Chapter No. 5
"Live Path Effects"
In this package, you will find:
A Biography of the authors of the book
A preview chapter from the book, Chapter NO.5 "Live Path Effects"
A synopsis of the book’s content
Information on where to buy this book

About the Authors

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For More Information:
Rigel Di Scala discovered computer graphics on a Commodore VIC-20 as a young child. Before going insane trying to render artistic landscapes using only the limited character set of his primitive 8-bit computer, he upgraded to a CBM Amiga 500 and started creating his first bitmaps with Dan Silva's Deluxe Paint II.

During his college years he started working part-time as a Web developer and consultant for several institutions and companies, and later as a system administrator, journalist, and editor in the computer games industry.

Today he works as a web application developer for an IT company based in Milan. He promotes and uses open-source technology exclusively in his projects. Inkscape is his tool of choice for developing vector graphics.

In his free time, he likes to freeclimb, skydive, and read Reddit.

I would like to thank my family for their constant support in everything I do.
Inkscape 0.48 Illustrator’s Cookbook

Inkscape is frequently mentioned, and lauded, as one of the best examples of open-source software available today. It is a mature, feature-full and flexible product, thanks to a very dedicated developer community. The latest version, 0.48, adds new tools, such as the Airbrush (which many have longed for), and advanced path editing, among many other additions and improvements.

Vector graphics are becoming increasingly important at the turn of this decade, now that the World Wide Web has begun its transition towards HTML5 technologies. All the major Web browsers are striving to conform to the SVG specification, as the attractiveness of scalable, high definition, three-dimensional, and Flash-free Web sites and games is irresistible. The future is bright, but the true outcome will ultimately depend on one decisive factor: user and developer adoption.

This is why a non-proprietary authoring tool such as Inkscape is important: it is a professional package for creating quality vector graphics which is freely available for everybody to use. Whether you wish to create Web site mockups, wallpapers to share with an Internet community, high-quality advertisements for the newspaper industry, digital art for a gallery exposition, or simply a Happy Birthday for your grandmother, Inkscape is available now and without limitations, to help you achieve your goal.

For More Information:
What This Book Covers

Chapter 1, Creating and Editing Objects – Familiarize yourself with the user-interface and start drawing simple vector shapes.

Chapter 2, Editing Colors – Learn the basics of coloring and use gradients to their full effect, by replicating an iconic image of a famous movie.

Chapter 3, Speeding Up Your Workflow – Streamline and accelerate development with a set of commonly used techniques, tips and tricks.

Chapter 4, Creating and Editing Clones – Use shape cloning to rapidly create interesting complexity in your drawing.

Chapter 5, Live Path Effects – Create, assemble, and replicate objects programmatically in a variety of scenarios.

Chapter 6, Extensions – Take full advantage of the many extensions available in Inkscape, to inspire and enhance your work.

Chapter 7, SVG Filters – Experiment with SVG filter effects, taking vector graphics to a new level of sophistication, and create your own!

Chapter 8, Putting it All Together – Use your knowledge, skills, and intuition to solve graphical problems in a variety of scenarios.

Chapter 9, Raster and Almost Raster – Befriend bitmaps and use them in your vector drawings, by importing, converting (tracing), and exporting.

Chapter 10, Web Graphics Preparation – Learn to design and prepare graphics for the modern web, from small but detailed widgets to the complete layout of webpage mockup.

Chapter 11, SVG in Websites – Use vector graphics in your websites, games, and presentations, with the help of new extensions available in version 0.48.

Chapter 12, Draw Freely – Complete your knowledge on SVG and Inkscape, by learning about document metadata, compiling the software from source, and programming your own extensions using Python!

For More Information:
In this chapter, we will cover:

- Bending paths
- Using Patterns along path
- Using Envelope Deformation
- Interpolating Sub-Paths
- Stitching Sub-Paths
- Creating gears
- Creating hatches (rough)
- Sketching shapes
- Constructing grids
- Creating rulers
- Creating knots
- Generating VonKoch fractals

**Introduction**

So far we have used Inkscape's main tools to assemble primitives into a variety of shapes. The process of creating these building blocks can be fully automated using features known as Live Path Effects (LPEs). They are very useful, easy to use, and ubiquitous that we couldn’t resist the temptation of using one in the very first chapter of the book: Spiro Spline.

