

# Final Project Design Document

12/15/2024  
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CSCI 379 – Design and Development for XR

Fall 2024

Prof. Brian King

This document is adapted from the VR Project Design Document used throughout the Unity Learn VR Development Pathway.

**Team Member(s):** Meiers Dixon

**Github / Gitlab URL:** <https://github.com/MeiersD/ChemStruct>

**Video URL:** <https://www.youtube.com/watch?v=7Rspczc9kWk>

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App Info

ChemStruct	
<input checked="" type="checkbox"/> Education & Training	<input type="checkbox"/> Mental Health & Fitness
<input type="checkbox"/> Travel & Discovery	<input type="checkbox"/> Media & Entertainment
<input type="checkbox"/> Productivity & Collaboration	<input type="checkbox"/> Gaming
<input type="checkbox"/> Art & Creativity	<input type="checkbox"/> Other: _____

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Pitch

To goal is for users to [learn | experience | practice | review | design | play | other]:

Learn the structure of simple organic molecules thought building them hands on so they can visualize those molecules in 3D space.

This will be especially [impactful | educational | memorable | effective | fun | other] in VR b/c:

Impactful for students who are interested in technology, have a VR headset, and like the challenge of creating things with their hands. This will be a powerful tool for students to understand how molecules can vary based on size and functional groups.

At a high level, during the app, users will:

During the app, users will improve their skills with visualization and appreciate how creating molecules based on their functional groups is as much an art as it is a science.

Users will interact in XR with (controllers? Hands? Gaze?):

Users will interact with this project using their Hands; controllers have not been tested with this project, as the goal is for users to get the feeling of building a molecule with a hands-on approach, increasing the immersion and user's interaction.

The app is designed to be (VR? MR? AR?) :

This app is designed to work in VR only. AR might be possible, but I think the background provided by the game gives the user the sense that they are in a workshop building something as a craftsman would.

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#### Basics

The app will take place in:

N/A the user is stationary, but can walk around to get a better view of their molecule.

and the user will get around the scene with:

[teleport | continuous | other | N/A - user will be stationary] movement.

The user will be able to grab:

- Carbon
- Nitrogen
- Oxygen

There [will | will not] be sockets:

- Will be sockets on each atom, 2 for O and 3 each for N and C
- The bonds are not socketed, they are build automatically.

Characterize more details of what the user will be able to do, and how, especially if you are planning on hand gestures, hand interaction, and/or mixed reality

#### Capabilities

- The user has dozens of molecules they could be randomly assigned, 14 amino acids, 8 hydrocarbons, 8 carboxylates and small molecules.
- Once an atom is picked up, if it has bonds attached, they are broken automatically to allow for the user to take apart incorrect atom placements.

#### Validation Algorithm

- The game uses a simplified form of MOL notation to validate structures. Each molecule is defined by a total sum of bonds and atoms rather than 3D spatial coordinates. This file is stored in an easily modifiable json file.

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#### Events & Interactions

There will be haptic / audio feedback when:

- N/A
- 

There will also be 3D sound from:

- N/A
- 

If the user is holding:

and presses the trigger,	Bond toggles from single to double or double to single.
and presses the	Atom is picked up and can be dragged, automatically breaking any bonds

	trigger,	attached to it in the process.
	and presses the trigger,	The structure validation algorithm is called and checks to see if the user has built the structure correctly.
		Suggestions: a UI change, a sound/video plays, a particle plays, an object is spawned or destroyed.

By default, the left hand will have a:

Ray	interactor.
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and the right hand will have a:

Ray	interactor.
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And you will not be able to toggle on a Ray interactor using the controller.

The main menu will be located:

The game is only one scene and therefore does not have a main menu. The task bar which is the closest thing follows the user's camera.

and from the main menu, the user will be able to:

- The current atom that they are tasked with building.

[Optional] There will be additional UI elements for:

- Bonds, which can be toggled to double bonds by either a direct or ray interaction.

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### Optimization & Publishing

To make the user experience more accessible / comfortable:

- To make the user experience more accessible, the game was created with XR Hands to encourage the user to better immerse themselves with their VR Environment.
- In addition, the project occurs in VR to better increase immersion

Given that this app is targeting the [headset model], target metrics are:

Frames per second:	$\geq 72$	FPS
Milliseconds per frame:	$< 14$	ms (= 1,000 / FPS)
Triangles per frame:	60,000	tris
Draw calls per frame:	80	batches

Lighting strategy:

<input type="checkbox"/>	All baked	<input type="checkbox"/>	Mostly baked with some mixed	<input checked="" type="checkbox"/>	All real-time
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Light probes **will not** also be used for more realistic mixed lighting.

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### Other features

Tested Hardware  
Meta Quest 3 Headset

Software  
Unity (On Meta Quest 3)  
Unity (on laptop)

#### How to run ChemStruct on your machine:

The project can be run through the following way:

- 1) Clone this repository with  
`git clone https://github.com/MeiersD/ChemStruct.git`
- 2) Open Unity Hub and create a project from Add -> Add project from disk and select this repository.
- 3) Open the project, connect your XR Headset with a USB-C USB-C connector to your laptop, and open Build Settings, and select your headset from buildsettings. Make sure that the required packages are installed, namely
  - Newtonsoft.js
  - XR Interaction Toolkit
  - XR Hands
  - OpenXR Plugin
  - TextMeshPro
- 4) Select Build and Run
- 5) Once finished building, the project should load onto your headset automatically.

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### Timeline (Optional)

	Milestone	Date
1	- Working MVP	12/8
2	- Finished product in Unity editor	12/9
3	- Functional product on headset	12/13
4	- Video	12/14
5	- XR Design doc	12/15