STUDENT GUIDE

Student Notes:

Lesson 6: Work in Multi-Model Environment with Surface

In this lesson, you will learn how to work in Multi-Model Environment with Surface.

Lesson Contents:

- Case Study: Multi-Model Environment with Surface
- Design Intent
- Stages in the Process
- Surface and Wireframe Publication
- Use Published Surface in Product Context

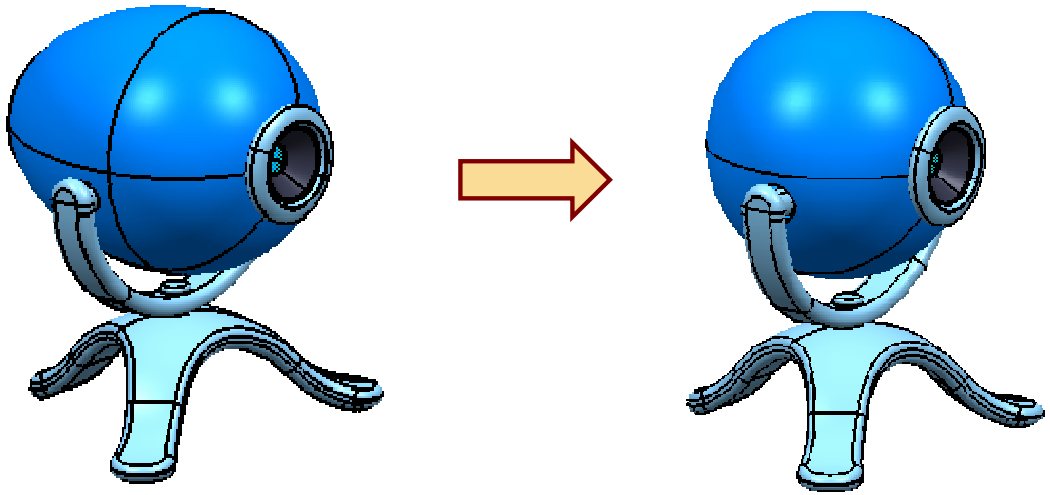
Duration: *Approximately 2 Hours*

1

Student Notes:

Case Study: Multi-Model Environment with Surface

The case study for this lesson is to create a 'Web Camera'. The focus of this case study is to create a model in multi-model environment using the Publication tool, in assembly context. Your goal is to establish link between two parts containing variants of the same part. The focus of the case study in this lesson is to understand, how the tool helps to manage the iterations in a product development cycle.

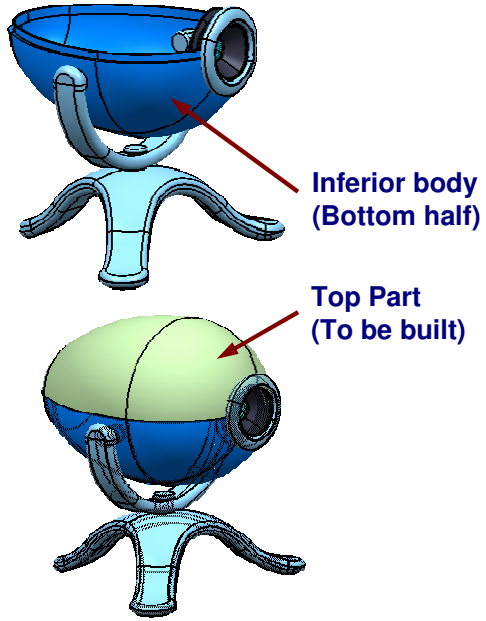


Student Notes:

Design Intent

The intent of the case study is to build multi-model links between parts using the Publication tool. This would help in managing design iterations during product development cycle and provides easy availability of geometric elements to different users.

- ✓ Built the top part using bottom half of the camera without using Publication.
  - Use the existing surfaces of reference part without publishing.
- ✓ Replace the bottom (referenced part) by its variant part, which has a different shape.
- ✓ Updating the model with new variant will not be possible with out re-routing the child features.
  - You will have to re-route the features. Note the changes. Close the assembly without saving.
- ✓ Publish the required surfaces of reference bottom half of the camera case.
- ✓ Build the top part again using the published surfaces.
- ✓ Replace the bottom (referenced part) by its variant part.
  - Ensure that the variant part has similar set of published elements and has the same nomenclature.
- ✓ Update the model. You will be able to update without any re-routing.

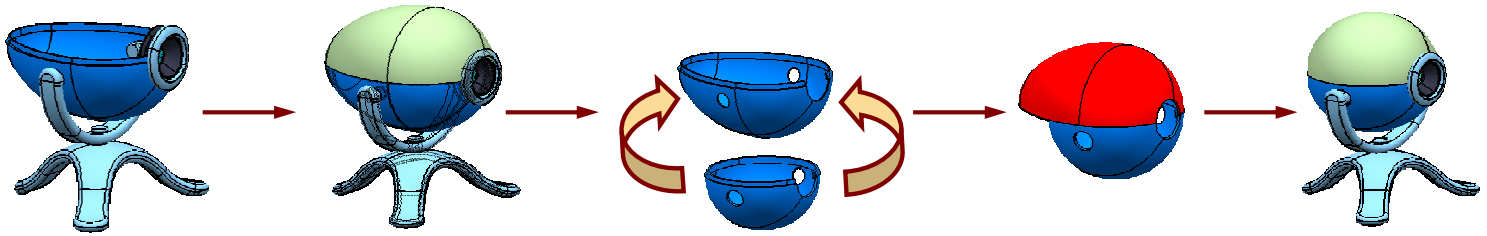


Student Notes:

Stages in the Process

The following steps are to be used to perform the case study:

1. Build the Top part referring to the Inferior body without using Publication.
2. Replace the Inferior body with its variant and update the assembly. You will have to re-route links.
3. Publish the reference part.
4. Rebuild the top part using published elements.
5. Now replace Inferior body with its variant (with published element) and update the assembly. Assembly gets updated without manual re-routing.

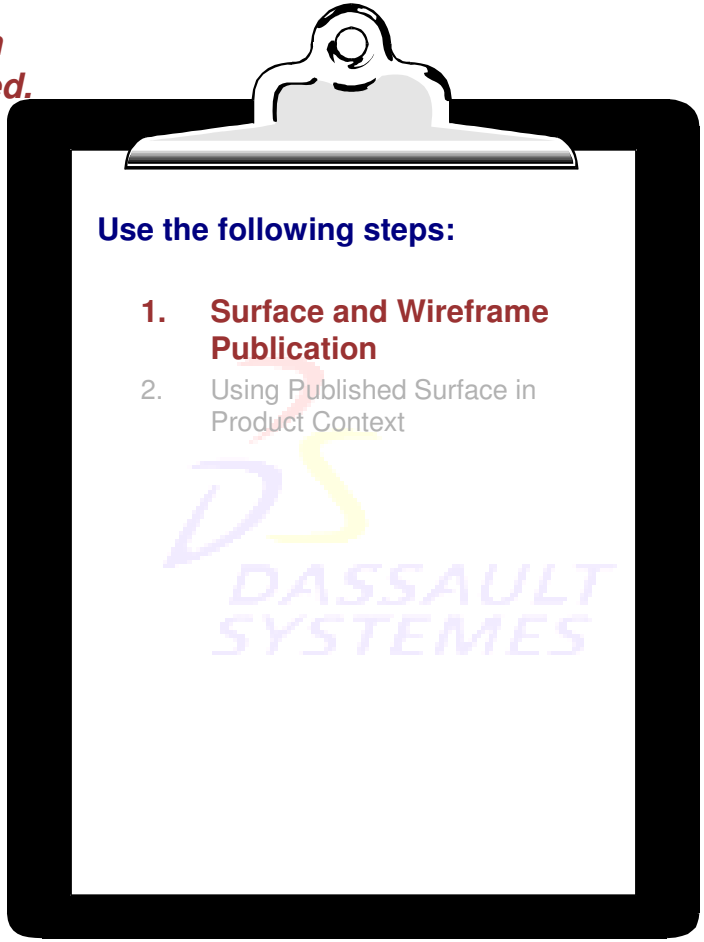


STUDENT GUIDE

Student Notes:

Step 1 : Surface and Wireframe Publication

In this section, you will learn about Publication and how surfaces and wireframes are published.



Student Notes:

Why Publish Geometry?

