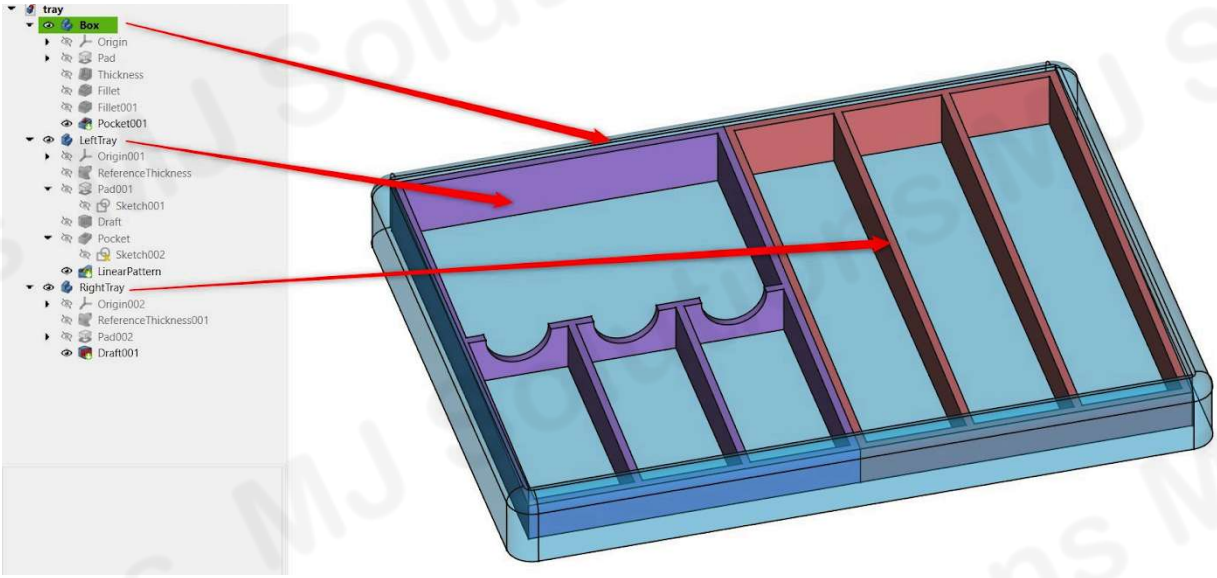
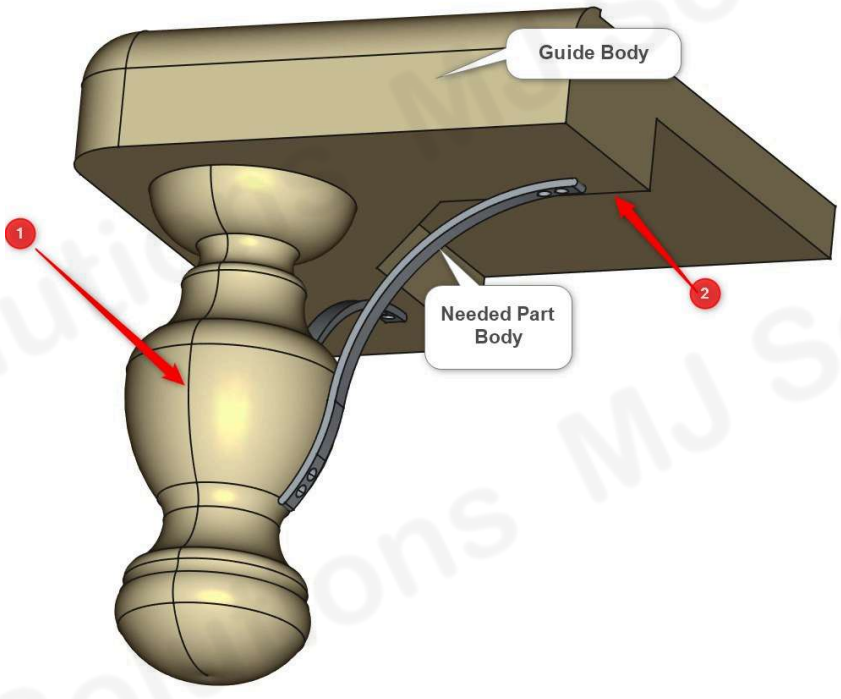
Chapter 7: Multi-Body Modelling

Lesson #30: Introduction

In this chapter, we will explore multibody modeling and learn how to use several Part Design tools, including Clone, Subshape Binder, and Boolean operations.