In a nutshell, LPEs twist, replicate, transform, and apply many other modifications to shapes in a sequential and repeatable way. There are many different types of LPEs available for Inkscape 0.48, and even more are being developed. In this chapter we will cover some of the most interesting ones available for this release.
**Bending paths**

In this recipe we will go through the basic Live Path Effect options using the Bend path effect. We will create a simple rectangle and morph it into a waving flag. We will also bend some letter shapes directly and through linking to objects to use as bending paths.

**How to do it...**

The following steps show how to use bending paths:

1. Create a rectangle using the Rectangle tool (F4 or R), set its fill to #D5D5FF, stroke to 60% Gray, and stroke width to 1.
2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor.
3. Under the Apply new effect, choose Bend and press Add, this will apply the Bend LPE to the rectangle but the rectangle won't change as a result of it.
4. We now have several options available under Current effect. Select the Edit on-canvas option, and notice the bending line on the rectangle that appeared.
5. Click on the green line (the Bezier segment) and drag slightly to bend the rectangle. Adjust more precisely using handles on the end nodes, and click on a node to show the handles. Here is what we have so far:

![Bending Path Example](image)

6. Duplicate the rectangle (Ctrl + D) and move it away. Notice that the duplicated object will keep the LPE applied.
7. Switch to the Node tool (F2 or N) and notice the four corner nodes of the original rectangle appear. The rectangle was automatically converted to a path when applying the LPE.

For More Information:
8. Turn on the Show path outline (without path effects) and Show Bezier handles of selected nodes to see the original shape and its node handles. Move the nodes with the Node tool and notice how the bent shape updates accordingly:

![Shape with node handles](image)

9. Press the 7 key to switch to the edit LPE bending path mode; if more adjustments are necessary, switch back to the Node tool using F2 or N.

10. Select the other rectangle (the one we got in Step 6), click on the Copy path button in the Path Effect Editor and paste somewhere on canvas (Ctrl + V or right-click and choose Paste from the pop-up menu). Remove the fill and add a stroke to the pasted path for more clarity. This is a copy of the rectangle bending path but it is in no way connected to the rectangle or its LPE.

11. Create an "S" using the normal mode of the Pencil tool (F6 or P) with Smoothing: set to 50.

12. Switch to the Selector tool (Space or F1 or S) and copy the "S" (Ctrl + C).

13. Select the rectangle with Bend applied to it and press the Paste path button in the Path Effect Editor to bend our rectangle in the form of the "S".
14. The shape might look a bit weird if our rectangle length and width are similar; this can be corrected in the Bend LPE by changing the **Width** value. In this case, reducing the width from 1 to 0.2 produces the desired results:

![Diagram showing the effect of changing the width](image)

15. Create a "C" using the normal mode of the **Pencil** tool (F6 or P) with **Smoothing**: set to 50 and copy it (Ctrl + C).

16. Select one of the objects with Bend applied to it and press the **Link to path** button in the **Path Effect Editor** in order to bend our rectangle in the form of the "C". The LPE object will be positioned over the "C" and the "C" shape will still be available for editing.

17. Change the **Width** value if necessary. In our case, a value of 0.2 proved adequate.

18. Select the "C" shape and edit it using the **Path** tool (F2 or N). Notice how editing the "C" shape automatically updates the LPE linked to it:

![Diagram showing the effect of editing the C shape](image)

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**There's more...**

Unexpected results can happen if the shape we're trying to bend is vertical (taller than wide); the Inkscape developers, in their wisdom, have provided a special **Original path is vertical** option that will adapt the bending effect accordingly.

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**For More Information:**

Bending groups
We bent only one object in this recipe but bending groups is also possible. Just make sure the objects within the group are converted to paths before the bending is applied.

Stacking LPEs
It's possible to apply more than one LPE to a single object. You can preview what the shape looks like with or without a particular LPE applied by toggling the "eye" icon in the Effect list.

