Research topics on 3D Graphics

3D Graphics:
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Assignment #1

Global illumination phenomena, such as shadows, are not computed by the local lighting model used by the 3D graphics rasterization-based pipeline. Therefore, they need to be somehow added to the scene or image as a separate process.

Develop a way to draw, given a large quadrilateral (the floor) on the plane Y=0, an object above the quadrilateral and a point light above the object, the shadow of the object on the quadrilateral (hint: think about Peter Pan shadow*). Verify that your method is correct by building a X3D scene as above, where you apply your method to visualize the object shadow.

Write then down all the limitations of your solution, and think about possible ways to improve it (e.g. what to do when the floor is not on the Y=0 plane?)

* Peter Pan's shadow is an entity separate from his body

Assignment #2

Global illumination phenomena, such as reflections, are not computed by the local lighting model used by the 3D graphics rasterization- based pipeline. Therefore, they need to be somehow added to the scene or image as a separate process.

Develop a way to visualize, given a large quadrilateral (a mirror) on the plane Y=0, and an object near the quadrilateral, the reflection of the object in the mirror (hint: think about Alice in Wonderland*). Verify that your method is correct by building a X3D scene as above, where you apply your method to visualize the object reflection on the mirror.

* where objects reflected in the mirror are independent objects

Write then down all the limitations of your solution, and think about possible ways to improve it (e.g. what to do when the mirror is not on the Y=0 plane?)

Assignment #3

Design a (non-working) prototype for a new 3D interface to a Web image search service (e.g. Google Images).

First, do a query on Google Images with some keywords and save the first n returned thumbnails (say, with n=20, but you can choose).

Design then and build a 3D scene that displays those thumbnails to the user, allowing her to click to reach the Web page where the image is contained (as Google Images does). With respect to Google Image Search, you can use a 3D space (instead of a 2D space), so how would you use this additional possibility? Which geometries would you use to display the thumbnails? Which animations, interactions, ...?

The idea is to try to come up with an interface that is hopefully more effective (e.g. in terms of number of images shown) and/or pleasant to use and see than Google Images. Of course, your solution will be just a prototype to demonstrate your ideas, and not a fully working interface.

When you've developed your solution, find 5 people that are not part of your group and have them try your prototype. Write down their impressions. Then, think about pros and cons of your solution and write them down.

Assignment #4

Assuming that you have a CAD model of some engineering object, and that you can translate it to X3D (most CAD packages will allow you to do it), develop a X3D scene that will teach about that object or demonstrate its usage (you can add textual explanations in a Web page where the X3D environment is contained).

To embed a X3D world in a Web page, you can use the embed tag in the HTML code:

<embed WIDTH="640" HEIGHT="480" NAME="FLUX" SRC="yourX3Ddocument.x3d" TYPE="model/x3d" />

which should work in any browser, provided you have a X3D plug-in installed. When you've developed your solution, find 5 people that are not part of your group and have them try your 3D environment to learn something. Write down their impressions. Then, think about pros and cons of your solution and write them down.