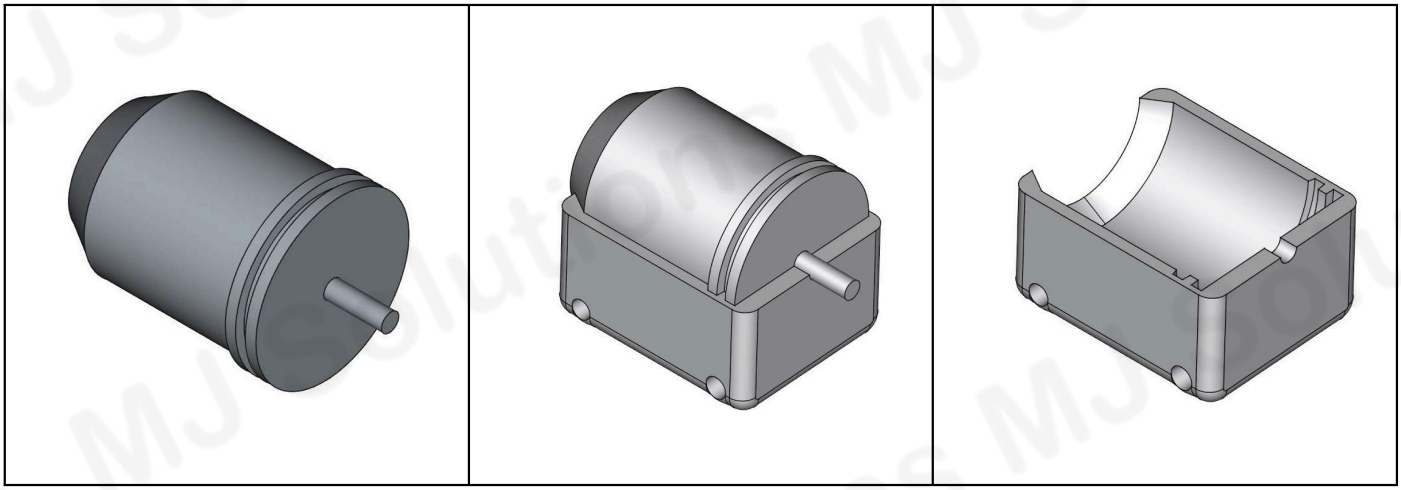
Multi-body modeling in Part Design involves creating multiple body containers each with its own modeled part within, we can additionally share information and geometry across them using various tools and operations.





These bodies can be used as construction aids for modeling. In the below example the table and leg are one body and act as a guide to model the brace. The brace follows the contour of the leg using subshape binders connected to the revolve edge of the leg (1). This binder is rotated into place. Another binder is attached to the flat surface edge of the table (2).

As components of the main design (see the previous but one example of a tray with a number of compartments as separate bodies) or for subtractive and additive operations by removing or merging volume with other bodies. In the following example a dummy motor has been modeled from measurements from the actual component to allow a housing to be made.

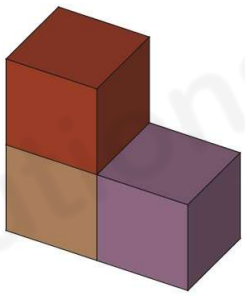
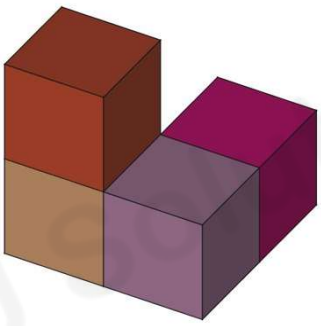


It is important not to confuse multibody with multi-solid. A multi-solid is a body that contains multiple solids which is achieved by enabling the "Allow Compound" property and then designing a body with unconnected components. By default, a body contains only one solid. We will explore use cases where multiple solids are beneficial later.

