

MemoVis

A GenAI-Powered Tool for Creating Companion Reference Images for 3D Design Feedback



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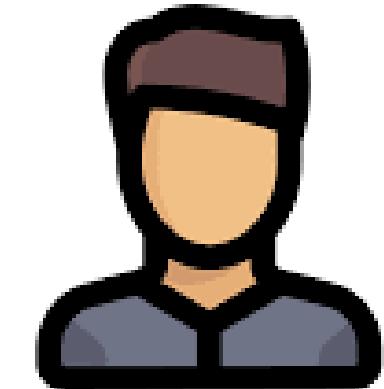
UC San Diego
THE DESIGN LAB

Adobe



ACM Transactions on
Computer-Human Interaction

Asynchronous Feedback in 3D Design Review Workflows



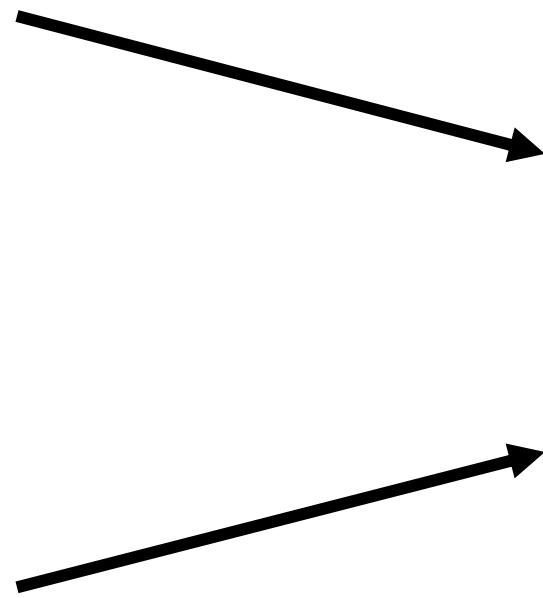
Collaborators



- Review the design
- Highlight issues
- Propose changes



Clients



3D Design

This is an example 3D model for review.



+

Add Textual Comments to 3D Models

Example Powered by 

Model Tree

- model
 - Trousers
 - FM02_Tunic_A
 - Elegant_Cut
 - CC_Base_Tongue
 - CC_Base_Eye
 - Headband
 - Katana_Saya
 - CC_Base_Body
 - Retiarius_Shoes
 - Male_Sword
 - Short_ponytail
 - CC_Base_Teeth
 - Katana

3DCommentView

3DCommentView

Find text or tools

All tools Edit Convert Sign Create Share

MODIFY PAGE

Organize pages

ADD CONTENT

Text

Image

Header and footer

Watermark

Link

Bates numbering

Button

Video

Sound

3D media

Attach file

Background

Article box

Design tools

Create standout documents with easy-to-use tools in Adobe Express. PDF will be uploaded to Adobe cloud storage.

Combine files

Redact a PDF

Prepare a form



Load & Explore the 3D Model



ONLINE 3D VIEWER

Drag and drop 3D models here.

Check an example file:

obj 3ds stl ply gltf off
3dm fbx dae wrl 3mf amf
ifc brep step iges fcstd bim

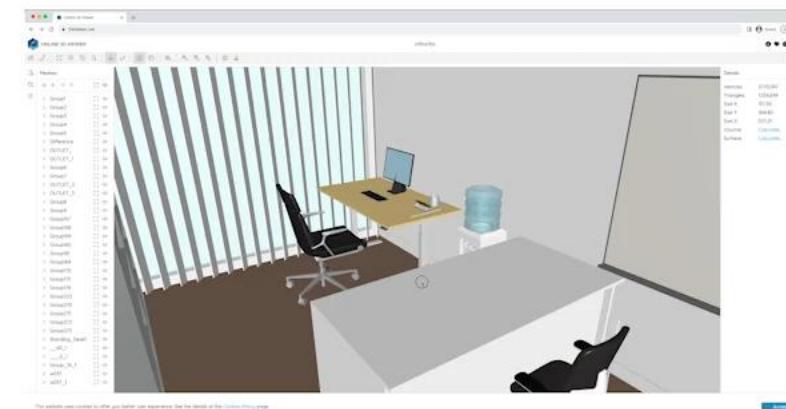
New Message

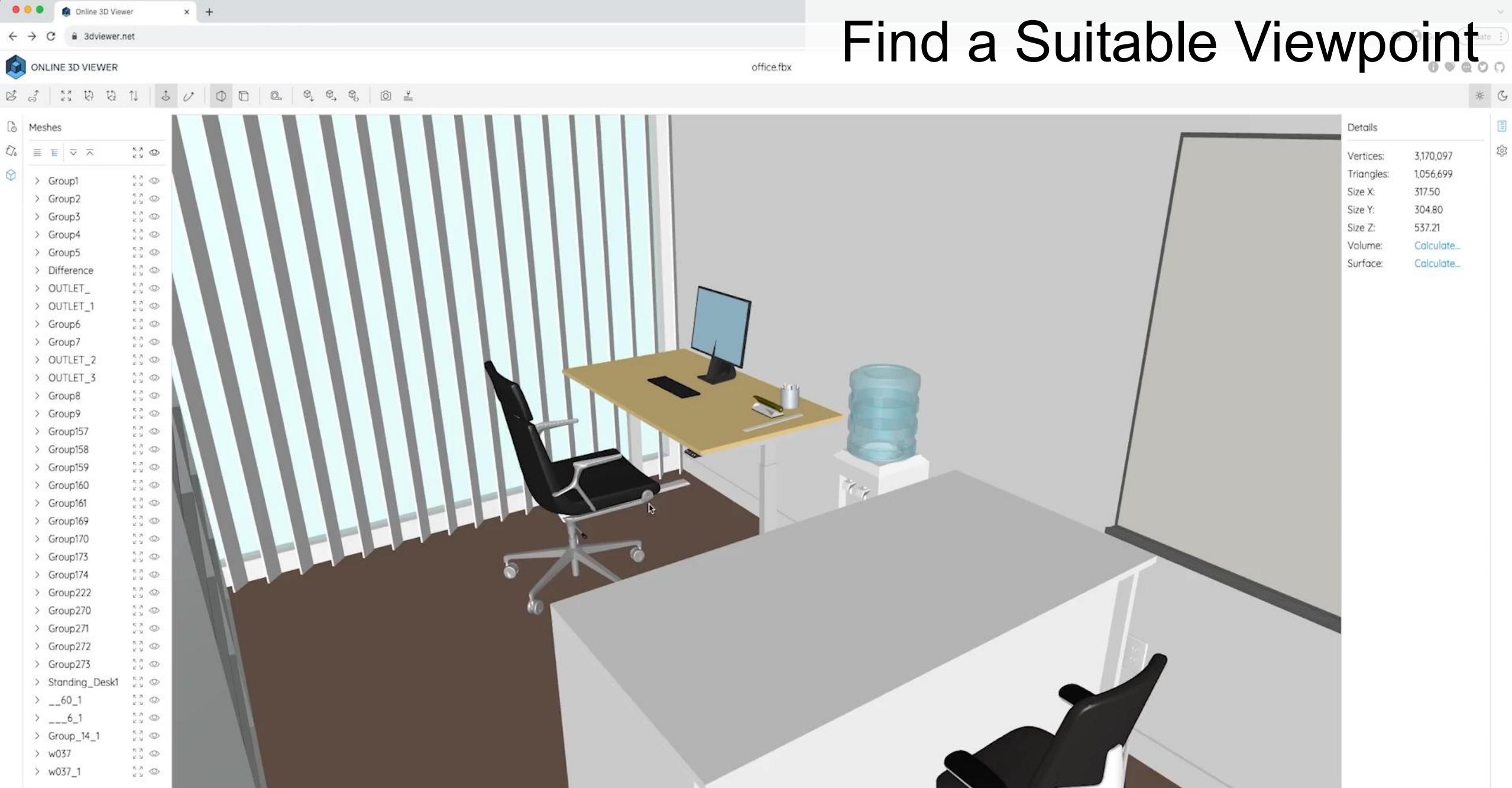
mike@anonymous.designer

Write the Feedback

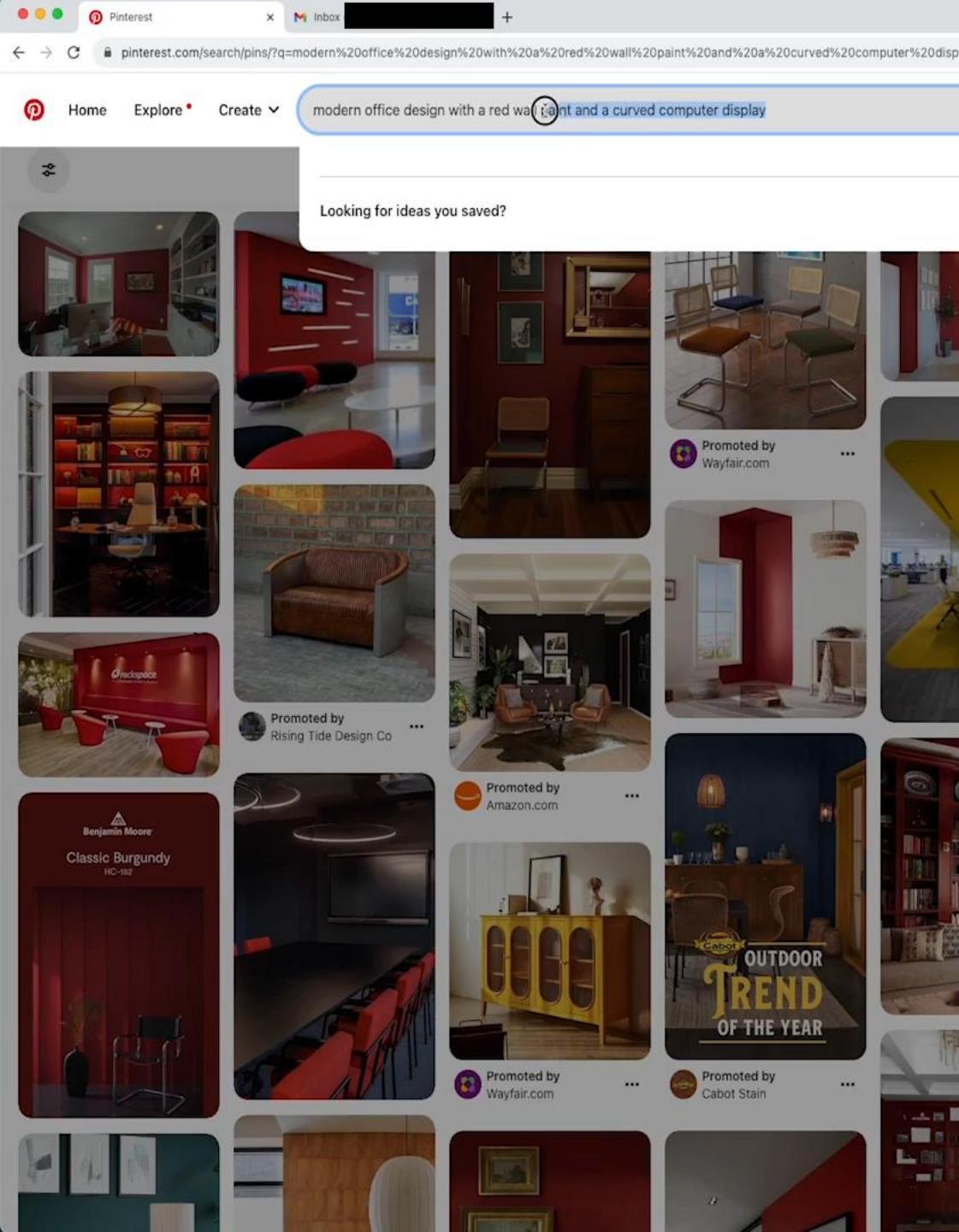
Example 3D Design Feedback:

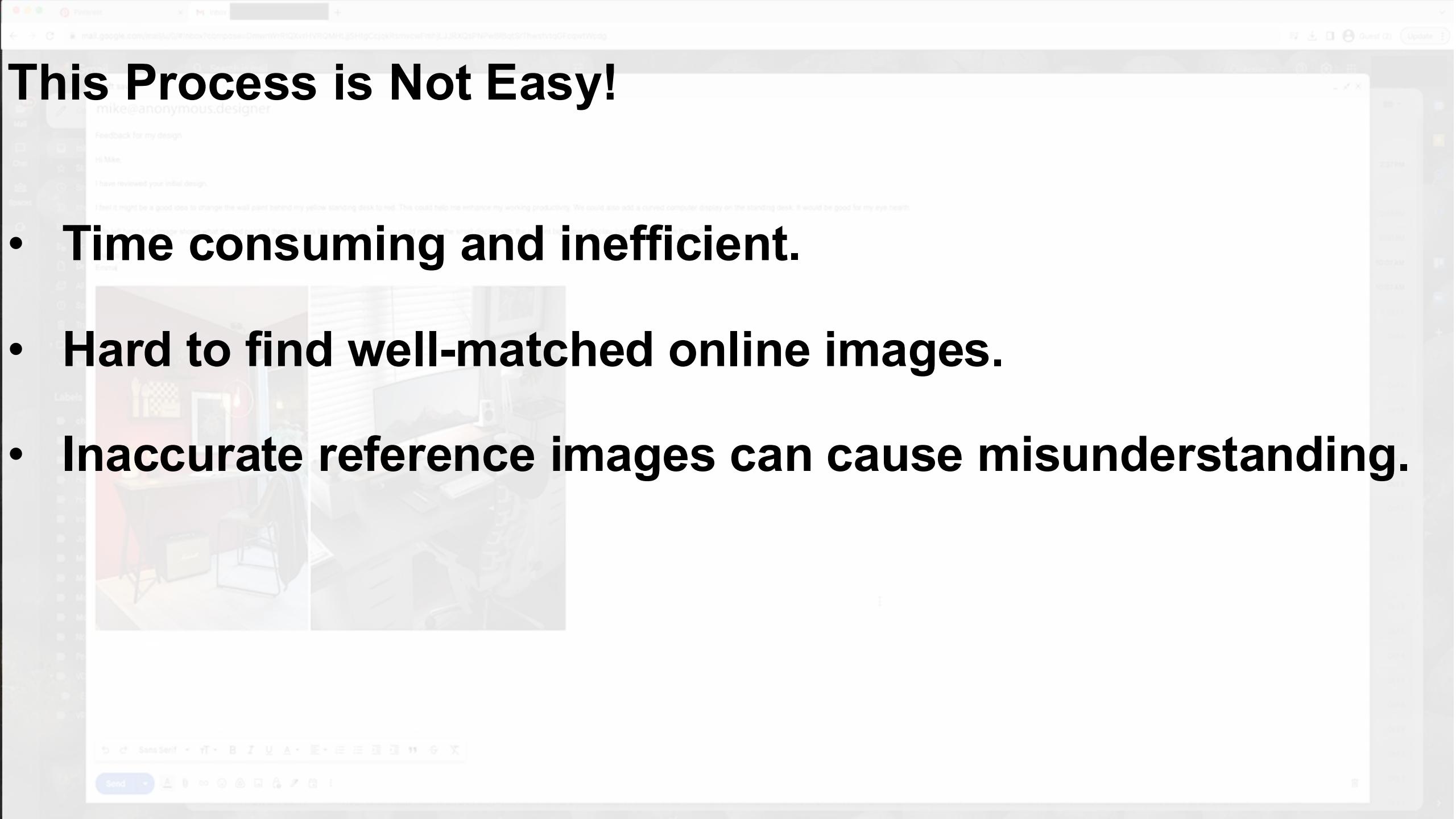
- Change to red wall paint.
- Use a curved computer display.





Search a Companion Reference Image & Finish the Feedback





This Process is Not Easy!

- **Time consuming and inefficient.**
- **Hard to find well-matched online images.**
- **Inaccurate reference images can cause misunderstanding.**



Textual Prompt: *“an office with a red wall paint”*.

Prompt

An office with a red wall paint.

Example Powered by





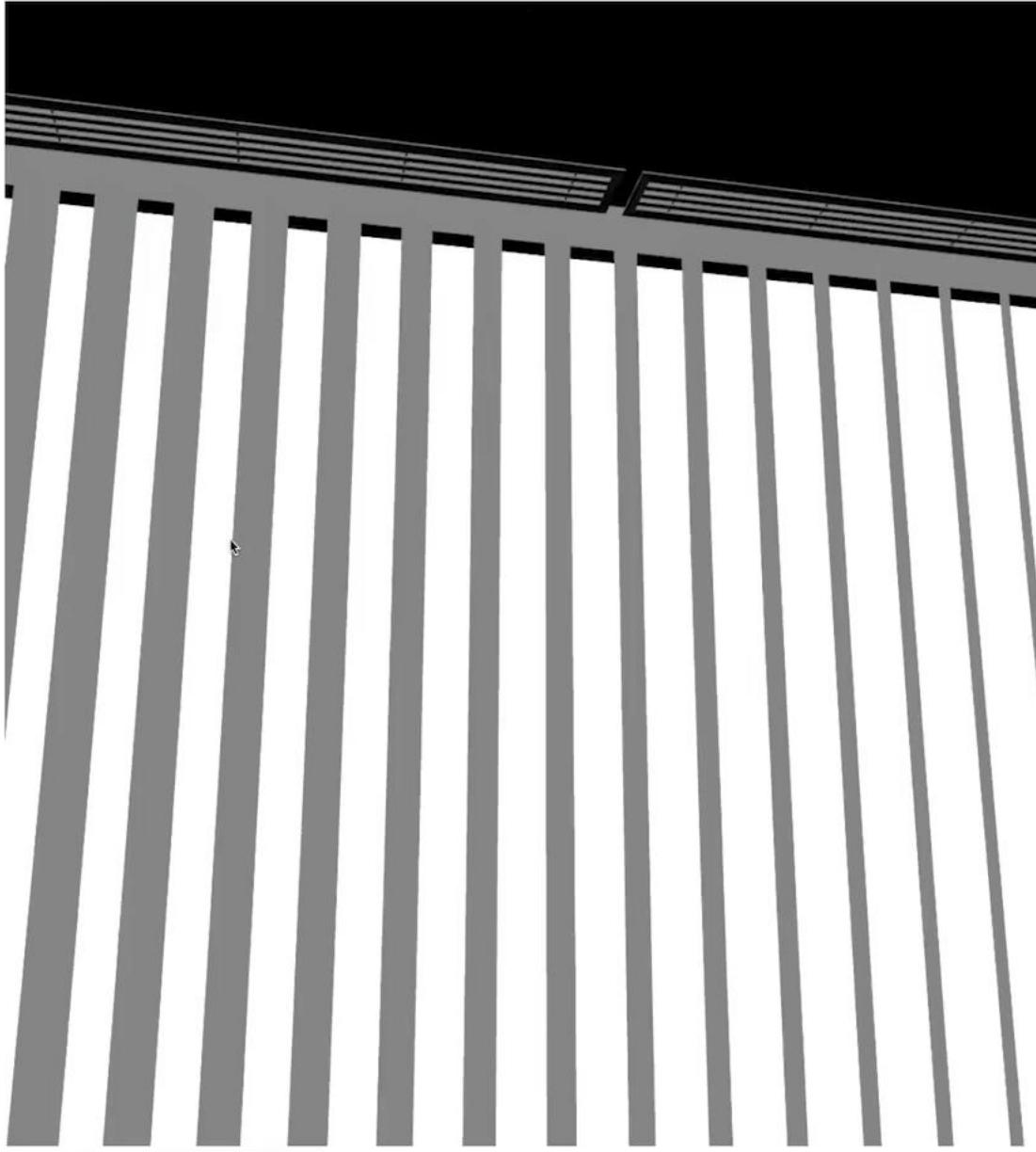
Type Your Design Feedback:

Type your design feedback here. Hit "Shift" to explore the possible views...



