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Task Sheets from Module B: 3D Objects

#	Handout	#	Task sheet
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		B1.2	Model and edit 3 objects - Part 2
		B1.3	Assembly of a bench vise
		B1.4	Assembly of a wheel
B2	3D Printing	**B2.1**	Testing and calibration
		B2.2	Changing the filament
		B2.3	Preheating and Cooling
		B2.4	Printing an object
B3	Photogrammetry	**B3.1**	Getting Started (Introduction to Photogrammetry)
		B3.2	3D-scan an object
		B3.3	3D-scan editing & mesh creation
		B3.4	Using the masking tool

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Module: 3D Objects

Topic: 3D Modelling

Task sheet B1.1: Model and edit 3 objects - Part 1

Time: 2 hours

General description:

This activity will consist of the creation of simple objects to scale using 3D modelling software. A picture of different objects with its dimensions will be provided. Furthermore, all objects will have a .STL file and a .STEP file, which are compatible with most 3D modelling software, in the respective folder so that participants can likewise load the object and edit it at will.

Learning objectives:

- Create and model a 3D object based on given dimensions;
- Edit the properties of a 3D object;
- Understand how to use measuring tools.

Material required:

- Computer with internet connection;
- Callipers and radius gauge (optional).

Description of the activity:

1. Start a new project/sketch and draw a geometric shape that resembles the shape of the object that you will model (e.g. For objects 1 and 3, draw a rectangle; For object 2, draw a circle);
2. Define its width according to the dimensions given in the picture so as to give a 3D graphic representation;
3. Use different commands to shape the object at your will:
    a. Extrude: enables to draw an object on top of an already existing object and force it out. (e.g. to make a hole in a cube you first design the circle, then extrude it, i.e. force the circle/cylinder out of the cube);
    b. Fillet: enables to round the edges of an object;
    c. Chamfer: enables to break sharp edges with a bevel.

How to adapt to different learners:

- If there are participants who are unfamiliar with 3D modelling, it is best that the trainer first demonstrates how to model one of the given objects. Participants can, simultaneously, replicate what the trainer is doing, in order to learn through practice;

- Alternatively, you can have participants load the objects (using the. STEP / .STL file available) and change their properties so that they can better understand how to manipulate the shape of an object;
- For participants that are familiar with 3D modelling, challenge them to create other objects using the ones that were just modelled (e.g. Object 1 can be a cup holder, or an ashtray, so the participant can model the rest of the object). Participants can access the videos in additional information to help with the assembly part.
- Optionally, you can also challenge participants to replicate a real object: for this, firstly show participants how to use a calliper and a radius gauge to effectively measure a real object; Afterwards have the participant select a small object (e.g. a smartphone, a pen, a ruler) and use measuring tools to get the right measures and then model it.

Additional information:

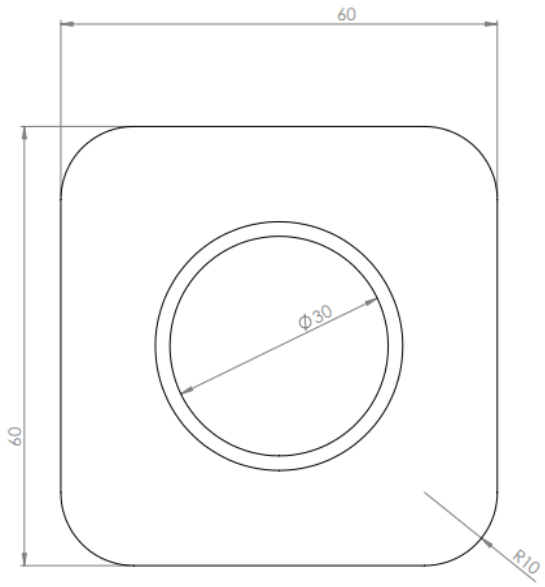
For more design options/commands for 3D modelling:

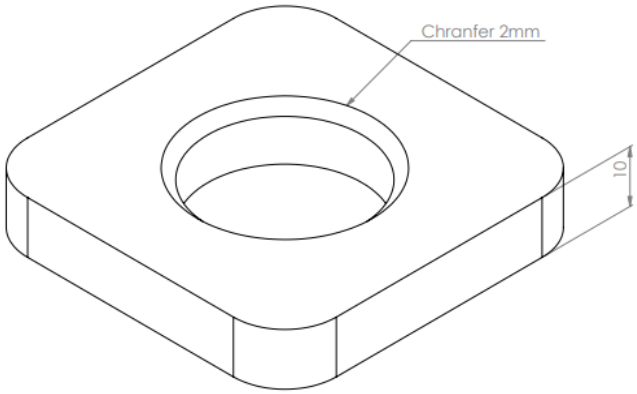
- Tinkercad:https://maker.pro/custom/tutorial/advanced-features-and-shortcuts-in-tinkercad
- OnShape:https://cad.onshape.com/help/Content/featuretools.htm?tocpath=Part%20Studios%7CFeature%20Tools%7C_____0
- Sketchup: https://help.sketchup.com/en/sketchup/getting-started-sketchup

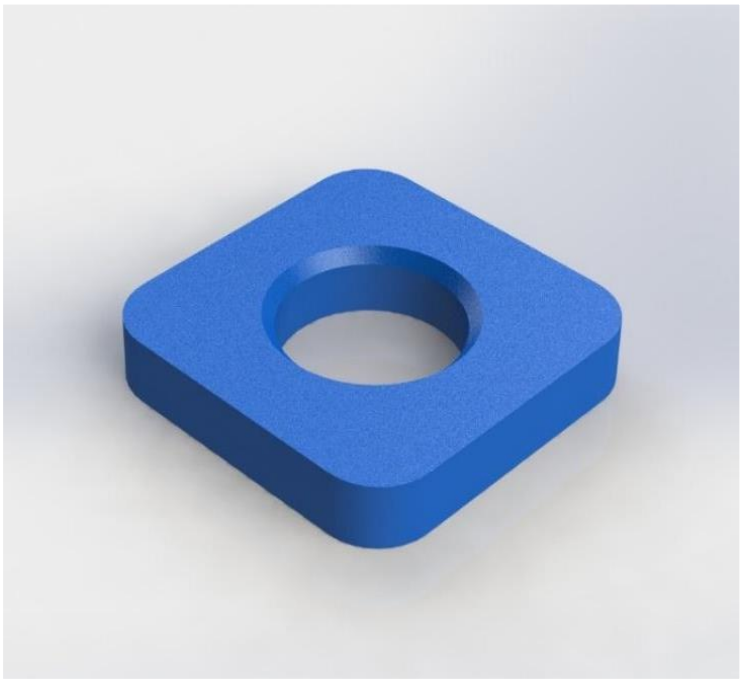
Video tutorials on basic assembling objects using:

- Thinkcad: https://www.youtube.com/watch?v=nsewHezYL3A
- OnShape: https://www.youtube.com/watch?v=QZzdRK8nSL4
- Sketchup: https://www.youtube.com/watch?v=tmiqcvM1cEc

