The second Teaching and Learning Activity in Sokolnice
Project title: Let's teach each other
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	Class:
	Task number:
	Date:
	Classification:

The aim of the worksheet is to model a 3D object and then print it on a 3D printer.
Tasks: 1. Introduction to Blender
2. Modeling a snowflake
3. Modeling an angel
4. Modelling a bell or a gingerbread man
5. Making a final presentation
  - Documentation with photos and videos (to be used in the final presentation)

Task 1: Getting to know Blender

Program control

Working with the mouse

- selection is done with the right mouse button (with SHIFT key we can add or remove to the selection, otherwise it is always done from the beginning, with CTRL key we select with the lasso key - this only adds to the selection)

- the position of the 3D cursor is set by pressing the left mouse button

- rotate the middle mouse wheel to zoom in / out of the scene, pressing the wheel allows you to manually change the view of the scene, pressing the wheel and SHIFT at the same time allows you to move the scene

Keyboard shortcuts

ltm = left mouse button
ptm = right mouse button
km = mouse wheel

Key	Mod	Meaning of	Note
0		Camera view of the scene	Valid for 3D window
1		Front view (X, Z axis)	Valid for 3D window
3		Side view (Y, Z axes)	Valid for 3D window
7		Top view (X, Z axes)	Valid for 3D window

F12		Render	
TAB		Switch editing/object (or other) mode	
W	edit	Additional options for selected vertices/edges/ surfaces.	e.g. rounding, splitting, merging vectors, hiding / display vectors, etc.
spacebar	obj.	Menus for selected objects, which can also be found basic program menu, e.g. inserting another object into the scene (Mesh, camera, curves, etc.).	ATTENTION: in edit mode you would insert another object into the selected
G		Move, object/vertex/etc.	can be limited to the given axis by pressing the appropriate letter
S		Scaling (changing the size of an object)	can be limited to a given axis by pressing the appropriate letter
R		Rotation	can be limited to the axis axis by pressing the appropriate letter

E	edit	Extruding (pulling out vertices/edges/flats), i.e. creation of additional vertices/edges/faces	Extruding (pulling out vertices/edges/flats), i.e. creation of additional vertices/edges/faces
A		Select all / deselect all	Select all / deselect all
B		Object/vertex selection	Object/vertex selection
2xB	edit	Selection using circular area	Selection using circular area
Shift + F	edit	If we select vertexes, this option between to create an area between them.	If we select vertexes, this option between to create an area between them.
Shift + W	edit	Creation of twisted shapes (corners).	Creation of twisted shapes (corners).
Alt + C	obj.	Converting curves or text to Mesh	Converting curves or text to Mesh

		Adding a vertex associated with the selected vertices	Adding a vertex associated with the selected vertices
Ctrl + ltm	edit	or a nodal point to a curve (can be selected	or a nodal point to a curve (can be selected
		only one other point can be selected).	only one other point can be selected).
W	obj.	Boolean operations with objects (intersect,	Boolean operations with objects (intersect,
		union - sum, difference - difference).	union - sum, difference - difference).
P	edit	Separation of a selected part of an object from the rest.	Separation of a selected part of an object from the rest.
Shift + D	obj.	Duplication of an object.	
Alt + D	obj.	Duplication with preservation of the link with the original object.	
Ctrl + J	obj.	Union of selected objects.	
Ctrl + E	edit	Marking the seams of an object for UV mapping	we must first select the appropriate edges
U	edit	Creating unwrap texture drawing for UV	
M		Moving a selected object to another layer	
Ctrl + T	obj.	Creating a constraint where the object selected first follows the object that was selected second	we must first mark two objects
Alt + A	obj.	Running an animation in the blender window before rendering.	
I	obj.	Inserting an animation key.	
Ctrl + P	obj.	Creating a parent binding usable for example for copying the movement of one object by another, or to move along a curve or for skinning. (creating a binding between an object and the created bones).	we must first mark two objects
p	obj.	Starting GE blender.	exit by pressing kl. ESC
Ctrl + šipka nahoru / dolu		Renders 3D windows full screen or back to the classic window and panel layout	

3D object modelling

Introduction

Creating a 3D scene requires at least three key components: models, materials and lights. This section focuses on the first of these, which is modelling. Modeling is simply the art and science of creating a surface that either mimics the shape of a real object or expresses your imagination of abstract objects.

