Boolean operations developed from the influential system of logic invented by George Boole in the mid nineteenth century. In computer modeling applications the functions are Addition (A+B, sometimes called Union), Intersection (the volume that is part of both A and B), and Subtraction (called Difference in Blender). Subtraction is the only operation that depends which object is chosen first; A-B is not the same as B-A.

Exercise
Here we have a blue sphere inside a white cube.

Let’s select the cube and give it a Boolean modifier.
We’ll start by choosing Intersect from the Operation list. Select the sphere from the Object list.

This strange object appears in the 3D window. In fact it’s two objects superimposed – the original cube, now changed, plus the unaltered sphere. Hide the sphere by clicking its eye icon in the Outliner and you can see the boolean result.

Why does Blender keep the sphere (and if you delete it you destroy the boolean result)? So that the operation can be animated. Make the sphere visible again and move it to one side of the cube in the first frame. The cube will disappear, as there is now no intersection between itself and the sphere. Add a location keyframe to the sphere with I. Go to the last frame and move the sphere to the other side of the cube so that there is again no intersection. Add a keyframe.

Now hide the sphere again and run the animation. The boolean operation will be shown animated.
Delete the sphere. The boolean intersect operation is destroyed and the cube appears as it was originally. Add a cylinder to the scene like this and go to frame 1.

This time select the cube (the modifier will still be present), choose Difference, and pick the cylinder as the Object. Add a keyframe locating the cylinder as above, then go to the last frame and move it until it cuts through the cylinder. Add a second location keyframe. Hide the cylinder and play the animation. A hole is drilled through the cylinder.

Change the operation to Intersect and a cylinder will grow out of nothing in the center of the scene. If you change it again to Union the cylinder seems to reappear, though in fact what you see is the union of cube and cylinder, which is one object with the cube’s name and properties.

When you apply a boolean modifier the second object can be deleted without affecting the result. Note that booleaned objects often need cleaning up with the Edge Split modifier to render accurately.

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