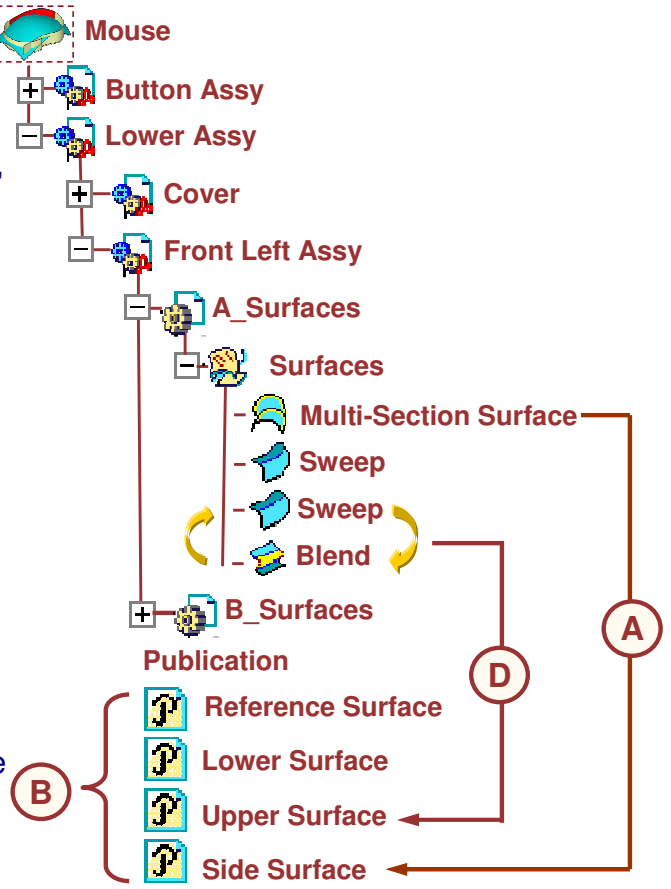
Publishing geometry has many benefits such as:

A. Label a geometry to give it a name that can be easily recognized (particularly in the case of publishing edges, faces, etc.).

B. To make a particular geometry easier to access from the specification tree.

C. Control external references. An option is available that allows you to select, as an external reference, only the published elements.

D. Easy replacement of one feature of the part with another. Published elements that have same name in the source part and the child part are automatically reconnected. You would have to reconnect them all one by one if they are not published.



Let us see these advantages (L6_PUBLICATION.CATProduct)

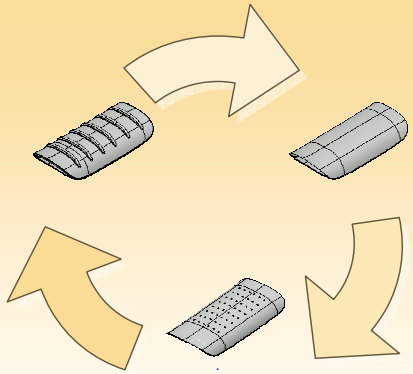
Student Notes:

When to Publish Wireframes and Surfaces?

In a **Concurrent engineering context**:

- Use style input data bound to be versioned (style iteration)
- Style input is mainly composed of wires and surfaces

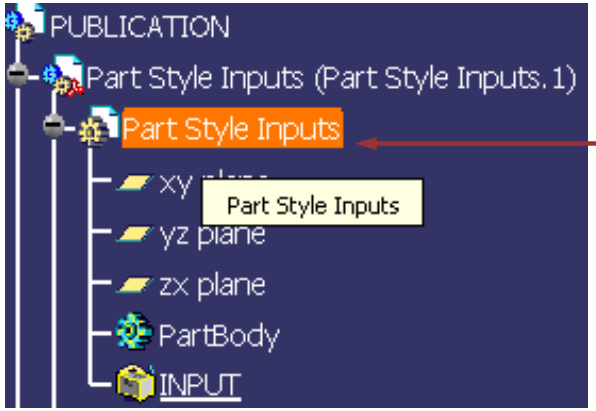
Wires and surfaces publication is important in a concurrent engineering context.

Iterations of the Inputs geometries	Elements to be Published	Benefits of Publication
	1. Reference Geometries. 2. Elements subjected to regular iterations. 3. Geometries commonly referred by different users.	1. Multiple user can refer the published feature and design the family parts. 2. Modifications in the parent published part are propagated to linked part without manual re-routing.

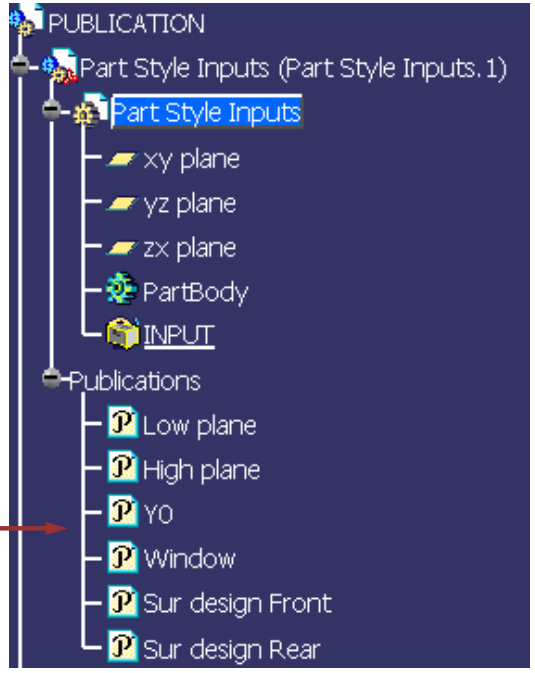
Student Notes:

Geometry Publication

Wires and surfaces involved in a concurrent engineering process are published at the part level:



The part containing the geometry to publish is activated



The publication appears in the tree

Let us see the geometry publication (L6_PUBLICATION.CATProduct)

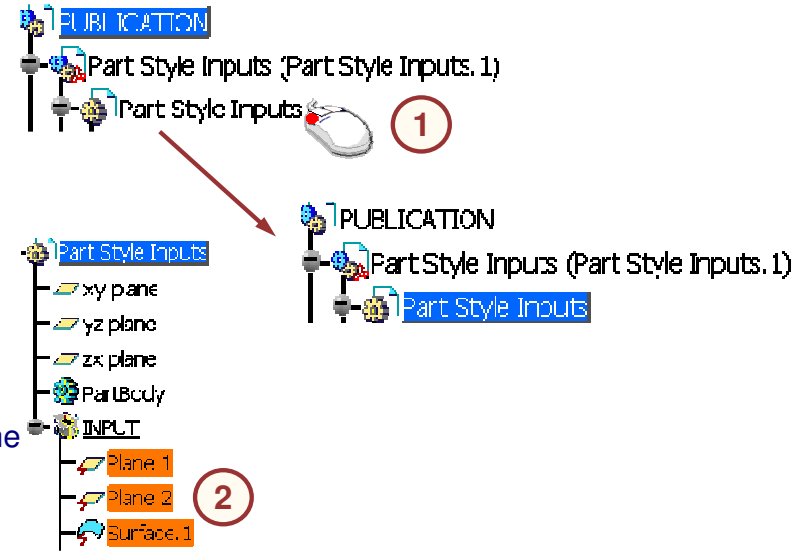
Student Notes:

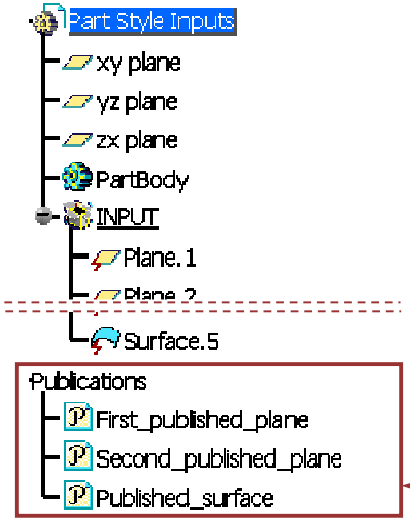
Publishing Geometry at a Part Level

Use the following steps to publish elements:

1. In the context of an assembly, activate the part containing the geometry to be published (double-click).
2. Select the elements to be published (multi-selection is possible).
3. Select **Tools >Publication.**
4. In the Publication dialog box, enter the publication names. Validate by clicking **OK.**

Observation: The published elements appear in the tree with their publication names.