Modes

Depending on the type of object you are trying to model, there are different types of modeling modes. Because the modes are not specific to modeling, they are covered in various sections of the manual. Switching between modes during modeling is common. Some tools may be available in multiple modes, while others may be unique to a particular mode.

Editing mode

Edit mode is the main mode in which you model. Edit mode is used to edit the following types of objects:

- Surface meshes

- Curves

- Surfaces

- Meta spheres

- Text objects

- Grid

You can edit only the surface mesh of the object you are editing. To edit other objects, you can exit edit mode, select another object and enter edit mode, or use Edit Multiple Objects.

Primary shapes

Mode

Object mode and editing mode

Add ‣ Surface mesh

Shortcut

Shift-A

A common object type used in a 3D scene is a surface mesh. Blender comes with a number of surface meshes of "primitive" shapes from which you can start modeling. You can also add elements of primal shapes in edit mode on the 3D cursor.

General options

You can specify these options in the Edit Last Operation panel that appears when you create an object.

Options included in more than one initial shape are:

Generate UV

Generates the default UV unfolding of the new geometry. This will be defined in the first UV layer (to be added if necessary).

Radius/Size, Align to view, Position, Rotation

Plain

A standard plane is a single square surface that consists of four vertices, four edges, and one face. It is like a piece of paper lying on a table; it is not a three-dimensional object because it is flat and has no thickness. Objects that can be created using surfaces include floors, tabletops, or mirrors.

Cube

A standard cube contains eight vertices, twelve edges, and six faces and is a three-dimensional object. Objects that can be created with cubes include cubes, boxes, or crates.

Circle

Vertices

The number of vertices that define a circle or polygon.

The type of fill

Sets the way the circle is filled.

Fan of triangles

Fills the base with triangular faces that have vertices in the center.

N-triangle

Fills the base with one n-gon.

Nothing

No fill. Creates an outer ring of vertices only.

UV sphere

The standard UV sphere is made of quadrilateral faces and a triangular fan at the top and bottom. It can be used for texturing.

Segments

Number of vertical segments. Like the Earth's meridians, going from pole to pole.

Rings

The number of horizontal segments. They are like the Earth's parallels.

Polygon

A polyhedron is a polyhedron sphere formed by triangles. Polygons are usually used to achieve a better isotropic arrangement of vertices than UV spheres, in other words, they are uniform in every direction.

Division

How much recursion is used to define the sphere. At level 1, the polyhedron is an icosahedron, consisting of 20 equilateral triangular faces. Each increase in the number of divisions divides each triangular face into four triangles.

Roller

Objects that can be made from cylinders include handles or rods.

Vertices

The number of vertical edges between the circles used to define a cylinder or prism.

Depth

Sets the initial height of the cylinder.

Header fill type

Similar to a circle (see above). If none is set, the object created will be a tube. Objects that can be created from a pipe include pipes or drinking glasses (the basic difference between a cylinder and a pipe is that a cylinder has closed ends).

Cone

Objects that can be created from cones include spikes or pointed hats.

Peaks

The number of vertical edges between circles or vertices that define a cone or needle.

Radius 1

Sets the radius of the circular base of the cone.

Radius 2

Sets the radius of the tip of the cone. This creates a truncated edge (pyramid or truncated cone). A value of 0 creates a standard cone shape.

Depth

Sets the initial height of the cone.

Base fill type

Similar to the circle (see above).

Ring (toroid)

The original wreath-shaped shape created by rotating a circle on its axis. The overall dimensions can be defined in two ways.

Operator preferences

Set the ring (toroid) preferences for reuse. These preferences are stored as scripts in the preferences settings folder.

Majority segments

The number of segments of the main ring toroid in the poloidal direction. If you think of a toroid as a "rotation" operation about an axis, this is the number of rotations of the ring.

Minority segments

The number of segments of the minor ring of the toroid in the toroidal direction. This is the number of vertices of each ring segment.