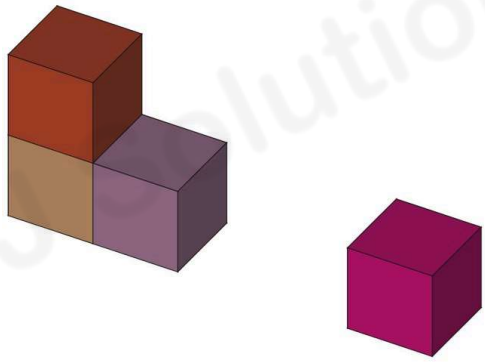
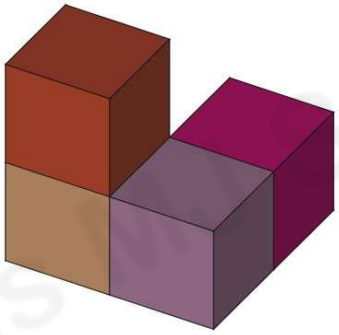
Multi-body modeling is useful when designing models that consist of multiple parts. For example, when creating a simple box with a lid, the container can be built using a pad and pocket or a pad with thickness.

A new body can be created for the lid, allowing us to use Subshape Binders to link its geometry to the container body, effectively building the lid around the container.

This approach follows a top-down modeling technique, where we create an initial part and model all other parts based on references to it. This means that changes in one part, such as its dimensions or shape, will automatically update dependent parts.

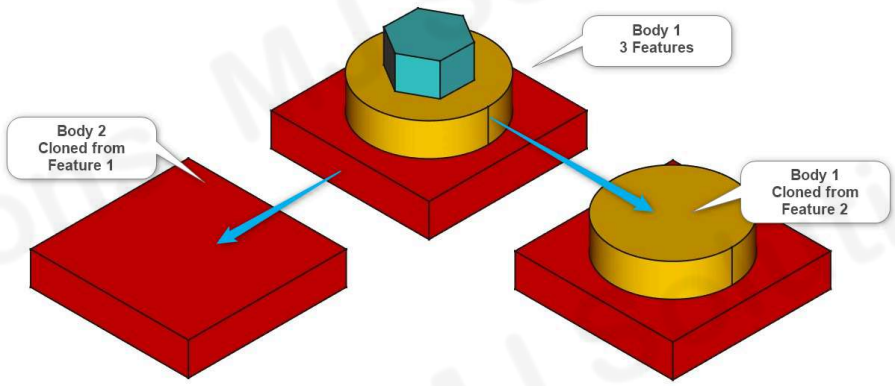
	
Bodies already designed and assembled or placed into the end position.	New part created with reference to the other bodies.

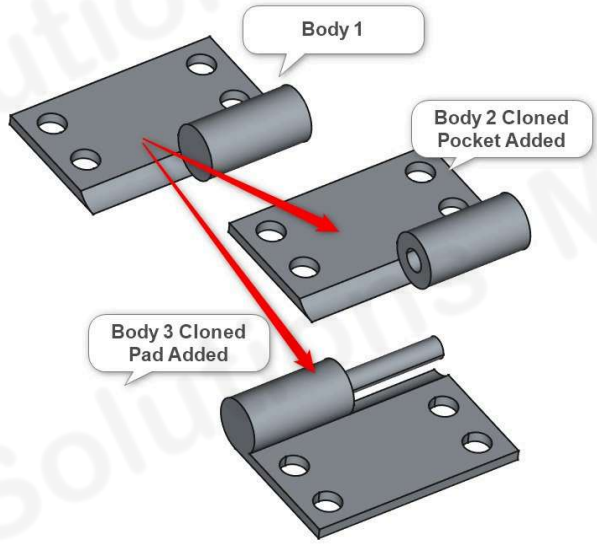
In contrast, a bottom-up approach focuses on designing individual parts separately and assembling them afterward. Updates to one will need to be manually added to the others.

	
Bodies containing a part created separate without reference to the other bodies.	Which is later assembled into the main body.

The Subshape Binder tool also allows for additional flexibility, such as using offset properties to add tolerances to planar binded areas..

Multi-body modeling also allows for branching at certain points in the design process. If multiple outcomes are possible, we can create a new body from our chosen operationion in the tree, continue modeling in that body, and even create another branch for a different approach or return to the main body to finish our modeling.