MemoVis:
A GenAI-Powered Tool for Creating Companion
Reference Images for 3D Design Feedback

Load & Explore 3D Model



ASSETS 3D EXPLORER 5 +

Type Your Design Feedback:

Type your design feedback here. Hit "Shift" to explore the possible views...

Typing Textual Feedback



ASSETS

3D EXPLORER



Type Your Design Feedback:

Type your design feedback here. Hit "Shift" to explore the possible views...

Do you want one of following views?



Suggesting Views in Real-Time



Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red.

ASSETS 3D EXPLORER

Choose a Matched View



Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red.

Do you want one of following views?

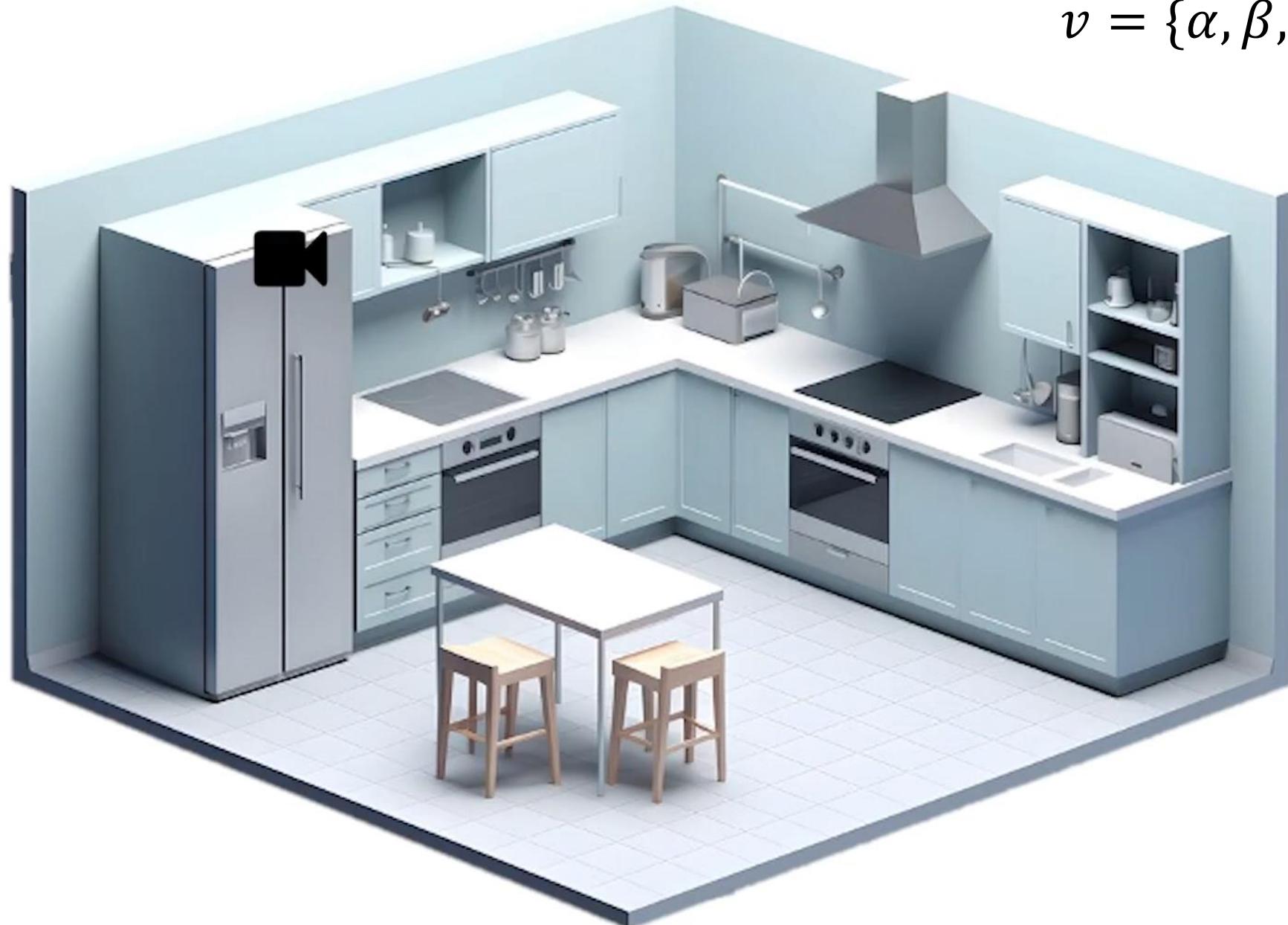


How do we realize the viewpoint suggestions in real-time?

View Sampling

Viewing Camera

$$v = \{\alpha, \beta, r, t_x, t_y, t_z\}$$



Viewpoint Suggestions in Real-time?

- When the 3D model is initially loaded

$$\mathbf{EncodeI}_v = f_{image}(I_v), v = \{\alpha, \beta, r, t_x, t_y, t_z\}$$

- Upon finishing typing textual feedback

$$v = \operatorname{argtop}_{k_v, k=4} \cos\{f_{text}(t), \mathbf{EncodeI}_v\}$$



Textual comments typed by the feedback provider

Type Textual Prompt

Enter the prompt to generate visual references ...

X

GO



ASSETS

3D EXPLORER

+

Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red.

Crop the Relevant Region



ASSETS

GRAB'N GO

5 +

Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red.