Removing Path Effects
Live Path Effects change the shape of an object while keeping the original shape information intact (these changes are made "Live", as in real time). This means that LPEs can be undone, and the Remove Path Effect option under the Path menu does exactly that. You have to remove the object from the selection and then select it again to update the Path Effect Editor display.

See also
For more information, refer to the recipes on Using Pattern Along Path and Using Envelope Deformation, which will be discussed later in this chapter.

Using Pattern Along Path
We have already used the Pattern Along Path effect without even knowing it by choosing a shape in the Shape: option of the Pen and Pencil tools (we told you LPEs are ubiquitous!). This LPE takes a path and applies it along another one, like a reverse Bend LPE. In this recipe we will learn another method to widen the outline of a tree trunk created using Spiro Spline and explore some other options of this LPE.

How to do it...
The following steps will show how to widen an outline using Pattern Along Path:

1. Create a tree trunk using the Spiro spline mode with the Pencil (F6 or P) tool. Set the Smoothing: to 34 and the Shape: to Triangle in.
2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....You will see two LPEs listed: Spiro spline and Pattern Along Path.
3. Select the Pattern Along Path by clicking on it to get to its options.
4. Use the arrow handles to widen the shape. Notice how this affects only the skeleton path and the “tree trunk” remains the same width because it's governed by the LPE shape.

For More Information:
5. To make the "tree trunk" appear wider change the original triangle using the Edit on-canvas option of the Pattern source. It will appear as a green path near the top-left corner of the page.

6. Move the top triangle corner upwards and the bottom one downwards. Notice how the "tree trunk" appears wider.

7. There is also another way to achieve the same result—using the Width option. Change it to 5 and see how the "tree trunk" gets even wider. This time the original triangle shape isn't modified.

8. Tick the Pattern is vertical option. Notice how the shape changes depending on what base triangle orientation is taken as the pattern.

9. Change the Pattern copies from Single, stretched to Single. Notice we only see a small triangle at the beginning of the skeleton path because the original triangle shape is much smaller than the skeleton path, and we're only using a single one without stretching it.

10. Change the Pattern copies to Repeated, stretched. The triangles are "copied" along the skeleton and positioned one next to the other. If there is a small part of the skeleton path not covered using the original triangle size they are stretched a bit to compensate for it. Since they are so small compared to the skeleton path there isn't much difference between using the Repeated, stretched and Repeated option. Notice the Pattern is vertical is still enabled.

11. Untick the Pattern is vertical option. Notice the change in triangles.

12. Change the Spacing option to 25. Notice how the triangles are now spaced out.

13. Tick the Pattern is vertical option. The triangles change shape again based on the orientation but now the spacing between them is noticeable.

For More Information:
How it works...

The Pattern Along Path LPE uses one path as a pattern that is to be stretched and/or repeated along a skeleton path. Other than using the Shape option of the Pen and Pencil tools we can create separate patterns and skeletons to be combined through the Path Effect Editor just like with any other LPE. The usual options to edit, copy, paste, and link are available, and both the pattern and the skeleton can be edited live.

Pattern Along Path also has some specific options to determine how the pattern is applied along the skeleton. We can choose to stretch it or repeat it, therefore increasing the separation between the repeated items.

There's more...

Normal and Tangential offsets are also specific options that influence the positions of the patterns in relation to the skeleton path. Normal offset moves the patterns away from the skeleton, and the tangential offset moves them along its tangent.

The difference between Pattern along Path and the other LPEs is that we can't use groups as patterns or skeletons.

Pattern along Path extension

Another (and older) way to achieve the same effect is by using the Pattern along Path extension found under the Extensions | Generate from Path menu. The extension also offers to choose between Snake and Ribbon as the Deformation type. Groups can be used as patterns, but the changes made to the pattern cannot be undone. The z-order determines which object is used as the pattern—the top-most one.

The extension doesn't always give the same results as the LPE; the straight segments stay straight when the extension is used, but the LPE bends them.

See also

For more information refer to the recipes that follow in this chapter.

Using Envelope Deformation

Envelope Deformation is often used to create interesting effects on text so this is the example we'll use in this recipe.

For More Information:
How to do it...