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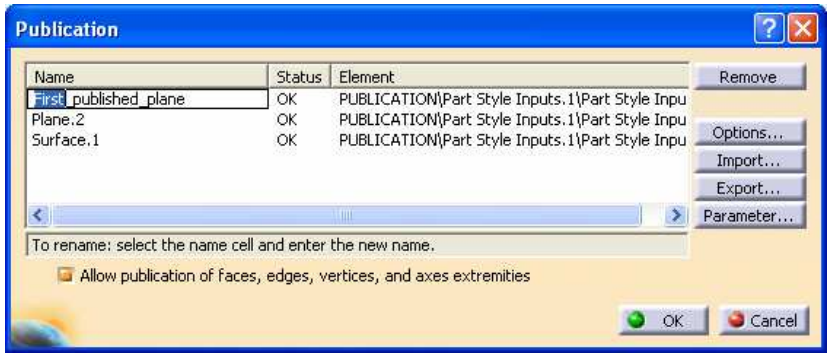
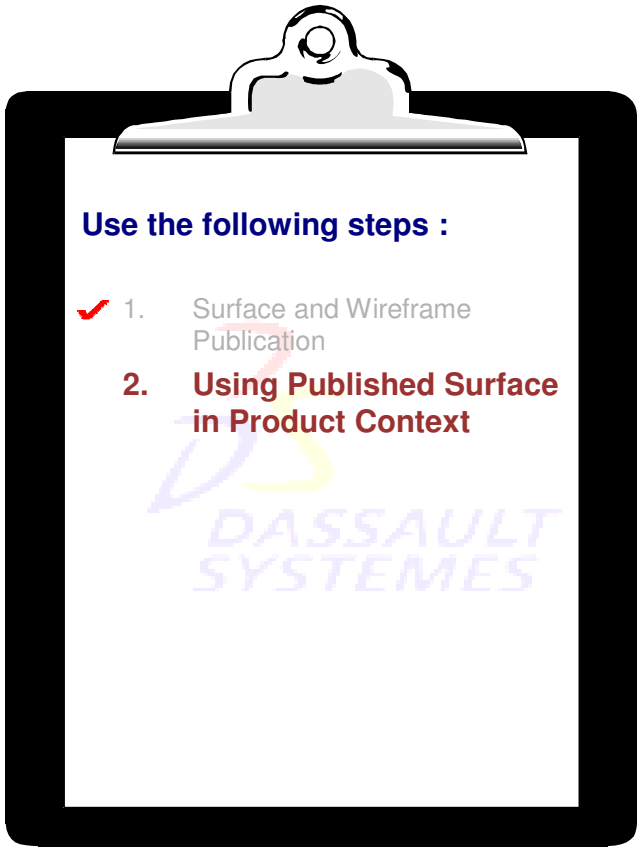


Published Elements

Student Notes:

Step 2: Use Published Surface in Product Context

In this section, you will learn about Publication and how surfaces and wireframes are published.



Student Notes:

Use Published Elements in Multi-Model Link (1/2)

There are two methods to use published geometry of a part in a multi-model environment.

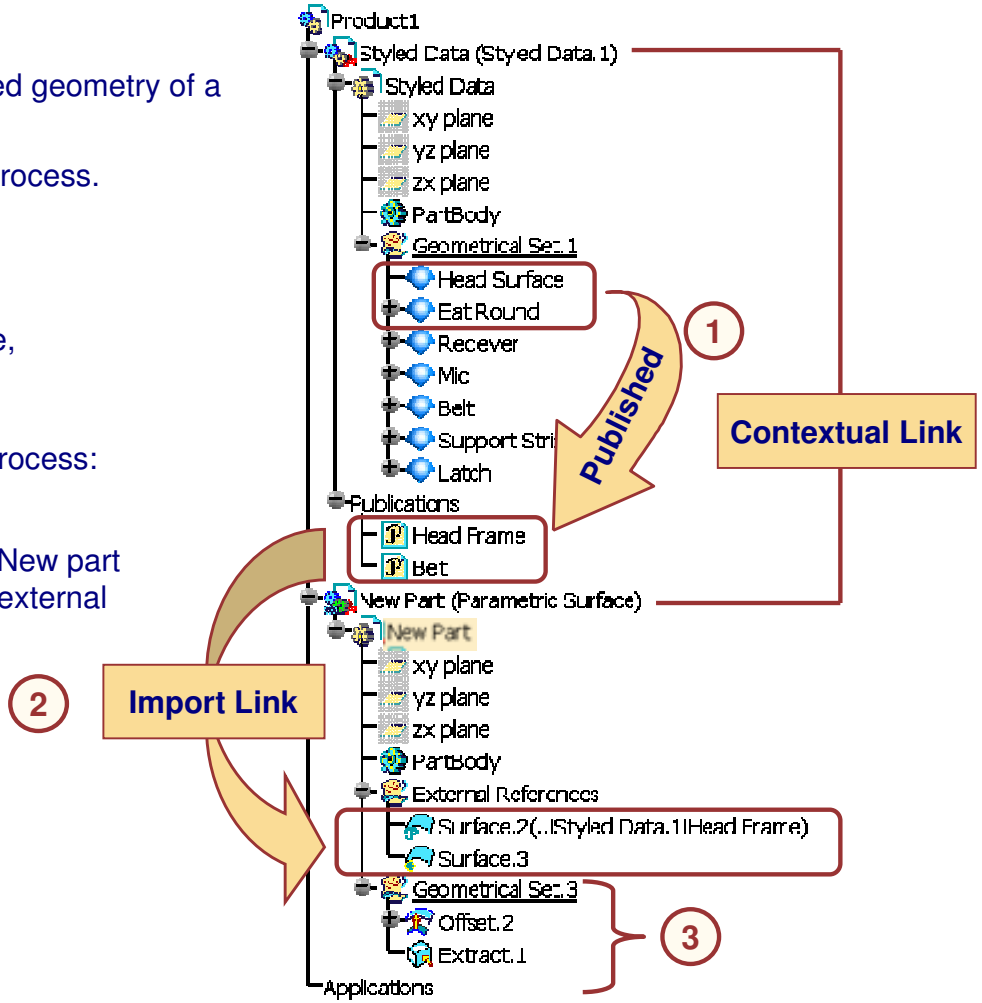
A. Geometry Selection during design process.

B. Copy/Paste published elements.

Let us understand this with an example,

A. Geometry Selection during design process:

1. Publishing of Elements
2. Creating External References in a New part
3. Creating parametric surface using external referenced geometry

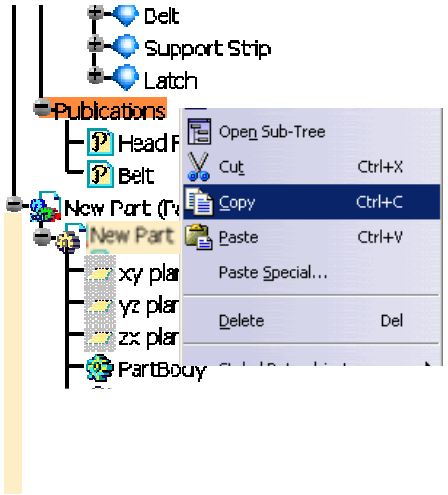


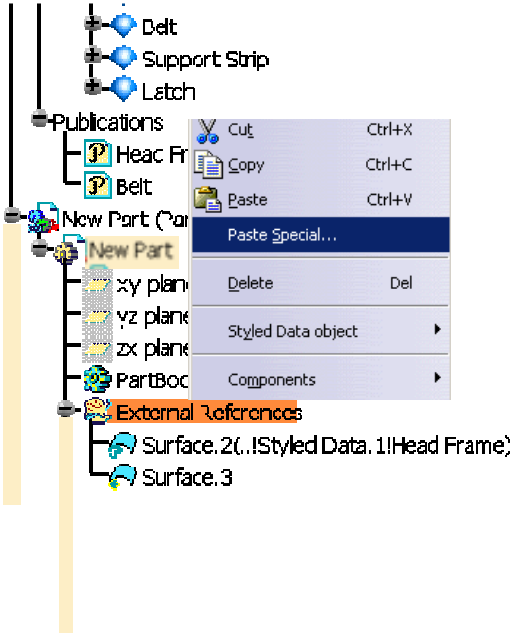
Student Notes:

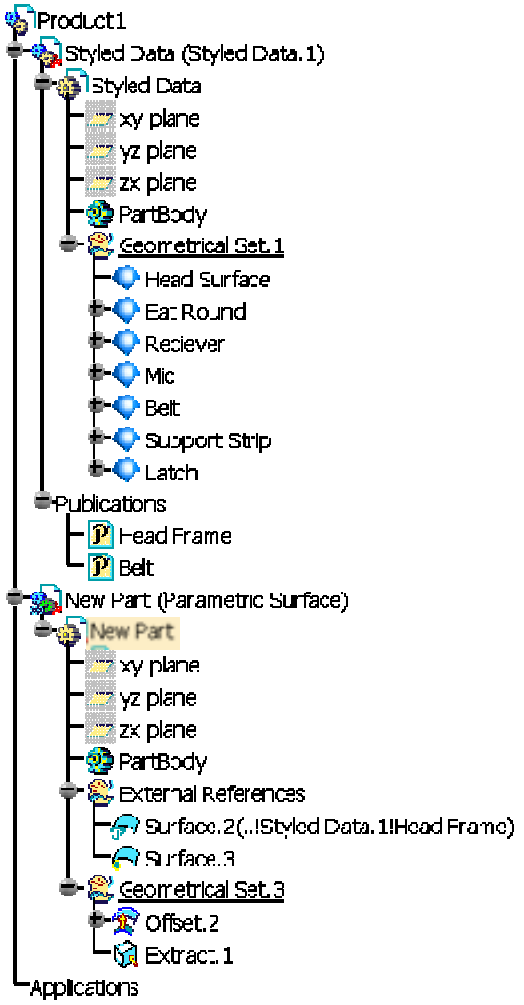
Use Published Elements in Multi-Model Link (2/2)

B. Copy/Paste of published elements:

You can also copy/paste the published elements with links, to place the external references in “New Part” before you need them. The result is the same even in the tree.







