Blender 3D Cookbook

This book will take you on a journey to understand the workflow normally used to create characters, from the modeling to the rendering stages using the tools of the last official release of Blender exclusively.

This book helps you create a character mesh and sculpt features, using tools and techniques such as the Skin modifier and polygon merging. You will also get a detailed, step-by-step overview of how to rig and skin your character for animation, how to paint textures and create shaders, and how to perform rendering and compositing. With the help of this book, you will be making production-quality 3D models and characters quickly and efficiently, which will be ready to be added to your very own animated feature or game.

What this book will do for you...

- Create a basic mesh depicting the character's overall shape and mood in a few simple steps
- Use your sculpting skills to carve the character features from the mesh
- Find the best possible flow for your edge-loops to enhance the character features and for the best possible range of deformation
- Paint your character to enhance the surface's details
- Mix both the Blender Internal and Cycles rendering engines in order to render materials as quickly as possible

Inside the Cookbook...

- A straightforward and easy-to-follow format
- A selection of the most important tasks and problems
- Carefully organized instructions to solve problems efficiently
- Clear explanations of what you did
- Apply solutions to other real-world situations

Quick answers to common problems
In this package, you will find:

- The author biography
- A preview chapter from the book, Chapter 1 'Modeling the Character's Base Mesh'
- A synopsis of the book’s content
- More information on Blender 3D Cookbook
Enrico Valenza, also known as "EnV" on the Web, is an Italian freelance illustrator, mainly collaborating with publishers such as Mondadori Ragazzi and Giunti as a cover artist for sci-fi and fantasy books.

He graduated from Liceo Artistico Statale in Verona (Italy) and was later a student of illustrator and painter Giorgio Scarato.

When he started to work, computers weren't that much in use among normal people, and he spent the first 15 years of his career doing illustration with traditional media, usually on cardboard; he specialized in the use of the air-graph, a technique particularly esteemed for advertisement work.

When the movie Jurassic Park came to theaters, he decided to buy a computer and try this "computer graphic" everyone was talking about. When it comes to the many aspects of CG, he has been totally self-taught; it has been his encounter with the open source philosophy that actually opened a brand new world of possibilities, Blender in particular.

In 2005, he won the Suzanne Award for "Best Animation, Original Idea and Story" with the animation "New Penguoen 2.38."

In 2006, he joined the Orange Team in Amsterdam for the 2 last weeks of production to help in finalizing the shots of the first open source cg animated short movie produced by the Blender Foundation, Elephants Dream.

From 2007 to 2008, he has been a lead artist in the Peach Project team for the production of Big Buck Bunny, the second Blender Foundation's open movie.

From 2010 to 2011, he has been an art director at CINECA (Bologna, Italy) for the "Museo della Città di Bologna" project, which is the production of a stereoscopic CG-animated documentary made in Blender and which explains the history of the city of Bologna.
Also, being a Blender Certified Trainer, he often collaborates as a cg artist with production studios that have decided to switch their pipeline to open source.

Enrico uses Blender almost on a daily basis for his illustration jobs, rarely to have the illustration rendered straight by the 3D package and more often as a starting point for painting over with other open source applications.

He has conducted several presentations and workshops about Blender and its use in productions.
Preface

This cookbook is based on the ultimate 2.7 series of Blender and illustrates the workflow to create from scratch the monster creature Gidiosaurus, a fictional humanoid biped reptilian warrior, almost 2 meters tall, with scaled skin and wearing a sort of simple medieval armor.

So, by the use of recipes in this book, we'll see all the stages that a character's creation workflow usually undergoes in a production pipeline based on the open source software Blender; starting from concept sketches used as reference templates for the modeling and sculpting; going through the re-topology, UDIM unwrapping, rigging, texturing, and shading stages; and finally ending with the lighting, the rendering of a simple walk cycle animation, and also a bit of compositing. You will find quite a lot of stuff in the industry usually solved through the use of different applications, but that can be almost completely tackled just in Blender!

The order of all the stages of such a workflow is mandatory for most of them; for example, all the stages from Chapter 1, Modeling the Character's Base Mesh, to Chapter 4, Re-topology of the High Resolution Sculpted Character's Mesh, but can also be subjective in others.