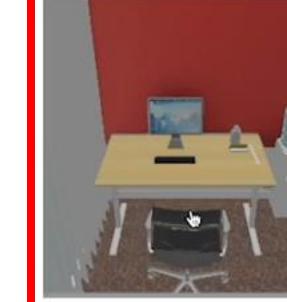


Finish Up Feedback

A 3D rendering of a workspace. It features a yellow standing desk with a black keyboard and a computer monitor displaying a world map. A black office chair with a mesh back is positioned in front of the desk. To the right of the desk is a large, grey server unit with three blue cylindrical components on top. The wall behind the desk is red. The floor is a brown carpet. In the bottom left corner of the image, there are some teal and white decorative plants.

Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red.

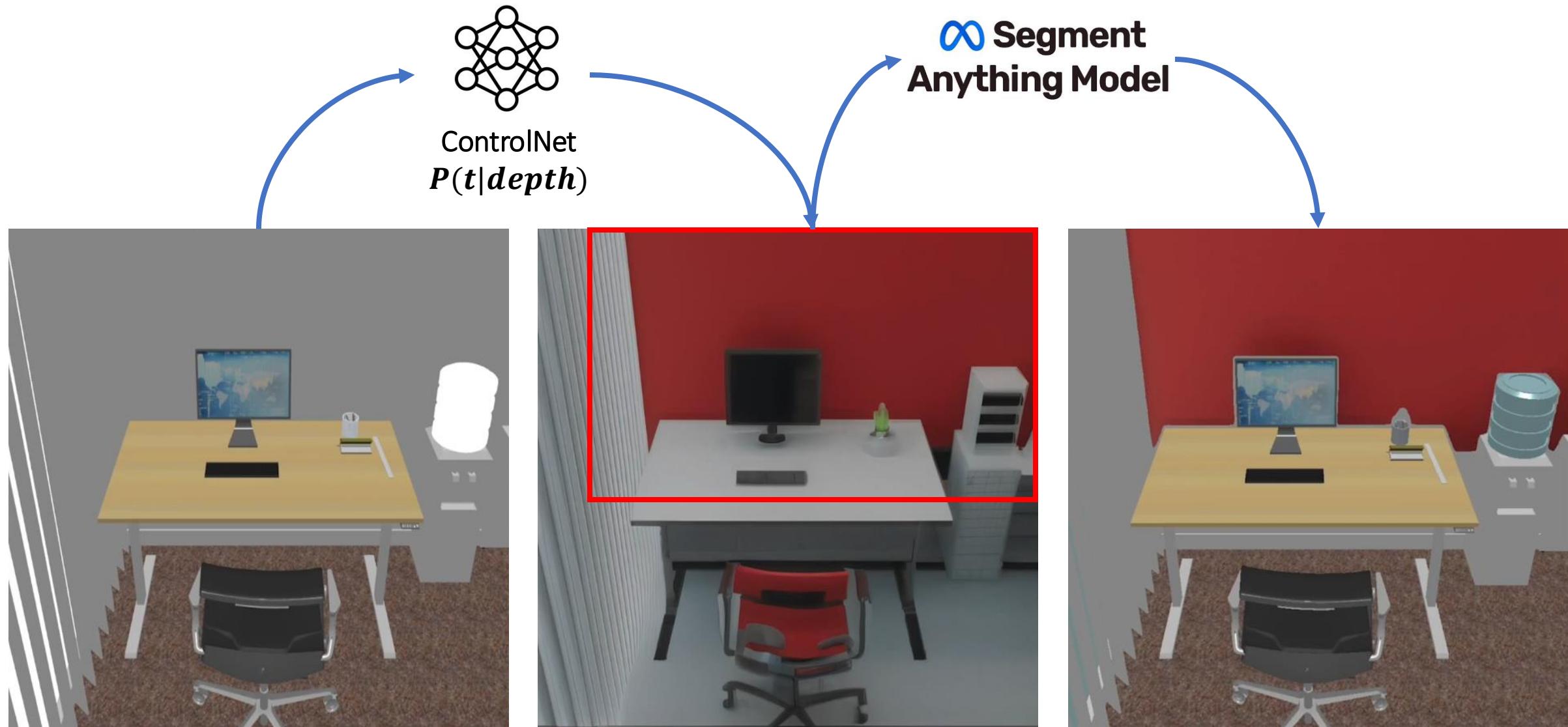
A small image showing the yellow standing desk from a slightly elevated angle, positioned in front of a red wall. A computer monitor is on the desk, and a black office chair is in front of it. The image is enclosed in a red rectangular border.

ASSETS

TEXT + PAINT

5 +

ControlNet + SAM



Change to a curved computer display?



Scribble & Define New Objects



Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red. This could help me enhancing my working productivity. We could also add a curved computer display on the standing desk. It could be good for my eye health.



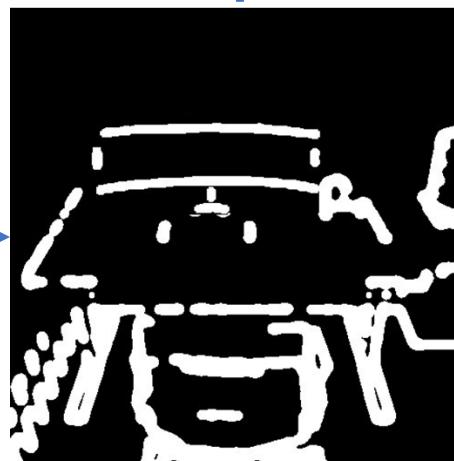
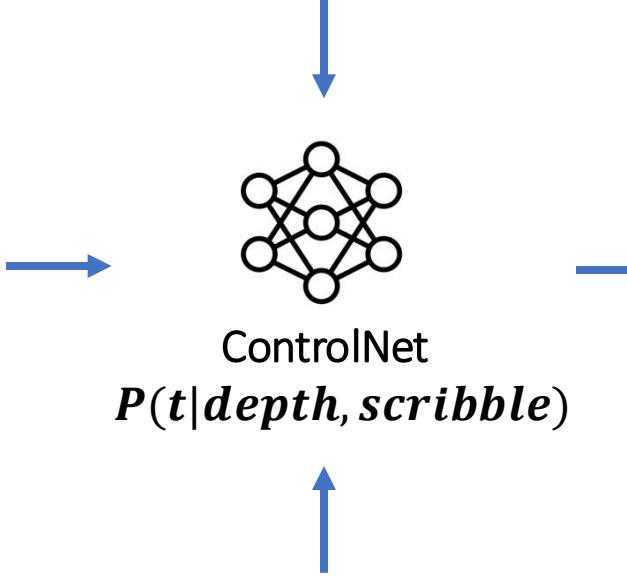
ASSETS **TEXT + SCRIBBLE** **5 +**