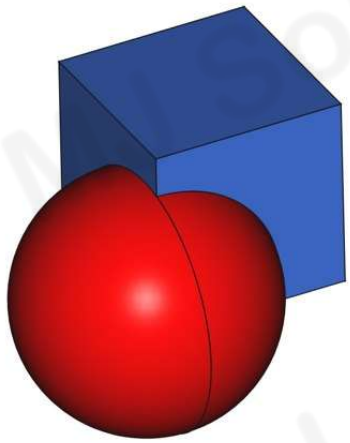
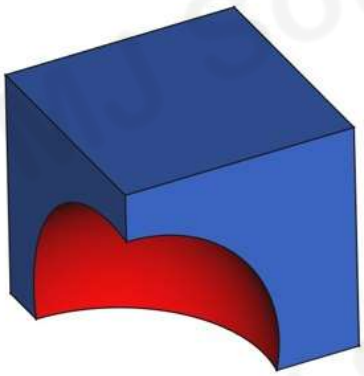
	This is achieved by using the Part Design Clone tool, it creates a linked copy of a selected operation from the treeview which makes up a feature. This will create a new body based off of the selected, allowing further isolated modifications. If the parent body changes, the clone updates accordingly from any operations it has inherited.

	This is particularly useful when creating template bodies. For example, in a hinge design where both parts are identical up to a certain point, we can select the main body and branch from there rather than branching from a feature. In this example we use this method to create the male and female sides separately.

This should not be confused with the Clone tool from the Draft workbench which is a more versatile tool that we have used in the past tutorials to clone sketches. But it clones multiple geometry, shapes, bodies etc.

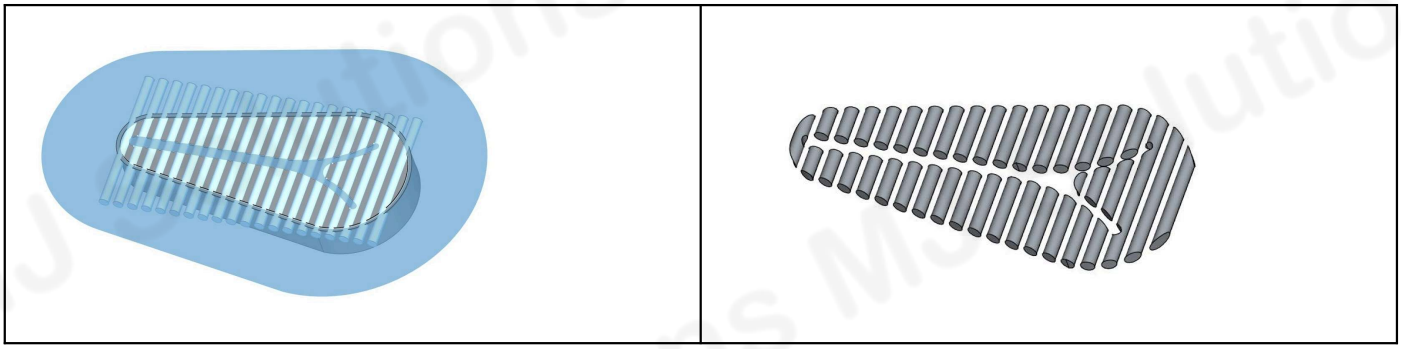
Part Design Clones are extremely useful, as well as allowing a means to use the products from other workbenches in the Part Design (more about that in the future) they can also help resolve dependency cycles in Boolean workflows, Boolean operations are yet another essential multi-body technique.

Boolean operations; **Fuse, Common, and Cut**; allow us to manipulate multiple bodies in different ways. **Fuse** merges multiple bodies into one, **Common** extracts the overlapping region between them, and **Cut** removes the shape of one body from another.

		
Fuse	Common	Cut

For example, if we have a base body with a pad and pocket and a second body with a sketch defining multiple rods for texturing, we may want to blend these together. When padding the rods, we must enable the "Allow Compound" property since multiple profiles create a multi-solid body.

In some areas, such as the rim and center detail, we may not want the texture to apply. By using a Subshape Binder with an offset, we can shape the rods so they do not intersect these restricted areas. Once shaped correctly, we can use a Boolean operation to merge the bodies.



If we perform a Boolean operation directly, we may create a dependency cycle. This happens when Body 1 updates Body 2, and Body 2, in turn, affects Body 1 through a shape binder. The result is an infinite update loop. To resolve this, we can create a Clone to branch away and use that for the final Boolean operation, breaking the cycle.

Now that we have a basic understanding of multi-body modeling, let’s move on to practical exercises in the next lesson.