Student Notes:

Published versus Unpublished Surface

Let us see the difference in the behavior on Copy/Pasting a link with a published surface and with an unpublished surface from one part to another.

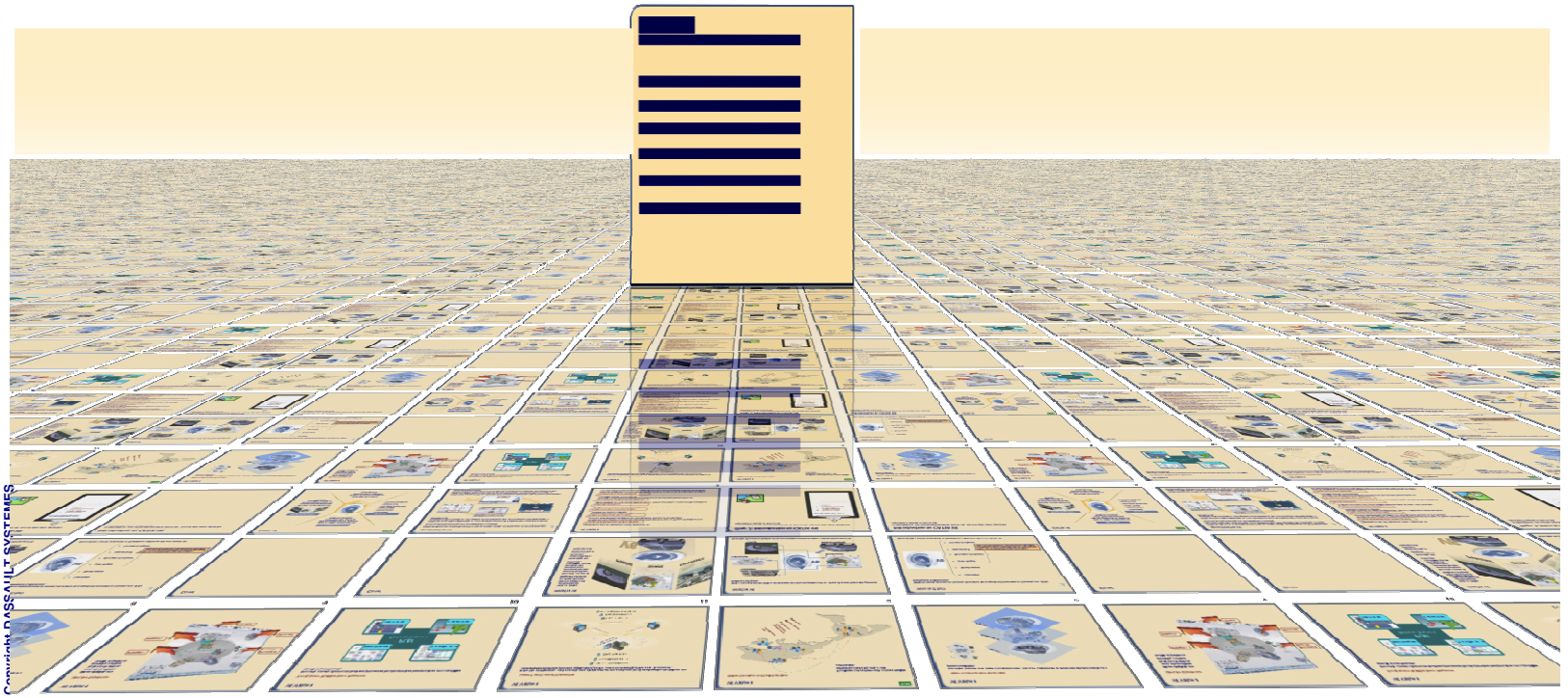
Action	Behavior in a Published Surface	Behavior in a Unpublished Surface
When a surface is modified in the source part	The modification is propagated to the target part surface	The modification is propagated to the target part surface
When the surface is deleted in the source file	A warning is displayed conveying the missing of source surface	The surface get isolated automatically
When the source surface is replaced by new surface or feature	Upon updating, the child surface synchronizes with the new parent.	Does not support the replacement of the surfaces or feature.

Let us compare the two behaviors (L6_PUBLICATION.CATProduct)

Student Notes:

To Sum Up

In the following slides you will find a summary of the topics covered in this lesson.

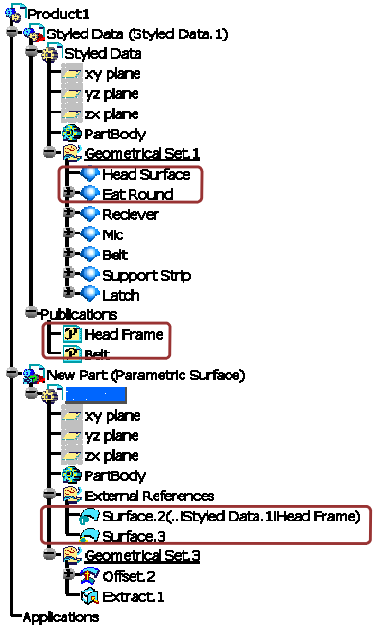


Student Notes:

Surface and Wireframe Publication

Publication helps in managing design iterations during product development cycle and provides easy availability of geometric elements to different users. Wires and surfaces are published at part level. Following points must be kept in mind:

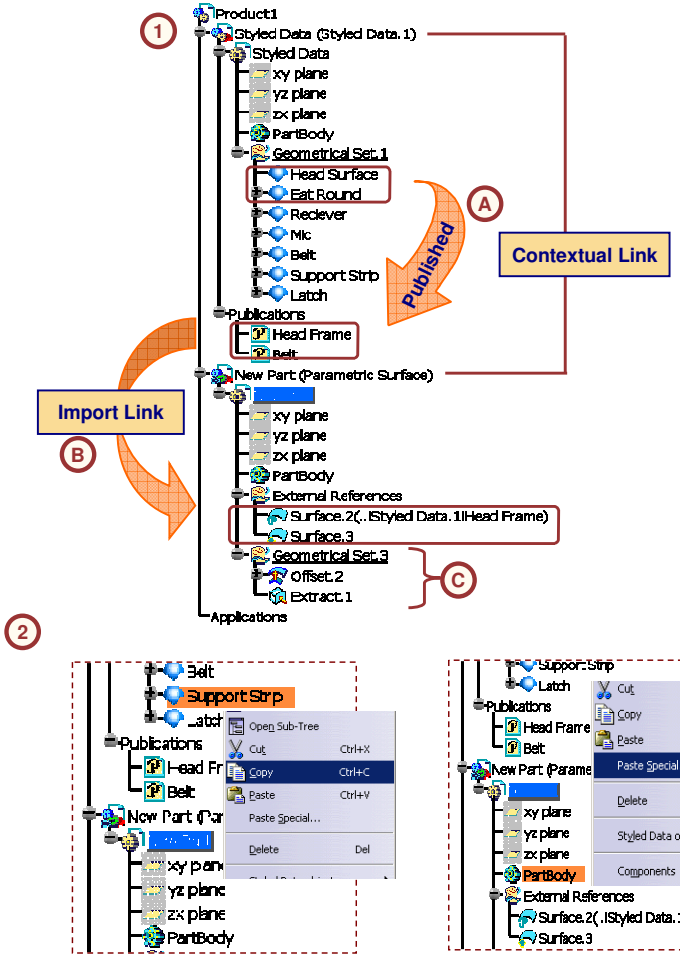
- ✓ The name of the published element must be exactly similar to that in source part and child part.
- ✓ Easily recognizable names must be given to the published elements.
- ✓ Geometry is grouped to give easier access in the Specification Tree.
- ✓ An option is available that allows to select, only the published elements as an external reference.



Use Published Surface in Product Context

There are two methods to use published geometry of a part in a multi-model environment.

1. Geometry Selection during design process.
   A. Publishing of Elements.
   B. Creating External References in a New part.
   C. Creating parametric surface using external referenced geometry.
2. Copy/Paste published elements: You can also copy/paste the published elements with links, to place the external references in “New Part” before you need them. The result is the same even in the tree.



Student Notes:

Student Notes:

Exercise 6A

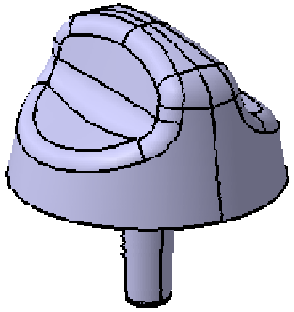
Recap Exercise

20 min

In this exercise you will build a model in a Multi-Model Environment. You will create a model for Appliance Knob using external references. Detailed instruction for this exercise is provided.

