Digital Media & Information Studies 2B Project:

VR & 3D Modelling

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***1. Introduction***

X3DOM presents information in a new form. As it is XML based this makes files portable, easily preserved and provides three-dimensional object-integrated hyperlinks on the web. The basis of the project is a Sylvanian Families dollhouse I had as a child. The toy manufacturing process exemplifies how 3D modelling emphasises the importance of play and builds on social, imaginative, and creative skills. Conceptualising an experience alongside structure also discloses the limitations of 3D modelling: the dimensional representation of an object requires high levels of data, and over-detailed representations also do not accurately visualise projects. Moreover, factors such as limited time and experience working with X3D restricted the model’s design and function.

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***2. Background***

This model was created using Notepad++. 3D modelling is used to validate the functionality of design ensuring technological displays of function translate into physical products (McIntosh, 2010). This means interactive aspects must consider light, contrasting viewpoints and materials to reduce labour costs of toy manufacturers and meet the desired consumer demographic. Notepad++ is compatible with various file extensions, helpful when validating syntax and files. As it was necessary to duplicate and transform many primitives, autocomplete, code highlight and temporary save features assisted in not losing sight of stages of the building process. X3D is non-immersive and incompatible with older browsers, when creating the head of my file I considered how an X-UA-Compatible meta tag allows a choice of what version of a page should be rendered (Microsoft, 2020). By creating and organising X3D on Notepad++ the HTML file was easily accessible when assessing the composition of the model throughout the design process.

***3. Stages of Design Process***

***3.1 Transformation, Scale & Rotation***

The model’s structure was initially, built by focusing on the rotation, scale, orientation, and transformation of shapes. The transform node uses rotation and scale relevant to the parent coordinate system, defining a location for its children. Moving all primitives backwards on the z-axis created a new centre. I started scaling four boxes on each side of the back walls. This created gaps for the windows by duplicating height and width parts twice and adjusting their translation. By scaling primitives, I intentionally overlapped shapes in the upstairs sidewalls. Scale familiarised me with dimensions and helped me estimate the size of the radius for alternative primitives. For the doorway structure, I used an inverse rotation on the x-axis of boxes creating an entrance slanting outwards. When rotating on the y-axis all roof parts slanted inwards by gradually increasing height towards the ridge of the roof. By rotating the z-axis, cones on the bases of furniture were flipped upside down and cylinders on window grilles were flipped sideways to create a grid pattern - repurposing shapes for new design functions. All primitives were primarily translated to join walls, create space between floors and layer detail over surfaces (e.g. doorknobs).

***3.2 DEF & USE***

DEF and USE allow efficient replication of shapes. This saved time and reduced memory requirements and computation power when storing the model as primitives were only created once. A consistent spacing can be created between shapes as their dimensions are replicated accurately and easily: cones along the roof ridge and cylinder ladder steps. Large sections of the structure could also be replicated: chairs, back walls, and windows. Temporary rotation before scaling allowed for the nonuniform scaling of children around an arbitrary orientation axis enabling the replication of the dollhouse as closely as possible.

***3.3 Viewpoints***

By using multiple viewpoints: interior, exterior and high angle this emphasises how children would physically engage with the product and exemplifies features from varying perspectives. When scaling the ‘inside’ viewpoint, the z-axis was distanced 20.577 and primitives were transformed using this viewpoint. Contrastingly, the orientation of the exterior ‘outside’ viewpoint was heightened by increasing the y-axis and distancing the z-axis further, orientating the perspective to 180 degrees by inserting 3.14 radians. The ‘upstairs’ viewpoint at a high angle was oriented downwards. Manipulating a viewpoint orientation emphasises how 3D visualisation provides a consumer understanding of the building layout – essential for children as they rely on visual aids. Moreover, contrast in viewpoint allows children to integrate moving location as social responses to play narratives which improves cognitive skills (Sutton-Smith, 2009).

***3.4 Material, Light & Texture***

Material specifies colour, texture, and customises lighting. The spotlight illuminates the insides of the structure and can be turned on and off using the button. EmissiveColor was used on the bulb on the ceiling to radiate DiffuseColor framed by a cone with a ‘false’ open bottom as a lamp shade. DiffuseColor was the most consistently used to distinguish warm tones (ladder, furniture, lampshade etc) from the colder tones of the walls. I also consistently used ImageTexture of my photos through Imgur by changing their file format this assisted in replicating the pattern and dimension of the roof, floors, upstairs wall, and door. Furthermore, I experimented with the material on the windows by adjusting SpecularColor to highlight a cool tone and increasing transparency by 0.5 to create see-through windowpanes.

***4. Challenges***

The greatest challenge was using directional lighting as it affected RGB texture and light did not diffuse properly this meant illuminating the inside of the structure using DiffuseColor independently, therefore I increased the width of the spotlight. Although this appropriately illuminates the interior this meant my shapes did not line up exactly, creating inconsistent angles and transparent flooring. Next time, I would use SpecularColor alongside DiffuseColor to reflect directional light onto the floors. The presentation was further affected by the inability to rotate the two-dimensional triangle on the second floor this meant layering image texture over the triangle to create a three-dimensional effect.

***5. Improvements***

To improve the model, I would increase user interactivity by allowing users to open doors including features of the toy activated by a touch sensor mode (X3D Graphics, 2012). Additionally, X3D extensibility allows authors to create prototype declarations and define new nodes built using Proto declare. This would allow custom shapes to be created and would level uneven surfaces like the roof and floors instead of having to create window gaps by creating a grid of boxes. By using TextureTransform on the walls of the model I would create a more realistic texture on the surfaces of the dollhouse as it aligns 2D images with underlying geometry. Additionally, the alignment of multiple ImageTexture could be improved by grouping shapes or scaling patterns using PixelTexture (web3d.org, 2012): the images of roof tiles. This lacking realism could be improved further by introducing viewpoints from within the dollhouse and including more furniture.

***6. Conclusion***

The reconstruction of this dollhouse incorporated basic primitives using Notepad++ to realise a virtual development of traditional modelling. Implementing technical changes would increase user immersion in both function and appearance. The ability to visualise objects using 3D primitives challenges conventional applications of creativity and continues to integrate functional art with realistic practices.

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