

Projective Uncertainty Visualization

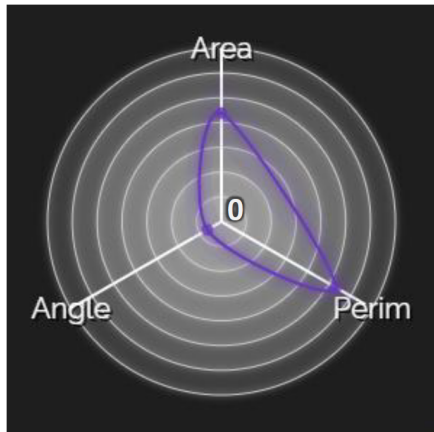
We developed a tool that allows the visual analysis of errors (distortions) created by the projection of objects (meshes) from 3D to 2D. With this user-study, we want to evaluate the ability of our visualization techniques to solve basic tasks.

* Required

Radar Plots

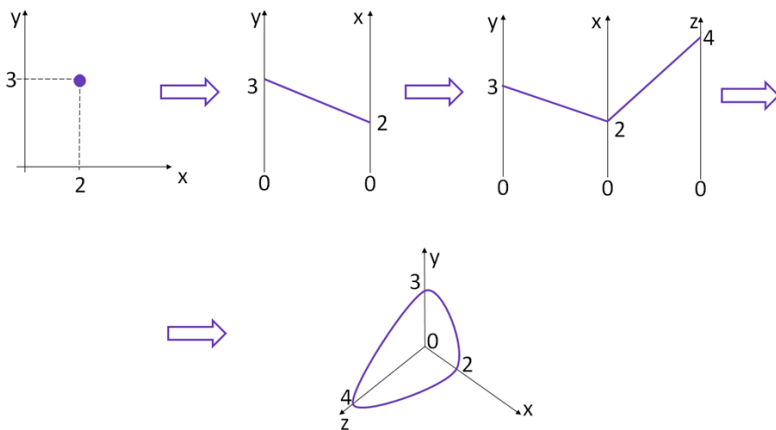
We calculate and visualize 3 types of distortions: area, angle and perimeter. One way of showing these 3 distortions is by drawing the average in a radar plot where low distortions values are placed closer to the center and higher ones farther out. In the example beneath we see low angular distortions and higher area and perimeter distortions.

Radar Plot



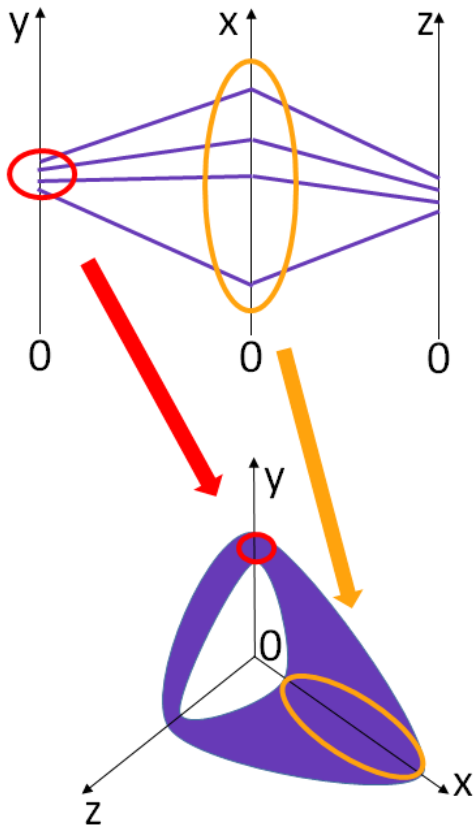
In case you are not familiar with radar plots, take a look at the figure beneath. Radar plots are able to show several values of an object at the same time. In contrast to a coordinate system, the axes are arranged in a circle and the corresponding values along each axis are connected with a line. The origin is located at the center of the plot.

Radar Plot Construction



Deviation

We can combine several together-belonging lines to one area. Depending on how far the lines are spread out, the width of the area in the radar plot varies from axis to axis.



Personal Questions

1. Age *

2. Are you a student? *

Mark only one oval.

- Yes
 No

3. Are you familiar with visualization (i.e., barplot, boxplot)? *

Mark only one oval.

