



**CINEMA 4D**

**Release 9**

**MoGraph**

# MoGraph Manual

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**CINEMA 4D**

**Release 9**

**I Introduction to MoGraph**

# 1. Introduction

## General

Welcome to the virtually limitless MoGraph module!

MoGraph offers the following exciting functionalities:

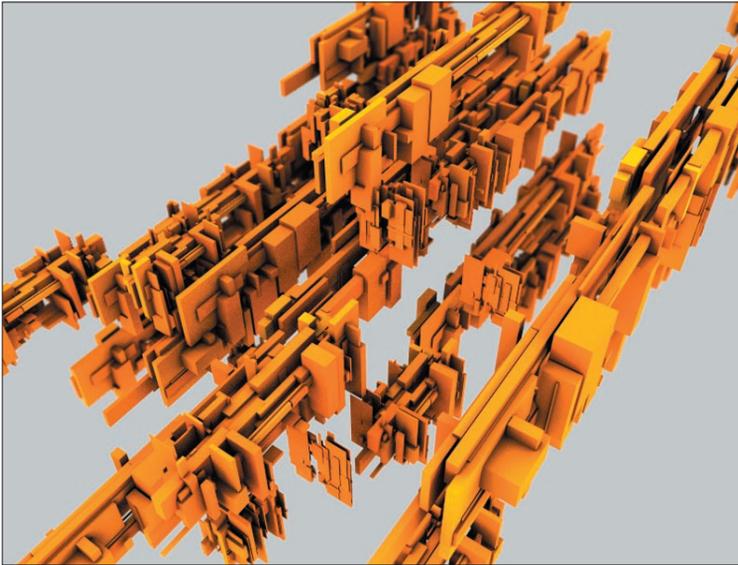
- Various ways in which to clone objects.
- Extensive control of clones via Effectors.
- Several special shaders for texturing and controlling clones.
- A special Text Object with individual controls for lines of text words and letters.
- The paths of movement of vertices / particles can be displayed as splines using the "Tracer".
- 2 special Deformation Objects that can be used to deform objects using splines (Spline Wrap) or textures (Displace Deformer).
- Effectors that can also be used as deformation objects.
- Spline Mask, a boole object for splines.
- An Extruder Object that can be used to extrude polygons of parametric objects. Each extrusion will be seen internally as a clone and can thus be controlled using Effectors.

Almost anything can be combined within MoGraph. This offers sheer endless possibilities for the creation of motion graphics. For this reason, we suggest you experiment as much as you can, even if what you want to do seems far too odd-ball. Just try it. MoGraph lets you easily create spectacular, interesting effects using simple primitives. Believe it or not, the following image was created using a single cloned cube and a single cloned sphere:



*Spectacular motion graphics using simple primitives!*

The next scene consists of only three parametric cubes that were cloned, made to intersect and positioned, colored and scaled randomly using the Random Effector. Add a little depth-of-field and HDRI lighting (Advanced Render module) and you too can create the following image:



3 cloned parametric cubes.

Imagine adding a Sound Effector (see chapter 3) to make the clones scale, move, rotate and even change their texture to the beat of music. This is only a small sample of what great-looking effects MoGraph lets you create with relatively little effort.

*Note:*

*MoGraph offers several objects with which new elements can be generated or that can be used to view existing CINEMA 4D objects as clones, thus making them able to be affected by MoGraph (Cloner Object, Matrix Object, Fracture Object, etc.). For purposes of convenience, we'll refer to these objects as "clones" once they have been taken over by MoGraph.*

### How are clones arranged onto other objects?

The following mini-tutorial demonstrates a randomly chosen example of how clones can be arranged onto an object.

Goal: Clones should be arranged to form a particular word.

1. First, the necessary clones have to be generated that will later be arranged onto a text spline. Create a sphere, a text spline and a Cloner Object (main menu > MoGraph/Cloner Object). Reduce the sphere's radius to 10m and type any word into the text spline setting's "Text" field.
2. Make the sphere a child of the Cloner Object and switch to the Cloner Object's settings. Define the number of clones in it's "Count" setting (e.g. 500) and set "P.Y" to "0" and "P.X" to, for example, "2". The result should look similar to what's shown in the image below. The arrangement of clones can be adjusted to the text length by moving the Cloner Object itself and varying the "P.Y" setting:



*The text spline was placed into a Sweep NURBS in order to make it more visible.*

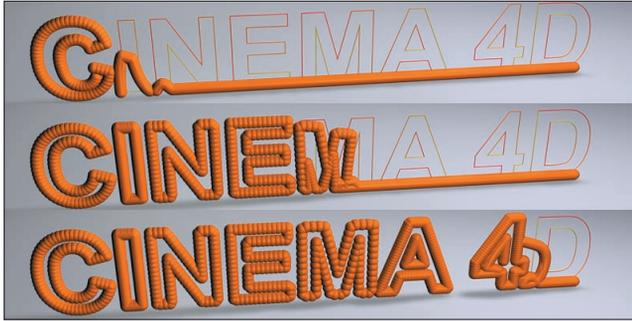
3. In order to arrange the clones onto the spline, a Spline Effector is needed. To add a Spline Effector, select the Cloner Object in the Object Manager and add a Spline Effector from the main MoGraph menu. The Spline Effector will automatically be assigned to the Cloner Object (it will be located in the Cloner Object's "Effector" field, located in its "Effector" tab). Switch to the Spline Effector's settings and drag the text spline from the Object Manager into the Spline Effector's "Spline" field. Subsequently, set "Segment Mode" to "Even Spacing".

Your scene should now look like this:



If you now vary the Spline Effector's "Strength" setting (Effector tab) you can transition the clones smoothly between a linear and a spline arrangement. But this is relatively unspectacular. Thus...

4. Switch to the Spline Effector's "Falloff" tab settings and set "Shape" to "Linear". Now rotate the Spline Effector around its Y-axis so that its Z-axis points in the direction of the linear clone arrangement ("Coord." tab: "W.B" = -90°). So, what have we just done? The Falloff settings can be used to limit an Effector's effect. The "Linear" setting makes the effect of the Effector work along its positive Z-axis. It will have no effect in the negative direction of the Z-axis. In the same tab, increase the Effector's Z-scale so that it encompasses 2 to 3 letters of the text spline. You can also do this interactively by simply dragging the orange grabbers in the editor view. The effect of the Effector will work smoothly within the orange and red planes. If the Effector is now moved or animated along the length of the clones, the clones will be arranged onto the text spline accordingly (the Effector's strength is set to 100% in the "Effector" tab).



*The Spline Effector moves from left to right using a “Linear” falloff.*

Now change some of the settings, e.g. set “Falloff” to “Sphere” or play around with some of the other settings and see what happens. The settings are described in detail in the following chapters.

### Object order in the Object Manager

CINEMA 4D has a strict hierarchy (sequence and order in the Object Manager) that defines exactly which object should be executed when. In some instances, a hierarchy in MoGraph, can also be important. Each time other objects are affected by a Target Object, the Target Object should be placed in front of those objects in the Object Manager. This helps avoid unexpected effects such as incorrect depiction in the editor view, strange rendering effects, etc.

The following could be important factors:

- A Cloner Object in “Object” clone mode that has arranged its clones onto the vertices of a target object (even a target object that is deformed using a deformation object).
- Effectors that use a target object, e.g. a Spline Effector (target: spline), Inheritance Effector (target: any object) or Target Effector (target: any object).

### Where can I find MoGraph components?

- All MoGraph objects and tools are located in the main “MoGraph” menu.
- The three MoGraph-specific shaders can be found anywhere where shaders can be selected, in the “Motion Graphics” menu.
- The MoGraph-specific bake function is implemented as a tag and can therefore be found under “File/MoGraph Tags/Cache Tag.



**CINEMA 4D**

**Release 9**

**2 Cloner Object**



## 2. Cloner Object

### General



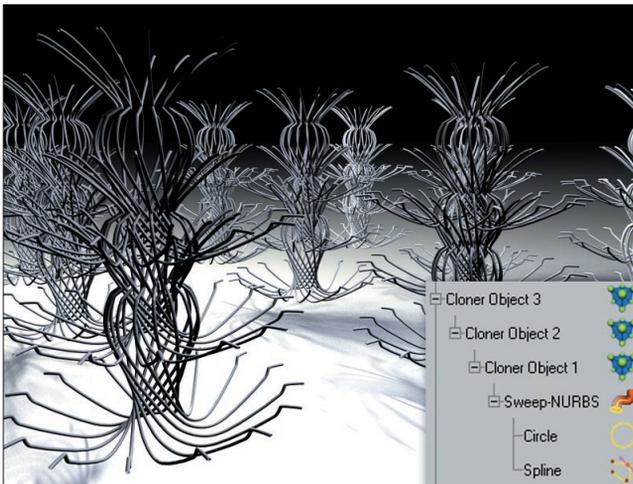
The Cloner Object is THE object for the duplication of other objects, arranging clones onto vertices of other objects, arranging clones onto splines, etc. The Cloner Object sets your object(s) up so they can be affected by various Effectors. These Effectors can be used to “disrupt”, animate, color or modify your object and much more.



In order for the Cloner Object to work, the object to be cloned must be made a child of that Cloner Object.

The Cloner Object can in turn also be made a child object of another object if the clones should be arranged onto vertices, edges, polygons of that parent object (“Mode” = “Object”).

Cloner Objects can be arranged in just about any order in the hierarchy. Although very interesting effects can be achieved by using the simplest elements.



In the image above, a Sweep NURBS was applied in conjunction with 3 Cloner Objects. Each Cloner Object worked as follows:

- 1<sup>st</sup> Cloner Object: Clones the Sweep NURBS thrice linearly (“Mode”=“Linear”)
- 2<sup>nd</sup> Cloner Object: Clones the result several times, in a radial manner (“Mode”=“Radial”) which results in a single wire column.

- 3<sup>rd</sup> Cloner Object: Clones the wire columns in a grid pattern (“Mode”=“Grid Array”), whereby several wire columns were created.

If the above sample can be so easily created by animating the settings of Cloner Objects and Effectors you can imagine what kind of spectacular effects you can achieve once you’ve gotten to know the MoGraph module a little better.

Cloner Objects can be made editable at any time (each clone will be converted into an actual object) by simply activating the Cloner Object and selecting “Make Editable” in the Object Manager’s “Object” menu (or by pressing the “c”-key on your keyboard). Each clone will be made an individual object.

*Note:*

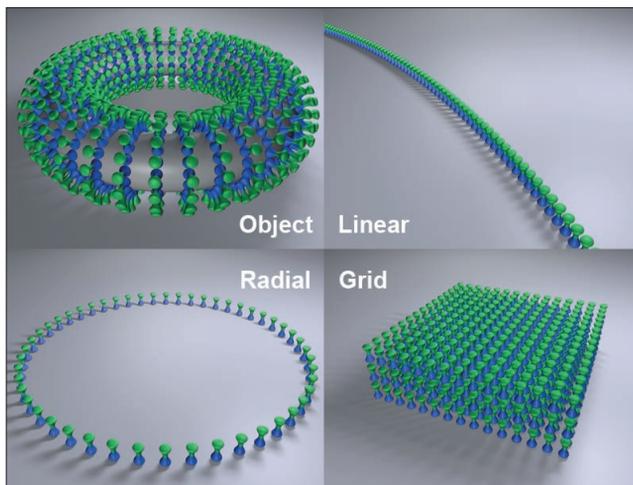
*We suggest you use this function sparingly, though. Otherwise it can be easy to loose track of what you’ve done, and limitations can occur when baking for animations (see chapter 4). Aside from that, you can end up creating hundreds of thousands of clones that can be a killer for your workflow.*

### Make Object Editable

MoGraph also offers other clone-generating objects, such as the Matrix Object, the Fracture Object and more that share some of the Cloner’s settings, like those in the “Transform” and “Effectors” tabs. These are only described here with regard to the Cloner but the functions are the same.

### Object Tab

The four available modes all have their own corresponding settings, which will be displayed for the mode selected.



### Object Mode

When in this mode, a Cloner’s children will be assigned to other objects. There are two methods that can be used to tell the Cloner on which object clones should be generated:

1. Make the Cloner Object a child of the “shaping” object.

2. Place the “shaping” object into the “Object” text field.

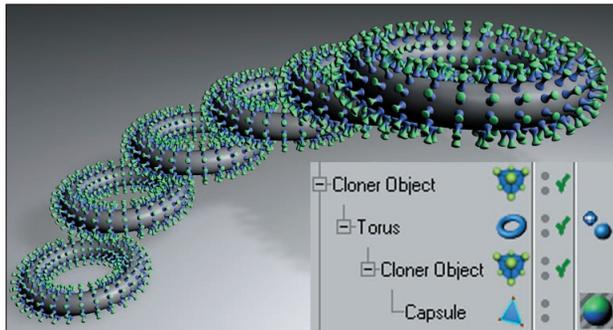
If both of the above-mentioned conditions are true, #2 will receive priority.

The clones will be assigned as follows:

- Polygonal objects: Vertices, edges, polygon center, randomly arranged onto an object’s surface, selections.
- Splines: Along the splines.
- Particle emitters or Thinking Particles particle groups: Onto the particles.
- Matrix Objects: A clone will be positioned onto each vertex of the matrix.

*Note:*

*A Cloner will also function if it is itself a child of a polygon object, spline or emitter. In the case of the emitter, the “Object” text field should not contain any object. Even Cloner Objects within a hierarchy can be cloned, e.g. if the hierarchy below is used:*



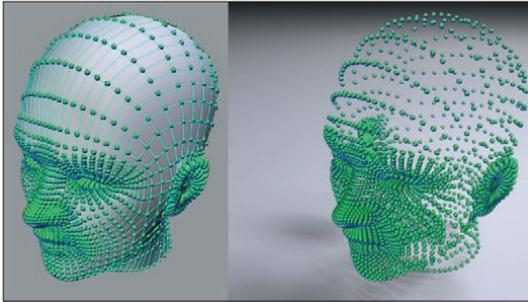
### Clones / Fix Clone / Fix Texture

These functions are the same as described under “Linear Mode” (p. 17).

### Object

Objects such as those listed in the image above can be placed into this field. The object that defines the “shaping” must be made a child of the Cloner. The settings that will subsequently be made available will correspond to the shape used. These settings are described below.

## Polygonal Objects



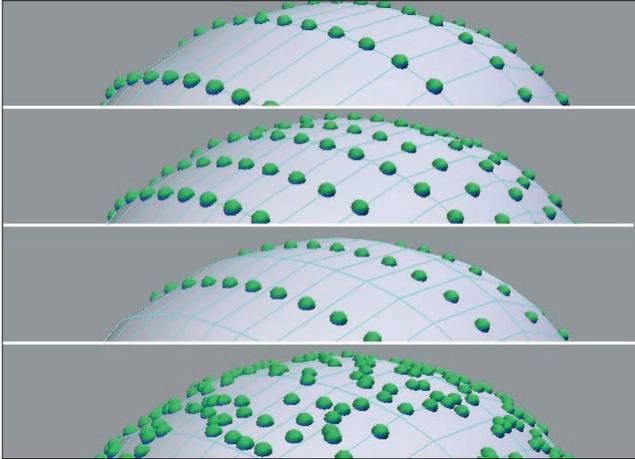
If a polygonal object is used as a cloner, the clones will be arranged onto its vertices, edges, polygons, surfaces or selections. Either polygonal or parametric primitives can be used. Of course HyperNURBS can also be used. By nature, many vertieces will be created , thus really bogging down your computer due to the immense number of clones that will be generated.

### Up Vector

Activating the “Align Clone” option clearly aligns a clone’s Z-axis but not the rotation around it. Picture a surface, deformed using a Displace Object and an animated noise, on whose vertices clones have been arranged. When viewing the animation you will see that the Z-axis point in the direction of the corresponding surface normals but the rotation around this axis takes place in a more or less random fashion. If an up vector is now set (using the coordinate system of the object on which the clones grow) this random rotation will be halted. Basically, this works in the same fashion as the “Align” expression (CINEMA 4D Tags), the only difference being that a ready-made vector has to be selected instead of a target object being defined.

As an alternative, a Target Effector can also be used. The result will be similar.

## Mode



Use this setting to define where the clones should be arranged:

- Vertex: A clone on each vertex point.
- Edge: A clone on each edge (additional settings will be made available).
- Polygon Center: A clone on each polygon center.
- Surface: Clones randomly arranged over an object's entire surface.

"Edge" mode offers the following options:

- Offset: Moves the clones along the edge (values less than 0% or greater than 100% can also be define, whereby the movement of the clones will not be limited to the edges).
- Scale on Edge: The clones will be scaled in the direction of the edge.
- Edge Scale: Use this slider to adjust the size of the clones in the direction of the edge (only available if "Align Clone" and "Scale on Edge" are active).

Selecting "Surface" will make the "Seed" and "Count" settings ("Seed": Different values will result in different random arrangements; "Count": Number of clones that will be randomly arranged onto the object's surface). If this mode is selected when working with a selection, the clones that lie outside of the selection will be hidden. For example, if a specific number of clones to be arranged onto a given surface have been defined (e.g. 473), only those clones on the selection will be displayed (e.g. 34).

## Selection

Any vertex-, edge-, or polygon selection made using the Selection Tag can be placed into this field. The clones will then be arranged only in the area of that selection.

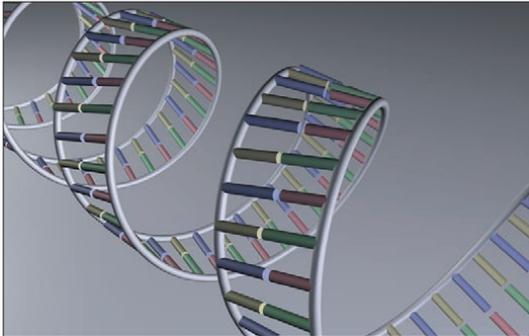
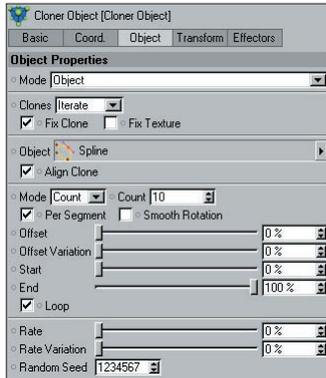
## Enable

Use this setting to enable or disable cloning on a given Selection Tag.

## Restrict to Live Selection

Use this setting to restrict the clones to a currently active selection.

## Splines



*A simplified DNA strand created using two helix splines. Clones were used to create the base pairs.*

If the Cloner is used in conjunction with a spline (spline primitives will work as well), the clones will be arranged onto the spline. The type of spline used does not play a role (the Cloner offers settings that can be used to arrange clones uniformly).

The Spline Effector can also be used to, among other things, evenly transform any arrangement of clones onto a spline.

## Align Clone

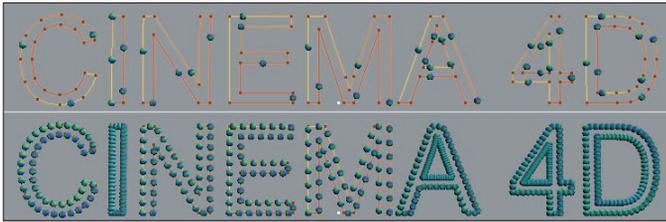
Activating this setting will make the clones follow the shape of the spline tangentially with their Z-axis.

## Mode

Use this setting to define how the clones will be spaced on the spline:

- **Count:** Use the neighboring “Count” setting to define the number of clone segments. Clone spacing will not be uniform, but dependent upon the spline interpolation (i.e. “Natural”, “Even” or “Adaptive”). This result is more often not desired and can be countered by the following modes.
- **Step:** Use the neighboring “Step” setting to define the interval between clones along the spline. The spline will be covered in its entirety by clones.
- **Even:** Use the neighboring “Count” setting to define a number of clones. The clones will be arranged with equal intervals along the spline.

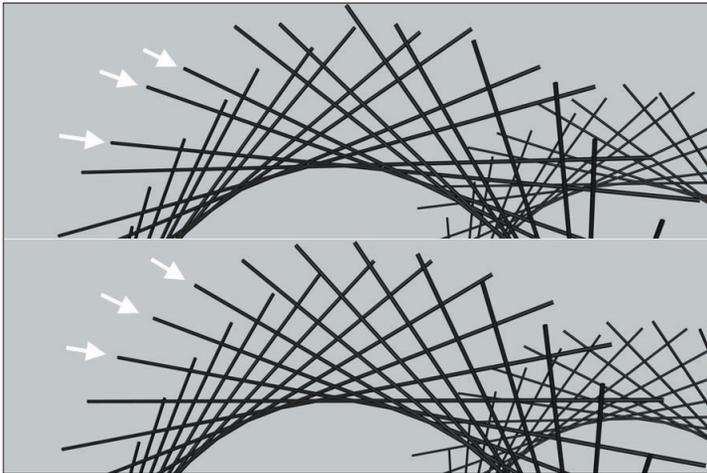
### Per Segment



At top: “Per Segment” not active. At bottom: “Per Segment” active.

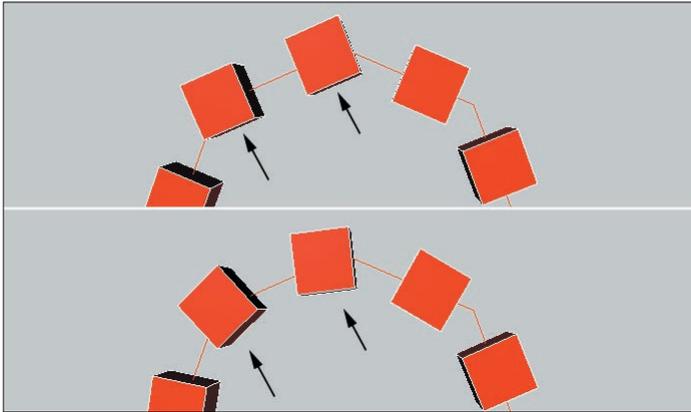
Activate or deactivate this setting depending on whether the defined number of clones or steps should be applied to a spline as a whole or per spline segment (each segment will then be viewed as an individual spline).

### Smooth Rotation



At top: “Smooth Rotation” not active. At bottom: “Smooth Rotation” active. Long cylinders were cloned along a helix-shaped spline).

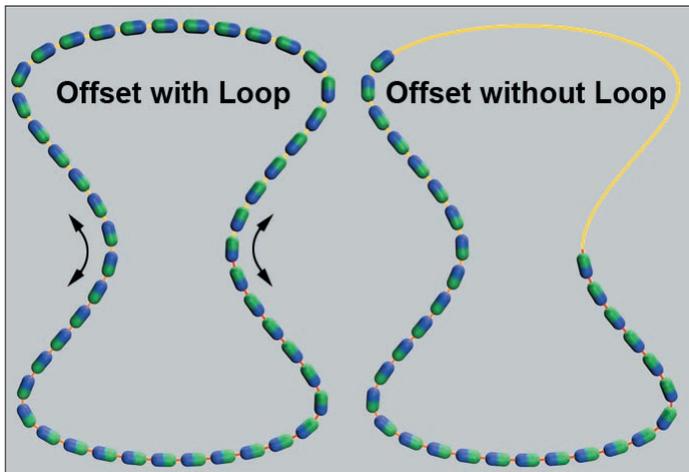
If irregular results occur, as in the top half of the above image, this setting should be activated in order to achieve a more exact calculation of angles for all clones. Irregular results very often occur when splines with few defined vertices are used. Nevertheless, activating this option can also lead to unwanted results:



Top: "Smooth Rotation" not active. Bottom: "Smooth Rotation" active.

Both marked clones are located on a straight spline segment. If "Smooth Rotation" is active, the clones will be rotated smoothly, thus preventing a tangential orientation (which can occur if "Smooth Rotation" is not active).

## Offset



A spline always has a beginning (yellow in point mode) and an end (red). If “Offset” is set to 0%, clones will be arranged from the beginning to the end of the spline. If the “Offset” value is raised, the first clone (as well as all subsequent clones) will be arranged further along the spline, in accordance to the value entered. If “Loop” is also active, all clones will be arranged along the spline in a complete loop. If “Loop” is not active, the clones that are arranged past the end of the spline will be deleted. Setting the “Rate” slider to a value not equal to 0% will cause the clones to circle in the course of an animation (setting keys for “Offset” will not be necessary).

### Offset Variation

Use this setting to vary the otherwise equal intervals between clones.

### Start / End

Use these settings to limit or expand the arrangement of clones along the spline.

### Loop

If “Offset” and “Rate” are set to values not equal to 0%, clones arranged past the end of the spline will be deleted (“Loop” not active) or seamlessly (without transition) reinserted at the beginning of the spline (“Loop” active).

“Loop” should always be activated if the clones should circle endlessly on the spline.

### Rate

“Rate” basically functions like “Offset”, with the exception that the clones will move automatically when the animation is played, without having to set keys. This setting defines the distance the clones should travel per frame of animation. Activate “Smooth Rotation” if any irregular movement should occur.

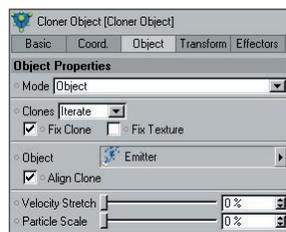
### Rate Variation

Use this slider to randomly vary the clones’ velocity. If the value defined is high enough, individual clones can even be made to move in reverse. Values less than 0% and greater than 100% can also be defined.

### Random Seed

This setting influences the random dispersion of velocity of the clones. Vary this value to randomly vary the clones’ velocity.

### Particles (CINEMA 4D)



If a Cloner is used in conjunction with a CINEMA 4D emitter, a clone will be created for each particle. This, combined with the numerous available Effectors, offers possibilities above and beyond what the CINEMA 4D particle system by itself can offer.

### Align Clone

If this setting is active, the clone's Z-axis will be aligned with the particle velocity vector, which will result in a tangential behavior along the particle path. The Emitter's "Tangential" setting must also be activated.

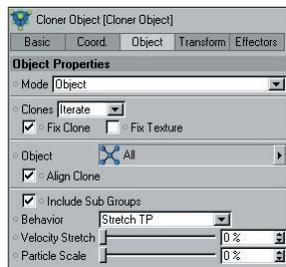
### Velocity Stretch

Use this slider to stretch the clones in the direction of the velocity vector. The clones will be stretched proportional to the particle speed. The greater the particle speed, the more the clones will be stretched, independent of the value entered for "Velocity Stretch".

### Particle Scale

The Emitter's "End Scale" setting can be used to generate uniform particle growth. This slider merely multiplies this Emitter setting.

### Particles (*Thinking Particles*)



Thinking Particles can also be used in conjunction with MoGraph. Simply drag the desired Thinking Particles group from the Thinking Particles Settings (Plugins / Thinking Particles / Thinking Particles Settings) into the "Object" field. Clones will then be created for the particles.

### Include Sub Groups

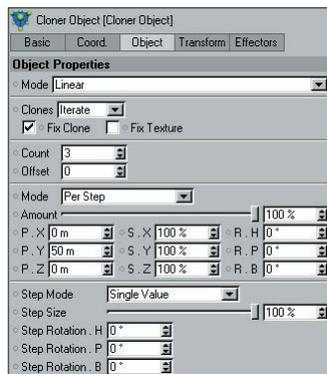
If this setting is active, sub-groups (in the order they are arranged in the Thinking Particles Settings) of the particle group placed into the "Object" field will also be included.

### Behavior

Two types of behavior are available:

- Standard TP: Reflects the normal behavior of Thinking Particles, with the exception that the clone size can be varied via the “Particle Scale” slider. The “Particle Scale” slider multiplies the value defined for the “Size” setting, for example for the “P Storm” node.
- Stretch TP: When in this mode, clones can be scaled along the velocity vector using the “Velocity Stretch” slider. Clone size can be defined using the “Particle Scale” slider. “Particle Scale” multiplies the value defined for the “Size” setting, for example for the “P Storm” node.

## Linear Mode

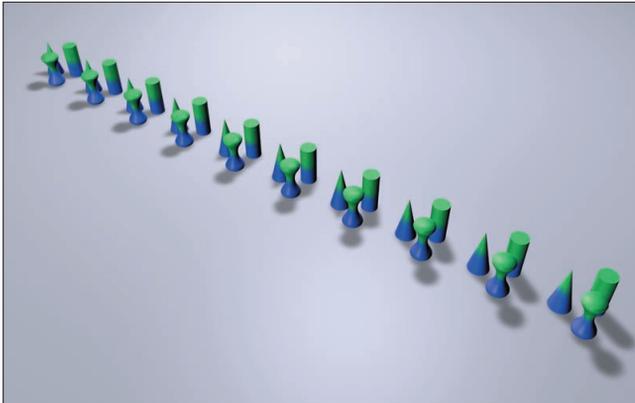


When in this mode, a clone’s child objects will be arranged linearly (can also be curved), originating from the Cloner. The clone’s “Position”, “Rotation” and “Scale” settings can be modified which will cause the child objects to move accordingly.