Text + Scribble Image Modifier

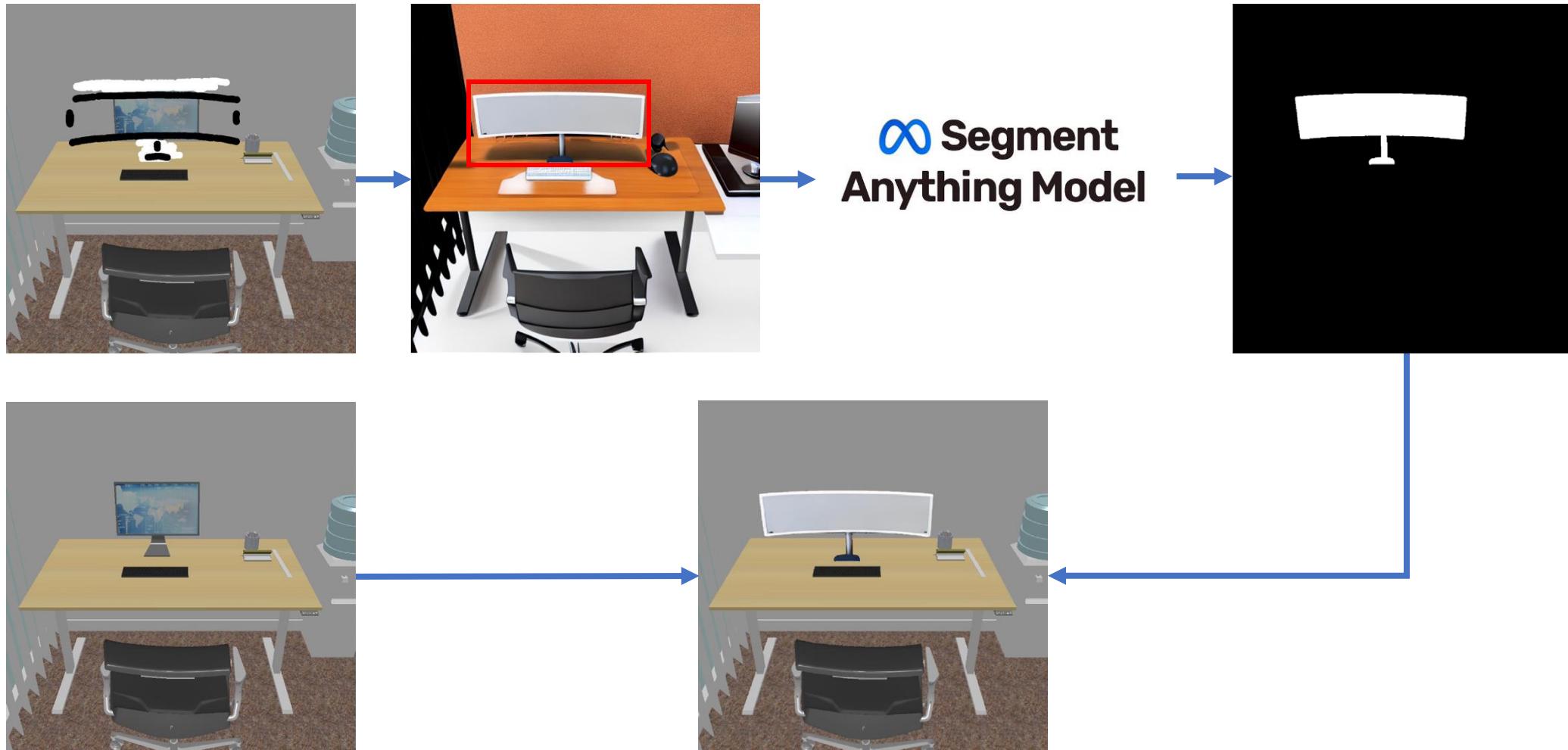
"An Office with a Curved Computer Display on the Desk."



Initial 3D Design



Text + Scribble



Initial 3D Design

Finish Up Feedback



ASSETS TEXT + PAINT 5 +

Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red. This could help me enhancing my working productivity. We could also add a curved computer display on the standing desk. It could be good for my eye health.



Paint & Define New Objects



ASSETS

TEXT + PAINT

5 +

Type Your Design Feedback:

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red. This could help me enhancing my working productivity. We could also add a curved computer display on the standing desk. It could be good for my eye health. We could also probably add a painting picture on the wall, behind the standing desk. This could help me relax myself during working break



mike@anonymous.designer

Subject

I felt it might be a good idea to change the wall paint behind my yellow standing desk to red. This could help me enhance my working productivity. We could also add a curved computer display on the standing desk. It could be good for my eye health. We could also probably add a painting picture on the wall, behind the standing desk. This could help me relax myself during working break.

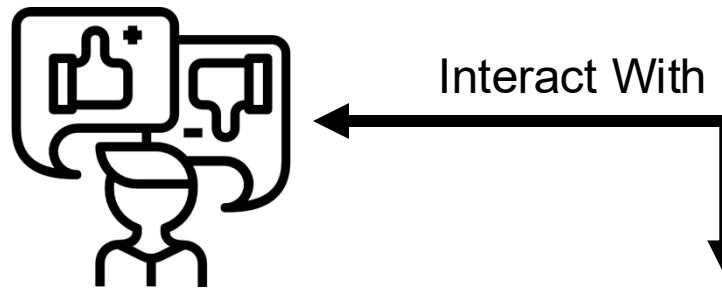
Send to the Designer



Send           

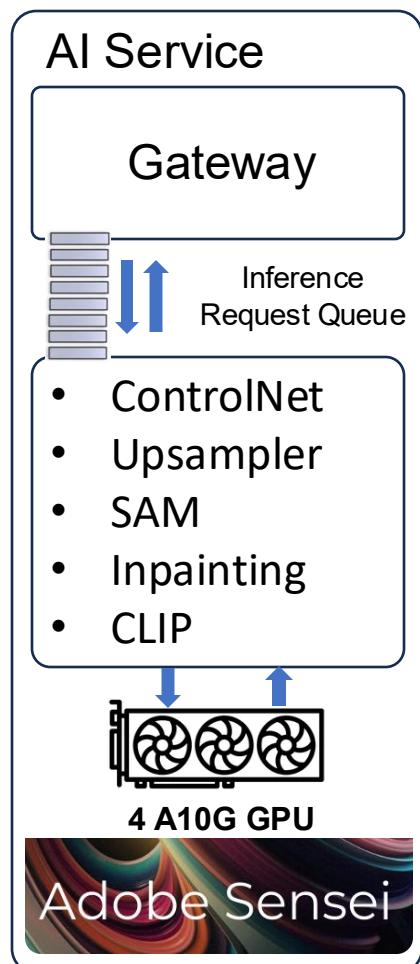
Deployment

Feedback Provider



Model Service: Storing and Serving 3D Models

RESTful Request



MemoVis: A Browser-Based App for Efficiently Creating 3D Design Feedback with Companion Reference Image

A curved computer display on the office desk.