- Yes
 No

4. Have you ever worked with mesh deformations or unfoldings (i.e., texture mapping, morphing, reformatting)? *

Mark only one oval.

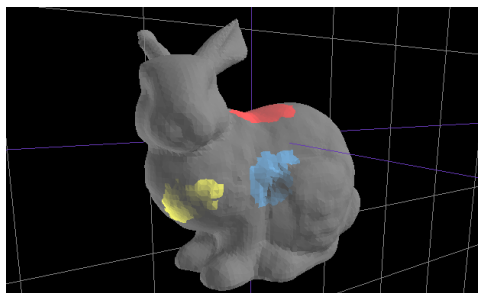
- Yes
 No

Find Local Differences

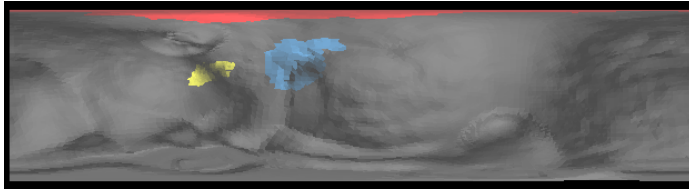
Instead of considering the distortions of the whole object, it can be helpful to only analyze them in selected regions. During this task, you will have to compare differences in distortions for the three colored regions beneath. The radar plots beneath show the average distortions for each region.

Compare Regions

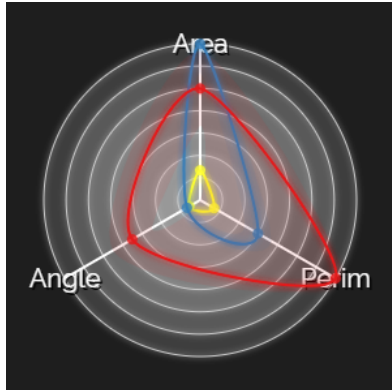
3D Bunny



2D Unfolding



Radar Plot



5. Which region suffers from the highest area distortion? *

Mark only one oval.

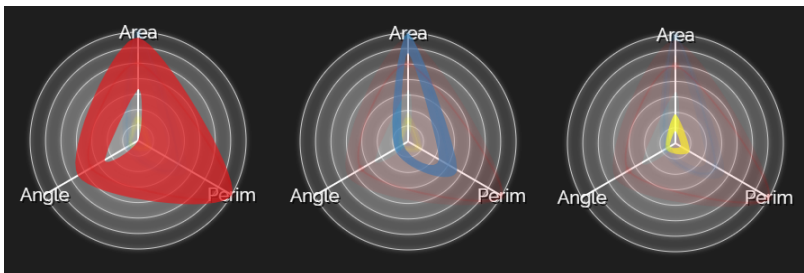
- Red
 Blue
 Yellow

6. Which region has the lowest overall distortions? *

Mark only one oval.

- Red
 Blue
 Yellow

Compare Deviations



7. Which attribute of the red region has the highest deviations? *

Mark only one oval.

- Area
 Angle
 Perimeter

8. Which regions have low overall deviations? *

Check all that apply.

- Red
 Blue
 Yellow

Find Local Differences - Feedback

9. How helpful was the radar plot for comparing the regions to one another? *

Mark only one oval.

- 1 2 3 4
 not helpful very helpful

10. How understandable was the radar plot? *

Mark only one oval.

1 2 3 4

very hard to understand very easy to understand

11. How understandable was the encoded deviation at the radar plot? *

Mark only one oval.

1 2 3 4

very hard to understand very easy to understand

12. Do you have any comments? (especially if you selected low points)

Compare Steps

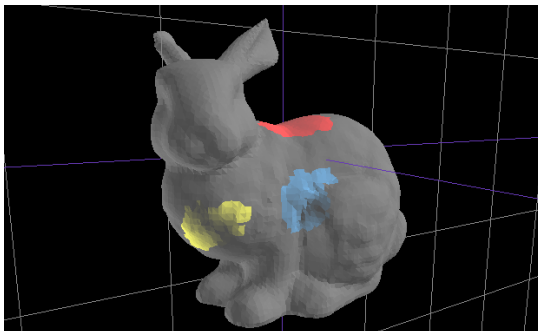
The projection beneath consist of 2 steps. In the 1st step, the 3D bunny gets blown up to a sphere and in the 2nd step, the sphere gets unfolded to a 2D map. During this task, you will have to analyze how the distortions add up over the 2 steps.