In fact, stages such as the rigging and the skinning, the unwrapping of the mesh, the creation of the shaders, and the textures painting are often, at least in my experience, simultaneous or interchangeable. I usually build the rig and make a quick skinning of the mesh to verify that the deformations work correctly and then, if it's the case, I modify the mesh, fix the unwrap, tweak the vertex groups weights, modify the rig, and so on.

That's why in this book, after the unwrapping stage (Chapter 5, Unwrapping the Low Resolution Mesh), there are chapters about the rigging, skinning, and animation, and only later there are the chapters about the shaders and the textures creation, which ideally would have been the natural followers. While we are rigging a character, sometimes the need for some modifications in the mesh topology or even in the geometry turns up, usually to allow for better deformation in certain areas; this is the kind of corrections that we prefer to have before the unwrapping and the complex texture painting stages are done.
Because the different stages must be kept separated and explained one by one through recipes, it would be difficult to keep this kind of simultaneity in the cookbook. That's why, in very few cases, you'll find blank steps linking to other recipes and some images showing the future effect of the involved processes; for example, in Chapter 2, Sculpting the Character's Base Mesh, there are recipes about the different ways to obtain the mesh subdivision that at a certain step link to a later recipe, or in Chapter 6, Rigging the Low Resolution Mesh, there are examples of the deformation effects that the rig will have on the already skinned mesh even if the reader hasn't approached the skinning stage yet and so on. If this is the case, it is clarified at the time.

If you are not a total beginner in Blender, you are probably already using your customized version of the User Interface, with your personal preferences as add-ons, modified screens, and whatever else already set in the User Preferences panel.

In this cookbook, by the way, we'll presume to start our workflow with the Factory Settings, which is the basic interface and the preferences situation we have at the very first time we start Blender just after to have downloaded the zip and uncompressed it to some location on our hard drive.

If this the case, in the Getting ready section of the recipes, instructions about any required add-on and/or particular settings to be enabled are provided.

In the making of this cookbook, I've used versions of Blender from 2.71 to 2.73a. So, besides the version number that you'll see in the images written in the main header, you can sometimes find a screenshot showing buttons or features not appearing in the other images; such as, for example, for the Node Editor toolbar between versions 2.71 and 2.72, as shown in the following screenshot (only relevant to Cycles):
In no case, things like these should be an issue because there aren't many differences in these versions, only improvements, and the provided files have been tested under all of them. Obviously, new features or bug fixes introduced in version 2.73a are not available in the previous ones, so always use the latest official Blender release (also, the new versions 2.74 and 2.75a, although not debated in the cookbook, are OK).


I want to assure you that no Gidiosaurus has been harmed in the making of this cookbook. Moreover, the Gidiosaurus is totally a fictional character and any reference to extinct or still living creatures is totally coincidental and fortuitous. Even more, the name Gidiosaurus (from Gidio = Gidio and saurus = lizard) is copyrighted; the Gidiosaurus character has been designed, sculpted, and modeled by Enrico Valenza and is released under the Creative Commons license CC BY-NC-ND 4.0 (http://creativecommons.org/licenses/by-nc-nd/4.0/). This means that any version of the Gidiosaurus model or the character's textures provided through blend files with this cookbook, besides special distribution permission granted by the author to Packt Publishing for this cookbook, cannot be used for commercial purposes, but only for personal projects and the appropriate credit must always be given anyway.

What this book covers

Chapter 1, Modeling the Character's Base Mesh, explains the different methods to set reference templates in Blender and the use of the Skin modifier to model the character's base mesh.

Chapter 2, Sculpting the Character's Base Mesh, explains how to prepare and sculpt the base mesh.

Chapter 3, Polygonal Modeling of the Character's Accessories, explains the polygonal modeling of the character's accessories and the use of Curves to add detailing.

Chapter 4, Re-topology of the High Resolution Sculpted Character's Mesh, explains how to plan the re-topology through the Grease Pencil and how to use the tools to re-topologize the sculpted mesh.

Chapter 5, Unwrapping the Low Resolution Mesh, explains how to UDIM unwrap the re-topologized mesh.

