



TERRAFOLD

User guide

Model the house, design the garden: a course
in modelling with TerraFold, step by step.



For TerraFold 0.1.0 · terrafold.appmire.be
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How to use this guide

This guide is a course. You learn Terafold by doing: every chapter has steps to follow in the app, and the chapters build on each other. Read it from the start if Terafold is new to you.

What you need

- Terafold on your computer, or the [web version](#) in your browser. Everything in this guide works in the trial; see [Licence, trial and viewer mode](#).
- A mouse with a scroll wheel. A trackpad works too, but orbiting and panning are quicker with a middle button.
- About an hour for the first three chapters, and a few evenings for the garden project.

How the chapters work

Each chapter starts with what you will learn, then takes you through numbered steps. Along the way you find four kinds of boxes:

WHY IT WORKS THIS WAY

The reasons behind the design: why a tool behaves the way it does. Once you know the idea, you can predict what a tool will do before you try it.

TRY IT

A short exercise to do on your own. The answer is in the text right before it.

TIP

A shortcut or a habit that saves time.

RECAP

What you have learned, at the end of each chapter.

The garden project

Chapters 1 to 3 use small practice models. From [chapter 4](#) on, you build one design: a small back garden, 12 m wide and 16 m deep, that rises 1.2 m from the house to the back fence. By the end of [chapter 11](#) it has a shed, a fence, a patio with planters, a retaining wall and steps, a gravel path, a lawn with a pond, planting beds and plants that grow over the years.

THE GARDEN PROJECT

Boxes like this one mark the steps of the project. Each chapter ends with a model file, such as [ch04.tfo](#), with the project as it should be at that point. Open it to compare, or to start a chapter without doing the earlier ones.

The models in the figures were made with the same commands you use, run from scripts, and every picture is Terafold's own: screenshots of the app, exported views and path-traced renders. The diagrams were drawn for this guide.

Conventions

- **Bold** words are what you see on the screen: menus, buttons and panels. **Tools** ▶ **Push/Pull** means the **Push/Pull** item in the **Tools** menu.
- Keys look like `Ctrl` + `Z`. On macOS, use `Cmd` where the guide says `Ctrl`, and `Option` for `Alt`.
- Values in `code` are typed exactly as shown, such as `2.4m, 1.8m`.
- Lengths are in metres. If you prefer feet and inches, type them with their units (`8'`, `6"`); Terafold converts.

The other chapters at the end

[Appendix A](#) is a printable card with every default shortcut, and [appendix B](#) sums up the whole way of working on one page. Print them and keep them next to your keyboard.

CHAPTER 1

The idea

Terafold has very few kinds of things in it and a handful of rules. Learn the rules once and every tool behaves the way you expect. This chapter explains them before you draw anything.

IN THIS CHAPTER

- how edges become faces, and faces become solids
- why geometry is "sticky", and what that means for you
- why you can type an exact value at any moment
- what it means that everything is a command

Edges make faces

A Terafold model is made of **edges** (straight lines between two points) and **faces** (flat surfaces bounded by edges). There are no boxes, cylinders or walls as separate object types. A box is six faces and twelve edges; a cylinder is a ring of faces with soft edges between them.

You never create a face directly. You draw edges, and **as soon as edges close a flat loop, Terafold fills it with a face**. Take the face away (erase it) and the edges stay; erase an edge and the face it bounded goes too, because it is no longer closed.

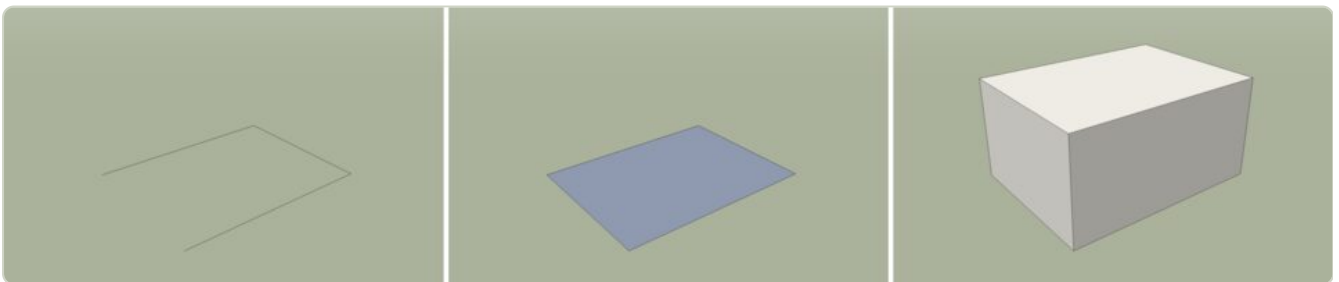


Figure 1.1 Three lines are just lines (left). The fourth closes a flat loop and a face appears (middle). Push/Pull turns the face into a box (right).

The face in the middle of [Figure 1.1](#) is blue-grey because you see its back. Faces have a front and a back: a face drawn on the ground faces down, so from above you look at its back. When you pull it up into a box, every outer face turns its front outwards.

Faces become solids

The second idea is **Push/Pull**: click a face and move it along its normal (straight out of the face). Terafold builds the sides for you. A rectangle becomes a box, a circle becomes a cylinder, a window outline drawn on a wall becomes a recess when you push it in.

This is how most things are modelled in Terafold: draw a flat shape that is right, then pull it into 3D. The flat shape is easy to get exact, and the third dimension follows.

Geometry is sticky

Edges and faces that touch become part of one surface. Where a line crosses a face, the face is split. Where two edges meet, they share their end point. Move a point, and every edge and face that uses it moves along.

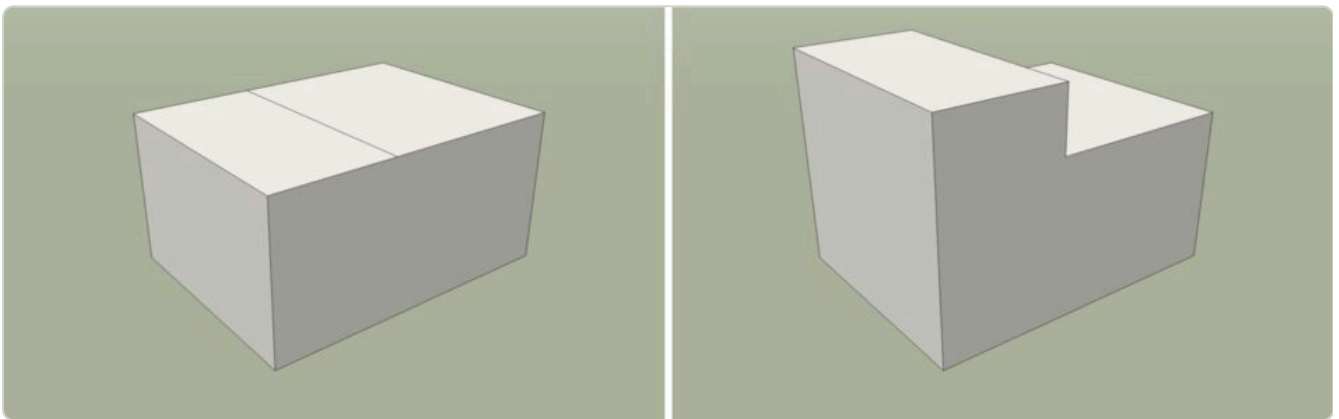


Figure 1.2 A line drawn across the top face splits it into two faces (left). Pull one of them up and the box gets a step, because the two halves share their edges (right).

WHY IT WORKS THIS WAY

Stickiness is what makes modelling with lines and faces quick. You don't have to tell Terafold that a line divides a face, or that a pushed-in window belongs to the wall: it sees that they touch. The price is that everything that touches is connected, so a table drawn against a wall sticks to the wall. That is why **groups** and **components** exist: they keep separate things separate. Remember the rule: **loose geometry sticks; groups don't**.

Type exact values at any time

You draw with the mouse, but you don't have to aim. Whenever a tool needs a length, an angle or a size, the **Measurements** box at the bottom right of the window shows the current value, and you can type a new one. There is no need to click the box first: start typing and press .

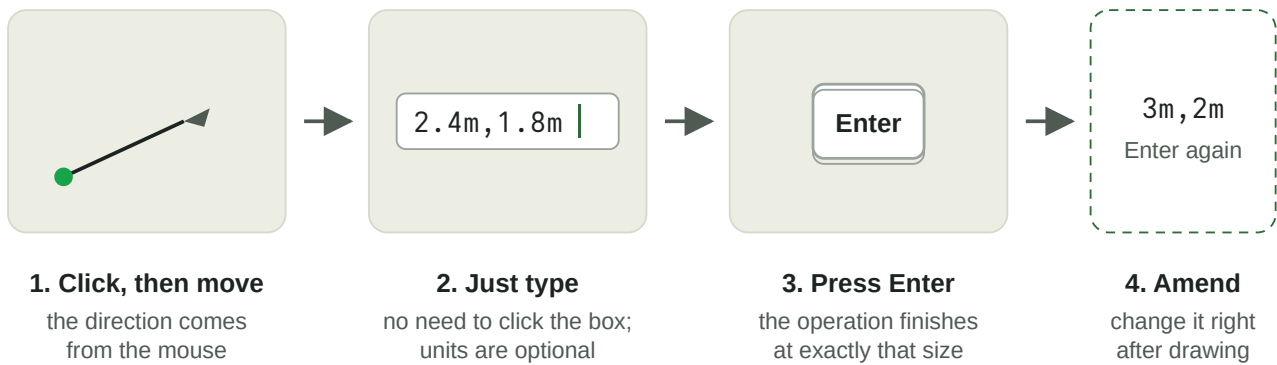


Figure 1.3 The Measurements box in four steps: the mouse gives the direction, the keyboard gives the size, and you can still change it afterwards.

The mouse says *which way*; the numbers say *how far*. Move the pointer to show the direction (along the red axis, for example), then type `2.4` and press `Enter`. Right after an operation you can type again to change it: draw a rectangle, then type `3m, 2m` and it becomes 3 m by 2 m.

Everything is a command

Every action in Terafold is a **command** with a name: `line`, `pushpull`, `move`, `garden_lawn`. The menu item, the ribbon button, the shortcut key, the right-click menu, extension scripts and the command-line tool all run the same command in the same way.

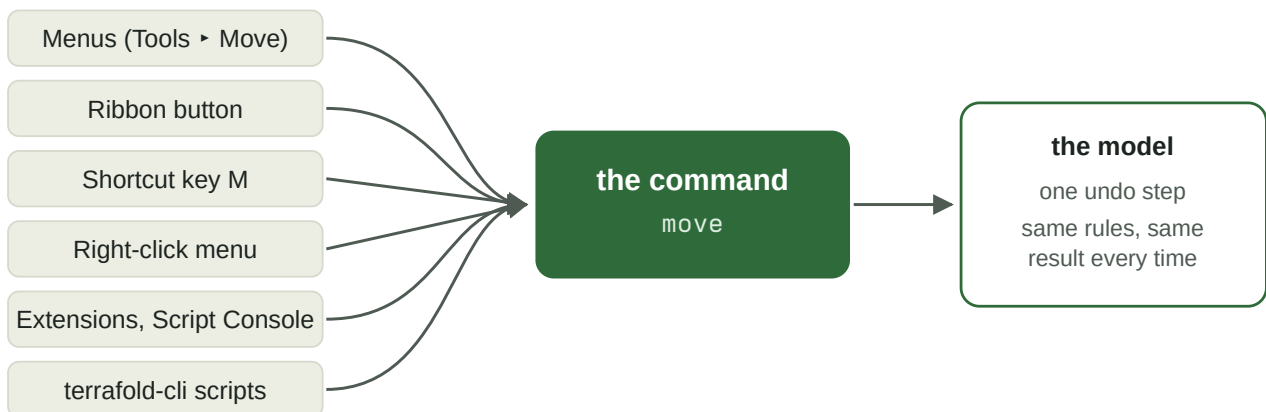


Figure 1.4 Six ways in, one command. Whichever way you start it, a command does the same thing and is one step of Undo.

WHY IT WORKS THIS WAY

Because there is only one way a command can work, there are no surprises: a button never does something slightly different from its menu item, and a script does exactly what you did by hand. It also means every change can be undone, including changes made by extensions, with **Edit ▸ Undo** (`Ctrl` + `Z`).

TRY IT

Before you start the app, predict: you draw a rectangle on the top face of a box and push it down all the way through the box. What do you get? (Answer: a hole. Pushing a face until it meets the opposite face removes both, because the loop no longer bounds anything.)

RECAP

- Edges close a flat loop, and a face appears. Faces have a front and a back.
- Push/Pull moves a face along its normal and builds the sides.
- Touching geometry sticks together; groups and components keep things apart.
- Type exact values at any time; the mouse gives the direction.
- Everything is a command, and every command can be undone.

CHAPTER 2

Getting around

Before you build anything, learn the window and how to look around a model. You will orbit, pan and zoom hundreds of times in every session, so make it a habit to do it with the mouse, without thinking.

IN THIS CHAPTER

- the parts of the window: menus, ribbon, viewport, tray, status bar and Measurements box
- the ribbon's context tabs, and how to collapse it
- orbit, pan and zoom with the mouse, and the standard views
- units and templates

The window

Start TerraFold. If the **Welcome to TerraFold** window opens, choose **New model**. The first time, TerraFold also shows the end user licence agreement; read it and choose **I Accept**.

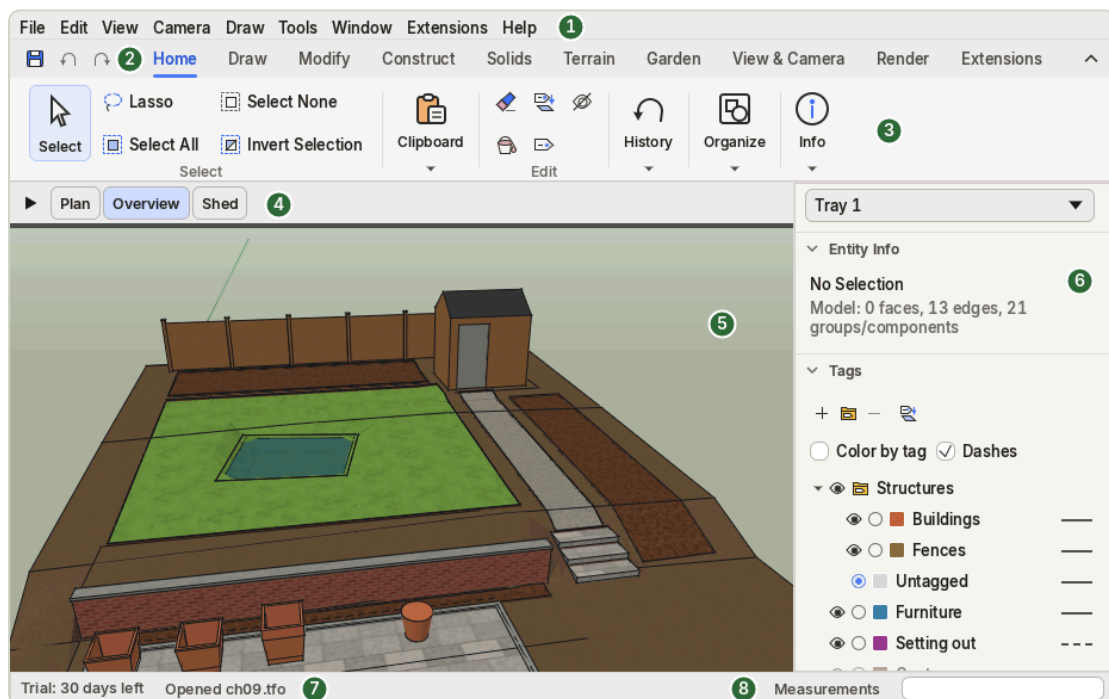


Figure 2.1 The TerraFold window with the guide's garden open: (1) the menu bar, (2) the ribbon tabs with the Quick Access bar on their left, (3) the ribbon, (4) the scene tabs, (5) the viewport, (6) the tray with its panels, (7) the status bar and (8) the Measurements box.

1. The **menu bar** has every command, sorted by **File, Edit, View, Camera, Draw, Tools, Window, Extensions** and **Help**.
2. The **ribbon tabs: Home, Draw, Modify, Construct, Solids, Terrain, Garden, View & Camera, Render** and **Extensions**. The small buttons on the left are the **Quick Access bar** (Save, Undo, Redo).
3. The **ribbon** shows the commands of the chosen tab, in groups. Hover a button to see its name, its shortcut and, if it is greyed out, why.
4. **Scene tabs**, when the model has scenes ([chapter 6](#)).
5. The **viewport**: the model. The red, green and blue lines are the axes; they meet at the origin.
6. The **tray** with panels such as **Entity Info** and **Tags**. Open more panels from **Window ▸ Default Tray**.
7. The **status bar** says what the active tool expects next. Read it whenever you are unsure.
8. The **Measurements box** shows lengths and angles while you work, and takes the values you type.

Context tabs and the collapsed ribbon

The ribbon changes with what you do. Select a group and a **Group** tab appears at the end of the strip; select terrain and you get **Terrain tools**; start a tool with options and an options tab shows them as toggles. These are **context tabs**: they appear when they apply and disappear afterwards.

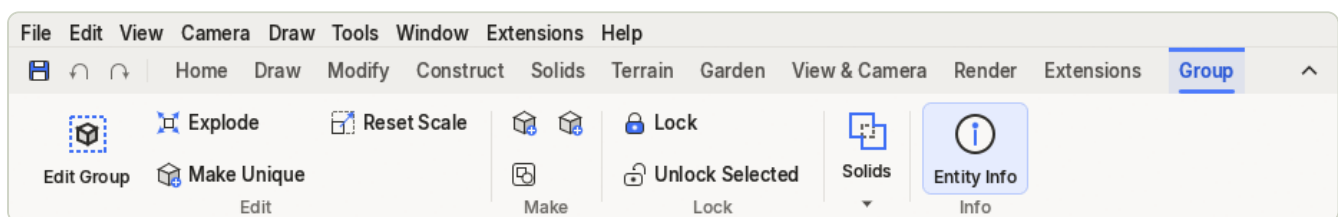


Figure 2.2 A group is selected, so the Group context tab appears at the right end of the tab strip, with Edit Group, Explode, Make Unique, Lock, the solid tools and Entity Info.

When you want more room for the model, collapse the ribbon: double-click a tab, click the chevron at the right of the tab strip, or press **Ctrl + F1**. Only the tabs stay; click one to show its commands over the viewport.

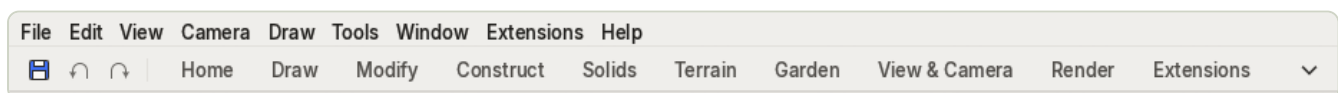


Figure 2.3 The collapsed ribbon: only the menu bar and the tab strip are left.

TIP

Press and release **Alt** on its own: letters appear on the tabs and buttons (KeyTips). Type them to run a command without the mouse. KeyTips are not available on macOS.

Look around

You need three movements: orbit (turn around the model), pan (slide sideways) and zoom (move closer).