## Clones

Use this setting to define in which order a clone’s child objects should be cloned. The following options are available:

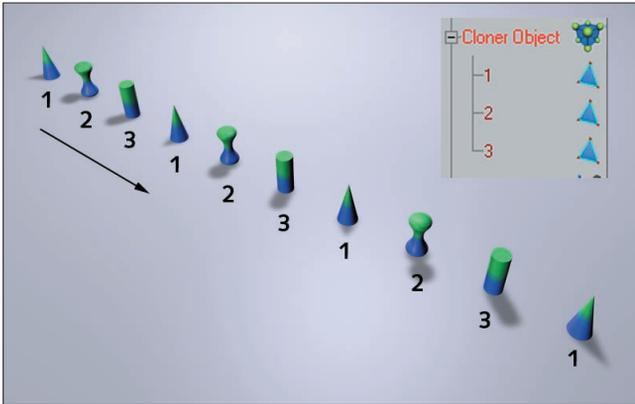
- Cluster



Three objects cloned in "Cluster" mode ("Fix Clone" not active). The three original objects were placed a slight distance apart; if all would have been placed at the same location, each of the resulting clone clusters would have consisted of three clones at the same location.

A clone's child objects will quasi be packed into one cluster and this cluster will be cloned as a whole.

- Iterate



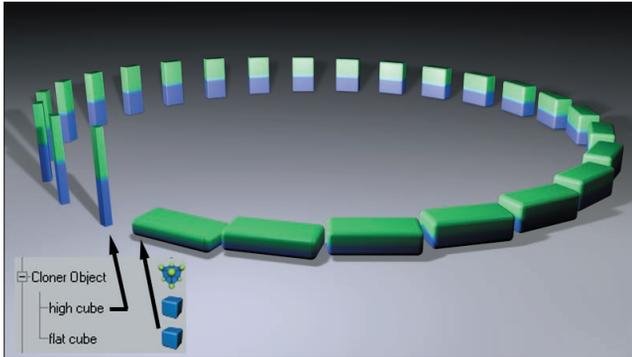
A clone's child objects will be cloned in the order they are arranged in the Object Manager, from top to bottom.

- Random

A clone's child objects will be arranged randomly when cloned. The random arrangement can be varied by modifying the neighboring "Seed" value.

- Blend

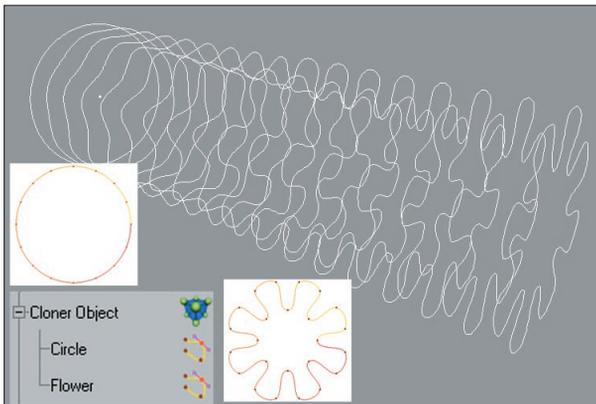
This mode has two functions: First, it can blend parametric primitives with differing settings, as shown below:



In the image above, two parametric cubes were cloned, each of which have differing settings “Scale” and “Fillet Radius” settings. The “Blend” ensures a correct interpolation of the object settings. The blend mode can also be applied to more than two child objects at once, whereby the interpolation of the settings will take place in the order they appear in the Object Manager. The parametric primitives must all be of the same type (otherwise no parametric interpolation will result!). Settings or options not able to be interpolated cannot be modified smoothly, but will abrupt.

*Example:*

*The “Blend” mode can also be used to blend spline shapes. The best results can be achieved if both splines have approximately the same number of vertices.*

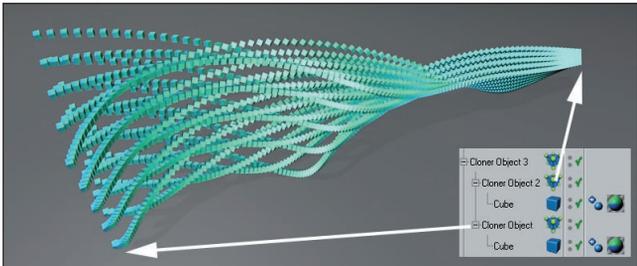


Lights, including their colors and many other settings, can also be cloned, the results of which can be very interesting:



In this example, color, shadow density and the diameter of the visible light were blended.

Two Cloners (each in "Grid" clone mode) were made children of a third in "Linear" mode ("Clone" set to "Blend"; "Fix Clone" not active, P.X", "P.Y" and "P.Z" =0).

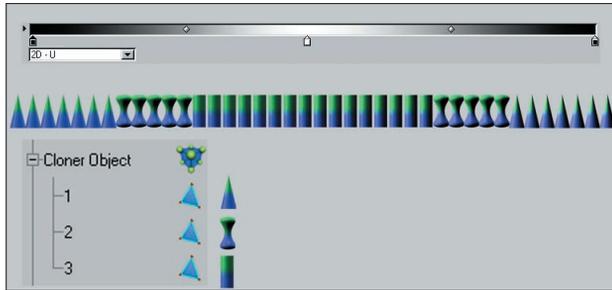


The "Blend" setting can be used to blend different Cloners.

- Sort

The "Sort" mode first flexes its muscle when used in conjunction with Effectors (those that support this mode must have their "Parameter" tab's "Modify Clone" value set to greater than 0%). The respective Effector can then vary position, scale, rotation, etc. as well as the sequence of child objects used to affect the Cloner. If no Effector were applied, only the first child would be cloned.

*Example:*

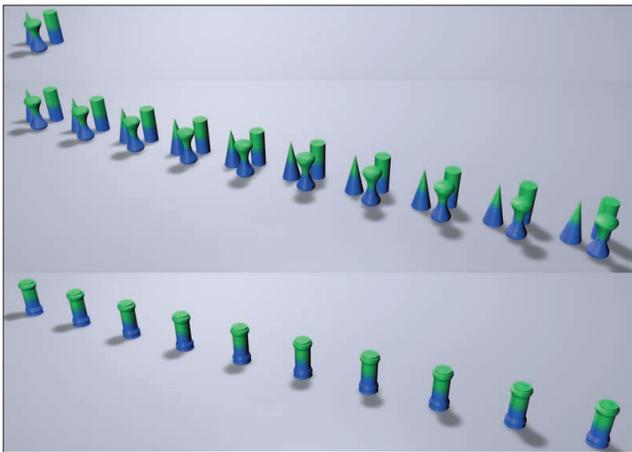


A Shader Effector was used in the previous image. The child objects are analyzed in the sequence they are arranged and affect the cloning process accordingly (black=first object; white=last object).

### Fix Clone

If this setting is not active, differences in position, scale and rotation between the Cloner and the objects to be cloned will be made apparent by the fact that the clones will also be rotated, scaled or moved. This makes sense especially in the "Cluster" clone mode since the objects to be cloned would otherwise share the same location (see next image).

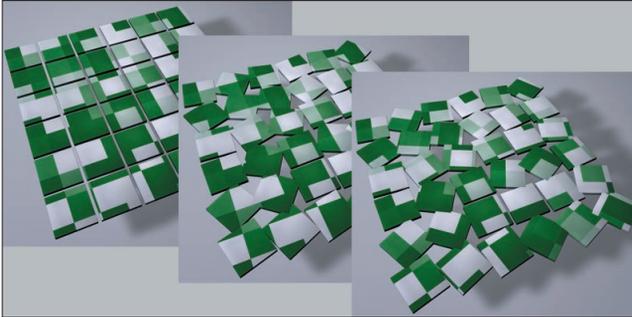
If this setting is active, the first clone will assume the position, scaling and rotation of the Cloner (for you XPresso lovers out there: its matrix will be assumed).



*At top are the three objects to be cloned, each at a slightly different location. Center: "Fix Clone" not active. Bottom: "Fix Clone" active.*

If this option is not active, position, scale and rotation values of animated objects to be cloned will be assumed for the clones.

## Fix Texture



*An arrangement of clones with a texture applied as a surface projection. Left: No Effector. Center and right: Random Effector with "Fix Texture" not active and "Fix Texture" active, respectively.*

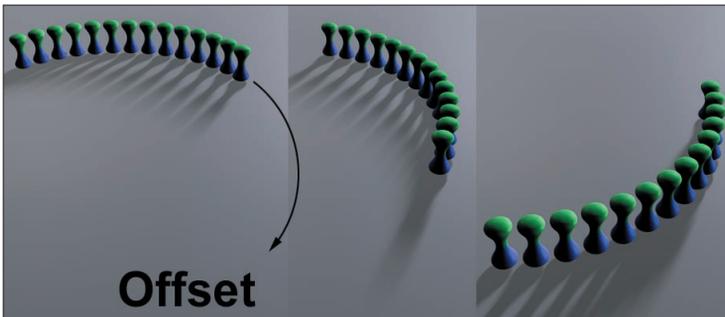
If a Cloner is textured, the "Fix Texture" setting will define if the texture should be projected onto the arrangement of clones not affected by the Effectors, thus fixing it on the clones. If the clones are then moved or rotated via an Effector, the texture will move with it. Otherwise the clones will basically move through the texture and will be affected by the texture according to their location.

This method works with every projection type, except for UVW-mapping.

## Count

Enter the number of clones to be created here. Each clone will be moved, rotated or scaled by a certain value relative to the previous clone in accordance with the values entered for P.X., P.Y, P.Z, R.X, R.Y, R.Z, S.H, S.P or S.B.

## Offset



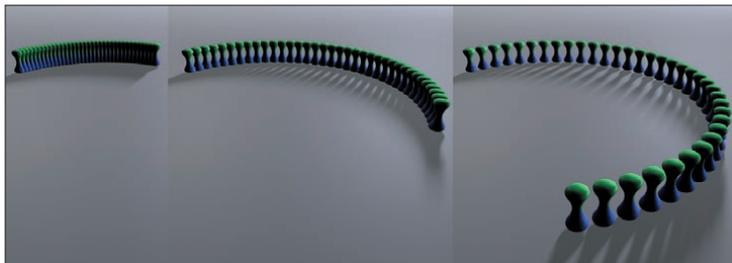
"Offset" will move the first clone, in accordance with the value entered, in the direction of subsequent clones, thus offsetting the entire line of clones. The function graph can also be used to define how "Offset" will be applied along the length of the line of clones.

## Mode

Use this mode to define if the “Position”, “Rotation” and “Scale” settings should apply per step (“Per Step”) or end point (“End Point”): the values will be interpolated between the start and end points). You can switch modes at any time.

The Step Effector has a similar function. The Step Effector also offers you a spline graph which can be used to define how the modified settings should be applied along the length of the clone.

## Amount



*An increasing “Amount” value from left to right. Only the position of each clone changes (scale and rotation can also be modified).*

This slider affects the actual effectiveness of the nine clone settings below it (position, scale, rotation), starting at “0”. Mathematically seen, “Amount” is merely a multiplying factor that affects these nine settings. This setting can be used to create good-looking growth effects.

## Position, Scale, Rotation

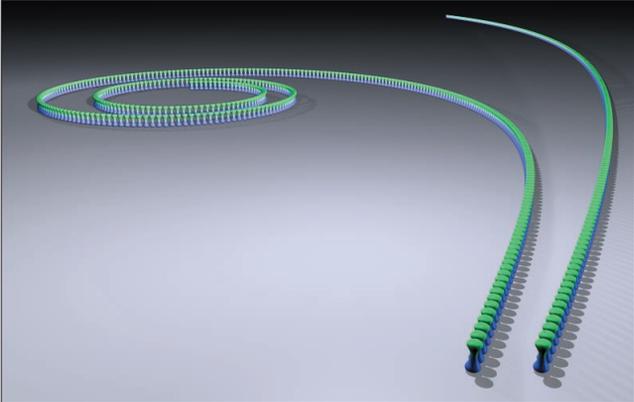
Use these settings to define if and how clones should be modified relative to the next clone’s position, scale or rotation.

If “Per Step” is selected, the values will reflect the difference to the previous or next clone. If “Endpoint” is selected, the values will reflect the difference between the first and last clone, and the values in-between will be interpolated. The position of the last clone can be modified interactively by dragging the orange handle in the editor view (as long as the “Step” settings have not been modified).

## The Step Functionality

The “Linear” mode can also be used to arrange clones along a curve or spiral, not just in a straight line, as the name may suggest. This can be done using the following settings:

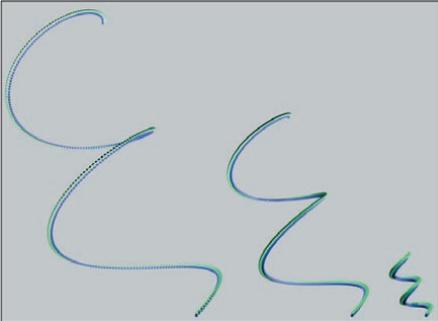
### Step Mode



From left to right: "Cumulative" and "Single Value" modes, respectively.

Use "Step Mode" to define if the change in rotation should steadily increase from clone to clone ("Single Value") or between the first clone and the last clone, starting at "0" ("Cumulative"). The latter results in spiral-like clone arrangements.

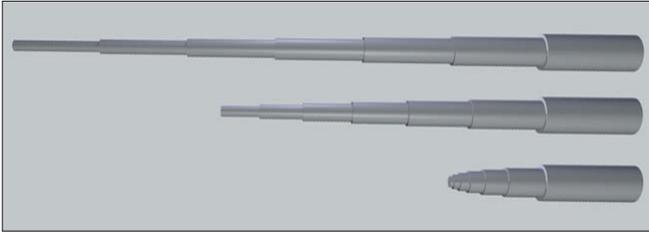
### Step Size



From left to right: Decreasing "Step Size" value (the spiral shape was a result of entering rotation values for all three "Rotation" settings).

Use this setting to define the step interval between individual clones. This is paramount to scaling the entire arrangement of clones (not only the clones themselves!), starting from the origin of the Cloner.

"Step Size" can also be used to animate a telescope extending (the "Amount" setting cannot be used to achieve this effect since it would simultaneously increase the cylinder diameter).



Telescoped cylinders with varied "Step Size" values in "Per Step" mode.

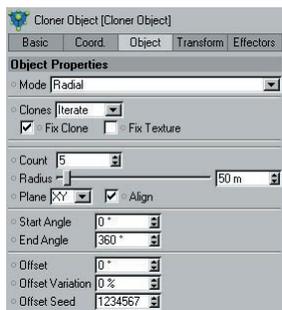
### Step Rotation

Use these three fields to define the curvature of the "clone line". If all values are set to  $0^\circ$ , no curvature will occur. Raising these values will increase the curvature accordingly.

### Step Rotation H/P/B

Modifying at least two of these values will result in the spline being spiraled; modifying only one of these values will cause the spline to bend in the direction of the respective value (H=Y-axis; P=X-axis; B=Z-axis).

### Radial Mode



Selecting this mode will arrange a clone's child objects circularly around the center of the Cloner.

### Clones / Fix Clones / Fix Texture

These settings work exactly as described for the "Linear" setting.

### Count

Use this setting to define the number of clones to be arranged onto the radius.

### Radius

This is the radius onto which the clones will be arranged around the Cloner. The radius can also be edited interactively, simply by dragging the orange handles in the editor view.

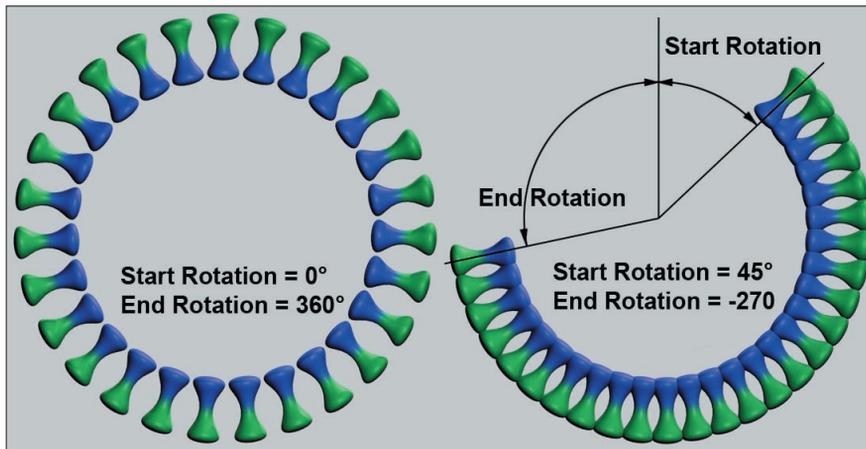
### Plane

Use this setting to define the axis plane on which the circle and clones should lie, whereby the Cloner's coordinate system remains the deciding factor.

### Align

If this setting is active, each clone will be arranged with its X-axis tangential to the circle. If this setting is not active, each clone will orient itself in accordance with the Cloner's coordinate system.

### Start Rotation / End Rotation



Use these settings to define onto which part of the circle the clones should be arranged. Values less than 0% and greater than 100% can also be defined (this will result in overlapping).

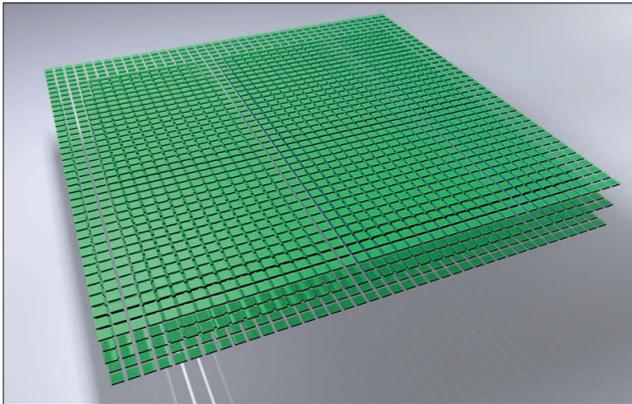
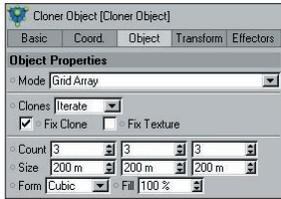
### Offset

Use this setting to let the clones move along the circle.

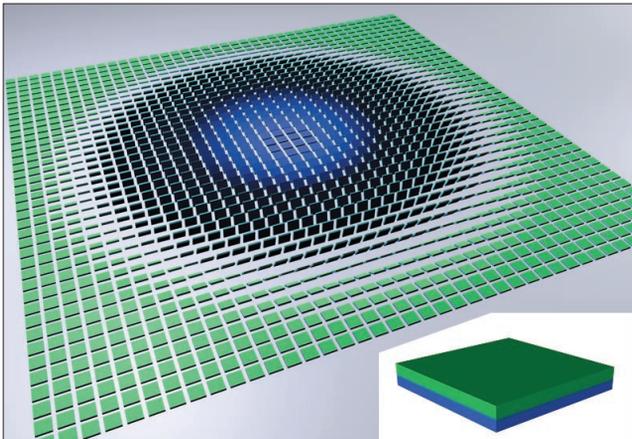
### Offset Variation

Use this setting to randomize the arrangement of clones for a more “coincidental” look.

## Grid Array



Selecting this mode will arrange a Cloner's child objects in a grid-like manner. This can be used to achieve effects such as the one below:



*The object (insert) was cloned and its rotation varied in the "Grid Array" mode.*

Some very nice effects can be achieved by letting an Effector fly through such an arrangement of clones.

Since using “Grid Array” can generate very many objects, thus slowing the editor view, the following CINEMA 4D level of detail settings can be used:

- Editor view: Display / Level of Detail
- Display Tag. Assign the Tag to the Cloner.

### Clones / Fix Clones / Fix Texture

These settings work exactly as described for the “Linear” setting.

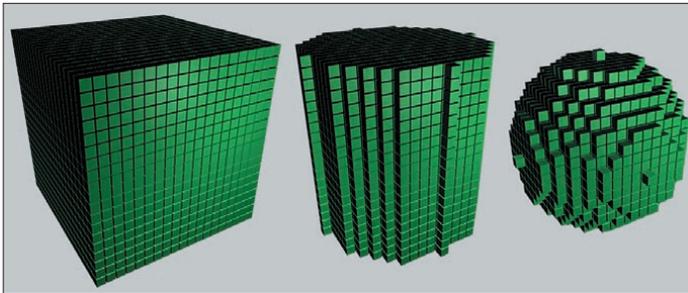
### Count

Use this setting to define the number of clones to be arranged in the X-, Y-, and Z-directions.

### Size

Use this setting to define the scale (expansiveness) of the entire arrangement of clones in the X-, Y-, and Z-directions. The orange handles can also be used to resize the arrangement of clones interactively.

### Form

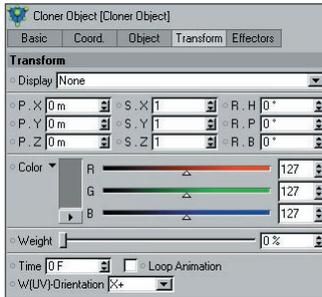


There are three types of forms from which to choose: “Cube”, “Sphere” and “Cylinder”. As you can see in the example above, when in “Cylinder” or “Sphere” mode, superfluous clones that don’t fit into the shape will simply be ignored.

### Fill

Lowering this value will reduce the number of clones on the inside of a defined shape accordingly – even to the point where the shape is made hollow (only its outer shell will remain).

## Transform Tab



## Display

Use these settings to aid in displaying various clone properties. These properties will be displayed in the editor view in the form of colored vertices (it may be necessary to hide the objects to be cloned in order to be able to see the vertices). The following options are available:

- None: The vertices will not be visible.
- Weight: Each clone's weighting will be displayed from red (0%) to yellow (max. weighting).
- UV: The internal UV-coordinates will be shown, starting at 0,0,0 (black), i.e. black to red, black to green and black to blue, respectively.
- Color: The clone color.

## P.X, P.Y, P.Z, S.X, S.Y, S.Z, R.H, R.P, R.B

Use these settings to rotate, move or scale each clone using its own coordinate system. Simple animations can be defined that will affect each clone uniformly. For example, modifying the "R.H" value will make all clones rotate uniformly around their Y-axis.

Even more control can be gained by also applying Effectors, which can affect individual clones using certain scaling factors.

## Color

Included in MoGraph are several shaders that work in conjunction with Cloners. If a material containing a MoGraph color shader is assigned to a Cloner, each clone will assume this color as its "initial color", which can subsequently be influenced by Effectors.

## Weight

Use this setting to assign each clone an initial weighting. Each Effector can then use this value to affect the clone accordingly. More about what can be done using weighting is explained in chapter 3 under "Weight Transform".

## Time

Let's say an object has been cloned whose position (or any other setting) was animated. The clones will assume this animation with the delay defined here.

If the “Fix Clones” option is active, it may occur that only one of the animated settings will work. Animated position, scale or rotation settings will not work.

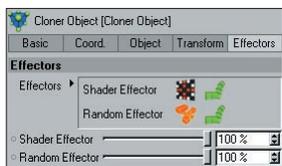
### Orientation (only in “Grid Array” mode)

Use this setting to define the direction in which the W-axis of the UVW-coordinate system should point.

### Animation Loop

If active, animations of parameter-animated clones will be looped.

## Effectors Tab



Place all Effectors into this field that should affect the Cloner. Effectors can be added to this field by:

- Dragged into this field from the Object Manager.
- Creating a new Effector for an active Cloner.

Clicking on the green checkmark will deactivate the Effector, clicking on the red “x” will again activate the Effector. This can also be done in the Object Manager. (the effect of the Effector will be applied globally).

Each Effector has a corresponding slider below the “Effectors” field, with which the Effector’s strength can be adjusted. This value will be multiplied with the Effector’s “Strength” setting.

#### Note:

*Arranging the Effectors in different sequences (top to bottom) in the “Effectors” field will lead to different results. For example, if a Random Effector and a Spline Effector are placed into this field: If the Spline Effector is executed before the Random Effector, all clones will not be able to be arranged onto the spline, which would be the case if the Random Effector were executed first.*

Also important is the sequence in which Effectors with weighting transformations are executed, i.e. if Effector 3 should use Effector 2’s weighting, Effector 3 should be placed after Effector 2 in the list.

The sequence of Effectors can be modified simply by dragging them to their desired positions.



**CINEMA 4D**

**Release 9**

**3 Effectors**



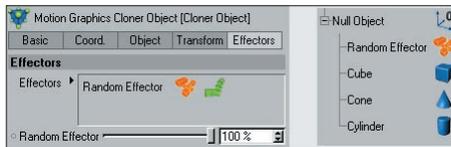
## 3. Effectors

### General

Effectors are objects that can affect the following:

- Clones, matrix, text objects, etc., i.e. all MoGraph clone-generating objects.
- MoGraph extruder objects (see chapter 4 “Extruder Object”).
- “Normal” CINEMA 4D deformation-free objects (e.g. those that can be made a child of a Fracture Object).
- As deformation objects on an object’s points or polygons (see also “Deformation Tab”).

Effectors must be arranged in the following manner in order to work:



*Left, the Random Effector affects a Cloner Object; right, the Random Effector effects CINEMA 4D objects.*

An Effector created for a clone-generating object will be placed in the Effector list (left).

### What do Effectors do?

Effectors take existing clones, objects, object points (only their respective positions) or object polygons and vary their position, size, angle and many other properties, according to Effector-specific idiosyncrasies (see chapter 3 “Parameter Tab”).

- The Random Effector.
- The Step Effector sequential.
- The Shader Effector in conjunction with a texture, etc.

### How do Effectors work?

For those who really want to know the nitty-gritty:

Effectors can be separated into two groups:

1. Effectors that ascertain an initial value per clone and transform them based on individual clone parameters (those that can be found in the “Parameter” tab). These Effectors are:
  - Shader Effector: Ascertain an initial value from a texture’s gray scale.
  - Formula Effector: Ascertain an initial value based on a formula.
  - Random Effector: Ascertain an initial random value.

- Sound Effector: Ascertain an initial value based on the sound level of various frequencies.
- Step Effector: Ascertain consecutive initial values between 0 and 1, which are then assigned to each clone.
- Time Effector: Ascertain a steadily increasing initial value in the course of an animation.

These Effectors ascertain the respective initial value, multiply it by strength, min/max values, falloff, and with the values set in the “Parameter” tab. Thus, a final position for each clone is calculated. Sounds a little complicated, but don’t worry, MoGraph can also be understood by those of you don’t read math books in your spare time...

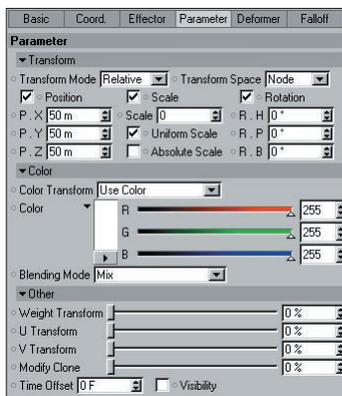
2. Special Effectors that, for example, use a spline or other animated object, etc. to carry out some sort of action. These Effectors are:

- Inheritance Effector: Assumes the position or animation of a reference object.
- Delay Effector: A special effect that affects every clone modification with regard to position, size and rotation simultaneously, e.g. to let them all bounce.
- Spline Effector: Arranges clones on a spline.
- Target Effector: Arranges clones.
- Group Effector: Groups Effectors into one Effector.

*Note:*

*In the following, for the purposes of convenience and easier reading flow, the term “clone” is used in place of listing “clone, matrix, text, extruder object, objects, object points, object polygons, etc.” each time.*

## Parameter Tab



Most Effectors have a “Parameter” tab in which all clone properties that should be affected by the Effector can be. Of course there are exceptions to the rule, as is the case with the Target Effector – it does not have a “Parameter” tab.

Some Effectors, like the Spline Effector or the Delay Effector, only have an effect on part of the clone properties described below. Irrelevant properties will be grayed out.

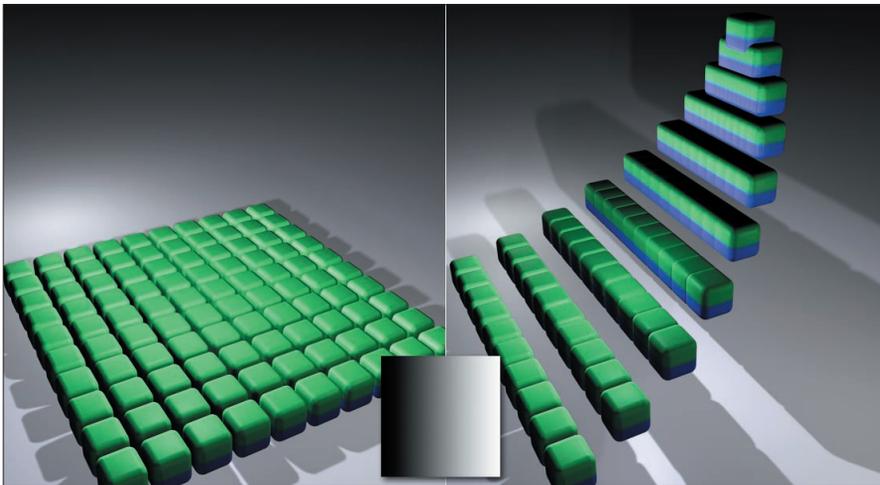
### Transform Mode



From left to right: Result without Effector, "Relative" mode, "Remap" mode, both with a Shader Effector with an integrated gradient and "Scale" transformation.