By the end of this exercise you will be able to:

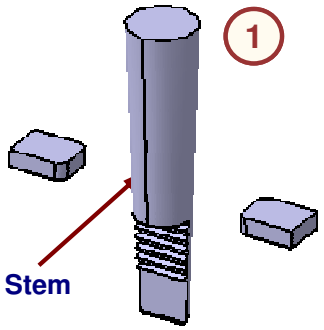
- Create a copy/paste special of one part to another using different options.
- Create a multi-model link between the parts.



Student Notes:

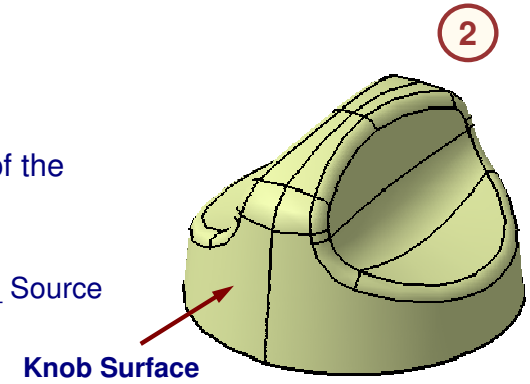
Exercise 6A (1/4)

1. **Open the Target file.**
   - Open the target file of the Knob consisting of the stem features of the knob.
     a. Click **File > open.**
     b. Browse and select the Part- Exercise_6A_target.
     c. Click Open.



Target Part

2. **Open the Source file.**
   - Open the source file of the Knob consisting of the outer surfaces.
     a. Click **File > open.**
     b. Browse and select the Part- Exercise_6A_ Source
     c. Click Open.

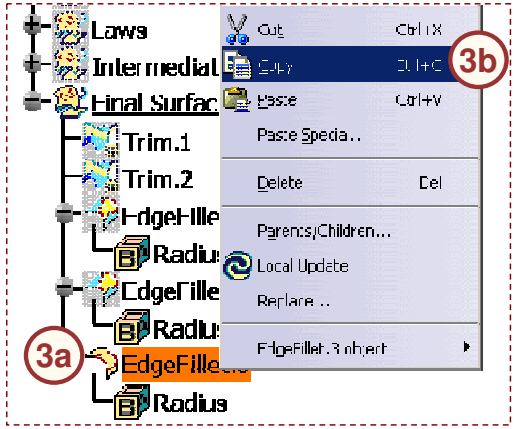


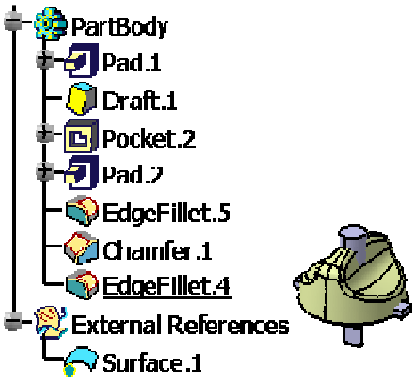
Source Part

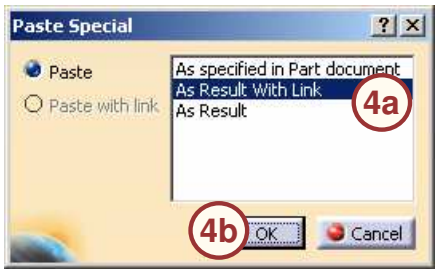
Student Notes:

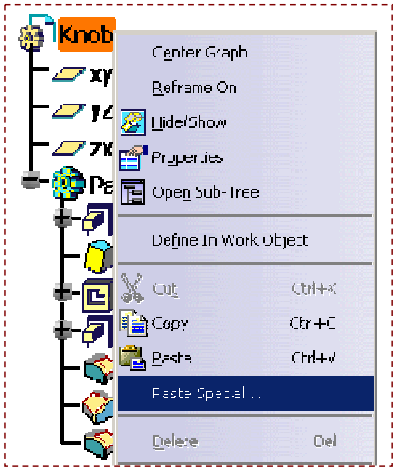
Exercise 6A (2/4)

3. **Copy the final surface of the knob from Source part.**
   - Copy the surface Edgefillet.3 from the specification tree of the source part .
     a. Right-click on Edgefillet.3
     b. Select Copy to copy the surface.
4. **Paste Special the copied surface into the target file.**
   - Paste special the surface Edgefillet.3 into the target part as shown.
     a. Paste Special –as a result with link
     b. Click OK
   - You will observe that a geometrical set named 'External Reference' is created and the surface linking to source part is pasted into it.





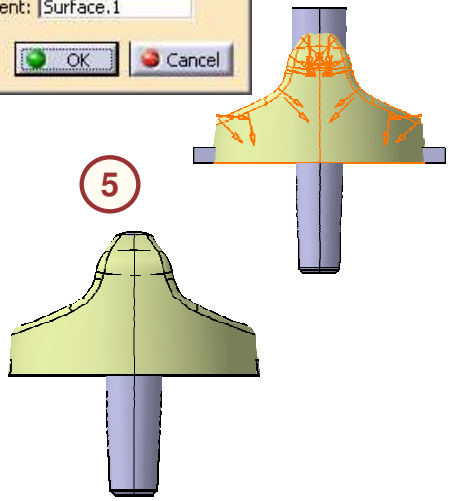




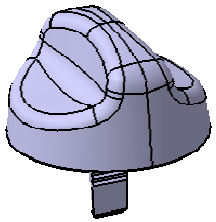
Student Notes:

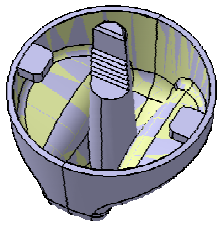
Exercise 6A (3/4)

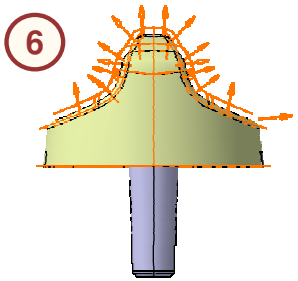
5. **In the Part Design workbench, Split the solid body using the external referenced surface.**
   - Split the solid using knob surface.
     a. Select **Insert > Surface-Based Feature > Split.**
     b. Select the surface as splitting element.
     c. Click OK.

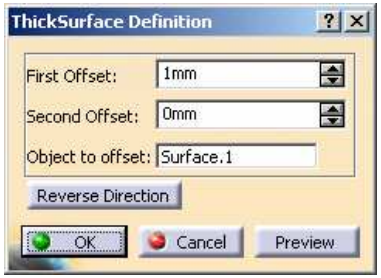


6. **Thicken the Knob surface**
   - Apply thickness to the surface as shown.
     a. Select **Insert > Surface-Based Feature > Thick Surface.**
     b. Select Surface.1 as splitting element.
     c. Click OK.







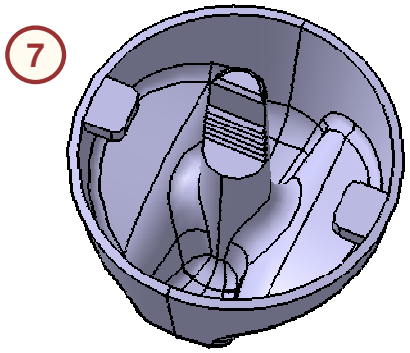


Student Notes:

Exercise 6A (4/4)

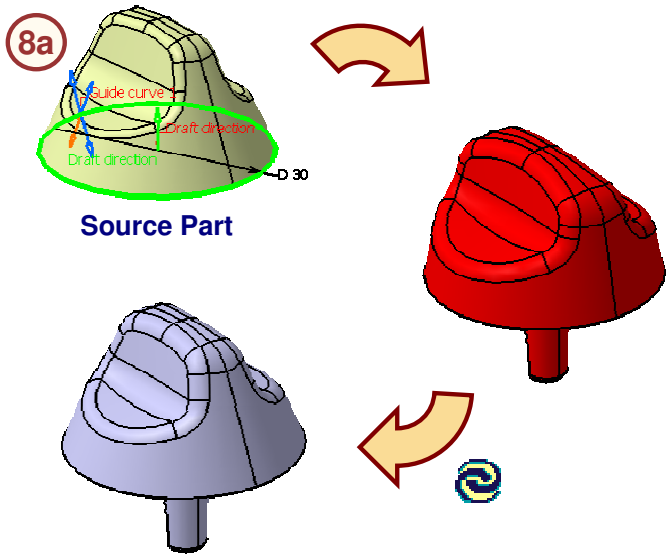
7. Fillet the sharp edges of the knob part.

- Edge fillet the inner edges.
  a. Select Edge filet icon.
  b. Select the internal edges of the knob as shown.
  c. Specify 2mm radius.
  d. Click OK.