Table 2.1 Navigating with the mouse

Action	With the mouse	Tool and key
Orbit	drag with the middle button (the scroll wheel)	Camera ▸ Orbit, O
Pan	Shift + drag with the middle button	Camera ▸ Pan, H
Zoom	scroll the wheel; it zooms towards the pointer	Camera ▸ Zoom, Z
Recentre	double-click with the middle button on a point	
See everything		Camera ▸ Zoom Extents, Shift + Z

Orbiting with the middle button works *while another tool is active*: you can turn the model half-way through drawing a line and carry on. That is why the mouse is the best way to navigate.

WHY IT WORKS THIS WAY

Zoom goes towards the pointer, not towards the centre of the screen. Point at the thing you want to see and scroll: it comes to you. If you get lost, **Zoom Extents** brings the whole model back into view.

On a trackpad, pinch to zoom, drag with two fingers to orbit, and hold **Shift** while dragging with two fingers to pan.

Standard views

Camera ▸ **Standard Views** has **Top**, **Bottom**, **Front**, **Back**, **Left**, **Right** and **Iso**. For drawings, combine them with **Camera ▸ Parallel Projection**, which removes the perspective so that parallel lines stay parallel and lengths can be compared. **Camera ▸ Perspective** brings the perspective back.

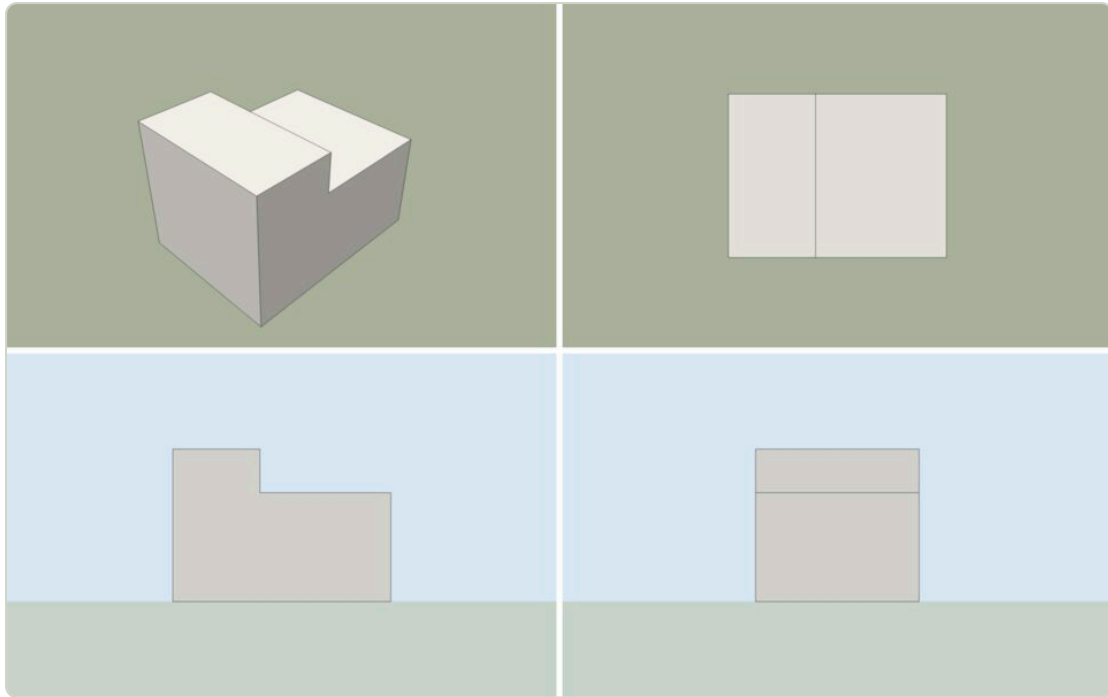


Figure 2.4 One block seen from Iso in perspective, and from Top, Front and Right in parallel projection.

Camera ▸ Previous goes back to the view you had before, like the back button of a browser.

Units and the template

Each model has its own units. Open **Window ▸ Model Info** to see and change them: metres, centimetres, millimetres, feet or inches, and the precision Terafold shows. You can always type a value in another unit (`250mm` , `8'`): Terafold converts it.

New models take their units from **Window ▸ Preferences ▸ Template**. If you always work in one unit, or always start with the same tags and styles, set up a model the way you like it and save it with **File ▸ Save As Template**. Choose it in **Preferences ▸ Template** to make it the default for new models.

TRY IT

Open the sample model with `terrafold --sample` (or any model), and practise: orbit around it, pan it to the left edge of the window, zoom in on a corner by pointing at it, then press `Shift` + `Z`. Switch to **Top** and **Parallel Projection**, then back to **Iso** and **Perspective**.

RECAP

- Menus have everything; the ribbon has the common commands and context tabs for what you are doing.
- The status bar tells you what a tool wants; the Measurements box shows and takes values.
- Middle-drag orbits, **Shift** + middle-drag pans, the wheel zooms towards the pointer, **Shift** + **Z** shows everything.
- Units are a property of the model (**Window** ▸ **Model Info**); templates set them for new models.

CHAPTER 3

Drawing precisely

Terafold models are exact: a 2.4 m wall is 2.4 m, not 2.398 m. You get there without a grid and without typing coordinates, through two things: **inference**, which snaps the pointer to what matters, and the **Measurements box**, which takes exact values.

IN THIS CHAPTER

- draw lines and rectangles
- read the inference markers, and lock a direction
- type lengths and sizes
- measure, and set out guides with the Tape Measure

Draw lines

1. Choose **Draw ▸ Lines ▸ Line**, or press **L**.
2. Click a start point.
3. Move the pointer. A line follows it, and the Measurements box shows its length.
4. Click to place the end point. The Line tool carries on from there; click again for the next segment.
5. When the lines close a flat loop, a face appears and the tool stops. Press **Escape** to stop at any time.

To make a segment exactly 2 m long, move the pointer in the direction you want, type **2**, and press **Enter**.

Inference: the pointer knows where it is

While you draw, Terafold looks at what is under the pointer and snaps to it. A coloured marker and a tooltip tell you what it found.

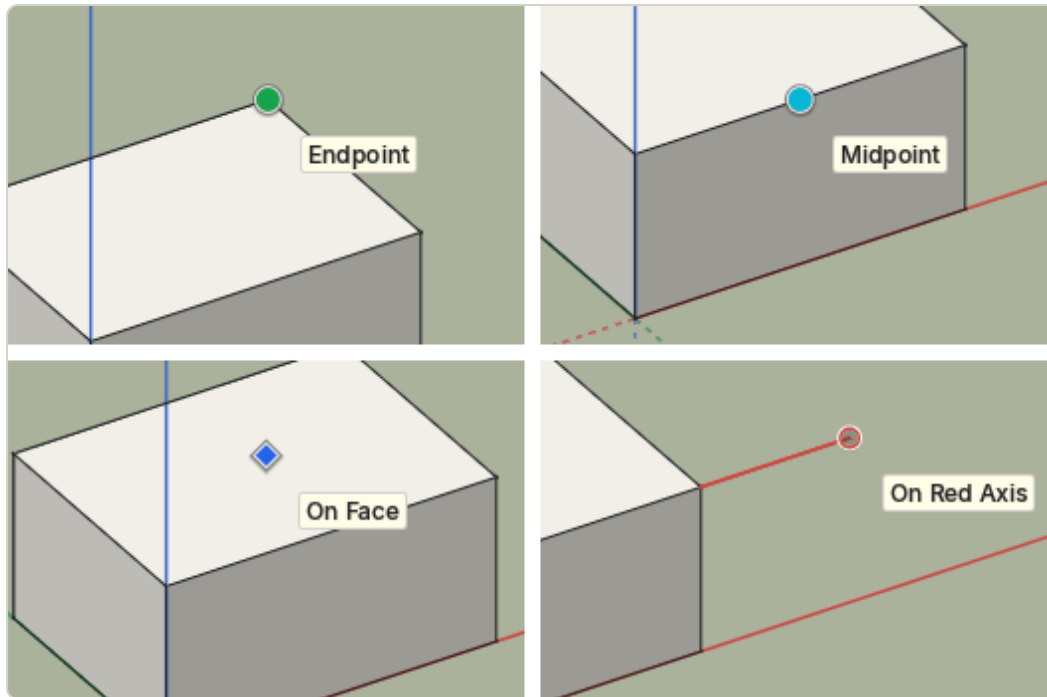


Figure 3.1 Inference while drawing a line: the end of an edge, the middle of an edge, a point on a face, and a direction along the red axis from the start point.

Points

- Endpoint, Center
- Midpoint
- On Edge
- ◆ On Face
- On Line, On Guide, Guide Point

Directions

- On Red Axis
- On Green Axis
- On Blue Axis
- Parallel / Perpendicular to Edge
- From a point you hovered

Lock it: hold Shift to keep the current inference · → red · ← green · ↑ blue · ↓ parallel, then perpendicular
Press the same arrow again to unlock.

Figure 3.2 The inference markers. Points snap to geometry; directions follow the axes and the edges you have drawn.

The most useful ones are:

- **Endpoint** (green) and **Midpoint** (cyan): the ends and middles of edges. Most of the time you start and end lines on these.
- **On Edge** and **On Face**: anywhere along an edge or on a face.
- **On Red Axis**, **On Green Axis**, **On Blue Axis**: the line runs parallel to an axis. The line itself takes the axis colour.
- **Parallel to Edge** and **Perpendicular to Edge** (magenta): hover over an edge first, then move in roughly the right direction.

Inference also works *between* things. Hover over a point for a moment, then move away along an axis: a dotted line shows that you are level with that point. That is how you draw a line that ends exactly in line with a corner elsewhere.

Lock a direction

Sometimes the inference you want is hard to keep while you move the pointer to where you want to click. Lock it:

- Hold **Shift** to keep the current inference while you move elsewhere.
- Press **Right** to lock the red axis, **Left** for green, **Up** for blue. **Down** locks parallel, then perpendicular, to the last edge you hovered. Press the same arrow again to unlock.

WHY IT WORKS THIS WAY

Inference replaces the grid and the coordinate entry of other programs. You don't need to know where the corner of the shed is in coordinates; you need to know that the next line starts *at that corner* and runs *along the red axis*. Terafold sees both, and the Measurements box adds the length. Points, direction, distance: that is all a precise line needs.

Draw rectangles

1. Choose **Draw** ▸ **Shapes** ▸ **Rectangle**, or press **R**.
2. Click the first corner.
3. Move towards the opposite corner. The Measurements box shows the size as width and depth.
4. Type both sizes separated by a comma, such as **2.4m, 1.8m**, and press **Enter**.

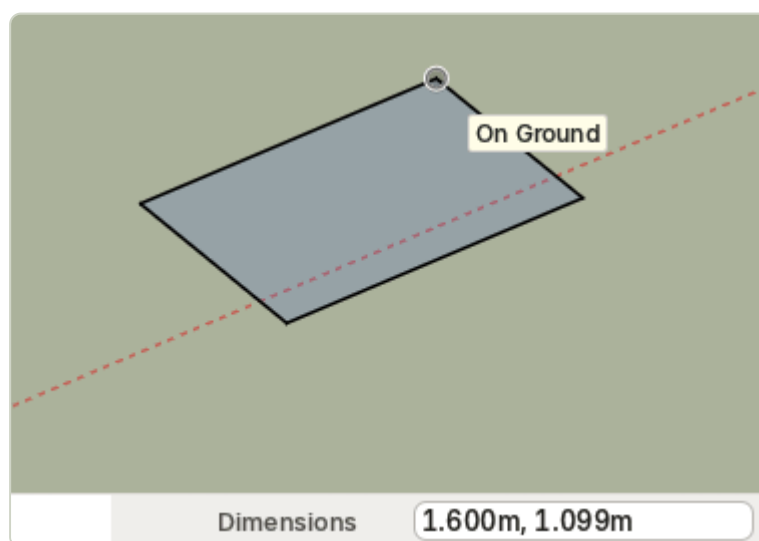


Figure 3.3 Drawing a rectangle: after the first click, the Measurements box shows the size; type 2.4m,1.8m and press Enter.

The direction of the pointer decides on which side of the first corner the rectangle goes; the numbers decide its size. A rectangle lies on the face you start it on, or on the ground. Hold **Ctrl** to draw it from its centre.

TIP

You can type just one of the two values: **3m**, keeps the depth you are pointing at and sets the width. And right after drawing, type again to change the size.

Measure and set out guides

Tools ▸ Tape Measure (T) measures and sets out.

- Click two points to measure the distance between them. The Measurements box shows it.
- Start on an edge and move away: a **guide line** parallel to the edge follows. Type a distance, such as **0.6**, and press **Enter** to place it exactly that far away.
- Start on a point and move: you get a **guide point** at the distance you type.

Guides are dashed construction lines. They are not part of the model's geometry, but the inference snaps to them, so they are perfect for setting out: put guides where things should go, then draw on them.

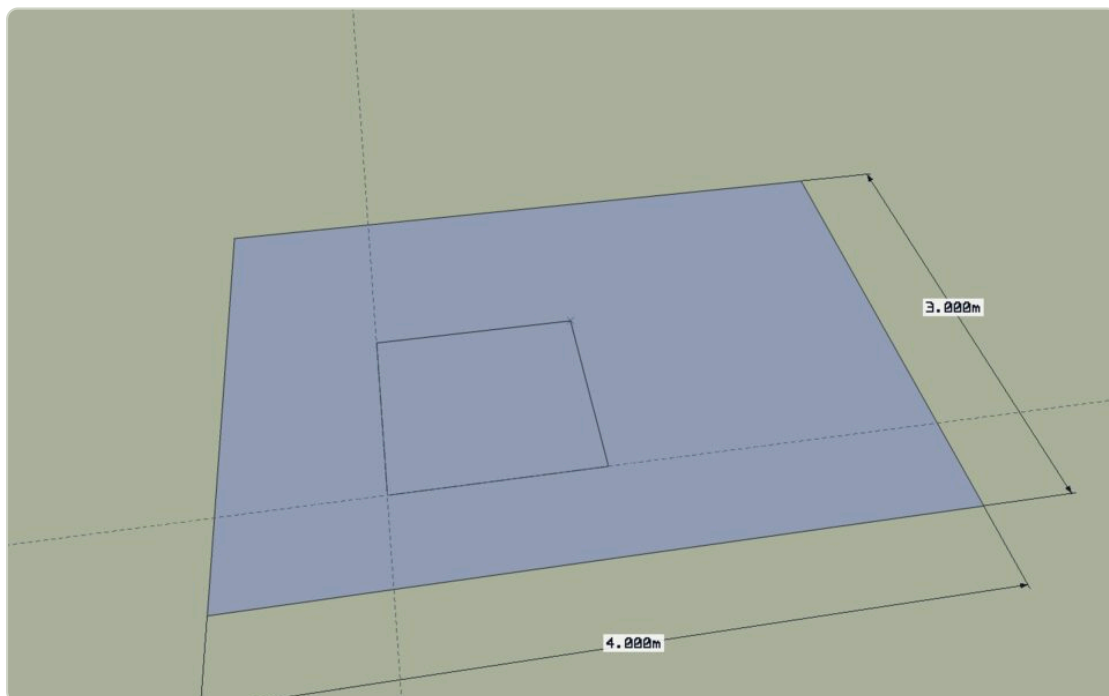


Figure 3.4 Two guide lines set 0.6 m and 0.9 m in from the edges of a 4 m by 3 m area, and a square drawn from where they cross. The dimensions come from Tools ▸ Dimensions.

View ▸ Guides shows or hides guides; **Edit ▸ Delete Guides** removes them all when you are done.

TIP

The Tape Measure can also resize a whole model: measure a length you know, type what it should be, and Terafold offers to scale everything. Handy for imported drawings at the wrong scale.

TRY IT

In a new model: draw a 4 m by 3 m rectangle. With the Tape Measure, set out a guide 0.6 m in from one long edge and 0.9 m in from one short edge. Then draw a 1.2 m square that starts exactly where the guides cross. Check its size with the Tape Measure.

RECAP

- Line (**L**) and Rectangle (**R**): click, move, type, **Enter**.
- Watch the inference tooltip: Endpoint, Midpoint, On Edge, On Face, the axes, Parallel, Perpendicular.
- Lock with **Shift** or the arrow keys.
- Type `w,h` for rectangles, a length for lines; amend right after.
- Tape Measure (**T**) measures and makes guides to draw on.

CHAPTER 4

From flat to solid

Now you build real things. This chapter starts the garden project with a small shed, then makes a planter and a pot for the patio. Along the way you meet the tools that turn flat shapes into solids: Push/Pull, Offset, Move, Rotate, Scale and Follow Me.

IN THIS CHAPTER

- Push/Pull walls up and recesses in
- fold a roof by moving a single edge
- Offset an outline for frames and rims
- Move and copy, with arrays such as 5x
- Rotate, Scale and Follow Me

THE GARDEN PROJECT

Start a new model (**File** ▸ **New**) with metres as the unit (**Window** ▸ **Model Info**). The garden runs 12 m along the red axis and 16 m along the green axis, with the house along the red axis at the origin. The shed stands near the back right; the planters go near the house.

The shed

Step 1: the floor plan

1. Press **R** for the Rectangle tool.
2. Click a first corner on the ground. Where exactly doesn't matter for learning; the project files have the shed 8.6 m along the red axis and 12.6 m along the green one, and you can always move it there later.
3. Move the pointer up and to the right, type **2.4m, 1.8m** and press **Enter**.

Step 2: the walls

1. Press **P** for **Tools** ▸ **Push/Pull**.
2. Click the rectangle and move the pointer up.
3. Type **2.1** and press **Enter**. The rectangle becomes a box 2.1 m high.

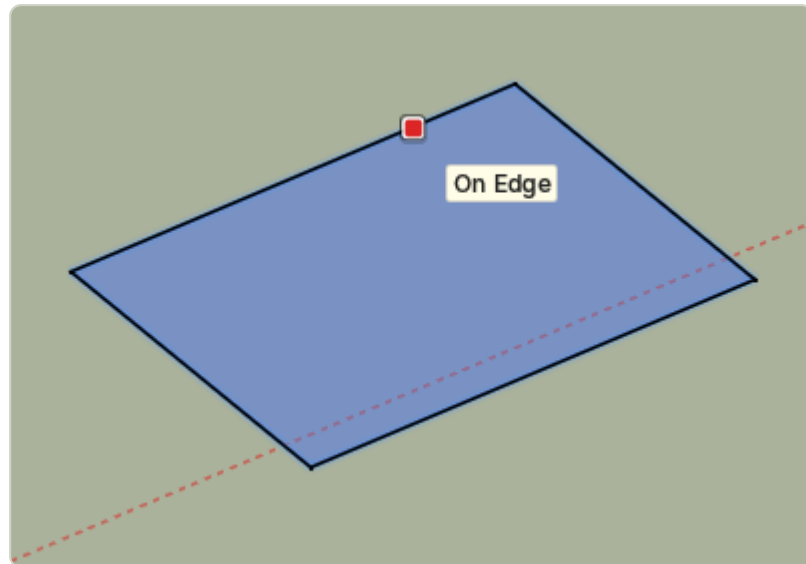


Figure 4.1 Push/Pull under way: the face follows the pointer and the sides are drawn as it goes, until you click or type the distance.

Step 3 and 4: a pitched roof

1. With the Line tool (**L**), draw a line across the top face from the **Midpoint** of one short edge to the **Midpoint** of the other. The top face splits in two.
2. Press **Space** for the Select tool and click that line.
3. Press **M** for **Tools > Move**. Click the line, move straight up (the blue axis; press **Up** to lock it), type **0.6** and press **Enter**.

