

# BlocksCAD : Making boxes, lids and model bookshelves

## Learning

In this project you will learn

- How to create and use Modules
- How to create scale models

In this worksheet, read everything. Things you must DO are marked with  to tick when done. *Hints are in italics*

## Project

To create boxes using a general module to create a box of any dimensions and to use this module to create more complex objects.

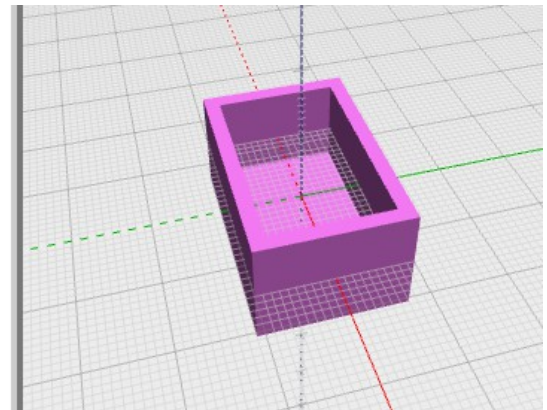
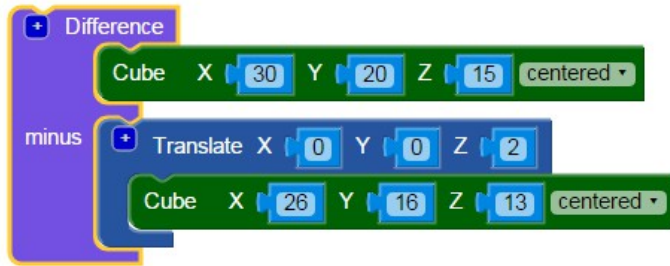
## Start a project in BlockSCAD

- Go to the BlocksCAD web site <https://blockscad.einsteinsworkshop.com/#>
- If you have an account, then login. If you don't you can use (WITH CARE) the class registration.
- Go to Projects then New.
- Give the project a name starting with your own name followed by Box eg. 'Noah Box'

## Make a box

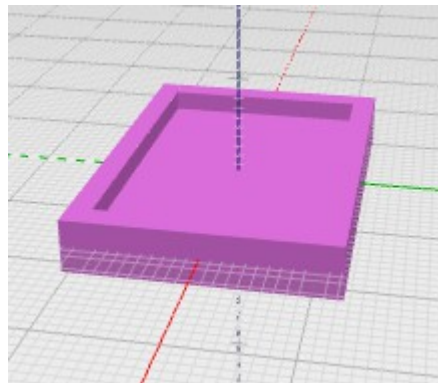
- Recall how you made a cup body *You remove an inner cylinder from a larger outer cylinder using Difference. The inner cylinder is lifted up a bit to make the base using Translate.*
- Use the same method to make a simple box using a cube. Make the box with a width (x) size of 30 , depth (y) of 20 and height of 15. The wall and base thickness should be 2. The boxes need to be centered.

## Solution



## Make a Lid

Think about how to make a simple lid for your box, one which fits over the top of the box like the one below:



Notice that the lid has the same form as the box, but with different dimensions.

