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CS 330

**Final Project – Milestone Submission**

**Overview**

This scene replicates a small living-room layout built from OpenGL primitives using Triangle & Cube Studios’ starter framework. I created a multi-part sectional couch, plus three additional distinct objects: an ottoman, a side table, and a router. A wood floor plane grounds the composition and provides a surface for lighting and shadows. Each object has its own transformation (scale, rotation, translation) and is composed using helper functions for clarity and reusability.

* Engine/Language: C++ / OpenGL
* Libraries: GLM for transforms, stb\_image for textures
* Project: 7-1\_FinalProjectMilestones (Debug | Win32)

**Objects Implemented**

1. Sectional Couch (multi-part)
   * Seat (box), back (box), left/right arms (2 boxes), chaise extension (box), legs (4 cylinders).
   * Materials/Textures: fabric (albedo), wood (legs).
   * Notable transforms: chaise extends on the negative X; back has slight negative X-rotation for natural lean.
2. Ottoman
   * Top cushion (box) + 4 short wood feet (cylinders).
   * Placed front-right of couch to balance composition.
3. Side Table
   * Tabletop (thin box) with 4 cylindrical legs.
   * Sits to the left of the couch near the back wall plane location.
4. Router (Tabletop Prop)
   * Body (box) + two upright antennas (thin cylinders).
   * Small scale and vertical elements add variety to silhouettes.

*(Supporting)* Floor Plane

* A large scaled plane textured as wood.
* Provides visible lighting response to demonstrate material/lighting settings.

**Geometry, Transforms, and Composition**

Geometry Sources: All objects are built from plane, box, cylinder (and optional sphere) meshes that are loaded once and re-used.

Transforms (TRS): Each object uses a specific scale → rotate → translate pipeline via a helper that populates the shader’s model matrix uniform.

Spatial Layout:

* + Couch centered at the origin with chaise toward ⟨left/right⟩.
  + Ottoman offset to ⟨+X, +Z⟩ for a natural path between furniture pieces.
  + Side table offset to ⟨−X, −Z⟩ behind the couch line.
  + Router placed on the side table.

**Lighting**

**Model**: Phong-style with ambient, diffuse, and specular components.

**Lights**:

* + **Key**: white light at ⟨3, 5, 5⟩ simulating a window/sun.
  + **Fill**: warm light at ⟨−4, 3, 2⟩ to soften contrast.

**Global Ambient**: Low value to avoid pure black in occluded areas.

**Per-Object Toggling**: Floor uses lighting to show highlights; some textured props can toggle lighting if needed for clarity.

**Camera & Navigation (Documented)**

Move: W/S forward/back, A/D left/right

Elevate: Q/E down/up

Look: Mouse (yaw/pitch)

Zoom/FOV: Mouse wheel; clamped to ~20°–80°

Reset View: R returns camera to default eye/target/up

Notes: Cursor is locked to the window for consistent mouselook; sensitivity tuned for small desk motions.

**Custom Functions Implemented (Documented)**

Scene Setup

* LoadSceneTextures() — loads/records textures, builds mipmaps, binds units.
* PrepareScene() — enables depth test, sets clear color, defines materials and lights, loads plane/box/cylinder(/sphere) meshes.

Transform & Render Utilities

* SetTransformations(scale, rotX, rotY, rotZ, position) — composes model matrix.
* SetShaderColor(r,g,b,a) — sets flat color & disables textures.
* SetShaderTexture(tag) / SetTextureUVScale(u,v) — selects texture & UV tiling.
* SetShaderMaterial(tag) — passes material constants to the shader.

Object Builders (Distinct Draw Calls)

* DrawCouch() — draws seat, back, arms, chaise; adds wood legs.
* DrawOttoman() — cushion + 4 feet.
* DrawSideTable() — tabletop + 4 legs.
* DrawRouter() — body + 2 antennas.

**What Changed Since Milestone 6-3 (Explicit)**

Added three new objects (Ottoman, Side Table, Router) and decomposed the couch into multiple parts (seat, back, arms, chaise, legs) so the scene now exceeds the four-item requirement.

Implemented and documented navigation controls (WASD, Q/E, mouse look, wheel zoom, reset).

Introduced custom object-builder functions (DrawCouch, DrawOttoman, DrawSideTable, DrawRouter) and material/lighting definitions.

Tuned UV tiling and mipmapped textures for cleaner appearance.

**Screenshots (Evidence)**

**Screenshot A – Front-Right Angle (All Objects Visible):**

**A cartoon of a couch

AI-generated content may be incorrect.**

**Build & Run Notes**

* Configuration: Debug | Win32
* Tested with depth test GL\_LESS, clear color ⟨0.10, 0.12, 0.13⟩, and viewport fallback to 1280×720 if none is set.
* Asset paths expect textures under Assets/Textures/.

**Reflection**

The major challenge was balancing object proportions and tiling so textures looked natural without stretching. Breaking the couch into multiple pieces improved realism and satisfied the “multi-part object” expectation while keeping draw code maintainable. Next steps would include a simple back wall plane to catch shadows and adding a neutral HDRI-style ambient term for softer contrast.

A couch in a room

AI-generated content may be incorrect.