The two halves of the top face fold into a roof, and the end walls grow into gables.

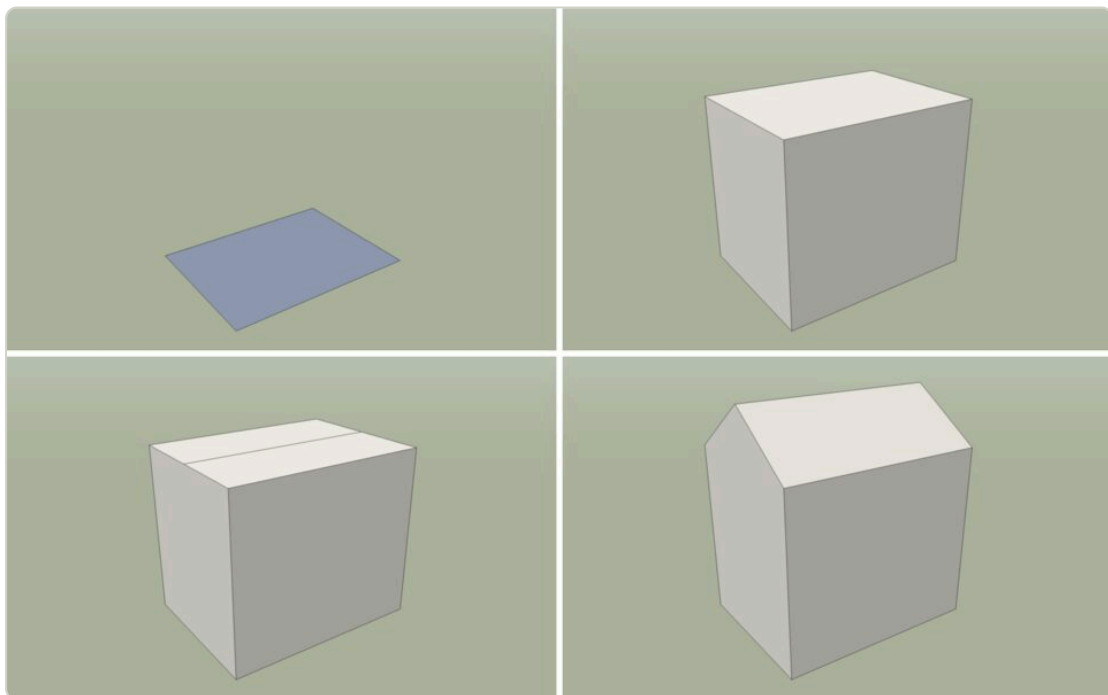


Figure 4.2 The shed in four steps: the floor plan (its back shows from above), Push/Pull 2.1 m, a line from midpoint to midpoint, and that line moved up 0.6 m.

WHY IT WORKS THIS WAY

You never drew a roof. You moved one edge, and the faces attached to it followed, because they share that edge: geometry is sticky. This is the most useful trick in Terafold. Moving edges and points reshapes everything connected to them; Terafold folds faces where they can no longer stay flat.

Step 5: the door

1. Draw a rectangle on the front wall, starting at the bottom edge: `0.9m, 1.9m`. It splits the wall face.
2. Push/Pull it 5 cm into the wall: click it, move inwards, type `0.05`, `Enter`.

Step 6: a window with a frame

1. Draw a rectangle on the side wall, 0.7 m by 0.6 m.
2. Choose **Tools** ▶ **Offset** (`F`), click the window face and move inwards. Type `0.05` and press `Enter`. A second outline appears 5 cm inside the first: the frame.
3. Push the inner face (the pane) 3 cm in.

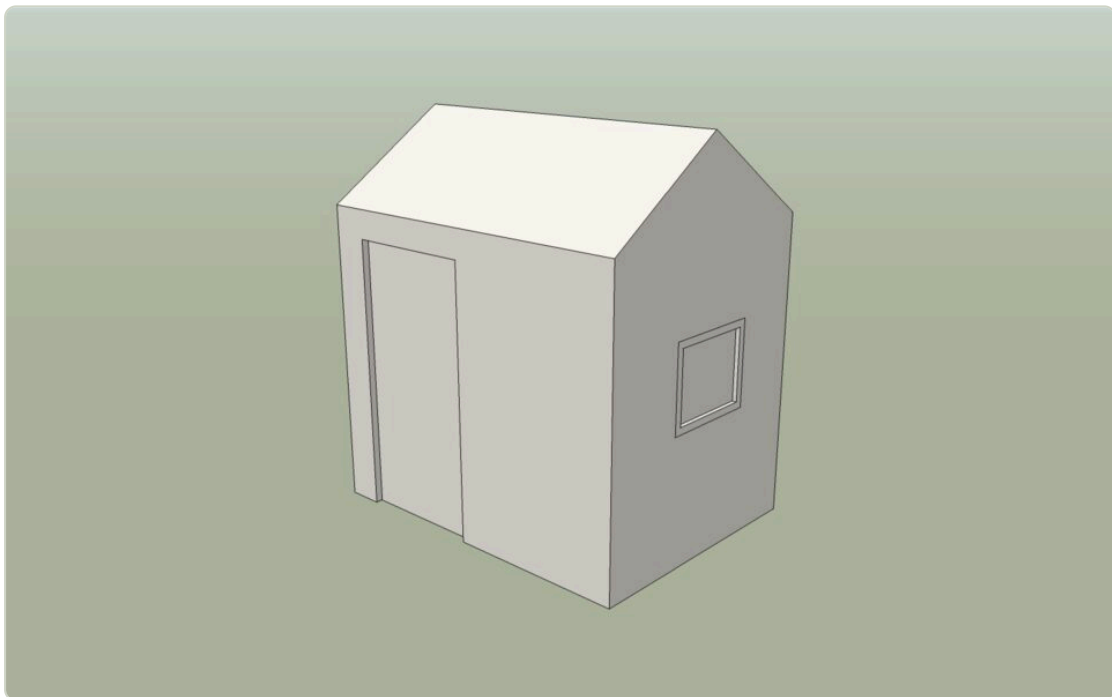


Figure 4.3 The finished shed: a door pushed in, and a window whose frame came from Offset.

Offset copies the outline of a face at a constant distance, inwards or outwards. Use it for frames, rims, kerbs, borders and wall thicknesses.

TIP

Double-click a face with Push/Pull to repeat the last distance. Push 3 cm once, then double-click the other windows.

A planter for the patio

Now a tapered planter, 50 cm square. You meet **Scale** here.

1. Draw a $0.5\text{m}, 0.5\text{m}$ rectangle near the house, and Push/Pull it up 0.5 m.
2. Select the top face. Choose **Tools** ▸ **Scale** (**S**). Grips appear around the selection.
3. Hold **Ctrl** to scale about the centre, drag a corner grip outwards, type 1.2 and press **Enter**. The top grows by 20 % and the sides lean outwards.
4. Offset the top face 4 cm inwards for the rim.
5. Push the inner face down 0.4 m: the planter is hollow.

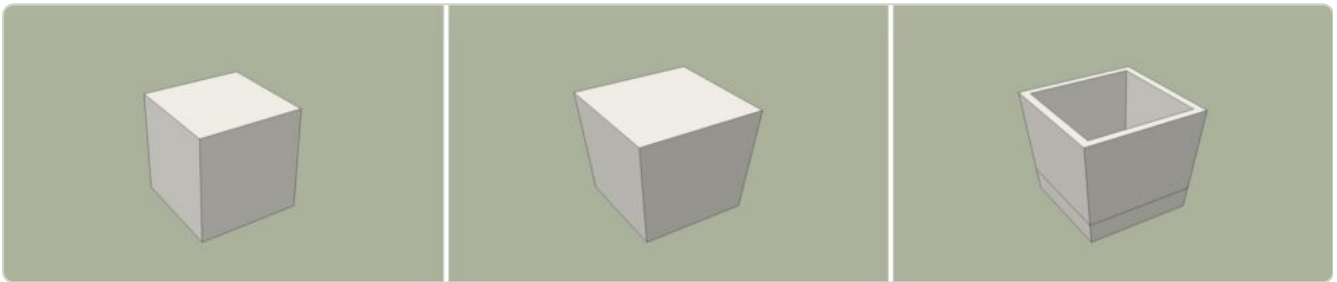


Figure 4.4 The planter: a box, its top scaled by 1.2 about its centre, then offset and pushed down.

Scale takes a factor (1.2), a factor per axis ($2, 1, 1$), or a length. A negative factor mirrors.

A round pot with Follow Me

Follow Me sweeps a face along a path. With a circle as the path it makes a turned shape, like a pot or a column.

1. Draw a circle on the ground (**Draw** ▸ **Shapes** ▸ **Circle**, **C**) with a radius of 0.2m .
2. Draw the pot's profile standing on the circle's centre, in a vertical plane: from the centre out to 18 cm, up and out to 25 cm at a height of 45 cm, and back to the axis. Lines that close the loop make a face.
3. Select the circle's edge (a circle is one curve: one click selects it all).
4. Choose **Tools** ▸ **Follow Me** and click the profile. It sweeps around the circle.
5. Erase the circle face left on the ground.



Figure 4.5 Follow Me: a profile standing at the centre of a circle (left) sweeps around it into a pot (right).

Move, copy and arrays

Tools ▸ Move (**M**) moves the selection from one point to another. It is also how you copy:

- Press **Ctrl** (**Option** on macOS) once while moving to make a copy instead.
- Right after a copy, type **5x** and press **Enter**: you get five copies, each the same distance further on. Type **/5** instead to spread five copies evenly between the original and the first copy.
- You can still type a new distance afterwards; the array keeps its count.

Tools ▸ Rotate (**Q**) works the same way around a centre: click the centre, a starting direction and an end direction, or type an angle such as **45**. With **Ctrl** it rotates a copy, and **6x** makes six copies around the centre.

WHY IT WORKS THIS WAY

Arrays are a typed amendment, like the size of a rectangle: you make one copy at the right distance with the mouse, then tell Terafold how many. The distance comes from a real point in the model (a corner, a guide), not from arithmetic.

TRY IT

Make a copy of the planter 1.2 m to the right, then type **2x**. You get two more planters in a row. You will redo this in the next chapter, the better way, with a component; undo it for now.

TRY IT

Rotate: draw a small box beside the patio, start **Tools ▸ Rotate**, click a corner as the centre, and rotate a copy by **30** with **Ctrl**. Type **5x**. Delete them when you are done.

THE GARDEN PROJECT

Your model should now look like [ch04.tfo](#): the shed with its door and window, one planter and one pot. Everything is still loose geometry; the next chapter fixes that.

RECAP

- Push/Pull (**P**) for walls and recesses; double-click to repeat.
- Move (**M**) edges and points to reshape; **Ctrl** copies; **5x** and **/5** make arrays.
- Offset (**F**) for frames and rims; Scale (**S**) with grips and factors.
- Rotate (**Q**) around a centre; Follow Me sweeps a profile along a path.

CHAPTER 5

Keeping models clean

So far everything you drew is loose geometry, and loose geometry sticks to whatever it touches. That was useful for folding the roof, but in a real project you want the shed, the planters and the fence to stay separate. This chapter explains why groups and components exist, and when to use which.

IN THIS CHAPTER

- why stickiness becomes a problem, and how groups solve it
- groups versus components: edit one, all change
- Make Unique
- the Outliner and Entity Info
- a fence panel component, copied as an array

When stickiness gets in the way

Imagine you draw a compost bin against the side of the shed. Its side face lands on the shed wall and its edges join the wall's edges. Now move the bin away: the shared edges come along, and the wall is pulled out of shape. Triple-click the bin to select it, and you select the shed too, because everything connected is one surface.

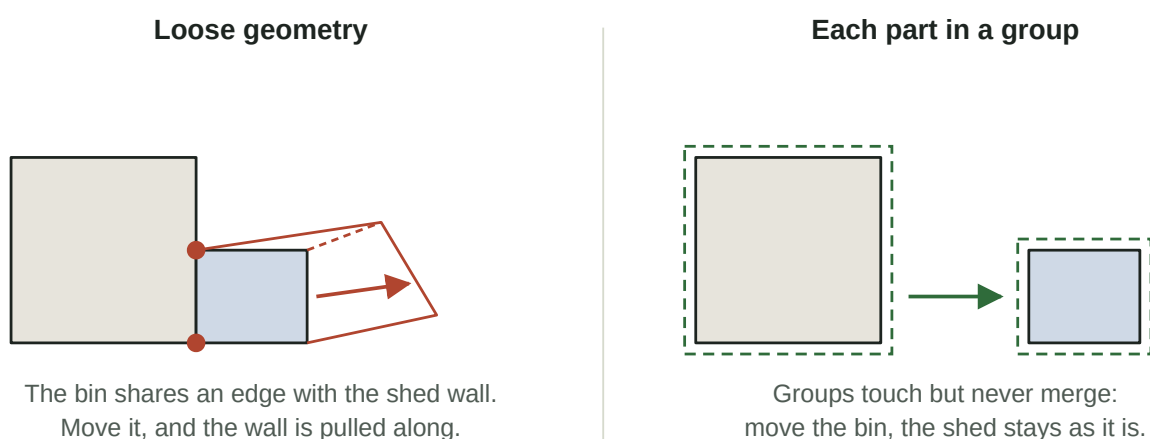


Figure 5.1 Loose geometry shares edges with whatever it touches (left). Put each part in a group, and they touch without merging (right).

The fix is to wrap each separate thing in a **group** or a **component** as soon as it is finished. Geometry inside a group sticks only to other geometry *in the same group*.

WHY IT WORKS THIS WAY

Terafold doesn't guess which lines belong together: it has one simple rule (touching geometry sticks) and one simple way out (put it in a container). That keeps drawing fast, because you never have to join things up by hand, and it keeps the model honest: what looks connected *is* connected.

Group the shed

1. Press `Space` for the Select tool.
2. Drag a selection rectangle from left to right around the whole shed. A left-to-right drag selects everything that lies fully inside it.
3. Choose **Edit ▸ Make Group**.
4. In **Entity Info**, type `Shed` as the instance name.

Click the shed now and it is selected as one object, with a box around it. To change something inside, double-click it: you are *in* the group, the rest of the model fades, and you edit as before. Click outside it, or choose **Edit ▸ Close Group or Component**, to leave.

TIP

Triple-click selects everything connected to what you click. It's a quick way to select one loose object, but a drag selection also picks up a window drawn in a wall, which a triple-click can miss in this version.

Groups and components

A **component** is like a group, with one difference that matters: copies of a component share their contents. The contents are the component's **definition**; each copy you place is an **instance** of it. Change the definition through any instance and all of them change.

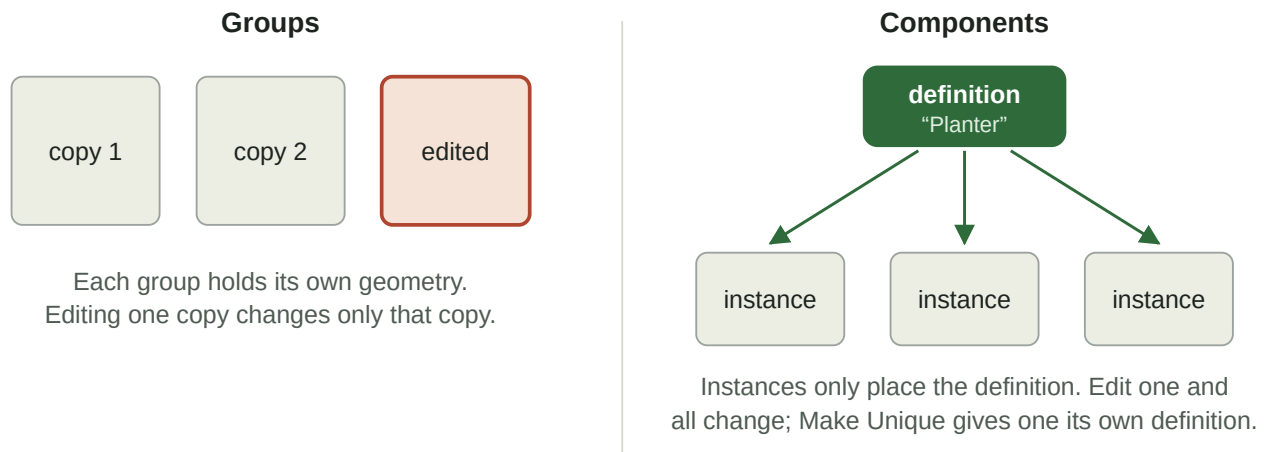


Figure 5.2 Groups are independent copies. Component instances all show the same definition.

Use a group for a one-off: the shed, a wall, the terrain. Use a component for anything that repeats: planters, fence panels, posts, windows, chairs. Components also keep files small, because the geometry is stored once.

Planters as a component

1. Select the planter (drag around it) and choose **Edit > Make Component** (**G**). Name it **Planter**.
2. Move a copy 1.2 m to the right: **Move** (**M**), press **Ctrl**, click a corner, move along the red axis, type **1.2**, **Enter**.
3. Type **2x** and press **Enter**. You have three planters.
4. Make the pot a component too, named **Pot**.

Now edit one planter: double-click it, Push/Pull its rim up 3 cm, and close it. All three get the taller rim.

Make Unique

Sometimes one copy should differ. Select the third planter and choose **Make Unique** on the **Group** context tab (or the button in **Entity Info**). It gets its own definition, called **Planter#1**. Edit it, push its rim up another 15 cm, and only that one changes.

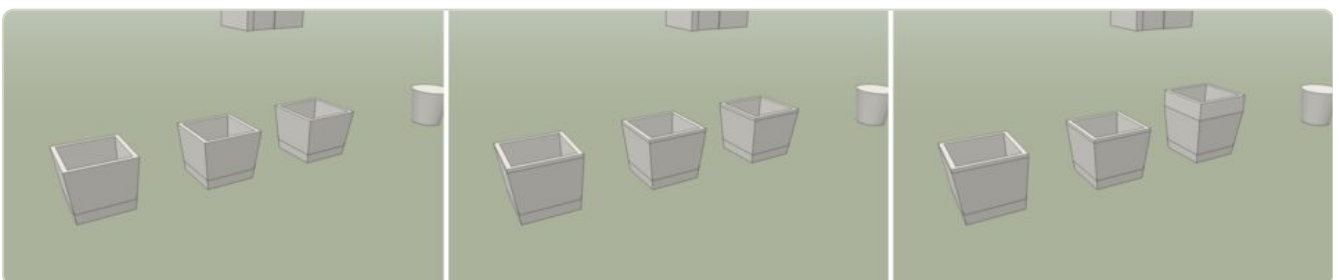


Figure 5.3 Three planter instances (left). One edited, all three change (middle). The third made unique and edited on its own (right).

Entity Info and the Outliner

Entity Info shows what is selected and lets you change it: for a component, its tag, material, instance name, definition name, how many instances there are, position, scale and buttons for **Make Unique**, **Reset Scale** and **Options**.