8. Modify the knob surface in the source part

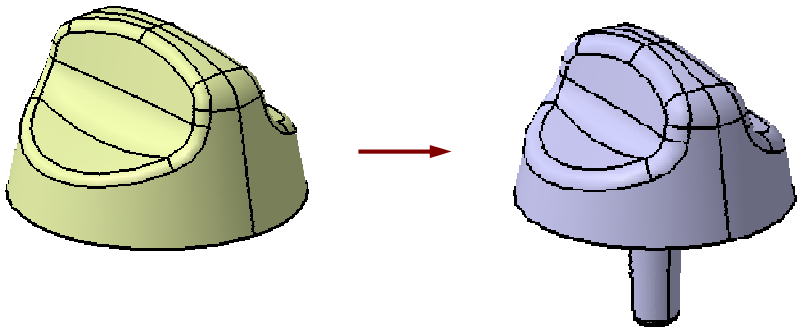
- Modify the draft angle of the knob surface.
  a. Double-click on the drafted surface (Sweep.1).
  b. Modify the draft angle to 22deg.
  c. Click OK.
- Update the target part to propagate the changes performed in the source part.

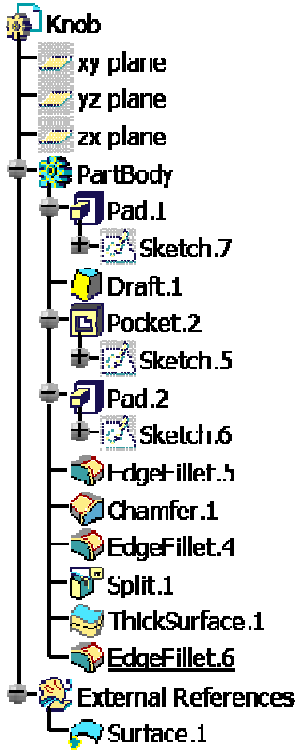


Student Notes:

Exercise 6A: Recap

- ✓ Create a copy/paste special of one part to another using different options.
- ✓ Create a multi-model link between the parts.





Student Notes:

Exercise 6B

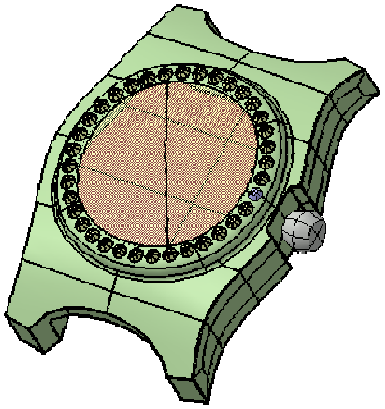
Recap Exercise

20 min

In this exercise, you will practice how to apply multi-model links using publication in assembly context. You will build the mechanical surfaces using styled surfaces and later update the model with modified inputs. Detailed instructions for this exercise are provided.

By the end of this exercise you will be able to:

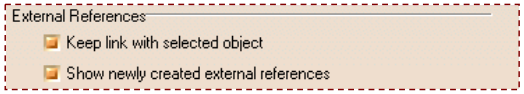
- **Create a multi-model link between parts using Publications.**
- **Publish geometries and rename them to your requirements.**



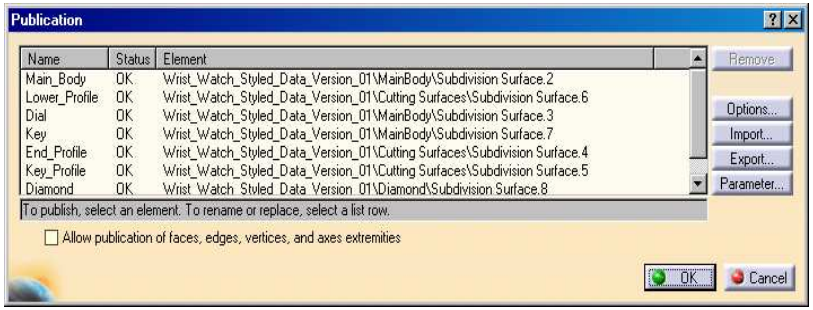
Student Notes:

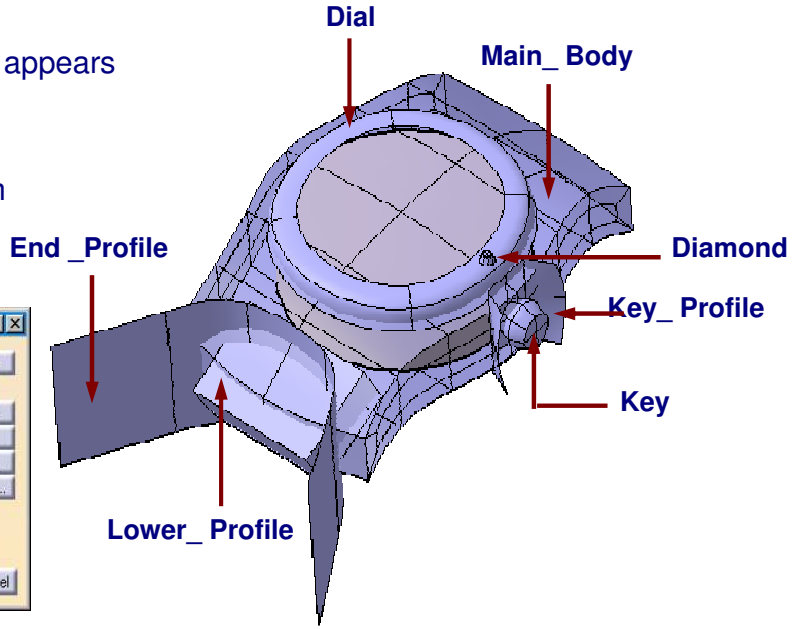
Exercise 6B (1/4)

1. **Open the given part consisting of the Styled surfaces for model of the watch in the Generative Shape Design Workbench.**
   a. Browse through the files and open the model 'Wrist_Watch_Styled_Data_Version_01.CATPart
   b. In **Tools > Options > Infrastructure > Part Infrastructure > General**. Select the boxes shown below.



2. **Study the model. Publish the styled surfaces and name the published elements.**
   a. Select **Tools > Publication.**
   b. Select Sub-division Surface. 4. the surface appears in the Publication box.
   c. Rename the Publication as End_Profile
   d. Select the other surfaces and rename them as shown in the picture.
   e. Click OK.



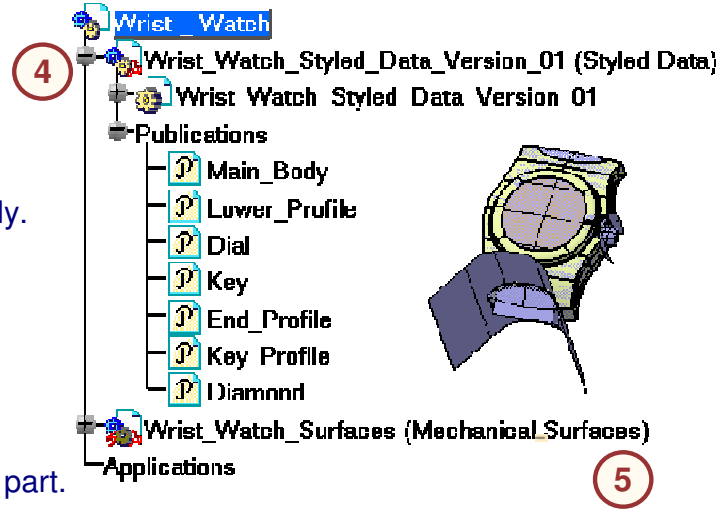


Student Notes:

Exercise 6B (2/4)

3. **Create a new assembly file (CATProduct).**
   a. Select **Start >Mechanical Design > Assembly Design**.
   b. Rename the Product as 'Wrist _ Watch'.

4. **Insert the styled data part into the assembly**
   a. Insert existing part ' Wrist_ Watch _styled_data_Version_01.CATPart' in the assembly.



5. **Insert a new part into the assembly.**
   a. You will build the mechanical surface into the new part.
   b. Rename it as Wrist_ Watch_ Surfaces (Mechanical_ Surface).

Student Notes:

Exercise 6B (3/4)

6. Create mechanical surfaces using published elements into the part 'Wrist_Watch_Surface'.

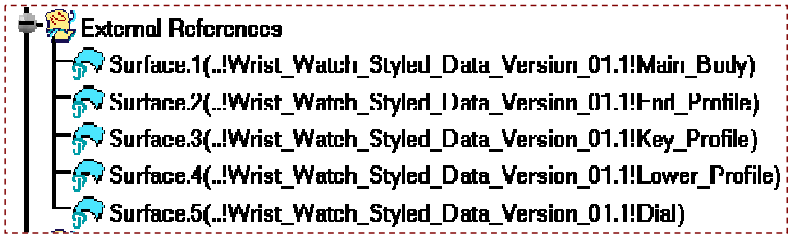
a. Trim the Main body by End_ Profile, Lower_ Profile, Key _Profile and Dial surfaces.

