

Chapter 01: Python's Integration with Blender

> (C:) > Program Files > Blender Foundation	
Name	Modified
Blender 2.93	9/28/2021 7:23 PM
Blender 3.1	4/15/2022 12:26 AM
Blender 3.2	6/13/2022 7:44 PM
Blender 3.3	9/15/2022 10:09 AM
Blender 3.4	3/13/2023 11:23 AM

← Microsoft Store

blender

PA

— □ ×

Home

Apps

Gaming

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Library

Help



Blender

Blender Foundation

Get

4.5 ★ Average

58 Ratings

Multimedia design

 **PEGI 3**
Age Rating: PEGI, PEGI 3

Screenshots



Description

Blender is the Free and Open Source 3D creation suite. It supports the entirety of the 3D pipeline—modeling, sculpting, rigging, 3D and 2D animation, simulation, rendering, compositing, motion tracking and video editing. Support Blender development on <https://fund.blender.org>.

Ratings and reviews

4.5

58 RATINGS

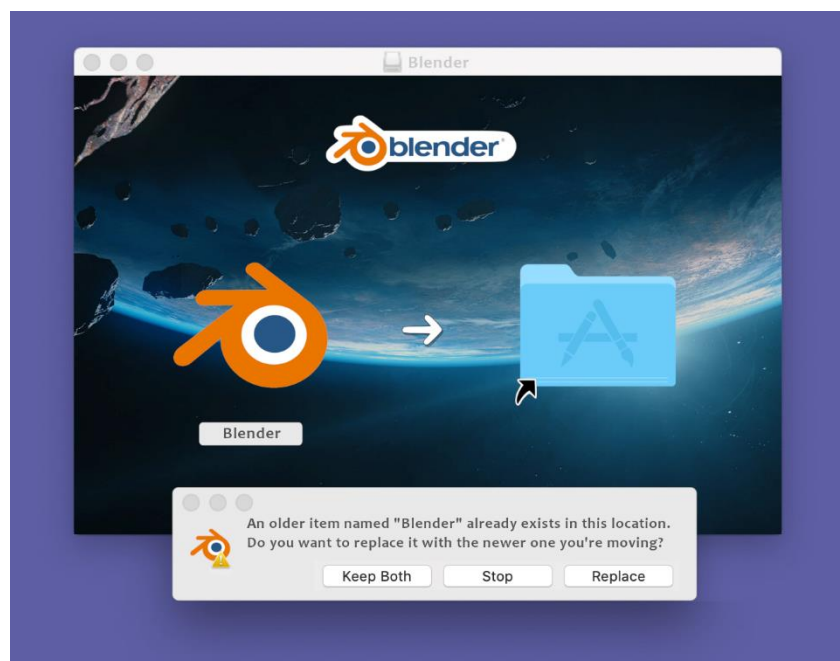
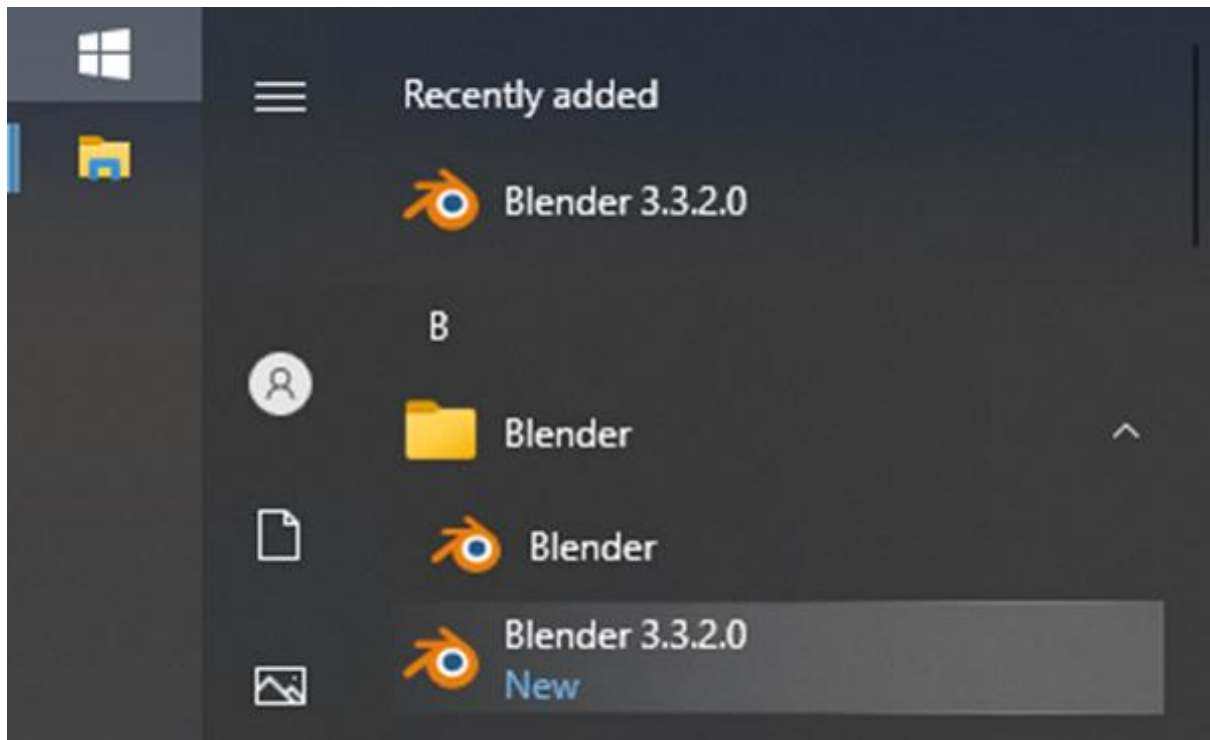
5 ★

4 ★

3 ★

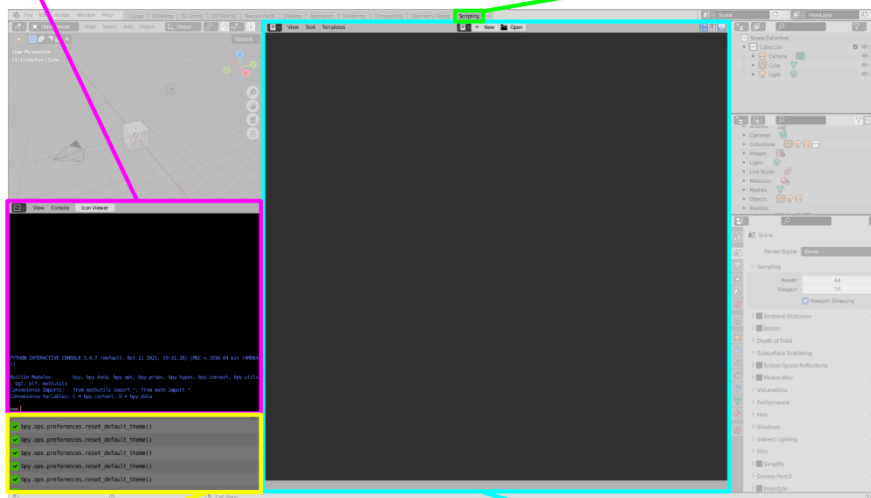
2 ★

1 ★



Python Console

Scripting Tab



Info Log

Text Editor

```
View Console
PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]
Builtin Modules:      bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data
>>> |
```

```
>>> print("Hello World!")
Hello World!
>>> |
```



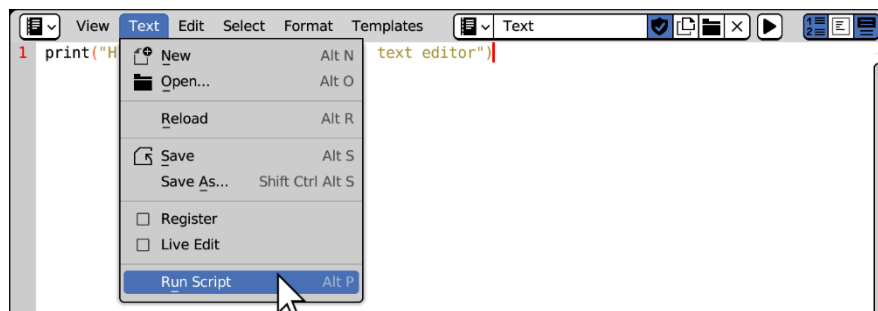
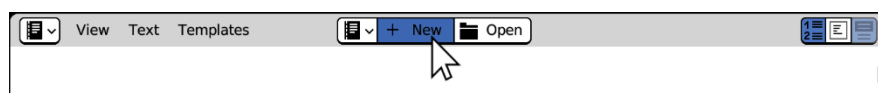
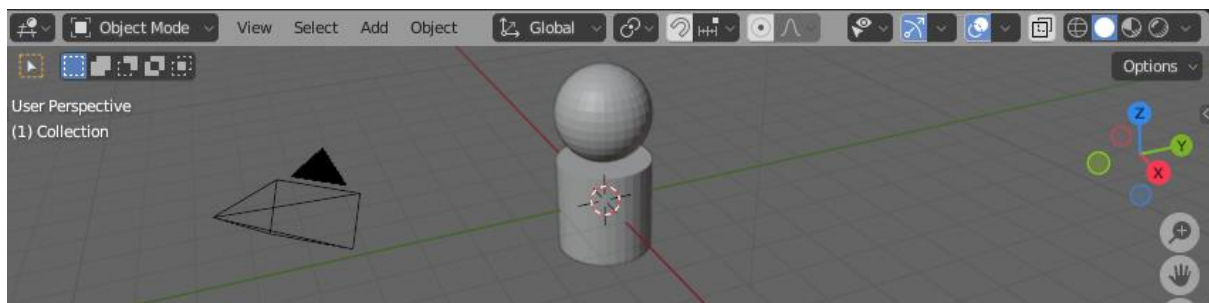
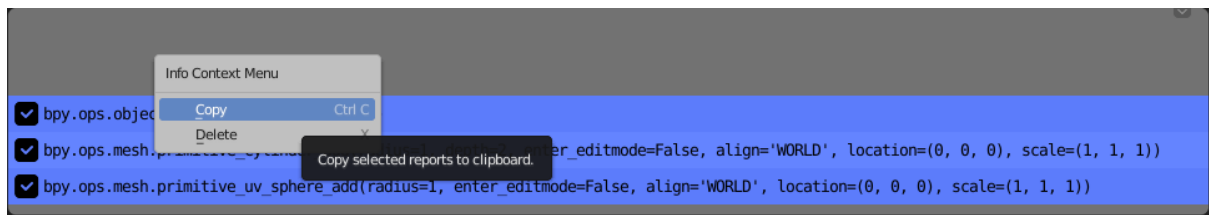
function name function argument

```
>>> print("We are learning Python here")
We are learning Python here
```

```

✓ bpy.ops.object.delete(use_global=False)
✓ bpy.ops.mesh.primitive_cylinder_add(radius=1, depth=2, enter_editmode=False, align='WORLD', location=(0, 0, 0), scale=(1, 1, 1))
✓ bpy.ops.mesh.primitive_uv_sphere_add(radius=1, enter_editmode=False, align='WORLD', location=(0, 0, 0), scale=(1, 1, 1))

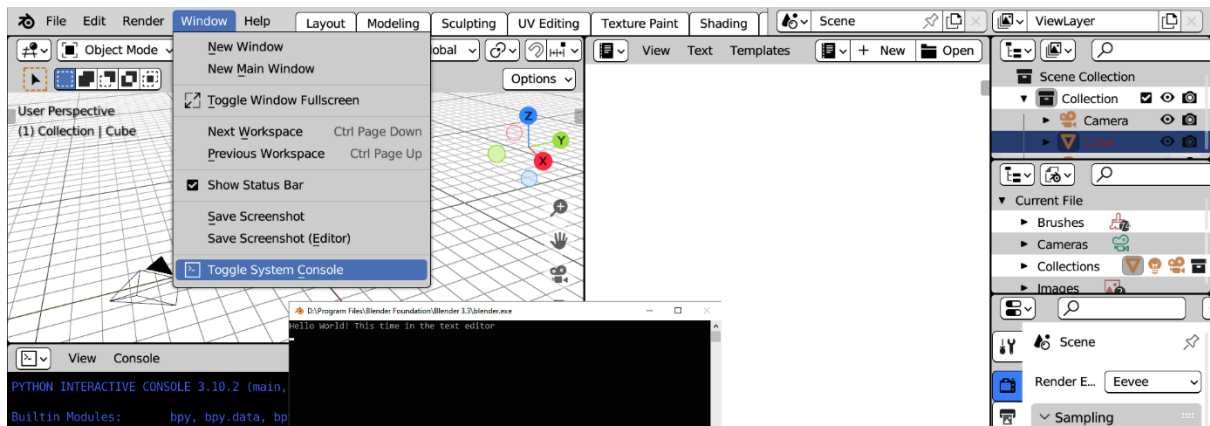
```



```

✓ bpy.ops.text.run_script()

```



```

1 print("Hello World! This time in the Text Editor")

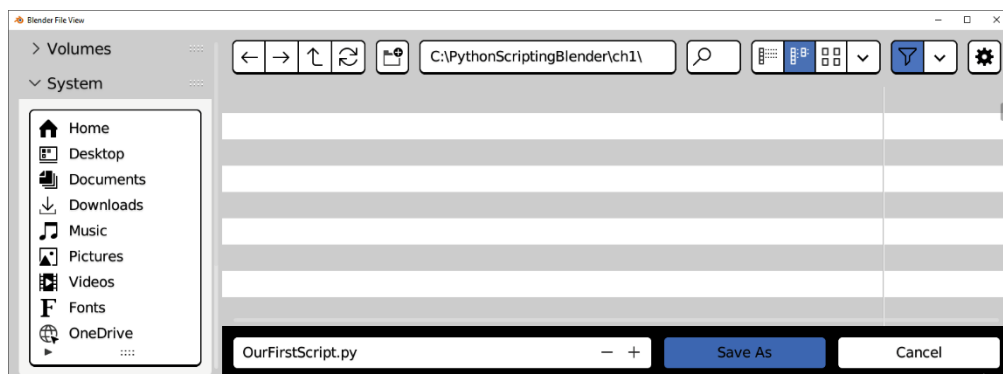
```

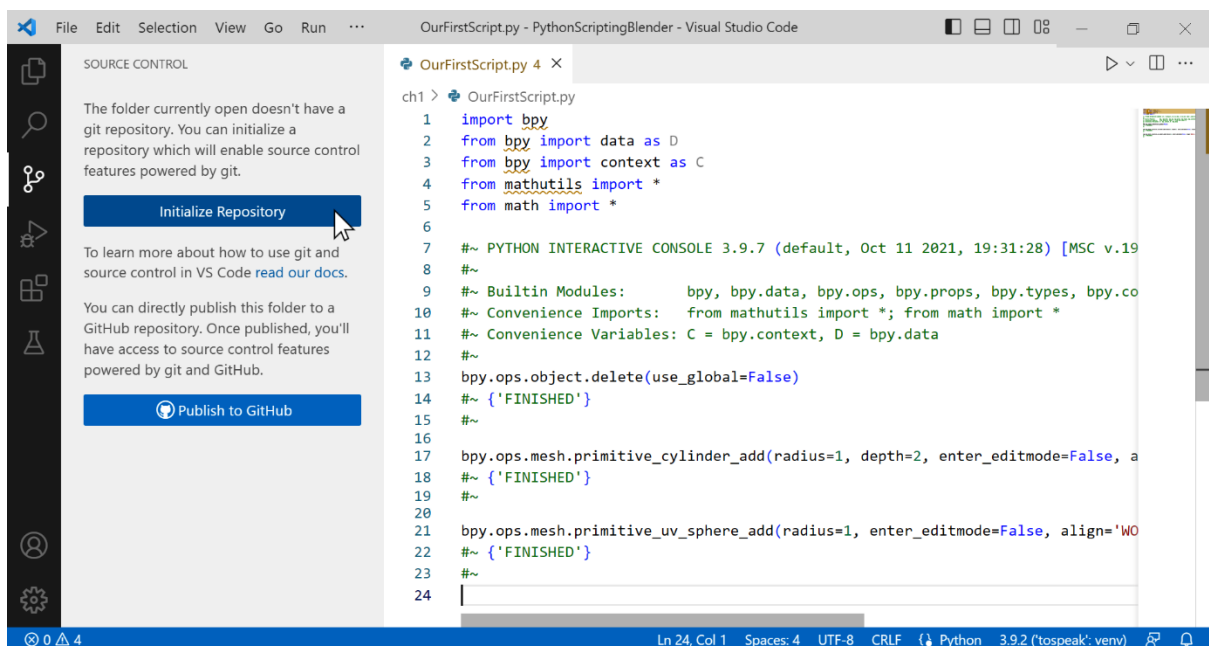
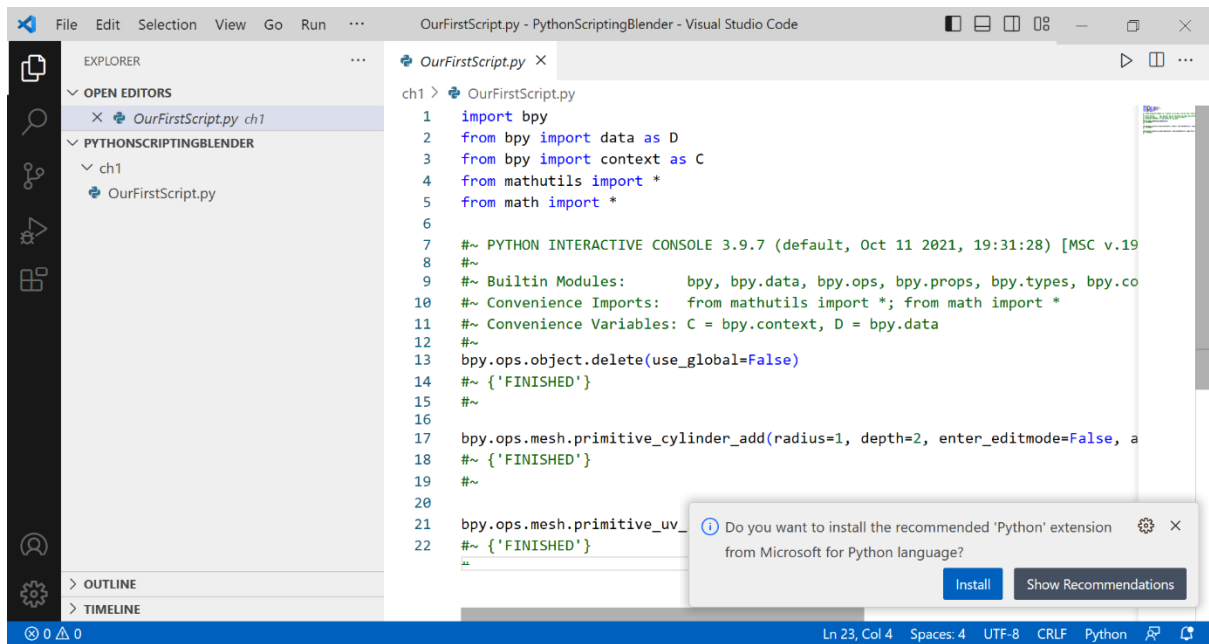
```

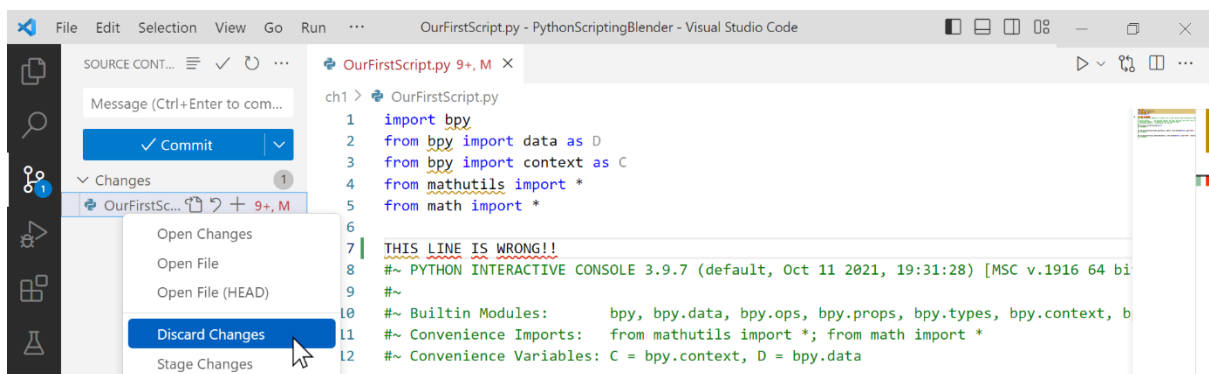
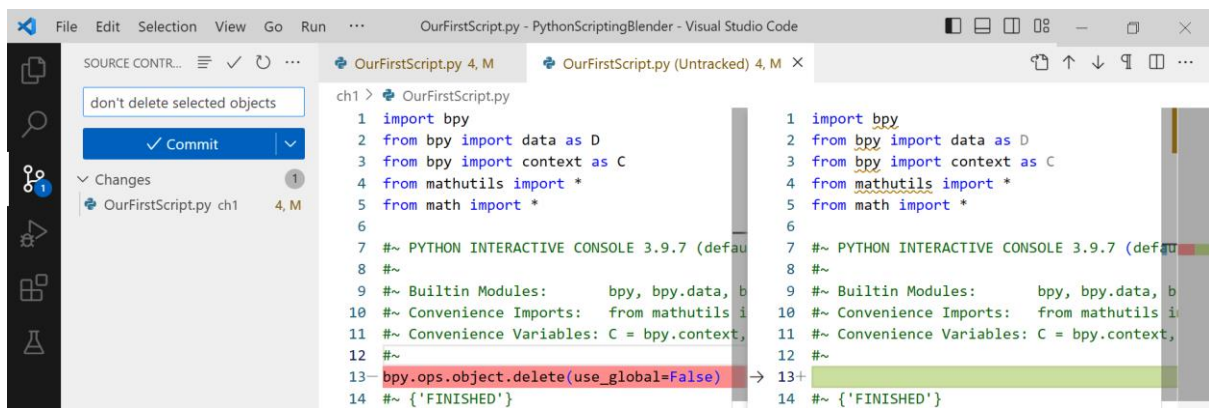
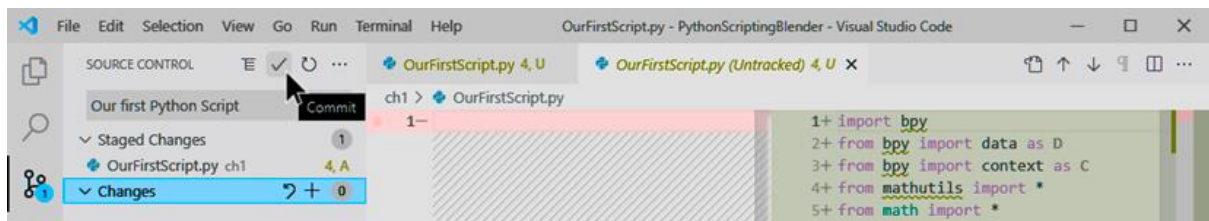
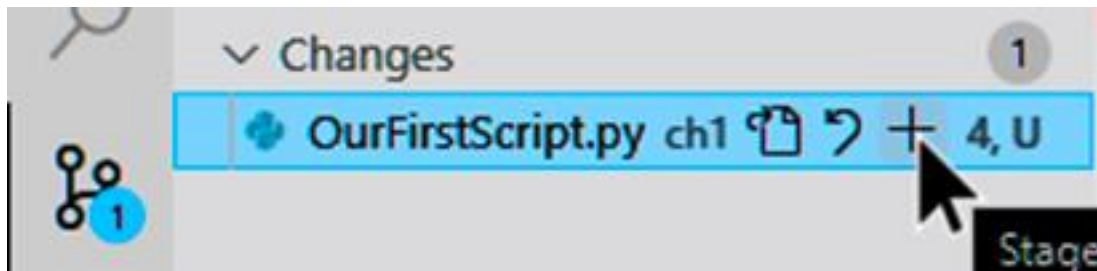
import bpy
from bpy import data as D
from bpy import context as C
from mathutils import *
from math import *

#~ PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]
#~
#~ Builtin Modules:      bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
#~ Convenience Imports:  from mathutils import *; from math import *
#~ Convenience Variables: C = bpy.context, D = bpy.data
#~
bpy.ops.object.delete(use_global=False)
#~ {'CANCELLED'}
#~
bpy.ops.mesh.primitive_cylinder_add(radius=1, depth=2, enter_editmode=False, align='WORLD', location=(0, 0, 0), scale=(1, 1, 1))
#~ {'FINISHED'}
#~
bpy.ops.mesh.primitive_uv_sphere_add(radius=1, enter_editmode=False, align='WORLD', location=(0, 0, 2), scale=(1, 1, 1))
#~ {'FINISHED'}

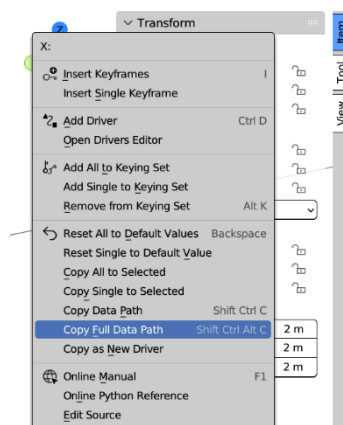
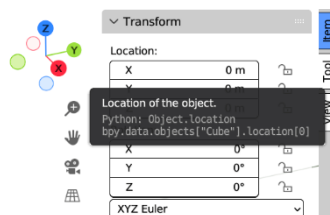
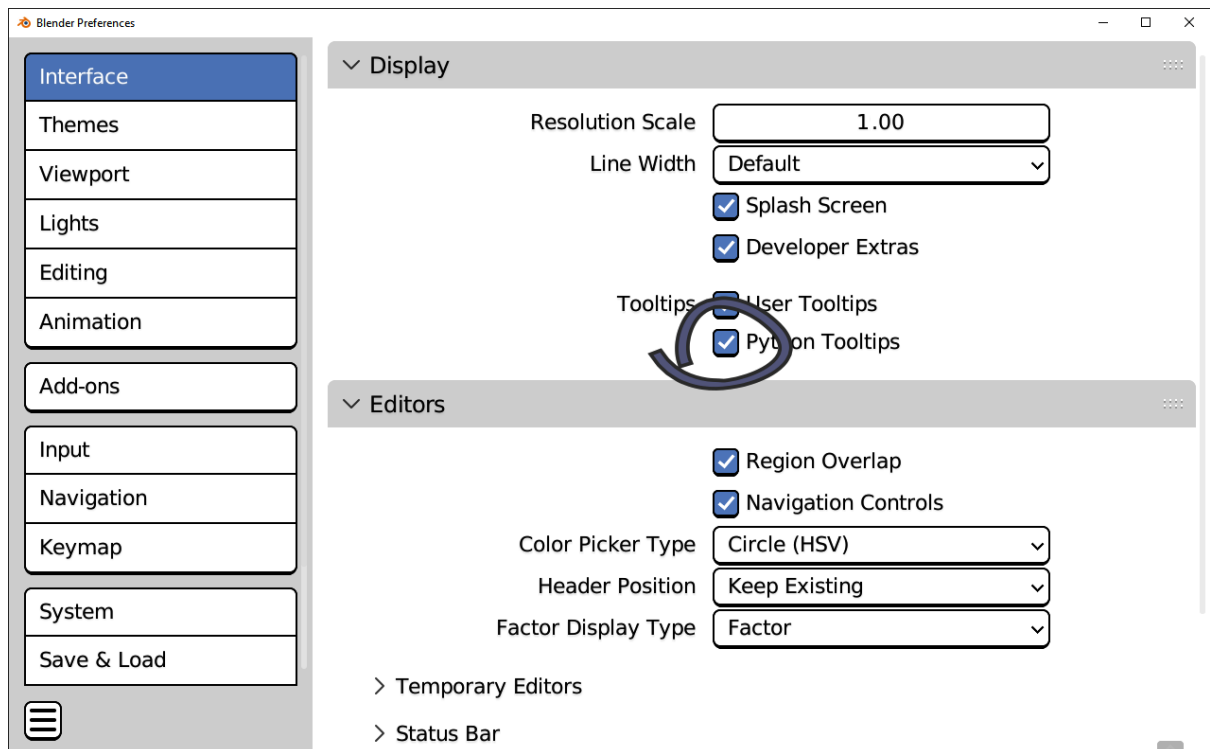
```







Chapter 02: Python Entities and API



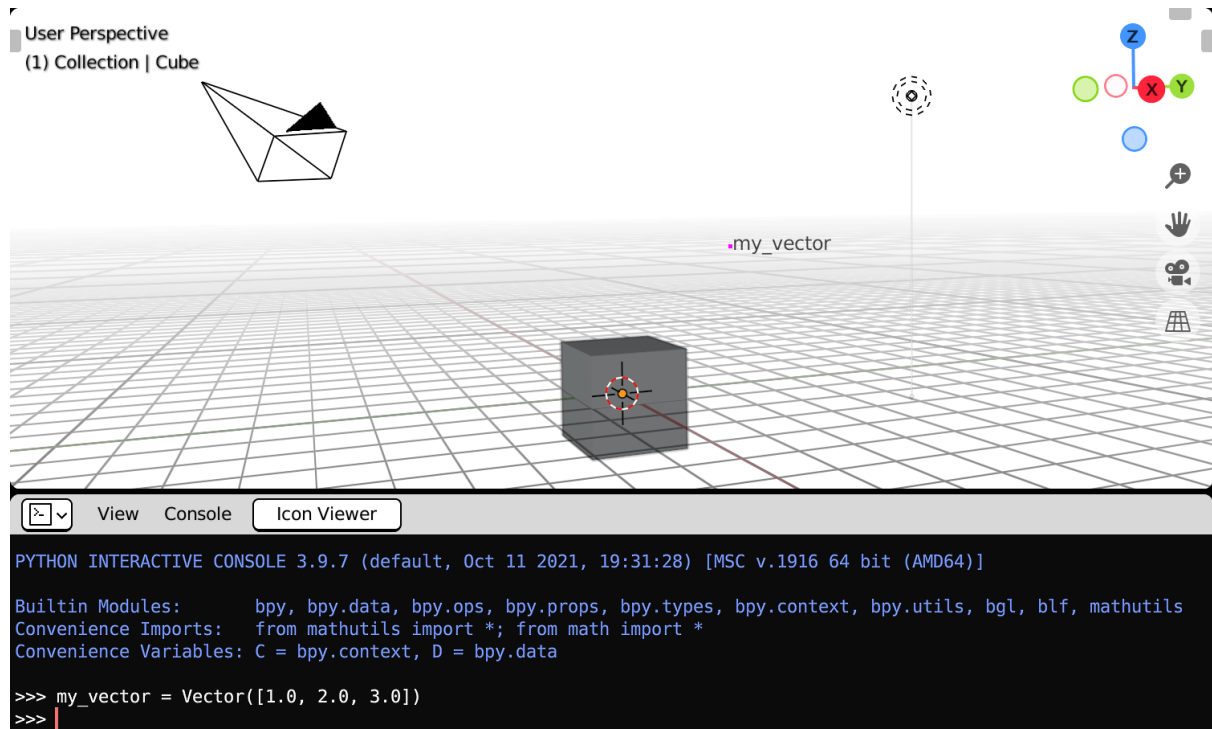
```

PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]

Builtin Modules:      bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>> print(
print(value, ..., sep=' ', end='\n', file=sys.stdout, flush=False)
Prints the values to a stream, or to sys.stdout by default.
Optional keyword arguments:
file: a file-like object (stream); defaults to the current sys.stdout.
sep: string inserted between values, default a space.
end: string appended after the last value, default a newline.
flush: whether to forcibly flush the stream.
>>> print(

```



```

PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]

Builtin Modules:      bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>>

```

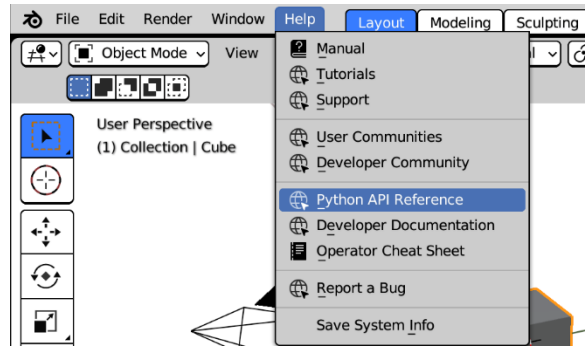
```

PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]

Builtin Modules:      bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>> bpy.
    app
    context
    data
    msgbus
    ops
    path
    props
    types
    utils
>>> bpy.