The following steps will show you how to use Envelope Deformation:

1. Select the Text tool (F8 or T) and create a text object by clicking on the Canvas and typing "INKSCAPE". Set the font size to 144.
2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor... Notice that we have the message Item is not a path or shape in the Current effect area. This means we can't use Envelope LPE on text objects.
3. Convert the text to a path (Shift + Ctrl + C). We will get a group.
4. Under Apply new effect, choose Envelope Deformation and press the Add button. Notice that the group hasn't changed.
5. Untick the Enable left & right paths option because if we're deforming text, results are better using only two opposite envelope edges.
6. Select the Edit on-canvas option for the Top bend path and edit it by dragging it or its handles.
7. Select the Edit on-canvas option for the Bottom bend path and edit it by dragging it or its handles:
8. Tick the Enable left & right paths option to see how the shape changes; the text deformation is now less elegant.

There's more...

We don't always have to use only two envelope edges. Sometimes it will be necessary to edit all four of them.

For More Information:
Envelope extension

Another (and older) way to achieve the same effect is by using the Envelope extension found under the Extensions | Modify Path menu. The path we want to morph this way must be converted to a path (Shift + Ctrl + C), and we have to create a four-node path to act as the envelope. For best results create the left-bottom node first, then move clockwise. The skeleton path must be selected second.

See also

For more information, refer to the Bending paths recipe seen earlier in this chapter.

Interpolating sub-paths

Interpolate Sub-Paths is an effect that can help us "blend" two sub-paths of an object. The interpolation in this LPE only affects the shape of the paths and not their style, since sub-paths cannot be styled separately.

This effect can create various 3D surface illusions, hair, hatches, and engravings, or it can be used to create shape variations so it's easier to choose the perfect one.

How to do it...

The following steps will show how to interpolate sub-paths:

1. Select the Pencil tool (F6 or P). Set it to normal mode, set Smoothing: to 35, and create a horizontal wavy line. Hold Shift while creating another similar line so it's added to the same object. Create the second line drawing in the same direction so their path directions are parallel.

   If you forgot to press Shift and created two separate paths, you can still combine them into one object by selecting both of them using Ctrl + K or by going to Path | Combine so they become object sub-paths.

2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....

3. Under Apply new effect, choose Interpolate Sub-Paths and press the Add button. Notice the additional three lines that have been interpolated between the sub-paths.

4. Under Current effect set Steps to 20 to increase the number of interpolated lines.

5. Select the Edit on-canvas button. Notice the green trajectory path appears over the object. This is the control path for this LPE.

For More Information:

6. Edit the trajectory by dragging its outline or node handles with the mouse. Notice how the interpolated lines change accordingly:

7. Add a new node on the trajectory next by double-clicking on the path.

8. Untick the **Equidistant spacing** option so the middle node now controls how interpolated paths are positioned. There is an equal number of lines between nodes but since the amount of space is not the same they appear thicker in area with less space between nodes.

9. Select the **Node** tool (F2 or N) and edit the original two sub-paths just as you would any path by dragging them or their nodes and handles. Notice how the interpolated paths automatically adjust with the changes.

### There's more...

The sub-paths we want to interpolate can also be closed paths.

The path direction affects the interpolation: if we reverse the direction of one sub-path the interpolation results will be different. You can enable displaying path direction in the **Inkscape Preferences** (`Shift + Ctrl + P`), by ticking the **Tools** | **Node** | **Show path direction on outlines**.

The following is an example of the same sub-paths being interpolated, only the top sub-path has the direction reversed in the second example:
If we need our interpolated objects to become normal paths we can use the **Object to Path** option (Shift + Ctrl + C) but this way we lose the ability to edit it further as a LPE.

**Interpolate extension**

The option to interpolate also exists as an extension that can be found under **Extensions | Generate from Path | Interpolate...** but there are differences between the extension and LPE features. The extension can be applied to two objects (they don't have to be sub-paths of a single object) and the styles can also be interpolated which can give very dramatic results. The **Exponent** option controls the spacing between interpolated objects. The disadvantage of the extension is that you can't monitor the live results. Here is a simple example of two spirals converted to paths with interpolated styles, and another one that simulates a complex gradient:

You can find these examples in the **InterpolateSubpaths.svg** file accompanying this chapter.