Chapter 6, Rigging the Low Resolution Mesh, explains the different methods to build the rig in Blender.
Chapter 7, *Skinning the Low Resolution Mesh*, explains the different methods and tools to skin the character's mesh to the rig.

Chapter 8, *Finalizing the Model*, explains how to create shape keys, the drivers, the use of the bone's constraints, and the finalizing of the model.

Chapter 9, *Animating the Character*, explains how to link the asset to be animated from a library, how to proxy it, how to animate a simple walkcycle, and the use of Non Linear Animation.

Chapter 10, *Creating the Textures*, explains how to paint textures both in Blender Internal and in Cycles, how to make them tileable, and how to bake them.

Chapter 11, *Refining the Textures*, explains how to bake the details of the sculpted mesh to a normal map, how to create a Vertex Colors map, and the possible use of the Quick Edit tool to paint directly onto the model through an external 2D image editor application.

Chapter 12, *Creating the Materials in Cycles*, explains the creation of the shaders in Cycles.

Chapter 13, *Creating the Materials in Blender Internal*, explains the creations of similar shaders in Blender Internal.

Chapter 14, *Lighting, Rendering, and a Little Bit of Compositing*, explains the setup of the lighting, image based lighting both in Blender Internal and in Cycles, how to render a preview OpenGL playblast, some suggestions to try to avoid fireflies and noise in Cycles, and the compositing of the rendered passes of both the render engines into one single final image.
Modeling the Character's Base Mesh

In this chapter, we will cover the following recipes:

- Setting templates with the Images as Planes add-on
- Setting templates with the Image Empties method
- Setting templates with the Background Images tool
- Building the character's base mesh with the Skin modifier

Introduction

In this chapter, we are going to do two things: set up templates to be used as a reference for the modeling, and build up a base mesh for the sculpting of the character.

To set up templates in a Blender scene, we have at least three different methods to choose from: the Images as Planes add-on, the Image Empties method, and the Background Images tool.

A base mesh is usually a very low poly and simple mesh roughly shaped to resemble the final character's look. There are several ways to obtain a base mesh: we can use a ready, freely downloadable mesh to be adjusted to our goals, or we can model it from scratch, one polygon at a time. What's quite important is that it should be made from all quad faces.

To build the base mesh for our character, we are going to use one of the more handy and useful modifiers added to Blender: the Skin modifier. However, first, let us add our templates.
Modeling the Character's Base Mesh

Setting templates with the Images as Planes add-on

In this recipe, we'll set the character's templates by using the Images as Planes add-on.

Getting ready

The first thing to do is to be sure that all the required add-ons are enabled in the preferences; in this first recipe, we need the Images as Planes and Copy Attributes Menu add-ons. When starting Blender with the factory settings, they appear gray in the User Preferences panel's Add-ons list, meaning that they are not enabled yet. So, we'll do the following:

1. Call the User Preferences panel (Ctrl + Alt + U) and go to the Add-ons tab.
2. Under the Categories item on the left-hand side of the panel, click on 3D View.
3. Check the empty little checkbox on the right-hand side of the 3D View: Copy Attributes Menu add-on to enable it.
4. Go back to the Categories item on the left-hand side of the panel and click on Import-Export.
5. Scroll down the add-ons list to the right-hand side to find the Import-Export: Import Images as Planes add-on (usually, towards the middle of the long list).
6. Enable it, and then click on the Save User Settings button to the left-bottom of the panel and close it.

The User Preferences panel with the Categories list and the Addons tab to enable the several add-ons
There are still a few things we should do to prepare the 3D scene and make our life easier:

7. Delete the already selected Cube primitive.

8. Select the Lamp and the Camera and move them on to a different layer; I usually have them on the sixth layer (M key), in order to keep free and empty both the first and second rows of the left layer's block.

9. The Outliner can be found in the top-right corner of the default workspace. It shows a list view of the scene. Set Display Mode of the Outliner to Visible Layers.

10. Lastly, save the file as Gidiosaurus_base_mesh.blend.

How to do it...

Although not strictly necessary, it would be better to have the three (at least in the case of a biped character, the Front, Side, and Back view) templates as separated images. This will allow us to load a specific one for each view, if necessary. Also, to facilitate the process, all these images should be the same height in pixels.