Bunny Unfolding Video

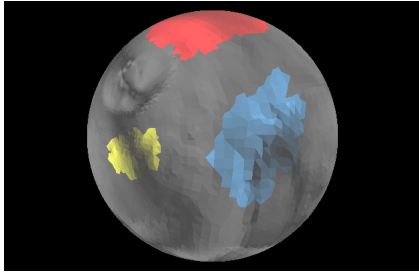


<http://youtube.com/watch?v=7OsuFePyNGo>

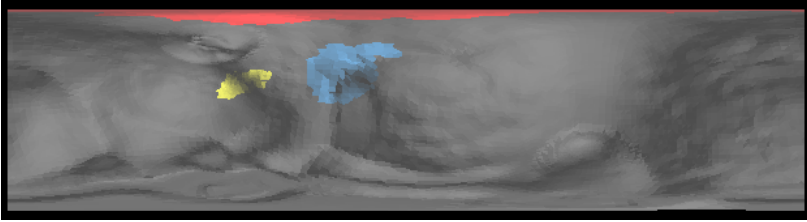
3D Bunny



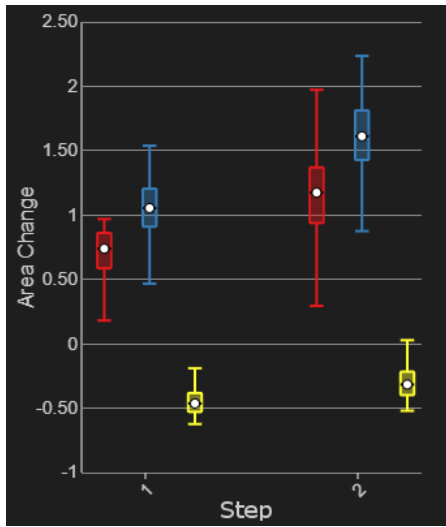
Step 1: Bunny blown up to a Sphere



Step 2: 2D Unfolding of the Sphere



Distortion Boxplots for Step 1 and 2

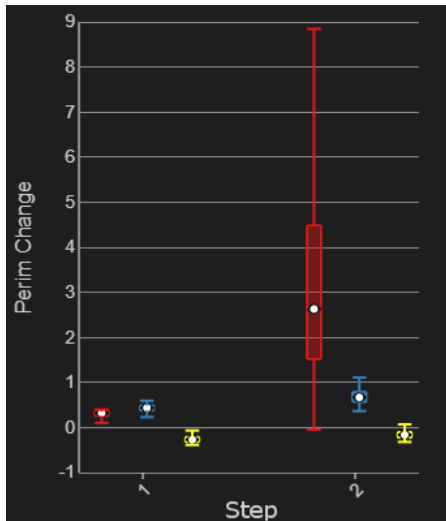


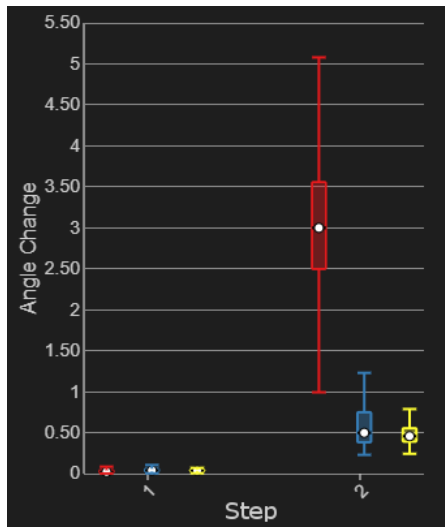
Note: With each following step, the distortions tend to add up, i.e., the distortions of step 2 are the sum of the distortions of the 1st and 2nd step.

13. Which step adds more area distortion? *

Mark only one oval.

- Step 1
- Step 2





14. The angle stays almost constant in step 1. *

Mark only one oval.