3D Explorer

Text + Scribble

Grab'n Go

Text + Paint

ASSETS

3D EXPLORER

3D Explorer

Type Your Design Feedback:

The yellow standing desk seems to be quite spacious. We should possibly use a large curved computer display, instead of the current small monitor.

Do you want one of following views?

Reference Image Created by MemoVis

Rich-Text Editor for Creating 3D Design Feedback

Two User Studies

Two User Studies

Study 1: Experience of creating 3D design feedback.

Study 2: Quality of the reference image.

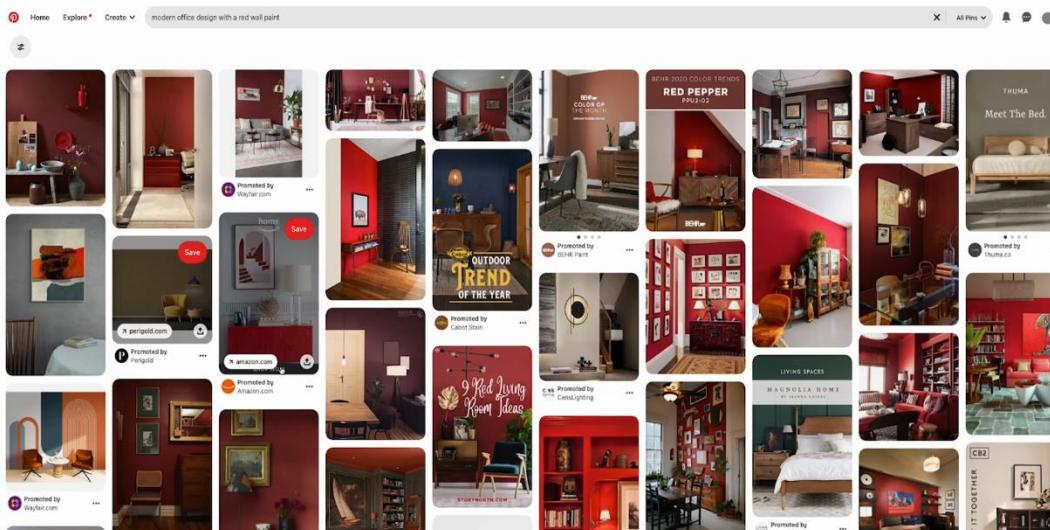
Study 1: Experience of Creating Reference Images

Participants: 14 Feedback Providers

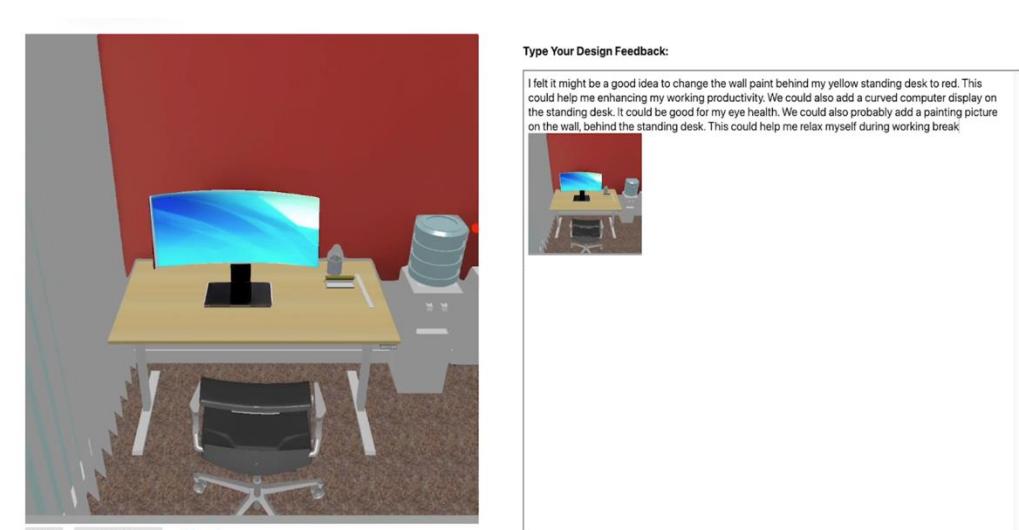
Research Questions (RQs):

- RQ1: Helpfulness of **real-time viewpoint suggestion features** can help feedback providers navigate the 3D scene while writing feedback?
- RQ2: How the **image modifiers** can help feedback providers visualize the textual comments for 3D design?

Interface Conditions:



Baseline: Reference image created by searching and/or hand drawing



MemoVis: Reference image created by MemoVis

Feedback Creation (Reference Image + Textual Comments)