**See also**

For more information, refer to the recipe on **Using Pattern Along Path** seen earlier in this chapter.

Stitching sub-paths

Stitch Sub-Paths LPE is almost like an opposite of Interpolate Sub-Paths LPE. It can create 3D surface effects, hair, hatches, and engravings but instead of generating additional paths "parallel" to the sub-paths, it creates them "orthogonally" to the original sub-paths.

Stitch Sub-Paths LPE also has some additional randomizing options and the possibility to use a custom path shape as "stitches".

In this recipe we will use Stitch Sub-Paths LPE to create a stitched effect on an alphabet. With a little practice, we can fashion a textual logo from a brand name using the very same technique.

How to do it...

The following steps will show how to stitch sub-paths:

1. Select the Text tool (F8 or T) and write the letter "C". Choose your favorite font family, set the font size to 500. Remove the fill, set stroke to Navy (#000080), stroke width to 8px, and miter cap to Round cap in the Stroke style tab of the Fill and Stroke dialog (Shift + Ctrl + F). This style will later be inherited by the stitches.

2. Convert the text object to a path (Shift + Ctrl + C) and ungroup it (Shift + Ctrl + G).

3. Select the Node tool (F2 or N). Break the path (that is currently closed) into two sub-paths by breaking the paths at two selected nodes or deleting the segment between the selected nodes. Make sure to break it at the ends of the letter "C" so we get similarly shaped sub-paths.

4. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....

5. Under Apply new effect, choose Stitch Sub-Paths and press the Add button. Notice the straight lines that appear and our original path is not visible any more.

6. Enter 30 in the Number of paths option. Notice that the "stitches" aren't confined inside the "C" shape. We didn't get the effect we were looking for because the sub-paths directions are opposite.

7. Reverse one of the sub-paths direction by first breaking it apart (Shift + Ctrl + K)—the stitches will disappear temporarily. Select only one of the resulting objects and reverse it by going to Path | Reverse. Then select them both and combine (Ctrl + K). You will see the stitches properly positioned.

8. Press the Edit on-canvas button and notice the green control path. Edit it by dragging it or its nodes and handles to change the shape of the stitches.

9. To randomize the start and end points' positions, and the spacing between the stitches, set all the Spacing variance randomizing boxes to 0.20.

For More Information:

10. If you don't like the result you got by randomizing, click on the dice icon next to the value you want to rearrange in a new random order. The following image shows some of the steps:

![Steps](image)

**There's more...**

As with the other LPEs it is possible to edit the original object with the **Node** tool and switch to editing the control path by pressing **7**.

In addition to using the green control path we can change the stitch path shapes by copying a path and using the **Paste path** button in the **Current effect** area. Here is an example of a star converted to a path and pasted as a stitch on our "C" object:

![Example](image)

For more examples of stitched sub-paths check out the `inkscape046StitchedGold.svg` file, a submission to the About screen contest for 0.46 Inkscape version when this LPE was first introduced.

**See also**

For more information, refer to *Using Pattern Along Path, Stitching sub-paths, and Creating hatches (rough)* in this chapter.

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**For More Information:**

**Creating gears**

The Gears LPE creates gears around each node of a skeleton path and adjusts the gear radius and the number of teeth, in order to make the device realistic. This effect can be employed, for example, to add a busy, mechanical look to a background. In this recipe we will take the LPE for a spin (no pun intended!) and create a very simple array of gears.

**How to do it...**

The following steps will show how to create gears around a path:

1. Use the **Pen** tool (Shift + F6 or B) to create a path with seven nodes by clicking on the canvas. Zigzag the nodes' positions (it doesn't matter if the segments are straight or curved).

2. Open the **Path Effect Editor** by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....

3. Under **Apply new effect**, choose **Gears** and press the Add button. Notice that gears appear around some of the nodes. Things don't look quite right: such a machine would probably crash and burn as soon as it is operated!

4. Enter 20 in both the **Teeth** and the **Phi** (Pressure angle) boxes.

5. There are probably nodes without their gears and some gears might overlap. To correct this use the **Node** tool (F2 or N) to move the nodes so that gears connect correctly. Notice how gears are adjusted automatically as we move the nodes.