In the image above, the Effector affects the scaling of the clone. Depending on what transformation mode you select, the clones will be scaled via addition to the original size ("Relative" – mathematical: "clone parameter" + (clone parameter\*Effector value") or starting from "0" ("Remap", mathematically: "clone parameters\*Effector value").

Select "Absolute" when applying position transformation. The clones will generate in the direction of a point defined with P.X, P.Y and P.Z.



Left the result, right the Shader Effector containing the gradient (insert) and with a position transformation applied.

### Transformation Space

Most clone transformations that require a direction, e.g. position, angle or rotation, can be assigned a coordinate system here. Imagine this coordinate system in each clone, from which point the transformation takes place. You can select from the following:

- Clone: The clone coordinate system.

- Effector: The Effector coordinate system.
- Object: The object coordinate system of the object generating the clones (e.g. the Cloner Object itself).

### Position, Scale, Rotation

These parameters let you do the following:

1. You can define what the Effector should vary: Position, scale and/or angle. Simply activate the desired option and additional parameters will be made available correspondingly.
2. Define areas in which the Effector should vary the clones with respect to position, scale and angle, based on the individual capabilities it was given.

Simply put, the Effector establishes values between 0% and 100%, whereby 100% reflects the maximum values that can be entered for position, scale and angle.

*Example:*

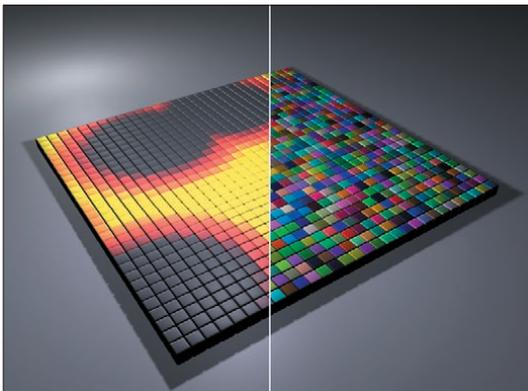
*A Shader Effector has been applied in conjunction with a black-and-white gradient. Black=0% and white =100%. If you now enter a value of 300m for P.Y, 300m will be the maximum Y-distance the clones will be moved by the Effector (to the location where the shader is colored white).*

### Scale

The following options will be made available when “Scale” is activated:

- Uniform Scale: The clones will be scaled uniformly in all three directions. If this option is not active, each direction can be set separately.
- Absolute Scale: It can occur, that negative weighting or scaling can result if unusual settings have been applied (e.g. cloned particles in conjunction with a Random Effector). The clones will then point in the wrong direction. Activating this option will eliminate this effect.

### Color



Left: Shader Effector. Right: Random Effector

The color modes primarily define if and how colors interpolated by an Effector will be combined with clone colors – those of the object from which the clones have been generated (see chapter 6, “Color Shader”). The Shader Effector and Random Effector are, though, somewhat different. Both generate shader and random colors when in the “Effector Color and Alpha” and “Effector Color no Alpha” modes, whereas other Effectors only output grayscales.

- Off: No color transformation. The clones will receive the color defined in the Cloner.
- Color with Effector Alpha: Use the color slider to define a color to be mixed with the original clone’s color, taking into account the alpha value of the Effector itself (the gray scale that corresponds to the “Effector Color no Alpha” mode).
- Color no Alpha: Use the color slider to define a color with which the clones will be colored, taking into account the falloff. This color has nothing to do with the Effector-specific transformation, i.e. it doesn’t matter if you define the color for a Formula Effector or a Step Effector, the clones will be colored uniformly within the falloff.
- Effector Color no Alpha: When applying the Shader Effector in conjunction with a Random Effector, the shader defined in the Shader Effector’s “Shading” tab will interpolate random colors. When using other Effectors, a gray scale value corresponding to the Effector’s effect will be interpolated.
- Effector Color and Alpha: See aforementioned point. In addition, an Effector-specific alpha channel will be taken into account (interpolated from the gray scale values of the colors created).

All modes, except for “Off”, offer a “Blending Mode” menu from which you can define the mode with which the interpolated colors should be mixed with the Cloner’s colors. The following modes are available:

- Mix: An average color between that of the Effector color and of the Cloner Object will be interpolated.
- Add, Subtract, Multiply: The colors will either be added, subtracted or multiplied.
- Divide: The Cloner’s color will be divided component-wise through the Effector color. This mode is not really a very effective one – it’s more for playing around with.

## Weight Transform

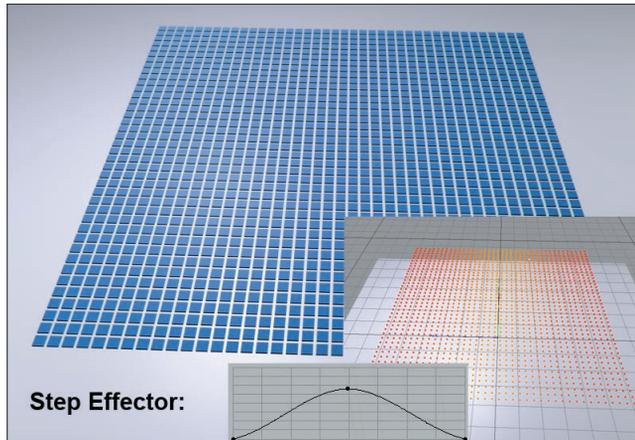
Imagine you can use one Effector to control any number of other Effectors: If, for example, a texture (Shader Effector) should define where the transformation of a Random Effector should have an effect. This is what “Weight Transform” does.

Basically, weighting can lie anywhere between 0% and 100%. The weight of any clone can be made visible by selecting the “Weight” display mode in the clone-generating object’s “Transform” tab. When that clone-generating object is active, the weight of each of its clones will be displayed and assigned a color between red and yellow, depending on the amount of weight it has (it may be necessary to make the clone-generating object invisible).

- Red: Weight = 0%
- Yellow: Weight = 100%

This weighting can be used by any other Effector when this Effector’s “Weight” slider in the “Falloff” tab is varied.

*Example:*

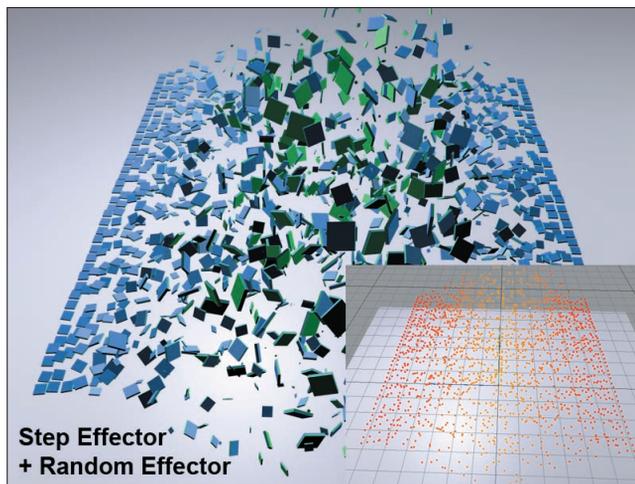


Above is an array of clones with a single cloned cube in the “Grid Array” clone mode. A Step Effector with the “Spline” function graph (see insert) was assigned to the cloned object. All settings for the Step Effector’s “Parameter” tab have been deactivated, except for “Weight Transform”, which was set to 100%. The only thing the Step Effector does now is give each clone a weighting of between 0% and 100%, as the red-to-yellow coloring of the grid shows.

If, for example, you want to use this weighting to control a Random Effector, follow these steps:

- Create a Random Effector and assign it to the Cloner. Make sure the Random Effector is executed after the Step Effector is executed (Cloner’s “Effectors” tab). Subsequently, make the desired changes to the position, scale and angle settings.
- Set the Random Effector’s “Weight” in the “Falloff” tab to 0%. It’s also a good idea to set “Shape” to “Infinite”. Otherwise the Effector’s falloff may still have an influence (unless, of course, this is exactly the effect you want...).

The result:



In the image above, the effects of position-, scale-, and angle transformation (and, if desired, all other transformations) caused by the weighting of the Step Effector can be seen. Using this weighting, any number of additional Effectors can be made to affect the Cloner. Sometimes it may be necessary to reset this weighting: The weighting can be set back to a defined starting value of 0% by creating a Shader Effector and setting its “Strength” value to 100% and “Maximum” and “Minimum” values to 0%, respectively (“Effector” tab). This shader must then be arranged behind all other shaders within the cloned object that are affected by the initial weighting.

## U / V Transform

All clones have internal UV-coordinates (they have nothing to do with texturing), with which the effect of each Effector is calculated. U / V Transform can be used to affect how Effectors that use these UV-coordinates, e.g. the Formula Effector, work.

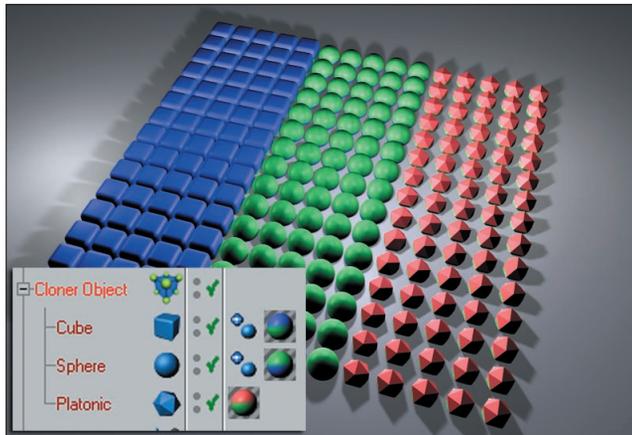
## Modify Clone

Use this parameter if you want an Effector to affect a clone’s child objects. This can be useful if the following is true:

- You have made several objects to be cloned children of a Cloner.
- The “Clone” setting has not been set to “Cluster”.

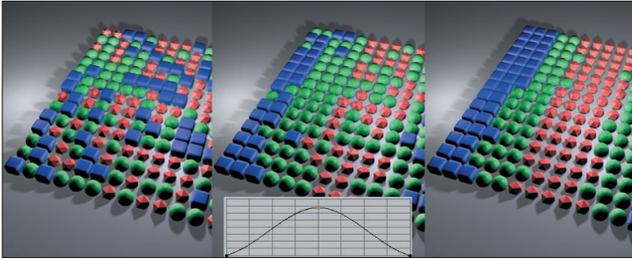
We suggest the “Sort” mode, which will make the effect more visible.

*Example:*



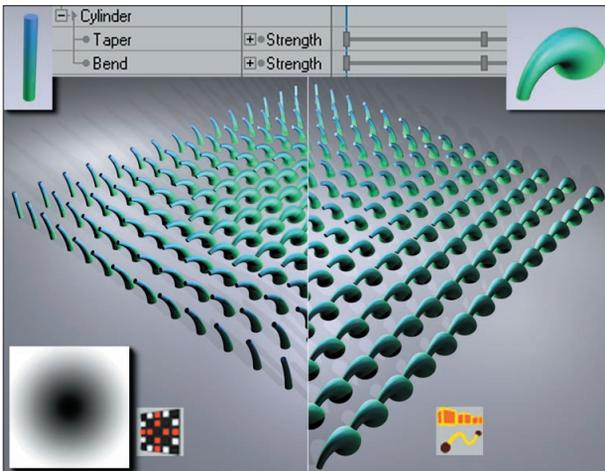
The Cloner Object in the image above was set to “Sort” and was subsequently assigned a Step Effector (see “Step Effector”). A “Modify Clone” setting of 100% will produce a result as shown above. The distribution of clones will change in accordance with any changes made to the “Modify Clone” setting. Values less than 0% or greater than 100% are also possible, which will vary the number of child objects used to create clones.

“Modify Clone” also works with other Cloner Object modes – the setting then simply modifies the number of clones to be modified:



The Step Effector curve (insert) causes the effects shown above when “Random” mode has been selected. The “Modify Clone” value increases from left to right.

### Time Offset



A cylinder animated using two different deformation objects: Left, a Shader Effector; right, a Step Effector.

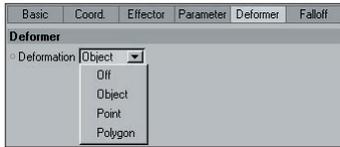
Lets say you have an object, animated solely via parameter animation (light source, deformation object, etc.). It would be nice if an Effector could generate clones from that object at different intervals. This is what “Time Offset” does.

In the image above, Taper and Bend objects were animated from frame 0 to 20. Each Effector was assigned a “Time Offset” value of 20 - the Effectors distribute the clones with the temporal offset in accordance with the gray scale values (Shader Effector), i.e. from clone 0 to the last clone (Step Effector) or from wherever the corresponding Effector draws its input values.

### Visibility

Use this setting to affect the visibility of clones. This option can’t be used with every Effector, though. This option can, for example, be used in conjunction with the Random Effector to randomly make clones invisible (make sure “Minimum” is set to -100%). The Step Effector and Shader Effector will hide clones set to “0”. This can occur with the Step Effector at the point at which the spline is set to “0” along the X-axis. In the case of the Shader Effector, this will occur in areas of black.

## Deformer Tab



The main function of Effectors is to work together with Cloners (see chapter 2, “Cloner”), whereby the clones will be deformed differently, depending on the Effector used.

All Effectors can also be used as deformation objects for normal polygon objects. Simply make the Effector a child of the object or make it, together with other objects within a hierarchical level, a child of a parent object. The “Deformer” tab also offers several additional useful settings. As you can see in the screen shot above, there are only a few transformations from which you can choose.

### Note:

*Using an Effector as a deformation object is useful if, for example, you want objects already placed under a Null Object to affect and Effector without the use of a clone-generating object. All objects will be treated equally, i.e. the Random Effector will arrange all objects with an offset of, for example, 1000m. The Effector cannot assign different values to different objects. If you want do to this, though, these objects must be made children of a Fracture Object (see chapter 4).*

## Deformation

Various options are available, depending on how an Effector should affect objects:

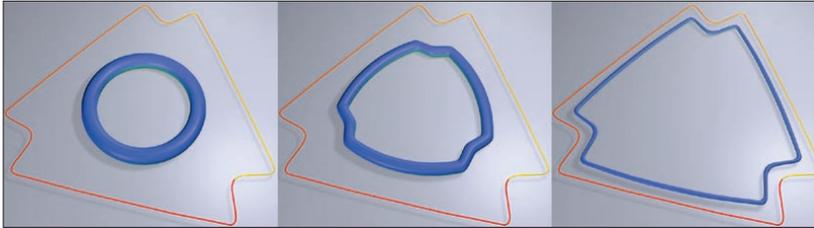
- Off: No deformation.
- Object: The objects as a whole will be modified.
- Point: Each point will be moved individually.
- Polygon: Each polygon will be moved individually using its own polygon coordinate system.

In the image below, the Random Effector was used to demonstrate how each element is moved.



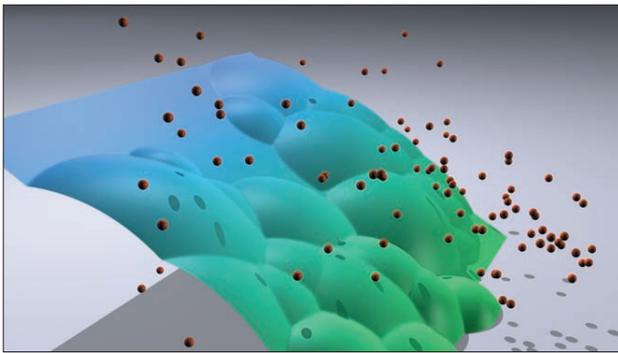
From left to right: “Object” mode, “Polygon” mode, “Point” mode. In the example on the right, all polygons were disconnected as well (main menu: Functions/Disconnect).

You can also use splines to transform objects using the Spline Effector, assuming the object has been sufficiently subdivided. A torus was used to create the examples pictured below.



*Increasing Spline Effector strength values from left to right with “Deformation” mode set to “Point”.*

Or how about a Simple Effector (a Shader Effector without a shader, only position transformation), whose falloff is defined by particles:



*The Effector falloff (in this example using a Plane) is defined by a radius around each particle.*

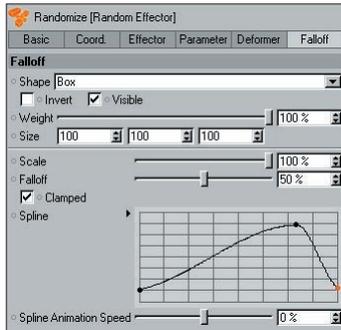
As you can see, a myriad of possibilities is available. As is the case with so many CINEMA 4D features, experiment to your heart’s content – there’s much to be discovered just by playing around with various settings.

**Note:**

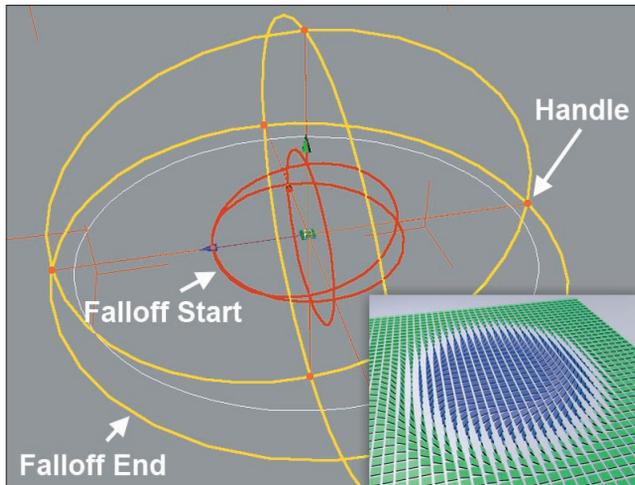
*There are some limitations when using Effectors as deformation objects: Transformation of color, “Time Offset”, weighting, etc. will not work. Concentrate on using the “Parameter” tab’s “Transform” menu. The Target Effector and Group Effector cannot be used as deformation objects.*

## Falloff Tab

### General



All Effectors have their own “Falloff” tab. Use the settings in the “Falloff” tab to define properties such as shape, expansion and much more for that Effector. Thus, the Effector can be limited in its spatial expanse (also with splines, particles, etc.). In the following, a Shader Effector without a loaded texture will be used to explain the settings that influence the R.P of each clone. Falloff works analog to any other parameter to be influenced.

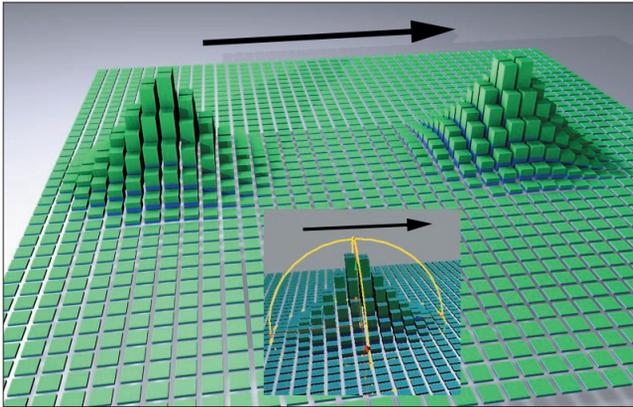


*The falloff of a spherical Effector. The actual falloff begins outside of the red radii.*

An Effector’s dimensions are displayed using the following colors:

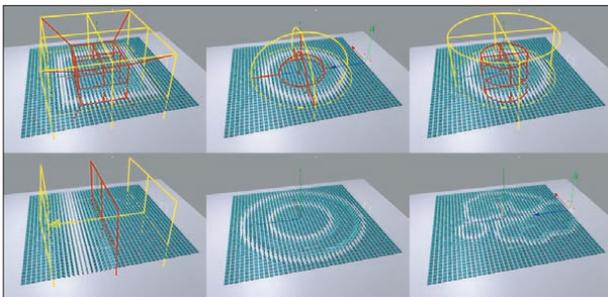
- Yellow: Maximum Effector expanse, beyond which it has no effect.
- Rot: The Effector’s strength is at its maximum within the red radii, outside of which the falloff begins, and continues to the yellow radii.
- Orange: Grabbers that can be moved interactively to adjust the Effector or falloff.

If you animate an Effector to pass through a group of clones, the falloff settings can be used to create soft transitions between areas not affected by the Effector and areas affected by the Effector.



An animated Effector with properly adjusted falloff settings results in a uniform displacement as it passes through a group of clones.

## Shape



Clockwise from the top left: "Box", "Sphere", "Cylinder", "Linear", "Source" (spline), "Source" (particle).

You can select from the following:

- Infinite: No falloff will be applied to the strength of the Effector. The Effector will affect the entire scene with full strength.
- Box, Cylinder, Sphere: The corresponding shape will result.
- Linear: Falloff will take place along the Effector's Z-length. The following applies: Full strength in the negative Z-direction, no strength in the positive Z-direction.
- Source: Splines or particles can be used and the falloff will take place within a certain distance surrounding the spline or particle.

### Invert

Inverts the falloff.

### Visible

Use this setting to turn the Effector's visible radius on or off (as long as "Shape" is not set to "Infinite").

### Weight

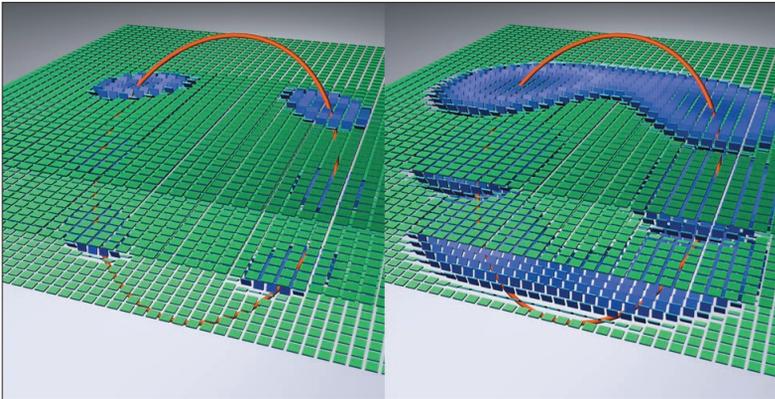
Use this setting to define to what degree an Effector should take into account any potential clone weighting (see also "Weight Transform"). A value of 100% means that the Effector will ignore the clone weighting; a value of 0% means the clone weighting will have a maximum effect.

### Scale

Use this setting to define the three-dimensional size of the Effector.

### Shape Source (Spline)

#### Sample Distance



Left a lesser, right a greater "Sample Distance" value.

Internally, a number of sample points (set using "Sample Detail") are assumed along the spline, around each of which a radius is created. The clones will be affected within these radii. If "Sample Detail" is set high enough, a tube will be visible around the spline, its radius equal to the "Sample Distance" setting.

#### Note:

*Interesting effects can be achieved when used in conjunction with the Displace Deformer (see chapter 4, "Displace Deformer").*

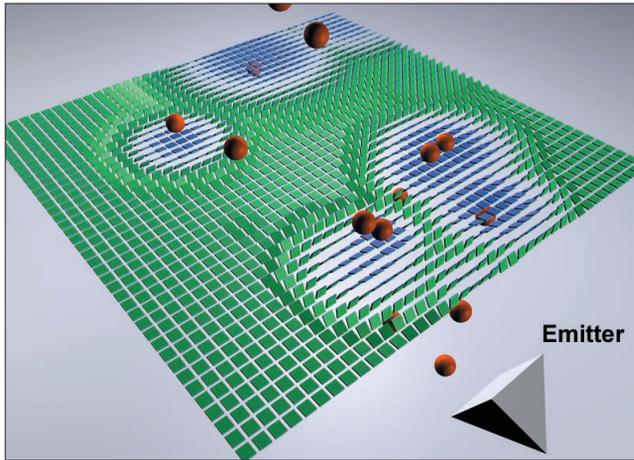
### Sample Detail

As you already know “Sample Detail” defines the detail with which the spline form will emulate the sample points. The higher the value set, the longer it will take to calculate and the more accurate the emulation will be.

### Source Link

Drag a spline from the Object Manager into this field on whose basis the effect of the Effector should be calculated.

### Shape Source (*particle*)



*Effectors can have an effect within a certain radius (“Sample Distance”) around particles.*

### Sample Distance

The Effector will have an effect around a particle within the distance defined here. Falloff will have an effect ranging from the center of each particle to the defined “Sample Distance” value.

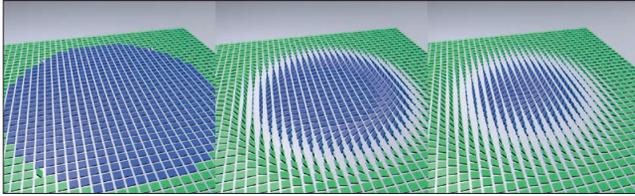
### Source Link

Drag the emitter (CINEMA 4D) or particle group (Thinking Particles module) into this field.

### Scale

Use this setting to scale the entire Effector, including falloff and the corresponding radii.

## Falloff



An increasing "Falloff" value from left to right.

Use the "Falloff" setting to define the radius (red) within which falloff should have an effect. The Effector's effect will be full strength ranging from its center to this (red) radius. The Effector's effect will fall off to zero from the red radius to the yellow radius ("Scale").

If "Falloff" is set to zero, the Effector's strength will be full strength within its overall size (yellow radius: "Scale"). If "Falloff" is set to maximum, a uniform transition from the Effector's center (max) to its overall size ("Scale"(min)) will take place.

### Tip:

*You can achieve some nice effects by letting Effectors with a maximum "Falloff" value pass through clone groups!*

## Clamped

Normally, the falloff value lies between 0 and 1. This setting is acceptable for most areas of use: Let's say you set an Effector's P.Y value to 200m. The strength of its effect is strongest at its center so the clone will be located at P.Y=200m. There are times, though, when you want to define larger values, independent of the "Falloff" value. To do so, deactivate the option and the resulting effect within the effective falloff will be increased dramatically.

Using this method, you can create interesting "controlled" explosions:

- Create a Random Effector and activate the "Position" option ("Parameter" tab).
- Set "Shape" to "Linear" in the "Falloff" tab and move the Effector through the clone group.

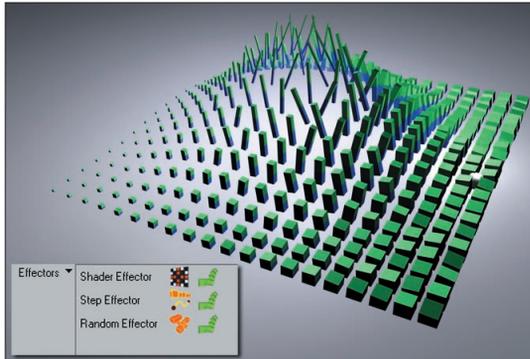
## Spline

You can custom-define a falloff using this spline curve. Define the falloff that will take place between the red (falloff begin) and yellow (max. effect range) radii.

### Spline Animation Speed

If the falloff you defined using the spline curve should take place over time, enter a value greater than "0" here. A value of 100% represents a one-second cycle.

## Group Effector



*Three Effectors in one Group Effector.*

The Group Effector is useful for grouping various Effectors that should be executed at a specific time via the “ReTime” function. If, for example, you’ve discovered an interesting or especially effective combination of a Step Effector and a Random Effector, you can group them in a Group Effector and assign the Group Effector to other objects as desired, without having to again assign the individual Effectors.

### Strength

As is the case with all Effector, the “Strength” slider defines the Effector’s strength. Values less than 0% and greater than 100% can also be defined.

### ReTime

Let’s say you’ve used a Group Effector to group several Effectors that have animated settings and the timing is a little off. You can either modify each Effector’s animated setting or you can simply activate the “ReTime” setting and each animation within the “Start” and “End” frame range will be compressed. This works best if all animations begin at frame “0”.

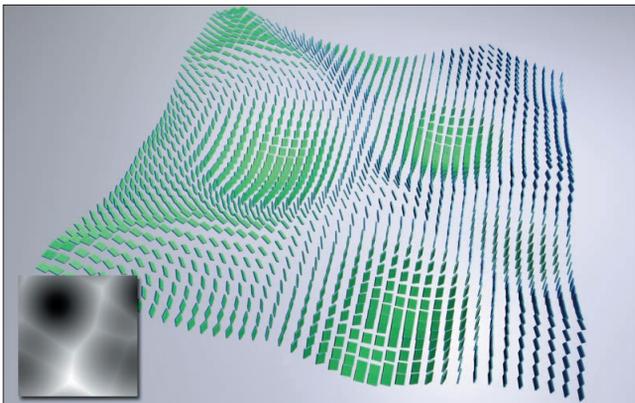
### Start / End

Define the frame range within which the Effector animation should take place. The smaller the frame range, the faster the animation will run.