```



```

View Console
PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]

Builtin Modules:  bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>> help(Euler)
Help on class Euler in module builtins:

class Euler(object)
  .. class:: Euler(angles, order='XYZ')
  .. This object gives access to Eulers in Blender.
  .. seealso:: 'Euler angles' <https://en.wikipedia.org/wiki/Euler_angles> on Wikipedia.
  :param angles: Three angles, in radians.
  :type angles: 3d vector
  :param order: Optional order of the angles, a permutation of 'XYZ'.
  :type order: str

  Methods defined here:
    __copy__(...)
    .. function:: copy()
    Returns a copy of this euler.

```

```

class mathutils.Euler(angles, order='XYZ')

This object gives access to Eulers in Blender.

See also
Euler angles on Wikipedia.

Parameters:
  • angles (3d vector) - Three angles, in radians.
  • order (str) - Optional order of the angles, a permutation of 'XYZ'.

import mathutils
import math

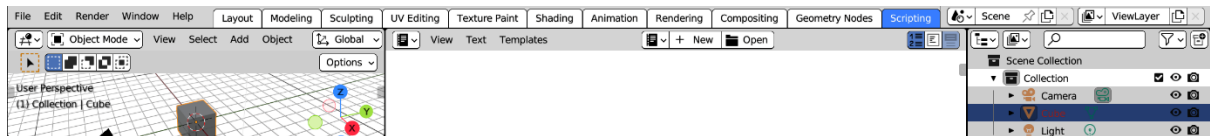
# create a new Euler with default axis rotation order
eul = mathutils.Euler((0.0, math.radians(45.0), 0.0), 'XYZ')

# rotate the Euler
eul.rotate_axis('Z', math.radians(10.0))

# you can access its components by attribute or index
print("Euler x", eul.x)
print("Euler y", eul[1])
print("Euler z", eul[-1])

# components of an existing Euler can be set
eul[0] = 1.0, 2.0, 3.0

```



```

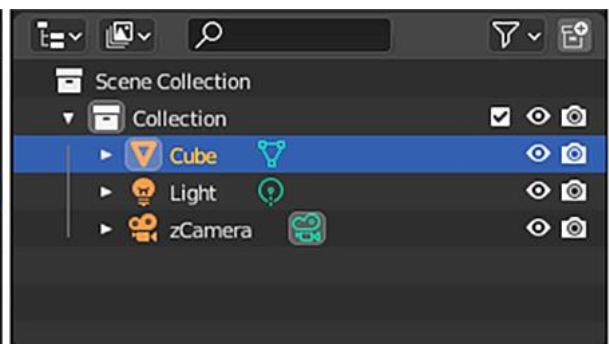
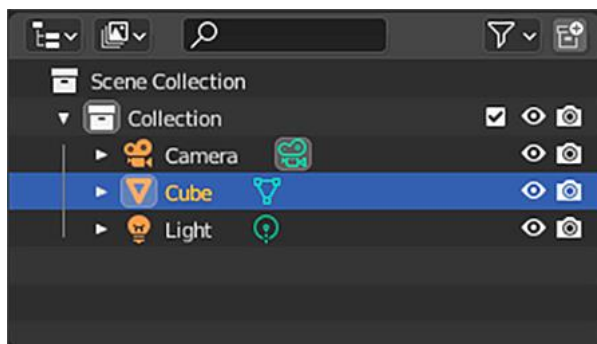
View Console
PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]

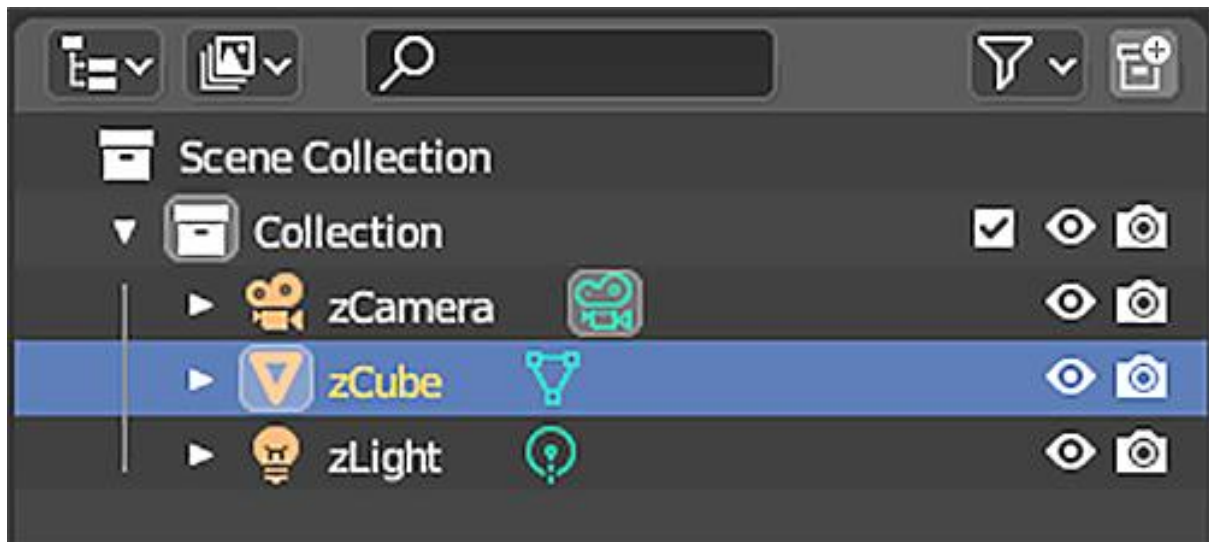
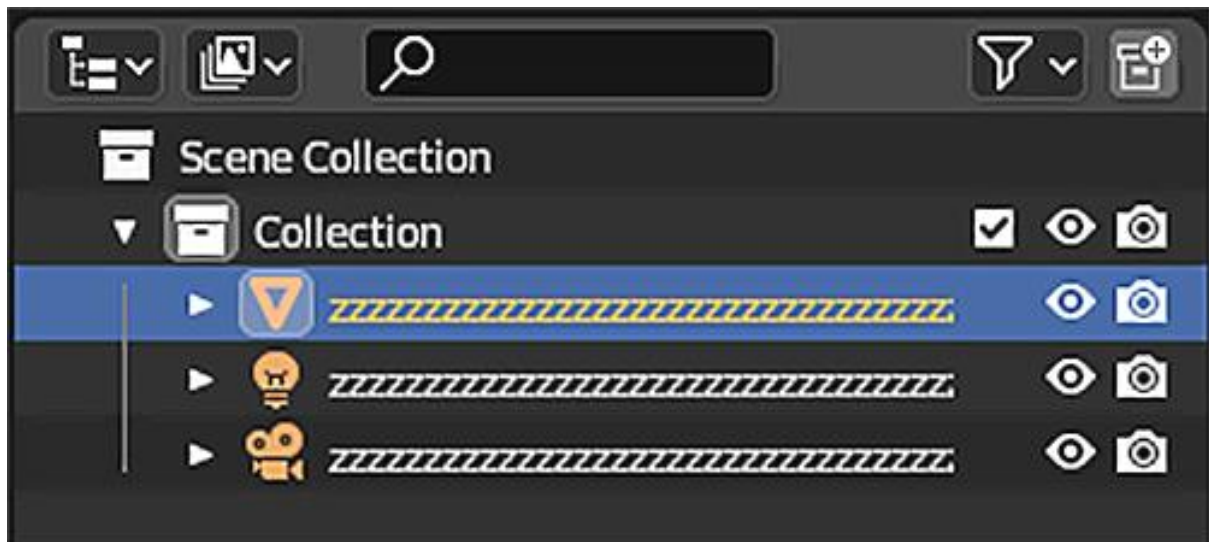
Builtin Modules:  bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>> bpy.data.objects['
Camera']
Cube']
Light']

>>> bpy.data.objects['

```





```
View Console

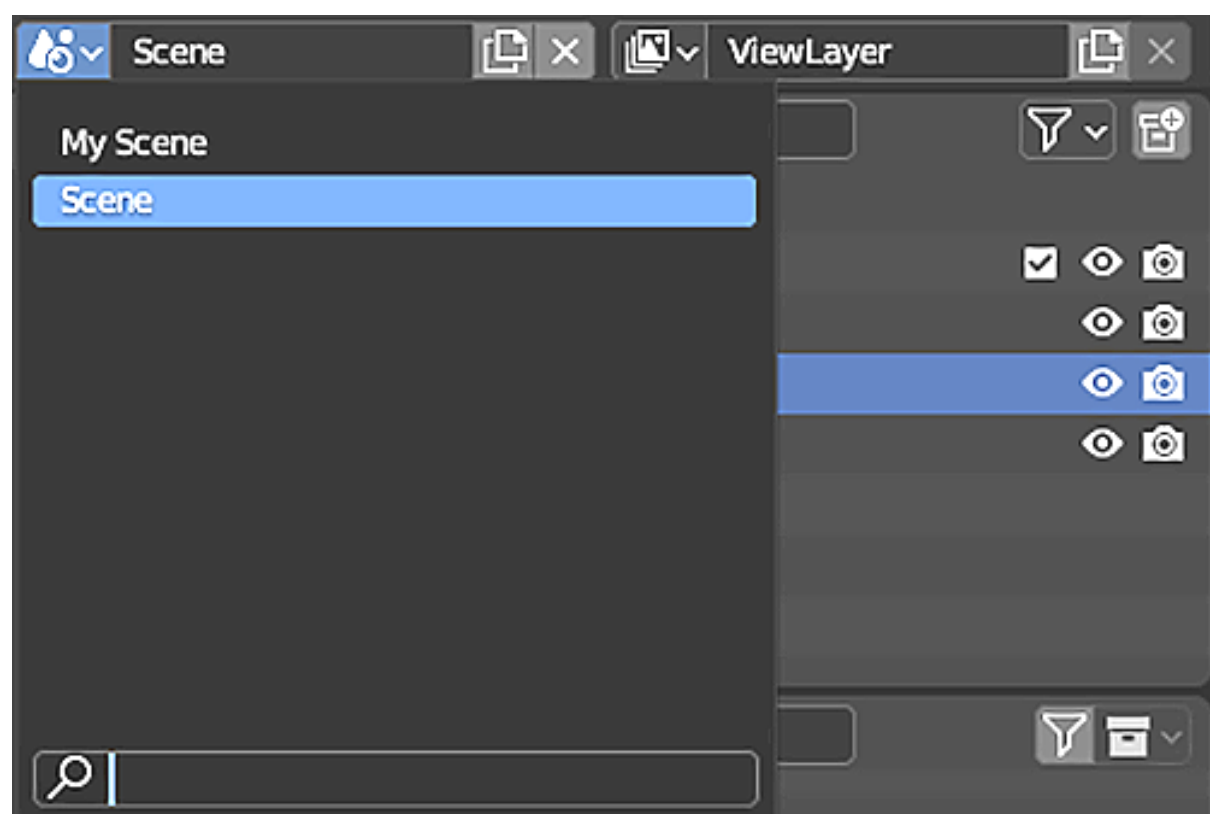
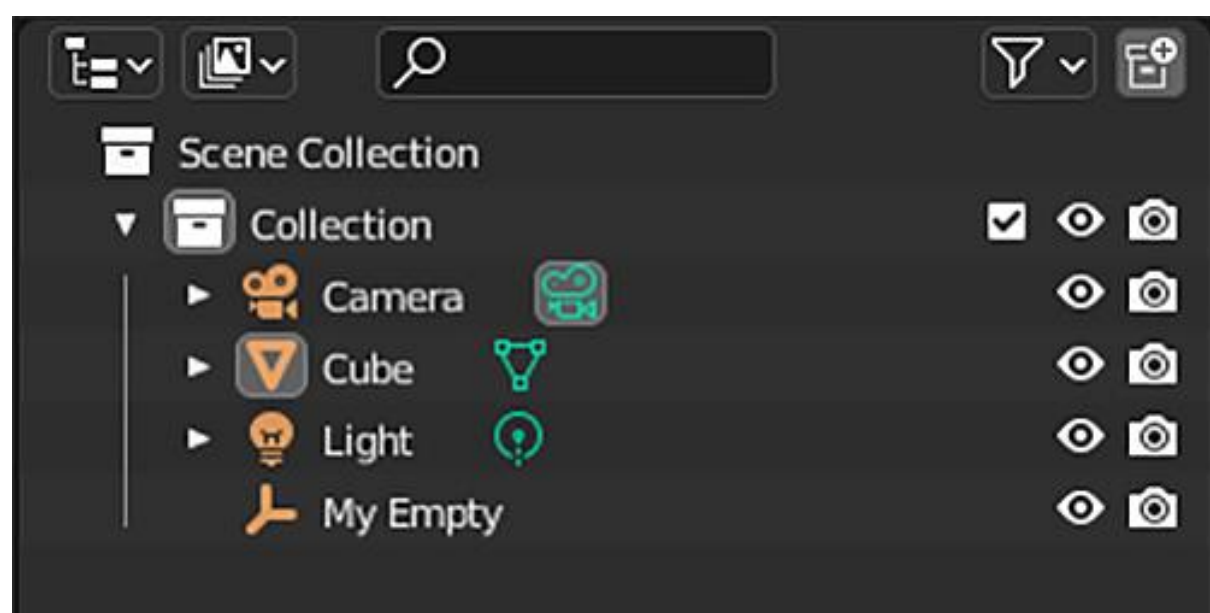
PYTHON INTERACTIVE CONSOLE 3.10.2 (main, Jan 27 2022, 08:34:43) [MSC v.1928 64 bit (AMD64)]

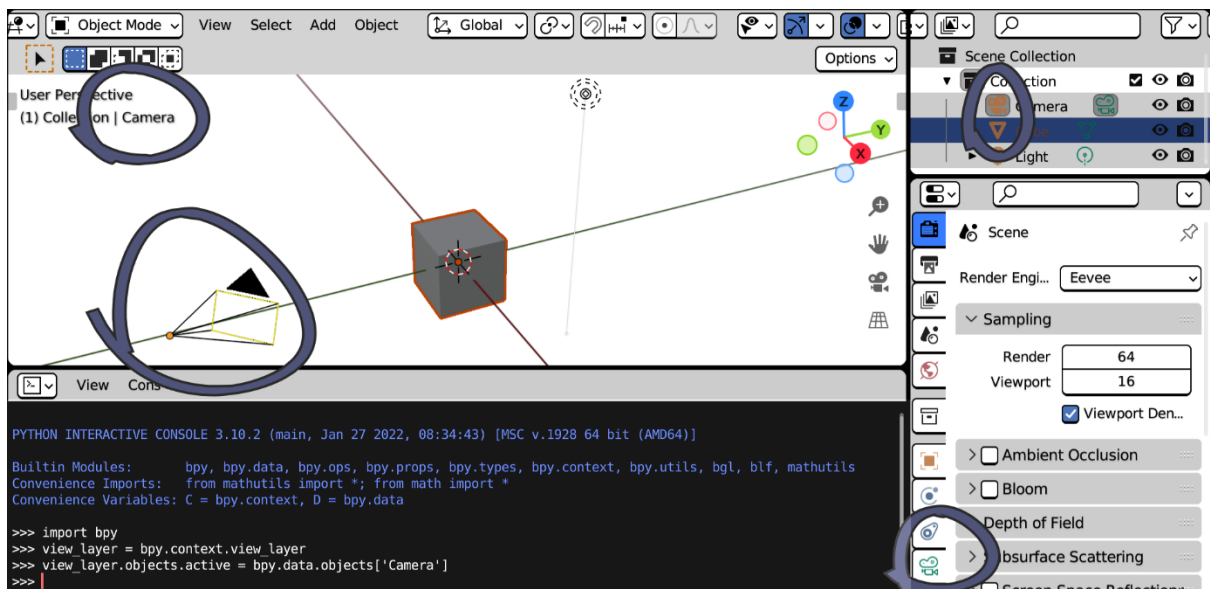
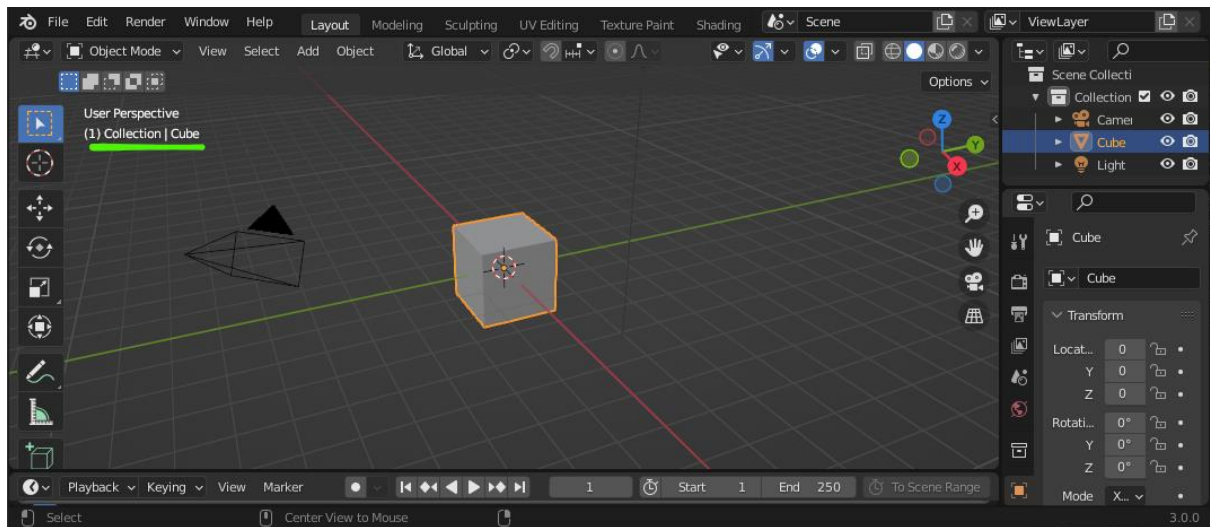
Builtin Modules:      bpy, bpy.data, bpy.ops, bpy.props, bpy.types, bpy.context, bpy.utils, bgl, blf, mathutils
Convenience Imports:  from mathutils import *; from math import *
Convenience Variables: C = bpy.context, D = bpy.data

>>> import bpy
>>> my_empty = bpy.data.objects.new('My Empty', None)
>>> print('New Empty created:', my_empty)
New Empty created: <bpy_struct, Object("My Empty") at 0x00000143279FAB08>

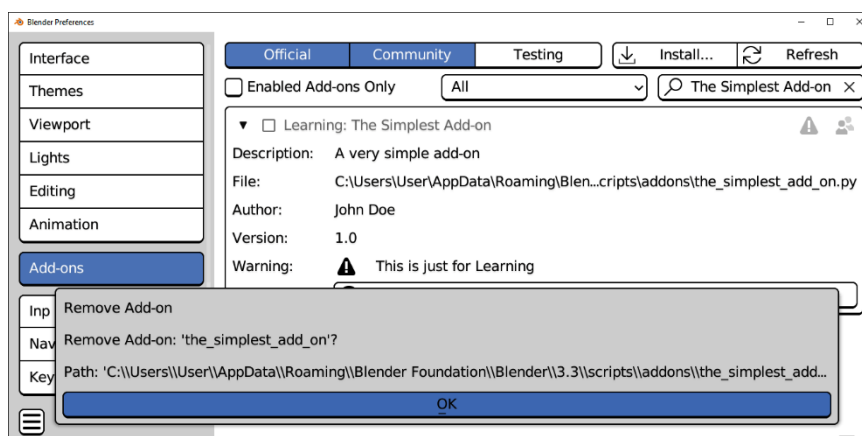
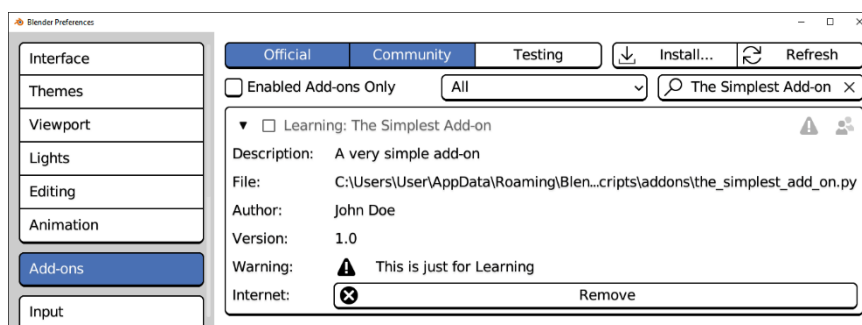
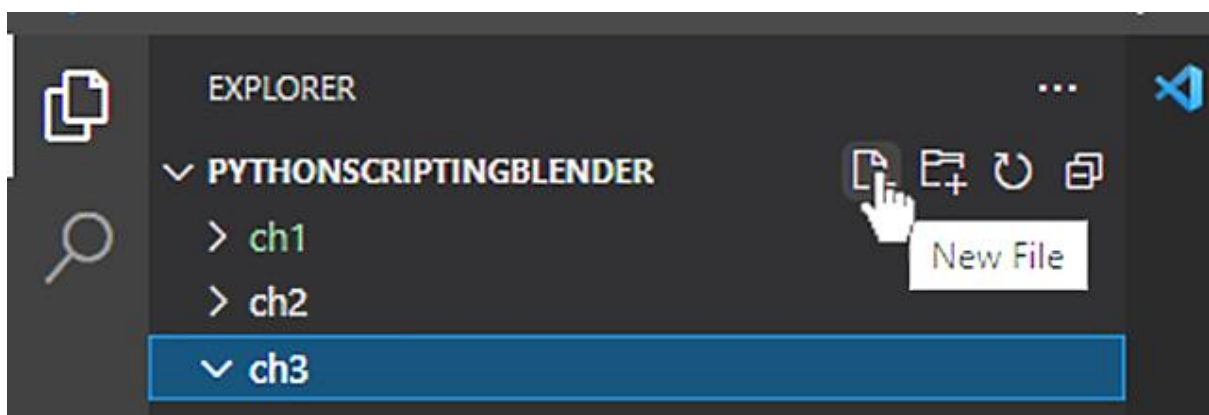
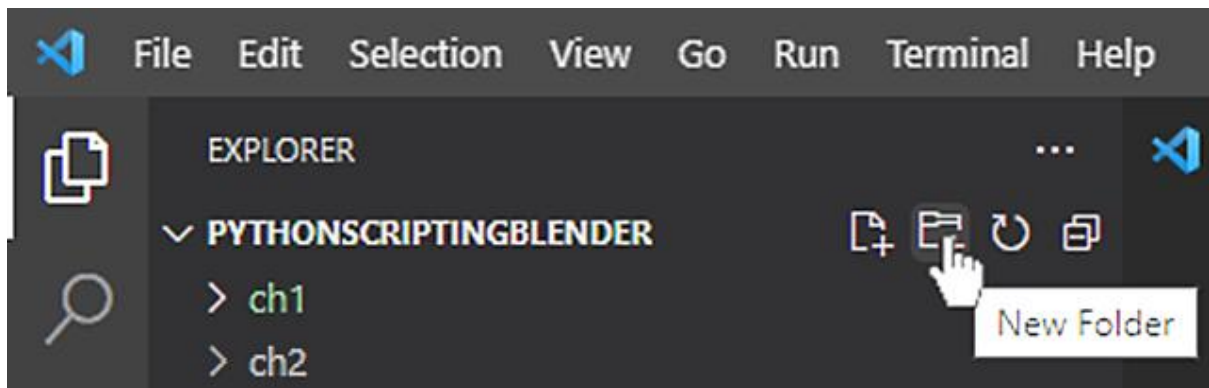
>>> bpy.data.objects['
    Camera']
    Cube']
    Light']
    My Empty']

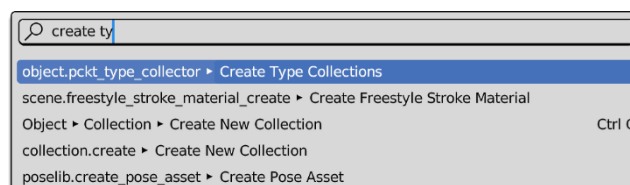
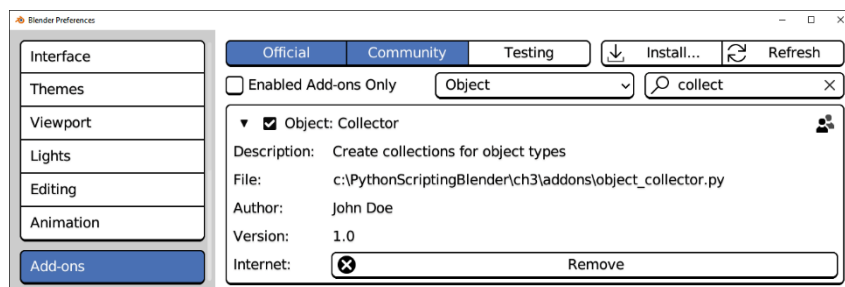
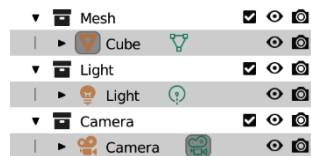
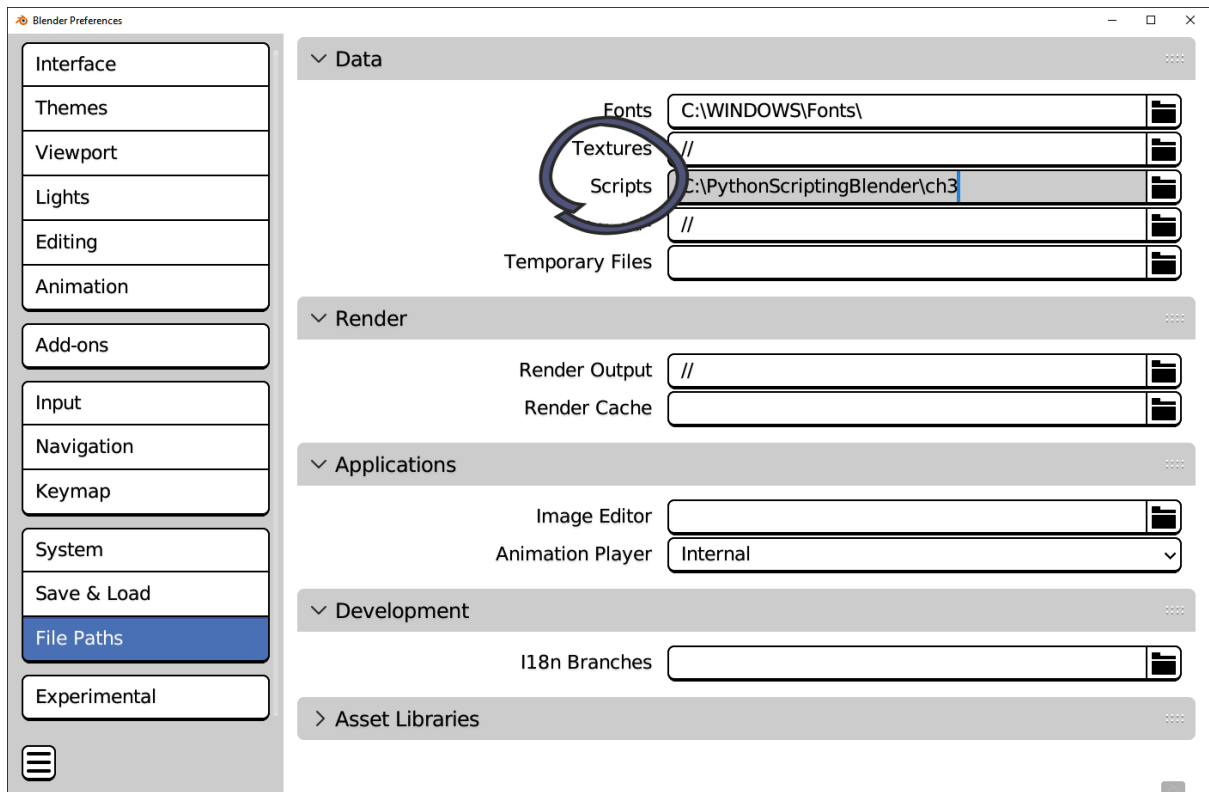
>>> bpy.data.objects['
```

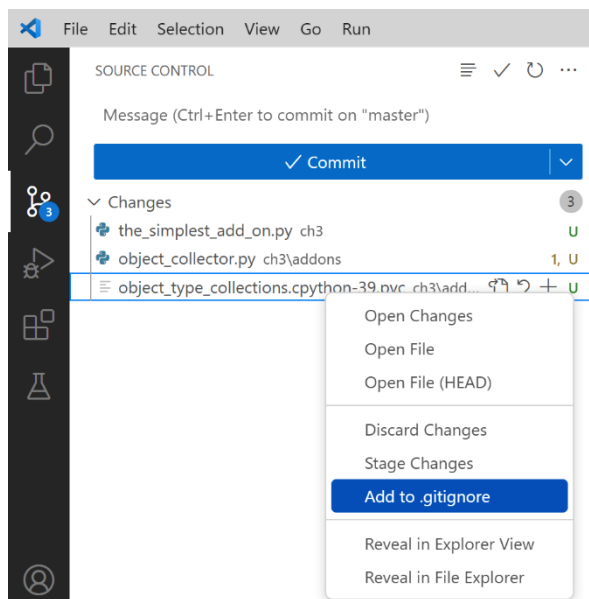
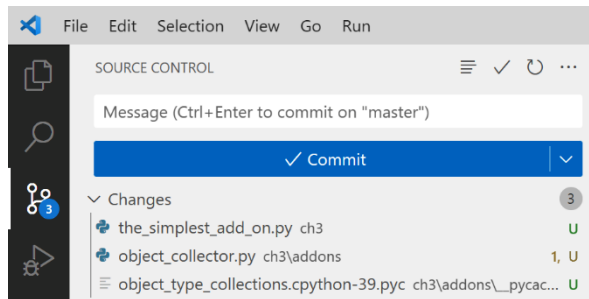
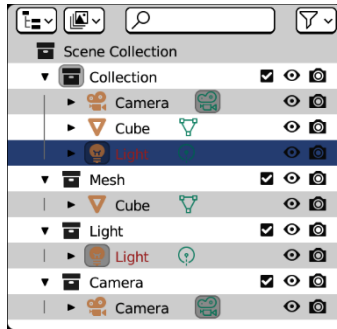