In our case, the required three views are provided for you in the files that accompany this book. You will find them in the templates folder. The Import Images as Planes add-on will take care of loading them into the scene:

1. Left-click on File | Import | Images as Planes in the top-left menu on the main header of the Blender UI.
On the page that just opened, go to the Material Settings column on the left-hand side (under the Import Images as Planes options) and enable the Shadeless item. Then, browse to the location where you placed your templates folder and load the gidiosaurus_front.png image:

3. Rotate 90 degrees on the x axis (R | X | 90 | Enter) of the Plane that just appeared at the center of the scene (at the 3D Cursor location, actually; to reset the position of the 3D Cursor at the center of the scene, press the Shift + C keys).

4. Press N to call the Properties sidepanel on the right-hand side of the active 3D window, and then go to the Shading subpanel and enable the Textured Solid item.
5. Press 1 on the numpad to go to the Front view:

The imported plane with the relative UV-mapped image

Now, we know that our Gidiosaurus is a 2.5 meters tall beast. So, assuming that 1 Blender Unit is equal to 1 meter, we must scale the plane to make the character's front template two and a half Blender Units tall (Note that it is not the plane that must be 2.5 units tall, it's the character's shape inside the plane).

6. Add an Empty to the scene (Shift + A | Empty | Plain Axes).
7. Duplicate it and move it 2.5 units up on the z axis (Shift + D | Z | 2.5 | Enter).
8. Go to the Outliner and click on the arrows on the side of the names of the two Empties (Empty and Empty.001), in order to make them gray and the Empties not selectable.
9. Select the Plane and move it to align the bottom (feet) guideline to the horizontal arm of the first Empty (you actually have to move it on the z axis by 0.4470, but note that by pressing the Ctrl key, you can restrict movements to the grid and with Ctrl + Shift, you can have even finer control).
Modeling the Character's Base Mesh

10. Be sure that the 3D Cursor is at the object origin, and press the period key to switch Pivot center for rotation/scaling to the 3D Cursor.

11. Press S to scale the Plane bigger and align the top-head guideline to the horizontal arm of the second Empty (you have to scale it to a value of 2.8300):

![Image showing the properly scaled plane in the 3D scene]

12. Left-click again on File | Import | Images as Planes in the top-left menu on the main header of the Blender UI.

13. Browse to the location where you placed your templates folder and this time load the gidiosaurus_side.png image.

14. Shift + right-click on the first Plane (gidiosaurus_front.png) to select it and make it the active one. Then, press Ctrl + C and from the Copy Attributes pop-up menu, select Copy Location.

15. Press Ctrl + C again and this time select Copy Rotation; press Ctrl + C one more time and select Copy Scale.

16. Right-click to select the second Plane (gidiosaurus_side.png) in the 3D view, or click on its name in the Outliner, and rotate it 90 degrees on the z axis (R | Z | 90 | Enter).

17. Optionally, you can move the second Plane to the second layer (M | second button on the Move to Layer panel).

18. Again, left-click on File | Import | Images as Planes, browse to the templates folder, and load the gidiosaurus_back.png image.

19. Repeat from step 12 to step 15 and move the third Plane on a different layer.

20. Save the file.
How it works...

We used a Python script, which is an add-on, to import planes into our scene that are automatically UV-mapped with the selected image, and inherit the images' height/width aspect ratio.

To have the textures/templates clearly visible from any angle in the 3D view, we have enabled the Shadeless option for the Planes materials; we did this directly in the importer preferences. We can also set each material to shadeless later in the Material window.

We then used another add-on to copy the attributes from a selected object, in order to quickly match common parameters such as location, scale, and rotation:

The imported Planes can be placed on different layers for practicality; they can also be on a single layer and their visibility can be toggled on and off by clicking on the eye icon in the Outliner.
Setting templates with the Image Empties method

In this recipe, we'll set the character's templates by using Image Empties.