### Effectors

Drag all Effectors from the Object Manager into this field that you want to place into the Group Effector. These Effectors will then no longer be assigned individually to the cloned object. Otherwise their effect would be doubled. Only the Group Effector will be present in each Effector’s Effector list. The Effectors will be executed in their defined sequence (see chapter 2, “Effectors Tab”).

## Shader Effector



Above, a noise (Voronoi) is used to define position and rotation of the clones via its gray scale values.

The Shader Effector primarily uses a texture's gray scale values to transform clones. To do this, the texture somehow needs to be projected onto the clones. UV-mapping is used in place of texture tags.

The Shader Texture can also be used to color clones (as well as lights!) directly. Simply define the following:

- A texture in the "Shading" tab (faster method) or
- Drag a material containing a texture in a texture channel onto the Shader Effector and select the corresponding texture channel in the "Shading" tab's "Channel" menu. In case you have several texture tags, simply drag the corresponding tag into the "Texture Tag" field. (offers better projection control).

When using linear or radial clone modes, we recommend using the "2D-U" "Color Gradient" shader.

*Note:*

*The Shader Effector serves well as a "basic" Effector if, for example, you only want to influence the clones based only on their position, scale and angle falloff settings. Make sure no shader or texture tag has been loaded in the "Shader" tab.*

### Effector Tab Settings

#### Strength

Use this slider to adjust the overall strength of the effect. As usual, values less than 0% and greater than 100% can be entered.

## Minimum / Maximum

Use these settings to reduce or expand the effect's area of influence.

*Example:*

*"P.Y" has been set to 200m in the "Parameter" tab. A noise shader, that normally provides values between "0" (black) and "1" (white), will vary between 0m and 200m, relative to "Minimum" and "Maximum" values of 0% and 100% respectively. If you would set "Minimum" to 30% and "Maximum" to 120%, the clones would be placed between 60m and 240m respectively.*

## Shading Tab Settings

The following settings are the same as for the Displace Object (see chapter 4, "Displace Object"), with the exception that the Displace Object lets textures be projected onto object points, and not onto clones.

### Channel

There are basically two methods for projecting textures onto a group of clones.

- With the help of an additional texture tag.
- With a shader that doesn't contain a texture tag (then only UVW-mapping)

First, select a material channel from the "Shading" tab's "Channel" menu, upon which the "Texture Tag" text field will be made available. You can then drag any texture tag from the Object Manager into this text field. The texture contained in the material will now be applied in the material channel you selected.

### Edit

Clicking on this button will open the corresponding shader's properties in the Attribute Manager for quick editing.

### Texture Tag

If you select "Custom Shader" a texture selection menu will be made available. From this menu, a texture or bitmap to be used by the Effector can be selected. We suggest the use of the texture tag method since it is simpler to use. Furthermore, the texture tools can be used to adjust texture coordinates interactively.

### Offset X/Y, Length X/Y

If "Custom Shader" is selected, several settings will be made available with which the texture can be moved (offset) or scaled (length) within the UV-coordinates. When using noise shaders, though, "Space" should be set to "UV (2D)".

### Tile

Use this setting to define whether or not the texture should be tiled.

## Use

Use this setting to define how the Shader Effector should view the colors it elicited from the clones. This only applies to the assertion of internal values, mentioned at the beginning of this chapter, and not for the coloring of clones.

- Alpha: If the shader or texture (e.g. a QuickTime video) contains an alpha channel, selecting this option will evaluate the alpha channel. If no alpha channel is present, the gray scale values will be used.
- Gray: The gray scale will be used.
- Red, Green, Blue: Each color will be used individually.

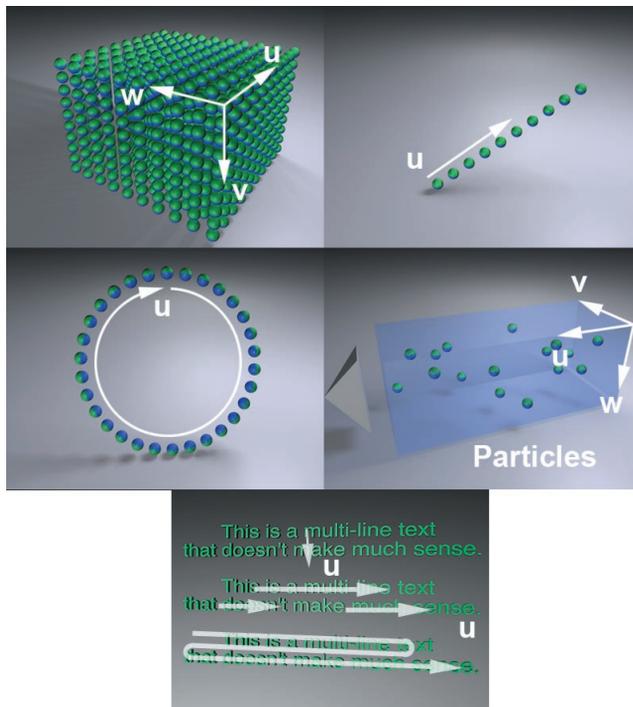
*Note: The "Alpha" mode does not work in conjunction with the layer shader. Use a different mode instead.*

## Invert Alpha

Inverts the effect of the alpha channel.

## UVW-Mapping in MoGraph

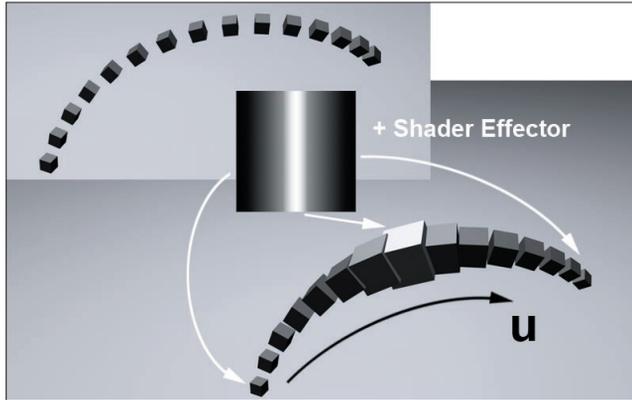
MoGraph has a lot of mysterious settings beginning with "U" or "V". The reason for this is that all clones possess internal U,V, and W coordinates. This coordinate system always has a range from "0" to "1". How this coordinate system spans the clones is illustrated in the image below:



*U,V,W coordinate span; text object from top to bottom; line text index; word text index; all text index.*

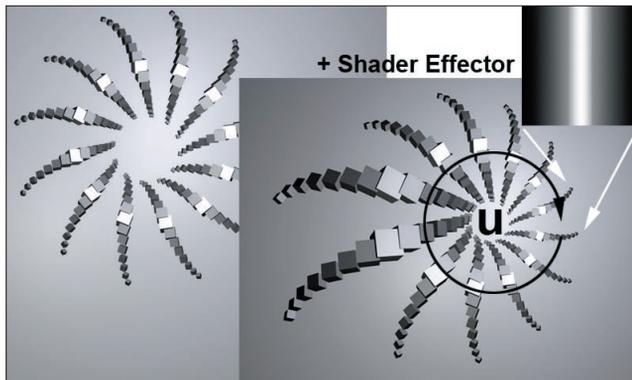
These UVW-coordinates have nothing to do with the texturing of clones. They serve exclusively to help Effectors assign each clone a value so that it may be transformed.

Example:



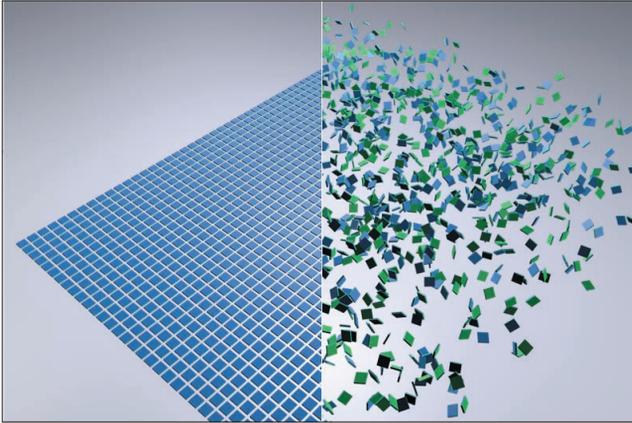
In the image above, a simple cube was cloned linearly using a Cloner Object (insert top left). Next, assign a Shader Effector (with "Scale" active and UVW-mapping) containing the gradient shown at center to the Cloner. The first clone's "u" value = "0", the last clone has a "u" value of "1". The scaling of the clones is a result of the applied gradient (type "2D-U").

If the first Cloner Object is now placed into the second Cloner Object (this time with clone mode set to "Radial"), the result will be as pictured at the top left (insert).



If the second Cloner Object is also applied to the same Shader Effector, the result will be as pictured at the right. Don't forget that "u" runs along the radius where start and end points of the pictured gradient meet (1<sup>st</sup> clone:  $u=0$ ; last clone:  $u=1$ ).

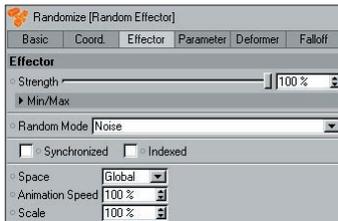
## Random Effector



Left, the initial state of the clones; right, the Random Effector was applied (position and angle were randomly modified).

Computer graphics can easily be recognized as such by its often all-to-uniform look. The Random Effector's job is to give your clones an irregular arrangement / look. This Effector's abilities are not limited to just position, rotation or size but can also modify color, weighting and more. Weighting in particular can help in achieving interesting effects when the Random Effector is used to simultaneously control other Effectors (or inversely). See also "Weighting Transformation".

## Parameter Tab



## Strength

Use the "Strength" slider to adjust the Effector's overall strength.

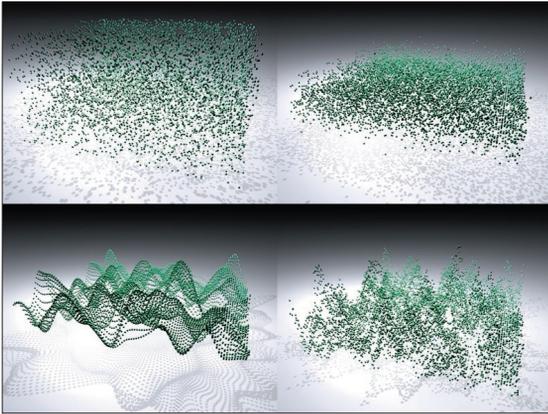
## Minimum / Maximum

Use these sliders to decrease or expand the Effector's range.

*Example:*

*"R.H." is set to 360° in the "Parameter" tab. If "Minimum" and "Maximum" are set to 0% and 100%, respectively, the clone angles will randomly vary between 0° and 360°. If "Minimum" and "Maximum" were set to -25% and +25%, respectively, the clone angles would randomly vary between -90° and +90°.*

## Random Mode



*Clockwise from the top left: "Random Mode" "Random", "Gaussian", "Noise", "Turbulence" (very large "Scale" values used for demonstration purposes). Transformation was done with "P.Y".*

Four random modes are available:

- **Random / Gaussian:** These two modes provide truly random results. "Gaussian" generally provides somewhat lower values as does "Random". Modifying the "Seed" value will result in completely different random values.
- **Noise / Turbulence:** Internally, a 3D noise is used to supply the clones with random values. "Turbulence" ensures that the noise is less uniform. "Noise" in particular is good for animating random values because it modifies the random values in a constant, harmonious manner. Basically, it has the same effect as noise loaded into a Shader Effector. Noise / Turbulence offer the following settings:
  - **Space:** When set to "Global", the noise is fixed in space, i.e. when the Cloner Object moves, the clones receive modifiable random values, in addition to the temporal modification (if the animation speed is > 0). When set to "UV", the values (i.e. the spatial values, not those with regard to animation) remain constant when the Cloner Object moves.
  - **Scale:** This value represents the noise's global scale. In the image above, very large "Scale" values were used for demonstration purposes, which actually has less to do with randomness. If the noise in the image above were made much smaller, the wave-like structure would become much more inconspicuous. Eventually each clone will really only randomly receive values from its neighbor.

## Synchronized

Activate this option if the same values for position, scale and angle, etc. should apply. Otherwise an individual random value will be interpolated for each transformation.

## Indexed

Important for “Noise” and “Turbulence” modes: If this option is not active, equal random values for X, Y, and Z will be ascertained when “Noise” is sampled internally, which can lead to diagonal movement when an animation is played.

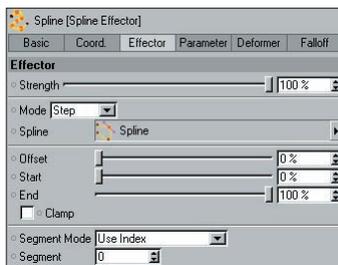
Activate this option to interpolate different random values, which will result in more random and natural movements.

## Spline Effector



The Spline Effector takes the clones and arranges them in turn on a spline. Clones and spline points are numbered internally. Simply put (i.e. without having changed any settings), the Spline Effector will arrange the first clone at the start of the spline and the last clone at the end of the spline. The positions of the clones that lie between the first and last clones will be interpolated based on various settings. This is all done by the Cloner Object as well. The trick is to get the various settings to make the clones move smoothly from their initial position (or scale, or angle) onto the spline. The clones can also be moved relative along the length of the spline or a copy of the spline will be assigned to each clone, along which the clones can move along (see below “Transformation”).

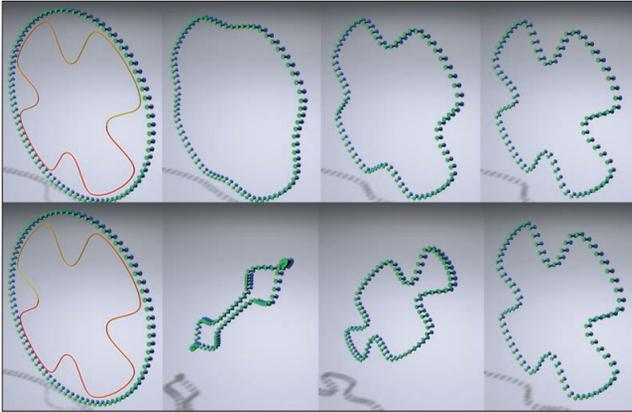
## Settings



## Strength

Use this slider to adjust the distance of the clones from the spline: A value of 0% means the clones will not approach the spline; a value of 100% will place the clones directly onto the spline (in so far as no other settings oppose this action).

If you want various splines to blend into one another, make sure the start and end points of the clones and spline lie in very close proximity of each other. Otherwise, an unwanted overlapping of clone movements could result.



From left to right: Increasing “Strength” values. In the top row, clones and spline match (start and end points lie very close together); in the bottom row, clones and spline are twisted in opposing directions.

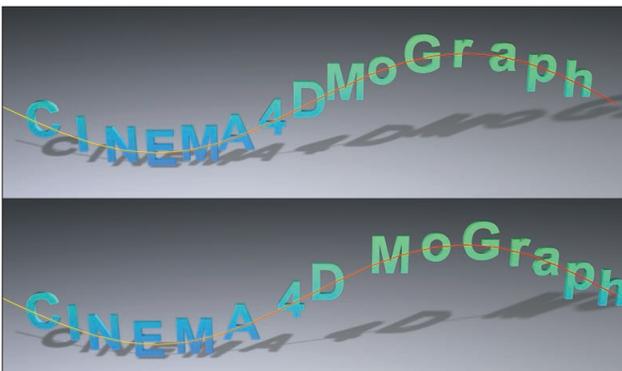
### Spline

Drag a spline object or tracer (see chapter 4, “Tracer”) from the Object Manager into this field.

### Mode

There are three modes from which to choose. They have the following properties:

- Step: The clones will be placed with equal intervals onto the spline.
- Falloff: In this mode, the position of each clone is primarily dependent upon the Effector’s falloff setting. Depending on the size of the falloff value, the clones will flow along the length of the spline. This works especially well in conjunction with the “Linear” falloff type and a maximum falloff value.
- Relative: If the clones have irregular intervals between them in the X, Y or Z directions before the Effector has taken effect, these irregular intervals can also be retained, proportionally, by the clones arranged on the spline.



A text object with an Effector in the “Letters” tab. At top: “Step” mode. At bottom: “Relative” mode.

This is especially useful when working with text because the relative letter spacing will be maintained (only works with single-line text).

### Offset

If “Strength” is set to 100%, modifying “Offset” will make sure the clones wander along the spline. Lesser “Strength” values will produce interesting effects.

This is the most important setting when it comes to letting clones wander along a spline.

### Start / End

Every spline has a starting point and an ending point (these are colored yellow and red on splines made editable in point mode). Use the “Start” and “End” settings to define the area of the spline on which the clones should be arranged. If “Start” is set to 0% and “End” to 100%, the clones will be arranged along the entire spline.

#### *Tip:*

*If raising the “Strength” setting results in an intersection of clones, i.e. the first clone lies on the end of the spline and the last clone on the start of the spline, it often helps if you simply invert the positions of the “Start” and “End” sliders.*

### Clamp

If an offset value not equal to 0% has been selected, this setting determines whether clones that land on a spline’s start or end points should be deleted, or appear on the opposite end of the spline.

### Segment Mode

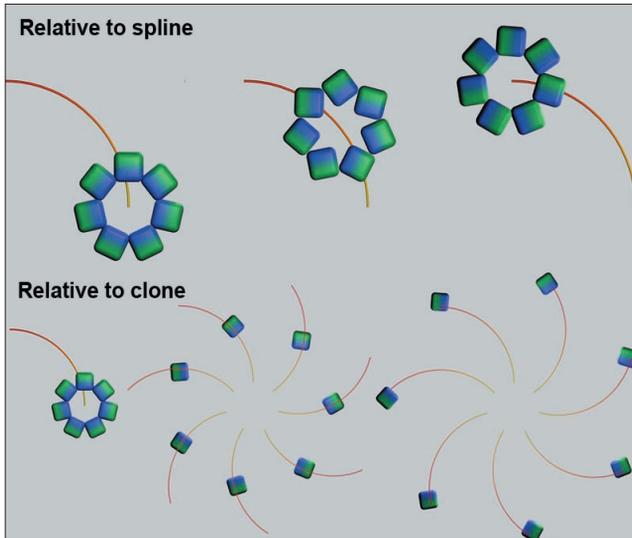
If splines consisting of several segments are used, these settings define the clones’ behavior on the splines. The following settings are available:

- Use Index: The segments are numbered (internally), starting at “0”. The “Segment” setting can be used to define a single segment to be used.
- Even Spacing: The clones will be distributed equally across all spline segments, their intervals remaining constant per segment.
- Random: Clones will be distributed randomly across all spline segments. The random distribution can be varied by modifying the “Seed” setting.

### Transform Mode

Here are several Effector-specific settings: If “Absolute” is selected, the clones will be arranged directly onto the spline, which is exactly what most users want.

The other modes are especially then useful, if both “Start” and “End” are set to 0%. The clones will then move as shown in the image below when the “Offset” setting is varied:



At top: A varied "Offset" setting and "Start" and "End" set to 0%. At bottom: Initial states with "Offset" set to 0%.

- Relative to Spline: Varying the "Offset" value will move the clones in unison, relative to the spline, without being placed onto the spline.
- Relative to Node: Imagine a copy the spline on each clone (with its first spline segment oriented in the direction of the Z axis), which the clone follows via the "Offset" variation.

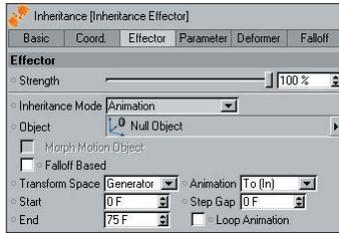
Activating "Rotation" will make the "R.H", "R.P" and "R.B" settings available, with which each clone can be rotated according to its coordinate system.

## Inheritance Effector



Spectacular effects can be achieved by using the Inheritance Effector. Position, angle and animations are passed on ("inherited") from one object to another. Furthermore, an object's clones can be more-or-less morphed onto the clones of another Cloner. In the past, these types of effects were only possible using the Thinking Particles module.

## Settings



### Strength

Use this setting to adjust the strength of the Effector's influence. 0% will have the same effect as deactivating the Effector itself. Values less than 0% or greater than 100% can also be entered.

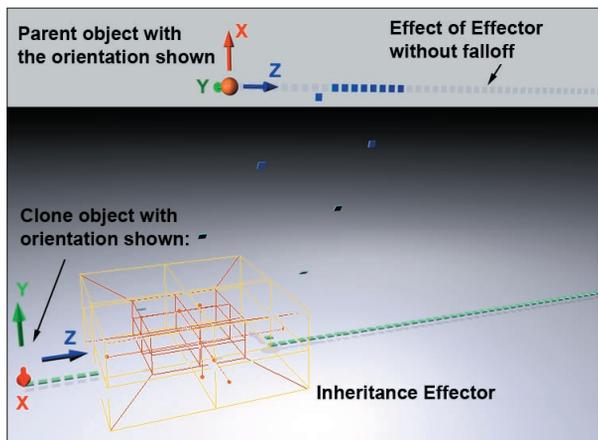
### Inheritance Mode: Direct

In this mode, clones will inherit states directly from the "parent object", without temporal delay.

### Object

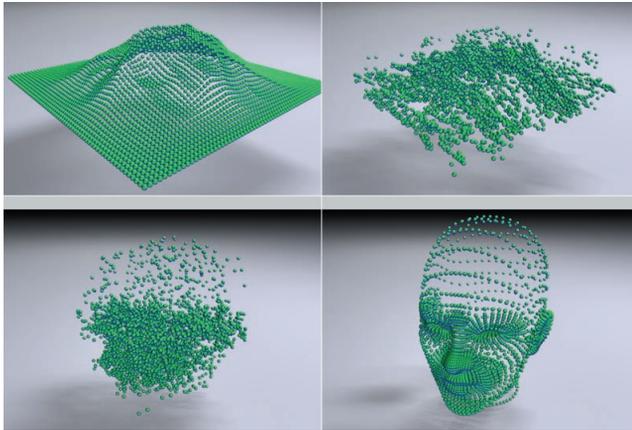
Drag the object ("parent object") into this field whose position, angle and size should be passed on. The results will differ, depending on whether you drag a normal object or one of the MoGraph Cloner Objects (e.g. Cloner Object or Matrix Object, etc.) in to this field. The "parent object" can, of course, be animated.

- Normal object



*The "parent object" has been moved to a position across from the Cloner Object and rotated. This results in a transformation of the clone's position and orientation.*

- Morph Motion Object



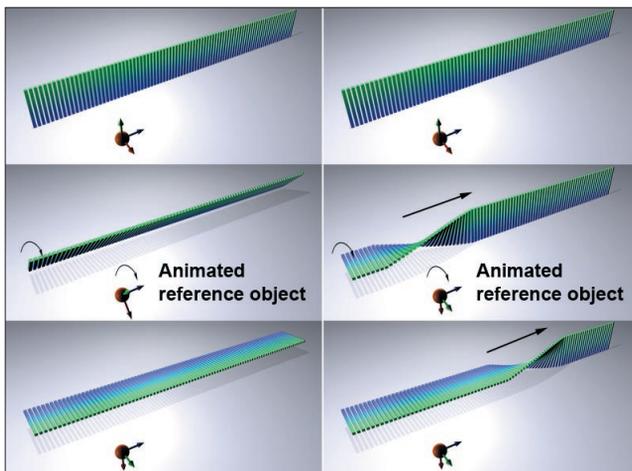
*The Inheritance Effector can be used to transition from one Cloner Object to another (each in "Object" clone mode). The "Morph Motion Object" option must be activated.*

If you use a MoGraph object (Cloner, matrix object, etc), the clones of the original object will be transferred to the clones of the MoGraph object. When creating such effects, we suggest the Cloner Object and "parent object" contain pretty much the same number of clones.

### Morph Motion Object

If this option is activated, effects such as the one pictured in the previous image will result. If this option is not active, behavior as described for "Normal Object" will result.

### Inheritance Mode Animation



*The reference object is rotated 90° in the course of the animation. Left: "Step Gap" = 0. Right: "Step Gap" = 2.*

Whereas “Inheritance Mode” “Direct” automatically activates the “Position”, “Scale” and “Rotation” settings, the “Inheritance Mode” “Animation” transfers animation data which can be made to affect individual clones one after the other.

The following special settings are available.

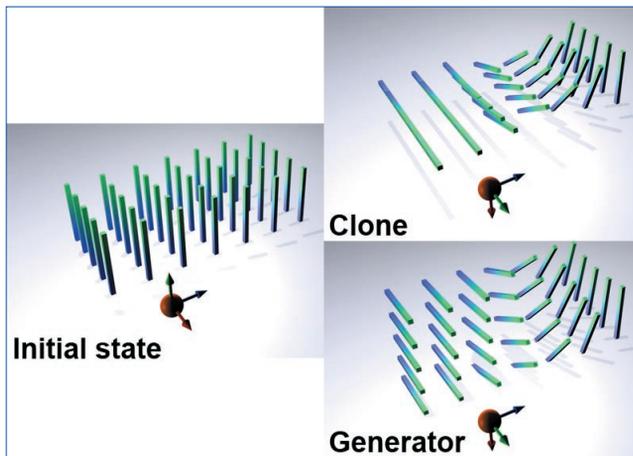
### Falloff Based

If this setting is activated, the clone will be affected by the reference object’s complete animation within the Effector’s falloff. Where the Effector’s falloff is zero (where the Effector’s maximum influence lies), the reference object will be in its final state; where the Effector’s falloff has no influence at all (outside of the Effector’s range of influence), the reference object will be in its initial state. The greater effect can be achieved by deactivating this setting.

### Transform Space

Use this setting to define how a conglomerate of clones should go about inheriting an animation. This can best be seen when applied to an animated (rotation or scale) reference object:

- Generator: The entire conglomerate of clones will rotate/scale around a single axis.
- Clone: Each clone will rotate/scale around its own axis.



“Clone” and “Generator” modes.

### Start / End

Use these settings to define within which frame span the reference object should affect the clone. We suggest the reference object animation be started at frame “0”. Otherwise, effects may result that are very difficult to control.

By varying the “Start” and “End” settings, the speed of the transferred animation can be adjusted. The transferred animation can run either faster or slower than the reference object animation.

*Example:*

*The reference object rotates 180° between Frames 0 and 20. The “Start” and “End” values are set to 100 and 150, respectively. The clones will now rotate in unison (“Step Gap” = 0) 180° from frame 100 to 150.*

### Animation

Use this setting to define from which state the clones should inherit the animation:

- From (Out): The reference object’s starting point.
- To (In): The end of the reference object’s animation.

### Step Gap

If you want each clone to inherit the reference object’s animation individually and with a certain time lag (instead of all clones inheriting the animation at once), set “Step Gap” to a value greater than “0”. A value of “0” will let all clones inherit the animation simultaneously, whereas a value of “2” will result in each clone animation beginning with a 2-frame delay to the clone before it.

The reference object’s rotation and angle can also be animated, which can result in interesting effects.

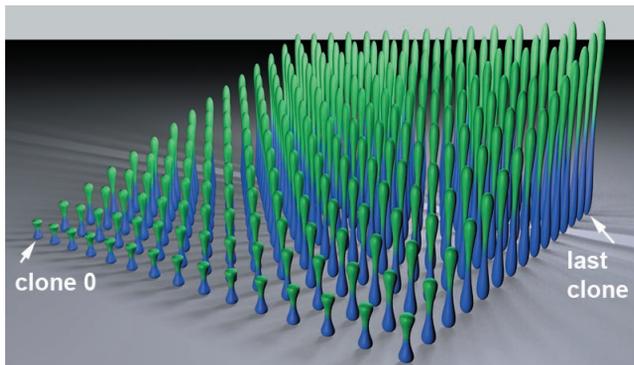
### Loop Animation

Activate this setting if you want to loop the reference object’s animation for the clones. Otherwise, the animation will stop after one loop. This works best if “Animation” is set to “To (In)”.

### Step Effector



The Step Effector works like this: Each defined transformation is applied to the last clone, and the transformation of the clones in between (i.e. clone “0” to the last clone) is interpolated.



*The Step Effector with “S.Y” set to “10”; the last clone is 10 times larger in the Y-direction than the first clone.*

The following applies to the numbering of clones:

- Clone mode “Grid”: When looking at the grid in the Z-direction: The first clone is at the bottom left. The sequence is basically as follows: 1<sup>st</sup> row at bottom front from left to right, 2<sup>nd</sup> row at bottom front from left to right, etc., then from front to rear.
- Polygon objects / splines: If cloning takes place on polygonal objects or splines, the first clone is always the one that is on the first object point or spline point.
- Particles: The first clone will be on the temporally first particle.
- Instance object: The first clone is the one directly behind the animated instanced object.