- True
 False

15. The red region seems to suffer from a high perimeter and angle distortion. Which step of the pipeline should be improved to change this? *

Mark only one oval.

- Step 1
 Step 2

Compare Steps - Feedback

16. How helpful were the boxplots for comparing step 1 and 2? *

Mark only one oval.

1 2 3 4

not helpful very helpful

17. How understandable were the boxplots? *

Mark only one oval.

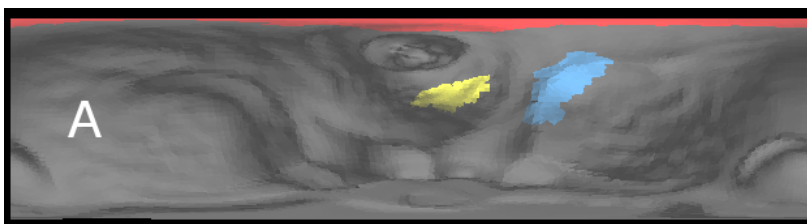
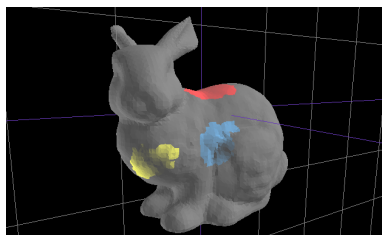
1 2 3 4

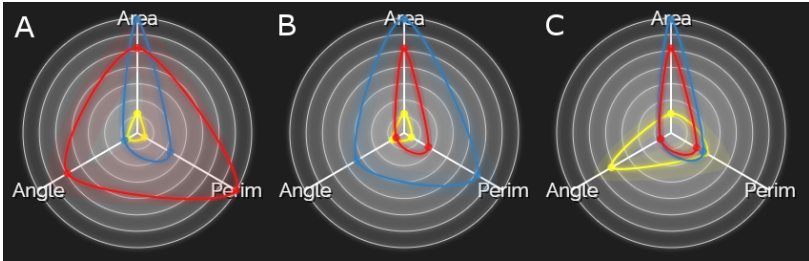
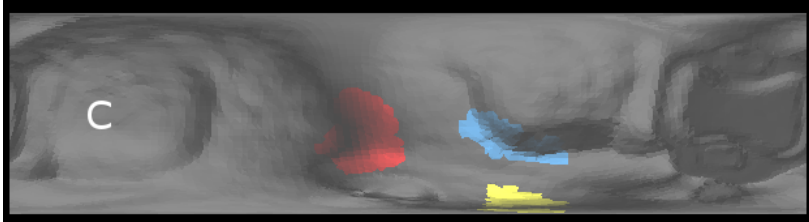
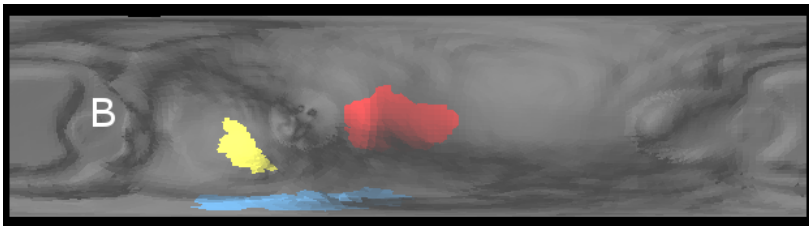
very hard to understand very easy to understand

18. Do you have any comments? (especially if you selected low points)

Compare Options

During this task, you will see 3 alternative ways of unfolding the bunny. Each has its own strengths and weaknesses. You will be asked to find the best option for a certain situation.