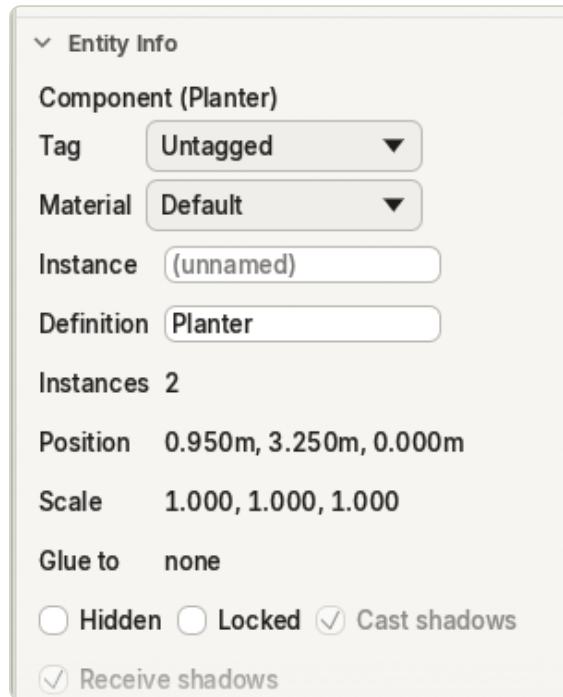


Figure 5.4 Entity Info for a planter: a component with two instances (the third was made unique).

The **Outliner** (**Window** ▸ **Default Tray** ▸ **Outliner**) lists every group and component as a tree.

Component instances show their definition in angle brackets. Click a row to select it, double-click to rename, use the eye to hide and the lock to protect it, and drag a row onto another to put it inside.

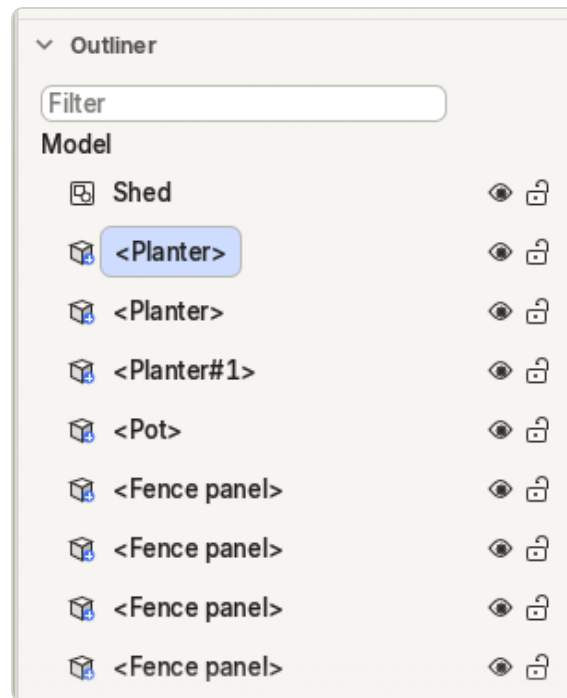


Figure 5.5 The Outliner of the project: the Shed group, the planters (one of them the unique Planter#1), the pot and the fence panels.

The fence

The back of the garden gets a fence of six panels, each a post and a board. You make one panel as a component and copy it.

1. Draw a 10 cm by 10 cm rectangle at the left end of the back boundary and Push/Pull it up 1.65 m: the post.
2. Draw the board as a rectangle standing against the post (start on the post's side face, it lies on that plane): 1.8 m wide, 1.5 m high, starting 5 cm above the ground. Push/Pull it 2 cm thick.
3. Select the post and the board and make them a component named `Fence panel`.
4. Move a copy 1.9 m along the red axis and type `5x`.

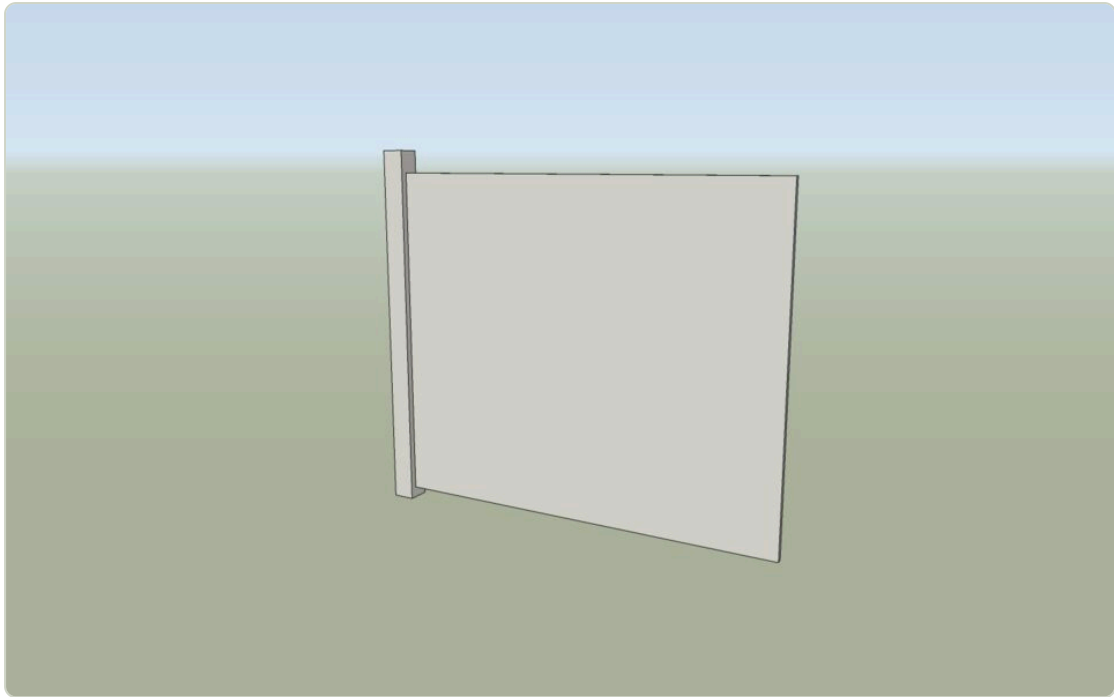


Figure 5.6 One fence panel: a post and a board, made into a component.

The **Components** panel (**Window** ▸ **Default Tray** ▸ **Components**) now lists **Planter**, **Pot**, **Planter#1** and **Fence panel** with how many of each the model has. Click one, or drag it into the viewport, to place another instance.

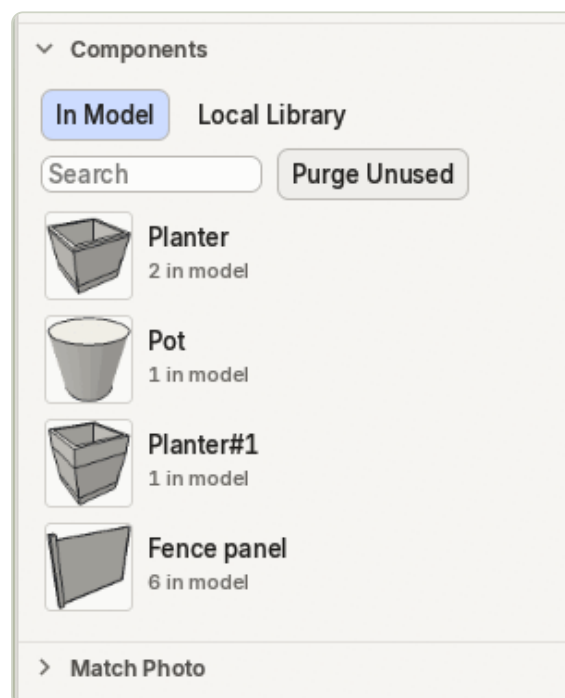


Figure 5.7 The Components panel: every component in the model with a thumbnail and a count.

TRY IT

The last panel has no post at its right end. Add one: make a copy of a post, or better, make the post a component of its own inside the panel definition and place one more instance at the end.

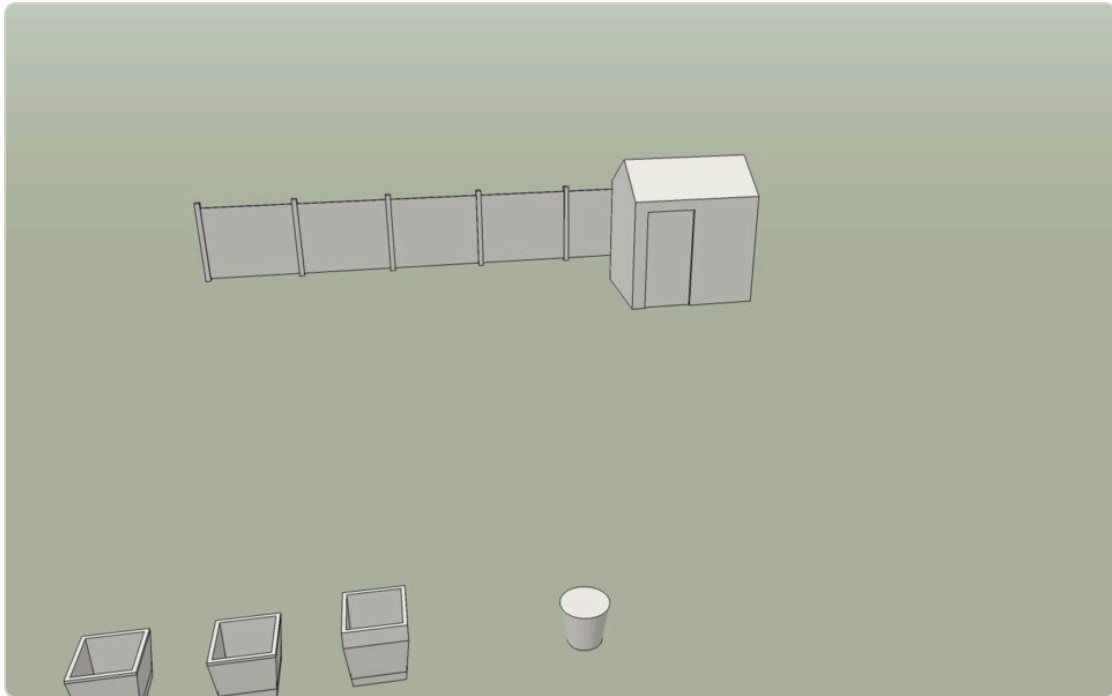


Figure 5.8 The project after chapter 5: the shed is a group, the planters, pot and fence panels are components.

THE GARDEN PROJECT

Compare with `ch05.tfo`. Nothing in the model is loose any more: open the Outliner and you see every part by name.

RECAP

- Loose geometry sticks to what it touches. Put each finished thing in a group or a component.
- Double-click to go inside; click outside to leave.
- Components share their definition: edit one, all change. Make Unique splits one off.
- Entity Info edits the selection; the Outliner shows the whole tree.
- Repeat things as component instances, with Move, `Ctrl` and `5x`.

CHAPTER 6

Organising

Groups and components keep geometry apart. **Tags** do something else: they sort things into sets that you can show, hide and colour, across the whole model. **Scenes** then remember a view together with which tags are visible. This chapter organises the project so that you can switch between a plan, an overview and a close-up in one click.

IN THIS CHAPTER

- tags and tag folders; colour and line pattern per tag
- the active tag and the Tag tool
- hiding versus deleting
- scenes: what they save, and what they don't

Tags, not layers

A tag is a label you put on an entity: the shed is on **Buildings**, the fence panels on **Fences**, the planters on **Furniture**. A tag doesn't move or change anything. It answers one question: *should this be drawn right now?* (Programs from the past called them layers; in Terafold they are tags, because an entity is simply labelled, not stacked.)

WHY IT WORKS THIS WAY

Put tags on groups and components, and leave the faces and edges inside them Untagged. A face on a hidden tag inside a visible group gives you a group with holes in it, which is rarely what you meant. Tagging whole objects keeps it simple: the object is shown or it is not.

Tag the project

Open the **Tags** panel (**Window** ▸ **Default Tray** ▸ **Tags**).

1. Click + three times and name the tags **Buildings**, **Fences** and **Furniture**. Click each colour swatch and choose a colour.
2. Select the shed and choose **Buildings** in the **Tag** row of **Entity Info**.
3. Tag the fence panels **Fences**, and the planters and the pot **Furniture**. (Drag a selection rectangle from right to left across the fence: a right-to-left drag selects everything it touches, so all six panels at once.)

4. Select **Buildings**, click the folder button to put it in a new **tag folder**, name it **Structures**, and drag **Fences** onto it too.

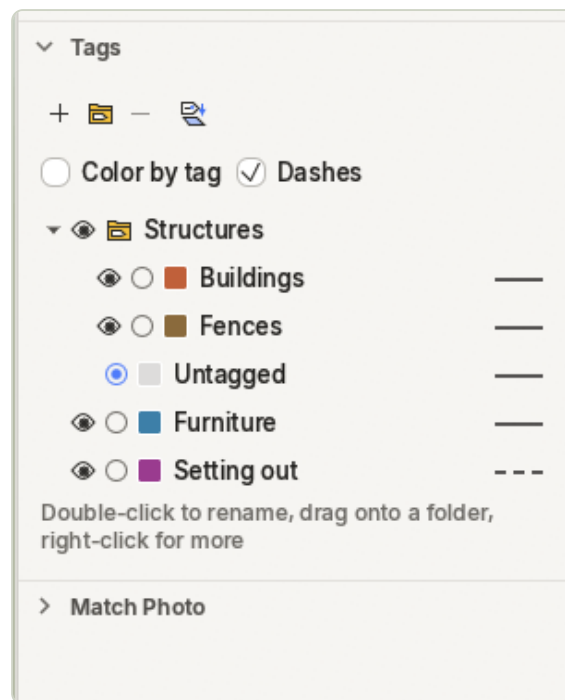


Figure 6.1 The Tags panel: a folder Structures with Buildings and Fences, the Furniture tag, and a dashed tag for setting-out lines. The filled round button marks the active tag.

Each row has, from left to right: the eye (show or hide), the round button (make it the **active tag**), the colour, the name and the line pattern. A folder's eye hides everything in it at once.

The Tag tool

Tools ▸ **Tag** works like a paint bucket for tags: choose a tag on its options tab, then click things to put them on it. **Ctrl**+click tags everything connected, **Alt**+click picks up the tag of what you click. It is quicker than Entity Info when you tag many things one after the other.

The active tag, and dashed lines

Whatever you draw goes on the **active tag**. Make a tag active with its round button, draw, then make **Untagged** active again.

1. Add a tag **Setting out**, and choose the dashed line pattern in its row.
2. Make it active and draw two lines on the ground: the front edge of the future patio, and the centre line of the path to the shed.
3. Make **Untagged** active again.

The lines are drawn dashed, at the same size on screen at any zoom. Setting-out lines, existing features to be removed, boundaries and services are typical dashed tags.

Colour by tag

View › Color by Tag draws every face and edge in its tag's colour instead of its material. It's a quick check of what is on which tag, and with **Top** view and **Parallel Projection** it makes a clear plan.

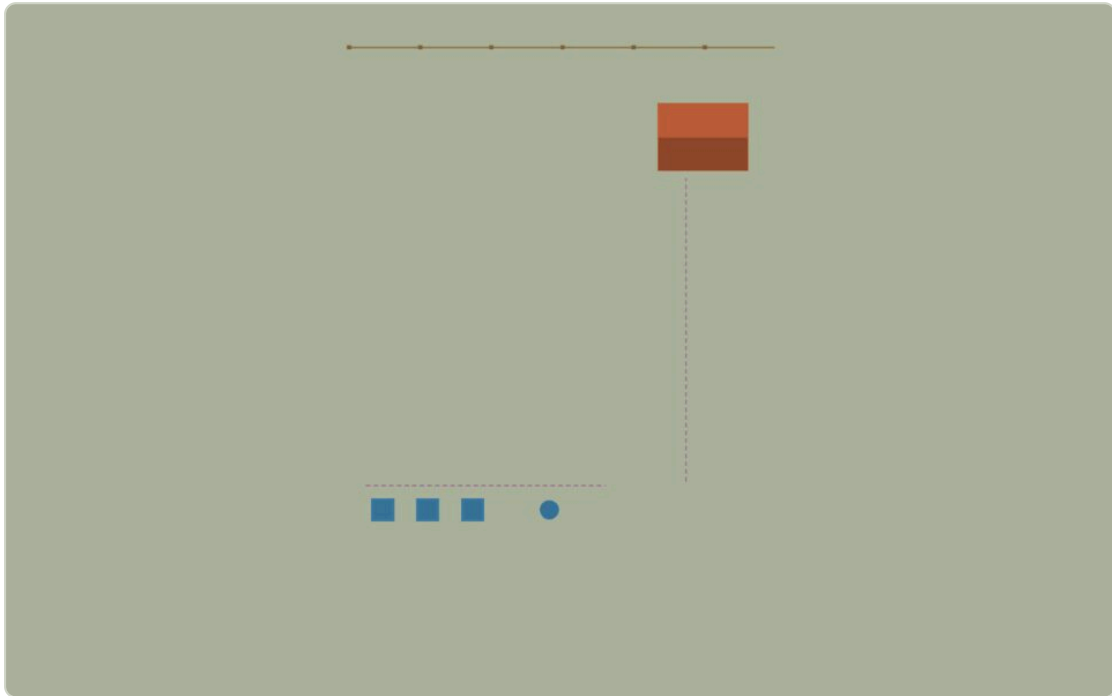


Figure 6.2 The project from above in parallel projection with **View › Color by Tag**: the shed, the fence, the furniture and the dashed setting-out lines.

Hiding versus deleting

Hiding a tag doesn't remove anything: the geometry is still there, still counted, still saved. Bring it back with the eye. Deleting a tag doesn't delete its entities either: they become Untagged. To remove geometry, select it and press .

You can also hide single entities with **Edit › Hide**, and bring them back with **Edit › Unhide**. **View › Hidden Geometry** shows hidden things dimmed so you can select them.

TIP

Hide what's in the way instead of deleting it. In the next chapters you hide the contour lines once the terrain exists, and the setting-out lines once the paving is laid.

Scenes

A **scene** is a saved way of looking at the model. It remembers the camera, which tags and folders are visible, hidden geometry, section planes, the style (including colour by tag), fog, shadows and the axes. It does **not** save the geometry: every scene shows the same model.

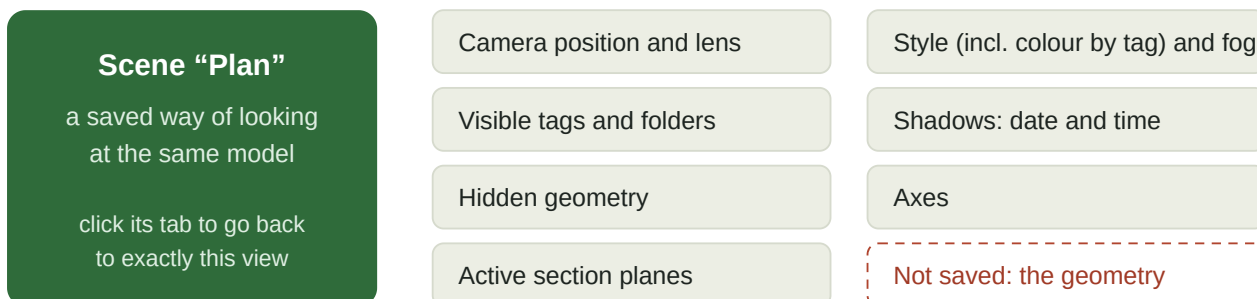


Figure 6.3 What a scene saves. Change the model and every scene shows the change.

1. Go to **Top** view with **Parallel Projection** and turn on **Color by Tag**. Choose **View ▸ Animation ▸ Add Scene**, and name it **Plan** in the **Scenes** panel.
2. Turn colour by tag off, orbit to a view over the whole garden, and add a scene **Overview**.
3. Zoom in on the shed and add a scene **Shed**.