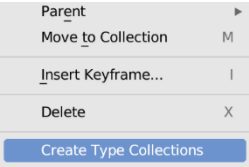
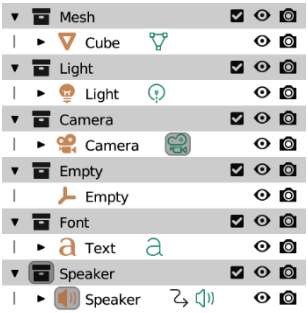
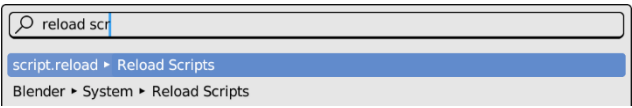
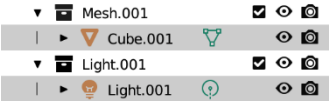
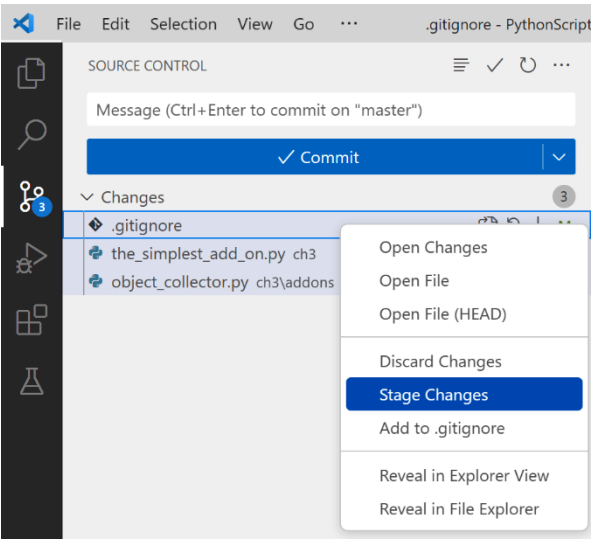


Chapter 03: Creating Your Add-Ons

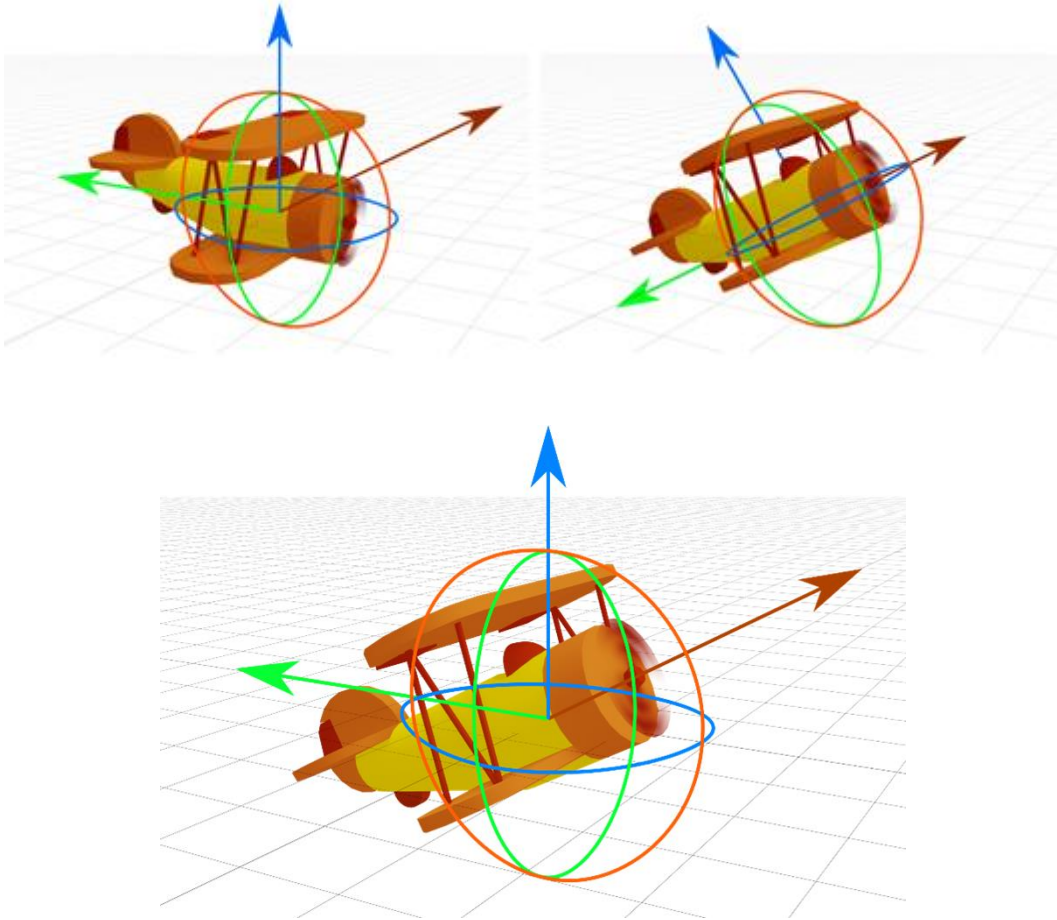








Chapter 04: Exploring Object Transformations



Rotation:

X	0°
Y	0°
Z	0°



XYZ Euler



Quaternion (WXYZ)

XYZ Euler

XZY Euler

YXZ Euler

YZX Euler

ZXY Euler

ZYX Euler

Axis Angle

Rotation Mode

Rotation:

4L

W	1.000
X	0.000
Y	0.000
Z	0.000



Quaternion (WXYZ)



Rotation:

X	0°
Y	0°
Z	0°



XYZ Euler



Scale:

Rotation:

4L

W	0°
X	0.000
Y	1.000
Z	0.000



Axis Angle

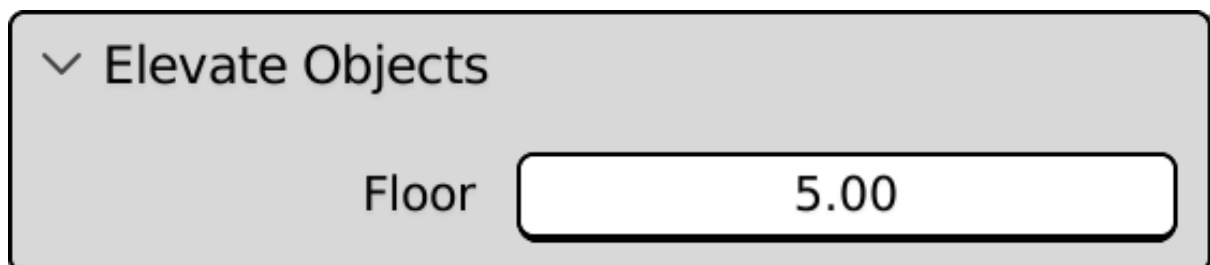
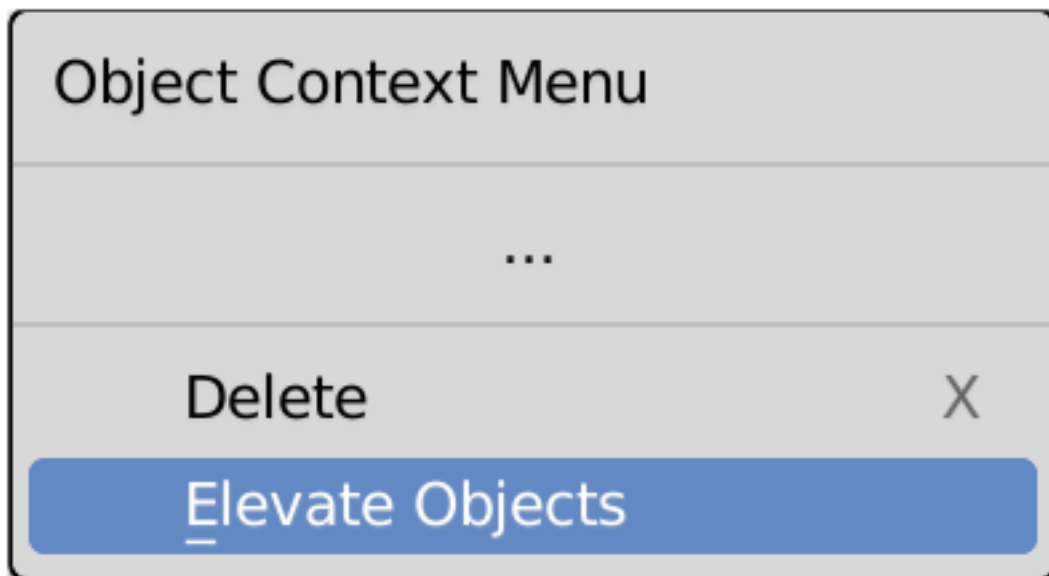
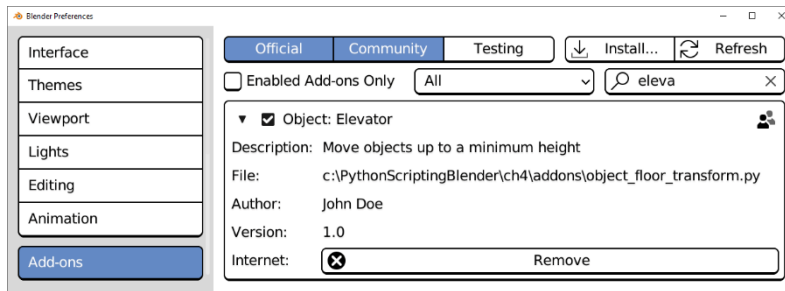
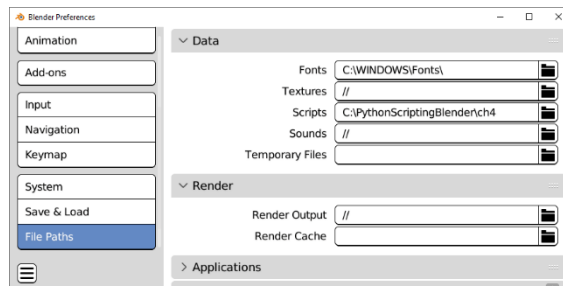


Add Object Constraint			
Motion Tracking	Transform	Tracking	Relationship
Camera Solver Follow Track Object Solver	Copy Location Copy Rotation Copy Scale Copy Transforms Limit Distance Limit Location Limit Rotation Limit Scale Maintain Volume Transformation Transform Cache	Clamp To Damped Track Locked Track Stretch To Track To	Action Armature Child Of Floor Follow Path Pivot Shrinkwrap

Scene Collection

- Collection

☒
- Camera
- Camera
- Cube
- Cube
- Light
- Light



rotation/scale

translation

row [0]
row [1]
row [2]

$$\begin{bmatrix}
 1.0, 0.0, 0.0, 0.0, \\
 0.0, 1.0, 0.0, 0.0, \\
 0.0, 0.0, 1.0, 0.0, \\
 0.0, 0.0, 0.0, 1.0
 \end{bmatrix}$$

x
y
z

▾ Elevate Objects

Floor



5.00

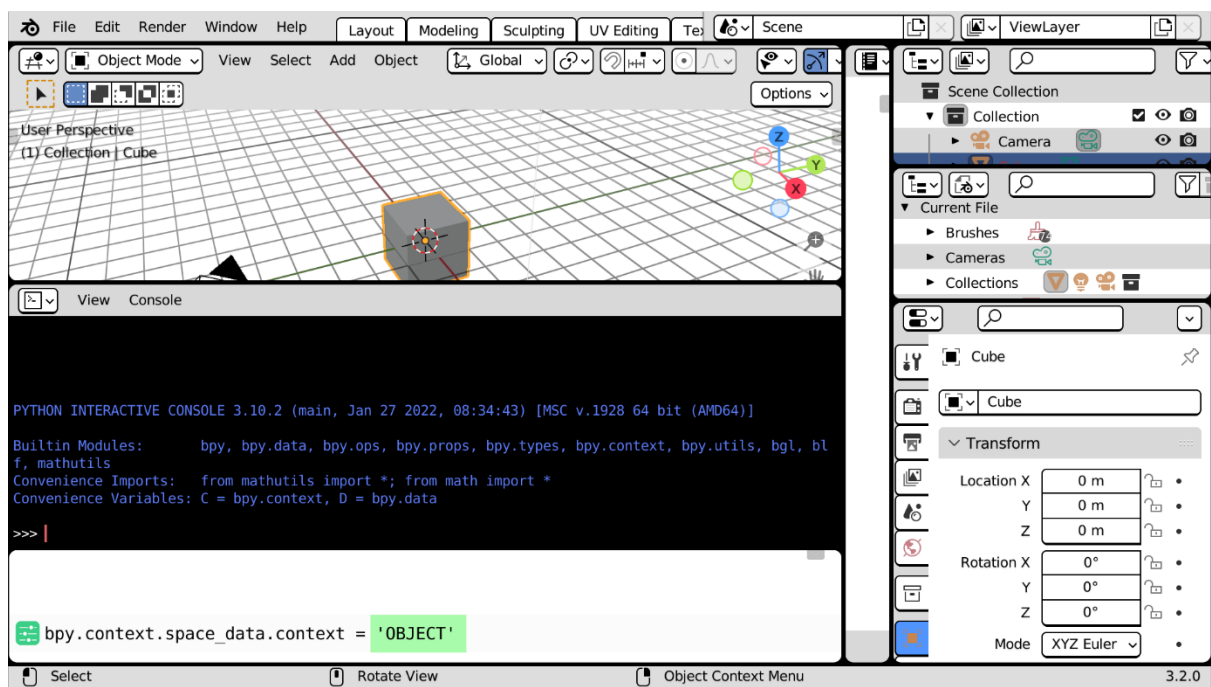
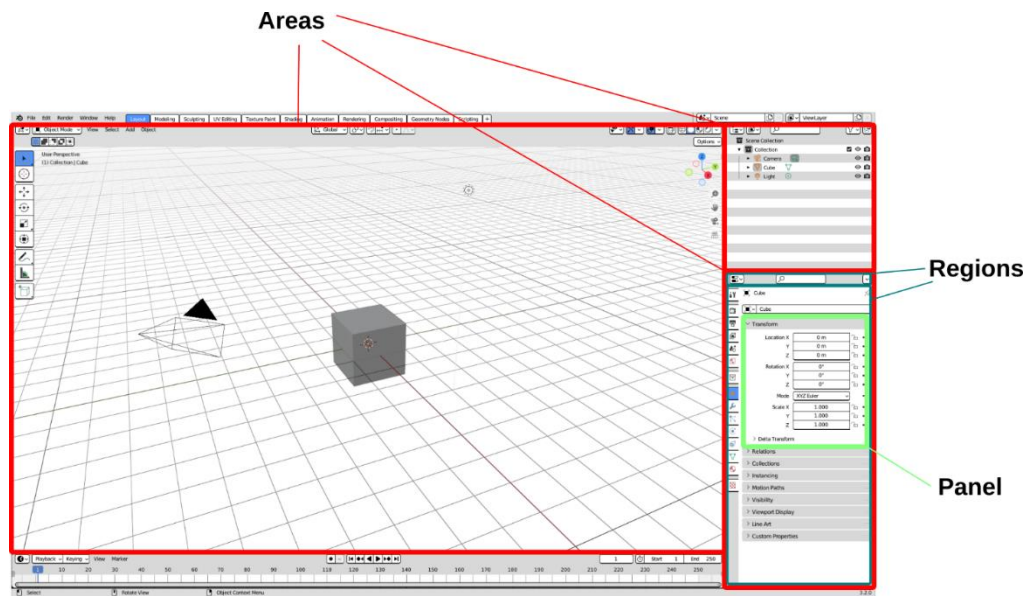


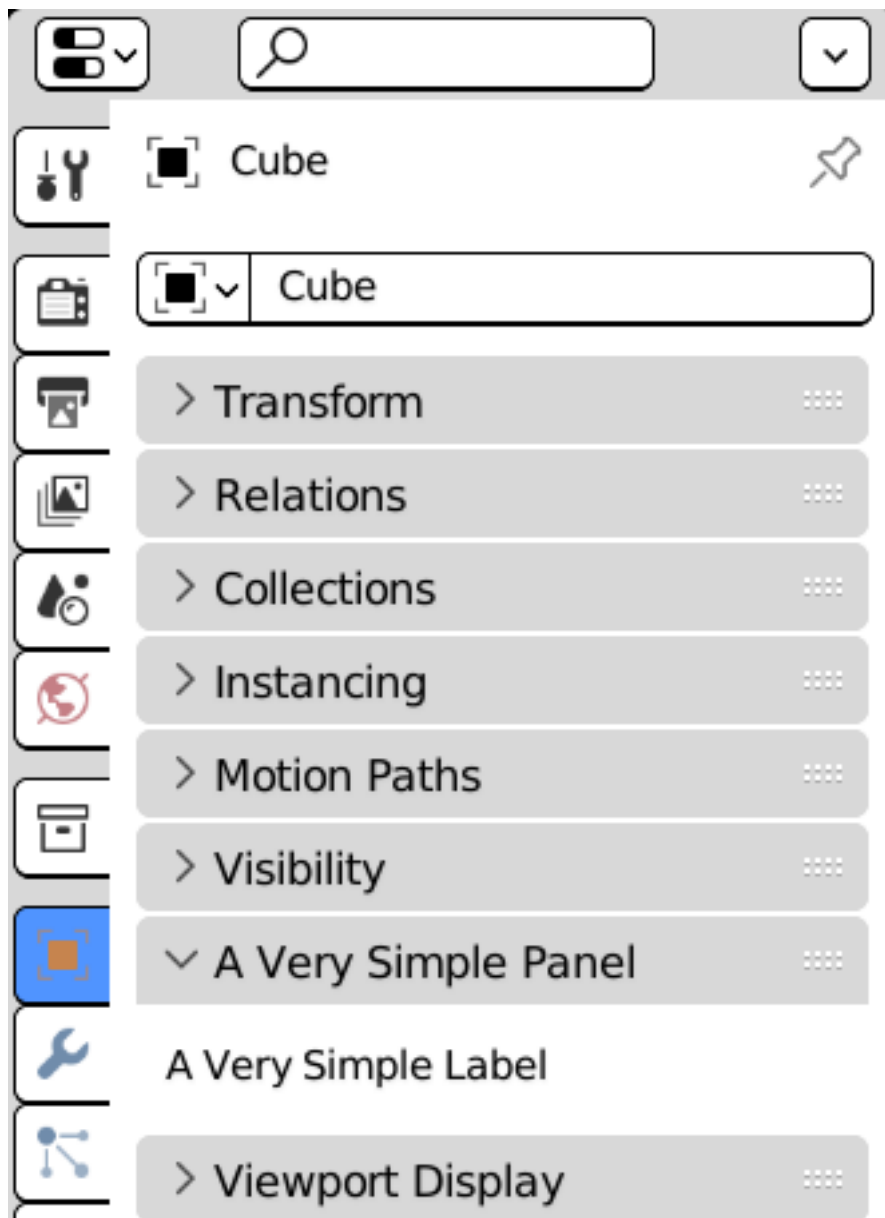
Constraints



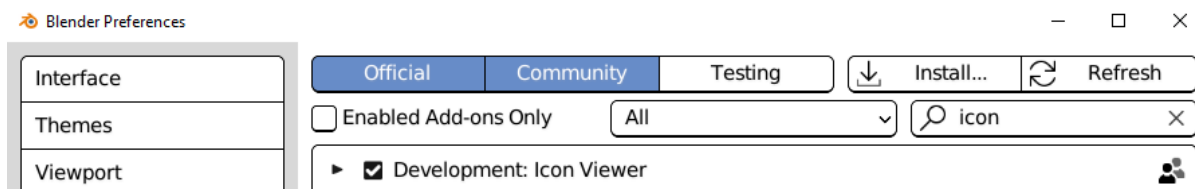
Reuse

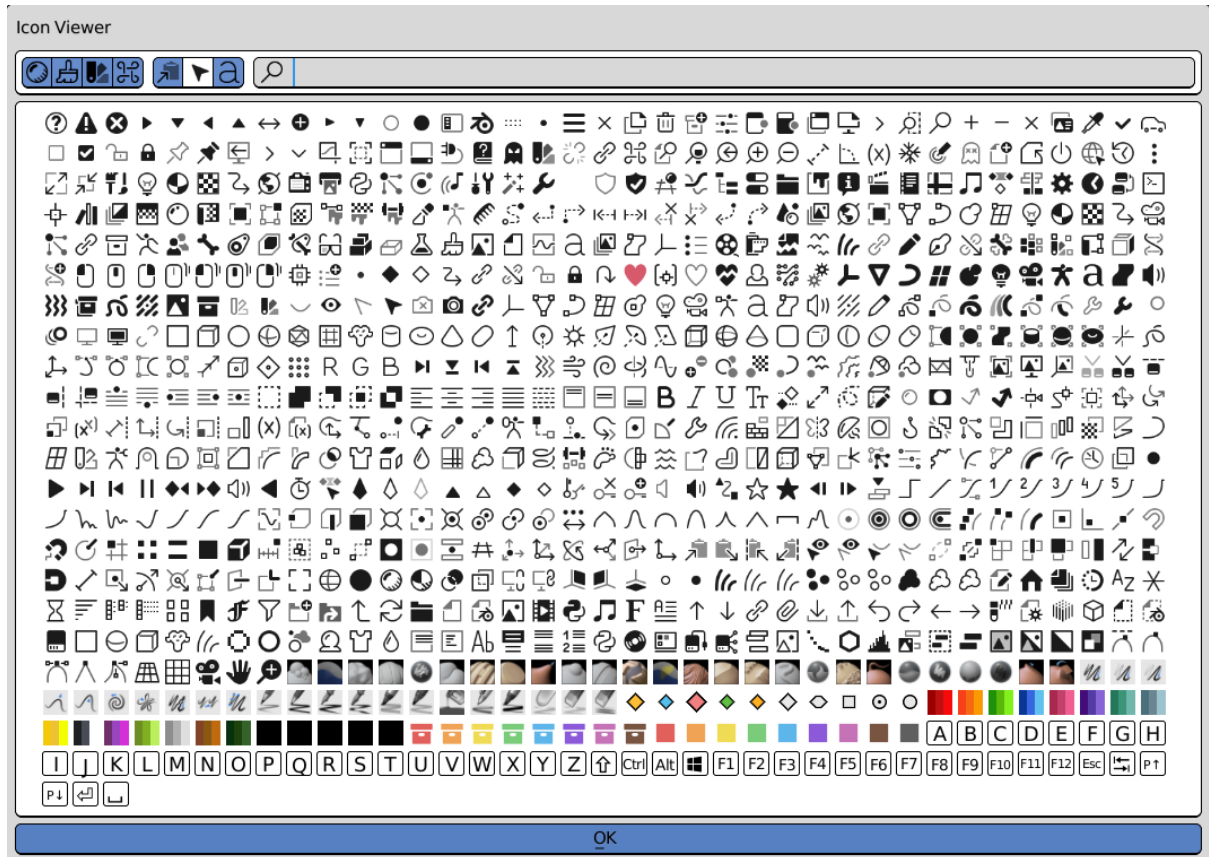
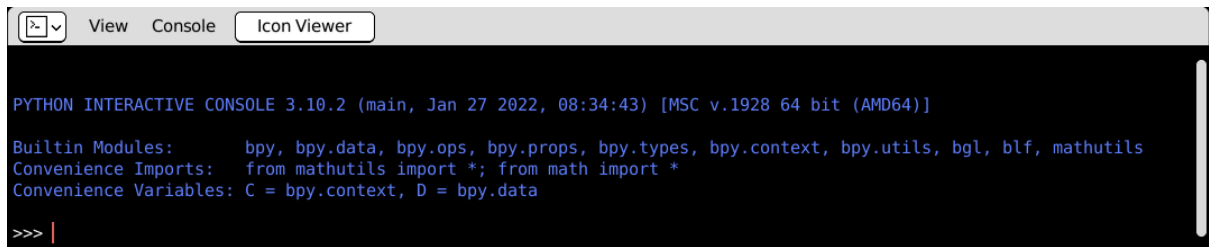
Chapter 05: Designing Graphical Interfaces

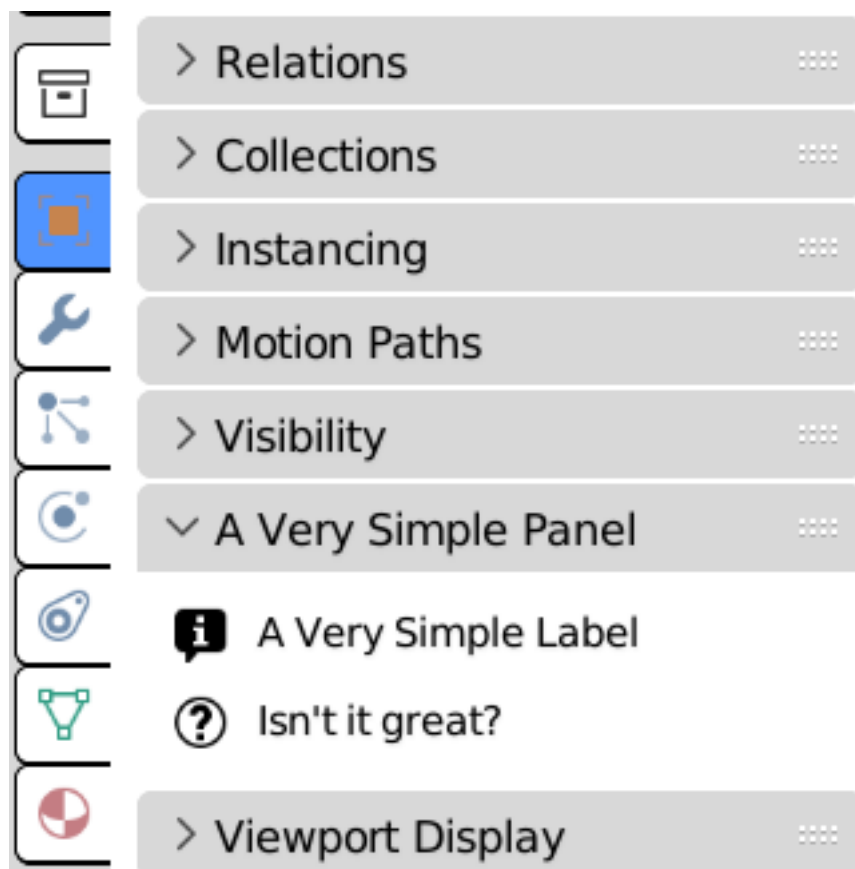
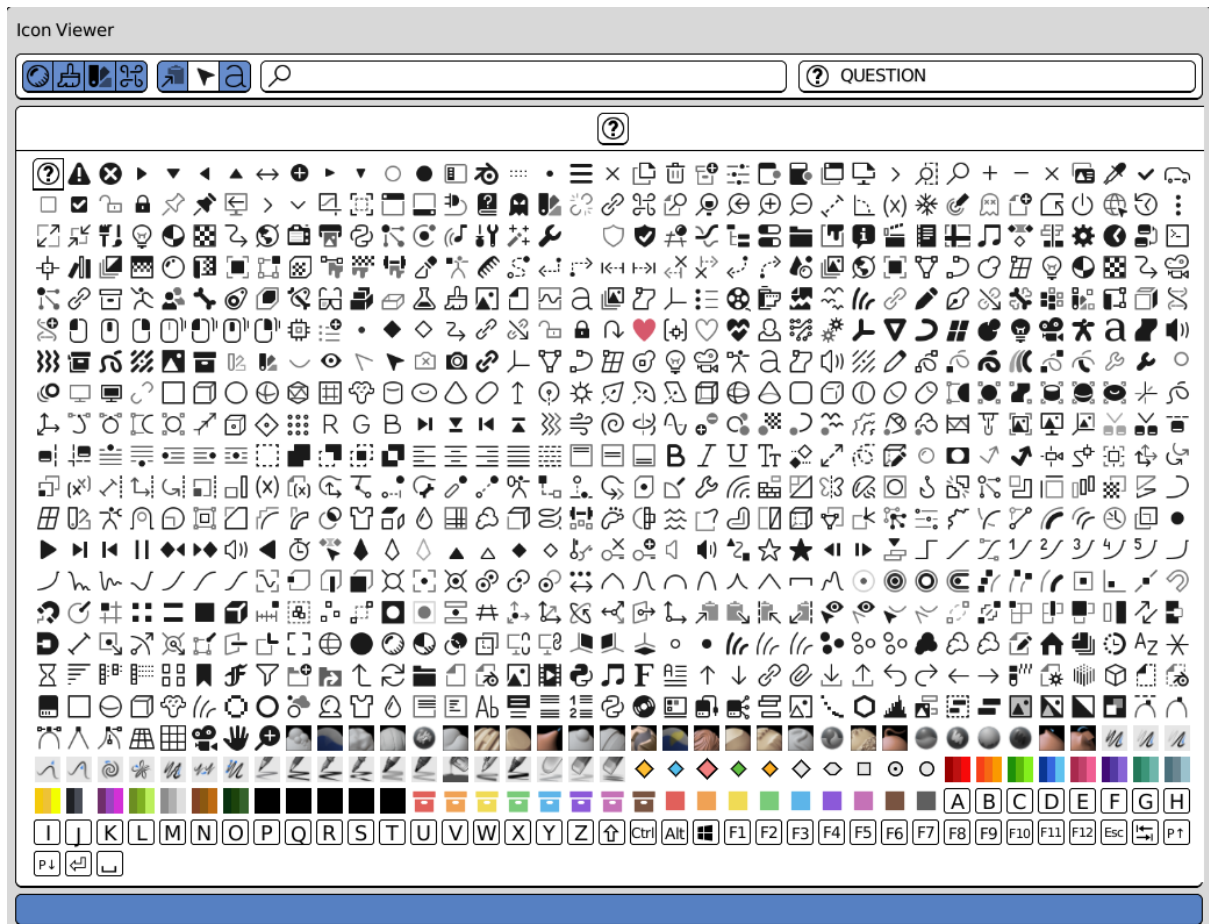




LIGHT









▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?

 Smile

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

version: (1, 0)

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

author:	John Doe
version:	(1, 0)

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in t...
category	Learning

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in t...
category	Learning

Scene Objects:

Cube

Camera

Light

Icon Viewer



▼ OUTLINER_OB_MESH



OK

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in t...
category	Learning

Scene Objects:

 Cube

 Camera

 Light

✓ A Very Simple Panel



 A Very Simple Label

 Isn't it great?

 Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in the UI
category	Learning

Scene Objects:

 Cube

 Camera

... (other 2 objects)

 Light

 Empty

✓ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in the UI
category	Learning

Scene Objects:

 Cube

 Light

 Camera

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in t...
category	Learning

Scene Objects:

 Light

 Camera

Delete

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in t...
category	Learning

Scene Objects:

 Cube

 Light

 Camera

Delete 1 object

▼ A Very Simple Panel



 A Very Simple Label

 Isn't it great?  Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in t...
category	Learning

Scene Objects:

 Cube

 Light

 Camera

Delete 2 objects

▼ A Very Simple Panel



A Very Simple Label



Isn't it great?



Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in the UI
category	Learning

Scene Objects:



Cube



Light



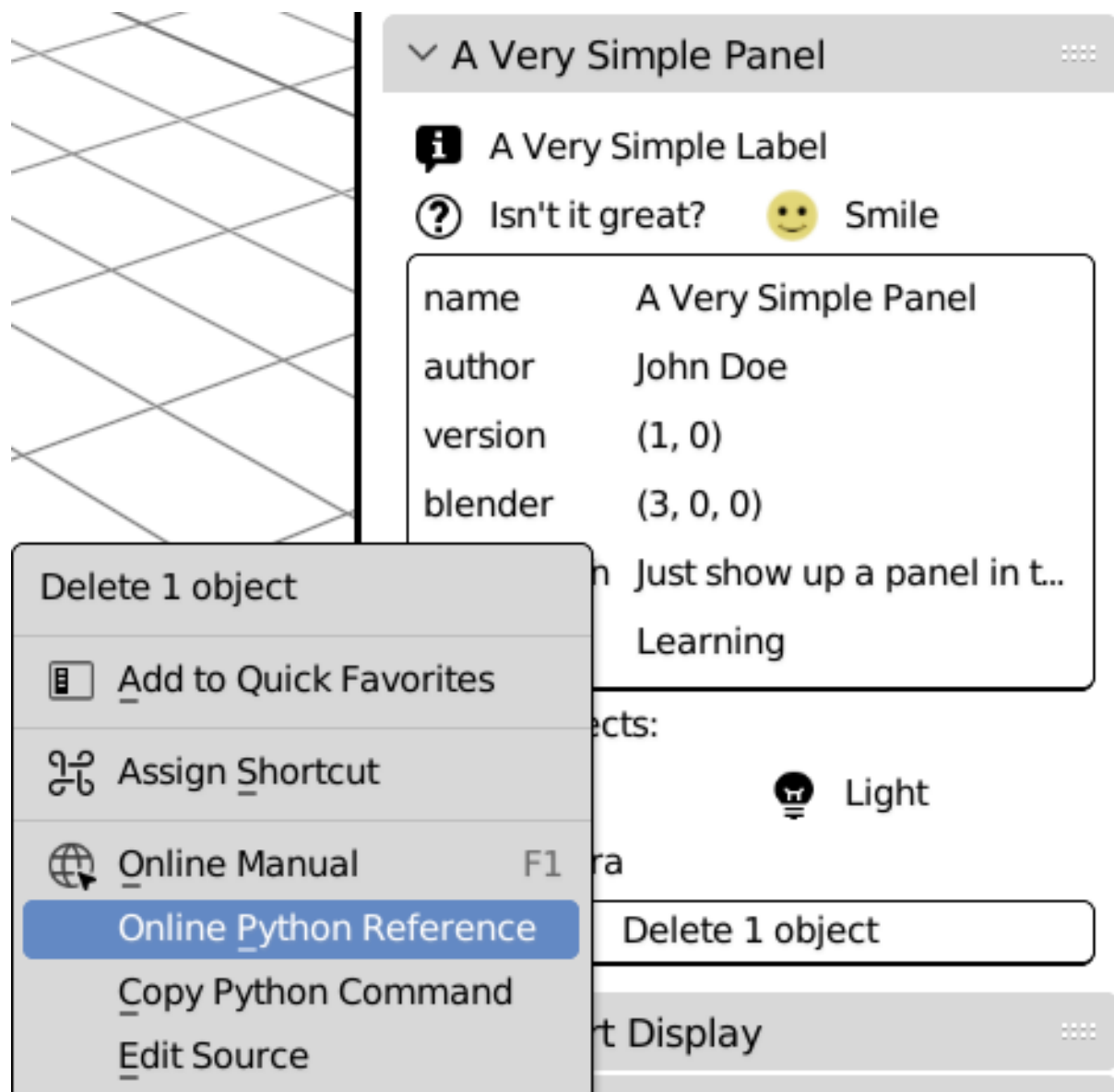
OK?

Delete

1 object

> Viewport Display





✓ A Very Simple Panel



 A Very Simple Label

 Isn't it great?

 Smile

name	A Very Simple Panel
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
description	Just show up a panel in the UI
category	Learning

Scene Objects:

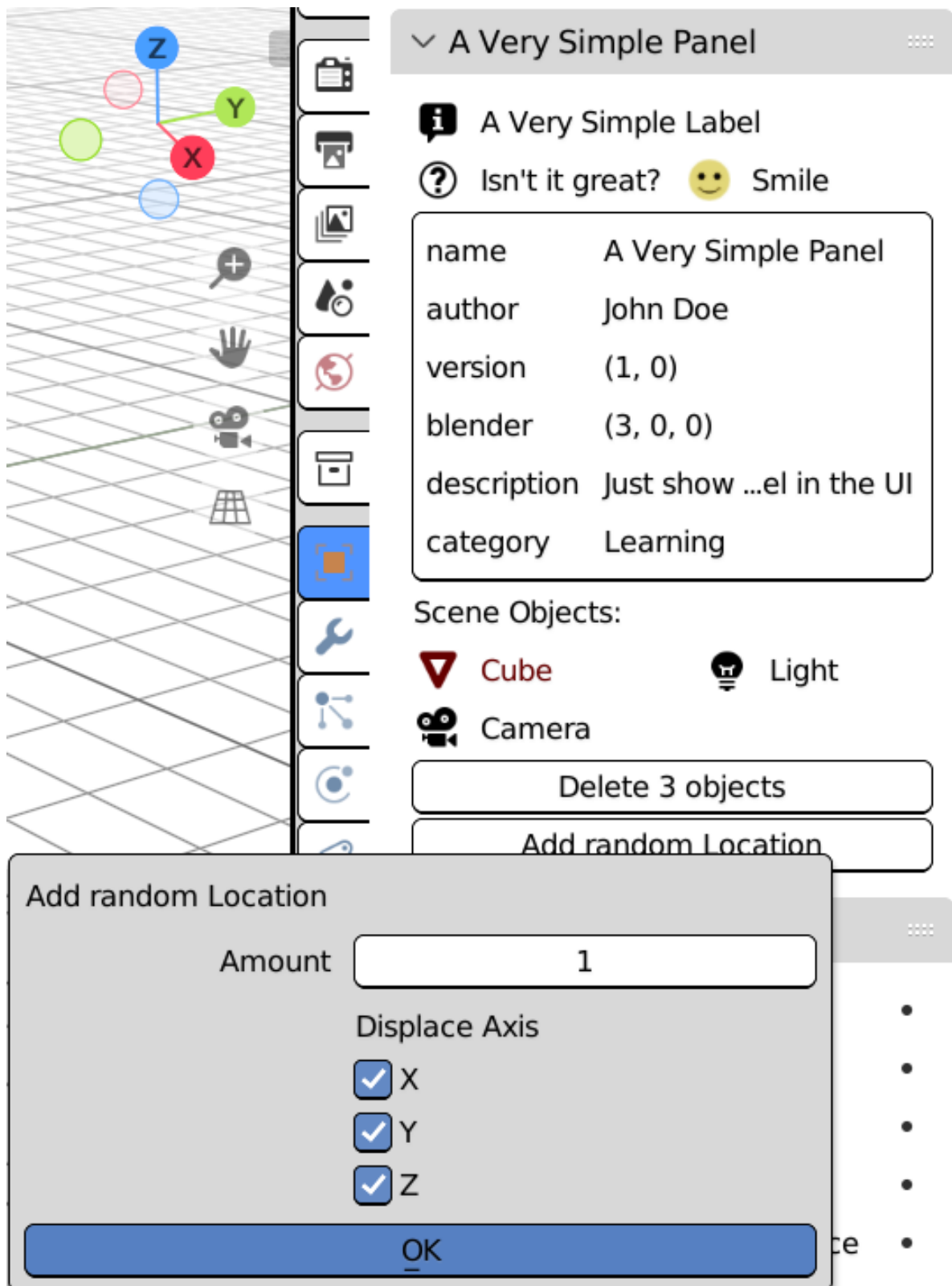
 Cube

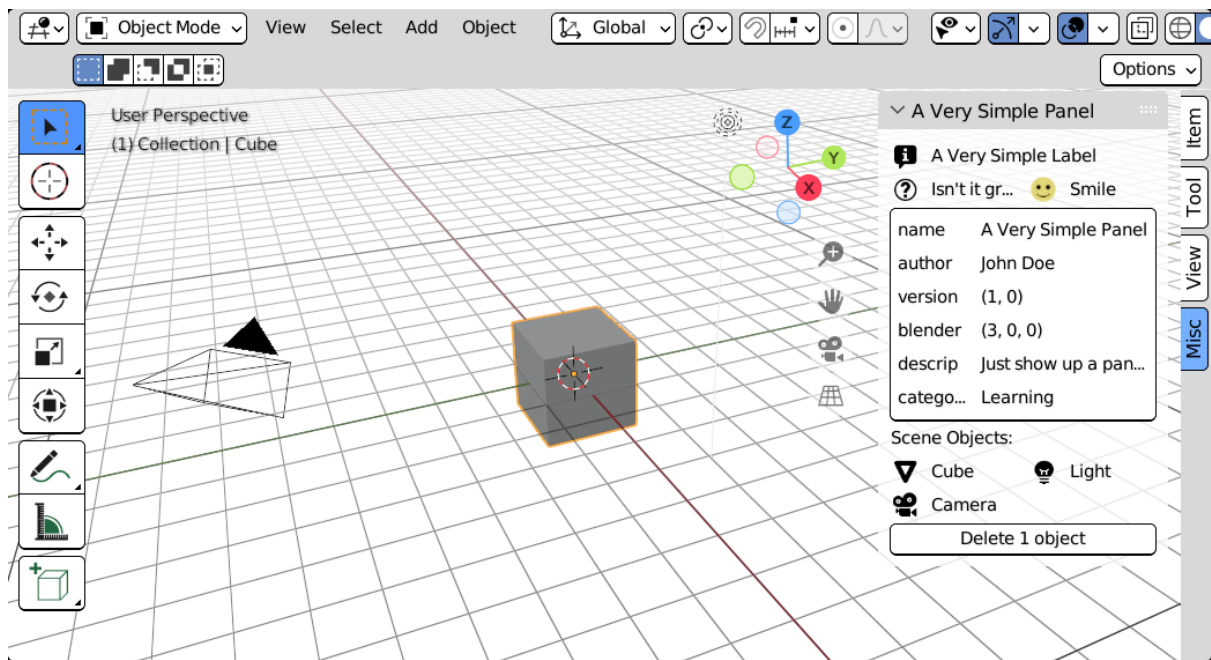
 Light

 Camera

Delete 1 object

Add random Location





✓ A Very Simple Panel



A Very Simple Label



Isn't it gr...



Smile

name	A Very Simple Pa...
author	John Doe
version	(1, 0)
blender	(3, 0, 0)
descript	Just show up a pa...
category	Learning

Scene Objects:



Cube



Light



Camera

Delete 1 object

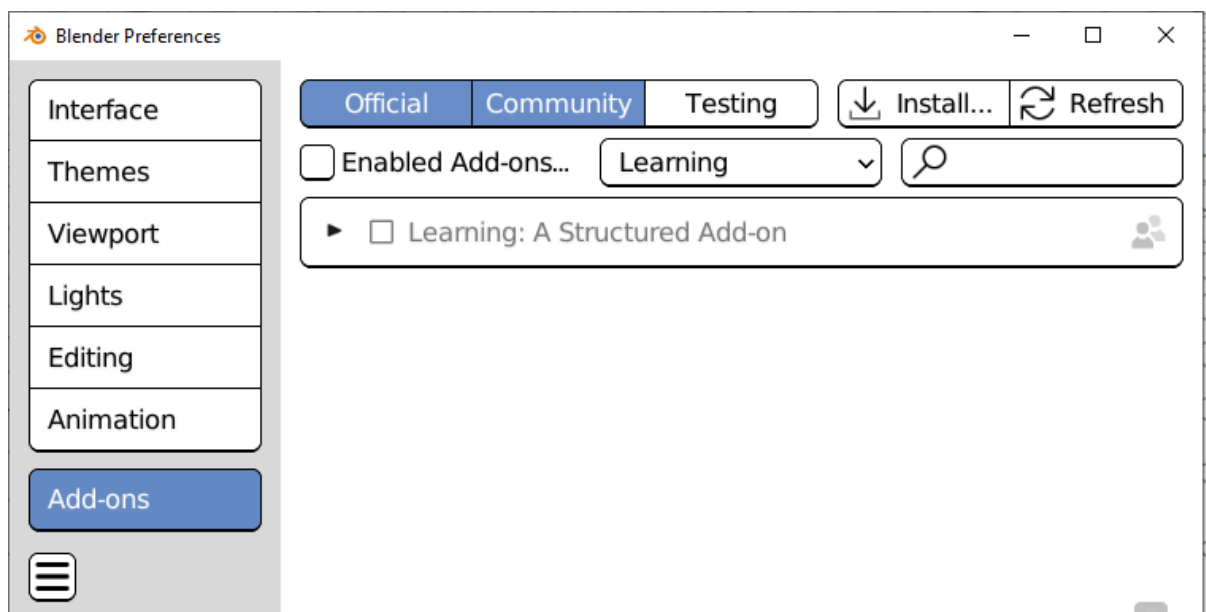
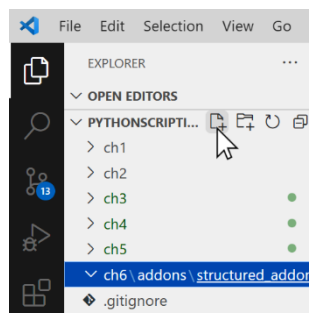
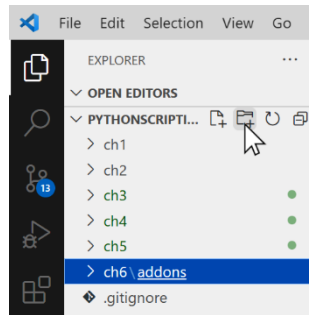
Item

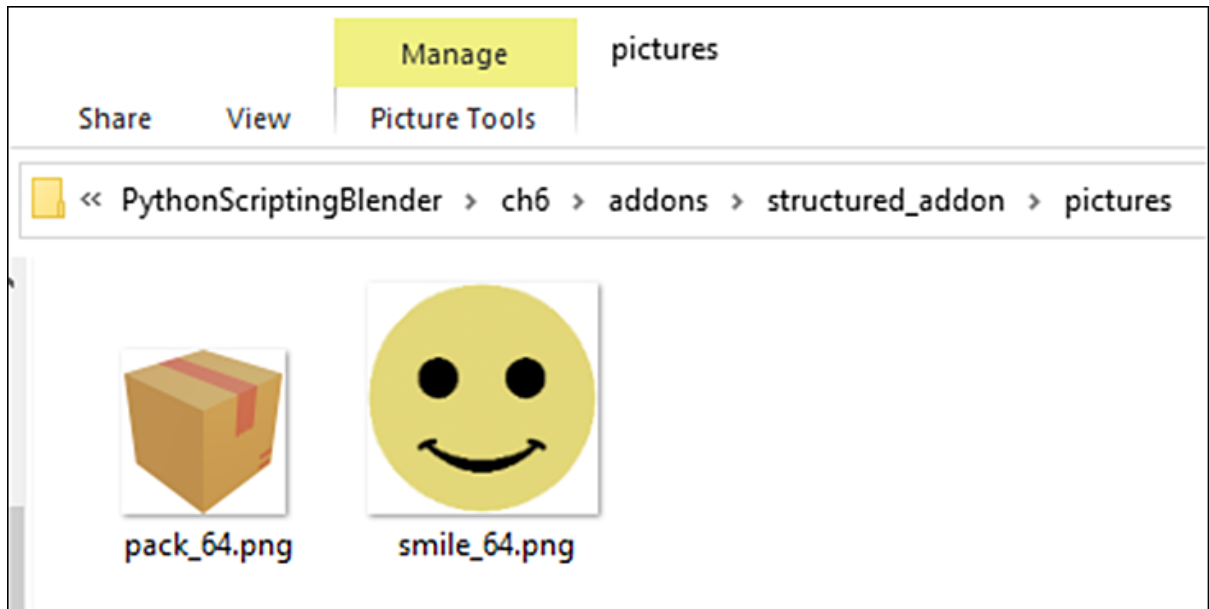
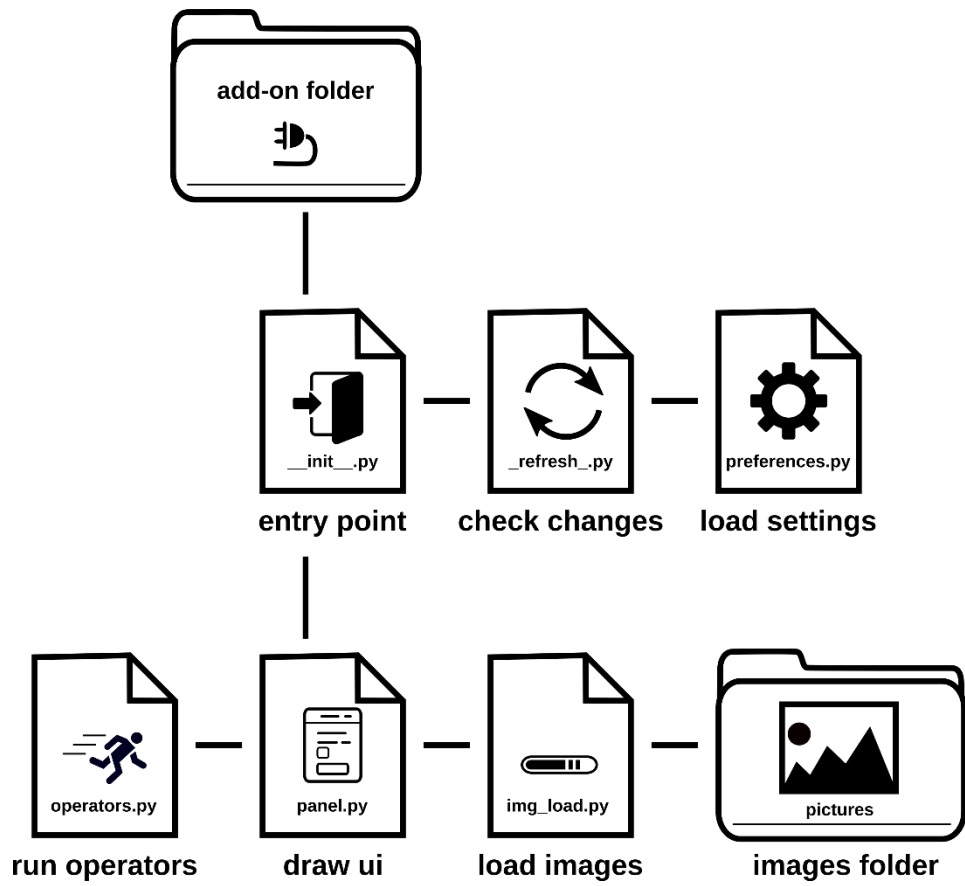
Tool

View

Our Panel

Chapter 06: Structuring Our Code and Add-Ons

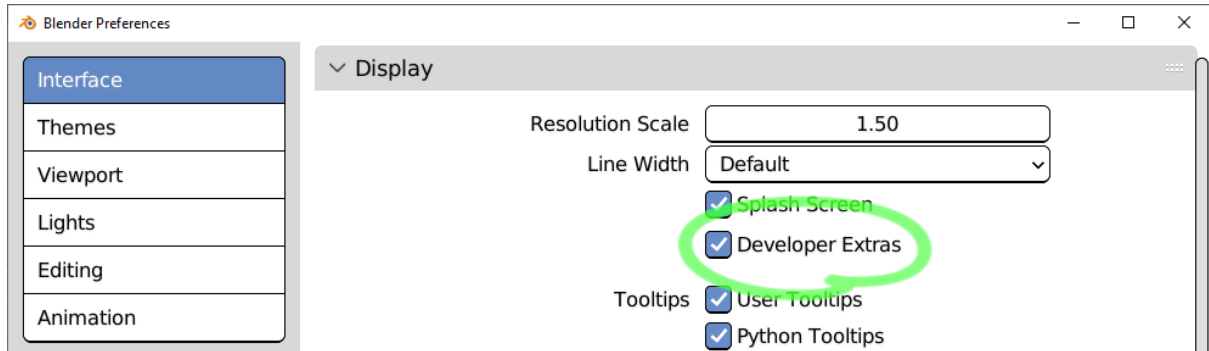




✓ A Modular Panel



A Custom Icon



✓ A Modular Panel



Scene Objects



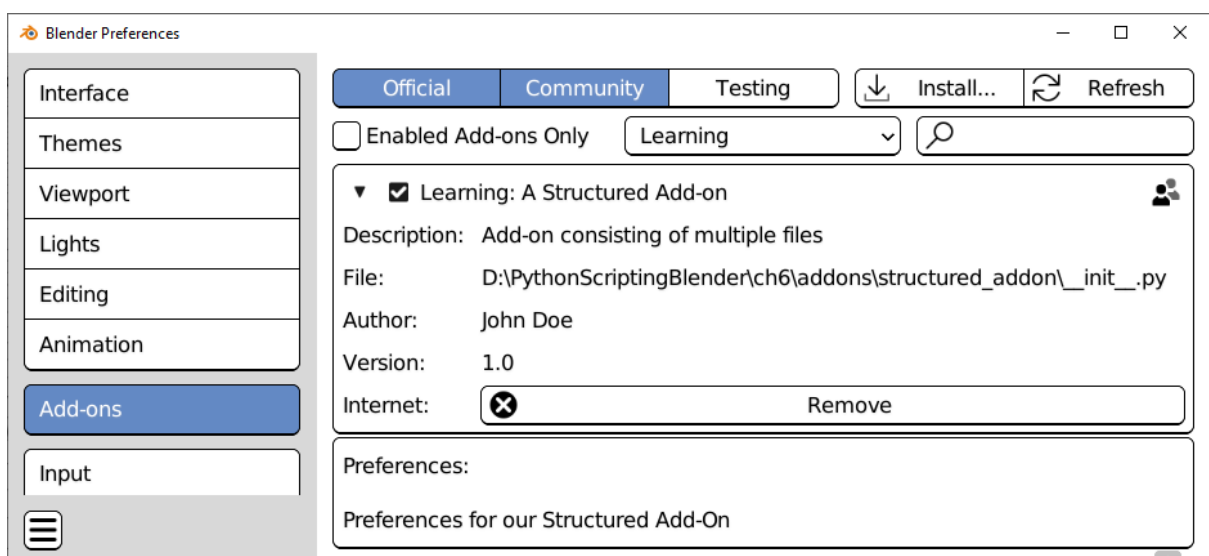
Cube

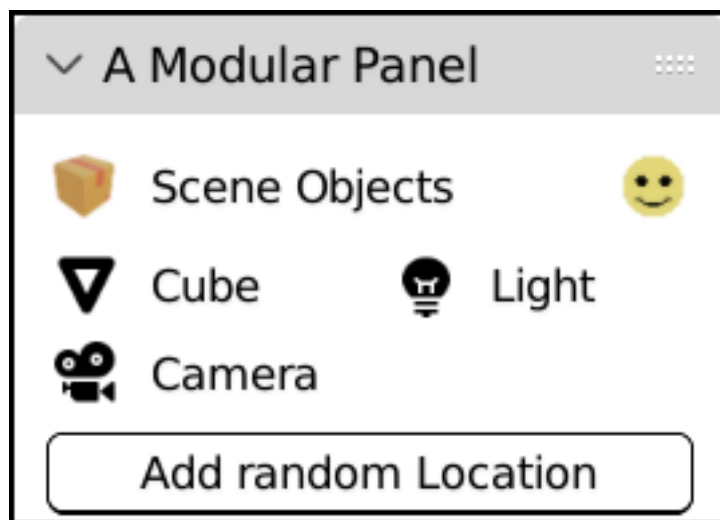
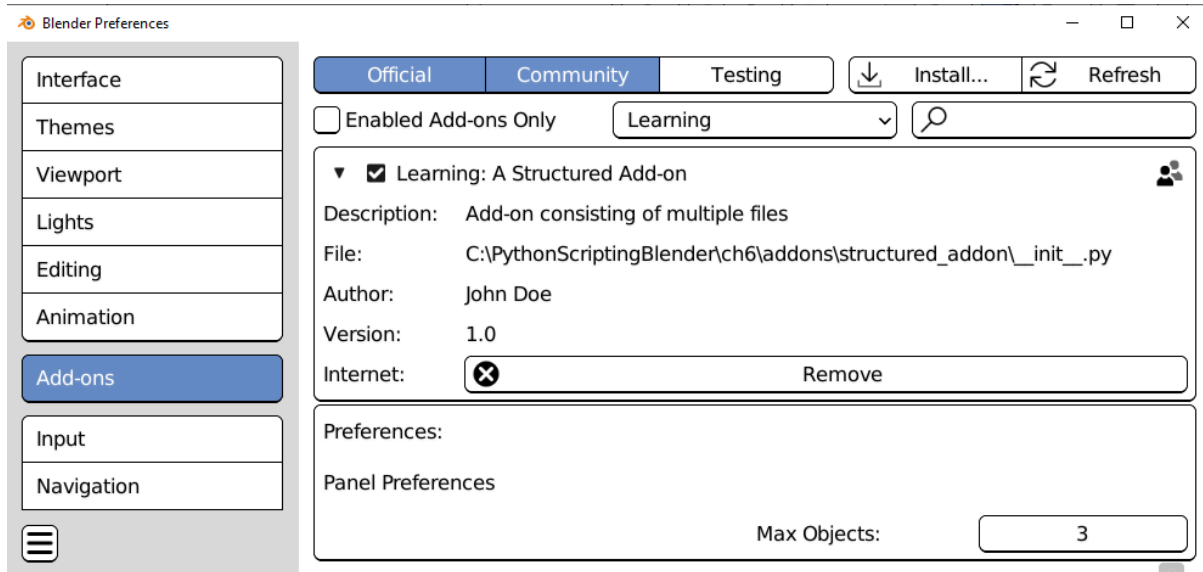


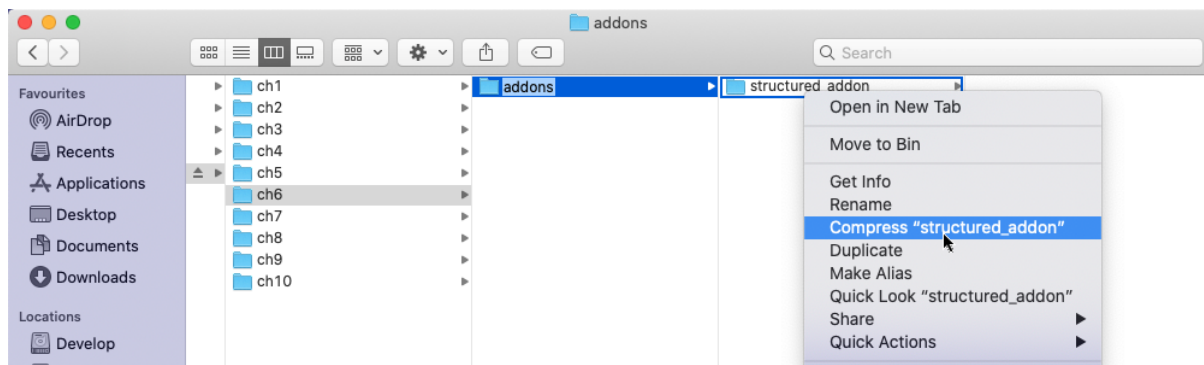
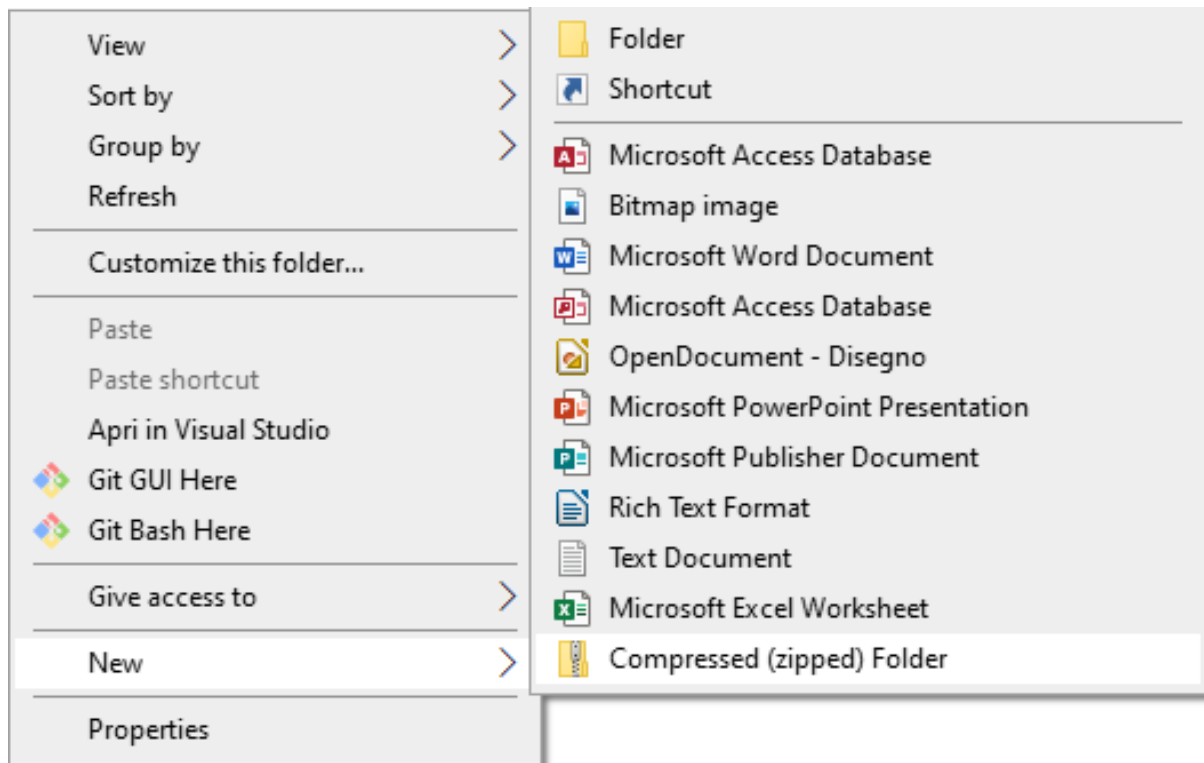
Light