## Strength

Use this setting to adjust the strength of the Effector’s influence. 0% will have the same effect as deactivating the Effector itself. Values less than 0% or greater than 100% can also be entered.

## Minimum / Maximum

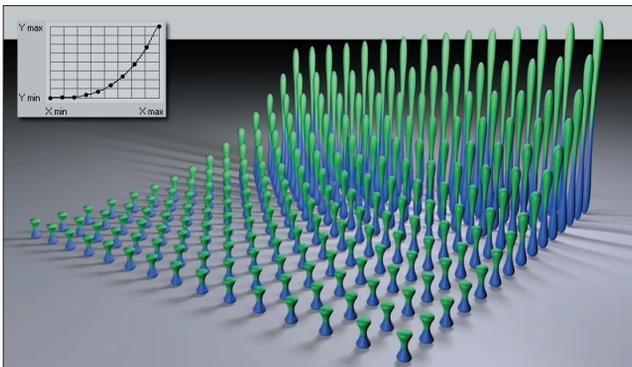
The values entered for the settings in the “Parameter” tab represent maximum values for those transformations. The Effector is free to choose from a range of values between 0% and this maximum value if the “Minimum” and “Maximum” sliders are set to 0% and 100%, respectively. Adjusting these sliders will affect the range of values from which the Effector has to choose accordingly.

*Example:*

*“R.P” is set to 90° in the “Parameter” tab. The following will apply:*

- *Minimum = 0%; Maximum = 100%: The first clone will be located at 0°, the last at 90°.*
- *Minimum = -100%; Maximum = 100%: The first clone will be located at -90°, the last at +90°.*

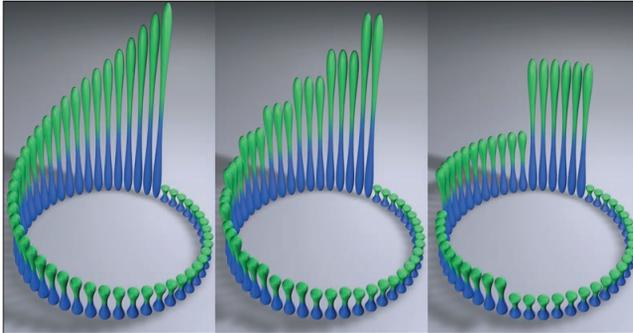
## Spline



The transformation shown is a result of the spline setting (insert) and a “S.Y” setting of 10.

Use these function graphs to influence the interpolation between the first and last clone. The interpolation will take place as it is shown by the graph.

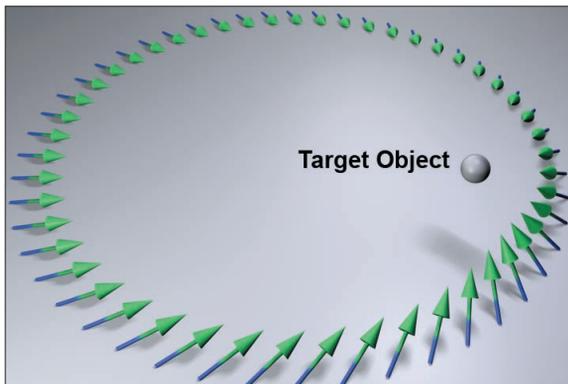
### Step Gap



*"Step Gap" settings from left to right: 0,2,10.*

Use this setting to influence the interpolation values between the beginning clone and end clone. Increasing values greater than "0" will result in a lessening of the difference between each clone; differences between clone groups, within which no transformations take place, will still be evident.

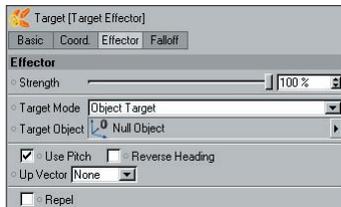
### Target Effector



*The clones are oriented towards the "Object Target". In this example, "Use Pitch" has been activated.*

Use the Target Effector to make clones orient towards a Target Object, each other or the camera.

## Settings



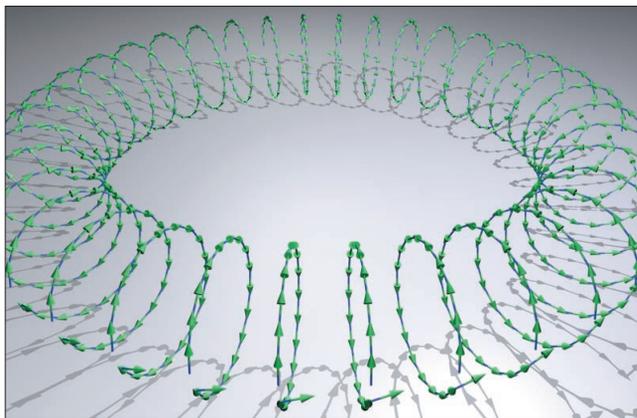
### Strength

Use this slider to adjust the strength of the Effector. A “Strength” setting of 0% means the Effector will have no effect.

### Target Mode

Depending on the option selected, the clones will orient themselves according to:

- **Object Target:** The clones will be oriented themselves with their Z-axis in the direction of the “Object Target”. The “Object Target” is defined by dragging the desired object into the “Target Object” field. If this field is left blank, the Target Effector itself will be used.
- **Look at Camera:** The clones will always orient themselves with their Z-axis in the direction of the camera in the 3D view.
- **Next Node / Previous Node:** Each clone will orient itself with its Z-axis according to the previous or next clone. In the example below, a torus was used to demonstrate:



*Each clone orients itself according to the previous or next clone.*

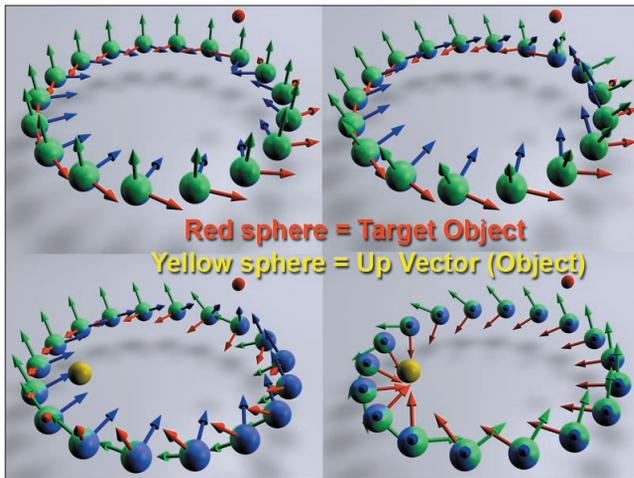
### Use Pitch

If this setting is activated, a clone's Z-axis will always point to the "Object Target"; if this setting is not active, the rotation's pitch direction will remain unchanged. An up vector can also be set.

### Reverse Heading

Instead of the positive Z-axis, the negative Z-axis will attempt to orient itself to the target.

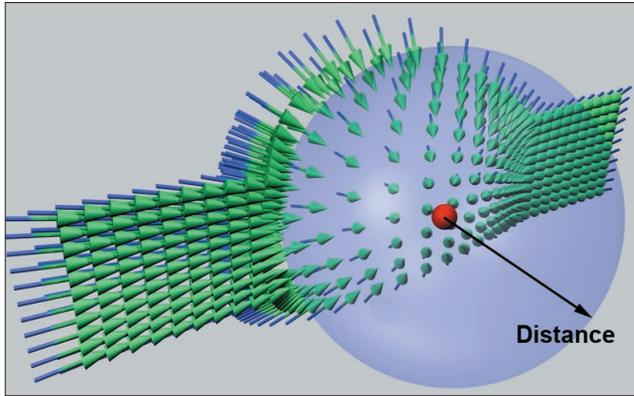
### Up Vector



*Clockwise from top left: "Use Pitch" deactivated; "Use Pitch" active; additionally, "Up Vector" set to "Object"; additionally "Target Mode" set to "Look at Camera".*

As soon as "Use Pitch" is activated, the clones will point with their Z-axis exactly in the direction of the position defined in "Target Mode" (in as far as "Reverse Heading" is not active). The rotation of the clones, though, is herewith still not set entirely. One of several pre-defined vectors or "Object" can be selected from the "Up Vector" menu in whose direction the clones should be oriented with their X-axis (in as far as the "Locked" Z-axis permits).

## Repel



Clones can be pushed away from a target object (here red) by activating the “Repel” setting. “Distance Strength” here has been set to 100%.

The following sliders appear when “Repel” is activated:

- Distance: Defines the minimum distance the clones must have from the target object (or an Effector in other modes) before being displaced.
- Distance Strength: Use this slider to adjust the strength of the repulsion.

## Time Effector

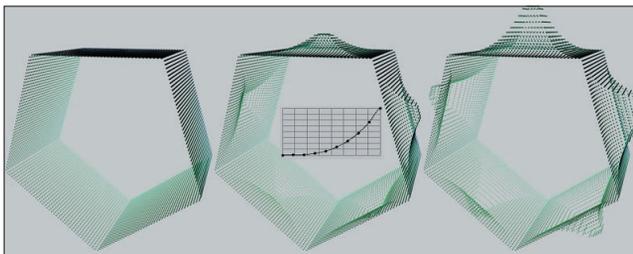


The Time Effector establishes its transformation values in accordance with the length of the animation. Thus, this Effector is ideal for creating effects based on animation length without having to set keys.

*Example:*

*Let’s say a bunch of clones should move at 300m / sec. Simply create a Time Effector and set “P.Y” to 300m. That’s it. Without having set a single key, this bunch of clones will move with a constant 300m / sec. in the Y-direction.*

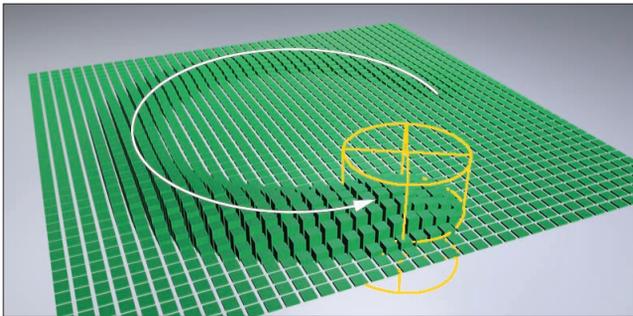
*If, in addition, the weighting should change from 0% to 100% within 10 second, simple set “Weight Transformation” to 10%. Yep, that’s it, you’re done.*



In the example above, a Time Effector is used to affect the clones in “P.Y”, with the falloff shown (insert graph). The effect will continue endlessly, without a single key being set.

Except for the “Strength”, “Minimum” and “Maximum” sliders, the Time Effector has no other special controls. Use the “Strength” slider to adjust the strength of the effect (values less than 0% and greater than 100% are possible). Use the “Minimum” and “Maximum” sliders to limit or expand the value range accordingly.

## Delay Effector



The Effector moving in a circular motion (not the Delay Effector!) drags a “trail” behind it as it moves. The “trail” is a result of the Delay Effector.

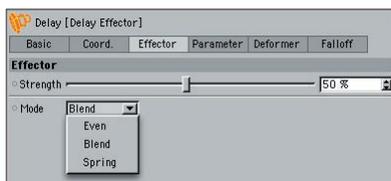
The Delay Effector ensures that the effects of other Effectors with regard to position, scale and rotation do not begin abruptly, but with a specified temporal delay. Basically an “effect trail” is dragged behind the corresponding Effector.

### Important:

*The Delay Effector should be arranged after the Effectors it should affect, i.e. it should be arranged after (below) these Effectors in the MoGraph object’s “Effector” list in the “Effector” tab.*

“Spring” is a very useful option for letting clone movements look more realistic. Using the Delay Effector saves time because adjustments to the Timeline (e.g. Curves) are done more-or-less automatically that result in realistic movements.

## Settings



## Strength

As is the case with all Effectors, this slider is used to define the overall strength of the Effector.

## Mode

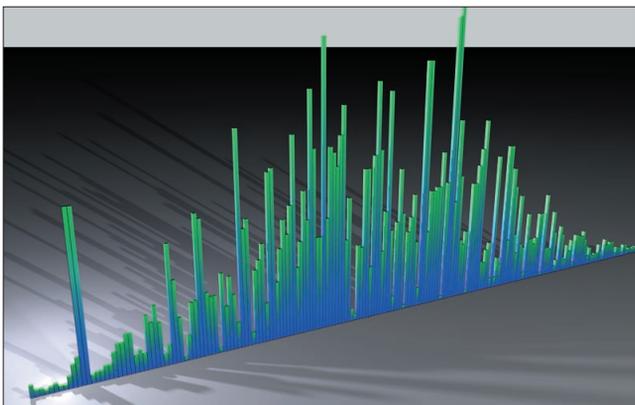
The three available modes can be characterized as follows:

- Blend: The clone states will first be blended quickly, then slowly. Use the “Strength” slider to adjust the overall speed with which this occurs.
- Spring: As the name suggests, the clones will behave as though they have springs between them, resulting in slight residual oscillation. Over-oscillation can also occur. Large values will increase residual oscillation, i.e. the larger the value, the softer the springs.
- Even: This mode will uniformly blend the clone states. Use the “Strength” setting to adjust the speed with which this occurs.

*Note:*

*Problems may be encountered when using this Effector in conjunction with scene motion blur (see “Post Effects in your CINEMA 4D reference manual”).*

## Sound Effector

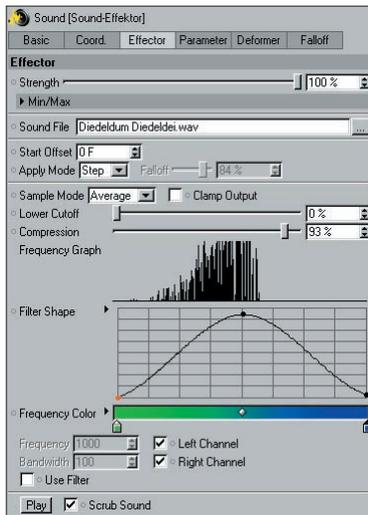


Using the Sound Effector, clones can be transformed using the frequencies emitted by sound files!

*Note:*

*If the audio sounds flawed when played in the editor, deactivating “All Frames” under “Animation / Frame Rate” in main C4D menu can help.*

## Settings



### Strength

As is the case with all Effectors, this slider is used to define the overall strength of the Effector. Values less than 0% and greater than 100% can also be defined.

### Minimum / Maximum

Use these sliders to limit or expand the internal range of values defined for the transformations.

*Example:*

*"S.Y" is set to 30. If "Minimum" and "Maximum" have been set to 0% and 100%, respectively, the clones will be scaled to 0 during times of absolute silence and to 30 when the frequency is loudest. If "Minimum" and "Maximum" are set to 50% and 80%, respectively, the clones will consequently be scaled between 15 (silent) and 26 (loud). Values less than 0% and greater than 100% can also be defined.*

### Sound File

Load a .wav or .aif sound file into this field. The files must be uncompressed.

The following is supported:

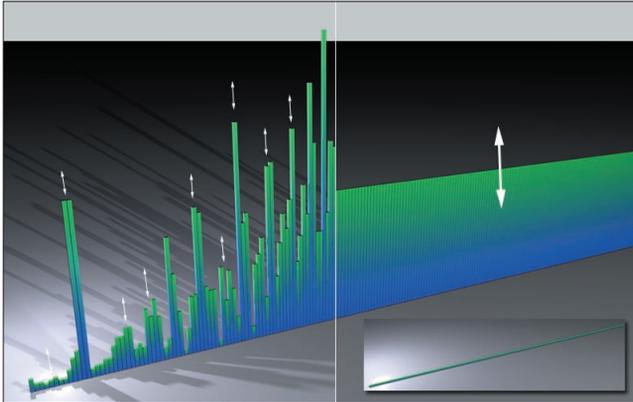
- 11,22 kHz and 44 kHz
- 8-bit and 16-bit

One second of CINEMA 4D animation is equal to one second of sound from the sound file. In other words, if a CINEMA 4D animation is played at 25 fps, the sound file's frequency spectrum will also be interpolated (sampled) at 25 fps.

### Start Offset

Enter the frame at which the sound file should start playing here. If "100" is entered, the sound file will start to play at frame 100 and the Sound Effector will have no effect before frame 100. A negative value can also be defined.

### Apply Mode



Left: "Step" mode. Right: "All"; at the bottom left the clones are not affected by the Effector, the Sound Effector scales the clones only in the Y-direction.

"Apply Mode" defines how the sound file should affect the clones. There are two options from which to choose:

- All: Each clone will fidget just like the other to the rhythm of the music. No differentiation is made between frequencies.
- Step: Frequencies will be assigned accordingly to clones, from clone 0 to the end clone. If, for example, the "Linear" clone method was selected (as in the image above), the lower frequencies will affect the clones at the left and the higher frequencies will affect the clones at the right. Higher frequencies will thus have an effect upon the numbering of the clones. The Effector will affect the clones according to how high or low the volume is set.

### Falloff

This setting is only available if "Apply Mode" has been set to "All". Use the "Falloff" setting to adjust how quickly the Effector value will fall after peaking. A setting of 0% will cause the Effector value to fall instantaneously; increasing the "Falloff" setting will slow the fall of the Effector value accordingly.

### Sample Mode

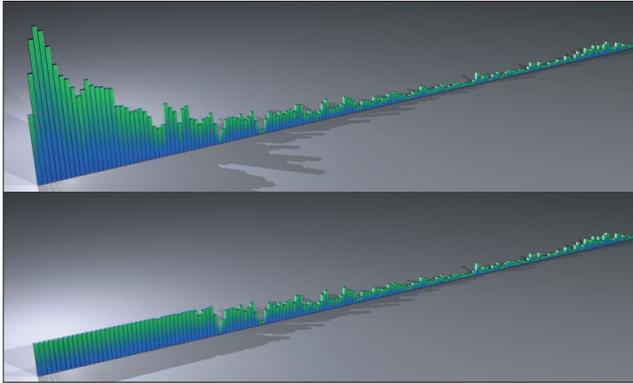
In order for the Sound Effector to be able to ascertain workable values from the "chaos" of a sound file, a small excerpt (e.g. one millisecond) is analyzed each time it is sampled. From this excerpt, frequency values are ascertained. How this happens is defined by the following modes:

- Peak: The peak within the excerpt is used.
- Average: The average value within the excerpt is used.

- **Switch:** This mode offers only two states: 0 and maximum. If no tone is detected, “0” will be output; if even the faintest tone is detected, the Effector will have a maximum effect.

The difference in resulting amplitude between “Average” and “Peak” are minimal. “Average” results in somewhat smaller amplitudes than “Peak”.

### Clamp Output

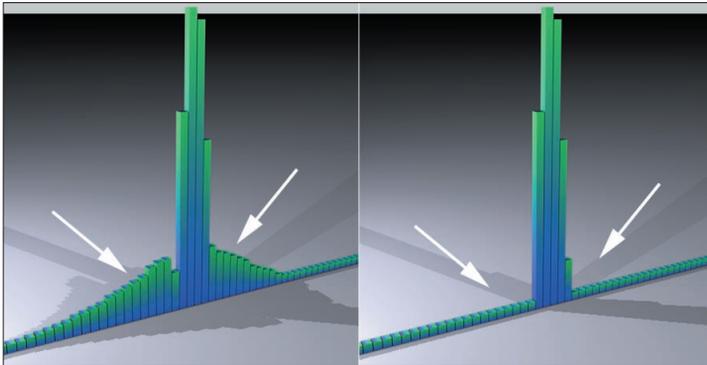


At top: “Lower Cutoff” deactivated; at bottom: active.

This setting is only available if “Sample Mode” is set to “Peak” or “Average”.

Activating this setting will cut the amplitudes off at a specified length. Even if a given sound file has a very high volume at certain spots the Effector will only have an effect at those spots with the maximum value. Extremely high values that can result from large compressions will thus be absorbed.

### Lower Cutoff



The effect of a 440Hz sound file. The amplitudes can be “cleaned up” by setting “Lower Cutoff” to its maximum value.

Use this setting to remove some of the chaos from the effects of the Sound Effector. Sounds are made up of a mixture of diverse frequencies that are difficult to single out. "Lower Cutoff" makes sure that frequencies with a lower volume are increasingly ignored the higher this value is set.

### Compression

Use this setting to increase the effects with quieter sounds.

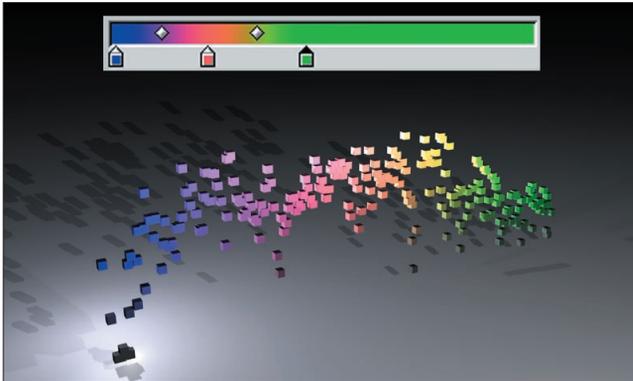
### Frequency Graph

This function graph offers you a visual representation of the frequency dispersion of the sound sample in its momentary state. The lower frequencies are depicted at the left and the higher frequencies at the right at their corresponding volume settings (decibels). Furthermore, the frequency band is displayed in blue below. The graph will not be updated as the animation is played. Simply click on the graph to get a view the current frequencies.

### Filter Shape

Use this function graph to set a varying multiplier across the entire frequency spectrum. A straight line on the Y-level will influence the Effector's effect, whereas areas near "0" will reduce the Effector's effect to "0".

### Frequency Color

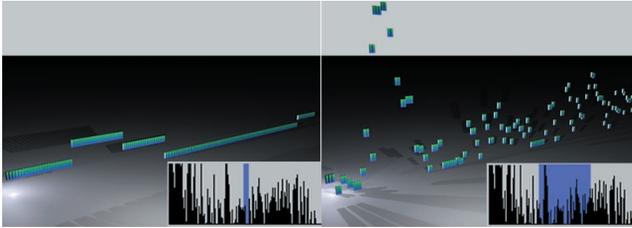


*Cube clone using "Linear" mode and colored according to their frequency using "Frequency Color". Additionally, the Sound Effector is set to affect "P.Y".*

This color gradient will only work if "Color Mode" is set to "Effector Color no Alpha" in the Sound Effector's "Parameter" tab. The gradient reflects the frequency band: Left the lower frequencies, right the higher frequencies. Note the cubes in the image above that are only slightly affected by the Effector (volume is low in these segments) and have received only little color.

### Use Filter

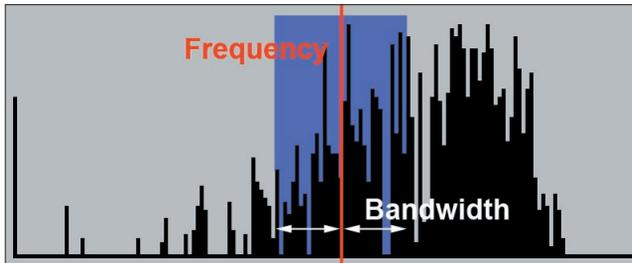
Activate this setting if you want to specify exactly which frequency range should be used by the Sound Effector.



*At left a small frequency excerpt, at right a larger excerpt. The Effector is set to affect "P.Y" only.*

Specific frequency ranges can be filtered out of a sound file. For example, you can select a lower frequency range if you want to filter out higher frequencies.

### Frequency / Bandwidth



*Use these settings to define a frequency band to be used by the Sound Effector. If, for example, "Frequency" and "Bandwidth" are set to 2000Hz and 2000Hz, respectively, a frequency range between 1800Hz and 2200Hz will be used and the rest marked blue. If the frequency is subsequently changed, the bandwidth will be calculated accordingly so the frequency range can maintain the same number of octaves.*

If the bandwidth is too small only a relatively rough Effector resolution can materialize.

### Left Channel / Right Channel

Use these settings to define which channels should be used when playing stereo sound files. A mono sound file requires only one channel.

### Play

Press to play the sound file, press again to stop.

### Scrub Sound

If this option is active, the sound file will be played while the animation plays or when the time slider is moved manually.

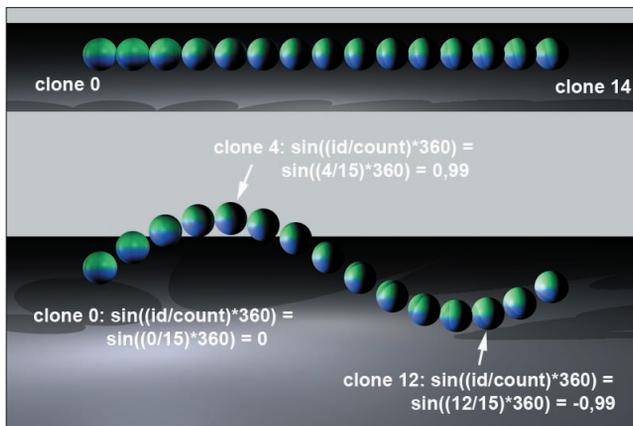
## Formula Effector



Now here's an Effector that will put a smile on the faces mathematicians amongst you. This Effector lets you create complex formulas with which you can control it.

The Formula Effector is not all that easy to understand, so let's back up a little: You're already familiar with the Shader Effector that effects clones using a texture and its gray scale values. The areas of black are given an internal value of "0", the areas of white a value of "1", and of course all the gray tones in-between that are also given an internal value. If, in the Shader Effector's "Parameter" tab, "P.Y." is set to 300, clones will be moved in the Y-direction between 0m and 300m in accordance with the gray scale values.

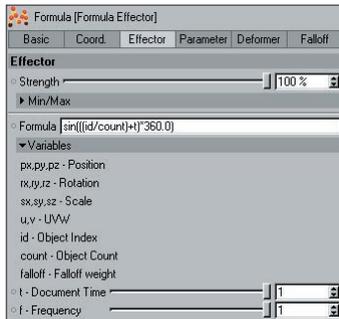
So, how does the Formula Effector fit into all of this? Instead of simple color or gray scale values, values from a formula are used that define where a given clone should be placed, between 0m and 300m (or outside of this range – simply add a "2" to the formula and all clones will be placed at a height of 600m).



At top the initial state of the clones, at bottom with the Formula Effector applied, containing the following formula: " $\sin((\text{id}/\text{count}) * 360)$ ".

In the example above, the Formula Effector uses the formula: " $\sin((\text{id}/\text{count}) * 360)$ ". As you can see, the results of the formula can vary, depending on the sinus function between 1 and -1. If "P.Y" is set to 300m these values will be transformed and vary between -300m and +300m. Consequently, if a simple "2" were entered into the "Formula" field, the clones would be placed at 600m. Since a linear arrangement of clones sets the value for the first clone to  $u=0$  and the value for the last clone to  $u=1$ , the same result can be achieved by using the formula " $\sin(u * 360)$ ".

## Settings



### Strength

Use this slider to define the strength of the Effector.

### Minimum / Maximum

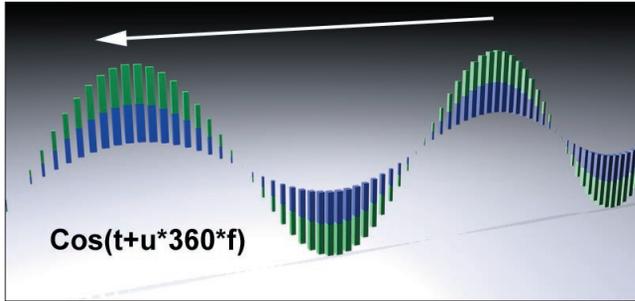
Use these sliders to adjust the Effector's range of influence. Values less than 0% or greater than 100% can be defined.

Let's assume you have entered the following formula: "t\*px". If "Minimum" and "Maximum" were also set to 0% and 100%, respectively, extreme values would quickly be reached. It would, therefore, be advisable to set "Maximum" to 1% (or even much smaller, depending on your scene or the desired result).

### Formula

The following variables can be used when writing a formula:

- px, py, pz: X-, Y- or Z-coordinates
- rx, ry, rz: Rotation for each dimension
- sx, sy, sz: Scaling for each dimension
- u,v,w: The (internal) UV-values for each clone
- id: The individual clone number (all clones are numbered sequentially, beginning with "0")
- count: The clone number
- falloff: The falloff value for each clone
- t: Animation time, i.e. if this variable is added to the formula, it will automatically be animated. This setting uses a slider as multiplier.
- f: The frequency. This setting uses a slider as a multiplier.



*Varying "t" adjusts the animation speed, varying "f" varies the spatial frequency.*





**CINEMA 4D**

**Release 9**

**4 Other Objects & Tags**



## 4. Other Objects and Tags

### The Matrix Object



For the most part, the Matrix Object carries out the same functions as the Cloner. Therefore, please refer to the Cloner description in chapter 2 for a description of all shared functions.