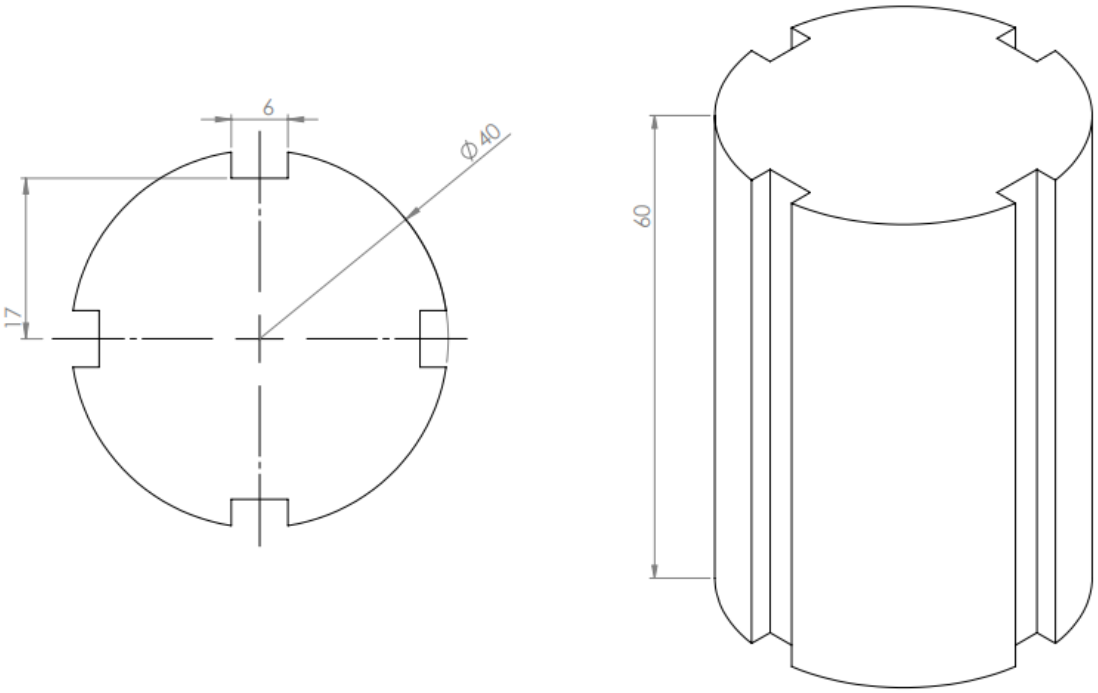
- **Object 1**

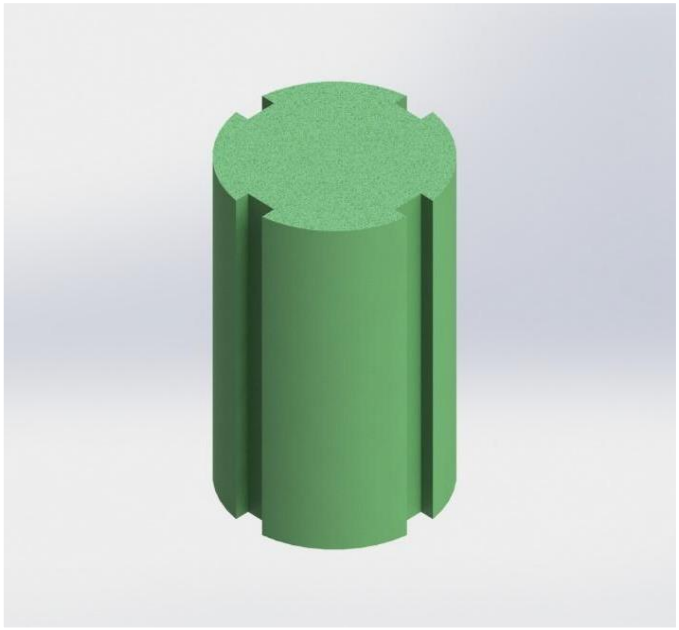




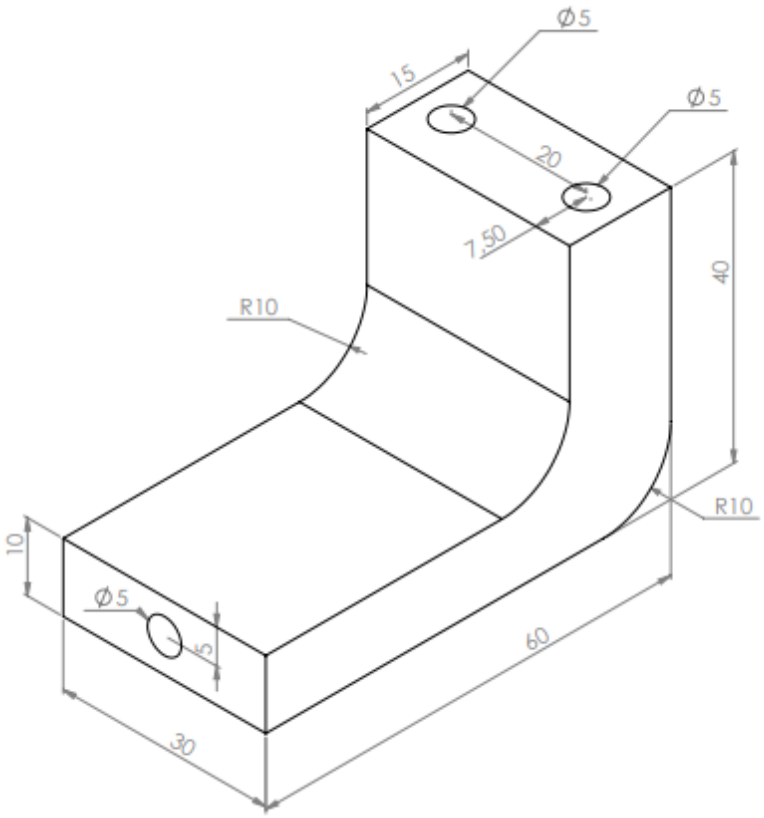


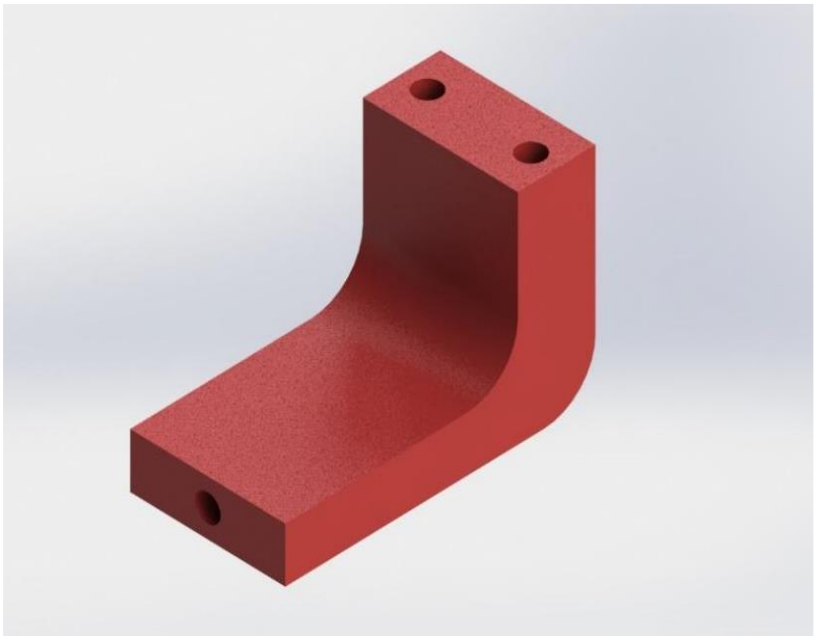
- **Object 2**





- **Object 3**





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Module: 3D Objects

Topic: 3D Modelling

Task sheet B1.2: Model and edit 3 objects - Part 2

Time: 3 hours

General description:

This activity will consist of the creation of simple objects to scale using 3D modelling software. A picture of different objects with their dimensions will be provided. Furthermore, all objects will have a .STL file and a .STEP file, which are compatible with most 3D modelling software, in the respective folder so that participants can likewise load the object and edit it at will.

Learning objectives:

- Create and model a 3D object based on given dimensions;
- Edit the properties of a 3D object;
- Understand how to use measuring tools.

Material required:

- Computer with internet connection;
- Callipers and radius gauge (optional).

Description of the activity:

1. Start a new project/sketch and draw a geometric shape that resembles the shape of the object that you will model (e.g. start from a rectangle);
2. Define its width according to the dimensions given in the picture so as to give a 3D graphic representation;
3. Use different commands to shape the object at your will:
    a. Extrude: enables to draw an object on top of an already existing object and force it out. (e.g. to make a hole in a cube you first design the circle, then extrude it, i.e. force the circle/cylinder out of the cube);
    b. Fillet: enables to round the edges of an object;
    c. Chamfer: enables to break sharp edges with a bevel.

How to adapt to different learners:

- If there are participants who are unfamiliar with 3D modelling, it is best that the trainer first demonstrates how to model one of the given objects. Participants can, simultaneously, replicate what the trainer is doing, in order to learn through practice;
- Alternatively, you can have participants load the objects (using the .STEP / .STL file available) and change their properties so that they can better understand how to manipulate the shape of an object;
- For participants that are familiar with 3D modelling, challenge them to create other objects using the ones that were just modelled (e.g. Object 4 can be a stamp holder, a participant is challenged to design the stamp's base; Object 6 can be a buckle, so a participant is challenged to make a (seat) belt). Participants can access the videos for additional information to help with the assembly part.
- Optionally, you can also challenge participants to replicate a real object: for this, firstly show participants how to use a calliper and a radius gauge to effectively measure a real object; Afterwards have the participant select a small object (e.g. a smartphone, a pen, a ruler) and use measuring tools to get the right measures and then model it.

Additional information:

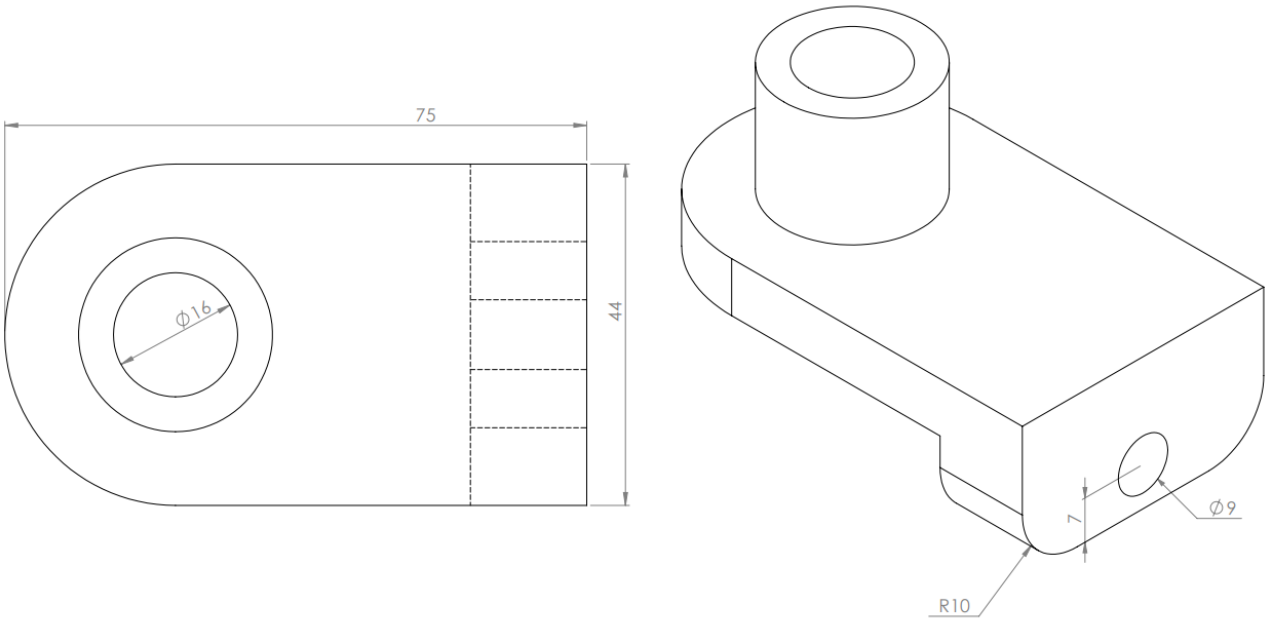
For more design options/commands for 3D modelling:

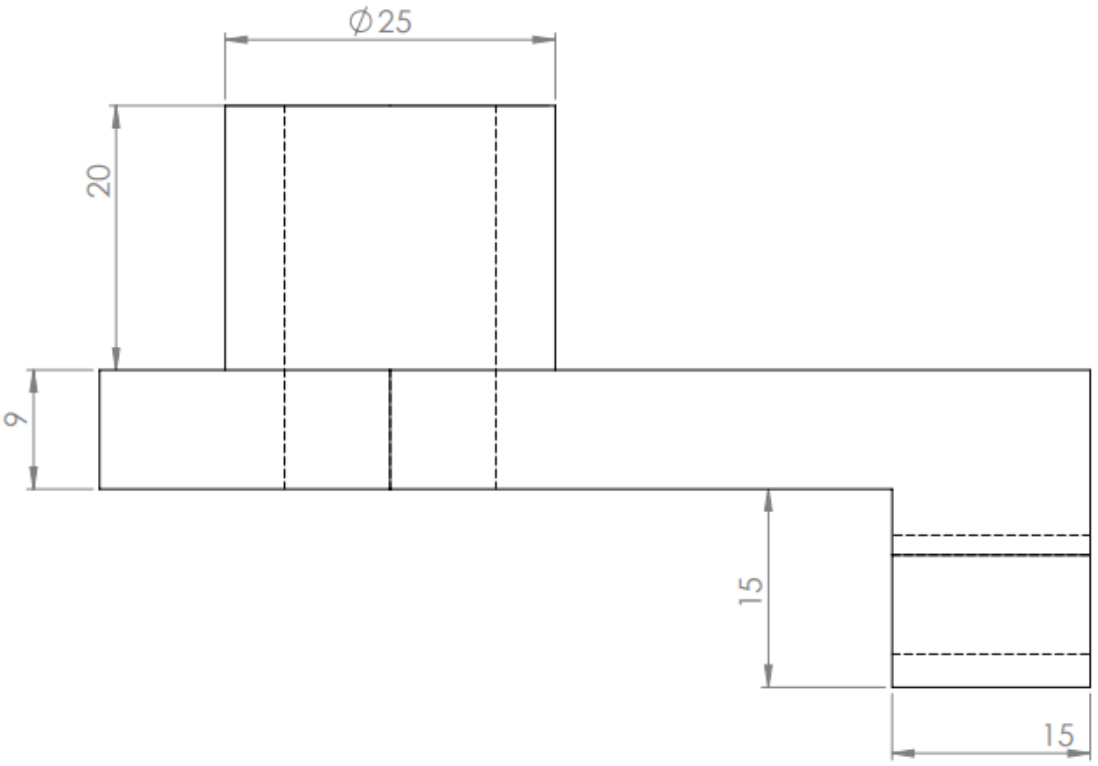
- Tinkercard:https://maker.pro/custom/tutorial/advanced-features-and-shortcuts-in-tinkercad
- OnShape:https://cad.onshape.com/help/Content/featuretools.htm?tocpath=Part%20Studios%7CFeature%20Tools%7C_____0
- Sketchup: https://help.sketchup.com/en/sketchup/getting-started-sketchup

Video tutorials on modelling different objects:

- Tinkcard: https://www.youtube.com/watch?v=nsewHezYL3A
- OnShape: https://www.youtube.com/watch?v=QZzdRK8nSL4
- Sketchup: https://www.youtube.com/watch?v=tmiqcvM1cEc

- **Object 4**





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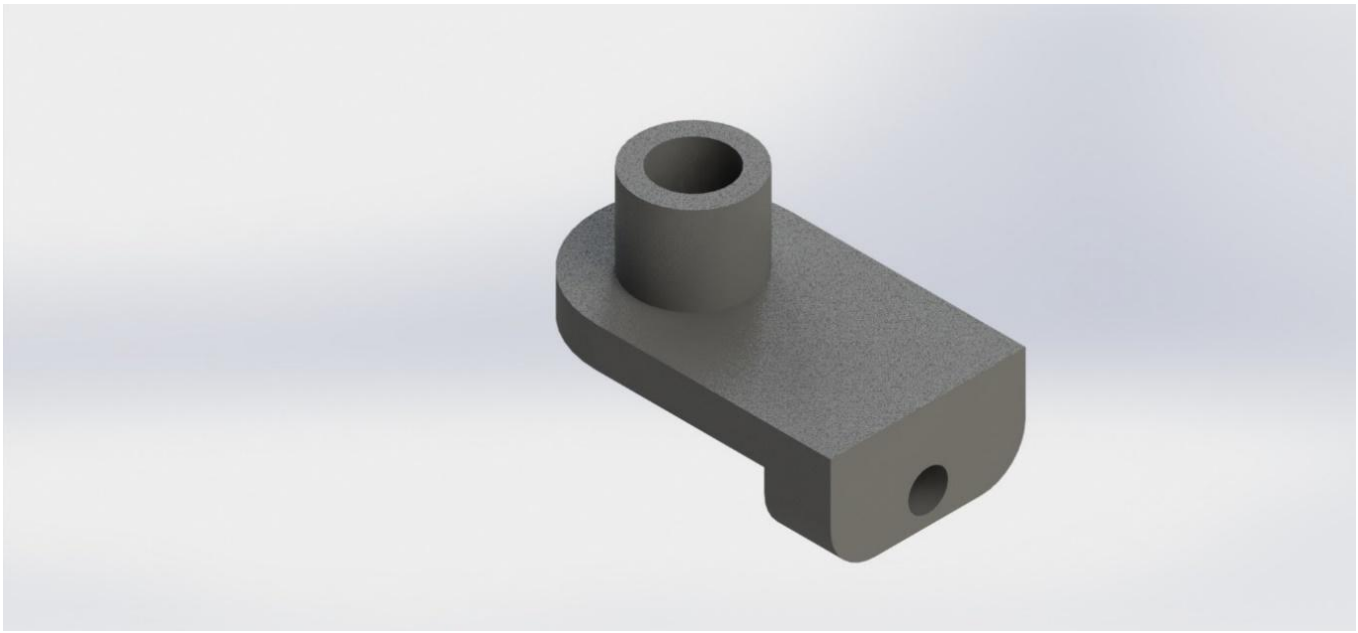
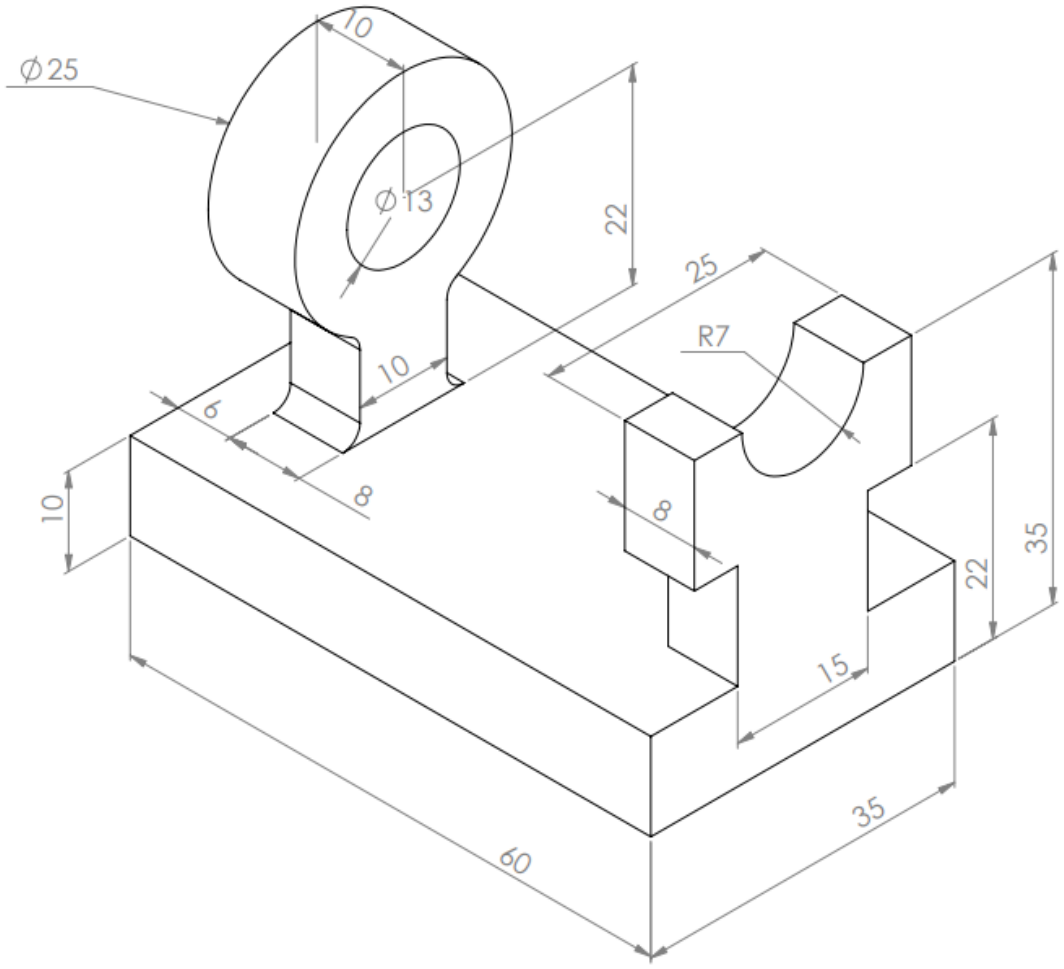
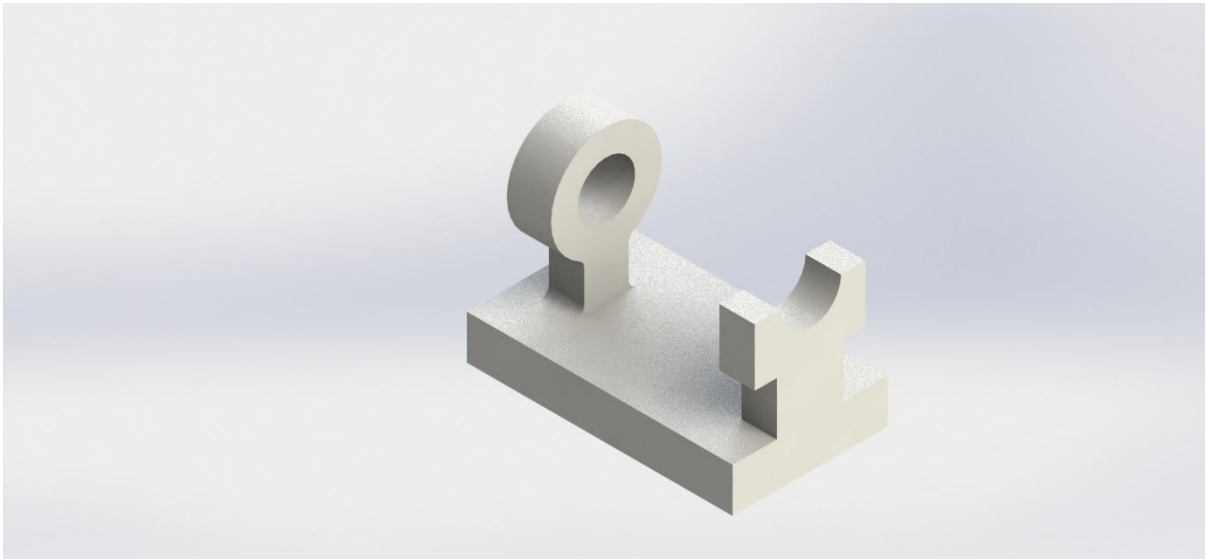