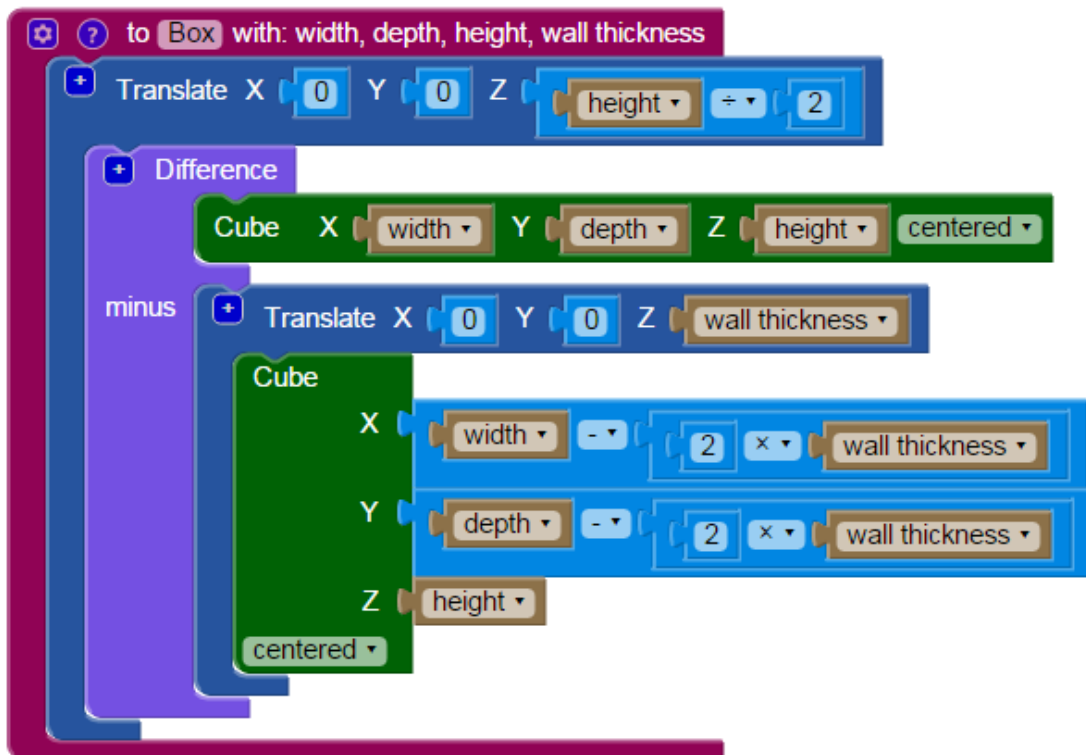
Make a lid for the box by duplicating the code for the box and changing the width, depth and height. The width will be the width of the box + twice the thickness of the lid, same for the depth and the height will be the height of the lip you want

You will find that these sizes will create a lid which is difficult to fit because the sides are not smooth and the printer isn't very accurate. So make the lid slightly bigger than the minimum size – perhaps by using  $2.5 * \text{thickness}$ .

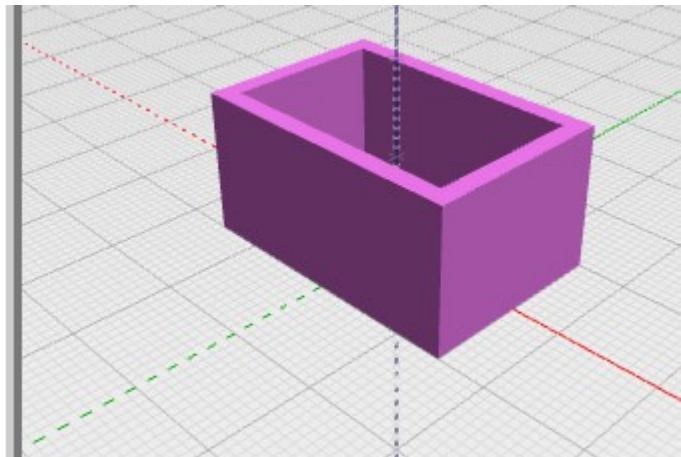
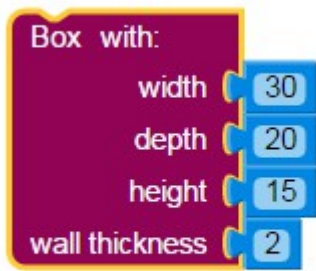
## Box Module

The box and the lid use the same code except that the numbers are different. A central programming idea is to capture the structure of the box in one place, called a module in BlocksCAD and provide the actual values for the width, depth, height and thickness each time the module is used. The variables in the module are called 'parameters'.

