Exercise 3: Procedural Modeling-Building Readme File

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1. Building Background

The building I decided to use to create procedurally for Exercise 3 was one of the four towers that makes up the Hale Aloha complex. The Hale Aloha complex is located in Honolulu, Hawaii. It is a dorm used to house the freshmen students who attend the University of Hawaii at Manoa.

Each tower is a 13-story building that is named for the flowers of four of the largest islands in the state:

Lehua (Big Island)
I'lima (O'ahu)
Mokihana (Kauai)
Lokelani (Maui)

2. Exercise Breakdown

In this exercise, a procedural model of a building was created using Houdini 12.1.185.

After gathering reference photos of the building, the first steps I took to create the tower was to create the basic shapes of each element by floors.

The base floor walls and the walls of the other floors were created using the circle node and then use the polyextrude node to create the "height" of the floors.

The pillars were created using a box node and editing the points to create the shape that was desired. The visor-like window accents were also created with the box node and editing the points to create the shape.

To create the windows and door, box nodes were used to make the "frame" of the door and windows. A second set of box nodes were created a bit smaller than the first set which will be used to make the "cutout" for the glass panes. In order to get the cutout of the frame, a cookie node was used to subtract the smaller box node shape from the larger box node shape. Another box node was created thinner than the other box nodes to resemble the glass panes of the

windows and door. These nodes were then merged together to achieve the final outcome of the door and windows.

The roof deck area was created using the circle node. Polyextrude nodes were used to create the shape of the deck. The rooftop room and the roof were both created using the tube node.

The most difficult part of this exercise was getting the pillars and windows to orient correctly to the circular shape of the tower. In order to achieve the correct orientation the pillars were copied to a line in the shape of a circle (created by the point node). A polyframe node and attribute node was used to fix the normals of the circle node to get the pillars to orient the correct way (in the shape of a circle) The same was also done to orient the windows in the shape of a circle.

Another challenging part of this exercise was to orient the door between the pillars so that when the radius of the building increases and the number of pillars increase, the pillars would not intersect with the door. In order to get the correct placement delete nodes were used on the point nodes (for the door and pillars) to delete point 0. The operation was set to **Delete by Expression**. The expression used was **$PT == 0**. The door was then copied to that position with the copy node.

Expressions were used to get the floors to stack on top of one another and also the roof.

The expression for the floors is used in the "translate y" parameter of its respective copy node (copy17):

($CY * ch("../floor_height")) + ch("../base_height")) + (ch("../floor_height") * 0.4)

The expression for the roof is used in the "translate y" parameter of its respective copy node (copy18, which is located under the building setup network box colored pink):

(ch("../floor_height") * ch("../number_of_floors")) + ch("../base_height")

Different user-defined parameters were created to control the behavior of the building. They are accessible on the top-level node. In order for these parameters to control the behavior of the building, they are relatively referenced to parameters located in the lower nodes.

These are the user defined parameters and what they are relatively referenced to.

building_radius: It is relatively referenced to the expression in the pillars' point1 node "position" parameter (x and z). It is also used in the base_walls' circle node (renamed *base_wall)* radius parameter. It is also referenced in the base_door's point4 node "position" parameter (x and z). It is used in

the floor_walls' circle node (renamed *floor_wall*) radius parameter. It is also used in the point2 node's (located in the complete_floor network box colored golden yellow) "position" parameter (x and z). it is also used in point3 node's "position" parameter (x and z) located in the golden yellow network box. It is also used in the roof's circle node (renamed *roof_deck*) radius parameter as well as the tube nodes' radius parameters (renamed *roof_room* and *roof*).

base_height: It is relatively referenced to the box node's "size y" parameter (renamed *pillar* which is located under the red base_pillar network box). It is also referenced in the polyextrude1 node's "translate z" parameter (the node is located under the red base_walls network box).

door_size: It is relatively referenced to the xform6 node's scale parameter which is located in the red base_door network box.

floor_height: It is relatively referenced in the polyextrude2 node's "translate z" parameter (it is located in the orange floors_wall network box). It is also referenced in the expression used in the copy17 node's translate y parameter (located in the golden yellow complete_floor network box). It is also referenced in the expression used in the copy20 node's translate y parameter (also located in the golden yellow complete_floor network box). It is also referenced in the expression used in copy18 node's translate y parameter (located in the pink building network box).

number_of_floors: It is relatively referenced in the copy8 node's number of copies parameter (located in the orange floor_wall network box). It is also referenced in the expression used in the copy18 node's translate y parameter (located in the pink building network box).

roof_height: It is relatively referenced in the xform5 node's scale y parameter (located in the green roof network box).

roof_room_height: It is referenced in the tube node's (renamed *roof_room*) height parameter (located in the green roof network box).

roof_deck_height: It is relatively referenced in the xform4 node's scale y parameter (located in the green roof network box).

3. Procedural Building Controls

Located on the top-level node are user-defined parameters that control the look of the exercise.

Here are the user-defined parameters and a description of what they do.

building_radius: This controls the radius of the building.

base_height: This controls the height of the base floor of the building.

door_size: This controls the size of the door located on the first floor of the building.

floor_height: This controls the height of the floors.

number_of_floors: This controls the number of floors that the building has.

roof_height: This controls the height of the roof.

roof_room_height: This controls the height of the room located on the top floor of the building.
roof_deck_height: This controls the height of the roof deck.

4. Improvements to Building

Some changes were made to the building in order to improve the look of it.

1. The visors located under the windows were redone. They are shorter than the previous version and are positioned more tightly to the building so they do not look like scales.
2. The hdr image in the final render and movie was taken out and replaced with just a plain background plane.
3. A different lighting rig was used. The setup now uses a skylight and distant light to light the scene instead of area lights.
4. The turntable was removed from the movie since the building is circular and is similar on all sides.
5. The roof deck and also the roof of the building was tweaked a little so that they appear much smoother than in the previous version.