Getting ready

For this and the following recipes, there is no need for any particular preparations. Anyway, it is handy to prepare the two Empties to have markers in the 3D view for the 2.5 meters height of the character; so we'll do the following:

1. Start a brand new Blender session and delete the already selected Cube primitive.
2. Select the Lamp and Camera and move them on a different layer; I usually have them on the sixth layer, in order to keep free and empty both the first and second rows of the left layer's block.
3. Add an Empty to the scene (Shift + A | Empty | Plain Axes).
4. Duplicate it and move it 2.5 units up on the z axis (Shift + D | Z | 2.5 | Enter).
5. Go to the Outliner and click on the arrows on the side of the names of the two Empties (Empty and Empty.001), in order to make them gray and the Empties not selectable.
6. Save the file as Gidiosaurus_base_mesh.blend.

How to do it...

So, now we are going to place the first Image Empty in the scene:

1. Add an Empty to the scene (Shift + A | Empty | Image; it's the last item in the list).
2. Go to the Object Data window in the main Properties panel on the right-hand side of the Blender UI; under the Empty subpanel, click on the Open button.
3. Browse to the templates folder and load the gidiosaurus_front.png image.
The Add pop-up menu and the Image Empty added to the 3D scene, with the settings to load and set the image

4. Set the **Offset X** value to **-0.50** and **Offset Y** to **-0.05**. Set the **Size** value to **2.830**:

The Offset and Size settings
5. Rotate the **Empty** 90 degrees on the x axis ($R \mid X \mid 90 \mid Enter$).

6. Go to the **Outliner** and rename it **Empty_gidiosaurus_front**.

7. Duplicate it (Shift + D), rotate it 90 degrees on the z axis, and in the **Outliner**, rename it as **Empty_gidiosaurus_side**.

8. In the **Empty** subpanel under the **Object Data** window, click on the little icon (showing 3 users for that data block) on the right-hand side of the image name under **Display**, in order to make it a single user. Then, click on the little folder icon on the right-hand side of the image path to go inside the templates folder again, and load the **gidiosaurus_side.png** image.

9. Reselect **Empty_gidiosaurus_front** and press **Shift + D** to duplicate it.

10. Go to the **Empty** subpanel under the **Object Data** window, click on the little icon (showing 3 users for that datablock) on the right-hand side of the image name under **Display**, in order to make it a single user. Then, click on the little folder icon on the right-hand side of the image path to go inside the templates folder again, and this time load the **gidiosaurus_back.png** image.

11. Go to the **Outliner** and rename it **Empty_gidiosaurus_back**.

**How it works**...

We have used one of the most underrated (well, in my opinion) tools in Blender: **Empties**, which can show images! Compared to the **Images as Planes** add-on, this has some advantages: these are not 3D geometry and the images are also visible in the 3D view without the **Textured Solid** option enabled (under **Shading**) and in **Wireframe** mode.

![Image Empties](image.png)

The Image Empties appear as textured also in Wireframe viewport shading mode
Exactly, as for the imported **Planes** of the former recipe, the visibility in the 3D view of the **Image Empties** can be toggled on and off by clicking on the eye icon in the **Outliner**.

### Setting templates with the Background Images tool

In this recipe, we'll set the character's templates by using the **Background Images** tool.

#### Getting ready

As in the former recipe, no need for any particular preparations; just carry out the preparatory steps as mentioned in the *Getting ready* section of the previous recipe.

#### How to do it...

So let's start by adding the templates as background images; that is, as reference images only visible in the background in **Ortho** view mode and, differently from the previous recipes, not as 3D objects actually present in the middle of the scene:

1. Press 1 on the numpad to switch to the orthographic **Front** view and press Alt + *Home* to center the view on the **3D Cursor**.
2. If not already present, press N to bring up the **Properties** sidepanel to the right-hand side of the 3D window; scroll down to reach the **Background Images** subpanel and enable it with the checkbox. Then click on the little arrow to expand it.
3. Click on the **Add Image** button; in the new option panel that appears, click on the **Open** button and browse to the templates folder to load the *gidiosaurus_front.png* image.
4. Click on the little window to the side of the **Axis** item and switch from **All Views** to **Front**, and then set the **Opacity** slider to **1.000**.
5. Increase the **Y** offset value to make the bottom/feet guideline of the reference image aligned to the horizontal arm of the first **Empty** (you have to set it to **0.780**).
6. Scale Size smaller, using both the Empties that we set as references for the 2.5 meters height of the creature (you actually have to set the Scale value to 0.875).