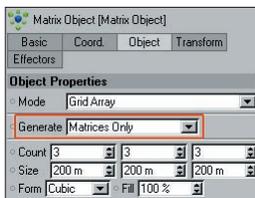
The Matrix Object has two main functions:

- It creates orthogonal matrices as opposed to the clones created by the Cloner. This allows CINEMA 4D deformation objects (e.g. bend objects, bones, etc.) to have an optimal effect on the Matrix Object (see below).
- For owners of the Thinking Particles module: In addition to matrices, Thinking Particles particles can be created. What this basically means is that matrices and particles alike can be affected by Effectors.

*Note:*

*The Matrix Object itself does not generate anything that can be rendered. How, then, is it possible to arrange clones onto the matrices created? Easy: Create a Cloner (see chapter 2), set its "Mode" to "Object" and drag the Matrix Object from the Object Manager into the "Object" field. The Cloner's child objects will now be arranged onto individual matrix positions.*

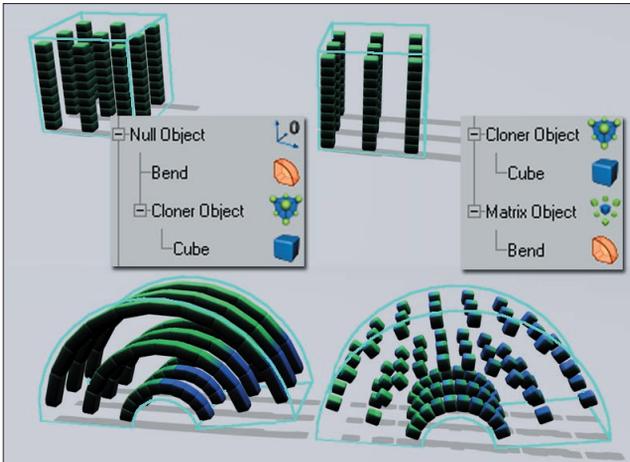
In the following, only those Matrix Object settings that differ from those of the Cloner will be described. These settings can be found within the "Generate" setting.



#### Generate Matrices Only

When in this mode, matrices will be created that are displayed as small cubes, but cannot be rendered. (these matrices can be seen as little coordinate systems whose orthogonal state will not be influenced by deformers).

So, what good are a bunch of little cubes that can't be rendered?

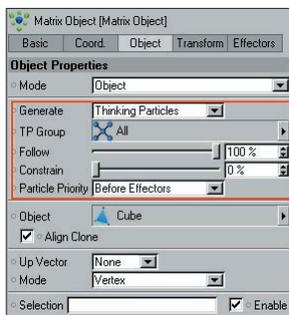


Top: Initial state. Bottom: Bend object applied.

Answer: A lot of good. In the image above, bend objects were used to affect clone arrangements. In both cases, the effect of position and rotation are the same. However, where no Matrix Object is applied, the Cloners will be distorted - which, in most cases, is an undesired effect. If the deformation object effects the Matrix Object, only position and rotation of the clones will be modified. No geometry will be distorted.

By also applying CINEMA 4D deformation objects, another weapon in your clone-positioning arsenal can be added.

## Generate Thinking Particles



For owners of the Thinking Particles module, selecting this option makes interfacing with Thinking Particles possible. This option lets the Matrix Object act as an Emitter, letting clones be affected by Thinking Particles nodes and vice-versa. Particles will be created in the very first frame of animation.

### TP Group

Drag the particle group (from the Thinking Particles settings) that should be disrupted by the particles created by the Matrix Object into this field. Leave this field empty if the particles generated should be assigned to the “All” group.

*Note:*

*If your scene contains two or more Matrix Objects that generate Thinking Particles, make sure that they are each assigned to different particle groups. Otherwise unwanted results may occur.*

### Follow

Use this slider to define how much of the initial clone movement (e.g. from an animated Matrix Object) will be transferred onto the particles/clones.

- If this slider is set to 100%, clones and particles will be affected uniformly by TP-Nodes and MoGraph Effectors.
- If this slider is set to 0%, particles will not be affected by Effectors.

The function of the “Follow” setting can be compared with the “PMotioninheritance” TP-Node, the only difference being that the movement of the matrices/clones will be inherited. In doing so, the differences in speed of the matrices/clones is taken into account, allowing the TP-Particles to continue moving freely based on the Thinking Particles nodes (e.g. if “PWind” was applied, its effect will be added to the movement of the matrices/clones).

### Constrain

Use this slider to define exactly how particles should come to lie on the actively changing position of the matrices/clones. If the slider is set to 100%, TP-Nodes will have no effect and the TP-Particles will be completely constrained onto the matrices/clones. If this slider is set to 0%, the TP-Particles will be able to move freely. The trick to using the “Constrain” setting is to effectively mix back and forth between matrices/clones and particles, i.e. letting TP-Nodes have influence and subsequently relinquishing control to MoGraph.

Normally this setting will result in a calming effect. If this setting is increased to 100% in the course of an animation, the clones will assume the position they would have if “Generate” were set from to “Matrices Only”.

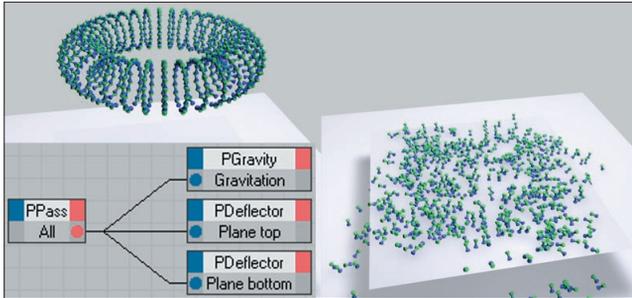
### Particle Priority

If the matrix Thinking Particles functionality is viewed as an internal Effector and not as a separate object, these options define where the Thinking Particles Effector should be placed within the list of Effectors:

- Before Effectors: First on the list of Effectors.
- After Effectors: Last on the list of Effectors.

The behavior of clones, as well as the visible limits of an Effector’s falloff in the editor view, is better discernable when “Before Effectors” has been selected. When in this mode, clones will in fact react in accordance with the visible falloff limits. If “After Effectors” has been selected, clones will only react if the Effector affects the Thinking Particle’s starting position (this effect will only be visible if the Effector’s falloff has not been set to “Infinite”).

*Example:*



Let's say we want to do the following: We have a ring-shaped Matrix Object whose clones should be randomly dispersed by a Random Effector that enters the scene from the right. The clones should then fall (gravity) and come to rest on both planes.

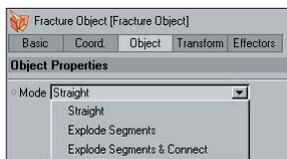
So, how is this done?

1. Create a Matrix Object, set "Generate" to "Thinking Particles" and assign a Random Effector with a "Linear" falloff to it. Set "Follow" to 100% and "Constrain" to 0%. Reposition and animate the Effector so it passes through the arrangement of clones.

2. Create an Xpresso Tag and set up a "PPass", "PGravity" and two "PDeflector" nodes. Connect the "PPass" node's output port to each of the other input ports and modify their respective settings accordingly (deflector type: object; assign each deflector node a different layer and set "Bounce" to 30%, for example).

Done. The clones will react to both MoGraph and Thinking Particles. If you raise the "Constraint" value in the course of the animation you will see that the clones will move in the direction of the clone position that would have resulted if Thinking Particles had not had an effect. Use this setting to regulate the strength of the Thinking Particles effect.

## Fracture Object



The Fracture Object does two things:

- It views all child objects as clones that can be affected by any Effector.
- If the child objects also happen to be unrelated objects (e.g. spline segments in extrude NURBS or objects) that have been separated into their individual components via the "Disconnect" command, these individual components can also be viewed as clones.

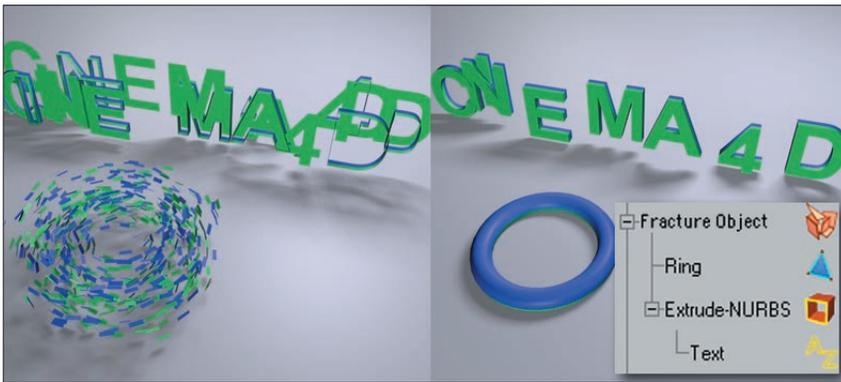
The Fracture Object itself can be separated into its individual components via the “Make Object Editable” or “Current State to Object” commands, taking into consideration each command’s settings.

## Modes

### Straight

If this mode is selected, each child object will be viewed as an individual clone. Use this mode if you want to open an old scene where no MoGraph was used and want to now let Effectors affect certain objects within this scene.

### Explode Segments



Left: “Explode Segments”. Right: “Explode Segments & Connect”. Both have a Random Effector applied.

When this mode is selected, spline segments (i.e. a Text Object in an Extrude NURBS) and polygon objects’ non-related polygons will be viewed as clones. Internally, the same functionality as in the “Disconnect” function is used.

This option can be used to create nice explosion effects.

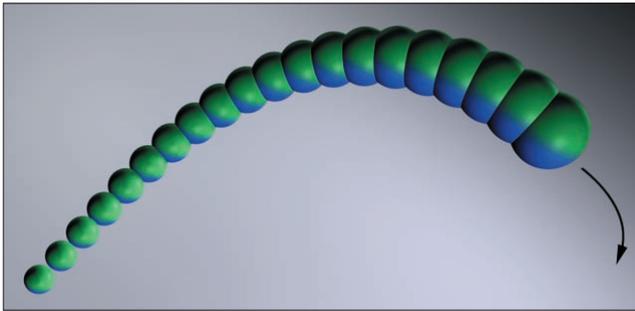
### Explode Segments & Connect

In this mode, a subsequent optimization is carried out after the segments have been exploded that fuses overlapping vertices. For example, if an Extrude NURBS is used, the surface areas will not be viewed as separate clones (see image above).

### Transform Tab/Effectors Tab

Please refer to chapter 2, “Transform Tab” and “Effectors Tab”, respectively, for a description of the settings contained in these tabs. The functionalities are the same.

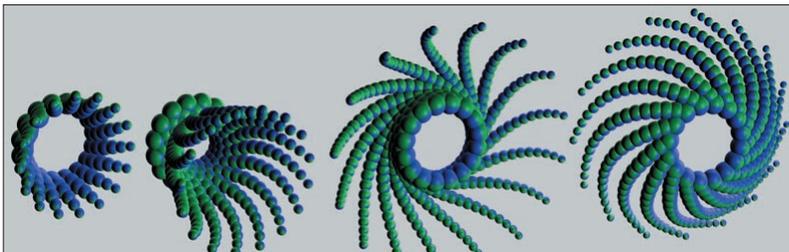
## Instance Object



An animated instance object with a sphere placed into the “Object Reference” field and a “History Depth” of 20. A Step Effector with “Scale” active has been applied.

An animated Instance Object can look back at its own “history” a specified number of frames and create past states in the form of instances. These instances, in turn, are regular clones that can be affected by any Effector (especially effective is the Step Effector). Press the CTRL-key if you want to view the effect in the editor view without playing the animation itself.

Instance objects can also be made children of Cloners, which can result in spectacular animations:



An Instance Object was made a child of a Cloner (“Radial” clone mode).

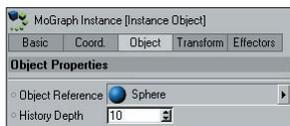
### Note:

Instances can only be rendered in the Picture Viewer if the Instance Object was baked, i.e. with a MoGraph cache tag assigned to it (see chapter 4, “Cache Tag”). Furthermore, when a scene is opened, instances will only be shown if the Instance Object has been baked. In other respects, strange results can occur (e.g. with scene motion blur), in which case it always helps to bake the clone-generating object.

### Note 2:

If the fact that the original object is visible bothers you, simply place the Instance Object and the Cloner Object into a Null Object, assign the Null Object 2 red vertices (not visible in the editor view or when rendered) and the Instance Object 2 green vertices (visible in the editor view and when rendered). Alternately, the object can also be moved outside of the view of the camera.

## Object Properties



## Object Reference

Drag the object to be used to generate the instances from the Object Manager into this field. When an Instance Object is created it will automatically place any object that happens to be active into this field. The first instance will be arranged at the position of the Instance Object itself. The position of the original object that was referenced is therefore non-crucial and can thus be moved out of the field of view of the camera.

Clone or Tracer Objects can also be placed into this field, which can lead to spectacular effects. Feel free to experiment with these settings, the possibilities are practically endless.

*Note:*

*Animating the referenced object's position, scale or rotation settings won't do any good - the Instance Object itself must be animated.*

## History Depth

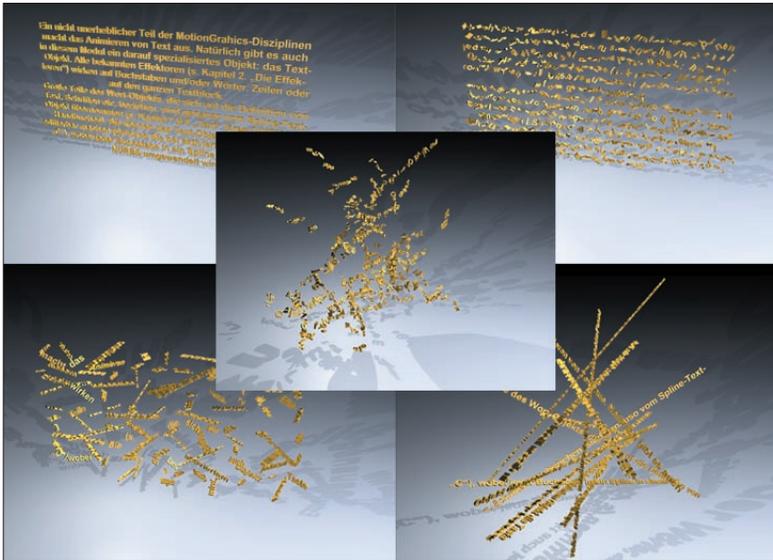
Use this setting to define the number of frames the Instance Object will look into the past when it generates instances.

## Transform Tab/Effectors Tab

Please refer to chapter 2, "Cloner" for a description of the settings contained in these tabs. The functionalities are the same.

## Text Object

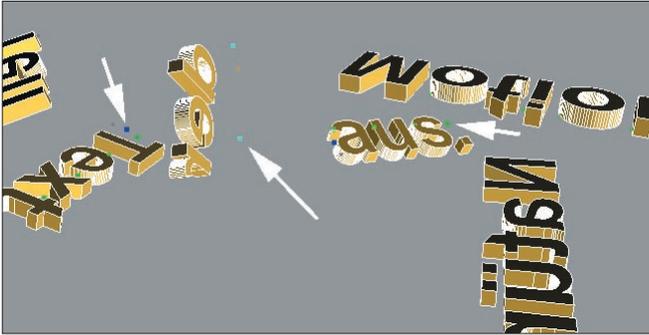
### General



*Clockwise from top left to center, Random Effector in the following fields: No Effector; "Letters"; "Lines"; "Words; in all three of the aforementioned.*

An important part of MoGraph is animating text. Of course there is also an object designed to handle this task: The Text Object. Any Effector can be used to affect letters and/or words, lines or an entire paragraph (these elements will be referred to in the following as clones).

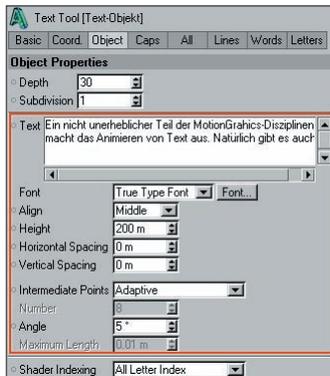
Many of the Word Object's settings with regard to defining text, fonts, etc. mirror those of the spline text object (refer also to your CINEMA 4D reference manual). The Text Object can also be made editable at any time (simply select the object and press the "c" key). Each letter will be transformed into a spline in an Extrude NURBS.



In the editor view, many colored points will be visible. Each represents the center of a particular clone (letters, words, etc.), around which they will rotate, for example. The following colors represent the following objects:

- Green: Letters
- Blue: Words
- Turquoise: Lines
- White: All elements

The center points can be placed into the text plane (see below).



You should already be familiar with the settings within the red frame from the text spline (described in your CINEMA 4D reference manual). The functionalities are the same. What's new:

### Depth:

Internally, the Text Object uses the Extrude NURBS to make it three dimensional. Use the "Depth" setting to define the extend of the text's 3D depth.

## Subdivision

Use this setting to define the subdivision of the extruded text elements. In most cases, a value of “1” will suffice. Only if you want to deform the text elements further, e.g. bend them, should “Subdivision” be set higher.

## Shader Indexing



From left to right: “All Letter Index”; “Line Letter Index”; “All Letter Index” with a color shader whose “Channel” setting has been set to “Index Ratio”.

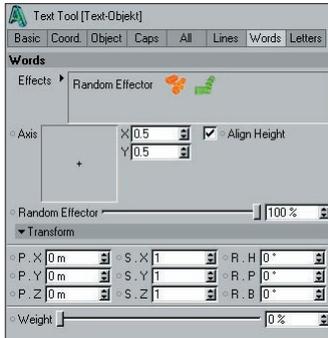
Each letter of the Text Object is numbered internally. Depending on which “Shader Indexing” option is selected, the letters of the Text Object will be numbered consecutively (“All Letter Index”), or the numbering will start again at “0” for each line (“Line Letter Index”) or word (“Word Letter Index”). So, what is this good for? Well, a color shader (see your CINEMA 4D reference manual) with an “Index Ratio” channel setting uses this numbering for orientation. Furthermore, the internal U-coordinates also orient themselves according to this numbering scheme. The U-coordinates, which always have a range of 0 to 1, will be assigned to the letters as follows:

- All Letter Index: From the first letter of the text to the last.
- Line Letter Index: Per line.
- Word Letter Index: Per Word

## Caps Tab

Please refer to your CINEMA 4D reference manual for more about caps.

## All, Lines, Words, Letters Tabs

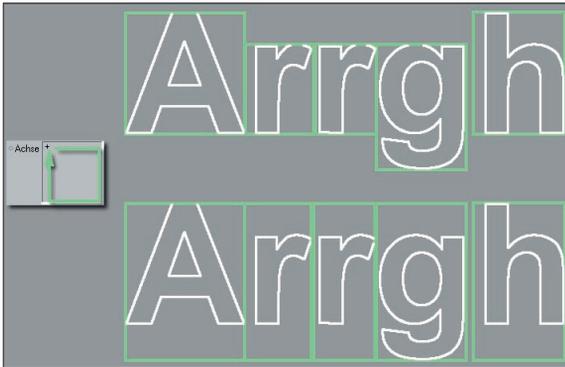


Each of these tabs offers the same types of settings which can be used to modify the entire Text Object, its lines of text or its words, all on their own level. Although a couple of exceptions apply: “Align Height” is not available for the “All” tab and color can only be assigned to all letters in the “All” tab.

## Effectors

Drag all Effectors that should affect the Text Object on a specific level (all, line, word, letter) from the Object Manager into this field.

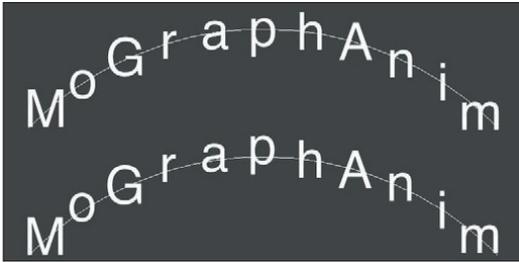
## Axis X/Y



Top: “Align Height” not active. Bottom: “Align Height” active. Center points within a highlighted frame can be accessed and modified using the “Axis” setting.

Each level of text (all, lines, words, letters) has its own center point around which the respective levels rotate or can be scaled. This center point can be moved two-dimensionally within the text plane. This can be done by dragging the crosshair in the “Axis” window or by manually entering X and Y values in the neighboring fields. The range of movement is defined by the text plane, e.g. “Words” allows movement within the entire surface of the words, “Letter” allows movement within the space of each letter.

## Align Height



Text arranged onto a spline. Top: "Align Height" not active, at bottom active.

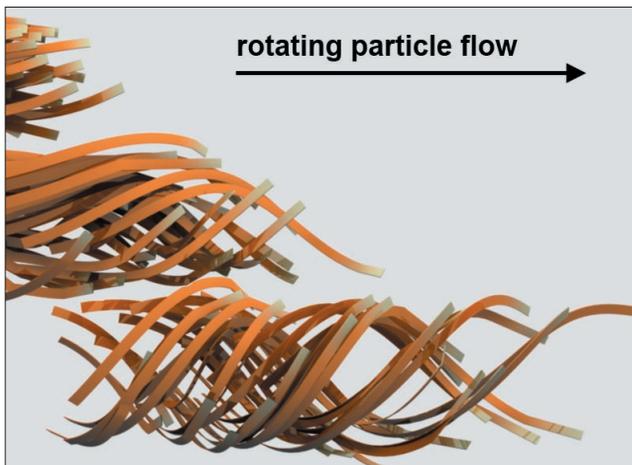
Activating this setting will cause the "Height" setting to be disregarded when the center point of that level is ascertained. This will cause the baseline to be maintained, as shown above. Activating this setting is recommended when arranging text onto a spline.

A slider will be made available beneath the "Axis" setting for each Effector applied to it.

The "Transform" settings are the same as described for the Cloner (see chapter 2).

## Tracer

### General

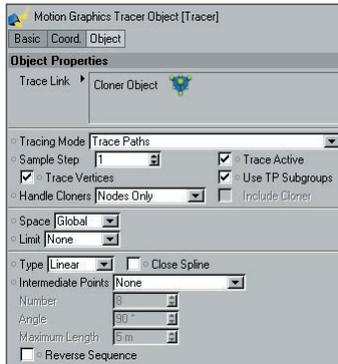


The Tracer creates splines internally, which lets Tracers be used in place of splines:

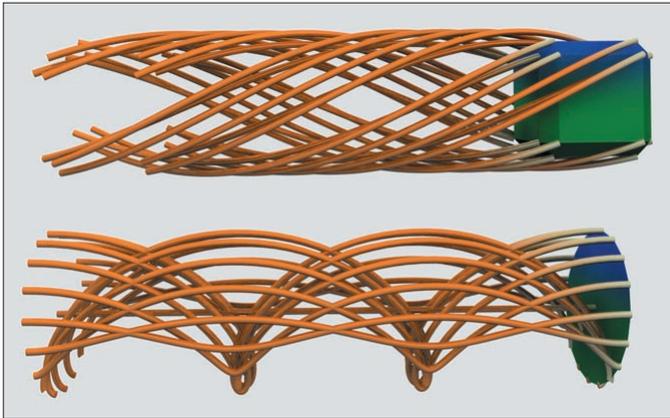
- NURBS (Sweep NURBS pictured above)
- Spline Effectors, etc.

The Tracer “traces” the movement of particles or object vertices and creates splines from these paths. The Trace Object can also be converted to splines via the “Make Editable” command in the Object Manager’s “Object” menu. You can also simply interactively move the object to be “traced” in the editor view to create splines.

## Settings



## Trace Link

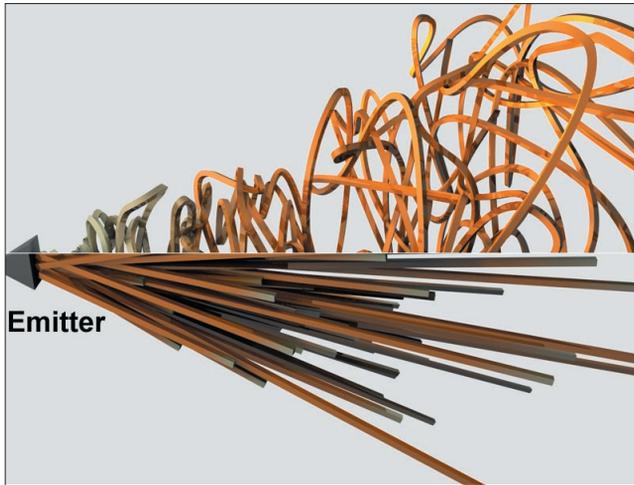


*The path of a cube (top) and a circular plane (bottom) are being traced using the Tracer.*

Drag the object(s) to be traced (polygonal objects or splines) from the Object Manager into this field. To trace particles, drag either the emitter (CINEMA 4D) or the particle group (Thinking Particles settings) into this field.

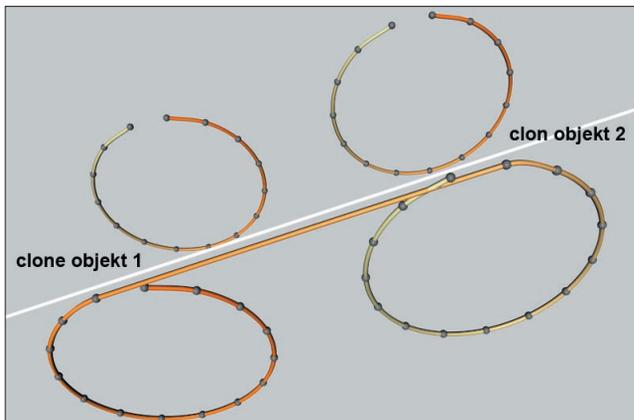
The Tracer can even be applied to PLA and Pose Mixer animations...

## Tracing Mode



At top: "Connect All Objects". At bottom: "Trace Paths". Both using one Particle Emitter.

- Trace Paths: Paths of object vertices or particles will be made to splines.
- Connect All Objects: Objects or particles will be connected with a segment by a common spline.
- Connect All Elements: Objects or particles (object vertices can also be connected, depending on the type of traced object or the "Handle Cloners" modes) from different objects traced by the same Tracer will be connected by a common spline but connected by different segments.



Two clones have been placed into the same Tracer (the Tracer lies in a Sweep NURBS). At top: "Connect All Elements". At bottom: "Connect All Objects".

## Handle Cloners

If several Cloners are nested in each other, the Tracer must know how to handle these objects. The following options are available:

- **Nodes Only:** Only the Cloner that has been placed in the “Trace Link” field will be used. This Cloner’s child objects will be ignored.
- **Immediate Clones:** Any child objects of the object located in the “Trace Link” field that are also clones will be included.
- **Clones from clones:** All clones will be included that are child objects of the Cloner located in the “Trace Link” field.



From left to right: “Nodes Only”; “Immediate Clones”; “Clones from Clones”. “Trace Vertices” active. Insert: Object hierarchy. The Tracer follows the Cloner, which moves from left to right.

## Include Cloner

This setting should be activated if the Cloner (not the clones!) should be included as a spline when the splines are generated internally. In most cases, though, this won’t be necessary.

## Sample Step

Use this setting to define at which frame interval (in an animation) in internal spline vertices should be set. 1 = one spline vertex each frame.

*Tip:*

*If “Type” is set to “B-Spline”, nice splines can be generated even if higher values for “Sample Step” are defined.*

## Trace Vertices

When tracing splines or polygonal objects, use this setting to define whether all object or spline vertices should be traced (active) or only the object’s center (not active).

## Trace Active

Use this setting to temporarily turn the Tracer off. This will result in gaps in the splines, thus creating spline segments.

## Use TP Subgroups

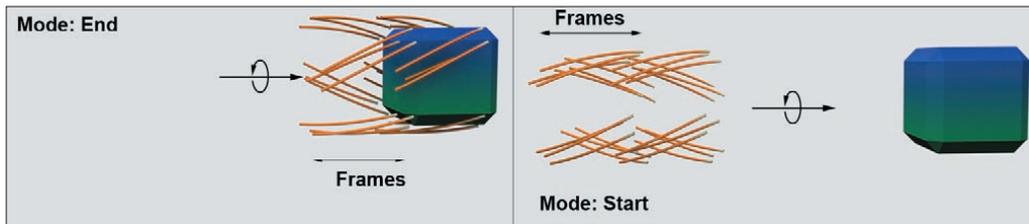
Particles can be placed into groups as desired when using Thinking Particles. Use this setting to define whether child objects of the particles groups in the "Trace Link" field should also be included.

## Space

You can position the Tracer and the object to be traced at any location. The following two options are available:

- **Global:** This will basically pull the rug out from under the splines, i.e. when the Tracer Object is moved, the spline tracings will be strongly affected. The object to be traced doesn't have to be moved - this would move the surrounding space itself.
- **Local:** The traced splines will be positioned relative to the Tracer Object. Only if the Tracer's position is set to 0,0,0 will the spline tracings match the traced object exactly. Otherwise the tracings will appear at a distance equal to the Tracer Object's distance from the world coordinates. What this basically means: In certain situations, an emitter that has been traced and placed into a Loft NURBS can be controlled more easily.