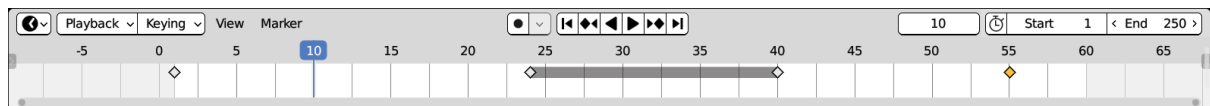
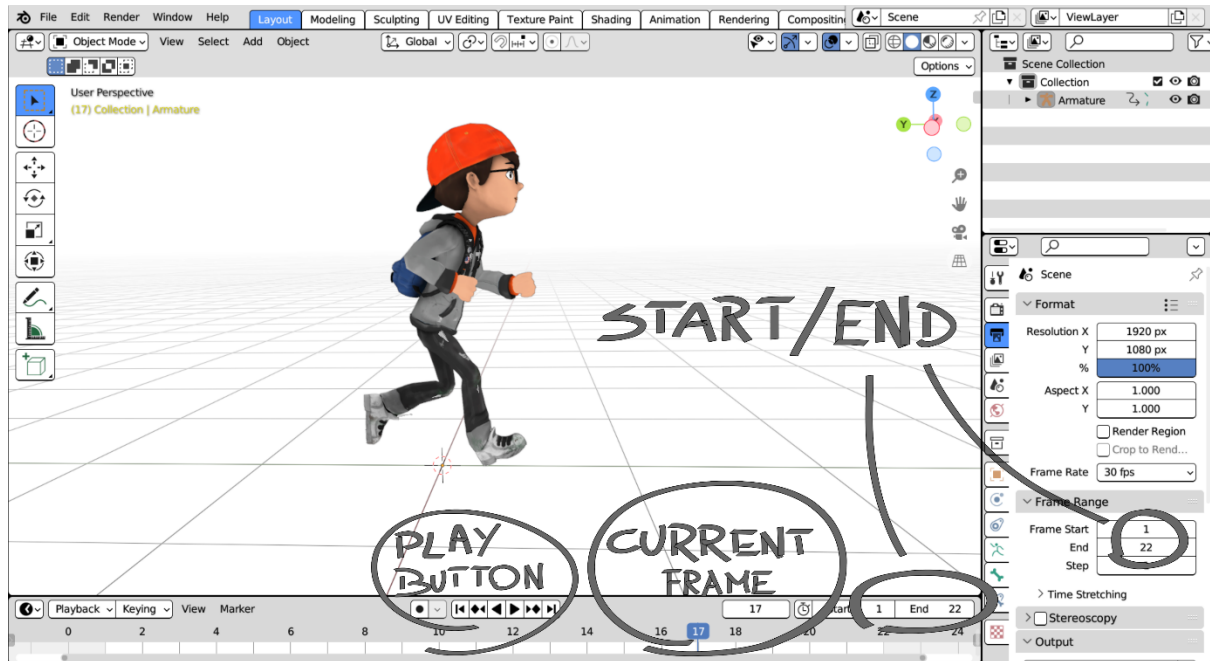
Camera

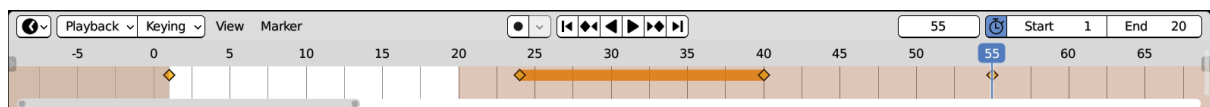


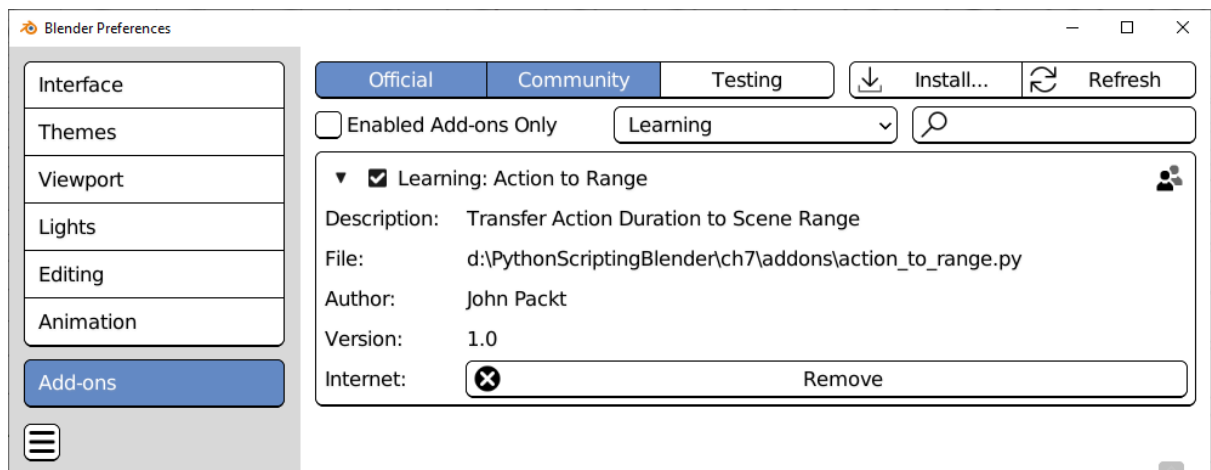
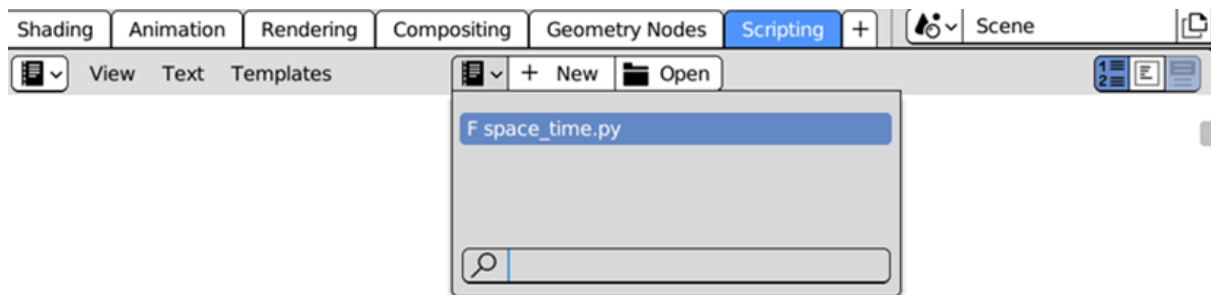
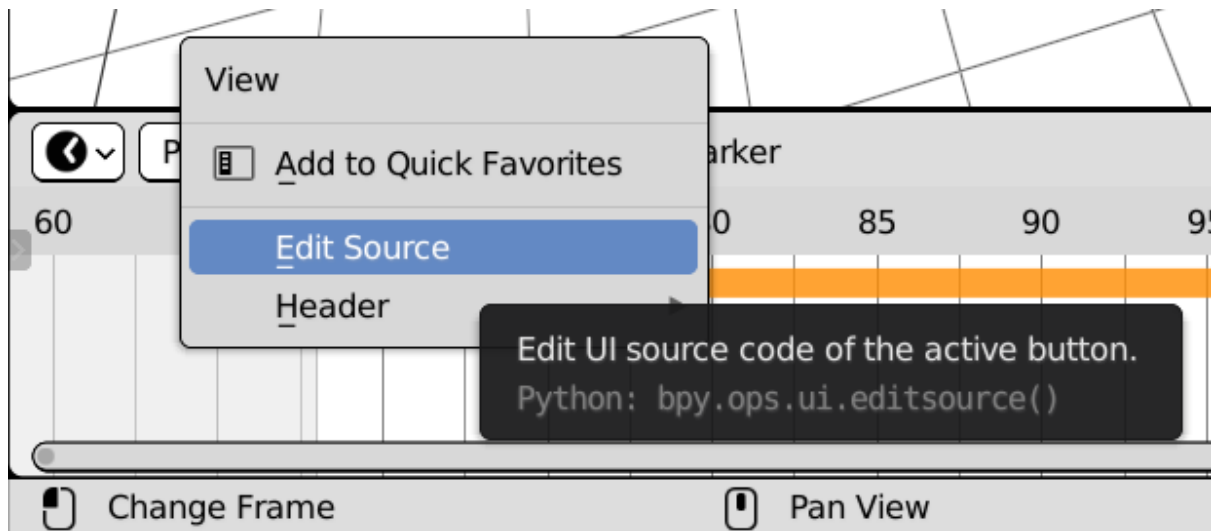


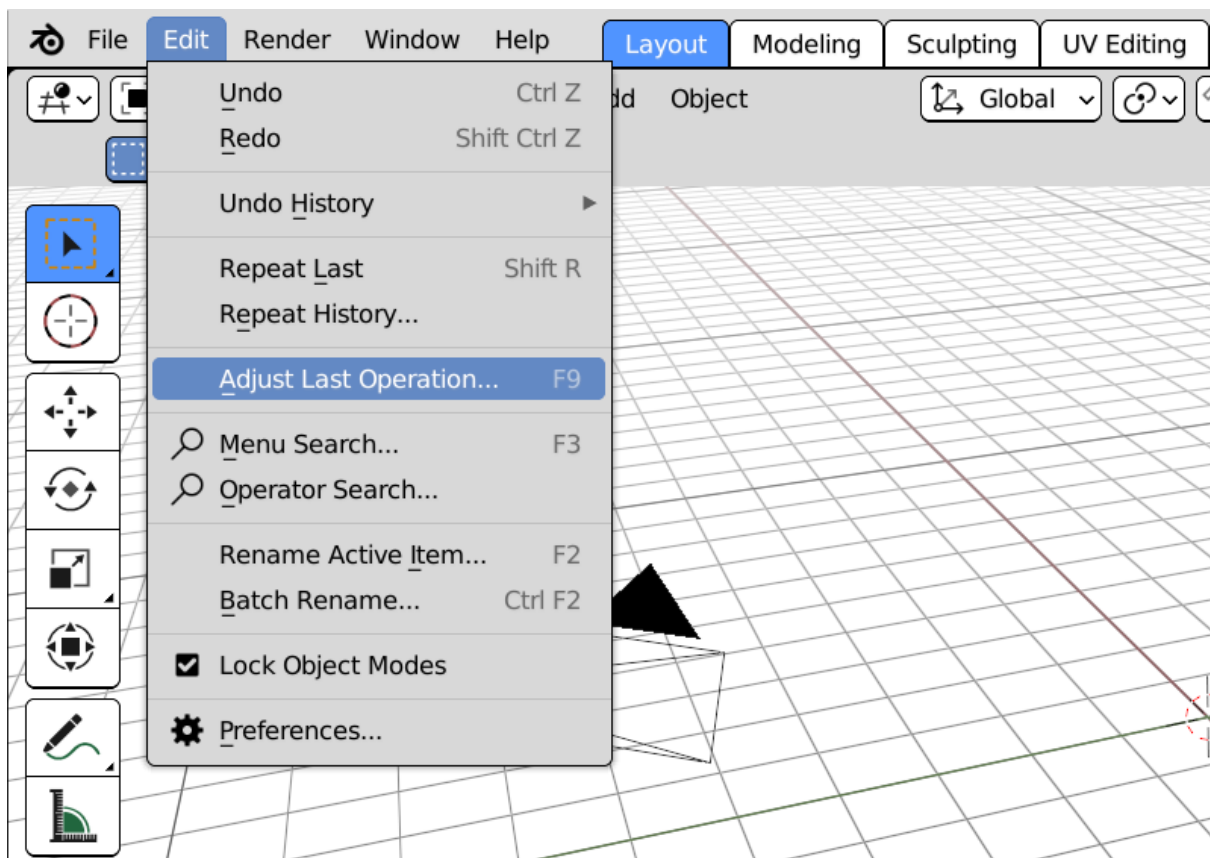
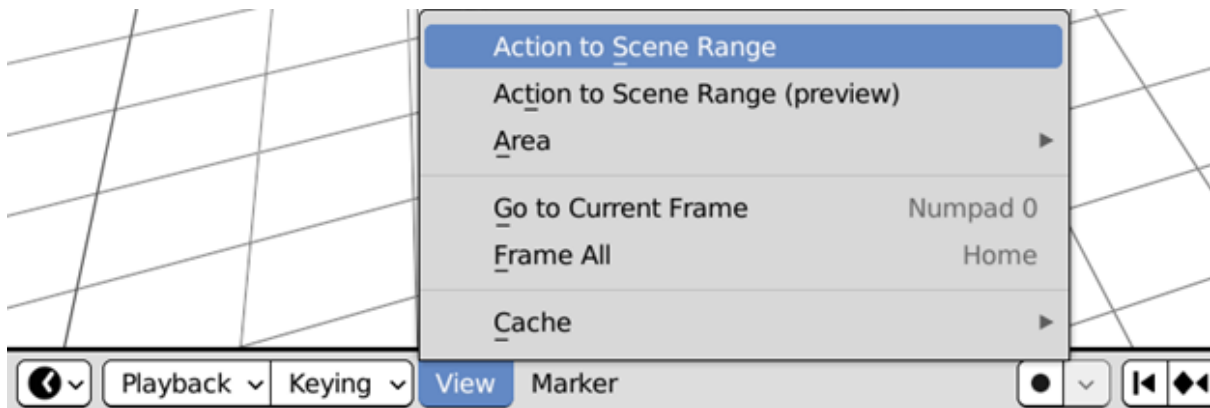


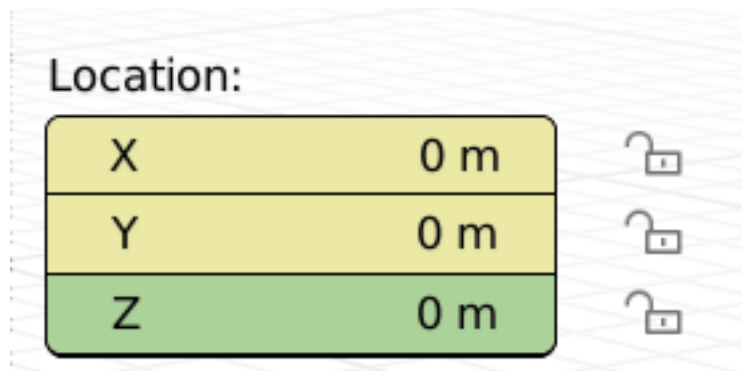
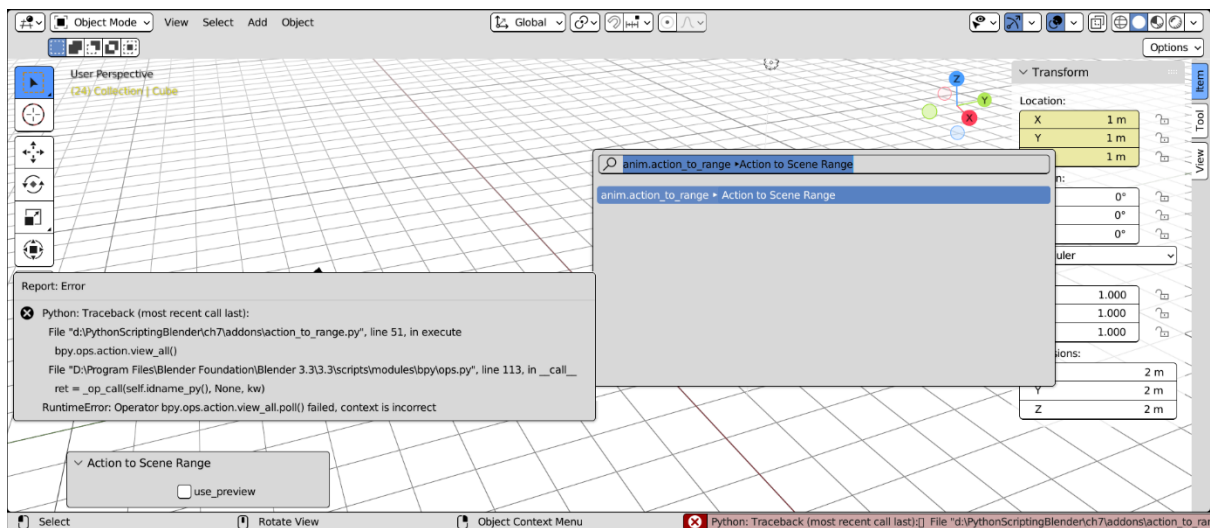
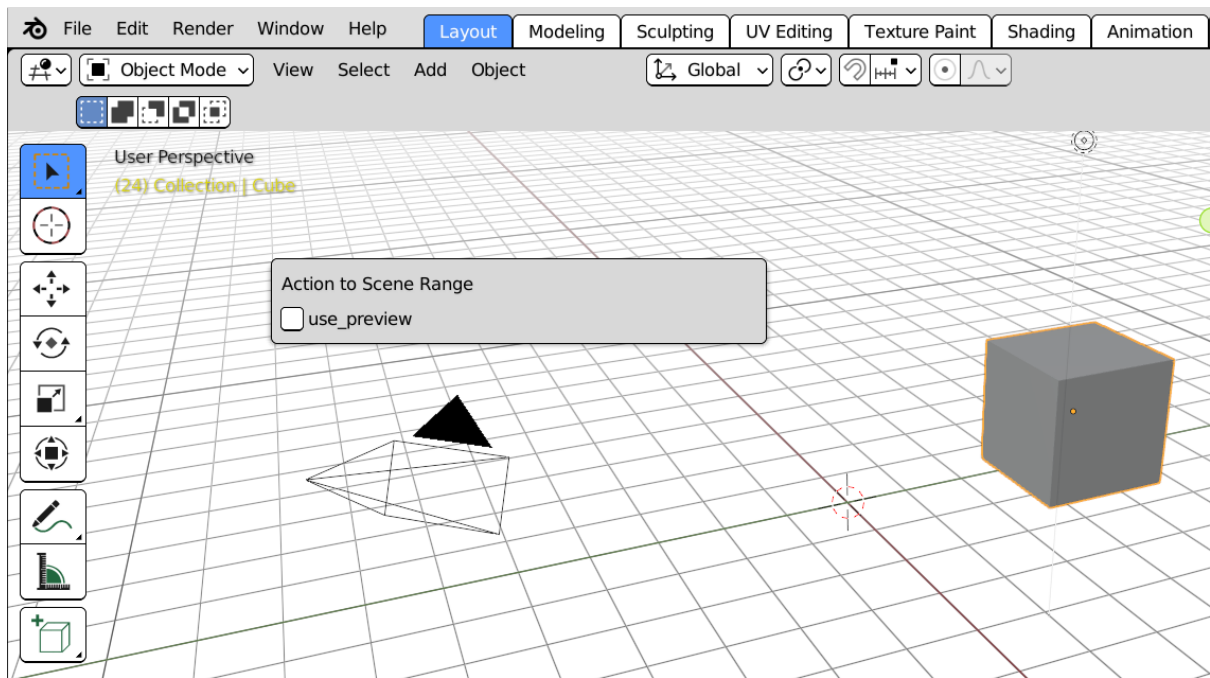
Chapter 07: The Animation System

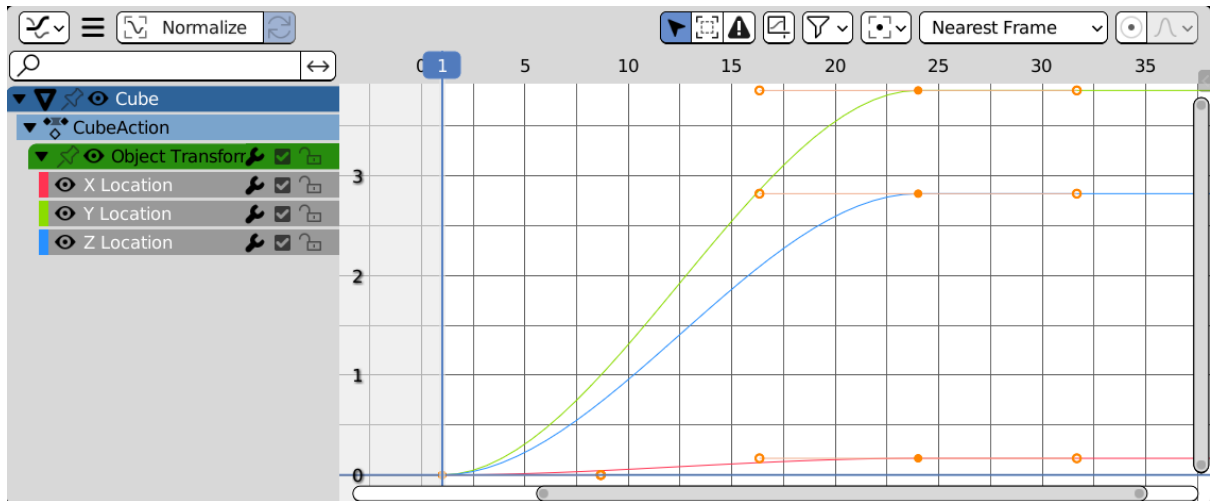
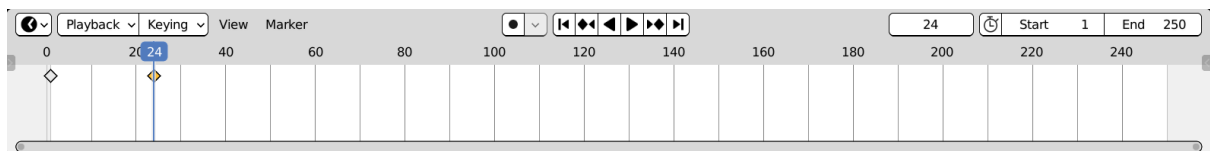




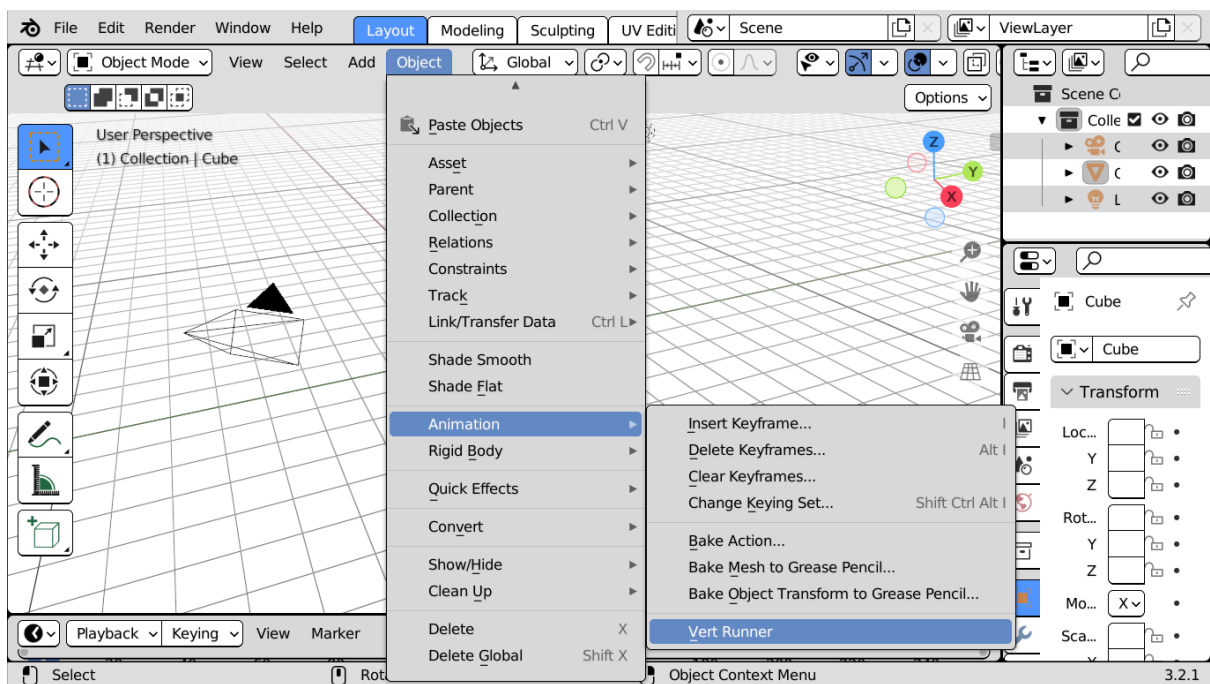
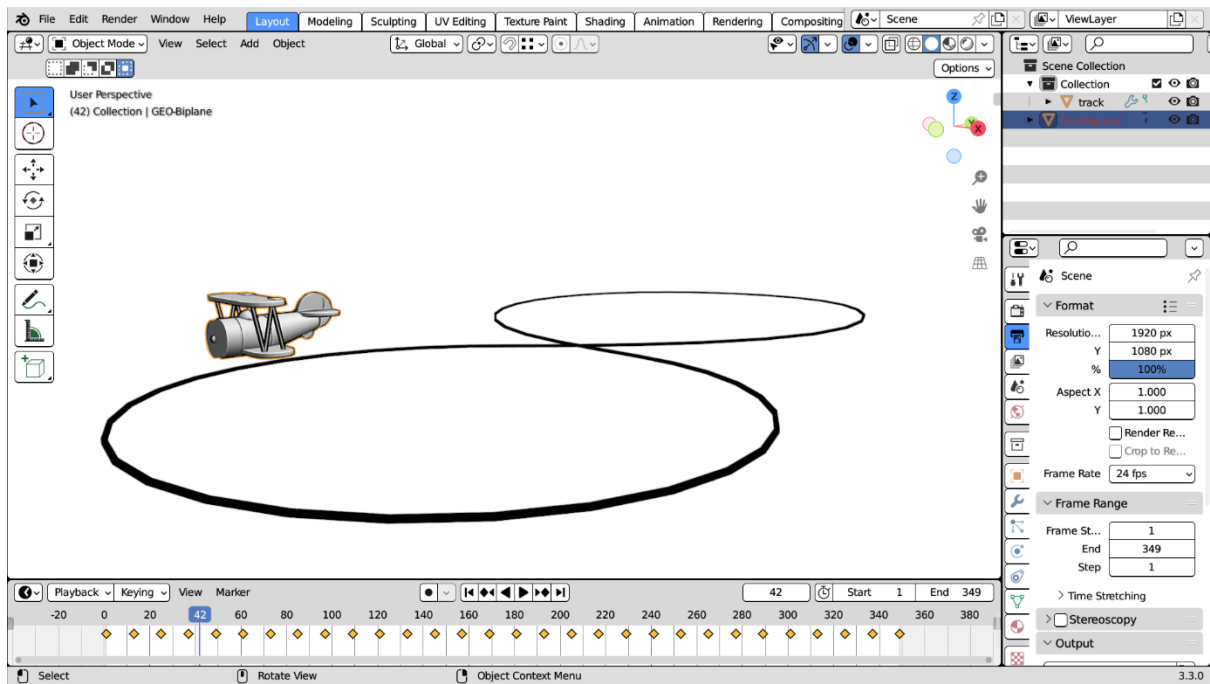


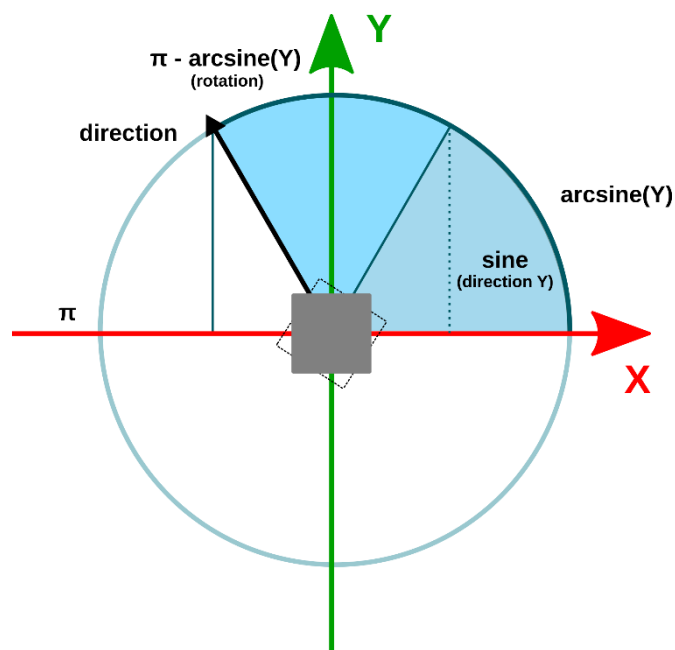
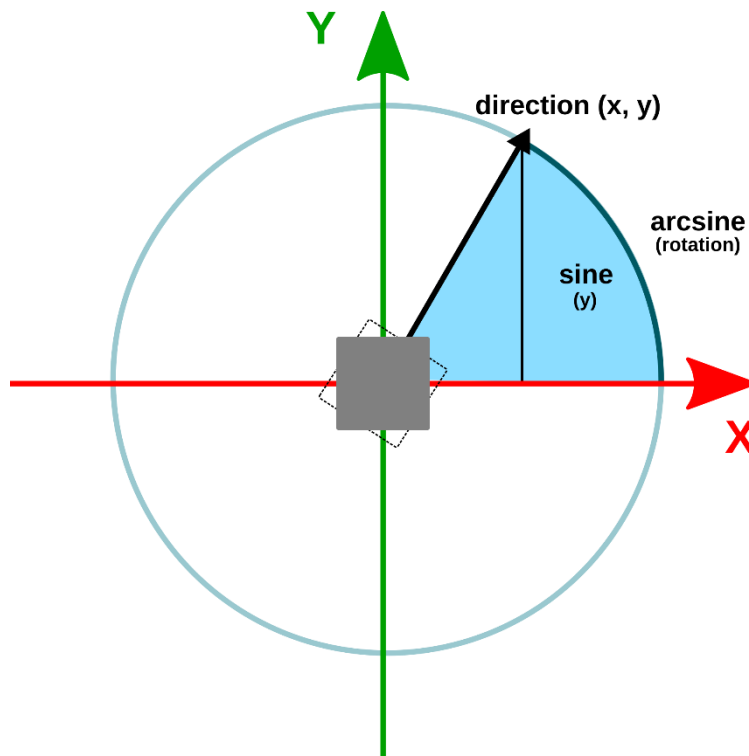