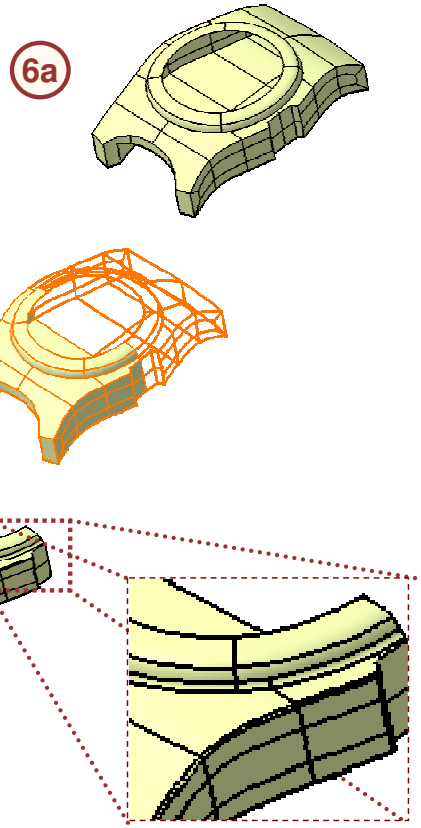
b. Split the resultant surface using XY plane.

c. Fillet the edges with 0.5mm radius.

d. Symmetry the surface along XY plane.

Observations: You will observe that, when published elements are selected to create mechanical surfaces, a contextual link is created between two parts and a geometrical set named 'External References' is created, containing linked surfaces.





Student Notes:

Exercise 6B (4/4)

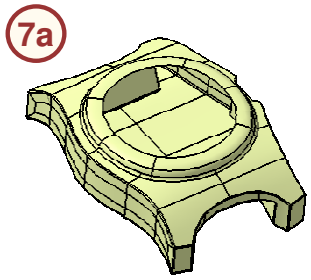
7. Replace the part containing styled data with its new version.

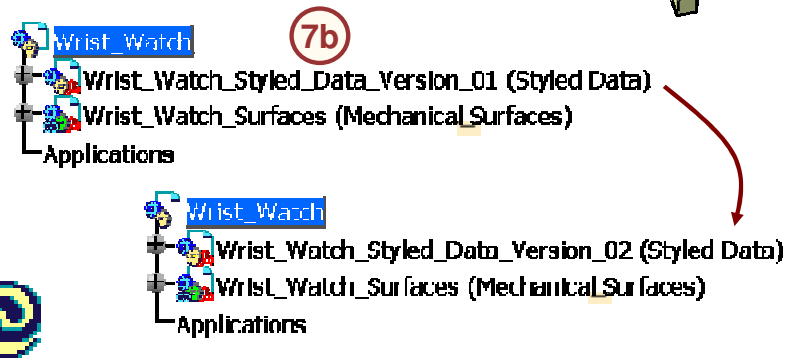
a. Ensure that the new version of styled data has similar set of published elements and the same nomenclature.

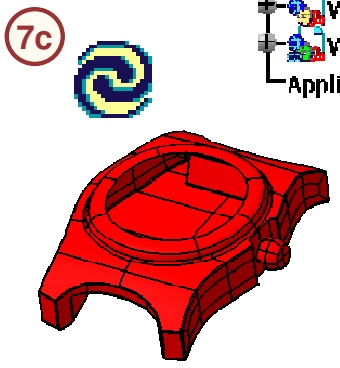
b. Replace the part 'Wrist_Watch_Styled_Data_Version_01.CATPart' with 'Wrist_Watch_Styled_Data_Version_02.CATPart'.

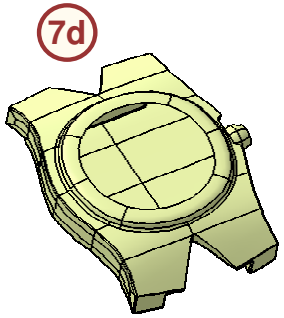
c. Update the CATProduct.

d. The model gets updated reflecting the new changes in Version_02 data.





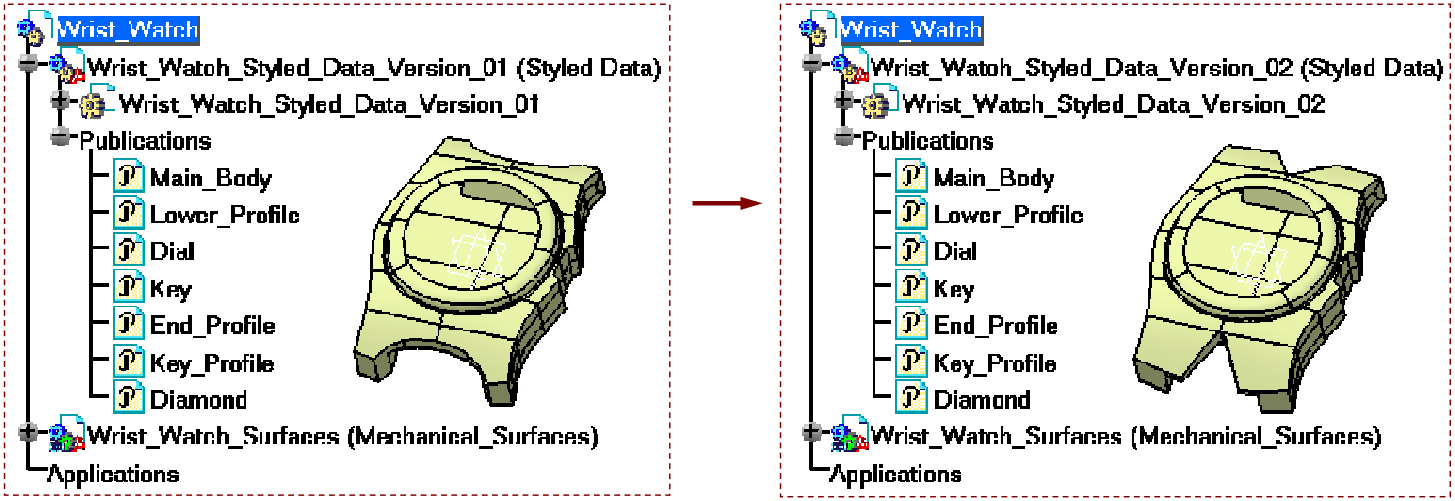




Student Notes:

Exercise 6B: Recap

- ✓ Study the styled surface data of a 'wrist watch' model.
- ✓ Publish the geometries which are referred to build mechanical surfaces.
- ✓ Build the mechanical surfaces in an assembly context using published elements.
- ✓ Replace the input data with its new version and update the model.



STUDENT GUIDE

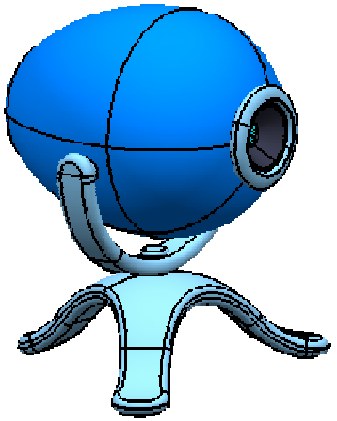
Student Notes:

Case Study: Multi-Model Environment with Surfaces

Recap Exercise

In this exercise, you will practice how to apply multi-model link using external references in the assembly context. You will understand the merits of using publication in an multi-model environment.

- ✓ Build the top part with the help of the lower half of the camera without using Publication.
- ✓ Replace the bottom (referenced part) by its variant part which has a different shape.
- ✓ Reroute the links in order to update the model with new variants.
- ✓ Publish the required surfaces of reference bottom half of the camera case.
- ✓ Build the top part again using the published surfaces.
- ✓ Replace the bottom (referenced part) by its variant part.
- ✓ Update the model. You will be able to update without re-routing the links.



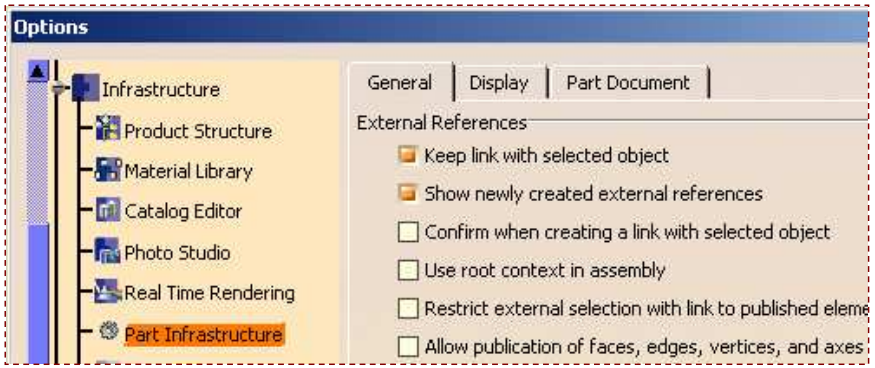
Using the techniques you have learned in this lesson and previous exercises, create the model without detailed instruction.