- **Object 5**





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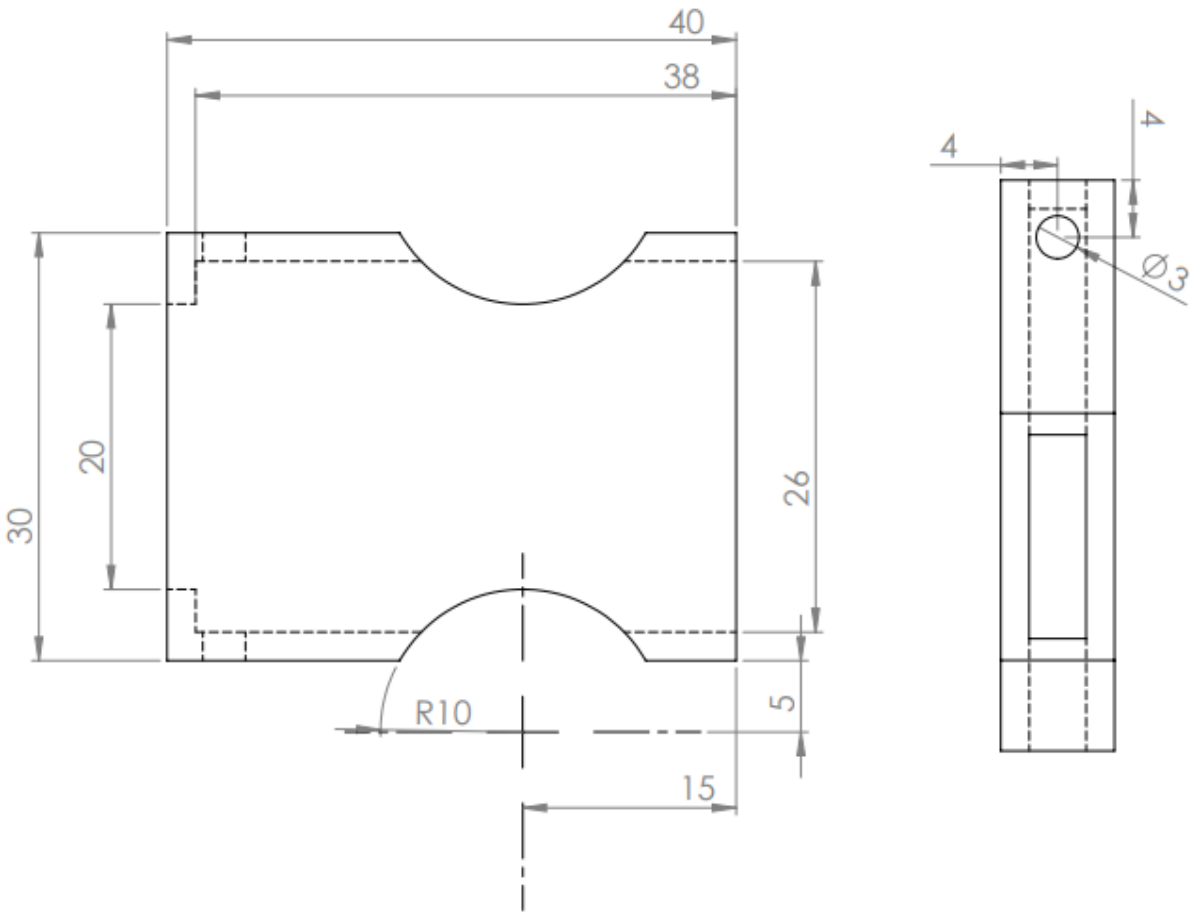

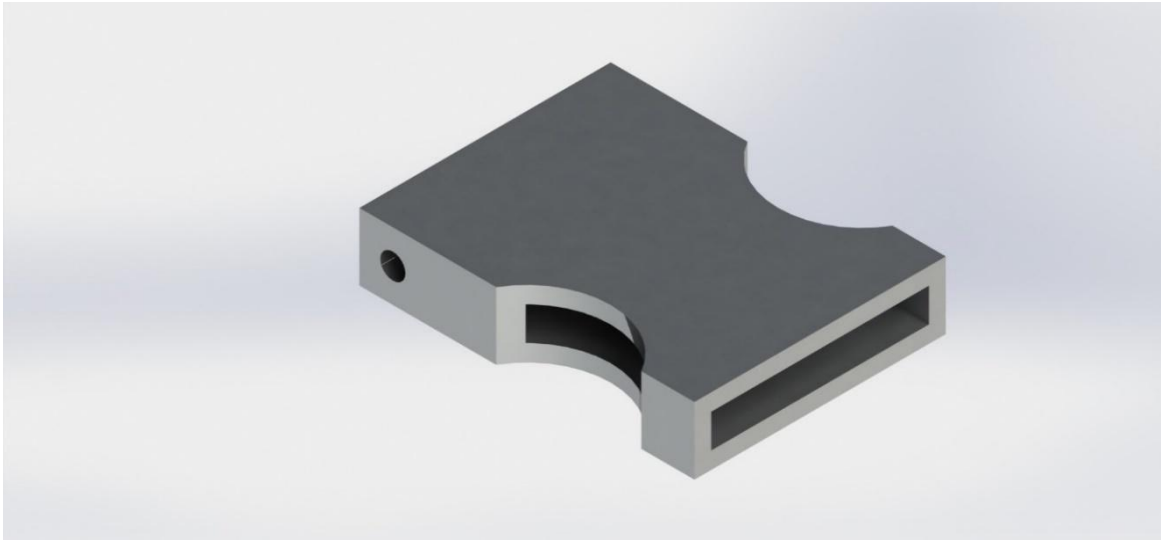

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Module: 3D Objects

Topic: 3D Modelling

Task sheet B1.3: Assembly of a bench vise

Time: 2:00 hours

General description:

This activity will consist in the assembly of a bench vise. For that purpose, .STL files and .STEP files, which are compatible with most 3D modelling software, of all parts that make up the bench vise will be provided. Depending on the shape of the object and its degree of freedom when assembled, a different mate technique may be used. By using an appropriate mate technique to assemble an object, it becomes easier to define the position of an object and its motion between two connected parts.

Learning objectives:

- Understand how to use different mate techniques to assemble different types of objects;
- Be able to assemble several different components together using CAD software.

Material required:

- Computer with internet.

Description of the activity:

1. Upload all the files that make up the bench vise to your 3D modelling software;
2. Fix the main base (Fixed body);
3. Assemble all pieces together by connecting the pieces to the main base, according to the image of the bench vise provided in additional information.