For More Information:

There's more...

There is also an extension that can create single gears. It can be found under Extensions | Render | Gear... and it can be used to create a single gear with somewhat more control over the gear properties.

See also

For more information, refer to Using Pattern Along Path in this chapter.

Creating hatches (rough)

The Hatches (rough) LPE fills an object's fill with lines that look hand-drawn. It comes with a variety of options to adjust the line properties, which we'll explore in this recipe.

How to do it...

To create rough hatches, carry out the following steps:

1. Select the Star tool (Shift + F9 or *) and create an upright star by clicking and dragging upwards while holding Ctrl. Set the star stroke to Black and width to 8.

2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor...

3. Under Apply new effect, choose Hatches (rough) and press the Add button. Notice the star shape becomes invisible and is replaced by squiggly lines inside its fill.

4. Set Frequency randomness, Magnitude jitter, and Parallelism jitter to 0 to get a more symmetric pattern.

5. Set Half-turns smoothness 2nd side in and out to 2 to make the top hills more curved.

6. Set Thickness: at 2nd side to 40. This is where it becomes obvious that the lines are actually created by two parallel paths, like a calligraphy path, and with certain settings we can make them separate to reveal the fill color between them.

7. Set Thickness: from 2nd to 1st side to 10, to make the stroke thickness vary depending on the direction of the curve.

8. Select the Node tool (F2 or N) and notice the hatches handles that appear. Hover over the diamond ones and read the statusbar tips to find out which one controls bending and which one controls direction and frequency.

9. Drag the handle for direction and frequency up and to the left to make the hatches diagonal and thicker.

For More Information:
10. Drag the handle for bending up and to the right to make the hatches curve.

See also

For more information, refer to Bending paths in this chapter.

Sketching shapes

The Sketch LPE simulates a hand-created sketch drawing with multiple attempts to "correct" the line, in a style somewhat resembling the famous blueprints of the inventor and polymath Leonardo Da Vinci. This LPE comes with a number of options that can be used not only to adjust the sketch effect but to also produce some less sketchy patterns. We will explore these options in this recipe.

How to do it...

The following steps will show how to simulate a sketch:

1. Select the Spiral tool (F9 or I) and create a spiral, set the stroke width to 2 and fill it with some color.
2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....
3. Under Apply new effect, choose Sketch and press the Add button. Notice the sketch effect gets applied with the default settings.
4. To make the sketch appear less cluttered set Strokes to 2.
5. Loosen the strokes by increasing the Average Offset to 15.
6. Increase Max. tremble to 15 and Tremble frequency to 7 to make the lines squiggly.
7. To make the construction lines more prominent set Scale to 150 and Max. length to 300.
8. If you don't like the result you got by randomizing, click on the dice icon next to the value you want to rearrange in a new random order.

For More Information:

How it works...

Sketch LPE traces paths with two kinds of lines:

- **Strokes** that follow the path curvature
- **Construction lines** that are straight shorter segments

The settings allow us to choose how many lines to use so it's possible to turn either line type off by setting its number to 0. There are a lot of options to control the appearance of lines creating different patterns, making the lines appear more regular or randomizing their properties.

See also

For more information, refer to *Using Pattern Along Path, Stitching sub-paths, and Creating Hatches (rough)* in this chapter.

Constructing grids

**Construct grid** is a very simple LPE that creates a grid using a path's first three nodes to determine the grid parameters.

How to do it...

The following steps show how to construct grids:

1. Select the **Ellipse** tool (F5 or E) and create a narrow ellipse at the bottom of the page.
2. Open the **Path Effect Editor** by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....

For More Information:

3. Under Apply new effect, choose Construct grid and press the Add button. Notice the ellipse becomes invisible and the grid is created using the ellipse handles position as grid parameters.

4. Enter 3 in both the Size X and Size Y boxes to reduce the number of grid fields.

5. Change the grid width and height by dragging the ellipse width and height handles (still using the Ellipse tool).

6. Use the ellipse circle handles to skew the grid as you see fit.

See also

For more information, refer to Creating rulers in this chapter.