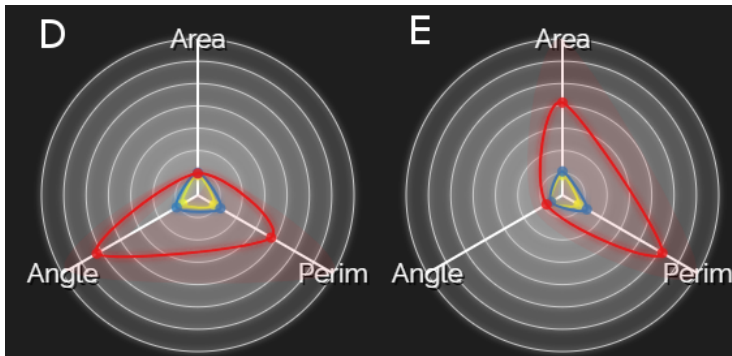
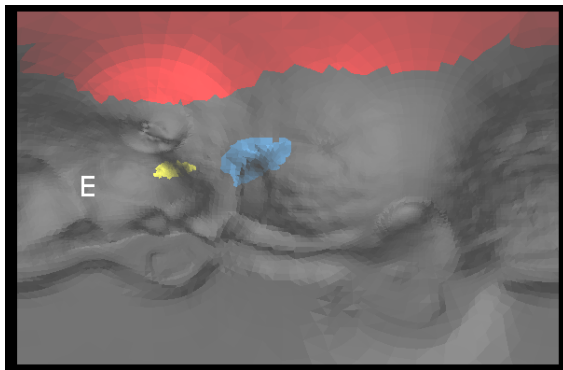
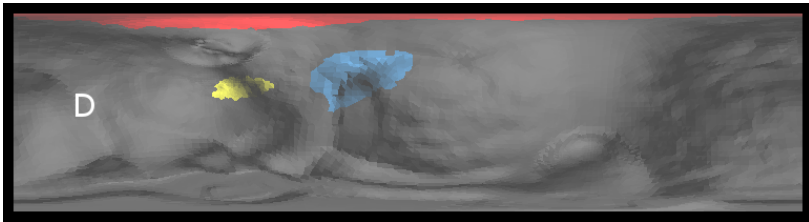




19. If you want to have the least possible overall distortions for both the red and blue region, which option should you choose? *

Mark only one oval.

- A
- B
- C



20. If you want the projected area to be as close as possible to the original area which of the two options D and E would you choose? *

Mark only one oval.

- D
- E

Compare Options - Feedback

21. How helpful were the radar plots for comparing different options? *

Mark only one oval.

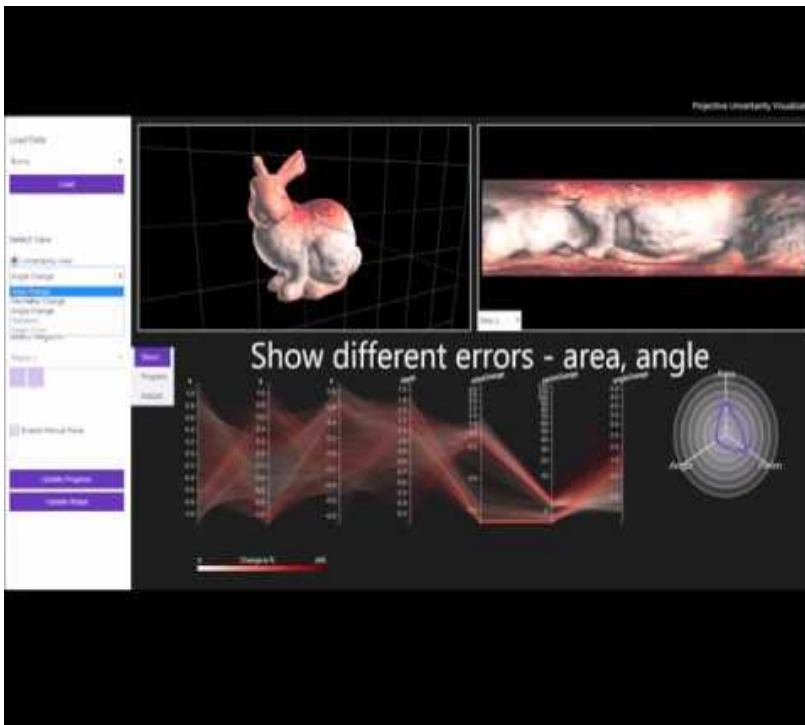
1 2 3 4

not helpful very helpful

22. Do you have any comments? (especially if you selected low points)

Final Overview

Here you can see how our whole tool looks like. If you have any comments, please, let us know in the comments below.



<http://youtube.com/watch?v=juzb0PgfJE>

23. General Comments

Thank you very much for your time and effort :)