Tabs for the scenes appear above the viewport (**View ▸ Scene Tabs**). Click one to go there, with a smooth camera move.

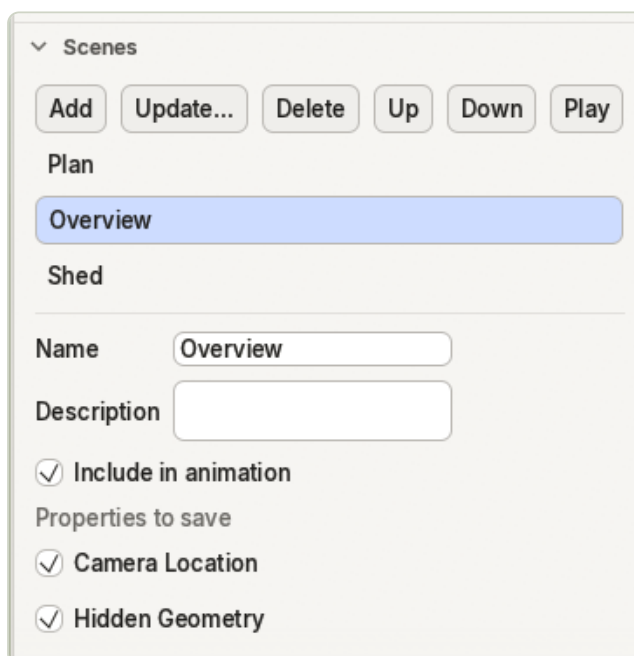


Figure 6.4 The Scenes panel: add, update, delete and reorder scenes, and choose what each one saves.

If you change a scene's view and want to keep it, click **Update...**: the scene takes the current view and settings.

TRY IT

Hide the **Furniture** tag, go to the **Shed** scene and back to **Overview**. Is Furniture visible? (Yes: **Overview** saved the tags as they were when you added it, and going to a scene restores them. To keep Furniture hidden in a scene, hide it there and click **Update...**)

THE GARDEN PROJECT

Your model now matches `ch06.tfo`: tags in a folder, a dashed setting-out tag, and the scenes **Plan**, **Overview** and **Shed**.

RECAP

- Tags decide what is drawn; groups decide what sticks together. Tag groups and components, not their insides.
- Tag folders hide many tags at once; each tag has a colour and a line pattern.
- New geometry goes on the active tag.
- Hiding keeps things; deleting a tag keeps its entities, Untagged.
- Scenes save the view and its settings, never the geometry.

CHAPTER 7

Materials and looks

Geometry says what a thing *is*; materials and styles say how it *looks*. They are separate on purpose: you can repaint a shed or switch the whole model to a sketchy pencil look without touching a single edge. This chapter paints the project and sets the sun.

IN THIS CHAPTER

- the Paint Bucket and the Materials panel
- painting groups versus painting faces
- textures, and positioning them
- face styles, built-in styles, shadows and fog

The Paint Bucket

Choose **Tools** ▸ **Paint Bucket** (**B**). The **Materials** panel opens with the materials **In Model**. Switch to **Library** for Terraform's own materials: colours, textures such as Wood, Brick, Concrete and Floor Tiles, physically based presets such as Brushed Steel, Glass and Water, and the garden materials. Click one to add it to the model and start painting with it.

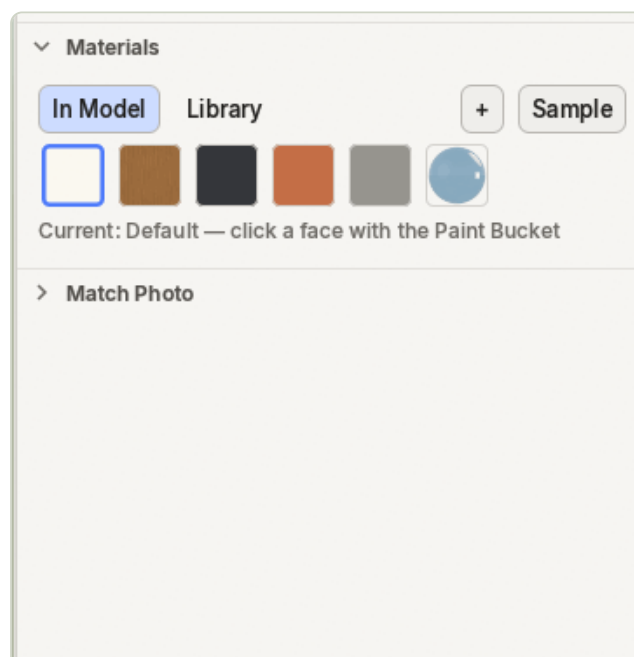


Figure 7.1 The Materials panel with the materials used in the project: wood, charcoal, terracotta, grey and glass.

Then click faces to paint them:

- click paints one face;
- **Ctrl** +click paints all connected faces;
- **Shift** +click replaces a material everywhere it is used;
- **Alt** +click picks up the material of a face (a pipette).

Paint the project

1. Click **Wood** in the library, then click the shed **group** (not inside it). Every face inside the shed that has no material of its own takes Wood.
2. Paint the fence panels Wood and the planters and pot **Terracotta** the same way: click the instances.
3. Double-click the shed to go inside. Paint the two roof faces **Charcoal**, the door **Stone Gray** and the window pane **Glass**.

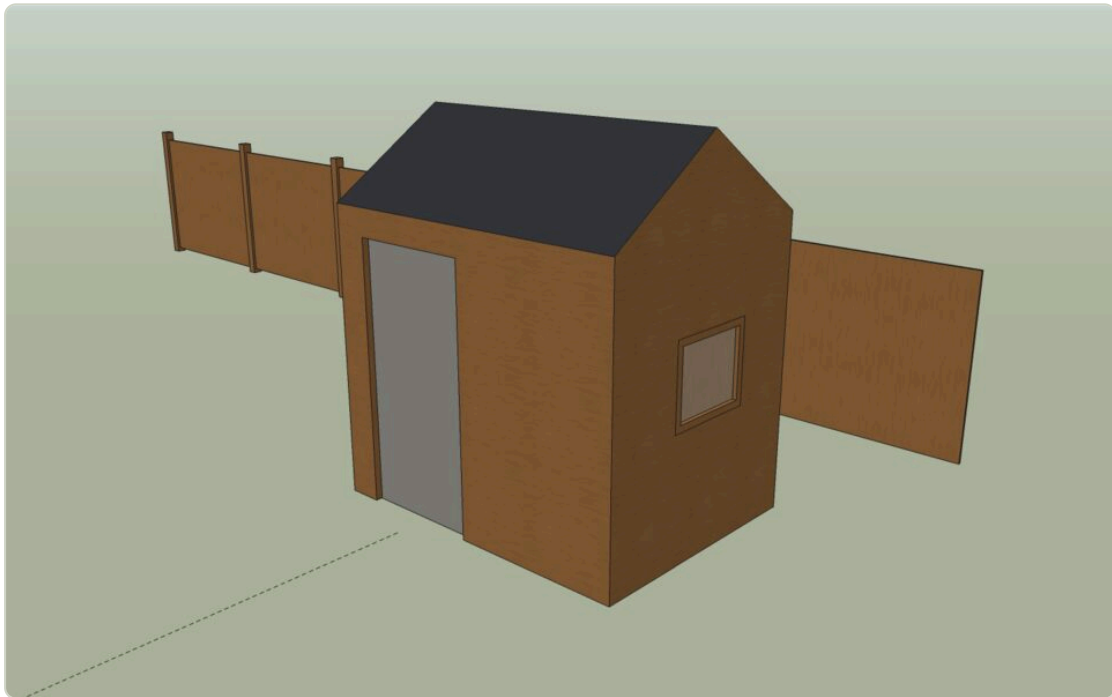


Figure 7.2 The painted shed: wood cladding, a charcoal roof, a grey door and a glass pane.

WHY IT WORKS THIS WAY

Painting a group or a component is a default: it fills only the faces that are still unpainted inside it. Faces you paint inside win. That is why you can paint the fence instances Wood here and a planter red somewhere else, while the component's own faces stay the same: the definition is shared, the paint on each instance is not.

Textures and their position

A textured material, such as Wood, repeats an image across the face. Its size is part of the material (**Edit** tab of the Materials panel: the texture's width and height). Its position and direction belong to each face.

The shed's cladding should run vertically. The **Position Texture** command turns, moves and scales the texture on a face; as a tool you drag to move the texture, **Ctrl**-drag to rotate it and **Shift**-drag to scale it. In this version it has no menu item or button yet, so use **Window > Script Console**: go inside the shed, select a wall, and run

```
run("texture_position", #{ face: selection()[0], rotation: 90 });
```

The texture on that wall turns a quarter turn. Repeat it for the other walls.

NOTE

Textures stick to their faces: move or push/pull a face and the texture moves with it.

Styles: how the model is drawn

View > Face Style changes how faces are drawn, without changing the model:

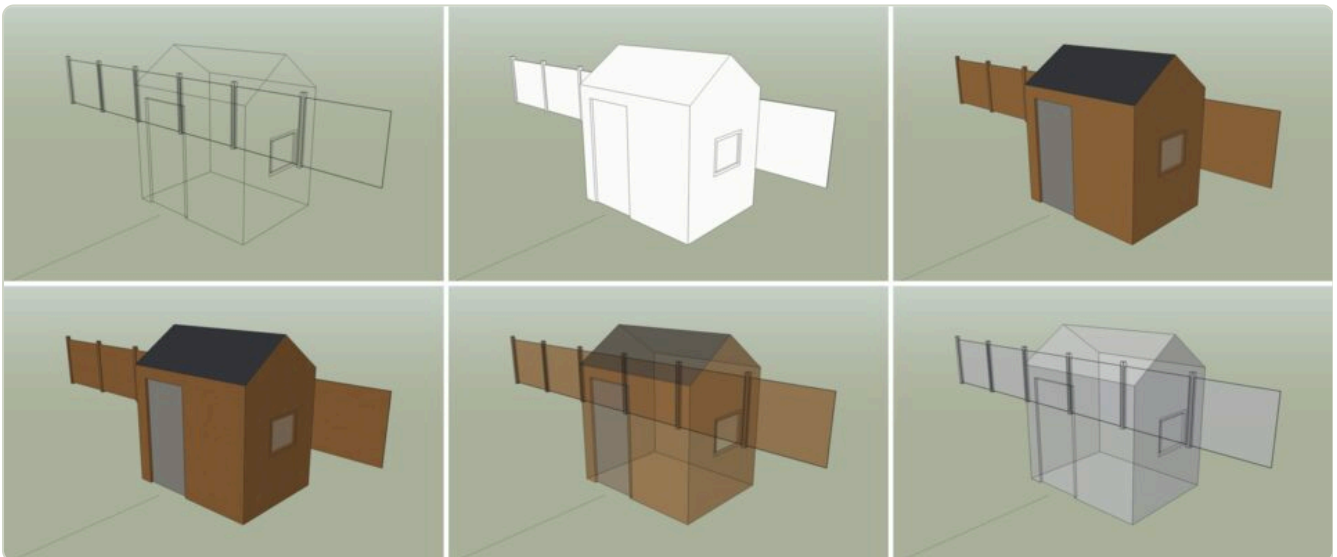


Figure 7.3 The face styles: Wireframe, Hidden Line, Shaded, Shaded With Textures, X-ray and Monochrome.

View > Edge Style adds **Back Edges** (hidden edges dashed), **Profiles** (thick outlines), **Depth Cue** and **Extension**. The **Styles** panel saves all of these together, with the background and the edge colour, as a **style**. Terafold comes with a few, such as **Pencil Study**, **Blueprint** and **Clay Model**.

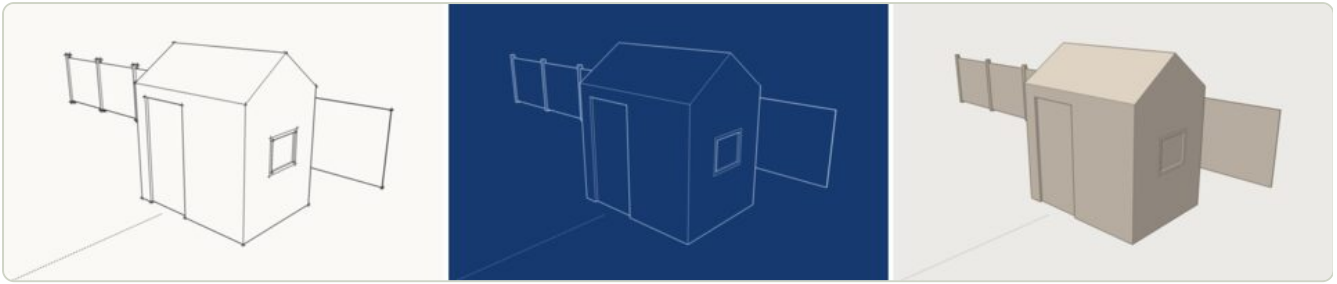


Figure 7.4 The same view in the built-in styles Pencil Study, Blueprint and Clay Model.

A style belongs to the model, and scenes remember which one they use. Make a scene for presenting (textures, shadows) and one for checking (monochrome, back edges).

Sun and shadows

Shadows come from a real sun: TerraFold works out its position from where the model is and the date and time.

1. Set the location with **File** ▶ **Geo-location** ▶ **Add Location....** For the project: latitude 51.05, longitude 3.72 (Ghent), time zone +1.
2. Open the **Shadows** panel (**Window** ▶ **Default Tray** ▶ **Shadows**), set the date to 21 June and the time to 16:00.
3. Turn shadows on with **View** ▶ **Shadows**.

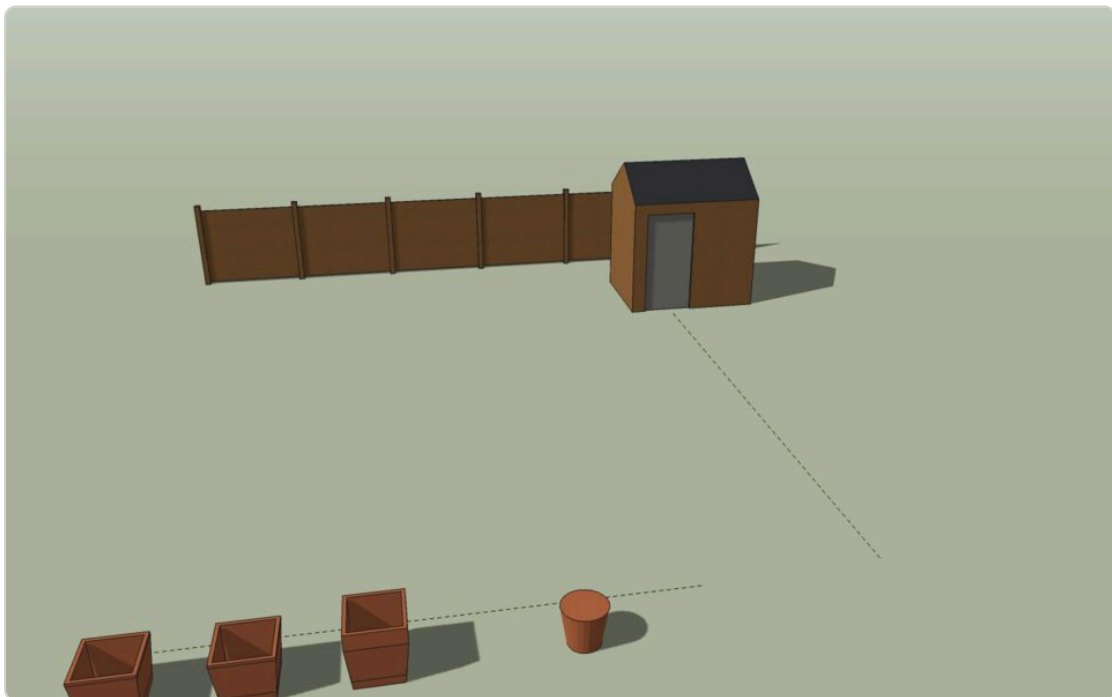


Figure 7.5 The project with materials and the sun of a June afternoon.

Shadows are worth checking early in garden design: where the shed throws its shadow is where shade-loving plants go.

View ▸ Fog fades the distance into the background colour (the **Fog** panel sets where it starts and ends). Useful for large sites, and for a soft look in presentations.

TRY IT

Make a scene called **Winter morning**: set the date to 21 December and the time to 10:00. Compare its shadows with a scene at noon in June. How far does the fence's shadow reach in winter?

THE GARDEN PROJECT

Compare with `ch07.tfo`. For colour-coded plans, remember **View ▸ Color by Tag** from the last chapter: it is part of the style too.

RECAP

- Paint Bucket (**B**): click, **Ctrl** connected, **Shift** replace, **Alt** pick up.
- Painting a group fills its unpainted faces; faces painted inside win.
- A material's texture size is in the material; its position is on each face.
- Face styles and styles change the drawing, never the model; scenes remember them.
- Shadows follow the sun from the location, date and time.

CHAPTER 8

The ground

Gardens are rarely flat. Our plot rises 1.2 m from the house to the back fence, and the shed, the patio and the lawn each need level ground. In this chapter you build the terrain from survey contours, grade level pads into it, and read the cut and fill numbers.

IN THIS CHAPTER

- terrain from contour lines, and from a grid
- why terrain is a TIN, and what that means for everything on it
- Grade Terrain: level and sloped pads with batters
- cut and fill volumes
- the sculpting brushes

Terrain from contours

A survey of a garden usually comes as contour lines: lines that join points of equal height. Terraform stretches a surface over them.

THE GARDEN PROJECT

Make a tag **Contours** and make it active. Draw the five contour lines at their heights (in the project files they run across the plot at 0 m by the house, 0.05 m at 4.4 m back, 0.6 m at about 5.8 m, 0.9 m at about 11 m and 1.2 m at the back). To draw a line at a height, type its points, such as `[0, 5.8m, 0.6m]`, or draw it on the ground and move it up. Make **Untagged** active again.

1. Select all the contour lines.
2. Choose **Draw** ▸ **Sandbox** ▸ **From Contours**.
3. Hide the **Contours** tag: the lines are no longer needed, but keep them.

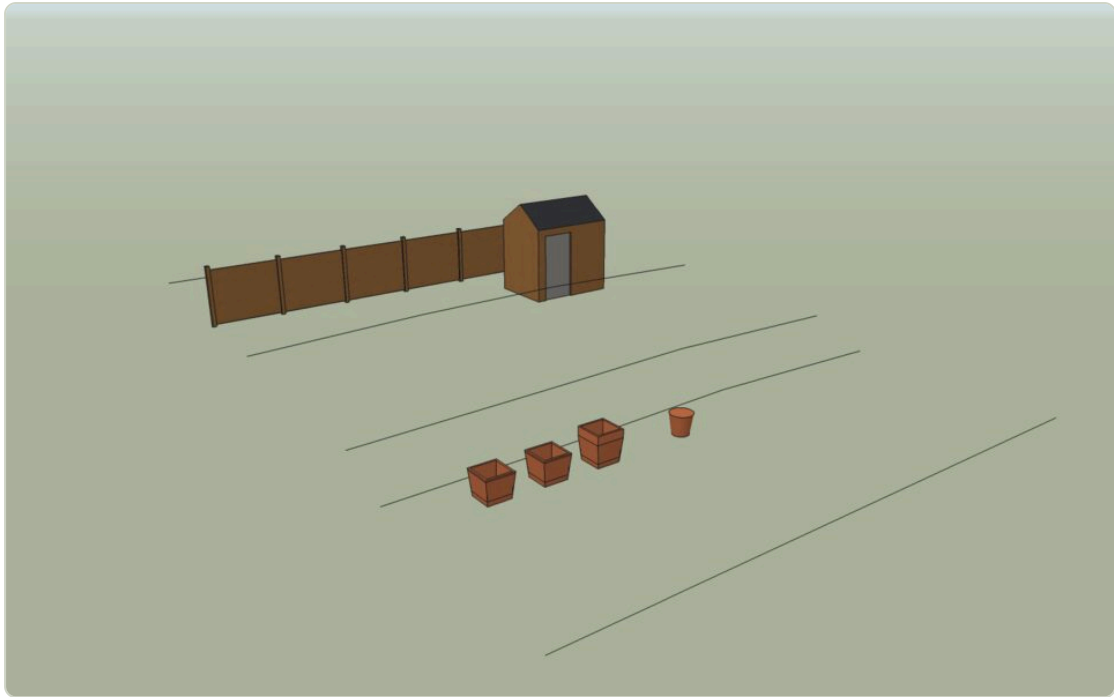


Figure 8.1 The contour lines at their heights: flat by the house, a short steep bank, then a gentle rise to the back.