Creating rulers

The Ruler LPE is a simple effect that applies ruler markers to paths. As the path is edited the ruler markers adjust automatically as we'll see in this recipe.

How to do it...

The following steps show how to create a ruler:

1. Select the Rectangle tool (F4 or R) and create a rectangle.

2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....

3. Under Apply new effect, choose Ruler and press the Add button. Notice ruler marks that appear outside of the rectangle.

4. Set Mark distance and Major length to 30, and Minor length to 15 to change the ruler scale and make it more readable.
5. Change the **Mark direction** to **Both** to center the ruler marks on the path stroke.

6. Select the **Node** tool (F2 or N) and make all nodes smooth by selecting them all (Ctrl + A) and using the appropriate button on the toolbar or Shift + S. Notice how the ruler marks adjust to the path shape.

7. Edit the path by dragging it or its nodes and handles. Notice how the ruler marks adjust automatically.

![STEP 3](image1.png) ![STEP 5](image2.png) ![STEP 7](image3.png)

**See also**

For more information, refer to *Using Pattern Along Path* in this chapter.

**Creating knots**

The **Knot** LPE creates visual gaps at the points where a path intersects itself as if the path is tied into a knot, with certain path segments running over others.

**How to do it...**

The following steps will show how to create knots in a path:

1. Select the **Star** tool (Shift + F9 or *), press the **Reset the shape parameters to their defaults** button and create a complex star shape with nine corners and rounded base radius with a value that gets an effect you like. Remove the star fill to keep it aligned with the goal of creating a knot out of a path and increase the stroke width to 6. You should get a shape similar to the one shown in the picture.

2. Open the **Path Effect Editor** by using Shift + Ctrl + 7 or by going to **Path | Path Effect Editor**.

3. Under the **Apply new effect**, choose **Knot** and press the **Add** button. Notice the gaps in the stroke around the intersection points.

For More Information:

4. Select the Node tool (F2 or N) and notice that a diamond handle appears over one of the intersections. Drag the handle to an intersection of your choice whose gap type you wish to change.

5. Click on the diamond handle once or twice to change which path segment goes over or under, or remove the gap altogether. Repeat if necessary on other intersections.

See also

For more information, refer to Using Pattern Along Path in this chapter.

Generating VonKoch fractals

The VonKoch LPE (named after the Swedish mathematician Helge Von Koch) creates a fractal pattern out of the object it is applied to by repeating it in a scaled form and positioning it according to control paths available in this LPE. In this recipe we will create a simple pattern using the VonKoch LPE.

How to do it...

The following steps will show how to create VonKoch fractals:

1. Select the Ellipse tool (F5 or E) and create a wide ellipse at the page center.
2. Open the Path Effect Editor by using Shift + Ctrl + 7 or by going to Path | Path Effect Editor....
3. Under Apply new effect, choose VonKoch and press the Add button. Notice the two additional ellipses beneath the original one.
4. Create an angled guide by dragging with the mouse out of the top-left corner of the ruler on to the Canvas. Change the guide angle to 60° by double-clicking on it to get a pop-up and position it so it touches the original ellipse's right edge.

For More Information:
5. Press the **Generating path** button. Notice the two green controlling paths over the smaller ellipses.

6. Move each controlling path separately so they touch the guide with their right-hand edges, one ellipse above and the other below the original ellipse.

7. Increase the **Nb of generations** to 3 to generate more fractal steps.

8. Press the **Reference segment** button. Notice the green controlling paths over the original ellipses.

9. Switch the focus back to the canvas from the dialog by pressing **Esc**.

10. Select both nodes (Ctrl + A) and move them to the left using the **Left** arrow key (it is easier to do it using the keyboard because ellipse handles cover the control path nodes making them hard to select using a mouse). Move the green control path until its right node reaches the left edge of the original ellipse. Notice how the generated objects shift automatically to satisfy the position condition in relation to the object in the previous generation.

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**There's more...**

Some VonKoch effects can also be created using the L-system extension found under **Extensions | Render | L-system**. This extension will be covered in more detail in the next chapter.

**See also**

For more information, refer to **Rendering L-system patterns** in Chapter 6.
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