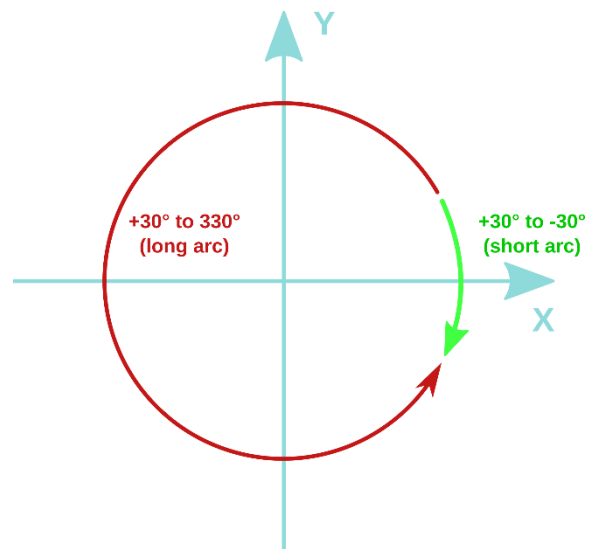




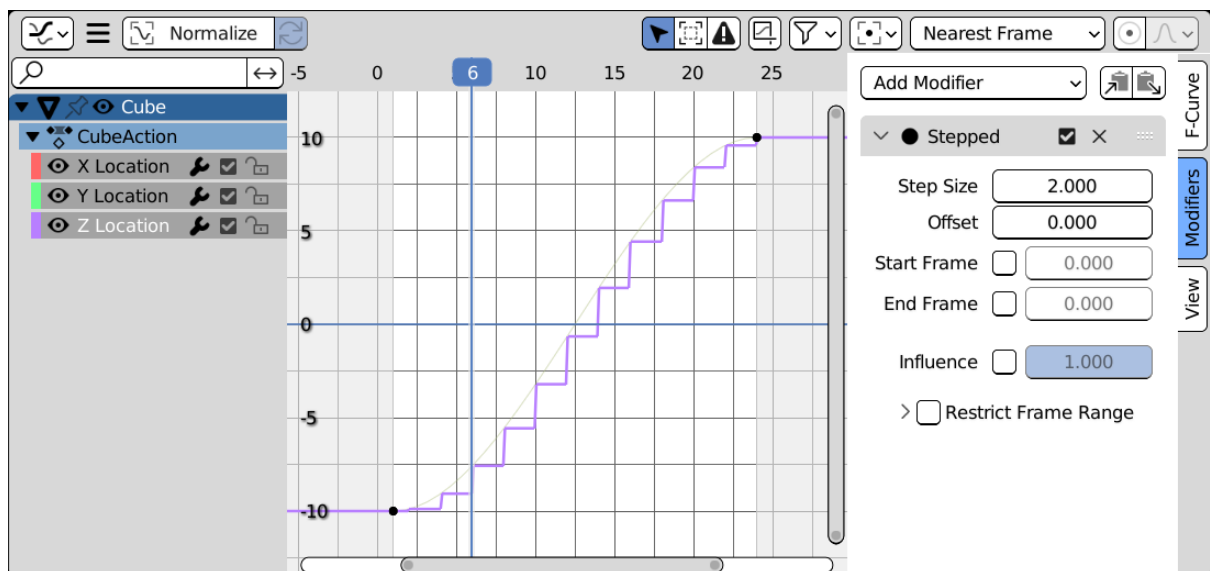
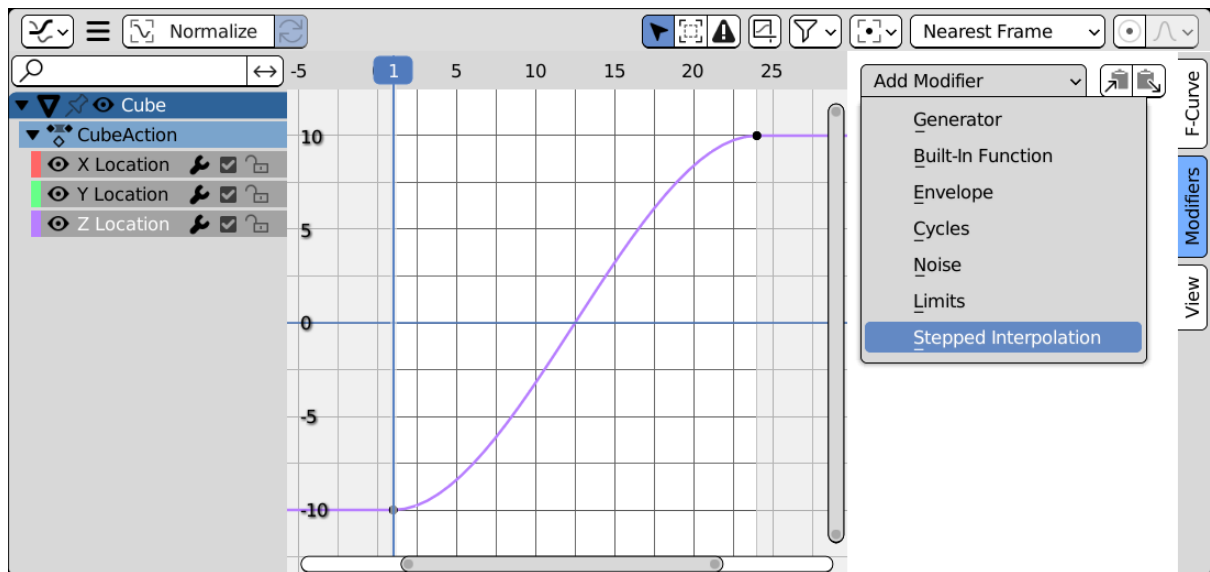
General	Animation	Scripting	Data
3D Viewport	Dope Sheet	Text Editor	Outliner
Image Editor	Timeline	Python Console	Properties
UV Editor	Graph Editor	Info	File Browser
Compositor	Drivers		Asset Browser
Texture Node Editor	Nonlinear Animation		Spreadsheet
Geometry Node Editor			Preferences
Shader Editor			
Video Sequencer			
Movie Clip Editor			



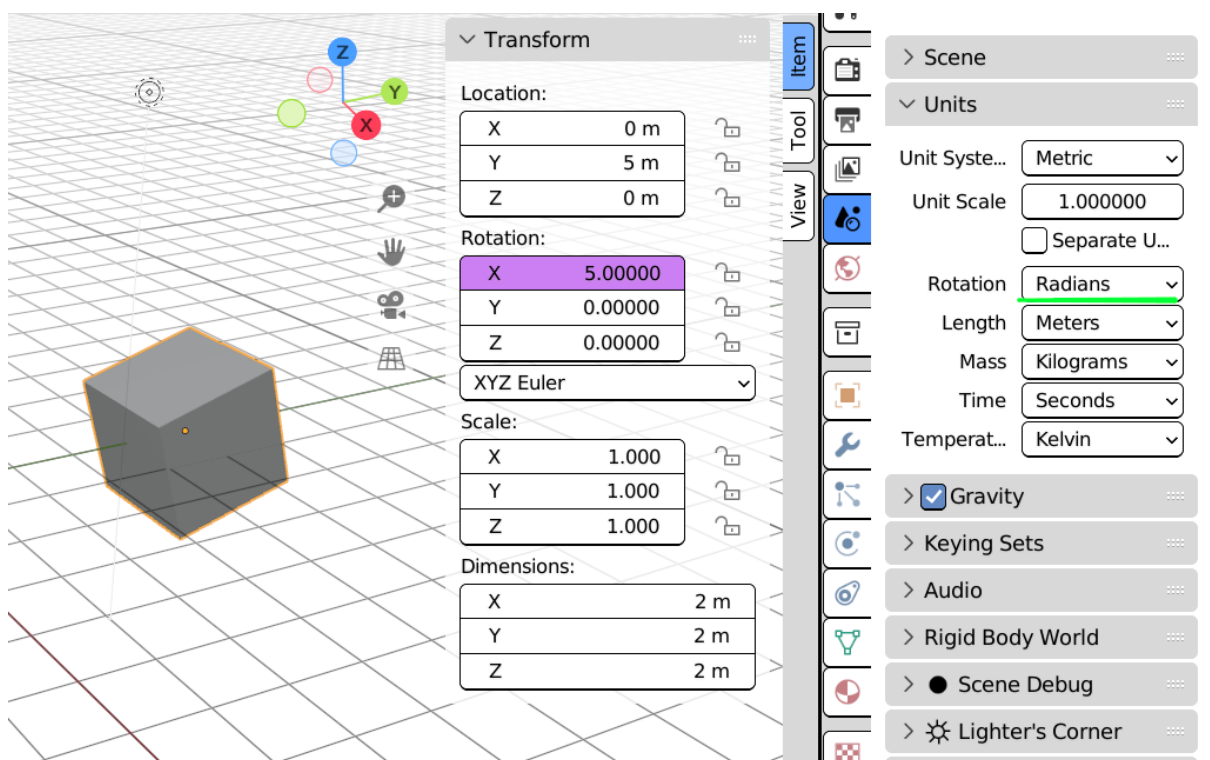
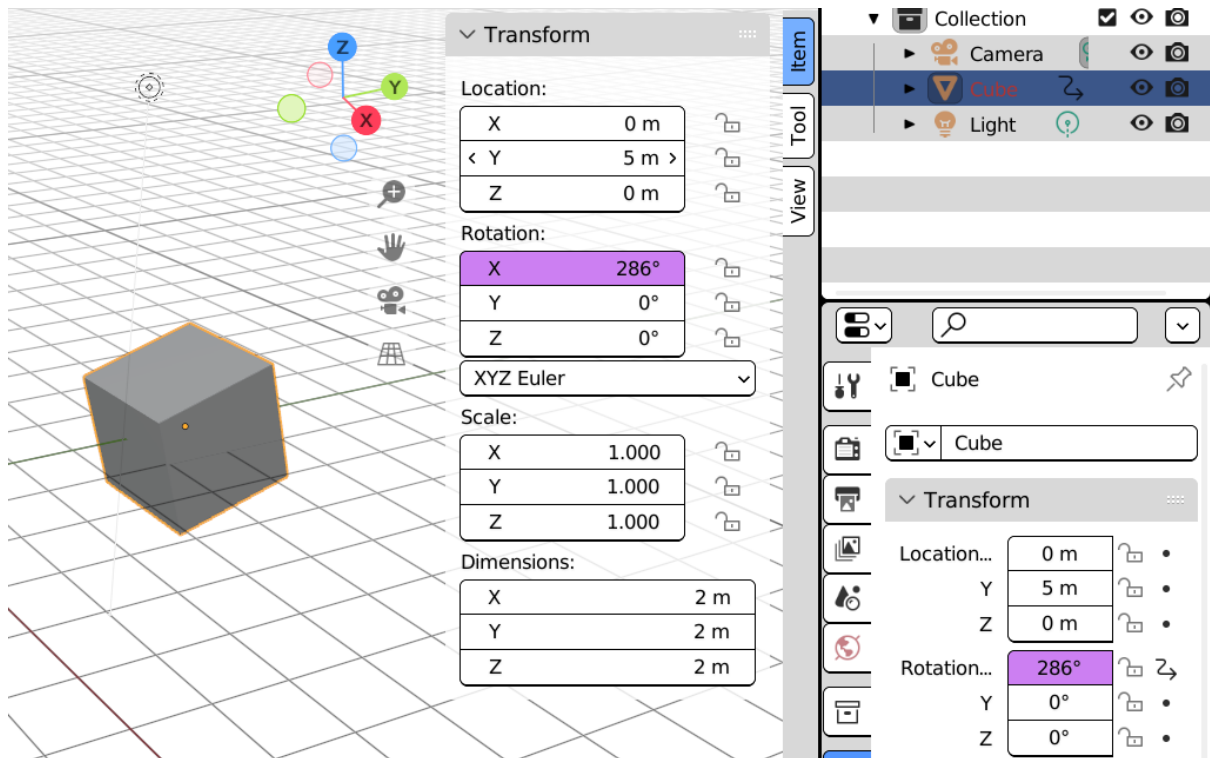


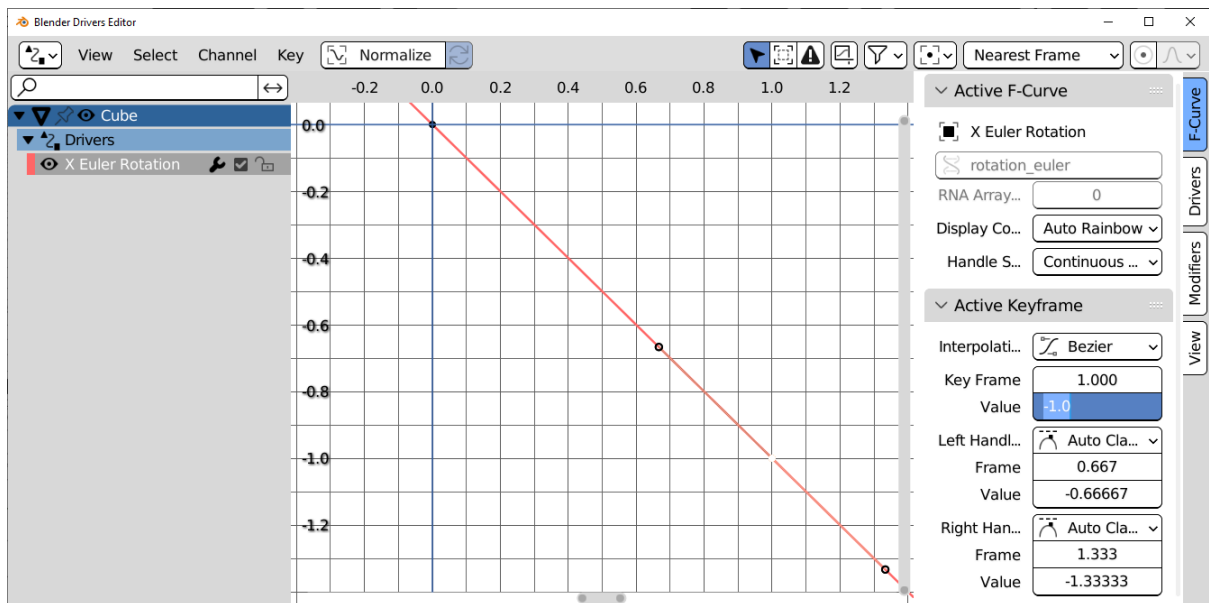
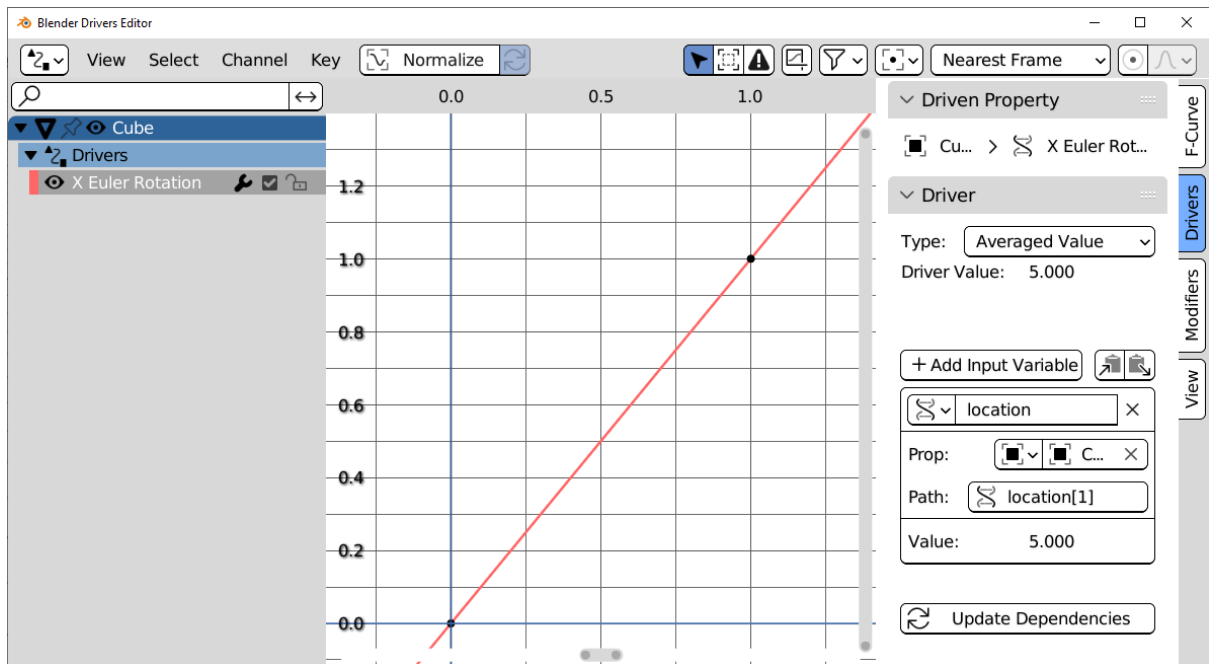


Chapter 08: Animation Modifiers



Chapter 09: Animation Drivers

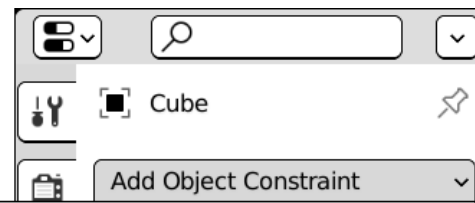
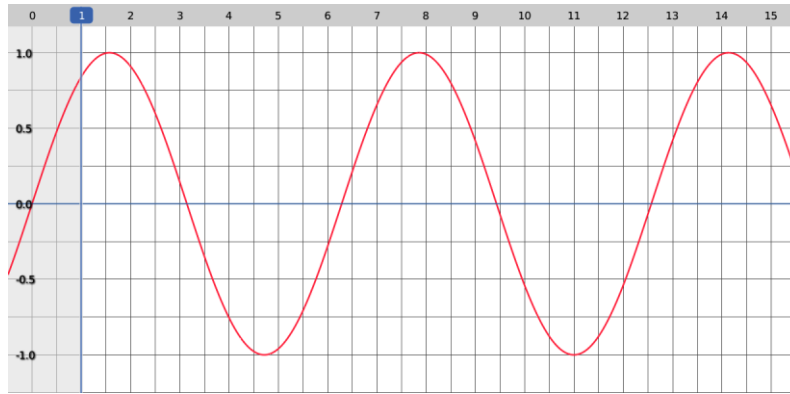




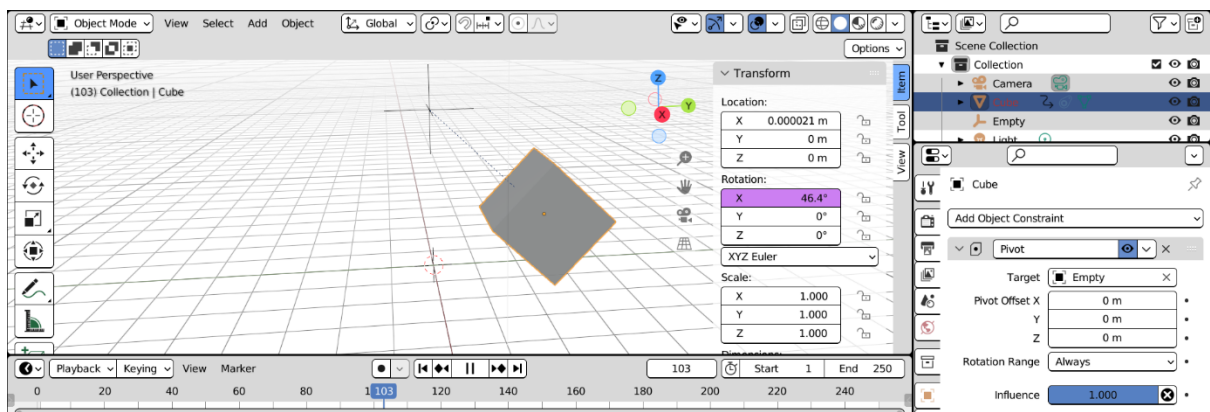
Rotation:

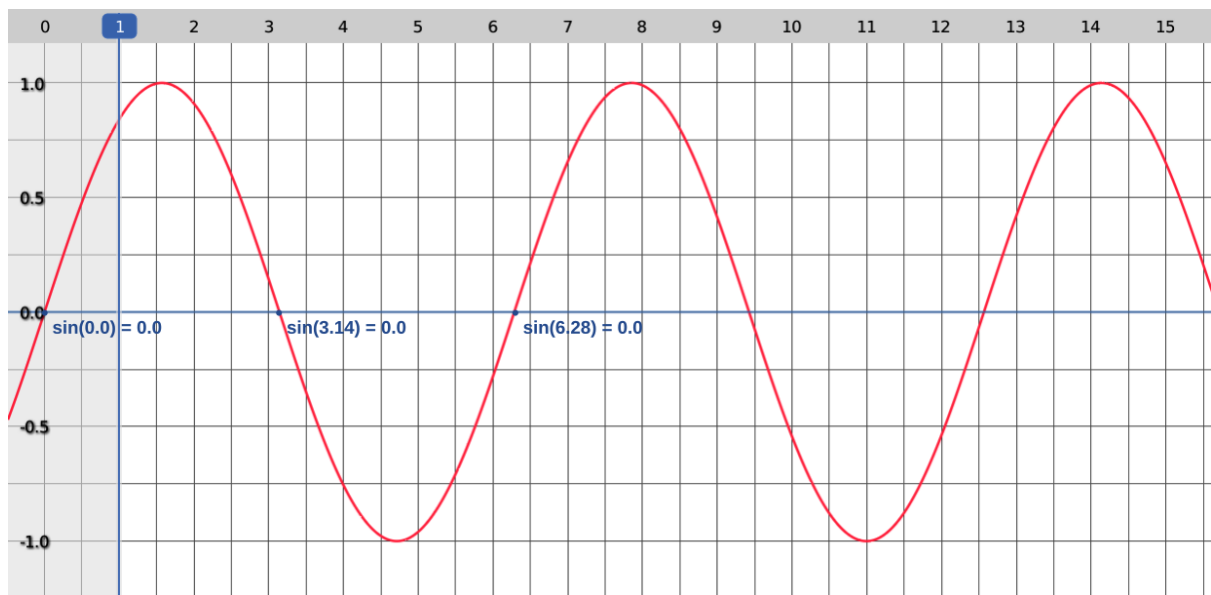
#sin(frame)	
Y	0°
Z	0°

XYZ Euler



Motion Tracking	Transform	Tracking	Relationship
- Camera Solver - Follow Track - Object Solver	- Copy Location - Copy Rotation - Copy Scale - Copy Transforms - Limit Distance - Limit Location - Limit Rotation - Limit Scale - Maintain Volume - Transformation - Transform Cache	- Clamp To - Damped Track - Locked Track - Stretch To - Track To	- Action - Armature - Child Of - Floor - Follow Path - Pivot - Shrinkwrap





Transform

Location:

X	0 m
Y	0 m
Z	0 m

Rotation:

#sin(frame / fps / sqrt(length/9.8))	
Y	0°
Z	0°

XYZ Euler

View Tool Item

Driven Property:

 Cube >  X Euler Rotation

Driver Settings:

Type: Scripted Expression 

Driver Value: 0.000

Expression:

`sin(frame / fps / sqrt(length/9.8))`

☐ Use Self

 ERROR: Invalid Python expressi...

+ Add Input Variable



Update Dependencies



Show in Drivers Editor

+ Add Input Variable





var


Prop:




Value: 0.000

Driven Properties


Cube

Driver Settings
Type:

Scene

Driver Value:

Expression:

sin(frame / f

☐ Use Self
☒ ERROR: I

+ Add Input Variable


var

Prop:




Value: 0.000

▲


Line Style


Library


Light


Key


Image


Collection


Grease Pencil


Font


Curve


Cache File


Camera


Brush


Armature


Action


Hair Curves


Texture


Text


Speaker


Sound


Simulation


Scene


Light Probe


Particle


Palette


Paint Curve


Object


Node Tree


Movie Clip

+ Add Input Variable



  fps

Prop:

   Scene

Path:

 render.fps

Value:

24.000

  var

 Single Property

 (X) Transform Channel

  Rotational Difference

  Distance

Type

▼ Driven Property



Cube > X Euler Rotation

▼ Driver



Type:

Scripted Expression



Driver Value:

0.381

Expression:

`sin(frame / fps / sqrt(length / 9.8))`

☐ Use Self



Add Input Variable



fps



Prop:



Scene



Path:



render.fps

Value:

24.000



length



Object 1:



Cube



Transform Space:

World Space



Object 2:



Empty



Transform Space:

World Space

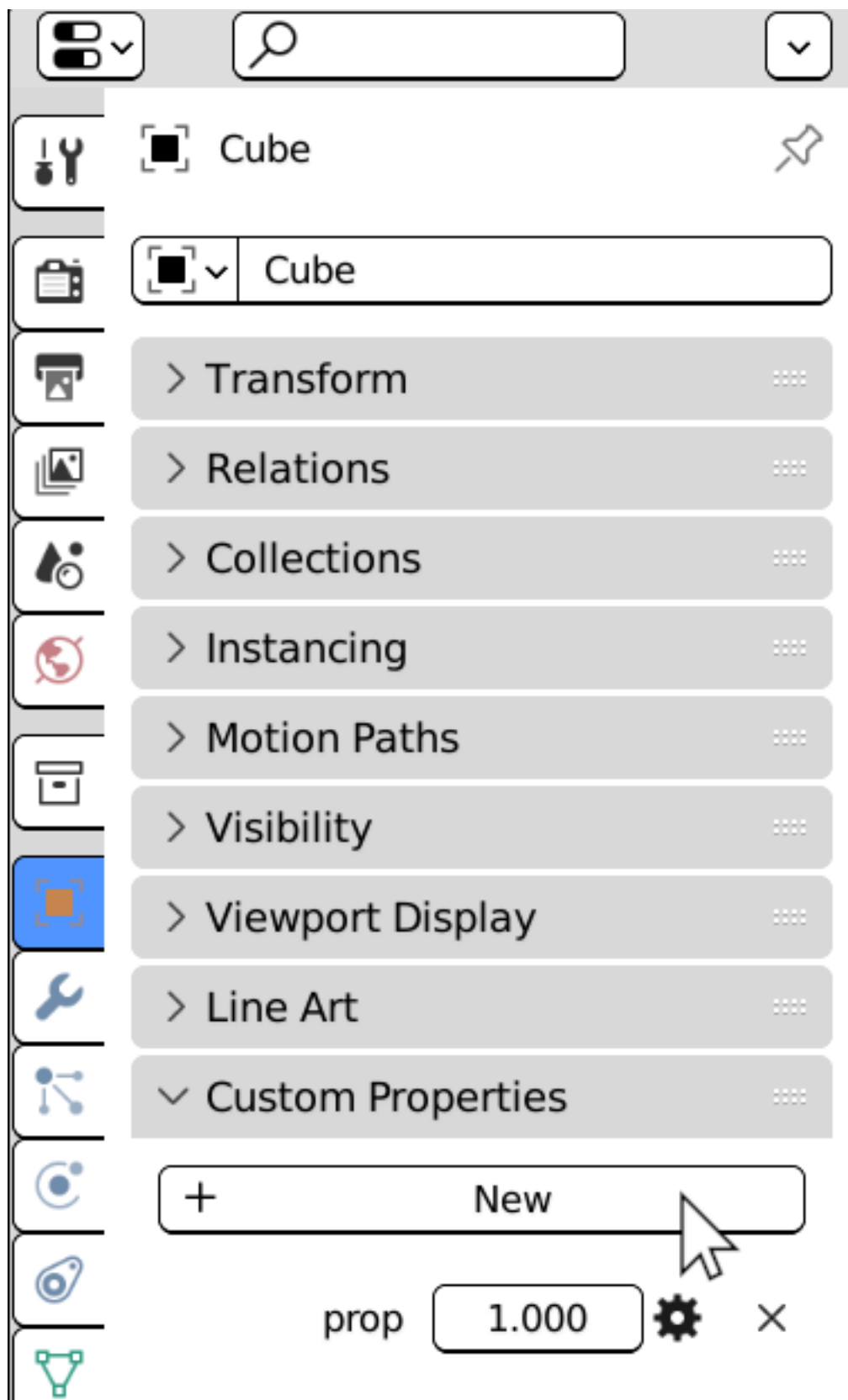


Value:

5.000

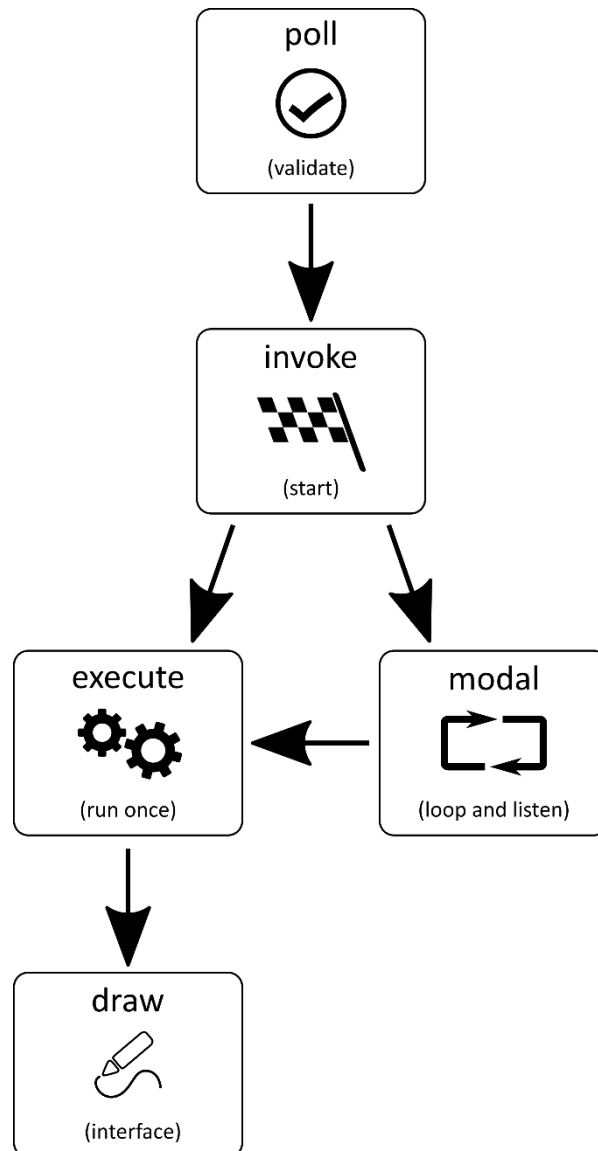


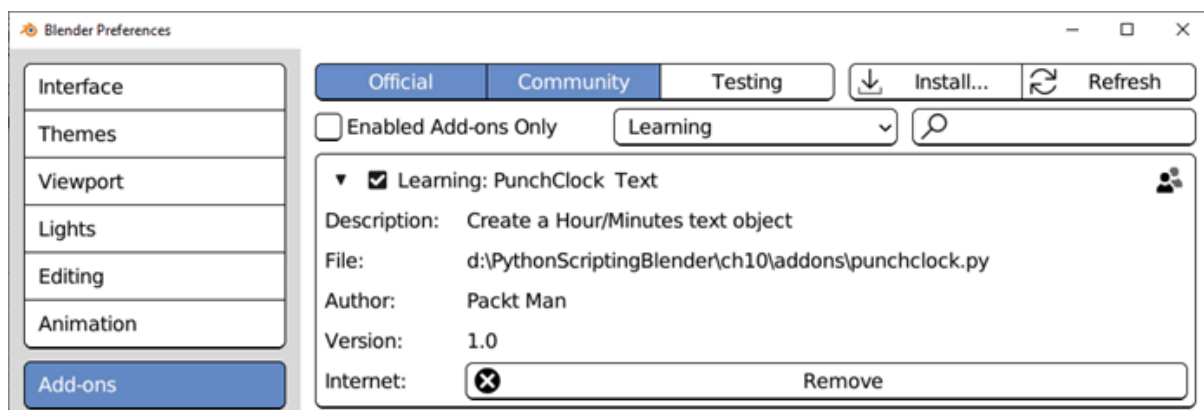
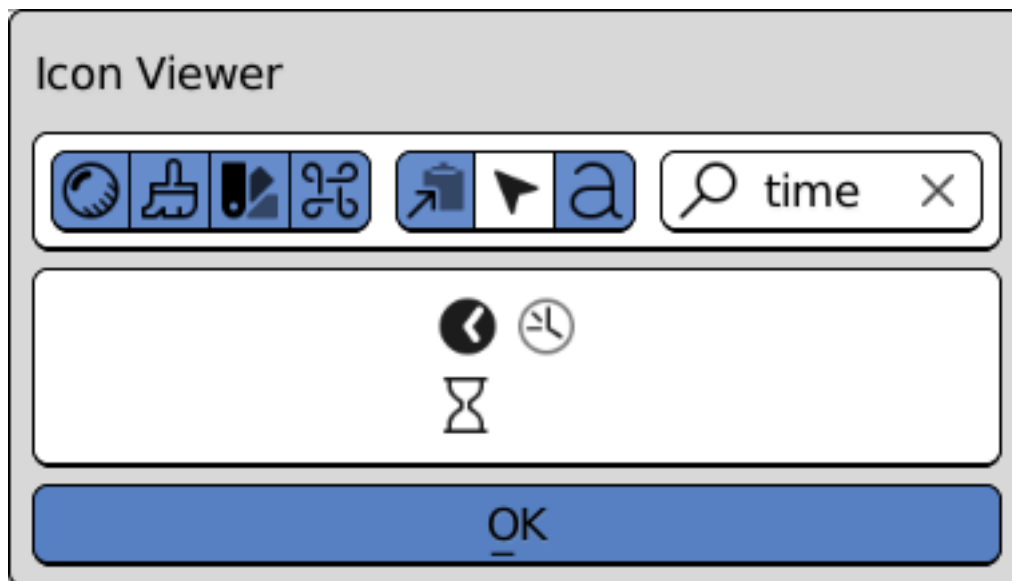
Update Dependencies