## Limit



*These effects were achieved by using different "Limit" modes.*

The spline length can be limited in the following ways:

- **None:** No limit will be set. All movements will be made to splines.
- **From Start:** Splines will be generated from the very beginning of an animation up to the number of frames defined by the "Amount" setting to the right.
- **From End:** The moving object or particle will drag a trail behind it. The length of this trail is defined by the number of frames set in the "Amount" setting to the right.

## Spline Settings

This is where the type of spline to be generated is defined. The options should already be familiar to you from your CINEMA 4D reference manual.

## Reverse Sequence

Activate this setting if you want to internally reverse the sequence of the vertices.

## Spline Mask



The Spline Mask is paramount to a Boole Object for splines (see your CINEMA 4D reference manual). Use the Spline Mask to cut out, connect, etc. spline shapes. This works best when the splines are smooth and all in on the same plane.

This is a very good tool for quickly creating spline shapes. Spline Mask objects can be used everywhere where a normal spline can be used:

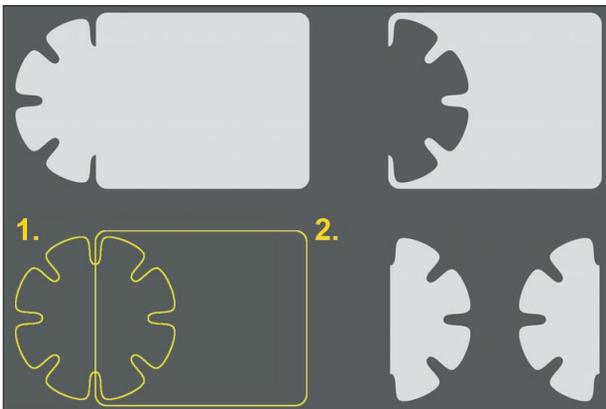
- Extrude NURBS
- Sweep NURBS, etc.

Furthermore, every (closed) spline shape can be displayed in polygon mode. A Spline Mask can be converted to a polygon object via the “Make Editable” or “Current State to Object” commands (“Create Cap” must be active).

*Note:*

*If unwanted effects such as rough edges should occur, change the spline interpolation type to, for example, “Natural” and increase the number of vertices.*

## Mode



The spline arrangement at the lower left were used to create the surrounding shapes. From top left: A union B; B subtract A; A intersect B; A subtract B.

Use this setting to define how both splines, which should lie on the same plane, should be combined:

- A union B: The splines will be added together.
- A subtract B: The second spline in the Spline Mask will be subtracted from the first.
- B subtract A: The first spline in the Spline Mask will be subtracted from the second.
- A intersect B: The intersection of the two splines will remain.

### Axis

Set this setting to reflect the same axis of the plane both splines lie on. For example: Both splines lie on the XY-plane, so "Axis" should be set to "XY (along Z)" (this only applies if the Spline Mask Object is still in the unmodified state in which it was created since its coordinate system will be used) in order to guarantee a flawless boole of the splines.

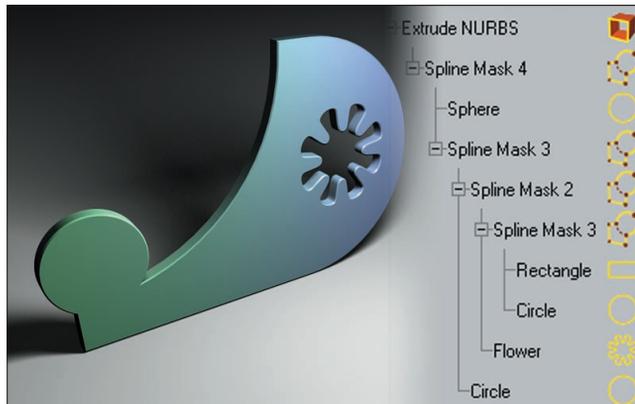
### Create Cap

If this setting is active, a polygon layer will be created within the closed spline (another reason both splines should lie on the same plane). This is how the results in the image above were achieved. Depending on how many spline vertices are used, the resulting polygon can contain very many surfaces.

*Note:*

*The algorithm has limits when dealing with segment vertices of both splines that lie exactly on top of each other (try using a circle spline and a cog wheel spline in the states in which they were created in conjunction with the Spline Mask). Rotating, scaling or moving the splines slightly can help.*

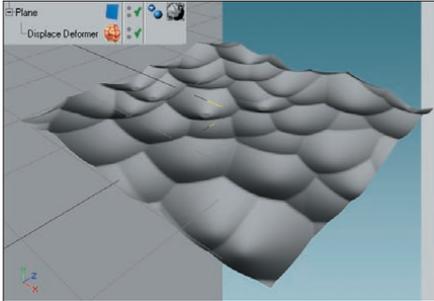
*A Spline Mask can contain several nested Spline Mask children. This method can be used to easily create complex shapes using simple primitive splines:*



Several nested Spline Masks in an Extrude NURBS.

## Displace Deformer

### General



*At left the editor view, at right the rendered view. The plane has a relatively height subdivision.*

Wouldn't it be nice if you could create displacement effects (see your CINEMA 4D reference manual) using a deformation object and have those effects visible in the editor view? Have you ever spent a lot of time simply experimenting and test rendering just to see how far-reaching the displacement is so you could finally align objects to it? Now your frustrations have an end: The Displace Deformer shows the displacement object per object deformation in the editor view, and does not have to be rendered in order to make the effect visible.

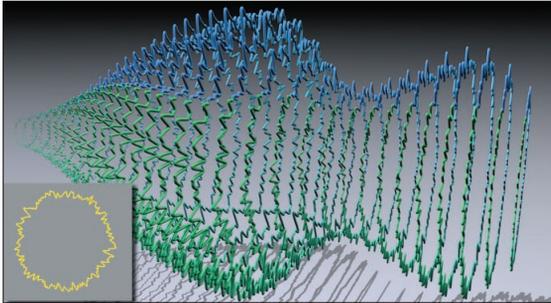
The Displace Deformer functions as a deformation object and must therefore be made a child of the object to be deformed (or be in the same hierarchy, below a common parent object). Make sure the object to be deformed contains enough subdivisions.

#### *Note:*

*With certain constellations (assuming you have an object that was deformed using the Displace Deformer, with whose help you have placed clones on the deformed object using a Cloner) the deformed object should be arranged before the Cloner in the Object Manager. Otherwise the editor view can display false results (arrangement of clones on the undeformed object). This applies only to the editor view; the rendered view will display the correct results.*

#### *Note2:*

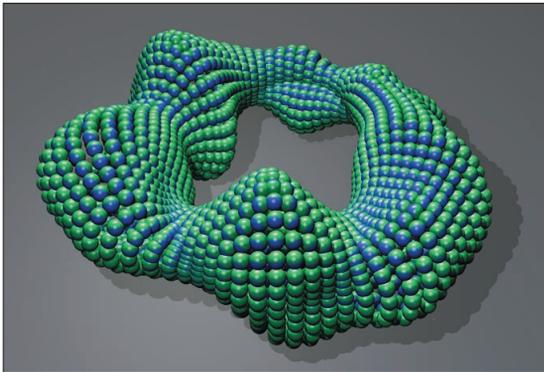
*The Displace Deformer can also be applied to splines. Below, a noise shader in the Displace Deformer has been applied to a circle spline. The circle spline, in turn, lies in a Sweep NURBS, which is cloned linearly by a Cloner. Additionally, a Step Effector was used for scaling and rotation.*



### Note 3:

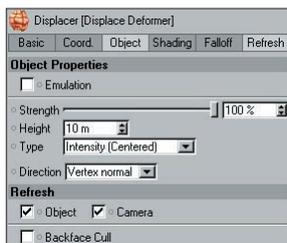
*Even users of Sub-Polygon Displacement (Advanced Render module) will benefit from this tool. Even though only the “normal” displacement is displayed, which completely depends on object resolution, this basically reflects the actual dimensions of the final rendering (assuming you haven’t used objects with only 8 vertices...).*

Of course the Displace Deformer also functions in conjunction with all other MoGraph objects. In the example below, a ring was deformed using a Displace Deformer and a noise shader. Subsequently, a sphere was cloned using the Cloner in “Object” mode:



If this ring were to be animated in its current position with the noise set to world coordinates (“Space” = “World”), really cool morphing, blobbing effects will result.

## Settings



## Emulation

If this setting is active, the Displace Deformer will attempt to emulate a displacement created by the “Displacement” material channel. Naturally, this can only work if a material with an active “Deformation” channel is applied to the object to be deformed. If this option is not active, the Displace Deformer can be assigned its own texture in the “Shading” tab.

*Note:*

*Mixing textures is only possible if “Emulation” is active.*

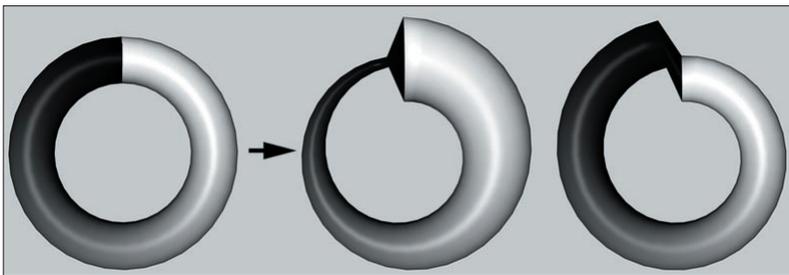
## Strength/Height/Type

These settings should already be familiar to you from the normal CINEMA 4D material displacement settings. Their functions are identical.

## Direction

Use this setting to define the direction in which the displacement should work. The following options are available:

- **Vertex Normal:** The shift will take place in the direction of the vertex normals.
- **Spherical:** The shift will take place around an imaginary sphere whose center lies within the Displace Deformer.
- **Planar:** The shift can be made to take place in the +X, -X, +Y, -Y, +Z and -Z directions via the added “Orientation” setting.



*From left to right: The ring in its initial state without Displace Deformer; with Displace Deformer and “Vertex Normal” mode; with Displace Deformer and “Spherical” mode.*

## Object/Camera (*Refresh* tab)

Deactivating these two settings will speed up the editor view display. Some deformations will simply not be refreshed. These settings have no influence on the final rendering. You can select from:

- **Object:** When the object to be deformed is moved, its deformation will be shown when this setting is active. The deformation will not be shown if this setting is not active.
- **Camera:** For camera-based mapping methods, this setting defines whether or not deformations should be refreshed if the camera is moved.

## Backface Cull

If this setting is active, object surfaces not facing the camera will not be deformed. This also serves to speed up the editor view. This setting also has no influence on the final rendering.

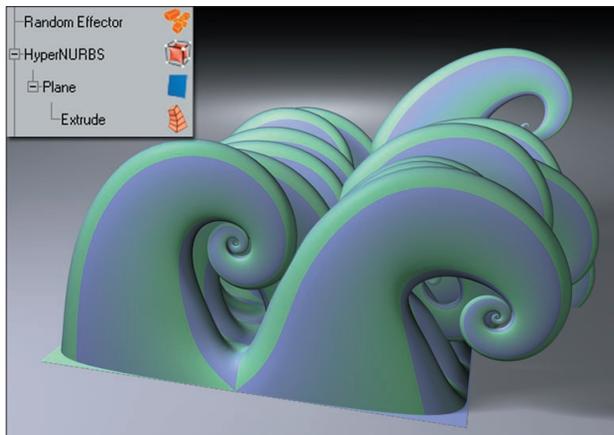
## Shading Tab Settings

These function the same as the settings described for the Shading Effector's "Shading" tab (see chapter 3). The exception: A texture tag assigned to the object to be deformed (or the Displace Deformer itself) can be used to affect the object, as long as "Channel" is not set to "Custom Shader".

## Falloff Tab Settings

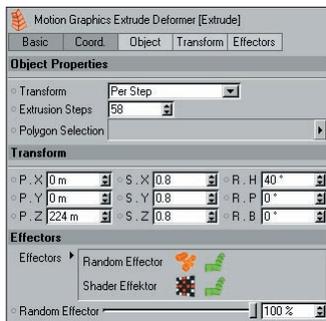
The displacement effect can be spatially limited. These settings work exactly as do the falloff settings for the Effectors (see chapter 3).

## Extrude



This deformer can be used to extrude any number of an object's polygons. Granted, that's nothing new - the "Matrix Extrude" function can do the same. But the Extrude deformer can do more:

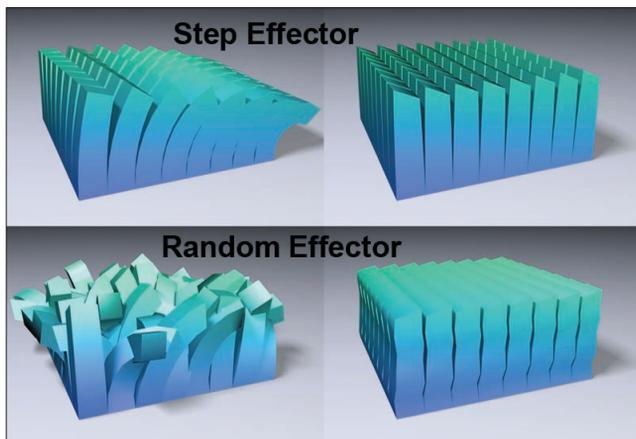
- The MoGraph Effectors affect each step of the extrusion (depending on the settings of the "Transformation" mode) as if it were a normal clone, i.e. the complete functionality of the Effectors can be used when extruding!
- Polygons of parametric primitives can be extruded.
- You can extrude along a spline.



## Transform

Two modes are available:

- **Per Step:** Internally, a clone will be created for each original polygon to be extruded. Subsequently, the transformation will take place once per extrusion step, according to the Extrude Object's settings, and once according to any Effector(s) applied.
- **From Root:** Internally a row of several clones will be created along the length of the extrusion. The Effectors will then have an effect along the length of the extrusion.



Images at left: "Per Step" mode. At right: "From Root" mode.

In general, the best results can be achieved by using the "Per Step" setting in conjunction with most Effectors. "From Root" is best used when extruding using the Spline Effektor or a spline defined in the field below.

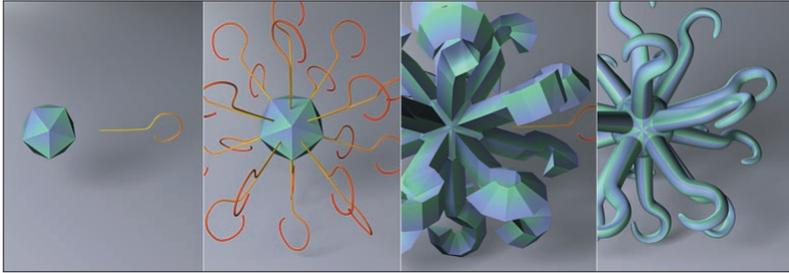
## Extrusion Steps

Use this setting to define the number of extrusion steps.

## Polygon Selection

If the extrusion should be limited to a selection tag only, place that tag into this field. Otherwise all polygons will be extruded.

## Sweep Spline



*Extruding using a spline. If the end result is subsequently placed into a HyperNURBS, a shape as pictured at the far right will be created. A Step Effector was also applied.*

This setting is only available in “Per Step” mode. Placing a spline (any spline) into this field will cause the extrusion to take place along the length of the spline. Internally, copies of the clones will be arranged onto each polygon, in such a way that the first two spline vertices point in the direction of the surface normals. The extrusion will then take place along these virtual spline copies. Spline subdivision and the number of extrude steps both have an effect on the extrusion itself.

The spline will control the extrusion, limiting the effectiveness of the Extrude Object’s “Transformation” tab settings. Instead, the Step Effector will be effective, e.g. to continuously narrow extruded elements to the tip of an object.

## Transform Tab

Use the settings in this tab to define how each clone, i.e. each extrusion, will differ in position, scale or rotation.

Don’t forget that these settings will be limited in their effectiveness if using an extrusion spline since the spline will control the extrusions.

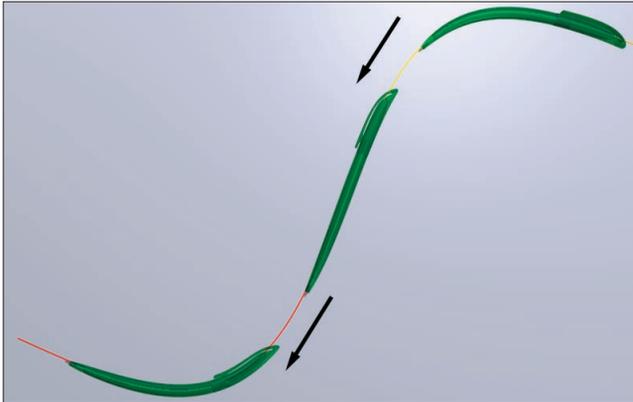
## Effectors Tab

See chapter 2, “Effectors Tab”. Note that for the most part only position, scale and rotation transformations will work in conjunction with the Extrude Object.

*Note:*

*When using Effectors, the “Visibility” setting (see chapter 3) can be used to limit extrusion. This offers additional control over extrusions, which is useful when working with parametric objects on which it is not possible to make a polygon selection.*

## Spline Wrap

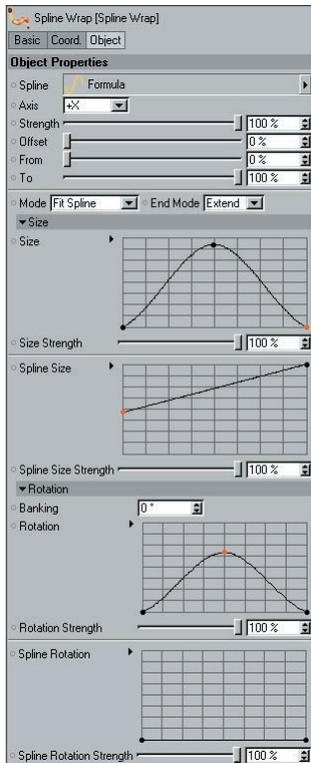


*A pen is moved along a spline as is deformed accordingly.*

Spline Wrap works like a deformation object and deforms objects using a spline. An object will move along a spline and be deformed accordingly.

If a spline with several segments is used, each segment will be assigned its own copy of the deformed object, functioning more-or-less like a Cloner.

## Settings



## Spline

Place the spline (or spline primitive) along which an object should be deformed. The quality of the spline's interpolation will have an effect on the quality of the deformations. The object to be deformed should also contain enough subdivisions to allow it to be deformed.

## Axis



*The pen is pointing in the X-direction of the world coordinate system. Set "Axis" to either "+X" or "-X" if the pen should be arranged along the length of the spline.*

Imagine the axis as a direction in the world coordinate system that runs along the length of the Spline Wrap, passes through the original undeformed object, and transfers object vertices onto that object. If you use an oblong-shaped object that would normally run along the length of the spline with its longitudinal axis, the object will point in a direction of the world coordinate system and "Axis" should be set accordingly.

## Strength

Use this slider to adjust the overall strength of the deformation. In most cases, the slider can stay at 100%.

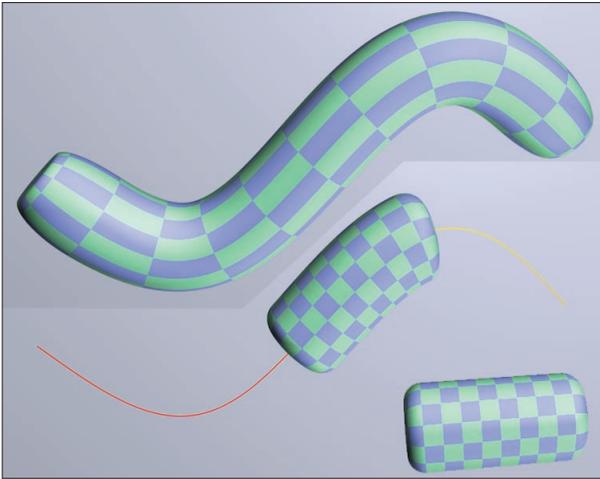
## Offset

Use this slider to move the deformed object along the spline. Values of less than 0% and greater than 100% can also be defined - this can lead to interesting effects, especially when "End Mode" is set to "Extend".

## From/To

Use these sliders to define over which stretch of spline the deformations should take place. For example, if "From" is set to 0% and "To" to 100%, the deformed object will be stretched along the entire length of the spline.

## Mode

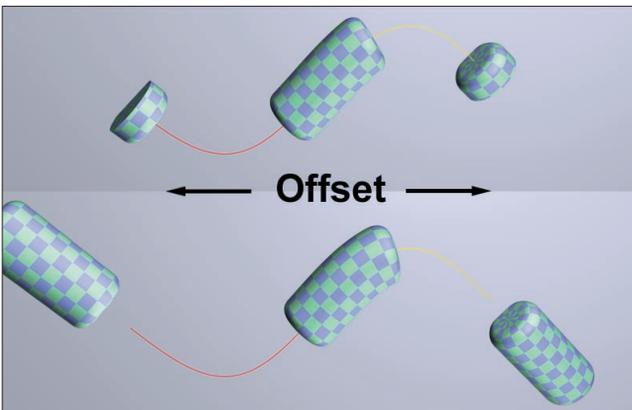


Modes from top to bottom: "Fit Spline"; "Keep Length"; Spline Wrap turned off.

Depending on which option "Mode" has been set to, 0% ("From") and 100% ("To") will have the following results:

- Fit Spline: The object to be deformed will be stretched to fit along the length of the spline.
- Keep Length: The object to be deformed will maintain its length with regard to the above-mentioned axis.

## End Mode

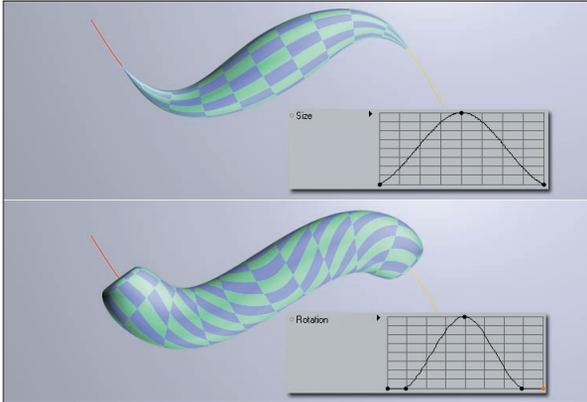


Top to bottom: "Clamp" mode; "Extend" mode.

The "End Mode" options have the following effect when an object is moved along the length of a spline via the "Offset" slider:

- **Clamp:** The object will end at the ends of the spline.
- **Extend:** The object will extend beyond the ends of the spline in accordance with the direction of the respective end, and will not be deformed further.

## Size



*"Size" and "Scale" examples.*

Use these function graphs to define the apportionment of size along the length of the deformed object. Scaling occurs on a plane vertical to the spline tangent. The graph's X-axis reflects the length of the deformed object, i.e. if the object is moved along the spline via "Offset", its scaling will remain constant (in contrast to the "Spline Size" graph).

## Size Strength

Use this slider to adjust the strength of the spline scaling.

## Spline Size

Use this function graph to define the change in scaling of the deformed object over the length of the spline, i.e. if the object moves along the length of the spline via an "Offset" variation, the objects scaling will be modified dynamically.

## Spline Size Strength

Use this setting to adjust the spline size strength.

## Banking

Use this setting to rotate (bank) the deformed object uniformly around its long axis.

## Rotation

Use this graph to twist the object into itself along its length. The strength of this twisting is defined by the following setting, "Rotation Strength".

### Rotation Strength

Use this slider to define the strength of the “Rotation” effect described above.

### Spline Rotation

Use this graph to twist a given object along its length, i.e. if the object is moved along the length of the spline using “Offset”, the degree of twisting will vary according to position

### Spline Rotation Strength

Use this slider to adjust the strength of the “Spline Rotation” described above.

### Cache Tag



The Cache Tag is located in the Object Manager menu under “File/MoGraph Tags/Cache Tag”. This tag is used to bake the movements of the clones, taking into account all applied Effectors (it must be assigned to these objects):

- Cloner Object
- Text Object
- Matrix Object
- Fracture Object
- Instance Object

When objects are baked, position, rotation and size information is saved internally, without having to be calculated “live”. By nature, the file size will increase accordingly. This increase in file size is displayed in MB under “Memory Used”.

MoGraph animations should be baked in the following instances:

- When rendering using NET Render
- If you want to make Instance Object effects visible or if they should be visible upon opening the scene itself.
- When using Delay Effectors
- When using Thinking Particles within MoGraph.
- When the editor view is too slow due to a large number of objects to be rendered.
- Anytime you sense the animation is not behaving correctly.

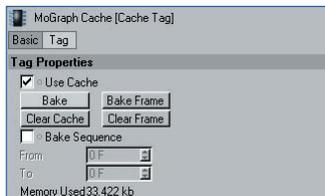
The different states of the Cache Tag will be colored as follows for easy recognition:

- Black: No internal cache files exist. Calculation will be done “live”.

- Green: The cache will be used. Calculation will not be done “live”.
- Red: Internal cache files exist, “Use Cache” is deactivated (or, momentarily, no files exist - this result can be achieved by pressing “Clear Frame”). Calculation will be done “live”.

The bake process can be halted at any time by pressing the ESC-key.

## Settings



### Use Cache

Use this setting to define whether or not internal cache files should be used or not. If none exist, calculations will be done “live” by default.

### Bake

Pressing this button will bake either the entire animation (setting not active) or the part of the animation defined in the “Bake Sequence” settings

### Clear Cache

Pressing this button will clear the entire internal cache: The .c4d file will be reduced in size accordingly and any subsequent calculation will be done “live”.

### Bake Frame

Pressing this button will bake only the current frame.

*Note:*

*A baked Matrix Object cannot generate Thinking Particles!! In case particles are present in your scene anyway, go to the first frame of the animation and press the “Clear Frame” button. Particles and cache are now present.*

### Clear Frame

Pressing this button will clear the current frame from the cache. This lets you, for example, modify Effector settings whose effects need to be seen right away. Bake the frame once modifications are complete so it is again placed into the cache.

### Bake Sequence

If this setting is activated, the exact frame span you want to bake can be defined using the “From” and “To” settings.

*Note (when baking nested Cloner Objects):*

*If you clone Cloner Objects or an Instance Object, difficulties can be encountered if clone-generating child objects are affected by local Effectors. If, for example, a child object affected by a Delay Effector or an Effector with an active falloff (whereby the falloff will not include all clones), the corresponding effects can only be baked in part or not at all. Objects should generally be baked from bottom to top, i.e. the child objects first.*



**CINEMA 4D**

**Release 9**

**5 Clone Tools**



## 5. Clone Tools

### General

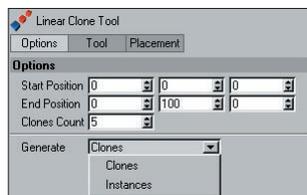
The three clone tools can be used to interactively clone an active object. Simply click in the editor view and drag the outer edge of the clone arrangement. This can be repeated several times (each time a Cloner will be created with either the initially active Cloner or, if preferred, an instanced object as a child object).

If several objects happen to be active, all will be cloned in the “Iterate” mode (see “Linear” mode). After having cloned an object interactively, the tool will continue to be active and several settings can be subsequently fine-tuned.

The MoGraph tools can be used in conjunction with the following keyboard shortcuts:

- SHIFT: Vary the number of clones.
- SHIFT+CTRL: Vary the number of clones in the Z-direction in conjunction with the Grid Clone Tool.

### Linear Clone Tool



#### Start Position

These settings represent the coordinates of the first clone (the location where you initially clicked with the mouse button) in the three-dimensional world coordinate system, in consideration of the Placement Plane (“Placement” tab). This position will automatically be entered here and can subsequently be fine-tuned.

#### End Position

These settings represent the coordinates of the last clone, i.e. where you let go of the mouse button.

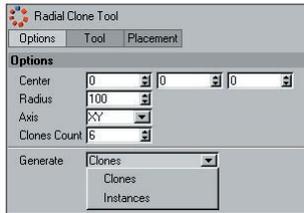
#### Clones Count

These settings can also be varied by simultaneously pressing the SHIFT-key.

## Generate

Use this setting to define if the original object or the instanced object should be generated as a child object of the Cloner. An instanced object can be used to create interesting trail effects.

## Radial Clone Tool



### Center

These settings represent the center of the radial clone arrangement (the location where you initially clicked with the mouse button) in the three-dimensional world coordinate system, in consideration of the Placement Plane.

### Radius

This setting represents the radius of the radial clone arrangement, i.e. the location you let go of the mouse button.

### Axis

Use this setting to select the level of the world coordinate system on which the radial clone arrangement should be made. The center of the arrangement will remain unaffected.