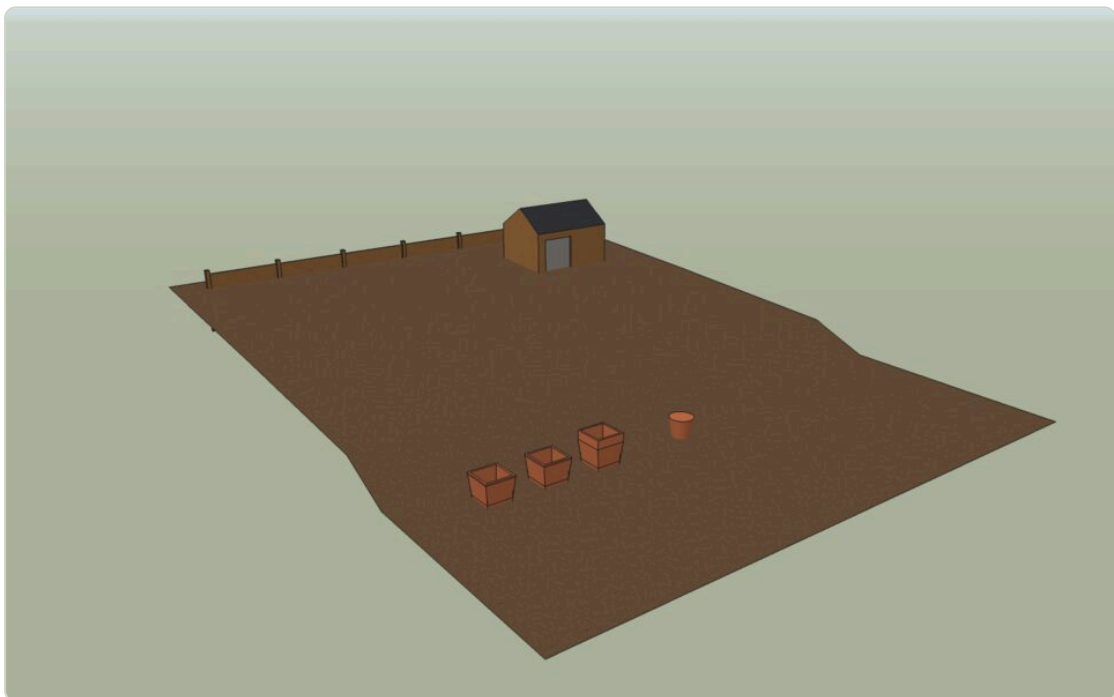


Figure 8.2 The terrain from the contours. View ▸ Hidden Geometry shows its triangles; the terrain is painted Soil.

The terrain is a group of triangles. Paint it (**Soil** from the library), and it will show through wherever you don't lay something on top.

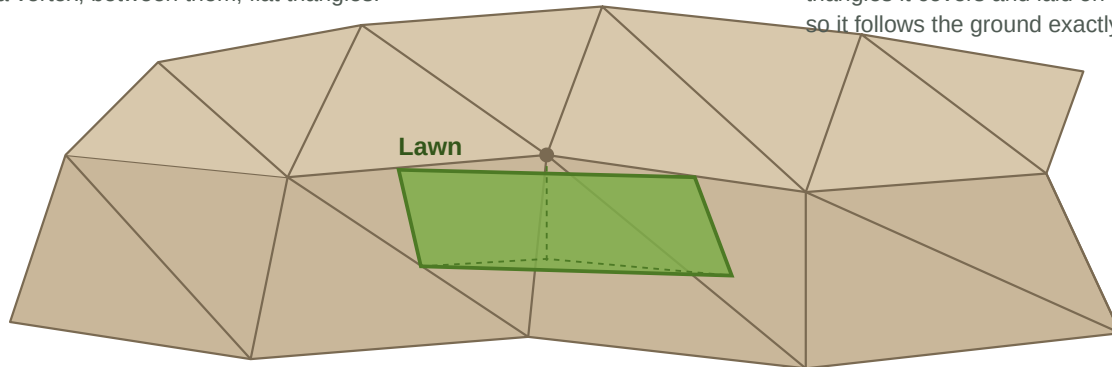
The other way to start is **Draw ▸ Sandbox ▸ From Scratch**: a flat grid of a given size and spacing, which you then shape with the brushes (below). Use it when there is no survey, or for a quick sketch.

Why terrain is a TIN

Terraform's terrain is a **TIN**, a *triangulated irregular network*: points at their real heights, joined by flat triangles. It is not a grid of heights, and it is not a smooth surface.

Every point you sculpt, grade or survey is a vertex; between them, flat triangles.

A garden area is cut along the triangles it covers and laid on them, so it follows the ground exactly.



Coarse where the ground is simple, fine where it changes: grading and brushes add triangles only where needed.

Figure 8.3 A TIN: vertices at the surveyed heights, flat triangles between them. A garden area laid on it is cut along the triangles and follows them exactly.

WHY IT WORKS THIS WAY

Triangles are exact. Every point of a triangle has a known height, so a path or a lawn laid on the ground can follow it precisely, and a volume between two surfaces can be computed exactly instead of estimated. A TIN is also economical: few large triangles where the ground is simple, many small ones where it changes. Grading and sculpting add triangles only where they are needed. Everything in the next chapters, from patios to ponds, is laid on this TIN.

Grade a level pad

Tools ▸ Garden ▸ Grade Terrain makes a pad: a flat or evenly sloped area, with the ground around it sloping back to the existing level at a **batter**.

The shed needs a level base, 30 cm larger than the shed on every side.

1. Choose **Tools ▸ Garden ▸ Grade Terrain**. Before clicking, type **1:2** and press **Enter**: the batter, 1 up for 2 across.
2. Click the four corners of the pad around the shed's position, and close the outline by clicking the first point again (or press **Enter**).
3. Move up or down to set the pad's height and click, or type how much to raise it (**0.1m**, or **-0.1m** to lower it) and press **Enter**. In the project files the pad is level at 1.05 m above the patio.

Do the same for the patio by the house: a pad 6.8 m by 4 m, level at 0.

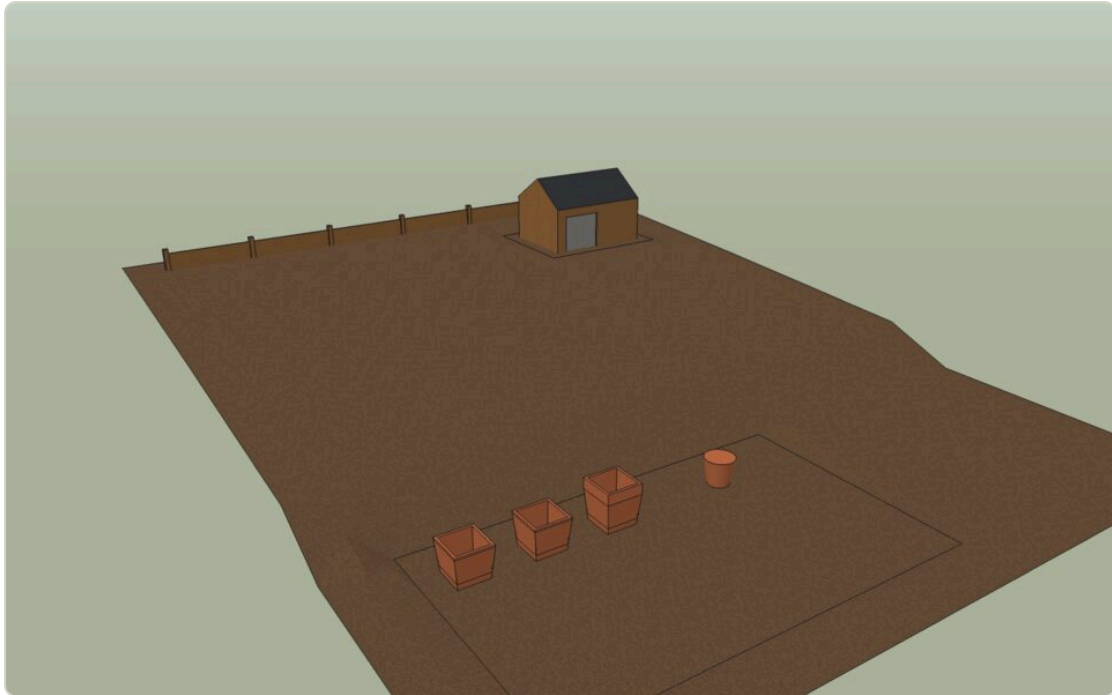
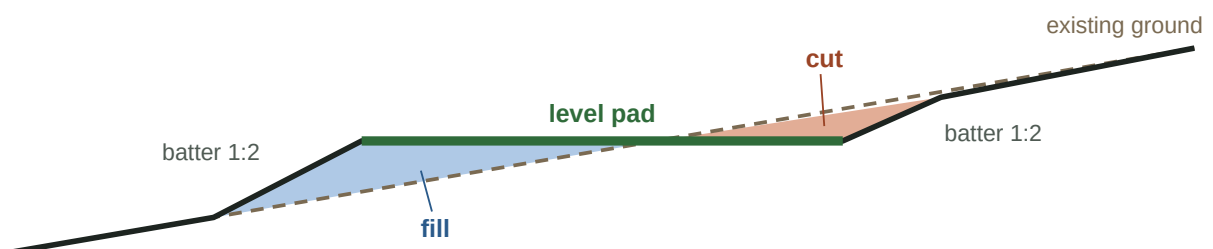


Figure 8.4 The terrain after grading two pads: the shed's pad at the back right, the patio's by the house. Hidden geometry shows the triangles added along the pads' edges.

To slope a pad, type a height and a gradient: `0.3m, 2%` raises it 30 cm and slopes it 2 % along its first edge, for drainage.

Cut and fill

Every grading records how much soil is dug out (**cut**) and how much is brought in (**fill**). Terafold computes them from the terrain before and after, triangle by triangle.



Terafold compares the terrain before and after: the volume above the old surface is fill, the volume below it is cut, triangle by triangle, so the numbers are exact for the model.

Figure 8.5 A pad on a slope: fill on the low side, cut on the high side, and batters back to the existing ground.

Table 8.1 The two pads of the project

Pad	Area	Cut	Fill
Shed, level at 1.05 m	7.2 m ²	0.13 m ³	0.25 m ³
Patio, level at 0 m	27.2 m ²	0.99 m ³	0.02 m ³

Each grading is stored with the terrain, and the **quantity report** adds them up over the whole project (next chapter).

TIP

Balance cut and fill where you can: soil you dig out at the patio can make the shed's pad. Try a few pad heights (each one is one step of Undo) and compare the net volume in the quantity report.

Put the buildings on the ground

The shed and the fence were drawn at height 0, before there was any terrain. Now lift them:

1. Select the shed, start **Move** (**M**), click a corner, press **Up** to lock the blue axis, type **1.05** and press **Enter**.
2. Select the six fence panels and move them up **1.12** m, so the posts stand just into the ground at the back.

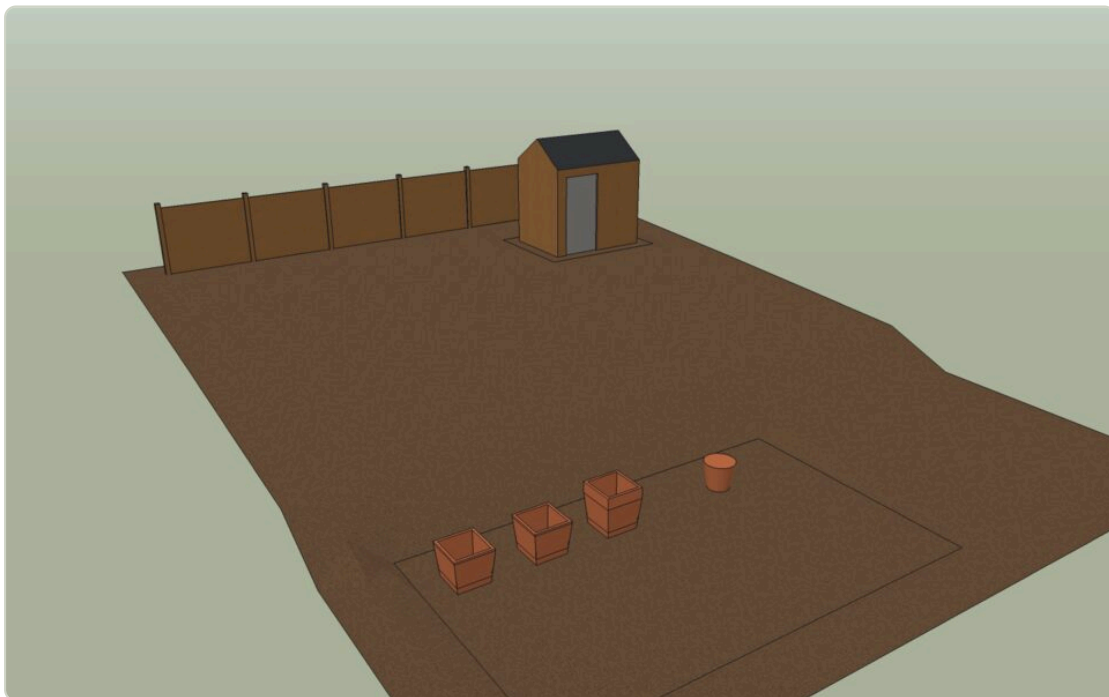


Figure 8.6 The project after chapter 8: terrain, the two pads, the shed on its pad and the fence on the ground.

Select the terrain and the green **Terrain tools** context tab appears with the Sandbox tools and grading.

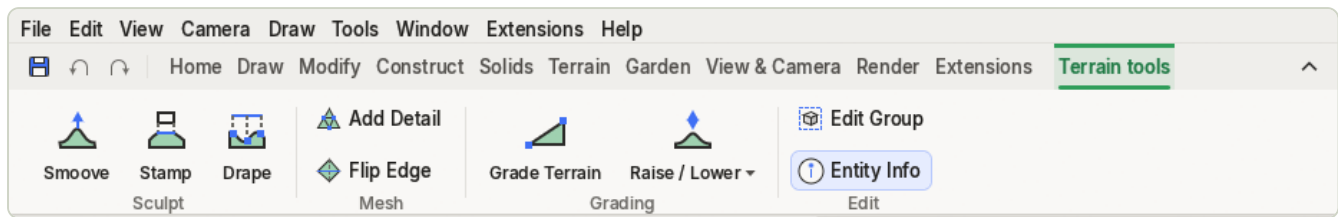


Figure 8.7 The Terrain tools context tab, shown while the terrain is selected.

Sculpt by hand

The brushes in **Tools** > **Garden** > **Sculpt** paint changes onto the ground: press and drag over the terrain, and the stroke is one step of Undo. Type `radius, strength` to change the brush.

- **Raise / Lower** builds mounds or hollows (a negative strength lowers).
- **Level** flattens to the height under the first point, or one you type.
- **Smooth** evens out bumps.
- **Relief** and **Relief in Area** add natural unevenness.

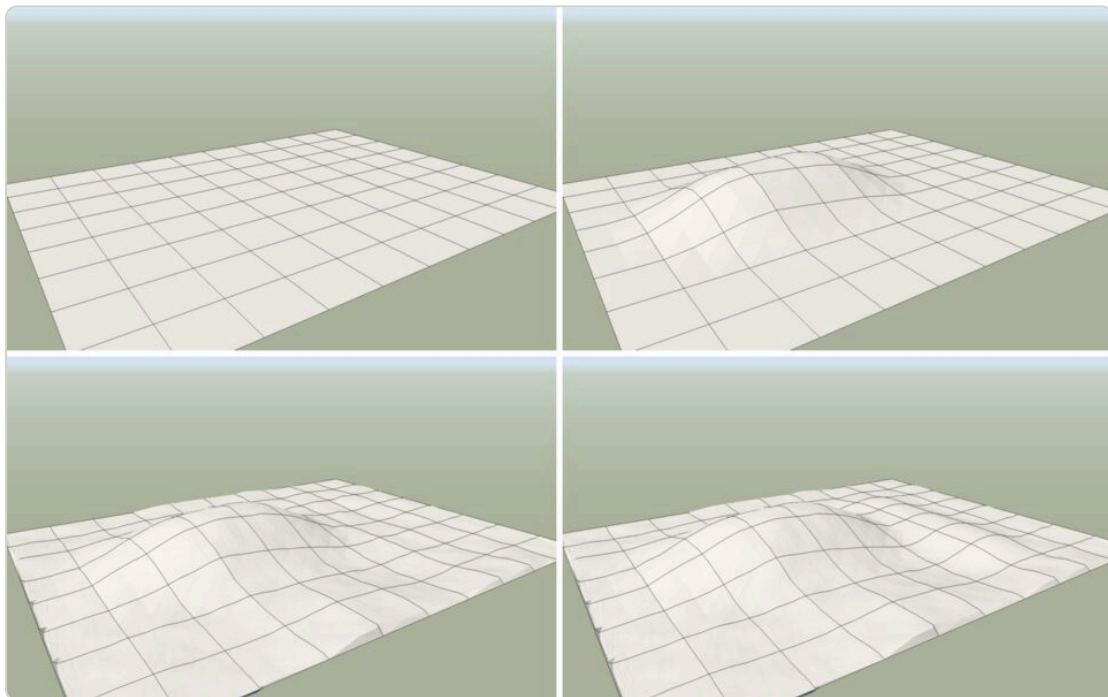


Figure 8.8 Sculpting a grid terrain: a flat grid (from scratch), a mound with Raise, relief and smoothing, and a levelled strip on the right.

Where the triangles are too coarse for the brush, Terafold refines them first. Every stroke also records its cut and fill.

TRY IT

In a new model, make a 10 m by 8 m terrain **From Scratch** with a 1 m spacing. Raise a mound in one corner, smooth it, then grade a level pad half on the mound. Run **Tools ▸ Garden ▸ Quantity Report** and look at the cut and fill.

THE GARDEN PROJECT

Compare with [ch08.tfo](#).

RECAP

- Terrain comes from contours or from a grid; it is a group of triangles (a TIN).
- Grade Terrain makes level or sloped pads with batters back to the ground.
- Cut and fill are exact, recorded with each grading and stroke.
- Draw buildings anywhere, then move them onto their pads.
- Brushes raise, lower, level, smooth and roughen the ground.