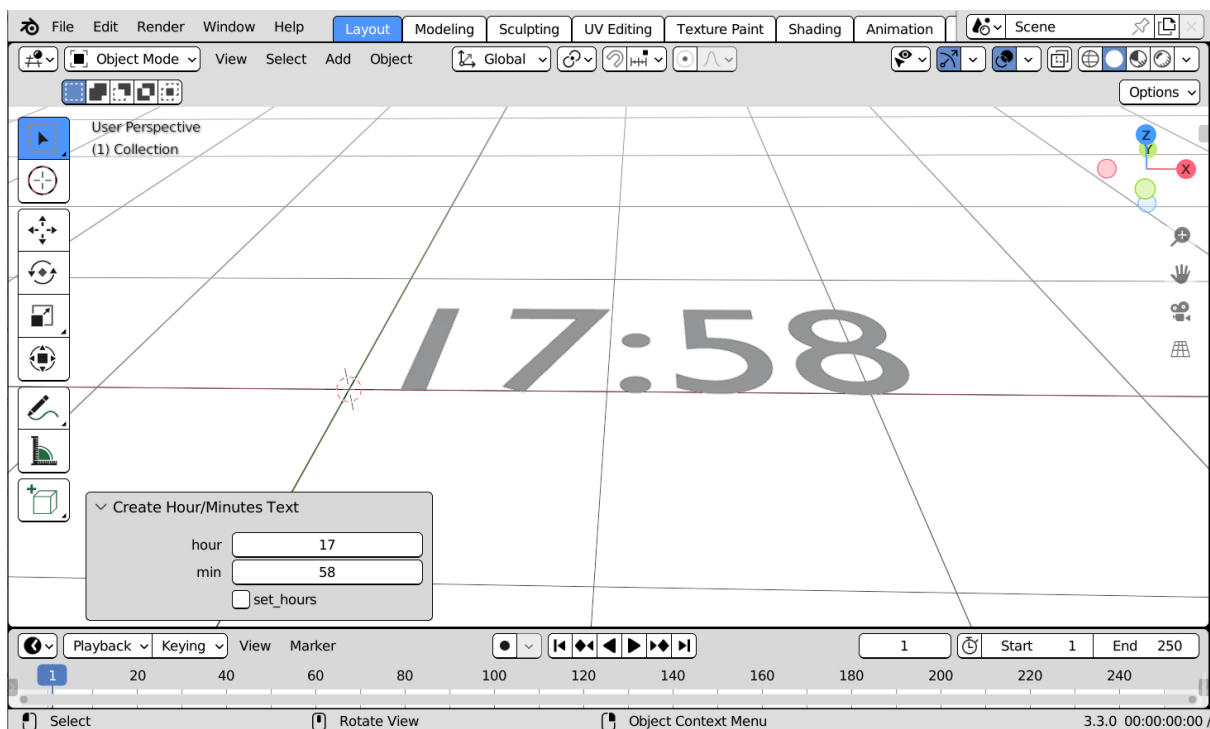
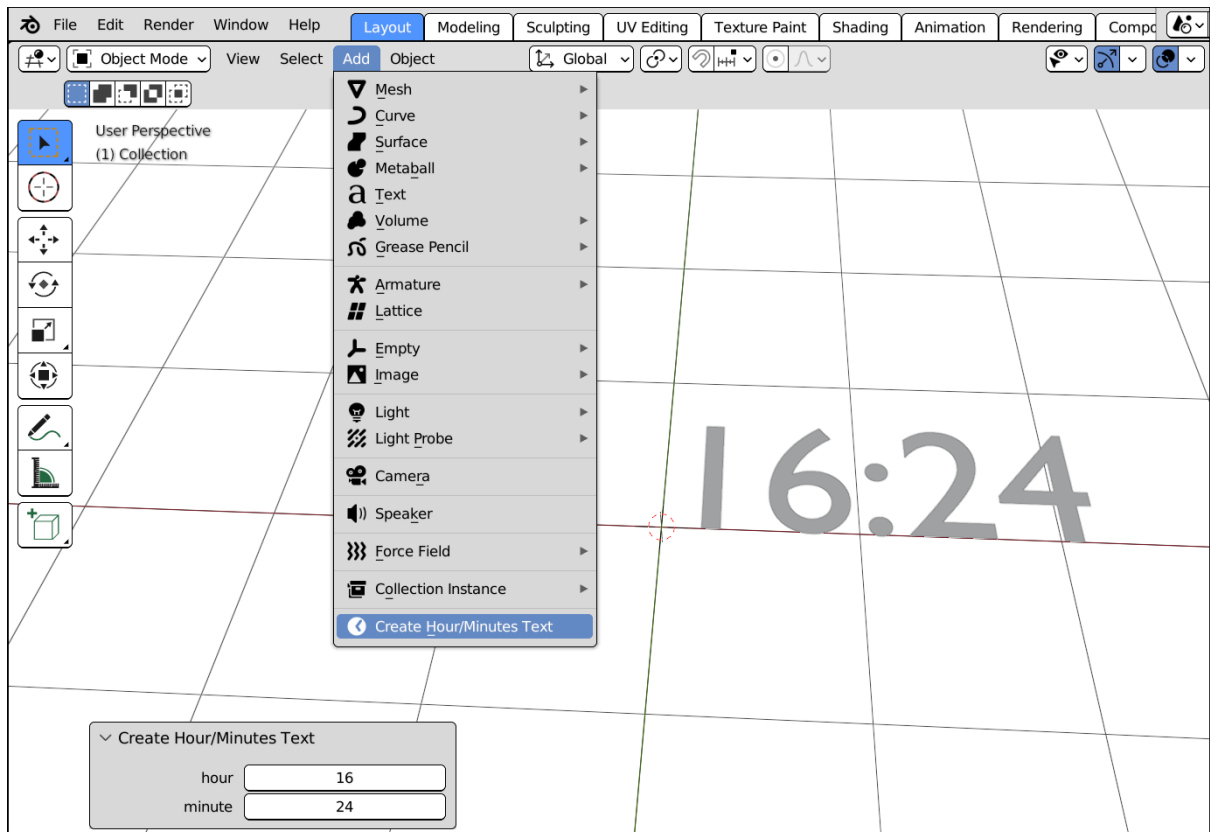


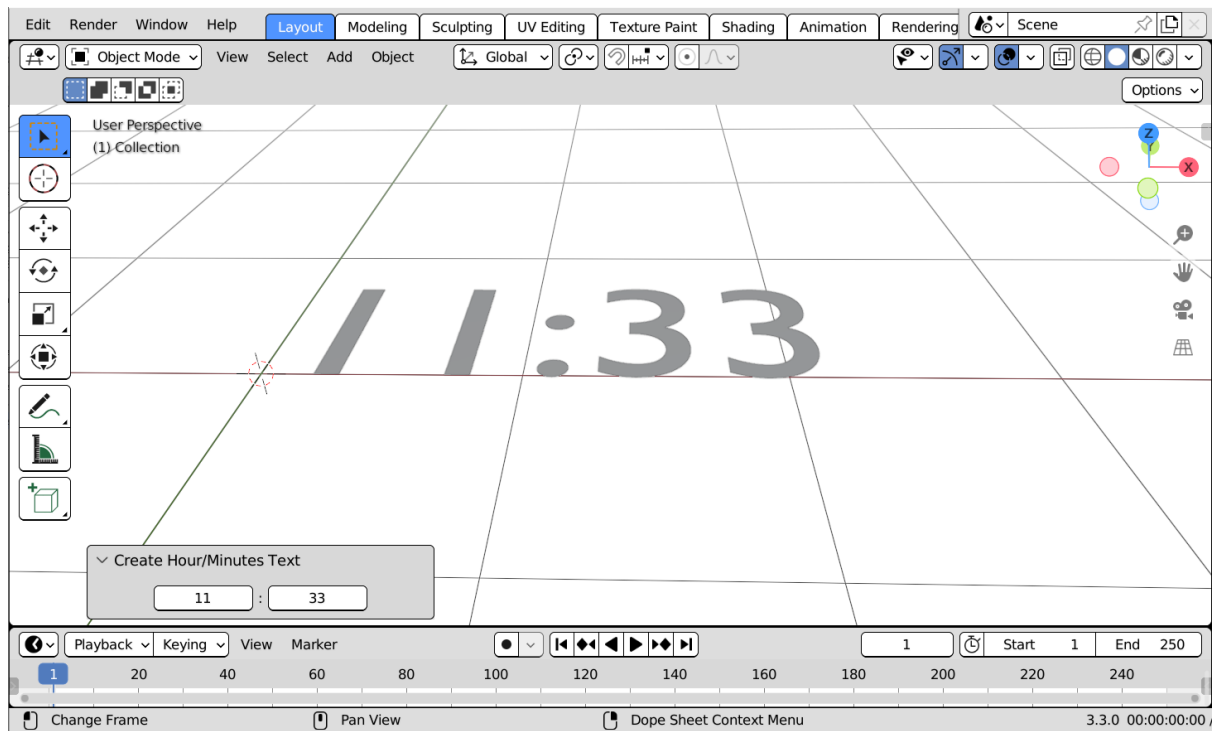
 amp		
Prop:	  Empty	
Path:	 <input type="text" value='["amplitude"]'/>	

Chapter 10: Advanced and Modal Operators

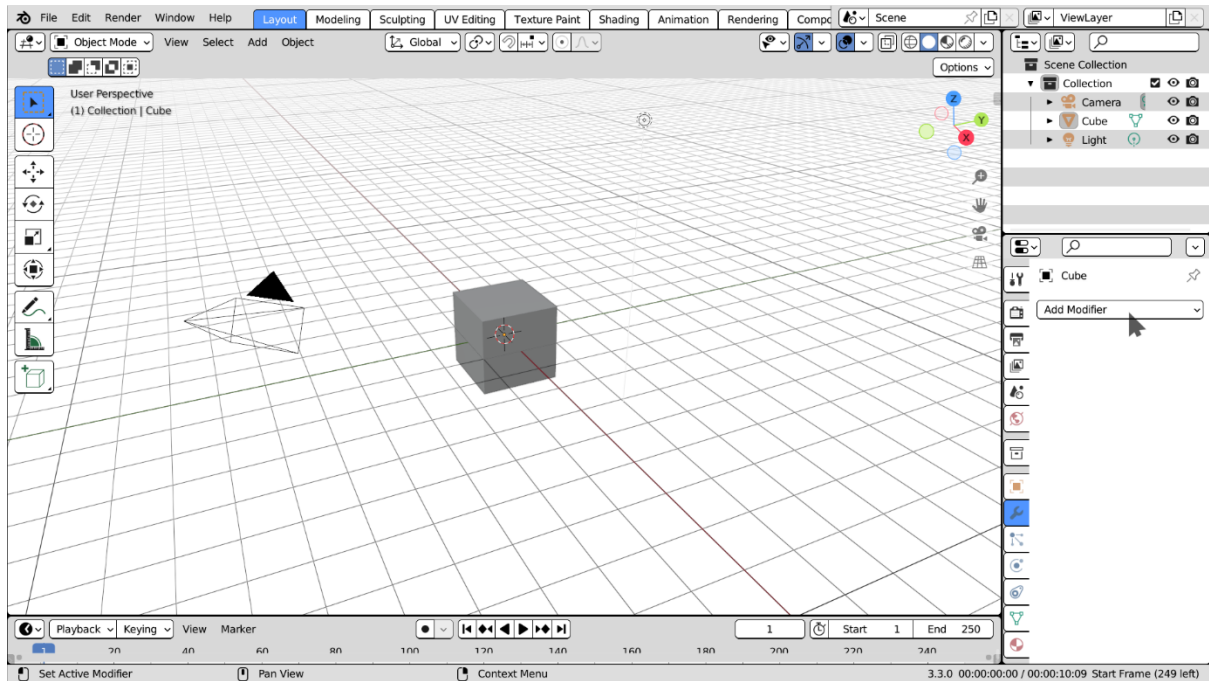




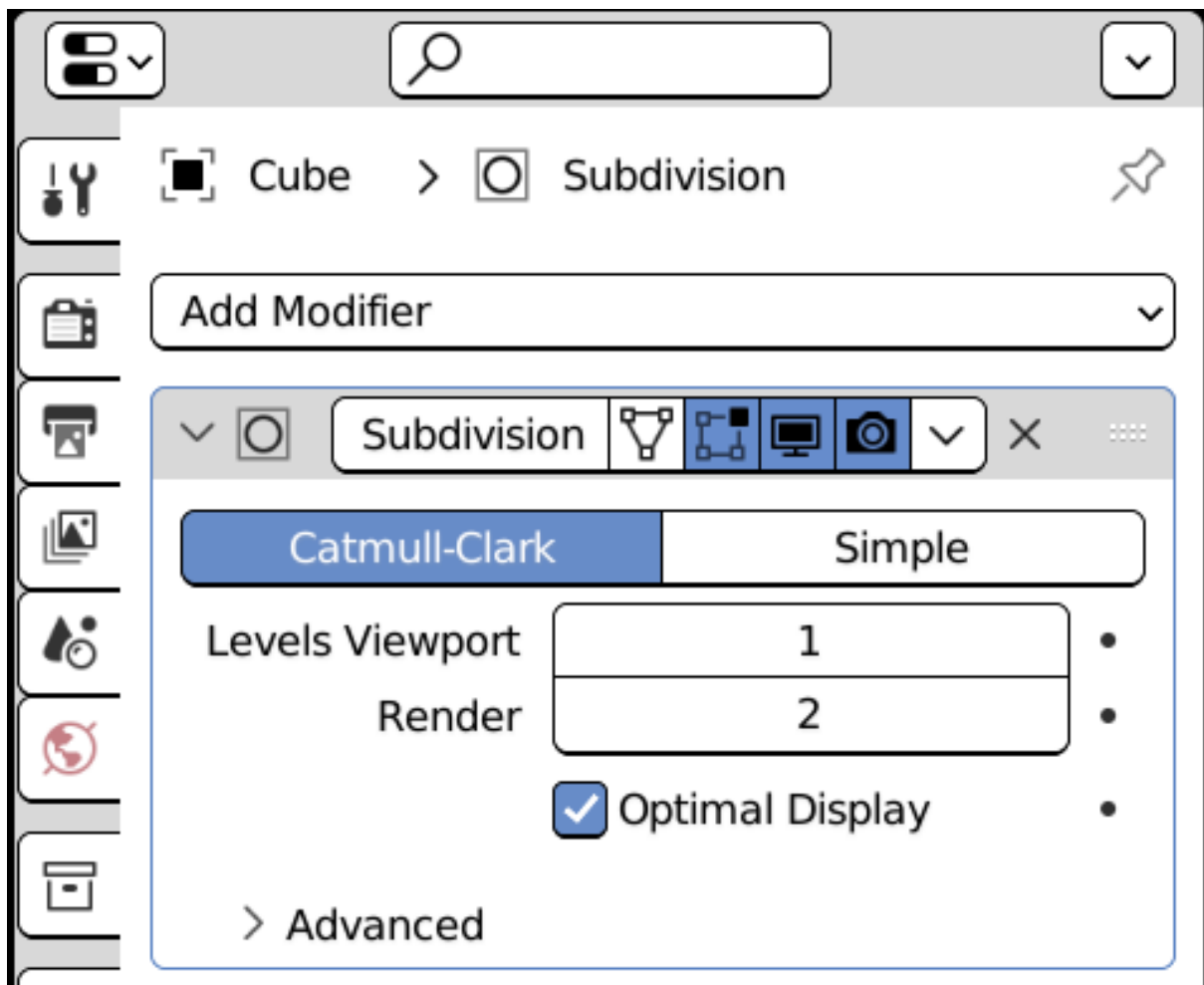
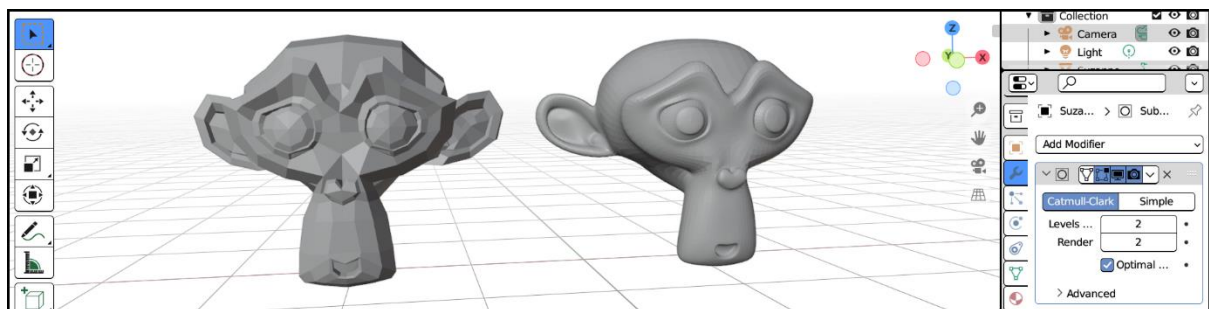




Chapter 11: Object Modifiers

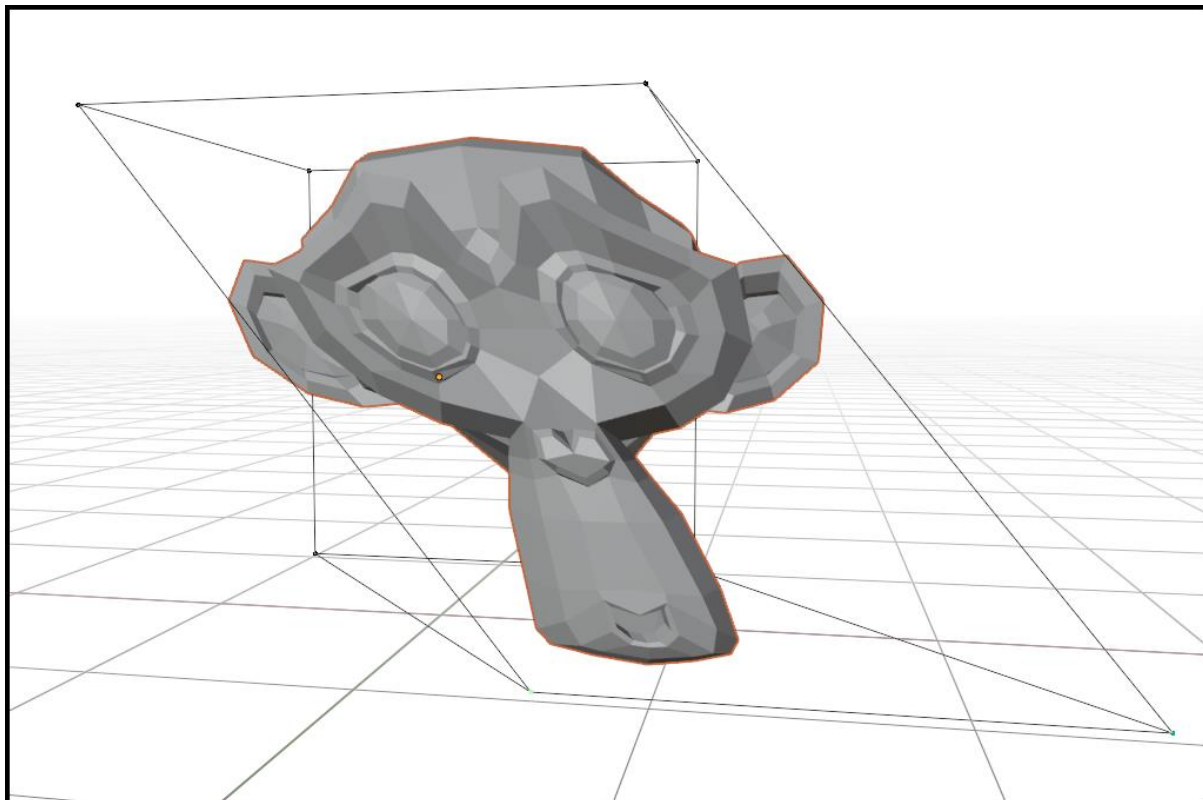
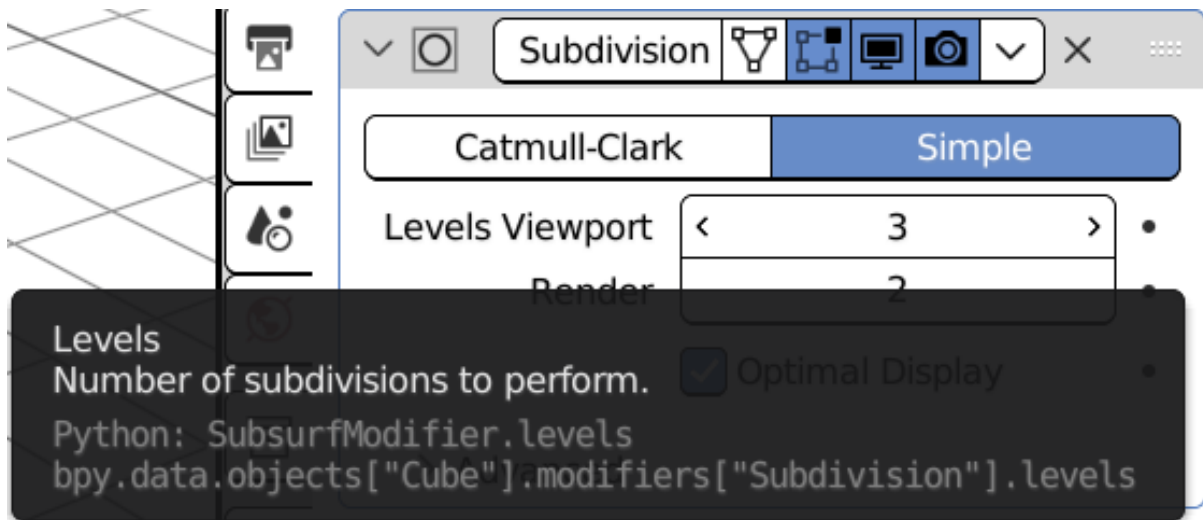


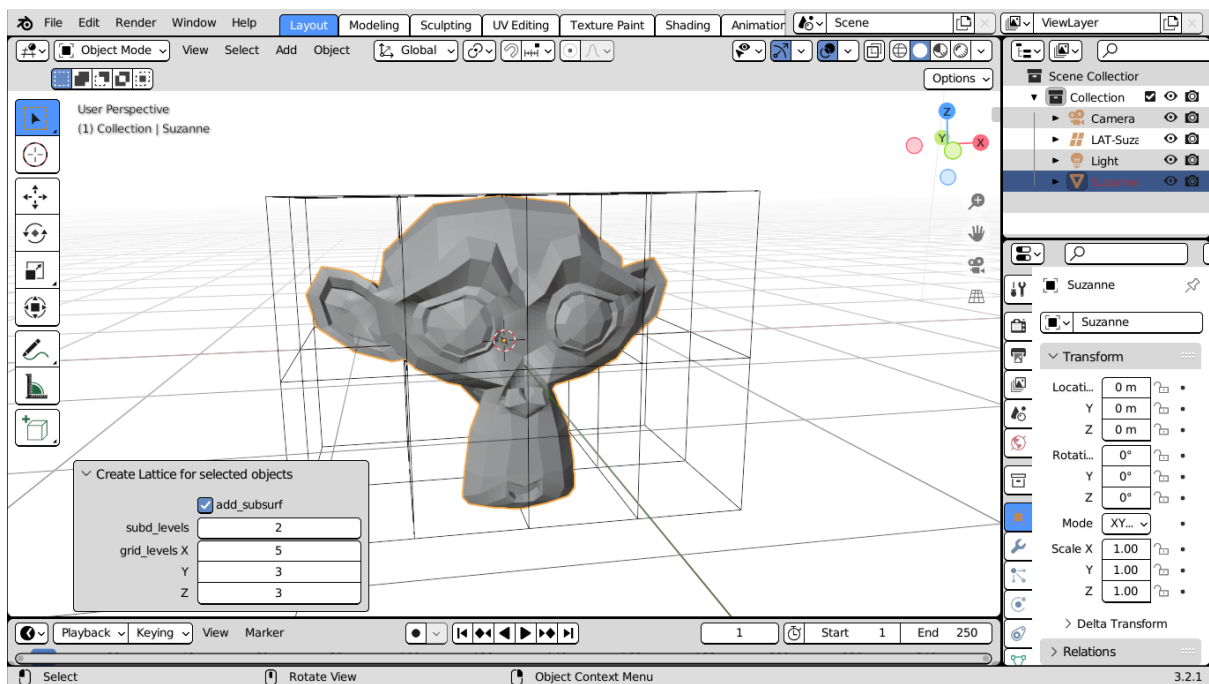
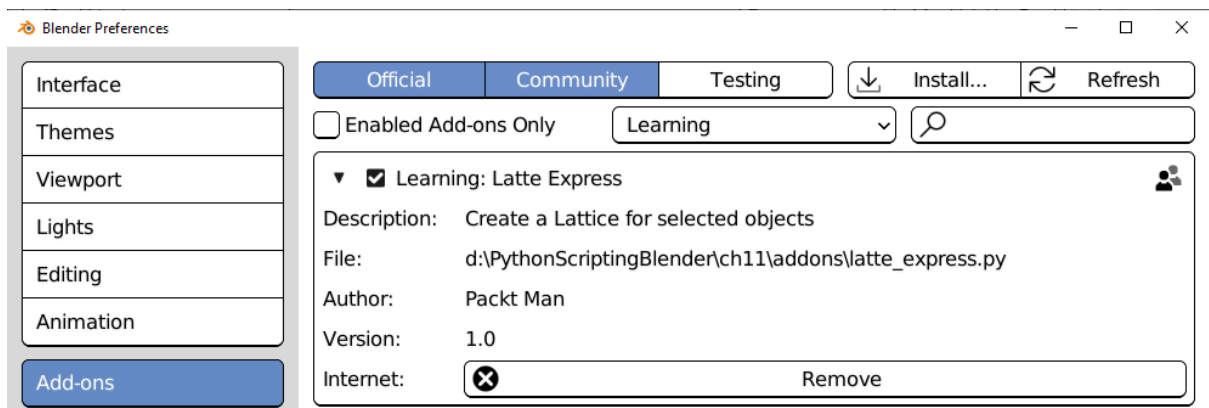
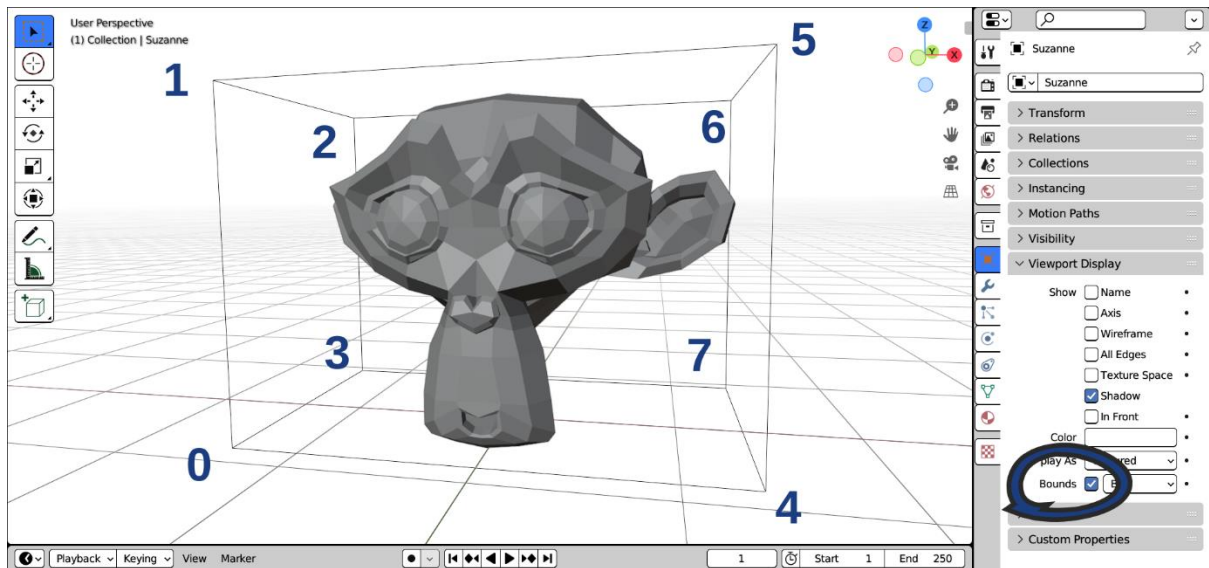
Modify	Generate	Deform	Physics
Data Transfer	Array	Armature	Cloth
Mesh Cache	Bevel	Cast	Collision
Mesh Sequence Cache	Boolean	Curve	Dynamic Paint
Normal Edit	Build	Displace	Explode
Weighted Normal	Decimate	Hook	Fluid
UV Project	Edge Split	Laplacian Deform	Ocean
UV Warp	Geometry Nodes	Lattice	Particle Instance
Vertex Weight Edit	Mask	Mesh Deform	Particle System
Vertex Weight Mix	Mirror	Shrinkwrap	Soft Body
Vertex Weight Proximity	Multiresolution	Simple Deform	
	Remesh	Smooth	
	Screw	Smooth Corrective	
	Skin	Smooth Laplacian	
	Solidify	Surface Deform	
	Subdivision Surface	Warp	