7. Click on the little white arrow on the top-left side of the gidiosaurus_front.png subwindow to collapse it.

8. Click on the Add Image button again; then, in the new option panel, click on the Open button, browse to the templates folder, and load the gidiosaurus_side.png image. Then, set the Axis item to Right, Opacity to 1.000, Scale to 0.875, and Y to 0.780.

9. Repeat the operation for the gidiosaurus_back.png image, set Axis to Back, and so on.

Press 3 on the numpad to switch to the Side view, 1 to switch to the Front view, and Ctrl + 1 to switch to the Back view, but remember that you must be in the Ortho mode (5 key on the numpad) to see the background templates:
Building the character's base mesh with the Skin modifier

In the previous recipes, we saw three different ways to set up the template images; just remember that one method doesn't exclude the others, so in my opinion, the best setup you can have is: Image Empties on one layer (visibility toggled using the eye icons in the Outliner) together with Background Images. This way you can not only have templates visible in the three orthographic views, but also in the perspective view (and this can sometimes be really handy).

However, whatever the method you choose, now it's time to start to build the character's base mesh. To do this, we are going to use the Skin modifier.
Modeling the Character's Base Mesh

Getting ready

First, let's prepare the scene:

1. In case it's needed, reopen the Gidosaurus_base_mesh.blend file.
2. Click on an empty scene layer to activate it; for example, the 11th.

![Image showing the starting empty scene and the scene layer's buttons on the 3D window toolbar]

3. Be sure that the 3D Cursor is at the center of the scene (Shift + C).
4. Add a Plane (press Shift + A and go to Mesh | Plane). If you are working with the Factory Settings, you must now press Tab to go in to Edit Mode, and then Shift + right-click to deselect just one vertex.
5. Press X and delete the three vertices that are still selected.
6. Right-click to select the remaining vertex and put it at the cursor location in the center of the scene (Shift + S, and then select Selection to Cursor).
7. Go to the Object Modifiers window on the main Properties panel, to the right-hand side, and assign a Skin modifier; a cube appears around the vertex. Uncheck X under Symmetry Axes in the modifier's panel:
8. Assign a **Mirror** modifier and check **Clipping**.

9. Assign a **Subdivision Surface** modifier and check **Optimal Display**.

10. Go to the toolbar of the 3D view to click on the **Limit selection to visible** icon and disable it; the icon appears only in **Edit Mode** and in all the viewport shading modes, except for **Wireframe** and **Bounding Box**, and has the appearance of a cube with the vertices selected:
11. Press 3 on the numpad to go in the Side view:

![The created geometry and the side-view template reference](image)

**How to do it...**

We are now going to move and extrude the vertex according to our template images, working as guides, and therefore generating a 3D geometry (thanks to the Skin modifier):

1. Press G and move the vertex to the pelvis area. Then, press Ctrl + A and move the mouse cursor towards the vertex to lower the weight/influence of the vertex itself on the generated mesh; scaling it smaller to fit the hip size showing on the template:
Moving the geometry to the character’s pelvis area

2. Press E and extrude the vertex by moving it up on the z axis; place it at the bottom of the rib cage.

3. Go on extruding the vertex by following the lateral shape of the character in the template. Don’t be worried about the volumes; for the moment, just build a stick-figure going up the torso:

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Extruding the vertices to create a new geometry
4. Proceed to the neck and stop at the attachment of the head location.

5. Select the last two vertices you extruded; press \texttt{Ctrl + A} and move the mouse cursor towards them to scale down their influence in order to provide a slim-looking neck:

\begin{center}
\includegraphics[width=\textwidth]{scaling_vertices.png}
\end{center}

Scaling down the influence of the vertices

6. Press 1 on the numpad to switch to the \textbf{Front} view, and then select the bottom vertex and extrude it down to cover the base of the creature's pelvis. Press \texttt{Ctrl + A | X} to scale it only on the x axis:

\begin{center}
\includegraphics[width=\textwidth]{front_view.png}
\end{center}

Adjusting the weight of the vertices in the Front view
7. Go to the **Mirror** modifier and uncheck the **Clipping** item.
8. Select the middle thorax vertex and extrude it to the right-hand side to build the shoulder. Press **Ctrl + A** to scale it smaller:

![Creating the shoulders](image1)