CHAPTER 9

Hardscape and water

With the ground in place, the hard parts of the garden go on top: a patio, a retaining wall, steps, a gravel path, a lawn, planting beds and a pond. Each one is drawn as an outline or a path on the terrain, and Terafold works out the rest: it follows the ground, grades where it must, and keeps count of areas and volumes.

IN THIS CHAPTER

- garden areas: patio, path, lawn, planting beds, decking; edging and build-up
- steps, ramps and retaining walls along a path
- ponds and pools, and their volumes
- the quantity report

The Garden tab

All these tools are on the **Garden** ribbon tab and in **Draw** ▶ **Garden**.

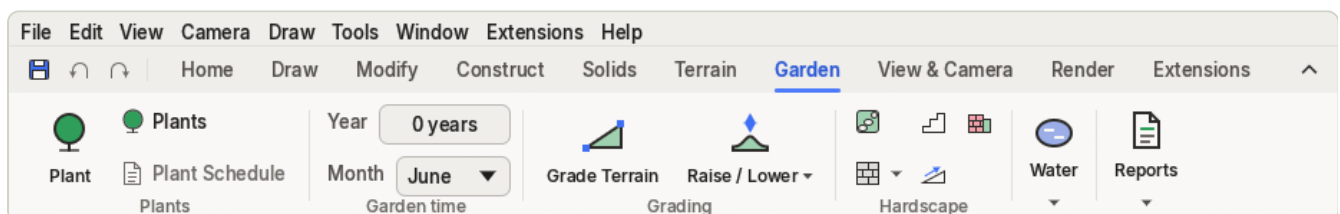


Figure 9.1 The Garden tab: planting, garden time, grading and sculpting, the hardscape tools and water.

They all work the same way: click points on the terrain, then close the outline (click the first point again, double-click, or press **Enter**). While you draw, **Backspace** removes the last point and **Escape** starts over. Typed values set the options: a length for the thickness or width, a word for a kind.

The patio

1. Choose **Draw** ▶ **Garden** ▶ **Patio**.
2. Type **kerb** and press **Enter** to give it a kerb edge.
3. Click the four corners on the patio's pad, 20 cm inside its edge, and close the outline.

The patio is a 60 mm slab of **Paving Slabs** laid on the pad, with a 125 mm kerb around it. It is a group that knows it is a patio: select it and the **Garden element** context tab shows its type and area.

The retaining wall and the steps

Behind the patio the ground rises steeply. A wall holds it back, and steps lead up beside it.

1. Choose **Draw** ▶ **Garden** ▶ **Retaining Wall**, click its start and end along the foot of the bank, and press **Enter**. Terraform builds the wall on the low side, levels 1.5 m of ground behind it, and sets the wall's height to the difference in level plus 10 cm, with a footing below and a cap on top.
2. Choose **Draw** ▶ **Garden** ▶ **Steps**. Type **1.2** for the width. Click the bottom of the slope at the patio, then a point at the top, and press **Enter**.

Terraform divides the rise into steps close to 150 mm high, with treads of at least 280 mm, and grades the terrain to the flight. If the proportions are uncomfortable it says so.

WHY IT WORKS THIS WAY

You draw the *path* of the steps, not the steps themselves, because the steps depend on the ground: the same path on a steeper slope needs more risers. Garden tools always start from intent (an outline, a path, a height) and let the terrain decide the geometry. Change your mind, undo, draw the path again.

3. Choose **Draw** ▶ **Garden** ▶ **Path**, draw the path from the top step to the shed's pad, 1 m wide, and paint it **Gravel**. Type **steel** before closing it for a steel edge.



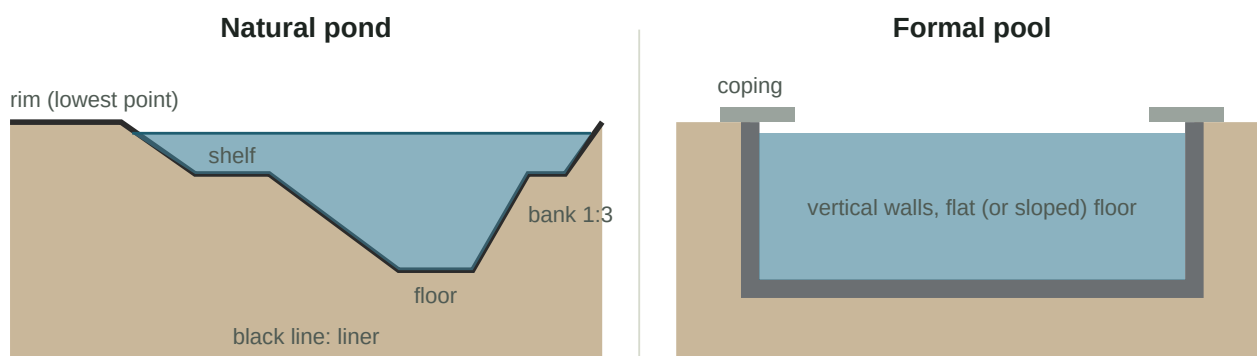
Figure 9.2 The patio with its kerb, the brick retaining wall with its cap, three steps and the gravel path to the shed.

The pond and the lawn

Dig the pond first, then lay the lawn around it.

1. Choose **Draw** ▶ **Garden** ▶ **Pond** (a natural pond; type `formal` to switch to a pool, or a length to change the depth).
2. Click the corners of the pond in the upper garden and close the outline.

Terraform digs the basin: sloping banks, a planting shelf, a flat floor and a liner, with the water 50 mm below the lowest point of the rim. **Draw** ▶ **Garden** ▶ **Pool** makes a formal pool instead, with vertical walls and coping.



The water stands 50 mm below the lowest point of the rim; the report gives its volume in m³ and litres.

Figure 9.3 Sections through a natural pond and a formal pool.

3. Choose **Draw** ▸ **Garden** ▸ **Lawn**, type `steel`, and draw the lawn over the whole upper level, around the pond. The lawn drapes into the pond's banks and stops at the water.



Figure 9.4 The pond in the lawn: the lawn follows the banks down to the water's edge.

WATCH OUT

Do the pond before the lawn. In this version, a pond dug into an existing lawn leaves the lawn's surface on top of the water.

TIP

Keep the corners of ponds and other outlines a little away from the terrain's own vertices and from grid points; Terafold handles it, but outlines that don't coincide with existing points give cleaner triangles.

Planting beds

Draw ▸ **Garden** ▸ **Planting Bed** draws a bed with 50 mm of **Bark Mulch**. The project has three: a narrow strip below the wall, the bank beside the steps, and a border along the back with a steel edge.



Figure 9.5 The project after chapter 9: patio, wall, steps, path, lawn with the pond, and three planting beds.

The quantity report

Every area, edge, wall, flight of steps and pond keeps its quantities. **Tools > Garden > Quantity Report** adds them up, and **File > Export > Garden Quantities** saves them as a CSV file next to the model, ready for a spreadsheet or a quote.

Table 9.1 The quantity report of the project (rounded)

What	Quantity
Patio: plan area, slab volume	21.8 m ² , 1.31 m ³
Path: plan area, volume	6.9 m ² , 0.34 m ³
Planting beds (3): plan area, mulch	29.3 m ² , 1.46 m ³
Lawn: plan area, surface area	54.6 m ² , 55.4 m ²
Edging: steel, kerb	64.9 m, 19.6 m
Earthworks: cut, fill, net	3.33 m ³ , 3.62 m ³ , +0.28 m ³
Retaining wall: length, face area, greatest height	7.8 m, 5.7 m ² , 0.73 m
Steps: risers, length	3, 1.2 m
Pond: water volume, water area, liner	874 litres, 6.2 m ² , 7.8 m ²

The lawn's surface area is larger than its plan area because it slopes and dips into the pond's banks: order turf by the surface area.

TRY IT

Change the pond into a formal pool: undo the lawn and the pond, draw a **Pool** instead, then the lawn again. Compare the water volume and the cut in the report.

THE GARDEN PROJECT

Compare with `ch09.tfo`.

RECAP

- Garden areas are outlines on the terrain; type `steel`, `kerb` or a thickness while drawing.
- Steps, ramps and walls are drawn as a path; the terrain decides their size and is graded to fit.
- Ponds and pools dig their own basin; dig them before laying areas around them.
- Everything counts itself: export the quantities as CSV.

CHAPTER 10

Planting

A garden is mostly plants, and plants change: they grow for years and look different every season. Terafold's plants know that. You place species from a library, and the model shows them at any age and in any month, in 3D and as plan symbols, and counts them for the nursery.

IN THIS CHAPTER

- the plant library and the Plants panel
- the Plant tool: single plants, rows and areas
- garden time: growth and seasons
- plan symbols and the planting plan
- the plant schedule

The Plants panel

Open **Window** ▸ **Default Tray** ▸ **Plants**. At the top is the **garden time** (years after planting and the month), then whether to show **3D plants** or **Plan symbols**, the **Schedule...** button, and the library of 68 species: trees, shrubs, hedges, perennials, grasses and groundcovers.

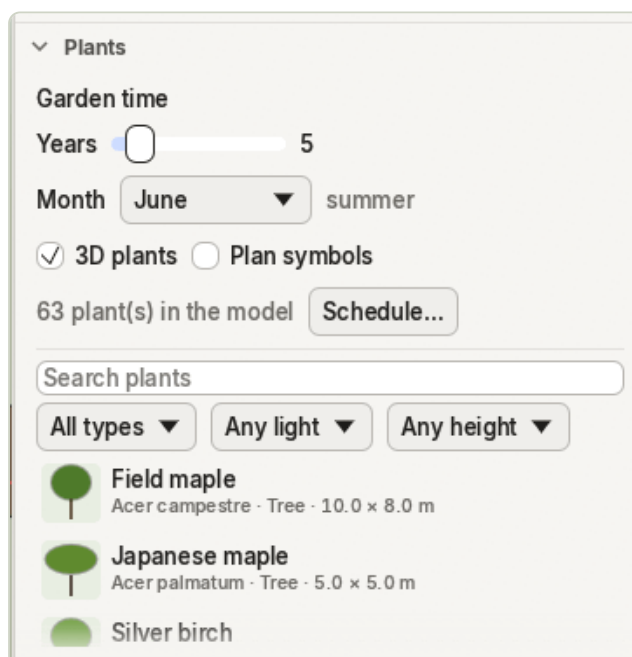


Figure 10.1 The Plants panel: garden time, display, the schedule, and the library with search and filters by type, light and height.

Search by common or botanical name, or filter by type, light and mature height. Hover a plant to see its size, growth rate, spacing, light, hardiness and flowering months. Click it to choose it: the Plant tool starts.

Place plants

Draw > **Garden** > **Plant** has three modes. Press **Alt** to go from one to the next, or choose the **Mode** on the **Plant options** tab.

- **Single**: click to place one plant.
- **Row**: click the start and the end; plants go in at even spacing. Hedges turn to follow the row.
- **Area**: click the corners of an area and close it; it fills with plants on a staggered grid, with a little natural variation.

The spacing starts at the species' planting distance. Type a length (**50cm**) to change it; type it right after a row or area and Terraform replants it at the new spacing.

THE GARDEN PROJECT

Plant the garden, clicking on the terrain, beds and planters:

1. Trees as single plants: a **Silver birch** in the back border on the left, an **Apple** in the back border on the right, a **Japanese maple** on the bank beside the steps.
2. A **Box** in each of the three planters.
3. Rows: a **Hornbeam hedge** along the left boundary, **English lavender** in the strip below the wall, **Chinese silver grass** along the bank.
4. An area of **Cranesbill** (*Geranium 'Rozanne'*) in the middle of the back border.
5. Two **Bigleaf hydrangeas** on the bank near the shed.



Figure 10.2 The planted garden, five years after planting, in June.

Garden time

The model has a **garden time**: years since planting and a month. Set it in the Plants panel or with the **Year** and **Month** controls on the **Garden** tab. Each plant starts at a nursery size and grows towards its mature size, quickly at first and then slower.



Figure 10.3 The same garden in June at planting time, after 5 years and after 15 years.

WHY IT WORKS THIS WAY

A design is a promise about the future. A tree planted at 2 m will be 8 m one day and shade the lawn; a hedge of 60 cm plants will be a 2 m screen in five years. Garden time lets you check both moments, and everything in between, in the same model: the size of a plant is not something you draw, it is something the model knows.

Seasons

Change the month and the plants follow the seasons: fresh green in spring, darker in summer, colours in autumn, bare branches in winter (hornbeam hedges keep their dry leaves). In their flowering months, part of the crown takes the flower colour.



Figure 10.4 Year 8 in April, July, October and January.

The planting plan

Each plant also has a **plan symbol**: a disc of its current spread, in its foliage colour, patterned by type. For a planting plan, tick **Plan symbols** and clear **3D plants** in the Plants panel, then use **Top** view with **Parallel Projection**.

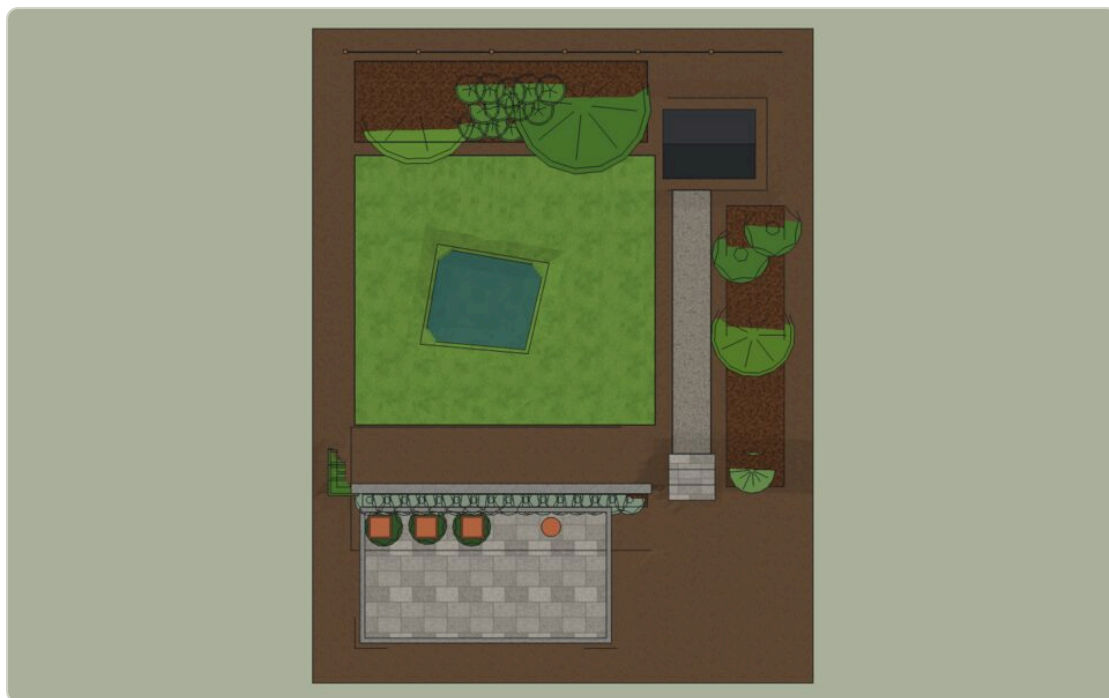


Figure 10.5 The planting plan: plan symbols from above, with the hardscape.

NOTE

On sloping ground, parts of a symbol can disappear under the ground or a garden area next to the plant. Check the plan from above, and move a plant slightly if its symbol is cut.

The plant schedule

File ▸ **Export** ▸ **Plant Schedule...** (or **Schedule...** in the Plants panel) saves a CSV file with one row per species: names, type, count, spacing, sizes at planting and at maturity, foliage and flowering months.

Table 10.1 The project's plant schedule (shortened)

Plant	Type	Count	Spacing	Size at planting	Mature size
<i>Betula pendula</i> , silver birch	tree	1	6 m	2 m	18 × 8 m
<i>Malus domestica</i> , apple	tree	1	5 m	2 m	6 × 6 m
<i>Acer palmatum</i> , Japanese maple	tree	1	4 m	2 m	5 × 5 m
<i>Carpinus betulus</i> , hornbeam hedge	hedge	21	0.4 m	0.6 m	2.5 × 0.8 m
<i>Lavandula angustifolia</i> , lavender	shrub	16	0.45 m	0.3 m	0.6 × 0.8 m
<i>Geranium</i> 'Rozanne', cranesbill	perennial	14	0.5 m	0.15 m	0.5 × 0.8 m
<i>Buxus sempervirens</i> , box	shrub	3	1 m	0.4 m	1.5 × 1.5 m
<i>Miscanthus sinensis</i> , silver grass	grass	3	1 m	0.2 m	1.8 × 1.2 m
<i>Hydrangea macrophylla</i> , hydrangea	shrub	2	1.2 m	0.4 m	1.5 × 1.5 m

TRY IT

Select the apple tree and change its **Species** in Entity Info to *Prunus avium* (wild cherry). Then set **Planted** to 3: it shows only as a plan symbol until year 3 of the garden time.

THE GARDEN PROJECT

Compare with ch10.tfo.

RECAP

- Choose a species in the Plants panel; plant single, in rows or in areas (**Alt** switches).
- Garden time (years and month) drives growth and seasons in the viewport and in renders.
- Plan symbols make planting plans; 3D plants make views.
- The plant schedule counts every plant for the order.

CHAPTER 11

Seeing the design

A garden design has to convince someone: a client, a neighbour, yourself. This chapter turns the model into pictures: views from where people will stand, a photoreal render, the design matched into a photograph of the real site, and an animation through the scenes.

IN THIS CHAPTER

- scenes as viewpoints for presenting
- the path-traced preview and photoreal renders
- Match Photo: the model in the perspective of a photograph
- exporting images and animations

Viewpoints

Good presentation views are eye-level views from where people will be: the back door, the patio, the far end of the lawn. Use **Camera ▶ Position Camera** to stand at a point at eye height, and **Camera ▶ Look Around** to turn your head. **Camera ▶ Field of View** widens or narrows the lens. Save each view as a scene ([chapter 6](#)).

THE GARDEN PROJECT

Turn on shadows for a June afternoon and add two scenes: **From the patio**, looking up the garden, and **From the shed**, looking back towards the house.

Photoreal renders

Terraform has a built-in path tracer: it follows the light from the sun and the sky as it bounces around the scene, so materials, shadows and reflections look real.

- **View ▶ Path Traced Preview** turns the viewport into a render that sharpens while the camera stands still. Use it to judge light and materials as you work.
- **Window ▶ Render...** makes a final image. Choose the **Quality** (**Draft**, **Good** or **Best**), the **Size**, and optionally **Depth of field**, then press **Render**. **Save PNG...** saves the image.



Figure 11.1 A path-traced render of the finished project, made with Good quality.

The **Environment** panel sets the light: a physical sky that follows the shadow settings, a single colour, or an HDRI panorama, with the exposure and tone mapping. Plants render in their colours for the garden time you have set: render the same scene in May and October for two very different pictures.

WHY IT WORKS THIS WAY

The render uses the same model, materials and sun as the viewport. Nothing is exported to another program, so there is nothing to keep in sync: change a material, press Render again.

Match Photo

Camera › Match New Photo... puts a photograph of the site behind the model and works out where the camera stood. You drag two pairs of lines onto edges in the photo that you know are horizontal and at right angles to each other, such as the walls of a house or the edges of paving. Where each pair meets is a vanishing point; from the two vanishing points Terafold finds the camera.