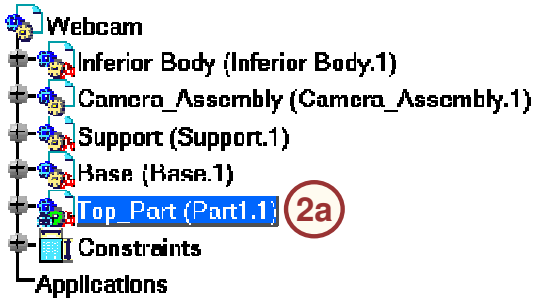
STUDENT GUIDE

Student Notes:

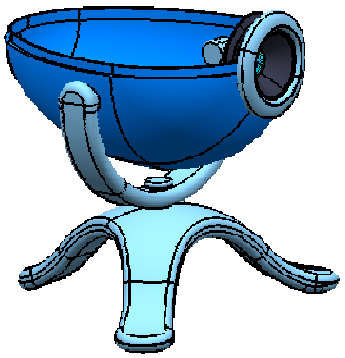
Do It Yourself: Multi-Model Environment with Surfaces (1/4)

1. **Open the Assembly of 'Web cam'.**
   a. Browse through the files and open the model 'Webcam_start.CATProduct.
   b. Select **Tools>Options>Infrastructure>Part Infrastructure> General** and select the options in the External Reference.





2. **Create a new part named 'Top_Part'**
   a. Position it on an inferior body by creating coincident constraints between xy, yz and zx planes.



Student Notes:

Do It Yourself: Multi-Model Environment with Surfaces (2/4)

3. Design the cover in context with 'Inferior_Body'.

a. Create a 360deg revolve using 'External Profile' Sketch of 'Inferior Body'. Use X direction as the revolution axis.
(Observe that after selecting of the sketch from 'Inferior Body' an External Reference Geometrical Set is formed in 'Top_Part').

b. Split the revolute surface using xy plane.

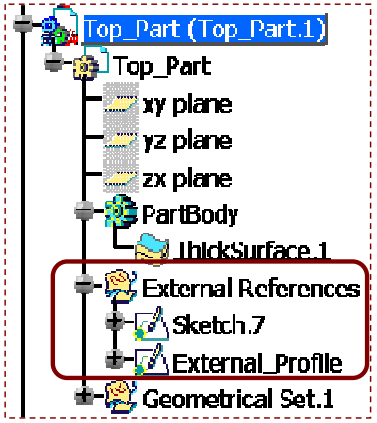
c. Project 'Sketch.2' of 'Inferior Body' on revolved surface along the X direction.

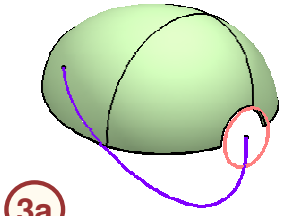
d. Split the revolute surface with a projected curve.

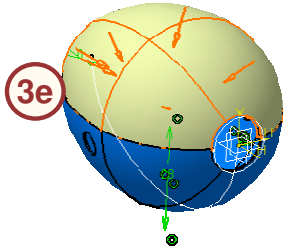
e. Thicken the surface by 2mm towards the inside as shown.

f. Save the product

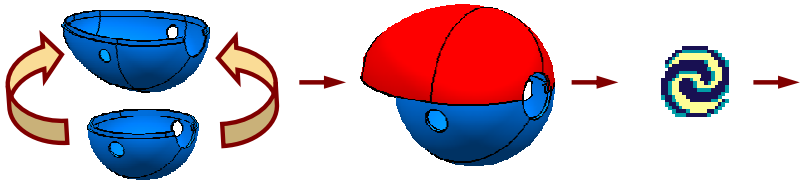
g. Open the Spherical_Body_Unpublished.CATPart.

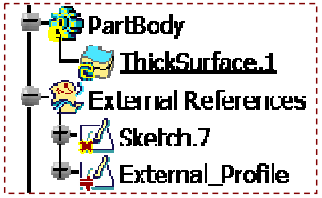


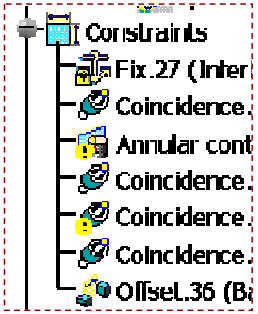




4. Replace the 'Inferior Body' with 'Spherical_ Body_Unpublished' and update the product.







Notice that some of the assembly constraints are broken. An error is displayed. These are the constraints that were pointing to the 'Inferior_body'.

STUDENT GUIDE

Student Notes:

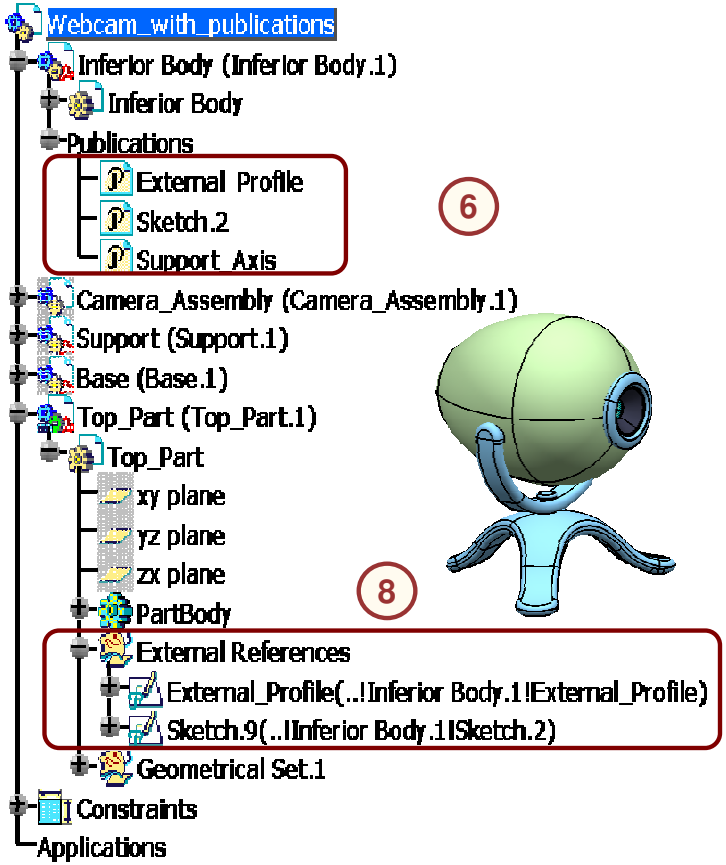
Do It Yourself: Multi-Model Environment with Surfaces (3/4)

5. **Close the product without saving the modifications.**

6. **Reopen the Web Cam assembly Webcam_start.CATProduct and publish the geometries of Inferior Body, which are referred to build the 'Top_Part'.**

7. **Rename the product as Webcam_with_publications.CATProduct.**

8. **Rebuild the 'Top_Part' using the published elements of 'Inferior Body'.**
   a. Insert the new part and follow the same process used in step 3, but this time use published elements of 'Inferior Body'.
   b. Recreate the constraints that need to be connected to newly published elements.
   c. Save the modified files through Save Management.



Student Notes:

Do It Yourself: Multi-Model Environment with Surfaces (4/4)

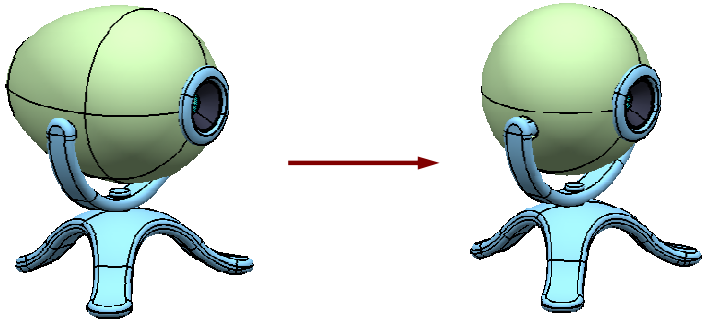
9. **Open Spherical_Body_Published.CATPart and check that it contains publication with exactly the same names as in 'Inferior Body'. If not, rename the publications of 'Inferior Body' and save the product again.**

10. **Replace the 'Inferior Body' by 'Spherical_Body_Published'.**

11. **Update the product.**

Observations: Notice that this time the geometry of 'Top_Part' has adapted to spherical shape of a new inferior body: the external reference of the Top_Part has been automatically reconnected to the published elements of replacing part.

Also notice that the axis of the Support is coincident with the axis of the Inferior Body. The constraints have automatically reconnected due to Publication.



STUDENT GUIDE

Student Notes:

Case Study: Multi-Model Environment with Surfaces Recap

- ✓ Build the top part using the lower half of the camera without applying Publication.
- ✓ Replace the bottom (referenced part) by its variant part which has a different shape.
- ✓ Reroute the links in order to update the model with new variants.
- ✓ Publish the required surfaces of reference bottom half of the camera case.
- ✓ Build the top part again using the published surfaces.
- ✓ Replace the bottom (referenced part) by is variant part.
- ✓ Update the model. You will be able to update without re-routing the links.