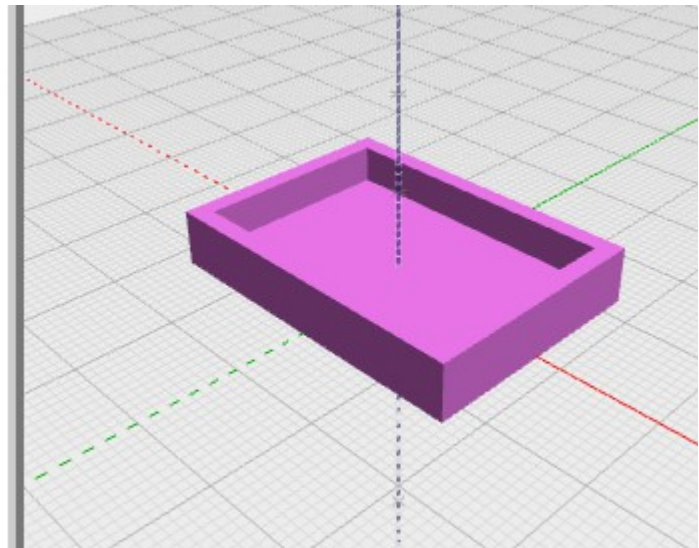
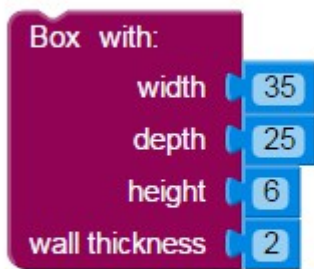
Here is the code for the box. I've added a translate upwards so the box lies on the x-y plane.



With this module we can make the box with :



and the lid with :



## Using the module

To save you having to make the Box module yourself, you can download it from my website <http://kitwallace.co.uk/BlocksCAD/home.xq> or find CW box on the class account on BlocksCAD . Please take care to make a copy of the file using your own name so that you don't damage my version.

Use this module to make a box which is 12 mm deep, twice as wide as it is deep and one third as high as it is wide. Make the wall thickness 1. *Work out these dimensions on paper first*

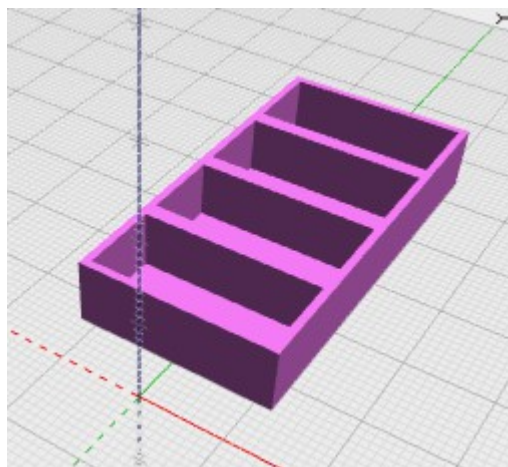
## Making a model bookcase

Each shelf of a bookcase looks like a box, so we can make a bookcase with a number of boxes placed side by side. To do this we will use a loop, and move each box to its position in the stack of shelves. *We will make the bookshelf lying on its back so it can be easily printed but this means that depth and height are swapped round so you need to be careful.*

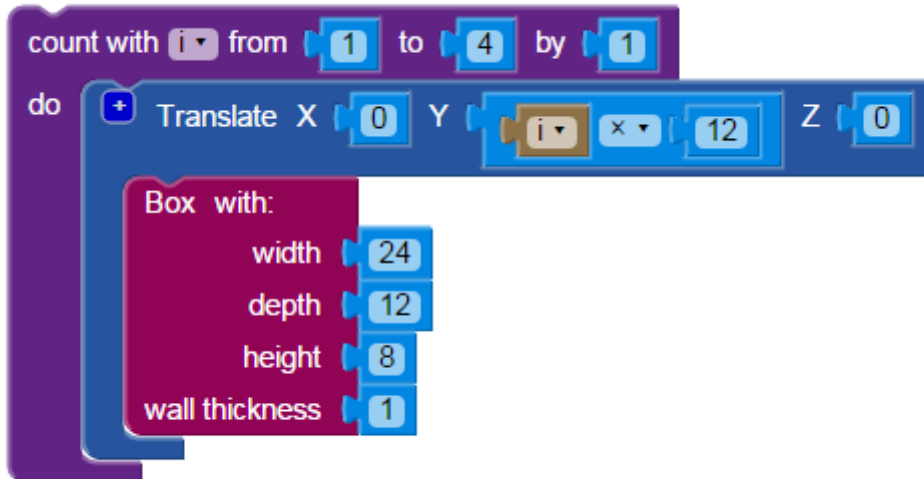
Take a Loop block and put it around the box you have just made. Let's make 4 shelves first so set the 'to' value to 4.

