click on **OK**.

Caution: After selecting **OK**, the 3D-Life program needs a couple of seconds to calculate the changed screen-coordinates of the Life-cells. This also occurs after starting the program. The reason for this break is that 3D-calculations have to be done for about 7000 points.

Sound (Game-Menu, Function Key F9)

Use this entry from the Game-Menu to turn on or off the control-sound that appears after displaying a new Life-generation. If turned on, the menu entry appears checked.

Speed... (Game-Menu, Function Key F8)

Adjust the speed of the 3D-Life game with this function from the Game-Menu. With the slider in the dialog-box, you set the delay between two generations in 1/1000 of a second. Select a longer delay to slow down the game and vice versa.

On slow PCs or if many cells are displayed, the selected delay should not be too small because more time is needed to build up the display.

By clicking on **OK** you confirm the selected speed.

Begin Game (Game-Menu, Function Key F5)

Start the Game of Life with this function from the Game-Menu. After a delay that can be adjusted with Speed..., the next Life-generation is calculated and displayed. The game can be stopped with End Game.

End Game (Game-Menu, Function Key F6)

Stop the Game of Life started with Begin Game by using this command from the Game-Menu.

Single Step (Game-Menu, Function Key F7)

Select this command from the Game-Menu to calculate and display the next Life-generation.

The Help-Menu

The Help-menu is used to display help information about 3D-Life:

Index (F1) shows the contents of this help.

Help on Help tells you how to use the Windows-help-facility.

About 3D-Life... displays informations about the 3D-Life program.

The History of "Life"

Certainly you have already heard of the classic "Life": As an "oldie" among simulation-games, that offers quite amazing effects similar to the growth of cells with modest means. The creator **John Horton Conway** (University of Cambridge) earned quite some acknowledgement for his discovery.

Scene of the events was a two-dimensional playfield that is divided in a lattice of cells that are either inhabited (alive) or not (dead). The state of the cells changes depending on the number of inhabited neighbor-cells (8 neighbors per cell). Astonishingly, while using certain rules, quite complex and sometimes even cyclic events occurred. That was how the grandfather of all Life-games was discovered. This game called **Life 2333** used the following rules:

- 2 - Alive cell stays alive, if at least 2 neighbors.
- 3 - Alive cell stays alive, if at most 3 neighbors.
- 3 - Dead cell becomes alive, if at least 3 neighbors.
- 3 - Dead cell becomes alive, if at most 3 neighbors.

But soon, the computer-user was not longer satisfied with a two-dimensional world: The step into the third dimension followed. The Cambridge-scientist **Carter Bays** invented a three-dimensional form of Life: The cells were now located in a three-dimensional lattice and had 26 neighbors, each. **Bays** found two interesting types of 3D-Life games: **Life 4555** and **Life 5677**. **Bays** also discovered a lot of objects that behaved in a quite interesting way: They survived many generations, sometimes transforming and sometimes even wandering through the 3D-Space. For instance, Glider-objects sweep through the Life-universe like their ancestors in Conway's **Life 2333**.

This version of 3D-Life, developed by **Frank Mathy**, supports both 3D-versions of Life and offers a selection of predefined objects that were discovered by **Bays**. In a 10x10x10 elements large playfield you are about to get to know the fascination of Life in three dimensions.

The Author Frank Mathy wishes you lots of fun with 3D-Life and would be happy about your comments and suggestions.

The program is freeware - so feel free to hand it to anybody!