Dimensional mode

Changes the way the toroid is defined.

Majority/minority, outer/inner

Majority radius

The radius from the origin to the center of the cross sections.

Minority radius

The radius of the cross section of the toroid.

Outer radius

When displayed along the major axis, the radius from the center to the outer edge.

Inner radius

When displayed along the major axis, this is the radius of the hole at the center.

Network

A regular square grid that is a divided plane. Pattern objects that can be created from grids include landscapes and organic surfaces.

X division

The number of spans on the X-axis.

Y division

The number of spans on the Y-axis.

Monkey

Adds a stylized monkey head that can be used as a test surface mesh, use the Split Surface function for a more perfect shape.

It is intended to be a test mesh of a surface similar to:

- Utah Teapot

- Stanford Bunny.

Toolbar

Tools for grid editing mode:

Select

Select or Move.

Select by circle or Select or Select or Grid.

Selects the geometry by dragging the circle.

Select the lasso by selecting a circle with the rotation of the lasso.

Selects geometry by drawing a lasso.

Cursor

Changes the location of the 3D cursor.

Move

A tool to change the position.

Rotation

Tool for rotation.

Scale

A tool for scaling.

Scale cage

Rescale an object by controlling its cage.

Transform

Tool for adjusting the displacement, rotation and scale of objects.

Annotation

Draws an annotation freehand.

Line annotation

Draws a straight annotation line.

Polygon Annotation

Draws a polygon annotation.

Remove annotation

Removes a previously drawn annotation.

Measurement

Measures distances in the scene.

Add cube

Interactively adds a surface mesh to the Cube object.

Add Cone

Interactively adds a surface mesh to the Cone object.

Add Cylinder

Interactively adds a surface mesh to the Cylinders object.

Adding a UV sphere

Interactively adds a surface mesh to the UV Sphere object.

Add polyhedron

Interactively adds a surface mesh to a polyhedron object.

Eject Area

Ejects a collectively selected region freely or along an axis.

Ejects the developed

Ejects a region and dissolves overlapping geometry.

Eject along the normal

Ejects a region along their local normals.

Extension alone

Ejects each individual feature along its local normal.

Eject to cursor

Ejects selected vertices, edges, or faces toward the mouse cursor.

Patch insertion

Inserts selected patches.

Conical surface

Creates a bevel from the selected elements.

Cut Loop

Creates a cut loop along the surface mesh.

Offset cutting loop edge

Adds two edge loops on either side of the selected loops.

Knife

Creates a knife cut on the surface mesh. Press the Enter key to confirm the cut.

Cut

Separates the surface mesh.

Build polygon

Creates geometry by adding vertices one at a time.

Rotation

Creates new geometry by extending and rotating.

Rotate copies

Creates new geometry by creating a copy and rotating it.

Smooth

Flattens the angles of the selected vertices.

Random

Randomly selects vertices.

Edge Offset

Moves the edge along the face.

Vertex Offset

Moves a vertex along an edge.

Shrink/flatten

Shrinks the selected vertices along their normals.

Print/retract

Prints or downloads (scales) the selected elements.

Cut

Scrolls through the selected elements.

Round

Moves the vertices of a spherical shape outward around the center of the object.
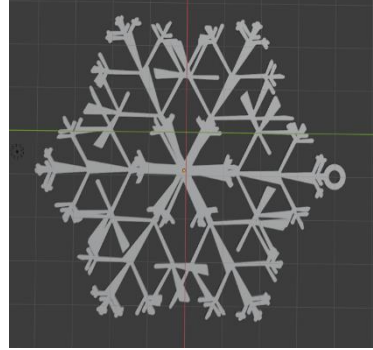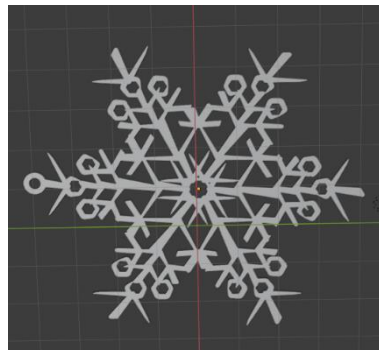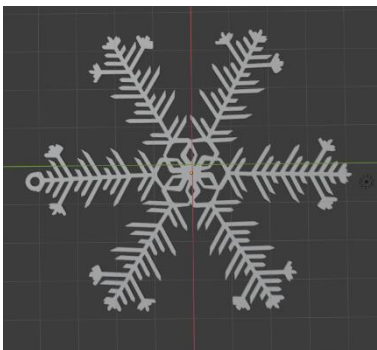
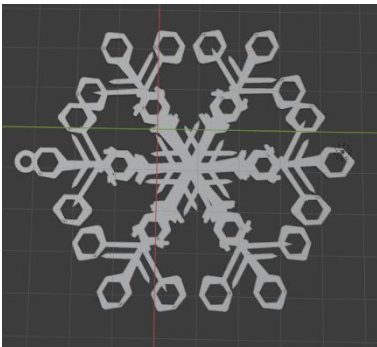**Tears off an area**