If we render this, we will see only one box because they will be all in the same place. We need to move or Translate each box to its position. We will place them along the Y axis and the Y measurement is depth, so we need to put the first box at  $y=\text{depth}$ , the second at  $2 * \text{depth}$ , the third at  $3 * \text{depth}$  etc. Add a Translate block with a math expression to calculate the Y position:

Try this yourself before looking at the answer. The result should look like this:



Code will look like this:



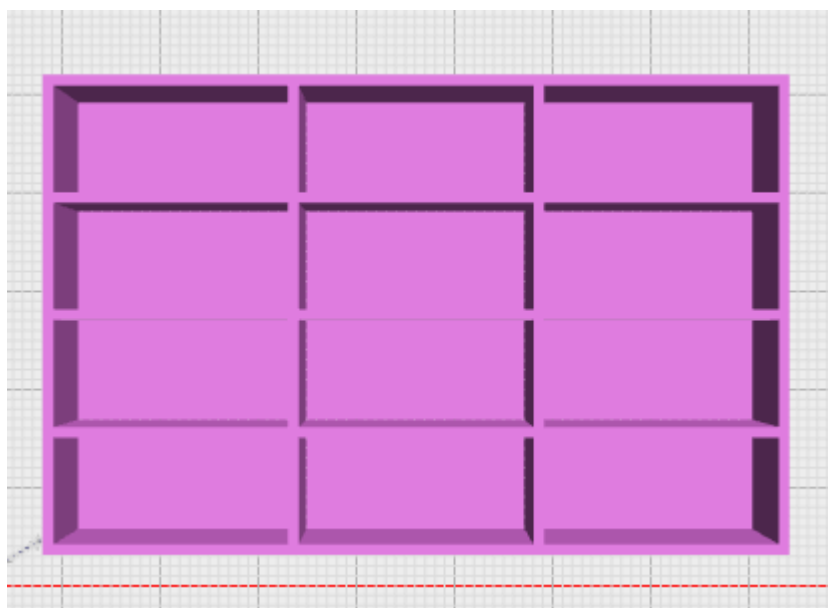
Looking closely we see that the shelves are double thickness.

Modify your code to make them only one thickness *Hint you need to change how far each box is translated.*

Make another bookcase with 6 shelves.

Make a bookcase which has 4 levels up and 3 along *Hint use two loops*

*It should look like this*



## Changing the module

We can use this module to make a box to hold something small like a coin. Measure the object to get the inside measurements, then work out the outside measurements and create the box.

When you know the inside measurements, it would be easier if the module allowed you to provide the values for the inner box and worked out the values for the outer box.

Copy the box module, rename it InnerBox and change the code so that width, depth and height are the inside measurements.

## Making toys to scale

Need some furniture for your doll's house? Need to plan a new kitchen? Need some scenic accessories for a model railway? 3D printing is an ideal way of creating small models but you will want them to look right amongst the other objects.

For doll's houses the most popular scale is 1/12 i.e an inch to a foot. So if the shelf of a bookcase is about 200 mm high, the model height would be  $200 / 12 = 16$  mm. Ours are a bit small since the height is on 12 mm so the scale is  $200/16 = 17$ ish

Model railways use a variety of scales but 1 in 76.4 is OO scale. Dinky cars are 1 in 64 scale. A typical scale for farm animals is one in 32. Wargaming sets use different scales like 1/100

Choose a type of model. Find out the scale or work it out from an object whose actual size you know (like the height of a person).

Design an object to fit into this toy set. Make it simple like these pieces of furniture (which are not to scale!) or a shed (how could you do a pitched roof?) Design it with BlocksCAD, save the blocks (not the STL) and send them to me for printing .

There are some examples of furniture on the Website to help you.

Chris Wallace  
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