Suggestion for assembly order:

1) Sliding jaw;
2) Screw
3) M6x10 Screw
4) Handle
5) Handle limiter(2x)
6) Sliding jaw limiter
7) Fixed body support (2x)
8) M6x25 Screw (4x)
9) M6x30 Screw (2x)

How to adapt to different learners:

- Different mate techniques are used depending on the shape of the object that is going to be assembled. Have participants explore the different options for mate, so that they can intuitively select the correct mate command when assembling the bench vise.
- If participants experience difficulties, stimulate them to look for online sources (there are plenty of bench vise assembly videos, an example can be found in additional information) to see if they can come up with a viable solution;
- Have participants take a look at the image of the bench vise provided in additional information, so that they know where objects should connect together.

Additional information:

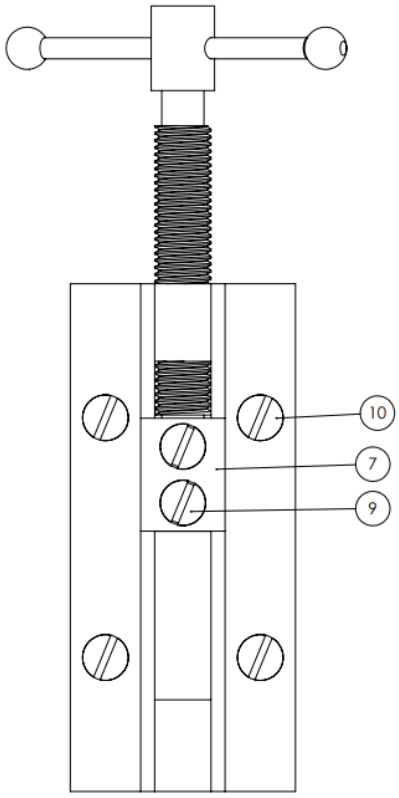
Learn more about mates in OnShape here:
https://www.onshape.com/cad-blog/onshape-assemblies-for-solidworks-users

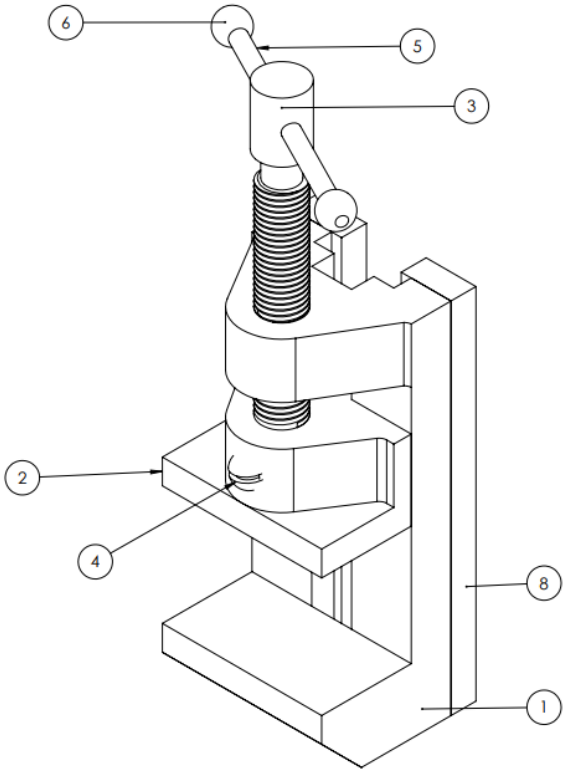
Video tutorial on assembly of objects:

- Tinkercad: https://www.youtube.com/watch?v=cHUOnpnxG9Q
- Onshape: https://www.youtube.com/watch?v=ZMsUnwgLzxU
- Sketchup: https://www.youtube.com/watch?v=40jHglQix7o

Video tutorial on the assembly of a bench vise using Onshape:
https://www.onshape.com/videos/onshape-cad-tutorial-build-your-first-assembly

- **Bench vise**:





Part Number	Name	Quantity
1	Fixed Body	1
2	Sliding Jaw	1
3	Screw	1
4	M6x10 Screw	1
5	Handle	1
6	Handle Limiter	2
7	Sliding Jaw Limiter	1
8	Fixed Body Suport	2
9	M6x25 Screw	4
10	M6x30 Screw	2

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Module: 3D Objects

Topic: 3D Modelling

Task sheet B1.4: Assembly of a wheel

Time: 2:00 hours

General description:

This activity will consist in the assembly of a bench vise. For that purpose, .STL files and .STEP files, which are compatible with most 3D modelling software, of all parts that make up the bench vise will be provided. Depending on the shape of the object and its degree of freedom when assembled, a different mate technique may be used. By using an appropriate mate technique to assemble an object, it becomes easier to define the position of an object and its motion between two connected parts.

Learning objective(s):

- Understand how to use different mate techniques to assemble different types of objects;
- Be able to assemble several different components together using CAD software.

Material required:

- Computer with internet.

Description of the activity:

1. Upload all the files that make up the wheel to your 3D modelling software;
2. Fix the main base (Main Plate);
3. Assemble all pieces together by connecting the pieces to the main plate, according to the image of the wheel provided in additional information.

Suggestion for assembly order:

1. Secondary Plate
2. Metal Shaft Limiter (2x)
3. Metal Shaft (2x)
4. Wheel

How to adapt to different learners:

- Different mate techniques are used depending on the shape of the object that is going to be assembled. Have participants explore the different options for mate, so that they can intuitively select the correct mate command when assembling the wheel;
- If participants experience difficulties, stimulate them to look for online sources to see if they can come up with a viable solution;
- Have participants take a look at the image of the wheel provided in additional information, so that they know where objects should connect together.

Additional information:

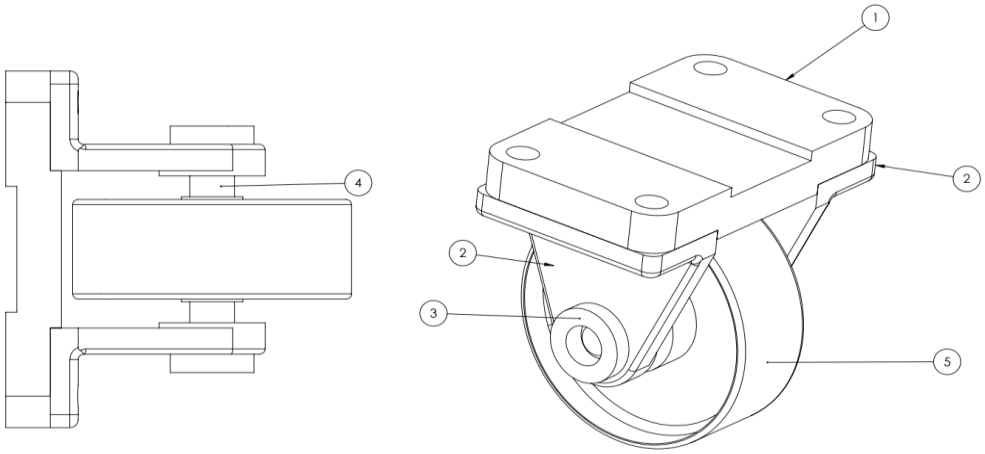
Learn more about mates in Onshape here:
https://www.onshape.com/cad-blog/onshape-assemblies-for-solidworks-users

Video tutorial on assembly of objects:

- Tinkercad: https://www.youtube.com/watch?v=cHUOnpnxG9Q
- Onshape: https://www.youtube.com/watch?v=ZMsUnwgLzxU
- Sketchup: https://www.youtube.com/watch?v=40jHglQix7o

Video tutorial on the assembly of a wheel using Onshape:
https://www.youtube.com/watch?v=XHY6r69PqPY

- **Wheel:**



Part Number	Name
1	Main Plate
2	Secondary Plate
3	Metal Shaft Limiter
4	Metal Shaft
5	Wheel

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Module: 3D Objects

Topic: 3D Printer

Task sheet B2.1: Testing and calibration

Time: 00:30 hours

General Description:

For every axis, the position of the end-stop switch has to be decided. The extruding unit is moved back and forth separately in every direction until the movement is smooth and limited to the available printing area.

Learning objective:

- Learn how to calibrate the movements of the printer.

Material required:

- Computer
- 3D printer

Description of the activity:

Print a single layer (ex. of a 20*20mm cube) with your first layer at 100% height and width. Then, use a calliper, measure the print in several places (at least 8) and adjust your bed or gcode z offset.

How to adapt to different learners:

This task is the basic exercise to test and calibrate the printer. The students can learn this procedure only with practice.

Additional information:

- Tutorial: “Top ten prints to calibrate your 3D printer https://www.matterhackers.com/articles/top-ten-prints-to-calibrate-your-3d-printer

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Module: 3D Objects

Topic: 3D Printer

Task sheet B2.2: Changing the filament

Time: 1:00 hour

General Description:

You can change filament during the print process to create a print with layered colours. Press the left arrow button to get to the Active Build menu, then select Change Filament. The extruder will move away from your print. Select Unload, then replace the spool and filament as you did in the steps above. After you change the filament, select the left arrow button to return to the Active Build menu. Select the entry to Resume Print.

Learning objectives:

- Learn to change the filament of a printer
- Learn how to use many colours.