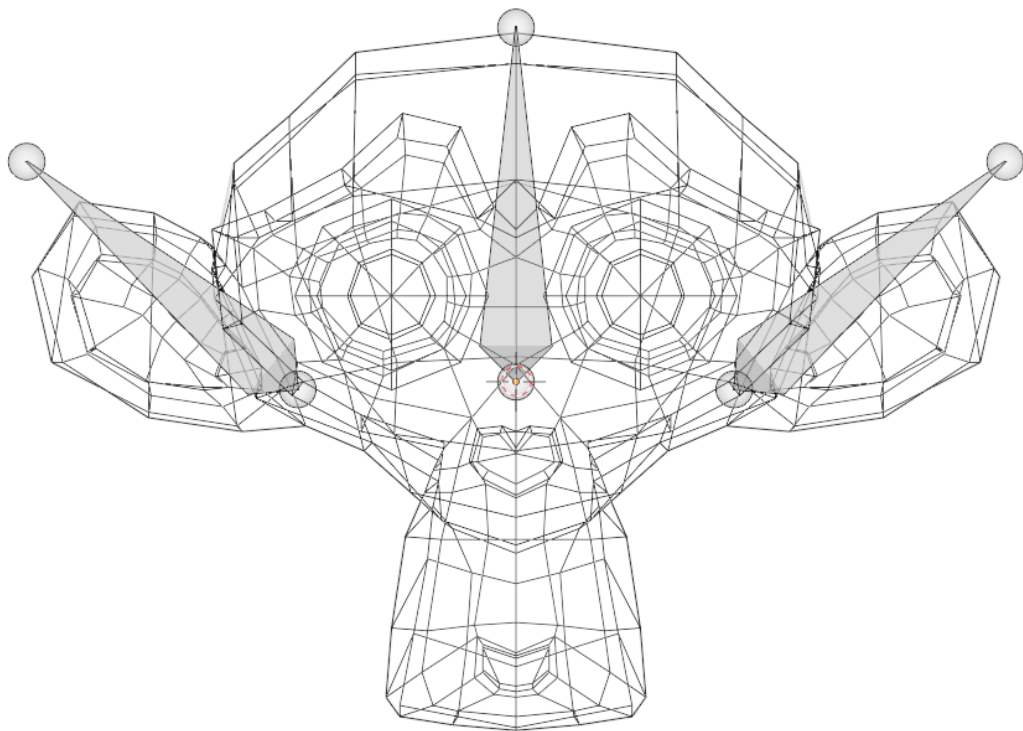
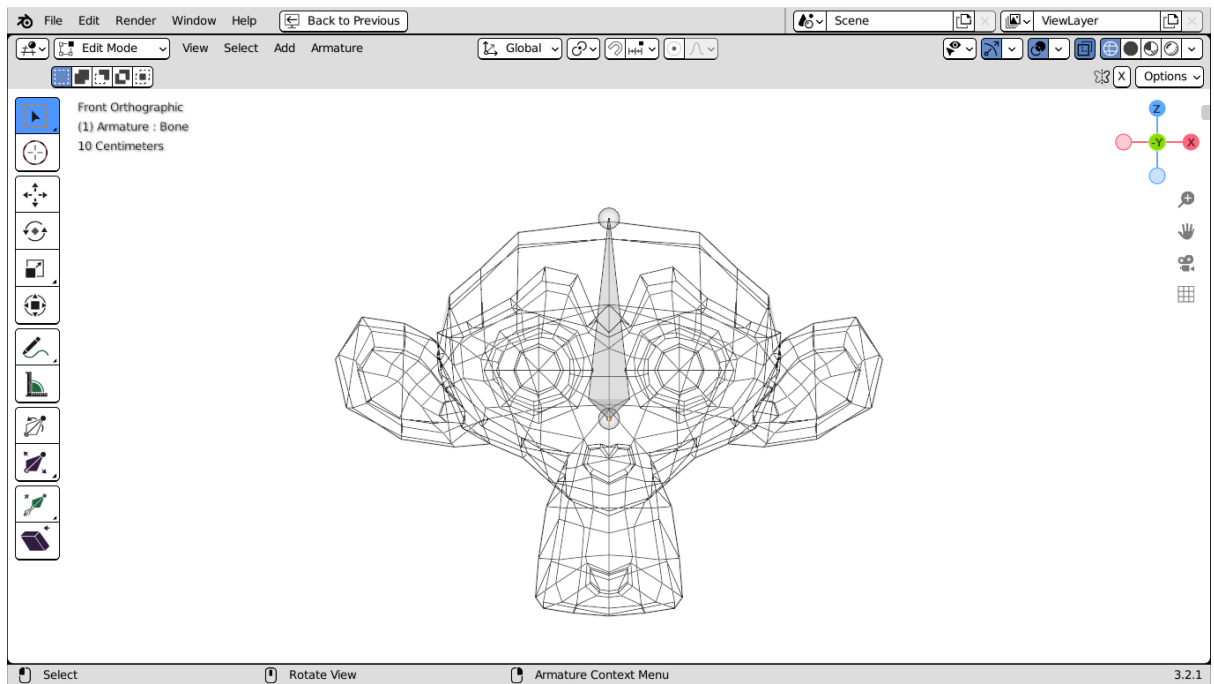


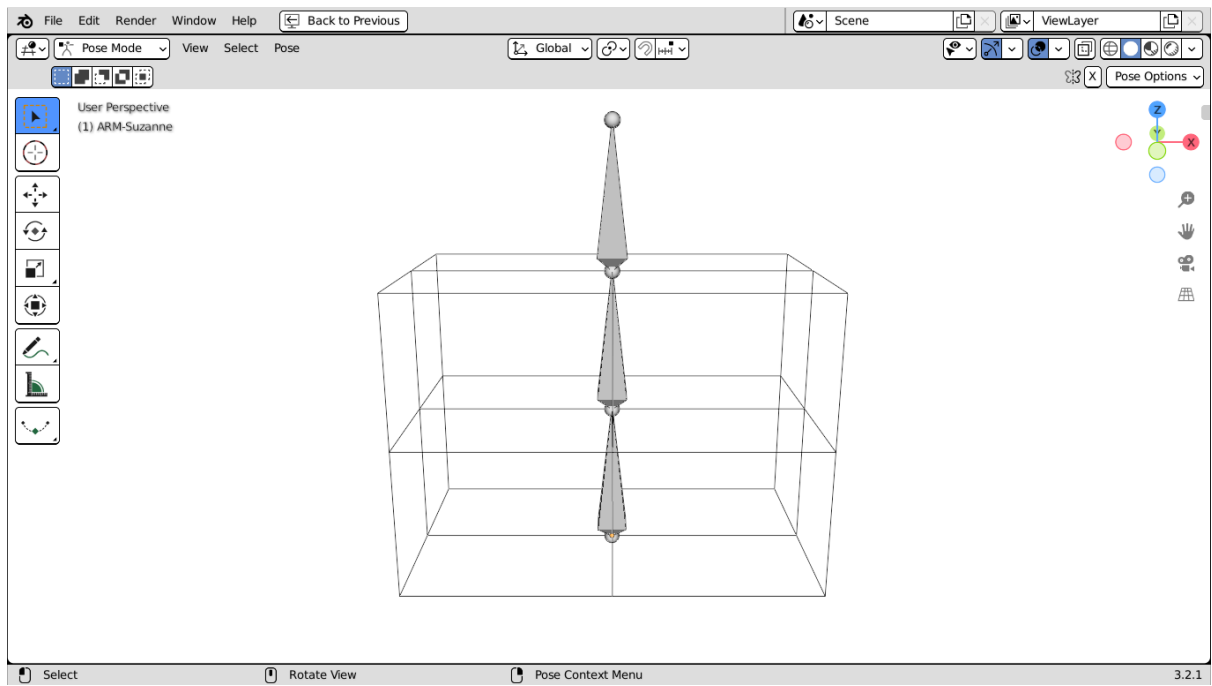
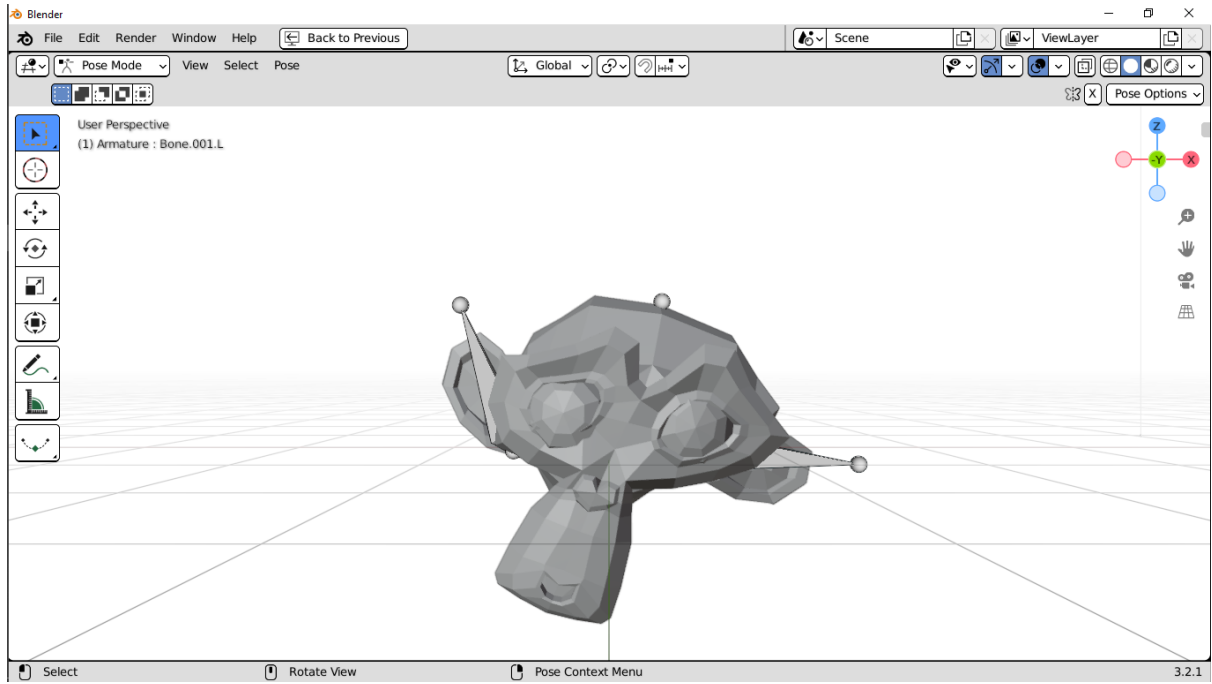
```
bpy.context.space_data.context = 'MODIFIER'
```

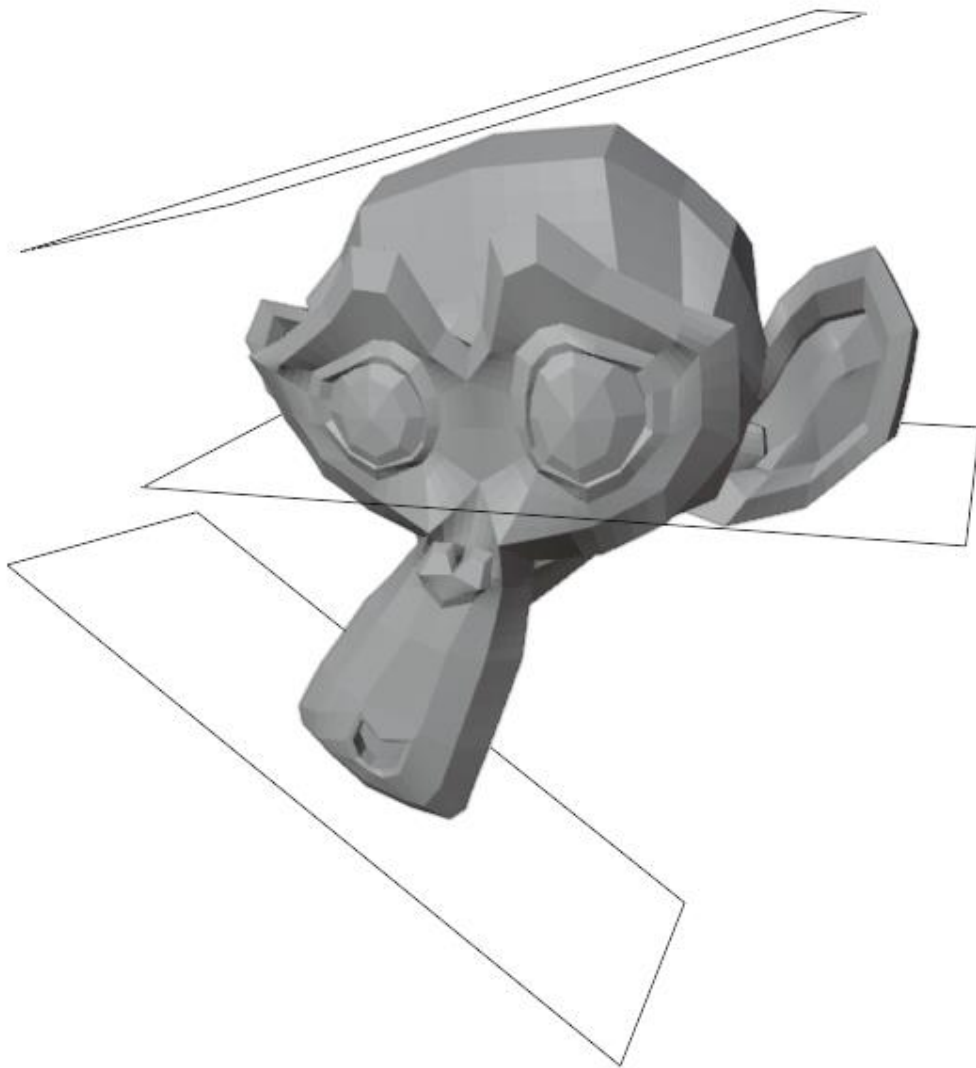
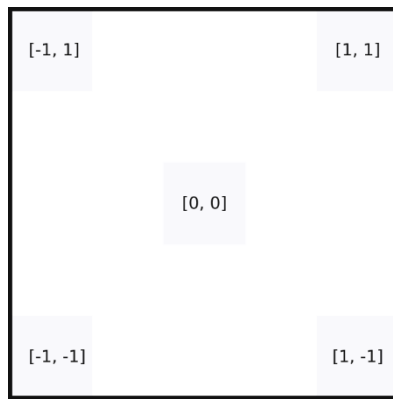
```
bpy.ops.object.modifier_add(type='SUBSURF')
```



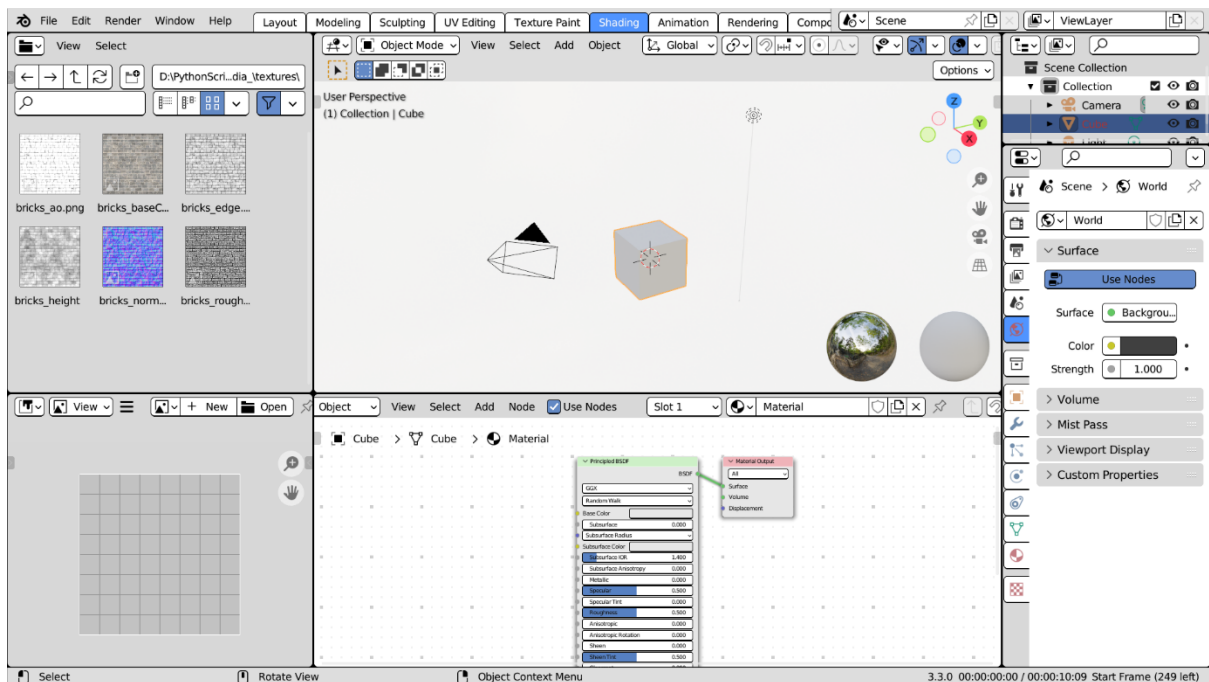
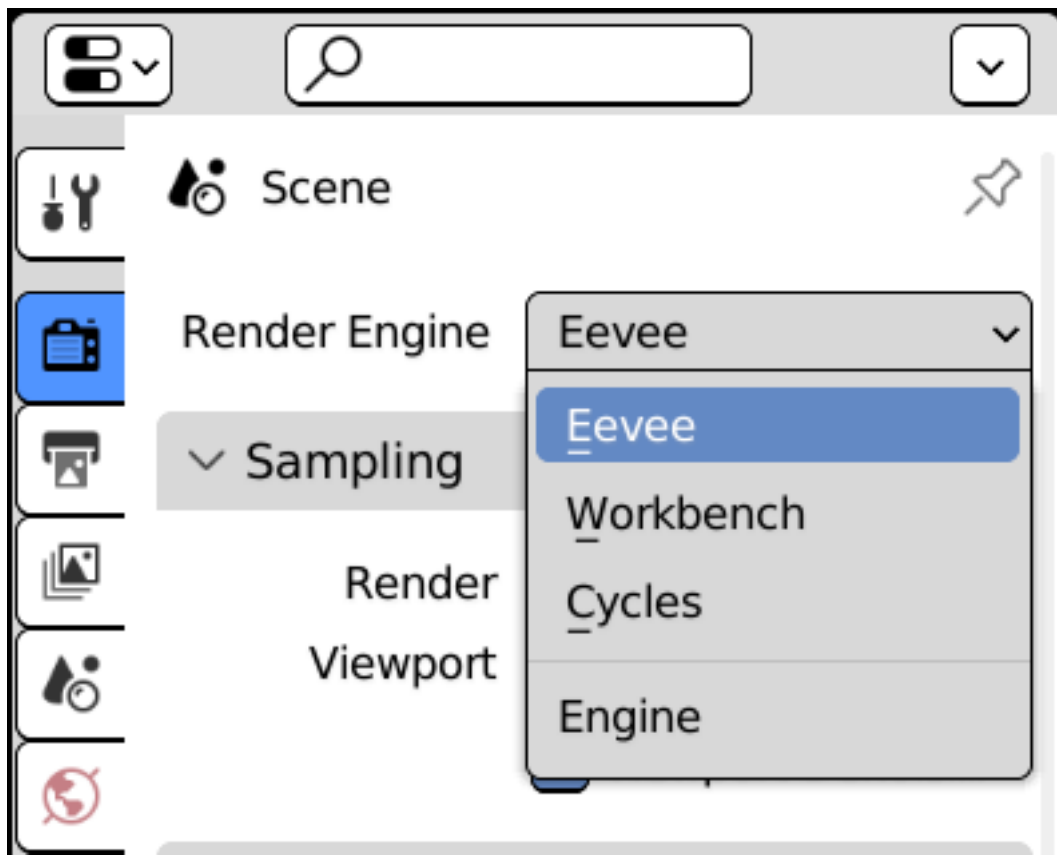


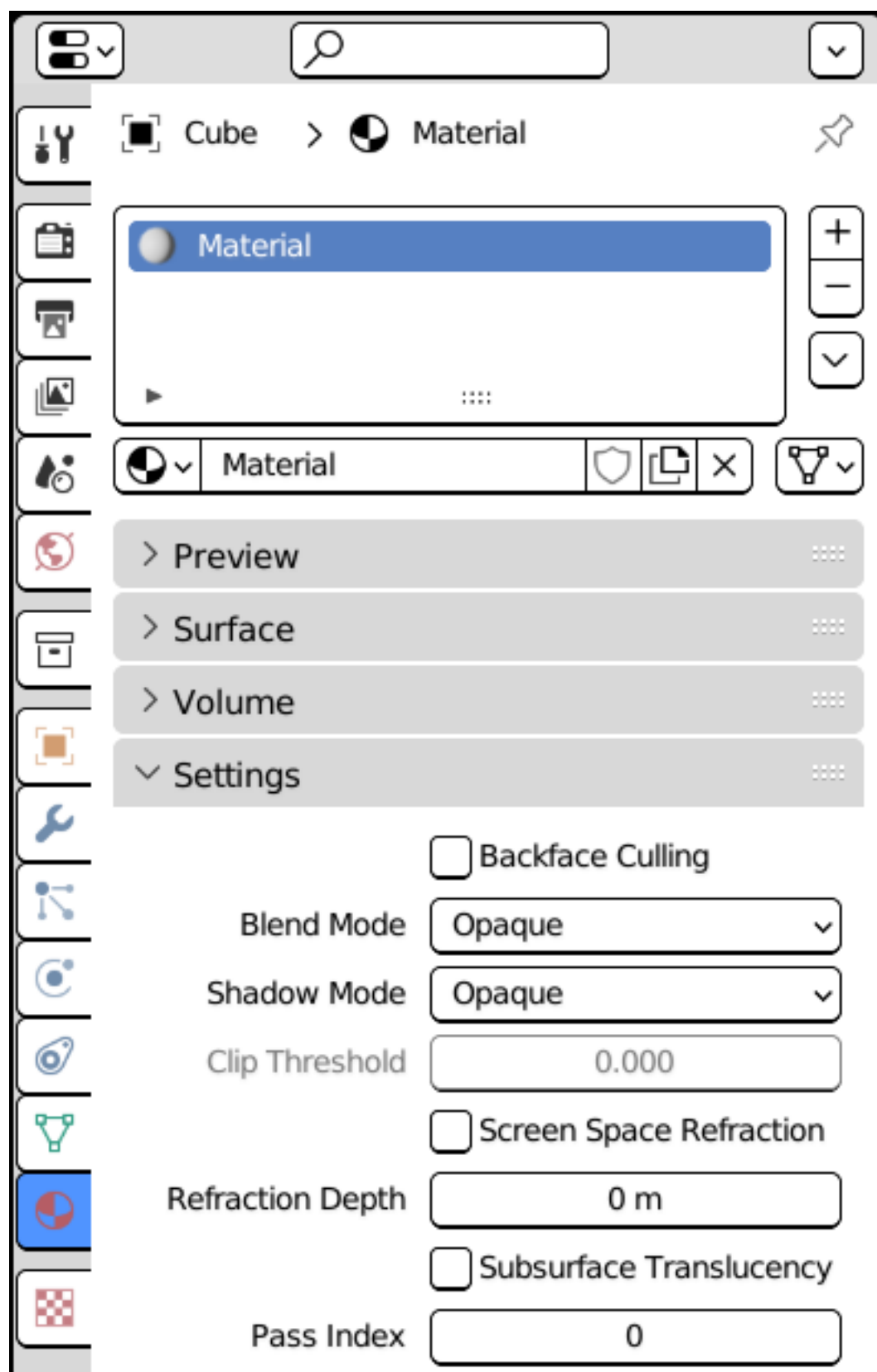


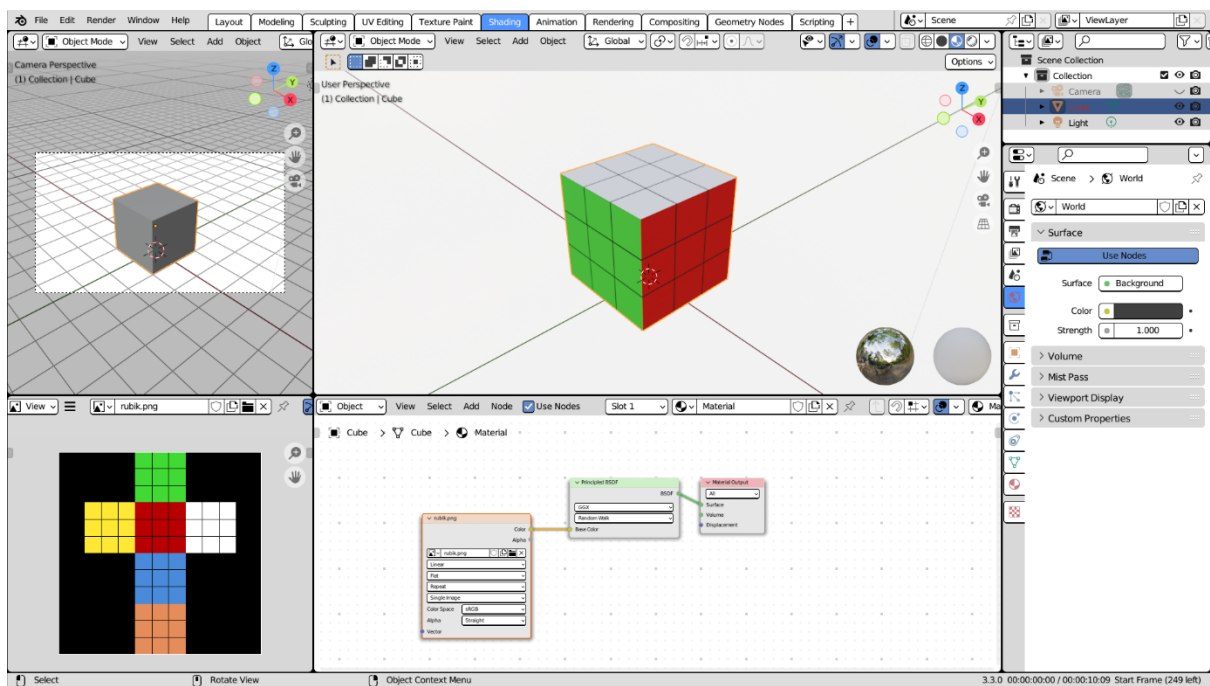
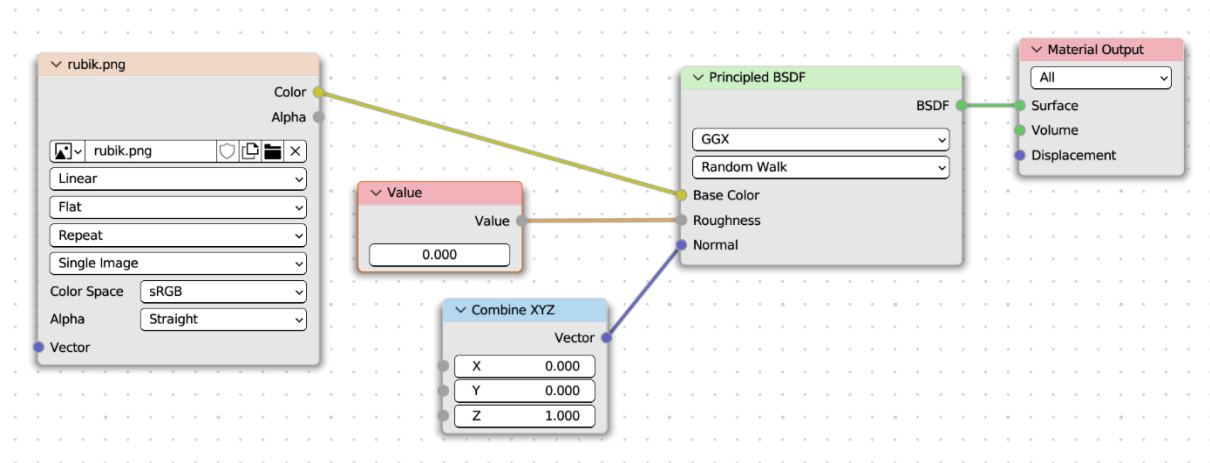
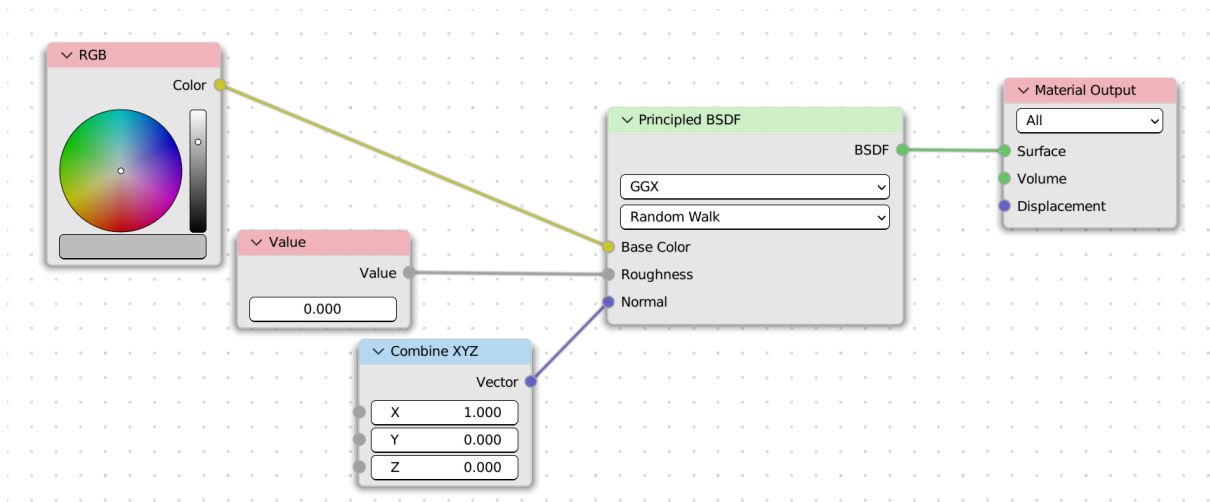


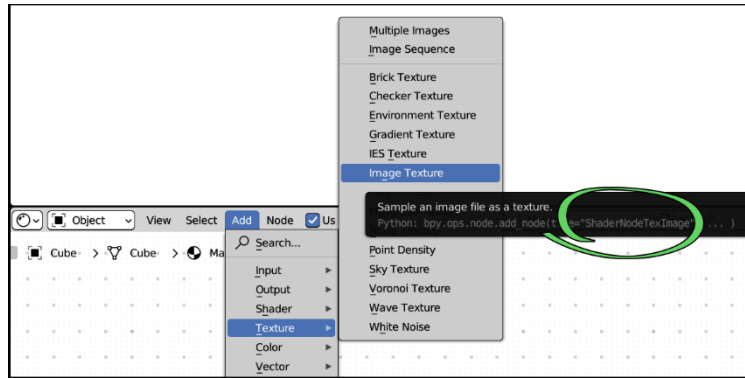


Chapter 12: Rendering and Shaders









```
View Text Edit Select Format Templates space_node.py
14 from bl_ui.properties_material import (
15     EEVEE_MATERIAL_PT_settings,
16     MATERIAL_PT_viewport
17 )
18 from bl_ui.properties_world import (
19     WORLD_PT_viewport_display
20 )
21 from bl_ui.properties_data_light import (
22     DATA_PT_light,
23     DATA_PT_EEVEE_light,
24 )
25
26 class NODE_HT_header(Header):
27     bl_space_type = 'NODE_EDITOR'
```