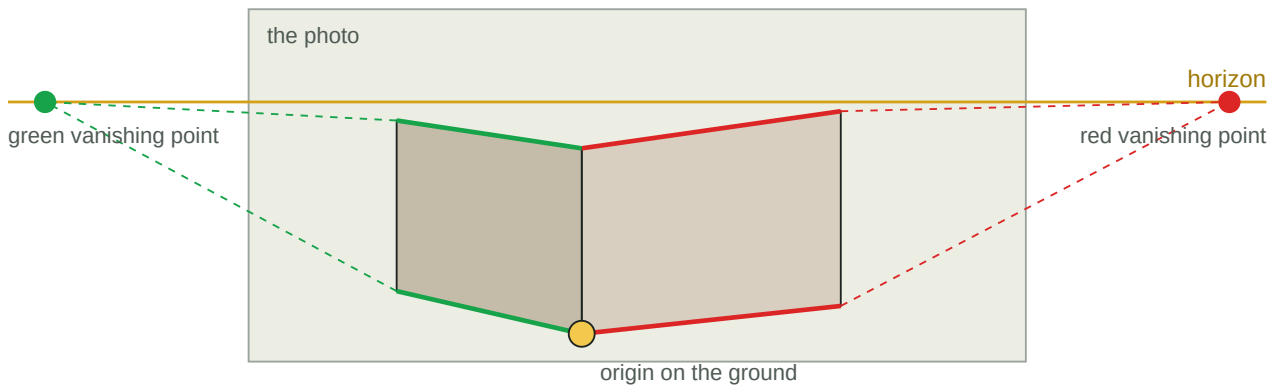


Figure 11.2 The idea: parallel edges meet at vanishing points on the horizon. The red lines follow the red axis, the green lines the green axis; the yellow origin sits on the ground where they meet.

1. Choose **Camera ▶ Match New Photo...** and pick a PNG or JPEG.
2. Drag the ends of the two **red** lines onto edges that run along one direction, and the two **green** lines onto edges at right angles to them. Keep each pair far apart.
3. Drag the yellow origin to a ground point where the two directions meet.
4. In the **Match Photo** panel, set the scale: choose an axis, type a length you know (**4m**), press **Set** and drag the white handle to the far end of that length.
5. Press **Done**. The photo is stored with a new scene.

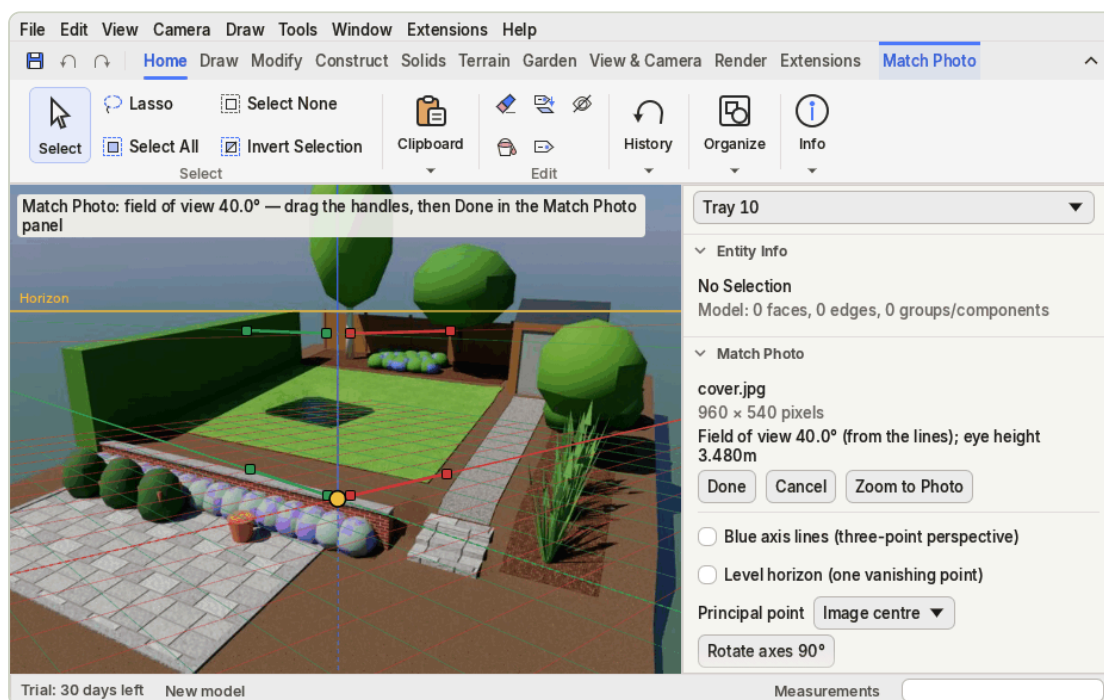


Figure 11.3 Match Photo with one of the guide's own renders as the photo: red and green lines on the edges of the patio, the horizon in yellow, and the Match Photo panel.

Now model in the photo's perspective: draw the new patio where it will be, and go back to the photo's scene to see it in place. **Project Textures from Photo** paints selected faces with the part of the photo behind them, a quick way to give a model of an existing building its real facade.

Images and animations

- **File** ▸ **Export** ▸ **2D Graphic...** saves the current view, in the current style, as a PNG.
- **File** ▸ **Export** ▸ **Section Slice...** saves a section cut as an SVG drawing (see **Tools** ▸ **Section Plane**).
- **View** ▸ **Animation** ▸ **Play** moves smoothly from scene to scene. **File** ▸ **Export** ▸ **Animation...** saves it as a numbered series of PNG frames, which any video editor turns into a film. Set the transition and pause times in **View** ▸ **Animation** ▸ **Settings**.

TRY IT

Make an animation of four scenes: From the patio, From the shed, Plan and Overview. Set the transition time to 3 seconds and export it. Then set the garden time to year 1 and to year 15 and export again: a before-and-after in moving pictures.

THE GARDEN PROJECT

Compare with ch11.tfo, the finished design.

RECAP

- Present from eye level; save the viewpoints as scenes.
- Path Traced Preview while you work; **Window** ▸ **Render...** for the final image.
- Match Photo: two pairs of lines, an origin and a known length put the model into a photograph.
- Export views as PNG, sections as SVG, animations as PNG frames.

CHAPTER 12

Working with others

A design rarely stays in one program. Surveys arrive as DXF, furniture as glTF, a client's builder wants an OBJ, and you may want to automate the boring parts. This chapter is a short tour of the ways in and out of Terafold.

IN THIS CHAPTER

- the `.tfo` file, and what other formats keep
- importing and exporting models
- extensions and the Script Console, in brief
- the command-line tool, in one paragraph

The `.tfo` file

A `.tfo` file holds everything: geometry, groups and components, tags, materials with their textures, scenes, matched photos, garden elements, plants and the garden time, the environment and a preview. Textures are inside the file, so one file is all you share. When you save over a file, the previous version is kept next to it as `<name>.backup.tfo`.



Imports arrive as one component; the `.tfo` file is the only format that keeps everything.

Figure 12.1 What goes in and out. Only the `.tfo` file keeps everything; the other formats carry the geometry and materials.

Import

File ▸ **Import...** brings a model into the open one as **one component**, named after the file, that follows the pointer until you click to place it. Its materials come along. Terafold reads COLLADA (`.dae`), glTF (`.glb` , `.gltf`), OBJ, STL, 3DS, DXF, KMZ and other `.tfo` files, and it imports `.skp` files (a preview, for files saved by versions up to 2017).

TIP

A DXF survey usually arrives in millimetres or without units. Check its size with the Tape Measure after importing, and use the Tape Measure's resize if needed ([chapter 3](#)). DXF layers become tags.

Export

File ▸ **Export** ▸ **3D Model...** writes COLLADA, glTF binary, OBJ, STL, 3DS, DXF and KMZ. Hidden geometry is left out of most of them. Pick the format the other program reads best: glTF for real-time viewers and game engines (it keeps physically based materials), OBJ or COLLADA for other modellers, STL for 3D printing, DXF for CAD drawings.

Images, sections, animations and the garden reports have their own exports, see [chapter 11](#) and [chapter 9](#).

Extensions and the Script Console

Everything is a command, so everything can be scripted. **Window** ▸ **Script Console** runs small scripts in the Rhai language, with the same commands you use:

```
run("rectangle", #{ corner: [0, 0, 0], size: ["2m", "1m"] });
model_info().counts
```

Extensions ▸ **Extension Manager** installs extensions: folders or `.zip` files with a script that adds its own commands, menu items and buttons. Extensions run in a sandbox: they can't read your files or reach the network, and each command they run is one step of Undo. See [Extensions](#) in the documentation.

The command-line tool

The desktop packages include `terafold-cli`, which works on models without a window:

`terafold-cli convert` converts between formats, `export` and `render` make images, `info` summarises a file, and `run` runs a script of commands on a model and saves the result. The figures

and model files of this guide were made that way. Run `terrafold-cli --help`, or see [File formats](#) in the documentation.

TRY IT

Export the finished project as `garden.glb` with **File › Export › 3D Model...**, then import it into a new model with **File › Import....** What is kept, and what is lost? (Geometry and materials are kept; scenes, tags, plants and the garden time are not: they only live in `.tfo` files.)

RECAP

- Share `.tfo` files: one file, everything inside.
- Imports arrive as one component; check their size and units.
- Export the format the other program reads best.
- Scripts, extensions and `terrafold-cli` run the same commands as the app.

CHAPTER 13

Licence, trial and viewer mode

Terafold works fully offline, and so does its licence. This short chapter explains the trial, what happens when it ends, and how to enter a licence key.

IN THIS CHAPTER

- the licence agreement and the 30-day trial
- viewer mode: what still works
- entering a licence key

The first start

The first time Terafold starts, it shows the end user licence agreement. Read it and choose **I Accept** to continue. You can read it again at any time with **Help ▸ Licence Agreement**, or on the [website](#).

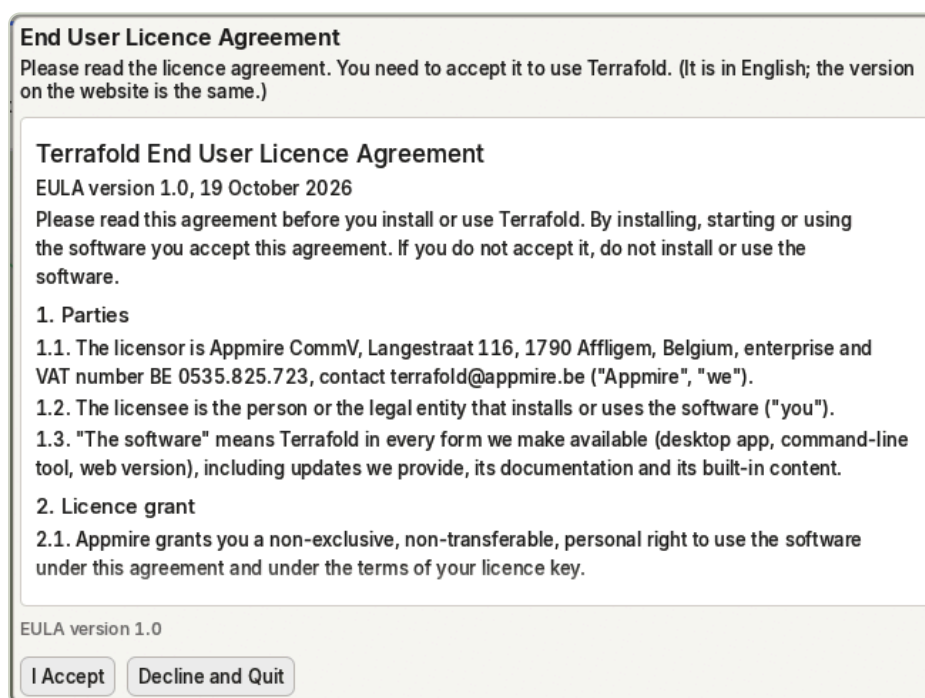


Figure 13.1 The licence agreement, shown once on the first start.

The 30-day trial

Without a licence key, Terafold is a full trial for 30 days from the first start. Every feature in this guide works. The status bar shows how many days are left.



Trial: 30 days left New model

Figure 13.2 The status bar during the trial.

A trial never ends while you work: a session that started on the last day keeps every feature until you close Terafold.

Viewer mode

After the trial, or when your licence doesn't cover the version you run, Terafold starts in **viewer mode**. The status bar says so, with **Buy** and **Enter key** buttons.

In viewer mode you can still open and look at models, use scenes, change things to try them out, and export images and renders. You can't save, export 3D models, or export the CSV reports. Nothing is lost: recovery copies are still written, and as soon as you enter a key you can save, without restarting.

WHY IT WORKS THIS WAY

Viewer mode is designed so that nobody is ever locked out of their own work. You can always open your models, show them to a client and make pictures of them; only creating new files needs a licence.

Enter a licence key

A licence key is a short block of text you receive by e-mail, or a `.tfl` file. Terafold checks it on your own computer: nothing is sent anywhere.

1. Choose **Help ▸ Enter Licence Key....**
2. Paste the key (everything from `-----BEGIN TERRAFOLD LICENSE-----` to `-----END TERRAFOLD LICENSE-----`), or choose **Open .tfl File....**
3. Choose **Enter Key**.

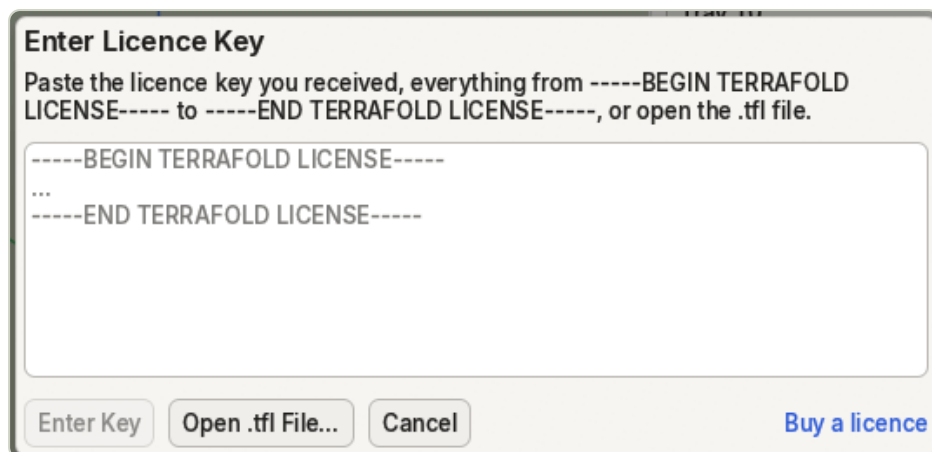


Figure 13.3 The Enter Licence Key dialog.

Help ▸ About Terafold and the status bar then show who the licence is for, and **Help ▸ License** shows its type, dates and the versions it covers. A perpetual licence covers the versions released during its first year, forever; a subscription works until its end date, plus 14 days to renew. To buy one, choose **Help ▸ Buy Terafold...** or see the [buy page](#). The [licence documentation](#) has the details, including `terrafold-cli license` for the command line.

RECAP

- Accept the agreement once; then 30 days of everything.
- Viewer mode keeps your work open and viewable; saving needs a key.
- Keys are checked offline: paste the text or open the `.tfl` file.

APPENDIX A

Shortcut card

Every default shortcut, by menu. Print this page and keep it by your keyboard. On macOS, use **Cmd** for **Ctrl** and **Option** for **Alt**. You can change any shortcut in **Window** > **Preferences** > **Shortcuts**.

File

Ctrl + Q	Exit
Ctrl + N	New
Ctrl + O	Open
Ctrl + S	Save
Ctrl + Shift + S	Save As

Edit

Ctrl + C	Copy
Ctrl + X	Cut
Delete	Delete
Ctrl + Shift + I	Invert Selection
G	Make Component
Ctrl + V	Paste
Ctrl + Y	Redo
Ctrl + A	Select All
Ctrl + T	Select None
Ctrl + Z	Undo

View

Ctrl + F1	Collapse Ribbon
-----------	-----------------

Camera

O	Orbit
H	Pan
Z	Zoom
Shift + Z	Zoom Extents

Draw

A	2 Point Arc
L	Line
C	Circle
R	Rectangle

Tools

E	Eraser
M	Move
F	Offset
B	Paint Bucket
P	Push/Pull
Q	Rotate
S	Scale
Space	Select
T	Tape Measure

While a tool runs

Table A.1 Keys and the mouse while you work

Key or mouse	Effect
type a value, Enter	exact length, size, angle or count (2.4 , 3m, 2m , 45 , 5x , /5 , 24s)
Backspace / Escape	edit the typed value / cancel the current operation
Shift (hold)	lock the current inference
Right Left Up	lock the red, green, blue axis
Down	lock parallel, then perpendicular, to the last edge hovered
Ctrl	copy (Move, Rotate), new face (Push/Pull), from the centre (Rectangle), about the centre (Scale), connected (Paint Bucket)
Alt	auto-fold (Move, Rotate), stretch (Push/Pull), overlap (Offset), pick up (Paint Bucket), mode (Plant)
the mouse	middle-drag orbits, Shift + middle-drag pans, the wheel zooms towards the pointer, a middle double-click recentres

APPENDIX B

The modelling philosophy on one page

The whole guide in a few rules. When a tool surprises you, one of these explains it.

Geometry

1. **Edges make faces.** A face appears when edges close a flat loop. Erase an edge and its face goes; erase a face and its edges stay.
2. **Faces become solids.** Draw the flat shape exactly, then Push/Pull it along its normal. Pushing a face through a solid makes a hole.
3. **Geometry is sticky.** Touching edges and faces share points and split each other. Move a point or an edge and everything attached follows, folding where it must.
4. **Faces have two sides.** A face drawn on the ground faces down; solids turn their fronts outwards.

Precision

5. **The mouse gives the direction, the keyboard gives the size.** Type at any time, press **Enter**; type again right after to amend.
6. **Inference replaces the grid.** Watch the marker: Endpoint, Midpoint, On Edge, On Face, the axes, Parallel, Perpendicular. Lock with **Shift** or the arrows.
7. **Set out with guides.** The Tape Measure makes guides; draw on them; delete them when done.

Structure

8. **Loose geometry sticks; groups don't.** Wrap every finished thing in a group or a component.
9. **Repeat with components.** Instances share a definition: edit one, all change. Make Unique splits one off.
10. **Tags decide what is drawn, groups decide what sticks.** Tag whole objects; leave their insides Untagged.
11. **Scenes save a way of looking, never the geometry.** Camera, visible tags, style, shadows.

Looks

12. **Paint is separate from shape.** Painting a group fills its unpainted faces; faces painted inside win.
13. **Styles change the drawing, not the model.** Face style, edges, colour by tag, fog and shadows are all part of the style or the scene.

The garden

14. **Terrain is a TIN.** Points at real heights, flat triangles between them; everything lies on it exactly.
15. **Draw intent, let the ground decide.** Outlines for areas, paths for steps and walls, a height for a pad: Terraform grades and sizes them, and counts cut and fill.
16. **Dig before you cover.** Ponds before the lawn around them; buildings onto graded pads.
17. **Plants know their future.** Garden time sets their age and season; plan symbols and the schedule come for free.

Everything

18. **Everything is a command,** from the menu, the ribbon, a key, a script or the command line, and every command is one step of Undo.



Figure B.1 The workflow of the whole guide: draw flat and exact, pull into 3D, group, organise, paint, then shape the ground, lay the garden on it, plant it and present it.