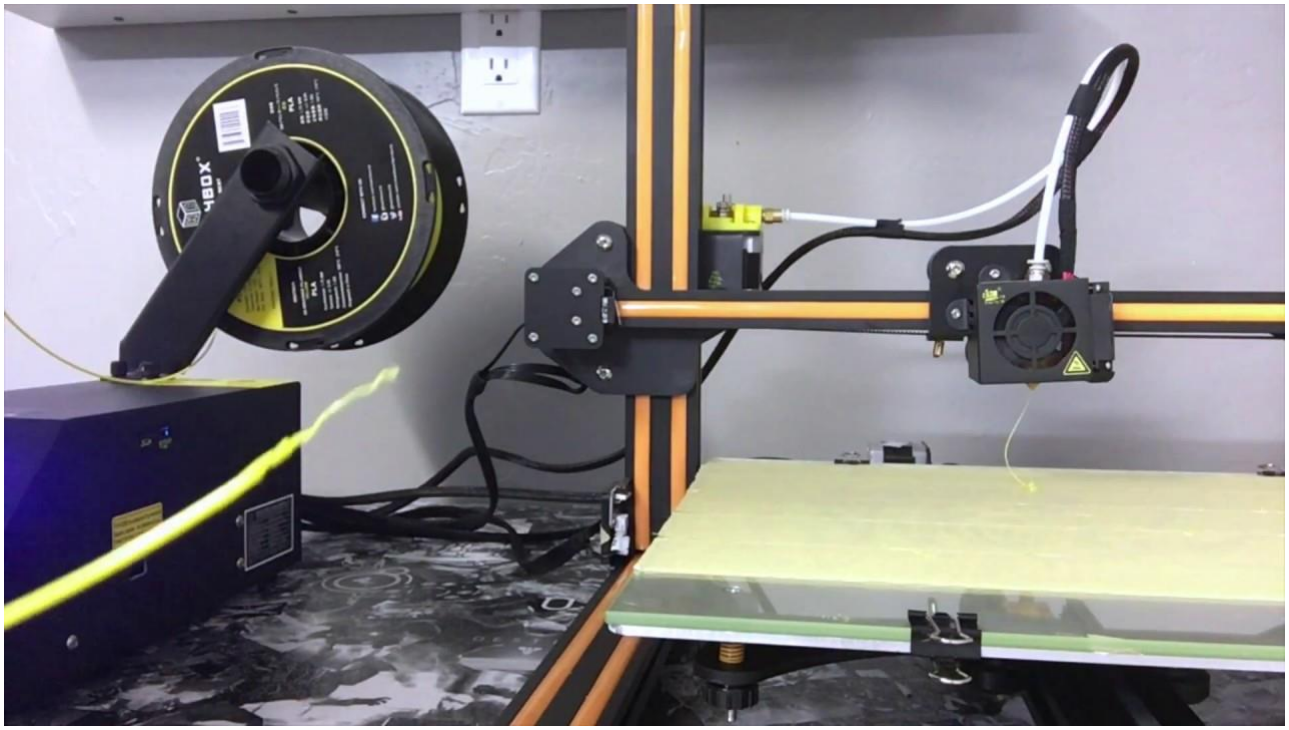
Material required:

- Computer
- 3D printer
- PLA

Description of the activity:

- On the LCD panel, select Utilities > Change Filament > Unload.
- Wait for the extruder to heat to the set temperature.
- Push down on the extruder arm and continue to hold it down as you gently pull the filament out of the extruder. Then release the extruder arm. If the extruder on your AnyCubic M3 does not have an extruder arm, just pull the filament free of the extruder.
- Remove the old spool and replace it with the new spool.
- Feed the AnyCubic PLA Filament through the filament guide tube.
- Go to the LCD panel and select Utilities > Change Filament > Load. The AnyCubic M3 will start to heat your extruder.
- When the extruder is heated, the LCD panel will prompt you to load the filament into the extruder. Click through the message until your AnyCubic M3 asks you to press the M when you see plastic extruding.
- If your extruder has a lever arm at the side, push it down and hold it in place. If you have an extruder without an arm at the side, continue to the next step.
- Insert the free end of the filament into the hole in the top of the extruder.

- Push the filament down until you feel the motor pulling it in. Wait until you see plastic start to emerge from the extruder nozzle. If your extruder has an extruder arm, release it. Watch to make sure plastic is still extruding from the nozzle. Then press the M button to stop extrusion.
  Note: If you're changing colours, you'll need to run the extruder for a few moments to clear out the old colour before stopping extrusion. If you're changing materials, it can take even longer -- make sure that all the old material is extruded before you start a new print.
- Push the guide tube back into the opening on the top of the extruder.



How to adapt to different learners:

- This task is the basic exercise to change the filament of the printer. The students can learn this procedure only by practicing.
- The trainer can use/refer to different kinds of filament (e.g. ABS, PET-G, TPU etc.) and explain the advantages and disadvantages of the respective material

Additional information:

- Tutorial: “Easiest way to change the filament on Ender3” https://all3dp.com/2/easiest-way-to-change-filament-on-ender-3/

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Module: 3D Objects

Topic: 3D Printer

Task sheet B2.3: Preheating and Cooling

Time: 00:30 hours

General Description:

The extruder needs to reach a particular temperature in order to melt the desired material, and the bed must be heated in order to keep the material warm after it comes out of the extruder. This prevents warping in your print.

Learning objectives:

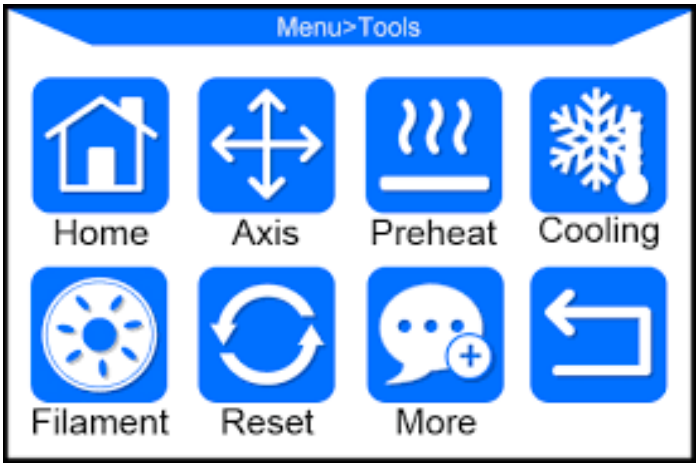
- Learn to preheat and cool the extruder and the printer bed
- Understand the effects of changing the temperature of the extruder and of the printing bed on the printing results (using PLA as example material - which is very common)
- Learn to adjust the temperature settings on the respectively used printer itself
- Learn to adjust the temperature settings via the slicer software (e.g. Ultimaker Cura) over a USB connection with a computer

Material required:

- Computer
- 3D printer
- PLA

Description of the activity:

- Click on “Tools” then “Preheat” and select your material.
- Select the temperature for bed and head and click pre-heat.
- From the “Tools” menu click on Filament and Filament in. The extruder motor will start to feed the filament into the hot end.
- Insert the SD card into the SD card slot at the base. Select your object and click print.
- Upon finishing, the print head and heated bed will be automatically cooling down. Only remove the printed object from the heated bed when it is cooled completely.



How to adapt to different learners:

This task is the basic exercise to set the temperature of the printer. The students can learn this procedure only with practice.

Additional information:

- Tutorial: “The best PLA print temperature: How to achieve it” https://all3dp.com/2/the-best-pla-print-temperature-how-to-achieve-it/

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Module: 3D Objects

Topic: 3D Printer

Task sheet B2.4: Printing an object

Time: 2:00 hours

General Description:

After bed calibration, it is time to print something.

Prepare and slice a 3D model. If you have already designed an object you can use that one. Alternatively, you can download a 3D model, for instance, from https://www.thingiverse.com/.

Learning objectives:

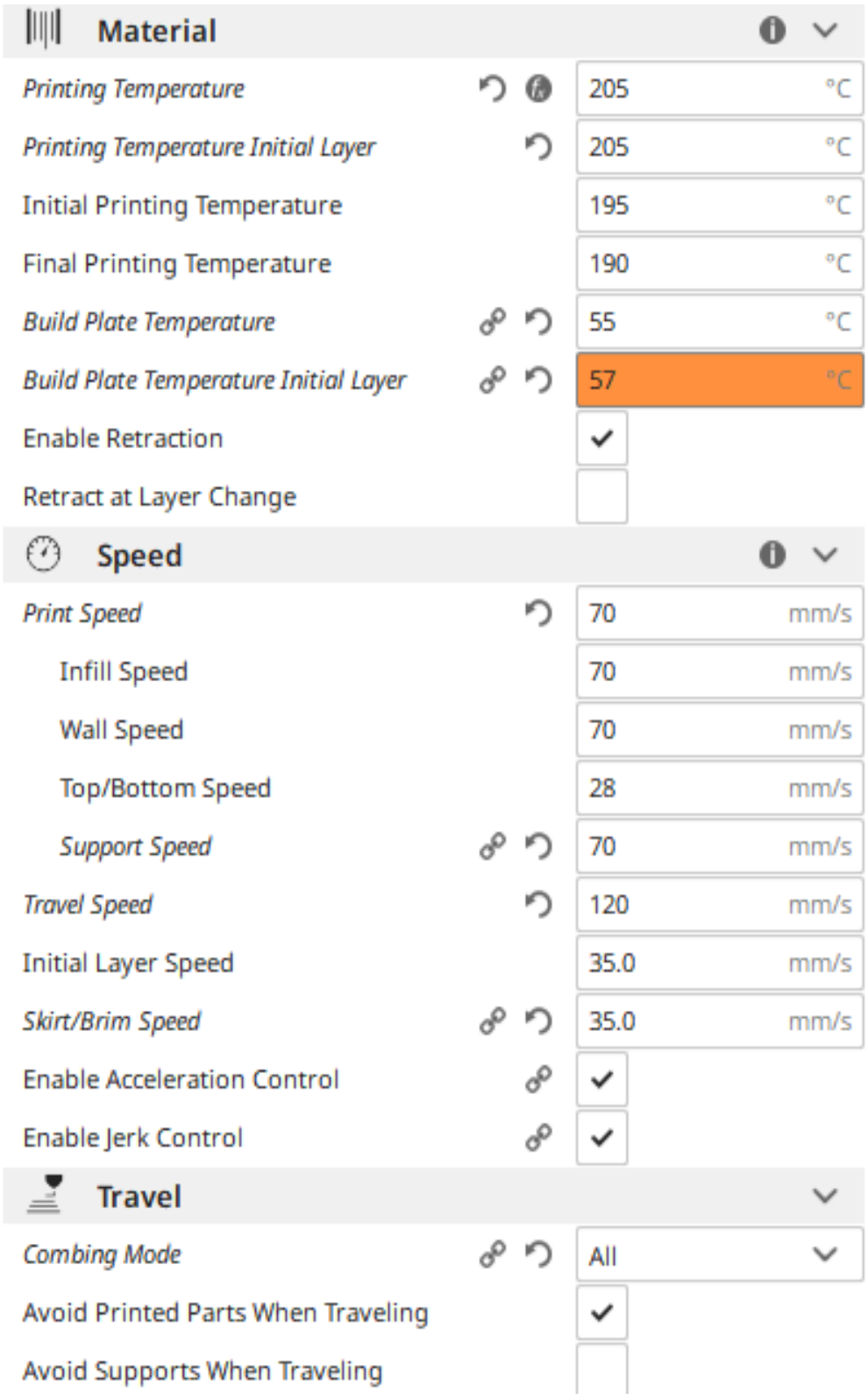
- Learn how to print example 3D objects
- Independently choose adequate slicing setting to successfully print several 3D objects
- Understand how the chosen values of the most important settings affect the printing outcome:
    - the temperature of the extruder and the printer bed
    - printing speed
    - layer height
    - wall thickness
    - infill density
    - printing plate adhesion
    - type and the use of support structures

Material required:

- Computer
- 3D printer
- Filament (e.g. PLA)

Description of the activity:

- Every spool of filament is different, even if it's the same brand and the same colour. So, firstly check your temperature settings.
- Check the quality, the shell, the infill and the material settings.
- Sometimes you need to improve your support. It will help you to print complicated designs.
- Clean the printer bed and print your object.
- The following pictures show the slicer settings. The trainer can explain how they will affect the printing results:



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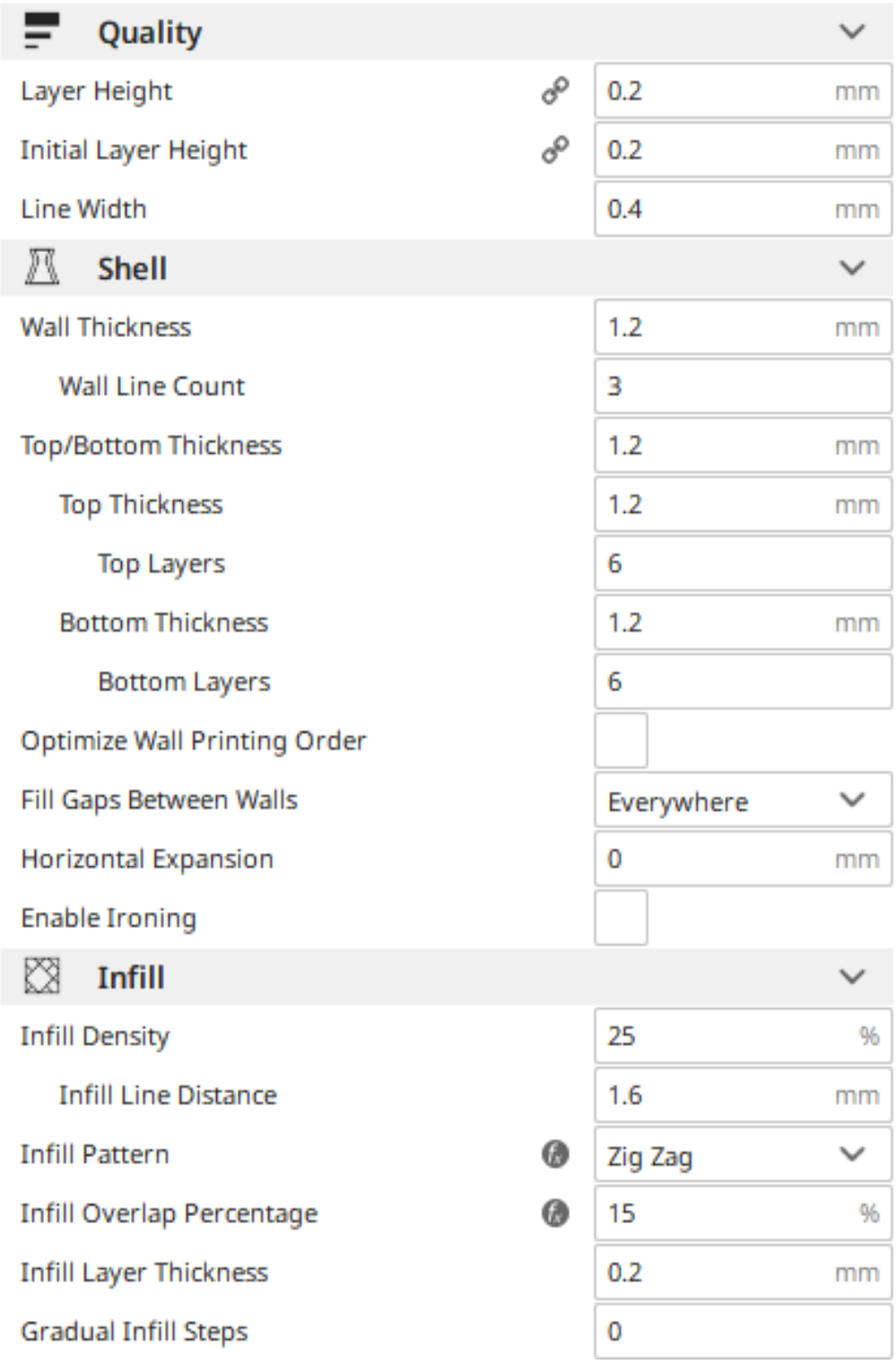
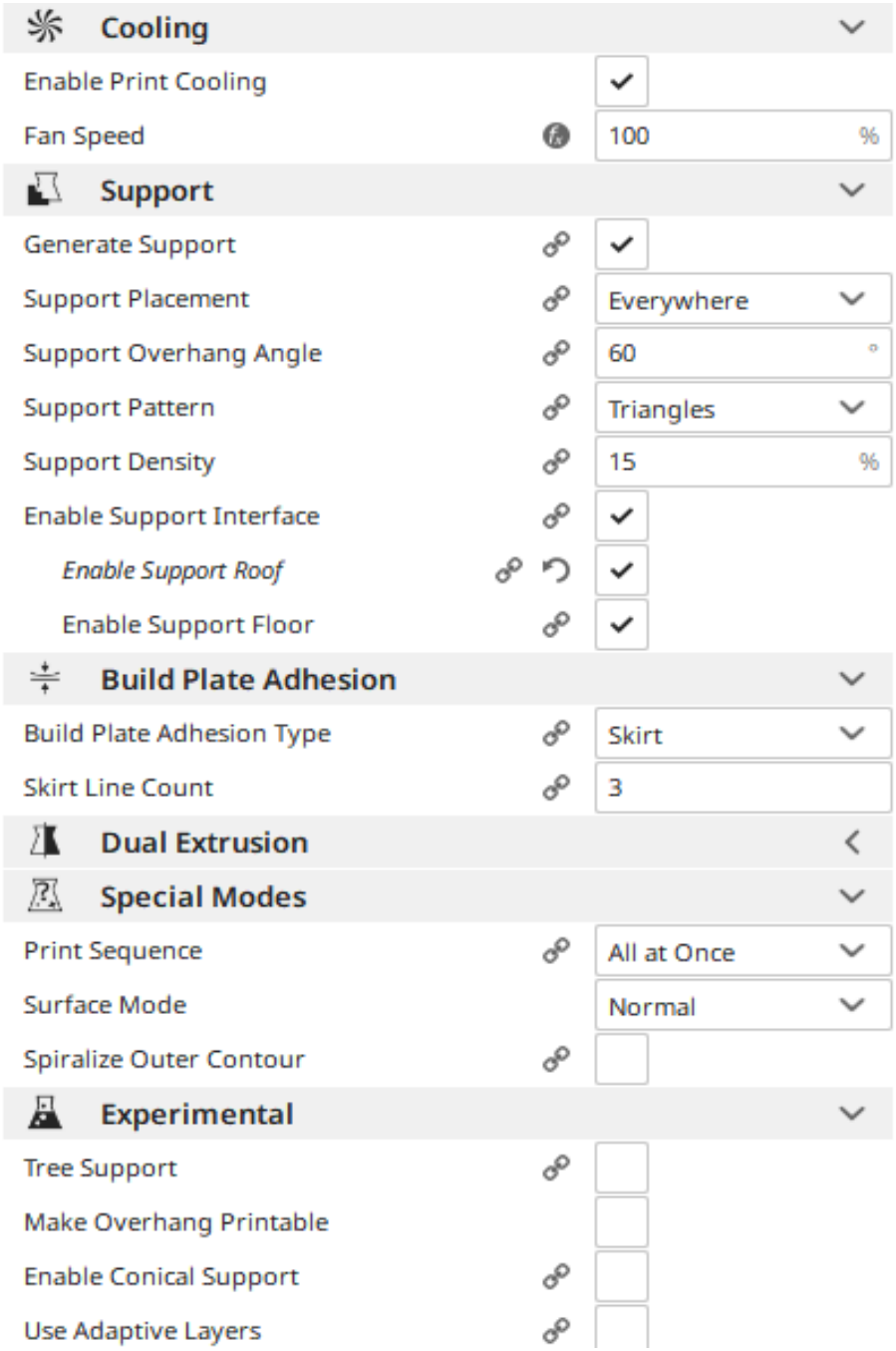