9. Extrude the shoulder vertex, following the arm shape, and stop at the wrist; select the just-extruded arms' vertices and use **Ctrl + A** to scale them smaller.
10. Reselect the shoulder vertex, and use **Shift + V** to slide it along the shoulder's edge in order to adjust the location and fix the area shape:

![Creating the arms](image2)
11. Select the middle thorax vertex we extruded the shoulder from and go to the Skin modifier; click on the Mark Loose button:

Making a more natural transition from the thorax to the arms

12. Select the second vertex from the bottom and extrude it to the right-hand side to build the hip, and then extrude again and stop at the knee. Use Ctrl + A on the vertex to make it smaller:

Extruding the thighs
13. Go on extruding the vertex to build the leg. Then, select the wrist vertex and extrude it to build the hand:

Extruding to complete the leg

14. Press 3 to go to the **Side** view.

15. Individually, select the vertices of the knee, ankle, and foot, and move them to be aligned with the character’s posture (you can use the widget for this and, if needed, you can press Z to go in to **Wireframe** viewport shading mode); do the same with the vertices of the arm:

Adjusting the arm’s position
16. Select the vertices of the shoulder and elbow, and move them forward according to the template position; do the same with the vertices of the neck and waist:

![Adjusting the position of the shoulders, thorax, and neck](image)

17. Select the vertex connecting the shoulder to the thorax and use `Shift + V` to slide it upwards, in order to make room for more vertices in the chest area. Use `Shift` to select the vertex at the bottom of the rib cage and press `W`; in the **Specials** pop-up menu, select **Subdivide** and, right after the subdivision, in the option panel at the bottom-left of the Blender UI, set **Number of Cuts** to **2**:

![Subdividing an edge](image)
18. In the Side view, select the upper one of the new vertices and use Ctrl + A to scale it bigger. Adjust the position and scale of the vertices around that area (neck and shoulder) to obtain, as much as possible, a shape that is more regular and similar to the template. However, don't worry too much about a perfect correspondence, it can be adjusted later:

![Refining the shoulder's shape](image)

19. Extrude the bulk of the head. Select the last hand vertex and scale it smaller. Then, select the upper hand vertex and extrude two more fingers (scale their influence smaller and adjust their position to obtain a more regular and ordinate flow of the polygons in the generated geometry):

![Creating the head, hands, and fingers](image)
20. As always, following the templates as reference, extrude again to complete the fingers; use all the templates to check the accuracy of the proportions and positions, and the **Front**, **Side**, and **Back** views too:

Adjusting the position of the fingers according to the templates

21. Do the same thing for the foot, and we are almost done with the major part of the mesh:

Creating the feet toes
Now, it's only a matter of refining, as much as possible, the mesh's parts to resemble best the final shape of the character. Let's try with the arm first:

22. Select the two extreme vertices of the forearm and press $W$ | **Subdivide** | $2$ (in the bottom **Tool** panel) to add $2$ vertices in the middle. Then, use $Ctrl + A$ to scale and move them outward to curve the forearm a little bit. Do the same for the thigh by slightly moving the vertices outward and backward:
23. Repeat the same procedure with the upper arm, shin, foot, and fingers; any part where it's possible, but don't go crazy about it. The goal of such a technique is just to quickly obtain a mesh that is good enough to be used as a starting point for the sculpting, and not an already finished model:

![Image of a character with base mesh]

The completed base mesh

24. Press Tab to go out of the Edit Mode; go to the Outliner and rename the base mesh as Gidiosaurus. Then, save the file.

**How it works...**

The Skin modifier is a quick and simple way to build almost any shape; its use is very simple: first, you extrude vertices (actually, it would be enough to add vertices; it's not mandatory to extrude them, but certainly it's more handy than using Ctrl + left-click to add them at several locations), and then using the Ctrl + A shortcut, you scale smaller or bigger the influence that these vertices have on the 3D geometry generated on the fly.

If you have already tried it, you must have seen that the more the complexity of the mesh grows, the more the generated geometry starts to become a little unstable, often resulting in intersecting and overlapping faces. Sometimes this seems unavoidable, but in any case it is not a big issue and can be easily fixed through a little bit of editing. We'll see this in the next chapter.
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