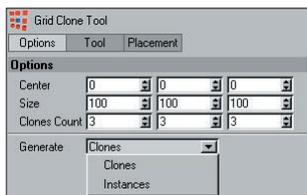
### Clones Count

These settings can also be varied by simultaneously pressing the SHIFT-key.

## Generate

Use this setting to define if the original object or the instanced object should be generated as a child object of the Cloner. An instanced object can be used to create interesting trail effects.

## Grid Clone Tool



### Center

These settings represent the center of the cubic clone arrangement within the three-dimensional world coordinate system.

### Size

These settings represent the dimensions of the cubic clone arrangement in the X-, Y-, and Z-directions.

### Clones Count

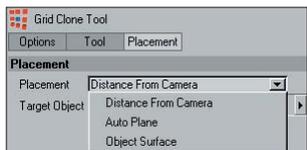
Use these settings to define the number of clones in the three-dimensional grid arrangement. These settings can also be modified interactively in conjunction with the following keyboard shortcuts:

- SHIFT: Count in Y and Z-direction.
- SHIFT+CTRL: Count in Z-direction

### Generate

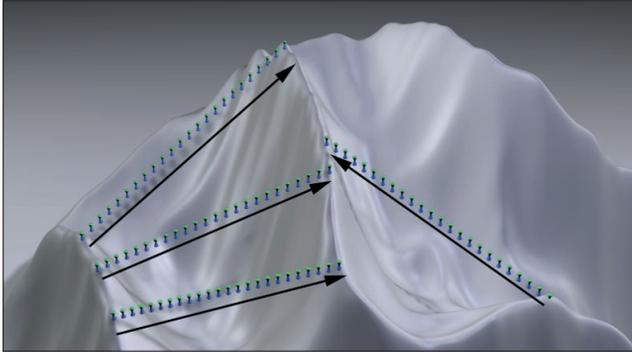
Use this setting to define if the original object or the instanced object should be generated as a child object of the Cloner. An instanced object can be used to create interesting trail effects.

## Placement Tab

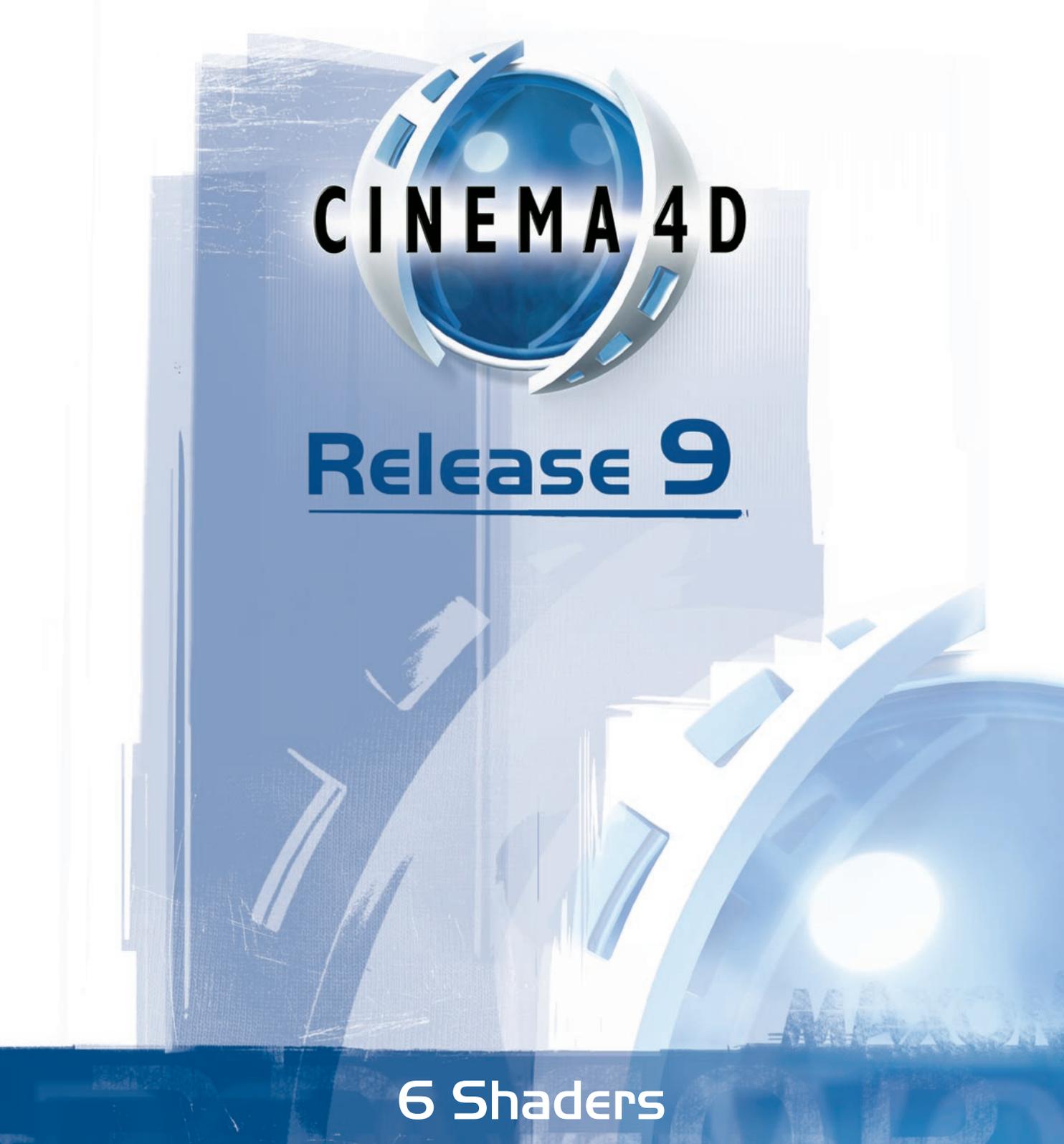


All three Clone Tools have a “Placement” tab. The settings in this tab are used to define the plane on which the cloning will occur, in accordance with where the mouse was clicked. The following placement options are available:

- **Distance From Camera:** The clones will be arranged onto a plane perpendicular to the point of view of the camera and run through the world coordinate system origin.
- **Auto Plane:** The clones will be arranged onto a visible plane. This plane is oriented according to the world coordinate system and thus facing the camera as frontally as possible. This ensures a quick and easy placement of clones on one of the three main planes.
- **Object Surface:** If an object is placed into the "Target Object" field, the start and end clones will always lie on this object (when using the Radial Clone Tool, this will apply to the center of the radius). This is a very practical feature when spanning rows of clones between points on an object.



*Rows of clones can be quickly and easily be created on an object in the "Object Surface" placement mode.*



**CINEMA 4D**

**Release 9**

**6 Shaders**



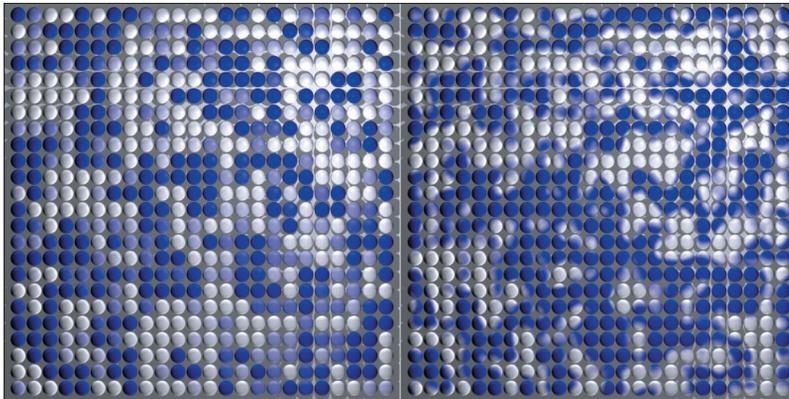
## 6. Shaders

The MoGraph (channel) shader can be found in the material's texture menu.

### Color Shader

There are several methods with which to color clones:

- A material is not applied: Clones can be colored using the settings available for the Cloners or Effectors.
- For advanced material effects, a material with a color shader in the color channel can be created. It should be assigned to the Cloner. Any number of additional material channels can be added.
- Create a basic material without a color shader and assign it to the Cloner or one of the other clone-generating objects. All MoGraph-specific colors will be ignored. Furthermore, the texture will be projected onto the entire arrangement of clones. The opposite, though, is true for the next method.
- Create a material and assign it to the Shader Effector. The Shader Effector will now, based on Shader and projection type, select a color for each clone. This color will be assumed by the entire clone (see image below). While in the same mode, the Random Shader can be used to randomly vary the color of the clones.
- Create a material using the color or multi shader and assign it to the Cloner. The Color Shader sorts out the Cloner's color and the various colors affected by the Effectors and can thus be applied to numerous material channels.



Left: Texture Tag on Shader Effector. Right: Texture Tag on Cloner.

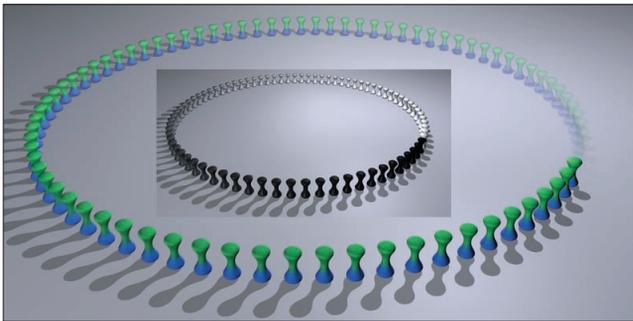
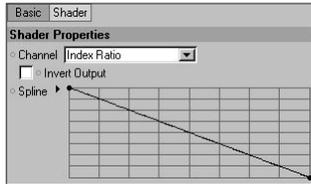
#### Note:

*If you place several objects into a Null Object and subsequently clone that Null Object, the colors varied by the Effectors will not be passed on to the objects in the Null Object. To circumvent this, make the objects to be cloned children of the Cloners instead.*

## Color Channel

This is where the colors are defined that are to be assigned by the respective Cloner (“Transformation” tab) or varied by the Effectors (“Parameter” tab).

## Index Ratio Channel



Main image: Color shader in the alpha channel in “Index Ratio” mode. Insert: Color shader in the color channel in “Index Ratio” mode.

Selecting this mode will assign each clone a grayscale value between black and white, increasing according to the internal U-coordinates. Use this mode if you want to hide cloned, e.g. using the “Alpha” material channel.

*Note:*

*When in “Grid” mode, the coloring of the clones will not transition smoothly but in series.*

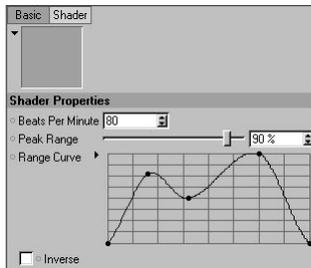
## Invert Output

Normally, clone “0” will be assigned the value black and the last clone white. Activating this setting will reverse this assignment.

## Spline

Use this function graph to precisely adjust the transition from white to black. Clone “0” is represented by the left end of the graph, the last clone by the right. “Y Max” = white.

## Beat Shader



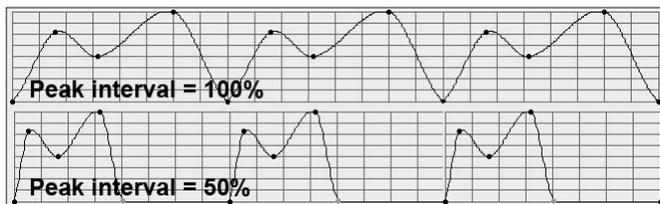
The Beat Shader is ideal for use in simulating such effects as the beat of a heart or other rhythmic effects. Based on its settings, the Beat Shader creates a temporal mix between black and white in accordance with the “Range Curve”. This shader is thus predestined to be loaded into a Shader Effector where it can have a direct effect on all settings to be transformed (including color).

This shader can also be loaded into the Displacer Deformer where it can, based on the falloff settings, be used to deform an object in a limited manner.

### Beats Per Minute

Use this setting to define the rhythm’s frequency, i.e. how often the “Range Curve” should cycle per minute of animation (when the peak is equal to 100%).

### Peak Interval



*The temporal effect of the “Range Curve” on a color gradient at 100% and 50%, respectively.*

If this slider is set to 100%, the “Range Curve” will be repeated seamlessly. If a value less than 100% is defined, the curve will be scaled horizontally from left to right, thus leaving a “null zone” at the right of the graph. As shown in the image above, the double heart beat will beat quicker when set to 50%. After each second beat nothing will occur while the “null zone” is played.

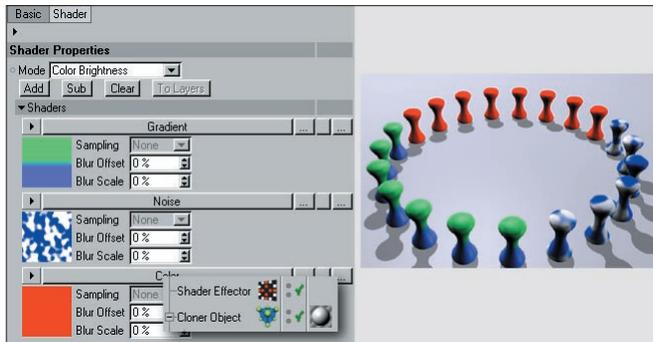
### Range Curve

Use this curve to define the mix between white (maximum) and black (minimum). This curve will be cycled according to the “Beats Per Minute” setting.

### Invert

Use this setting to invert the effect of the shader.

## Multi Shader



An example for a possible setup. A Multi Shader was loaded into the material assigned to the Cloner. The Shader Effector uses a black-to-white gradient to manage the allocation of the three shaders. This can also be done using a Step Effector.

A multi shader can contain several individual shaders that it can assign to clones using differing criteria.

### Mode

Use this setting to define which color values will be used in the allocation, or if the shaders should be allocated uniformly across all clones.

- Index Ratio: The shaders will be allocated uniformly across all clones (e.g. for “Radial” and “Linear” clone modes, the following would be true: If 2 shaders are applied to 10 clones, the first 5 clones will be assigned the first shader, the last 5 the second shader. For other clone modes, the U-coordinate will be used for the orientation of the UVW-coordinate system).
- Color Brightness: The clone’s grayscale value.
- Color Red/Green/Blue: A clone’s individual grayscale value.

### Add

Click this button to add a new empty shader selection.

### Sub

Pressing this button will delete shaders one at a time. The first two shaders cannot be deleted by pressing this button.

### Clear

Pressing this button will delete all shaders. Two empty shader selection fields will remain.

### To Layers

This button will be active if a video has been loaded into the shader. As soon as the button is clicked, each (!) frame of the video will be viewed as a separate shader. Make sure short videos are loaded. Otherwise your computer will be bogged down for quite a while...



**CINEMA 4D**

**Release 9**

**7 Nodes**

## 7. Nodes

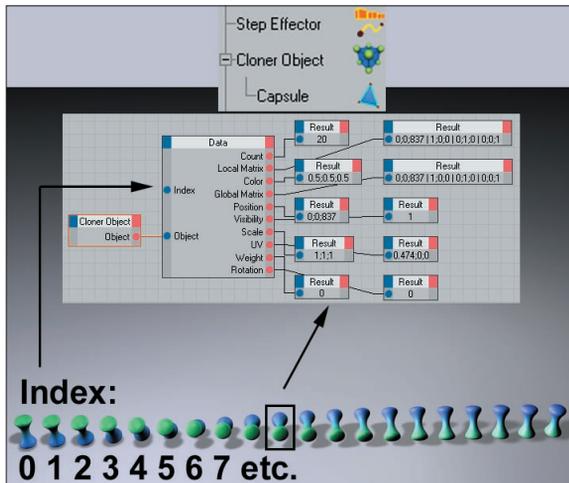
MoGraph XPresso Nodes give you access to MoGraph-generated clone and effector properties. For example, you can use the Falloff Node of a falloff field visible in the editor view for your XPresso setup.

### Data Node



Use this Node to read out all relevant data of subsequent clone-generating objects (any Effectors that affect these objects will be taken into account):

- Cloner Object (see chapter 2)
- Matrix Object (see chapter 4)
- Fracture Object (see chapter 4)
- Instance Object (see chapter 4)
- Text Object (see chapter 4)



In this example, the properties for clone #9 are being read out.

### Input Ports

#### Index

Feed the index number of the clone-generating object into this port. Internally, all clones are numbered sequentially - beginning with 0. An individual index value can also be defined for an active Node in the Attribute Manager.

*Note:*

*Text Object clones can only be read out on the letter “plane” (see chapter 4).*

## **Object**

Connect the “Object” output port of the clone-generating object whose properties should be read out to this input port. The following clone-generating objects can be used:

- Clone Object (see chapter 2)
- Matrix Object (see chapter 4)
- Fracture Object (see chapter 4)
- Instance Object (see chapter 4)
- Text Object (see chapter 4)

## **Output Ports**

Many of these output ports can be connected to the input ports of the same name on the Effector Nodes (see below).

### **Count**

The number of clones of the clone-generating object.

### **Color**

This port reads out a clone’s color, as defined in the clone-generating object and by any Effectors affecting that object.

### **Global / Local Matrix**

This port reads out the individual clone matrix. A local matrix refers to the object that lies above it in the hierarchy, i.e. if the Cloner Object is moved, normally the global matrix will be modified, not the local matrix.

### **Position**

This port reads individual clone positions out as vectors, taking into account any Effectors.

### **Visibility**

This port contains the visibility property as a boolean value of 0 or 1. The visibility of clones can be spread across clones randomly by using the Random Effector, for example.

### **Scale**

This port reads out the scale value as a vector.

## UV

This port reads out the clones' UVW-coordinates that run in the direction of one of the three dimensions, respectively, from 0 to 1. These UVW readouts are important with regard to the Effectors. For example, the "U", "V" or "W" value(s) can be used as variables in a formula defined for the Formula Effector.

## Weight

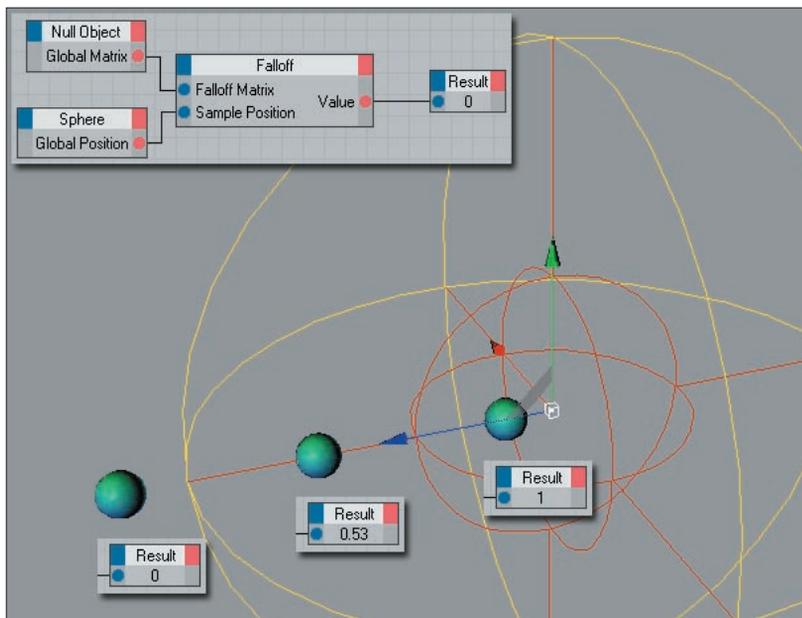
This port reads out the weighting for each clone.

## Rotation

This port reads out each clone angle as a vector.

## Falloff Node

The Falloff Node's purpose is to allow XPresso access to the MoGraph falloff functionality. The falloff field displayed in the editor view can then also be applied to any XPresso effect. All that's necessary is that the "Value" output port be included in the effect. The falloff values generally range between 0 (beyond the range of the maximum (yellow) effect) and 1 (within the range of the (red) falloff field) and can be set to any value range using the "Range Mapper" XPresso Node.



*The position of the sphere is fed into the "Sample Position" input port. Depending on its placement in the falloff field, one of the three positions pictured above will result.*

## Input Ports

### Falloff Matrix

Any object can be connected to this port (preferably a Null Object) and be used to define the position and direction of the falloff field. In most cases, the “Global Matrix” output port can be used. This setting is also available in the Attribute Manager.

### Sample Position

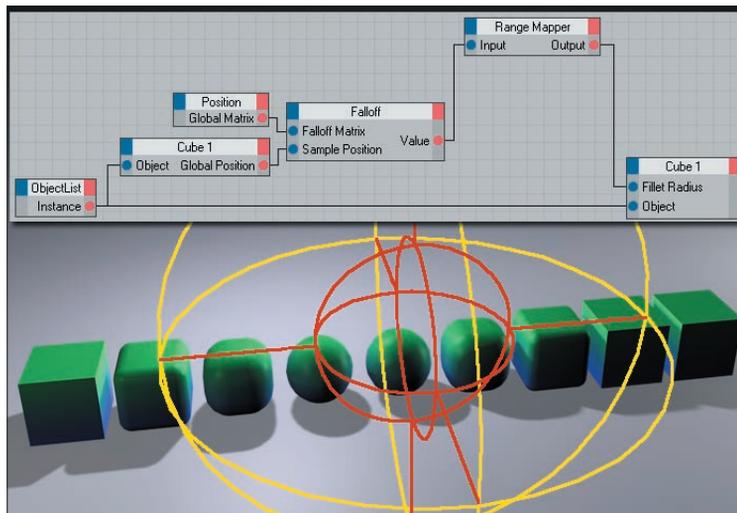
Feed position vectors into this port. The falloff will be calculated exactly at this position. This value will then be automatically passed on to the “Value” output port. This setting is also available in the Attribute Manager.

## Output Ports

### Value

This port reads out the calculated falloff value. This value will generally lie between 0 and 1 and can be set to any output value range using the “Range Mapper” Xpresso Node.

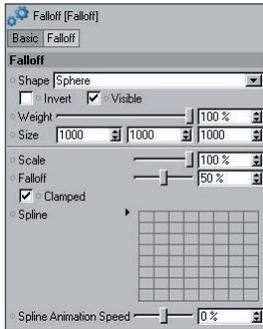
*Example:*



*Here the Falloff effects the cube's "Fillet Radius".*

The setup shown above scales the “Fillet Radius” of each cube in relation to its position within the falloff field. The “Range Mapper” Node serves to increase the output value of the Falloff Node from 0 - 1 to 0 - 100. All cubes are contained in the Iterator Node, “Object List”.

## Falloff Tab



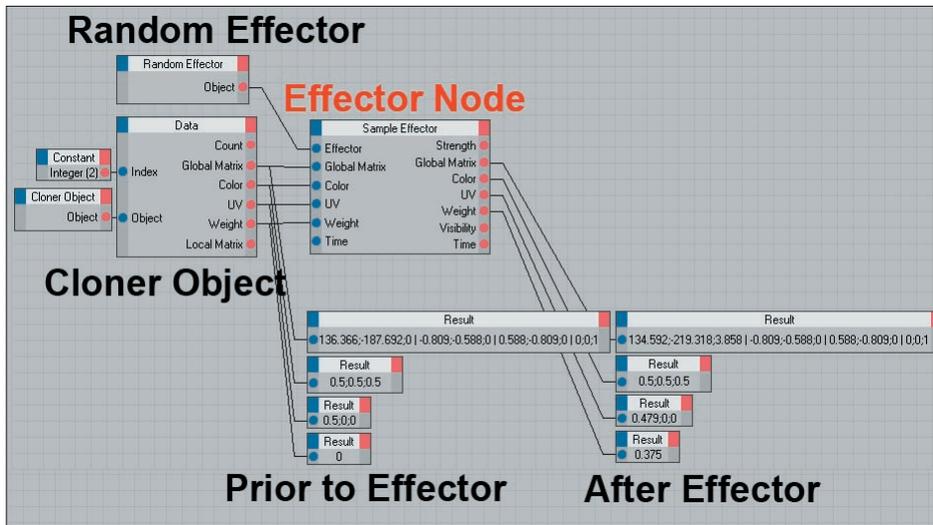
This tab contains many settings that work exactly as those described for the falloff function in chapter 3.

## Effector Node

This Node lets you ascertain all output values of a given Effector. Normally you would feed clones' properties (those that can be read out using the Data Node) into the input ports and grab the values that have been modified by the Effector at the output port. Naturally any object can be affected, whereby the "Global Matrix", "Weight" and "Strength" output ports are the most important.

*Note:*

*The output values of Special Effectors (see chapter 3) such as the Delay Effector and the Inheritance Effector do have limitations. Weight cannot be read out since this setting cannot be affected by the Effector itself. Only those values can be read out that are also present in the respective Effector's Attribute Manager settings.*



Several properties of clone #2 ("Index" ports) are read out, both before and after the Effector's effect. In both cases the color remains the same because the Random Effector's "Color" mode ("Parameter" tab) is set to "Off", thus resulting in no change in color.

## Input Ports

Connect the Random Effector's "Object" output port to the "Effector's" input port. "Time" is a time offset effect that can be fed with data which will simply be added to the Effector's result when an output port of the same name is tapped. All other input ports are basically self-explanatory and can, for the most part, be tapped by the output ports of the same name, respectively.

## Output Ports

The output ports read out settings modified by the attached Effector.

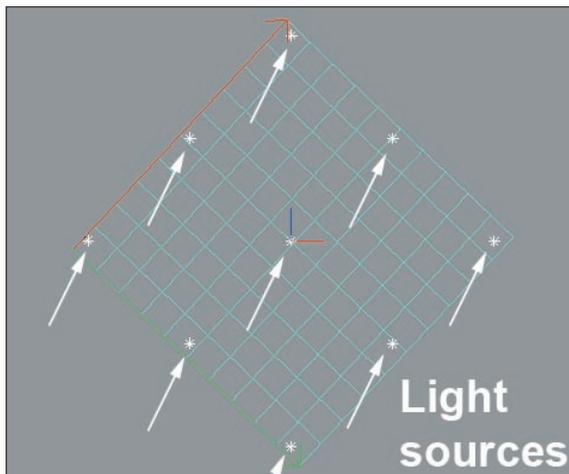
Worth mentioning here is "Strength", a result of combining strength (as defined for a given Effector), falloff, the prevailing scale of a given Effector controlled by the value of an input port (see chapter 3 "How do Effectors Work?") and "Weight" ("Weight" will be multiplied). These two ports are perfect for modifying "normal" XPresso setups (see "Example" below).

"Global Matrix", "Color", "UV", "Visibility" and "Time" area each values that are modified by the Effector and will only lead to meaningful results if their input ports are fed with data. "Visibility" is a boolean value that is generated by the Effector that will return a value of "0" when it reaches a certain threshold.

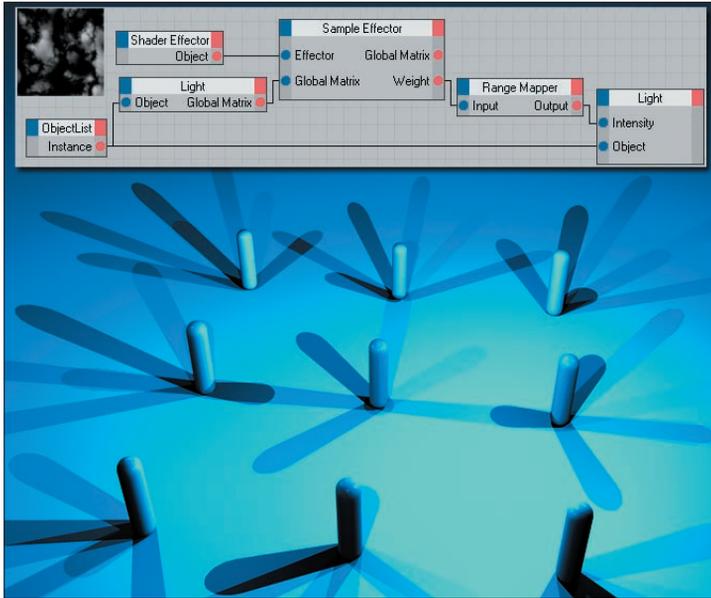
### Example:

*Let's assume you have a certain number of light sources and you want to use a shader to control their intensity. This is not a problem when using the Node Effector:*

1. Create a Shader Effector and assign a texture to it with a "Flat" projection. Set "Channel" to "Color" in the Shader Effector's "Shading" tab (of course the shader should be placed into the corresponding material's color channel) and drag the Shader Effector's texture tag into the "Texture Tag" text field. Use the texture tools to adjust the projection so that all light sources are covered by the texture.



2. Using the XPresso setup below, the intensity of the light sources can be adjusted using the shader shown (insert).



Using the “Object List” Node, to which all light source have been assigned, all of the lights’ global matrices will be applied to the “Effector” Node. The “Effector” Node will calculate a “Weight” value for each position which, in turn, will read out a reasonable intensity for the light sources via the “Range Mapper” Node. There you have it: Controlling intensity of light sources using a shader. This method can also be used to control an unimaginable number of object settings.

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