Quality		
Layer Height	0.2	mm
Initial Layer Height	0.2	mm
Line Width	0.4	mm
Shell		
Wall Thickness	1.2	mm
Wall Line Count	3	
Top/Bottom Thickness	1.2	mm
Top Thickness	1.2	mm
Top Layers	6	
Bottom Thickness	1.2	mm
Bottom Layers	6	
Optimize Wall Printing Order	☐	
Fill Gaps Between Walls	Everywhere	
Horizontal Expansion	0	mm
Enable Ironing	☐	
Infill		
Infill Density	25	%
Infill Line Distance	1.6	mm
Infill Pattern	Zig Zag	
Infill Overlap Percentage	15	%
Infill Layer Thickness	0.2	mm
Gradual Infill Steps	0	



How to adapt to different learners:

The trainer has to explain one by one the settings and show some examples of how each setting affects the object.

Additional information:

This tutorial will help you to understand the effects of the infill settings on Cura software: “Cura infill patterns: All you need to know” https://all3dp.com/2/cura-infill-patterns-all-you-need-to-know/

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Module: 3D Objects

Topic: Photogrammetry

Task sheet B3.1: Getting Started (Introduction to Photogrammetry)

Time: 02:00 – 03:00 hours

General Description:

A short introduction and learning about the chosen software

Learning objectives:

- Understand the basic principles of photogrammetry
- Have an idea of different application possibilities of photogrammetry
- Understand the basic functions and possibilities of the software

Material required:

- Camera(s)
- Computer(s)
- Photogrammetry software

Description of the activity:

- The trainer presents a short introduction about the history and the field of use of Photogrammetry
- The trainer presents an already scanned object and shows the basic functions of the software
- The trainer hands out a set of example pictures to be processed on the participants' computers
- The trainer shows step by step how to create a 3D object by processing the set of example photos while the participants reproduce the process

How to adapt to different learners

- Provide or suggest step-by-step tutorial videos about the use of the software and/or the use of the camera
- Provide Handouts for participants that contain the most important steps for operating the software as well as practical instructions on how to use the camera
- Variate the group size

Additional information

- The software should already be installed
- A set of pictures should already be available on the participants' computers

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Module: 3D Objects

Topic: Photogrammetry

Task sheet A3.2: 3D-scan an object

Time: 03:00 – 06:00 hours

General Description:

Participants practice taking pictures by themselves and analyze the results together.

Learning objectives

- Learn to take appropriate photos for photogrammetry
- Get a better understanding of how several photos are being processed to a 3D representation of the scanned object
- Know the basic functions of the chosen photogrammetry software
- Be able to create a digital 3D representation out of several photographs of an optional object

Material required:

- Camera(s)
- Computer(s)
- Photogrammetry software

Description of the activity:

- The trainer introduces the basic principles of taking pictures using a digital camera
- The trainer explains what participants have to pay attention to in order to get a successful 3D representation
- The trainer can divide the participants into groups and ask them to select an object to be scanned. He/she should make sure that the selected objects differ in size, shape and surface structure, in order to make the possibilities and limits of the procedure visible to the participants. Smaller objects in the course room are conceivable, objects outside the course room (larger stones, hydrants etc.) and buildings as well (e.g. trees are not suitable per se).
- Considering the sometimes-long computing time of image processing (which depends on the number of images and available computing power), it is recommended to collect the photos from the teams (or individuals) to process these photos until the next session. The results can then be analyzed together in the next session to draw attention to errors and possible improvements.

How to adapt to different learners

- Depending on the age group and technical understanding or previous experience, the time spent (theory and practice) can be varied and tasks can be repeated. The skills required to operate digital cameras can differ much among participants (e.g. taking sharp pictures, observing aperture values and lighting conditions etc.).
- The motivation of participants can be increased by allowing them to choose an object they like to be scanned.
- Provide handouts for participants that contain the most important rules to take good pictures for photogrammetry (maybe use additional tutorial videos).
- Trainers can use further scanning methods, e.g. using video files as input or using a turntable.

Additional information

- Tutorial on how to take good pictures: https://www.youtube.com/watch?v=E06kgYBftak
- Recommended: Intro To Photogrammetry: https://www.youtube.com/watch?v=3EENC9rFWhc
- Tutorial: Capturing Images: https://www.youtube.com/watch?v=mfQ4bdh_-hA
- Photogrammetry - 3D Scanning with your smartphone (any) camera: https://www.youtube.com/watch?v=45D0pFdqVgw

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Module: 3D Objects

Topic: Photogrammetry

Task sheet B3.3: 3D-scan editing & mesh creation

Time: 03:00 – 06:00 hours

General Description:

Participants learn to edit and repair 3D scans and export them in several formats.

Learning objectives

- Learn how to further edit the scan after processing
- Learn how to save and export the final scan file in several formats
- Learn how to create a 3D-printable and further editable mesh file
- Learn how to fix cracks, holes and errors in the scanned objects mesh file
- Acquire a deeper understanding of how 3D objects are structured[1]

Material required:

- Computer(s)
- Photogrammetry and mesh-editing software

Description of the activity:

- Using this method, you always have unwanted (sub-) objects in the background that you do not need. The trainer shows how to select the relevant area of the scan for further processing.
- The trainer shows how to export the scan in several export files (e.g. *.ojb, *.ply, *.stl)
- The trainer can refer to how 3D objects are mathematical, i.e. they are composed of thousands of triangles, forming the characteristic polygon surface structure. This can be presented by showing examples of scans (or other objects files)
- The trainer gives an introduction on how to fix cracks, holes and errors in the scanned objects mesh file in order to create a 3D-printable or further editable mesh file, using one or two selected mesh editing software(s)
- If there are not enough computers for every participant to practice (which is recommended) create small teams (max. 2-3 persons) or keep one half of the class busy with another exercise, while the other half works on the PCs and then switch. In order to improve the learning success participants, have to do activities themselves.
- The described activities in this task sheet can be combined well with 3D printing activities.

How to adapt to different learners

- Provide or suggest step-by-step tutorial videos about the use of the chosen software(s)

[1] the surfaces of 3D models are mathematical described with unstructured triangular meshes

- Repeat exercises with different object files or formats
- Provide Handouts for participants that contain the most important steps for operating the software in order to get the required result
- More capable participants can help participants in need and repeat things
- For a more advanced audience, the trainer can also show further possibilities to edit or transform 3D objects, e.g. how to reduce (or increase) the polygon density of the object file to reduce the complexity of the object (which can lower the processing time and can make it easier to 3D print an object) or merging two or more 3D objects into on ("Meshmixer").

Additional information

- We recommend working with *.obj files
- Further information on the difference between STL and OBJ: https://3dinsider.com/stl-vs-obj/
- As mesh editing software we recommend: "Meshmixer" or "Meshlab" (both are free)
- Here you find a Guide: How to Repair STL Files for 3D Printing With the 5 Best (Free) STL Repair Tools: https://formlabs.com/blog/best-stl-file-repair-software-tools (works also with OBJ-files).

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Module: 3D Objects

Topic: Photogrammetry

Task sheet A3.4: Using the masking tool

Time: 02:00 – 04:00 hours

General Description:

Participants learn how to use the masking function in order to improve scan results.

Learning objectives

- Ability to use the “masking tool” independently
- Understand for which cases this method is beneficial and for which cases the normal procedure is appropriate

Material required:

- A set of photos to practice
- Computer(s)
- 3D Flow Zephyr Software (or other software supporting this feature)

Description of the activity:

- In some cases, it can be useful to improve the results of a photo scan by using the masking function. Therefore, the user has to select these picture areas which belong to the object to be scanned and which areas belonging to the background. This has to be done for every single photo used for the scan.
- The trainer introduces the function and lets the participants practice. To this end, an appropriate set of photos has to be provided.
- The trainer explains for which cases this method is beneficial and for which cases the normal procedure is appropriate.

How to adapt to different learners:

- Provide or suggest a tutorial video about the use of the masking tool function.
- This activity is for participants who want to go deeper into the topic of photogrammetry and can be used for quick learners as a pursuing task, whereas other participants may still be working on the activities regarding “3D scan an object”.

Additional information

- Guide and Tutorial: Using the masking tool of 3D Flow Zephyr Software