Tears off an area and then moves it.

Breaks off an edge

Pulls the vertices out and then moves them.

Task 2 - Modelling a snowflake

Select one of the following sample 3D snowflake objects and create it in blender.

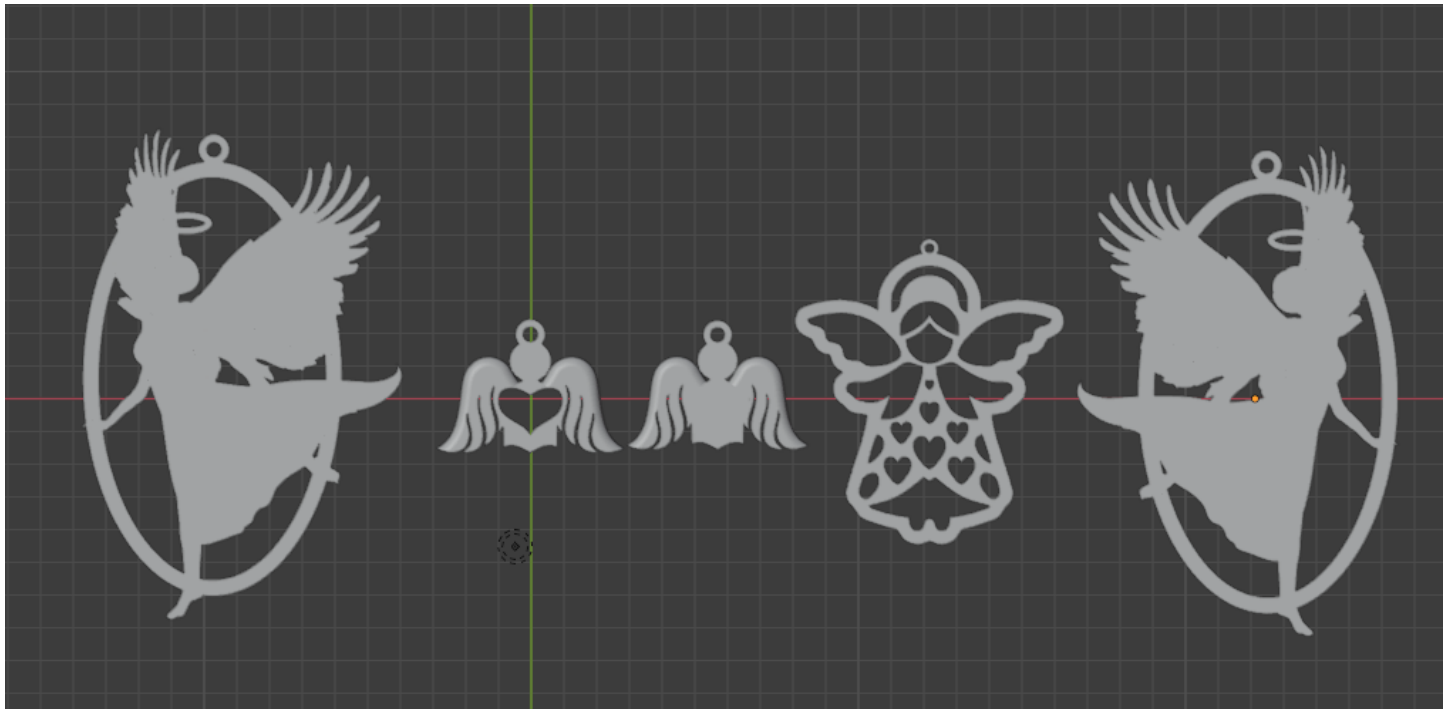The final product should look like this after modeling and printing on a 3D printer:

Task 3 - Modelling an angel

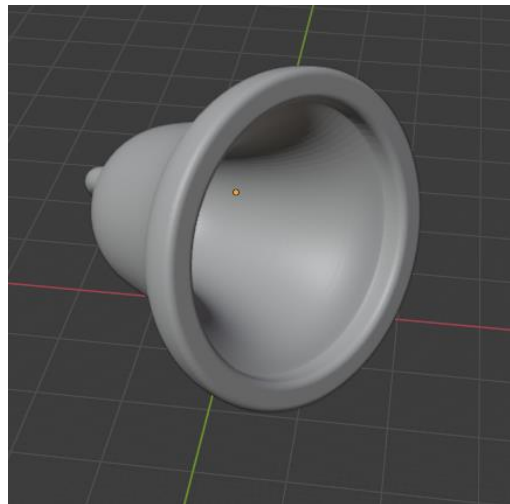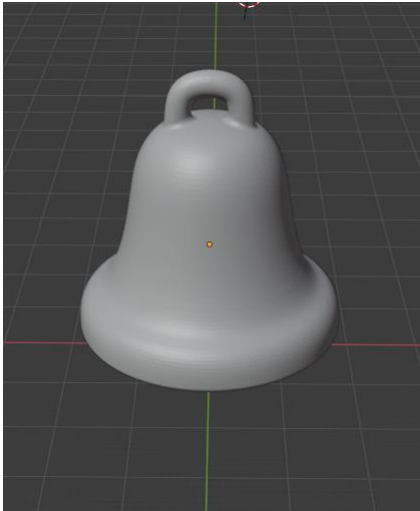Select one of the following sample 3D angel objects and create it in blender.

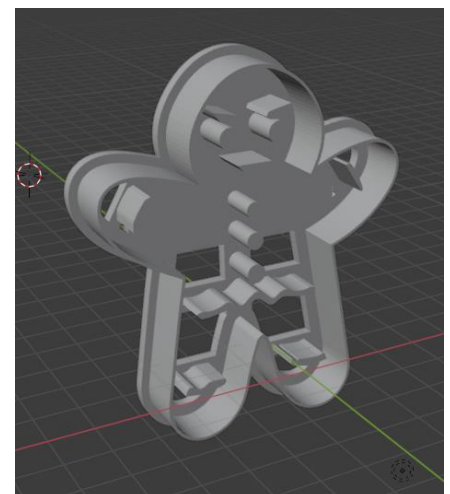The final product should look like this after modeling and printing on a 3D printer:
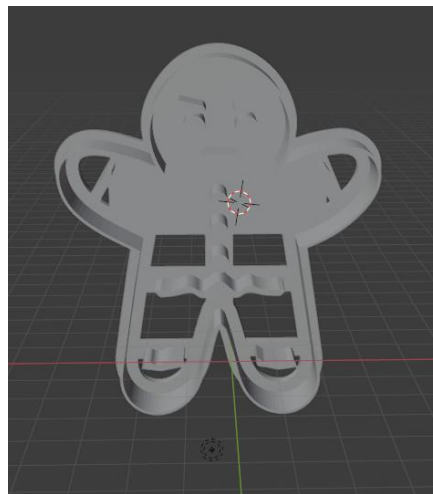
Task 3 - Modelling a bell or gingerbread house mould

Select one of the following sample 3D objects and create it in blender.

Ring

Gingerbread house mould

The final product should look like this after modeling and printing on a 3D printer:

Task 4 - Making a final presentation in Power Point

Create a short presentation of 4-6 slides on what you have managed to create or do. The conclusion of your work will be an evaluation of the whole session. Include a short video and photos of your work in your presentation.