Samurai Boy



Help Participants to Get Familiar with the System

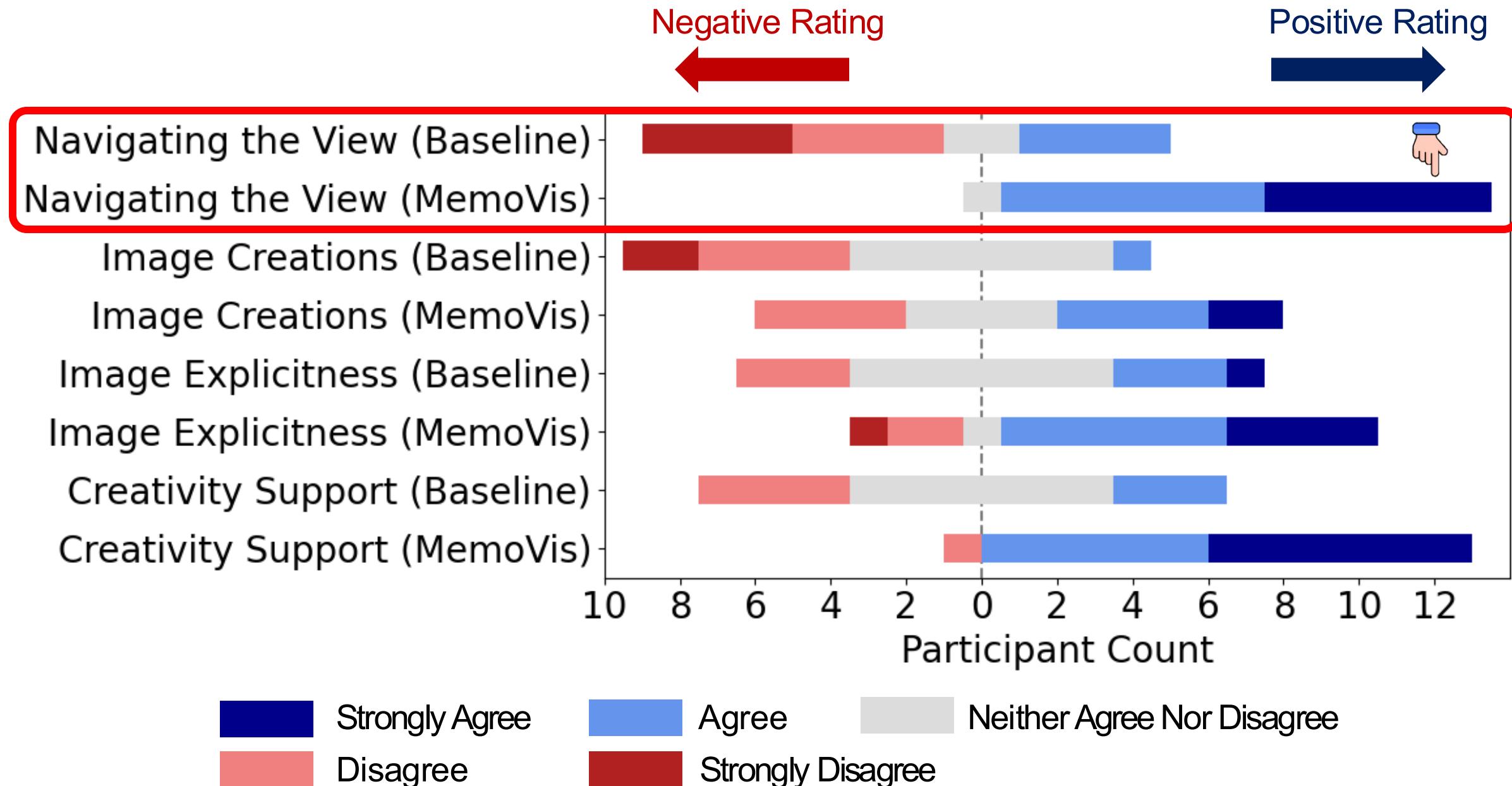


Bedroom

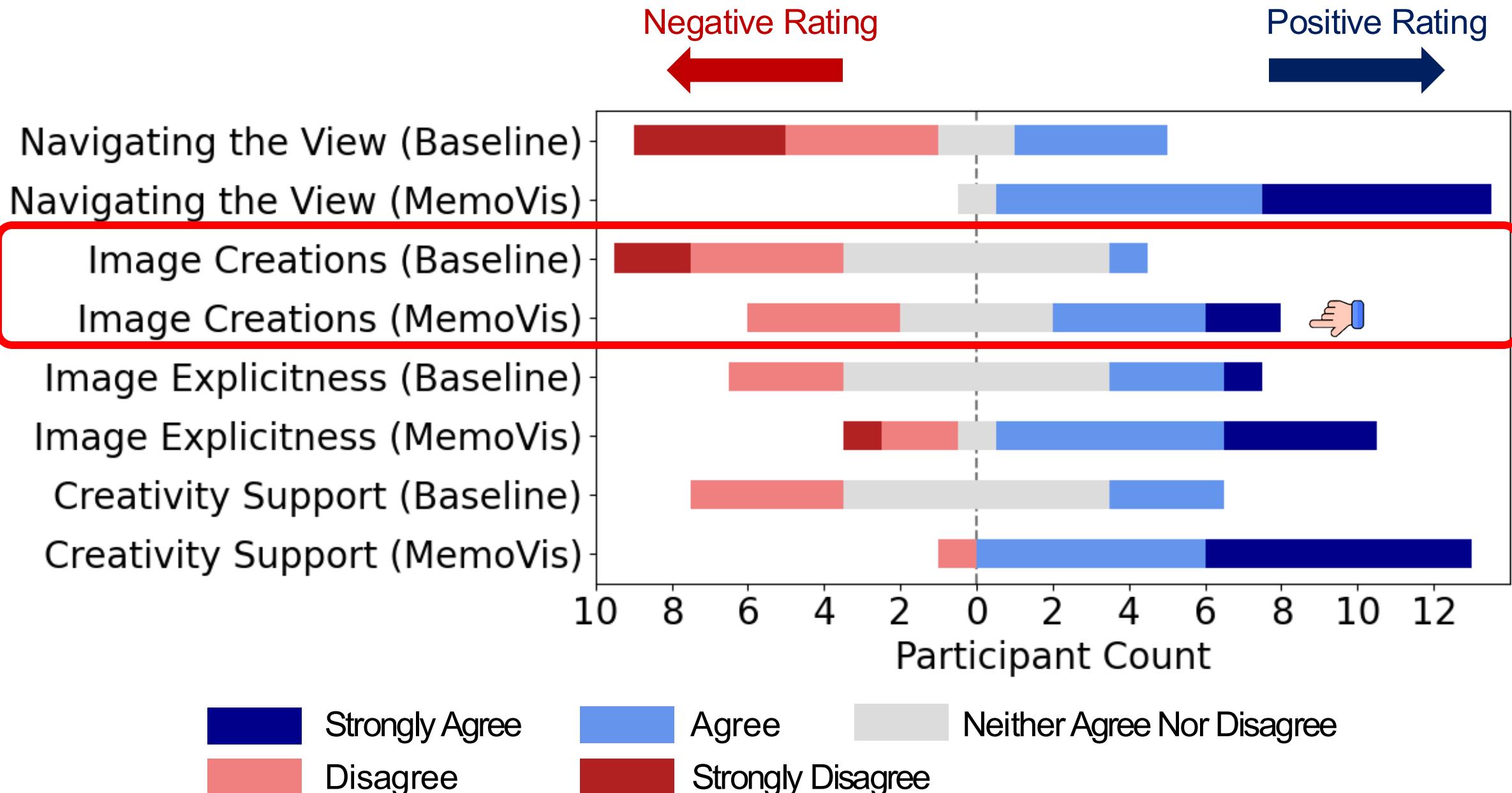


Car

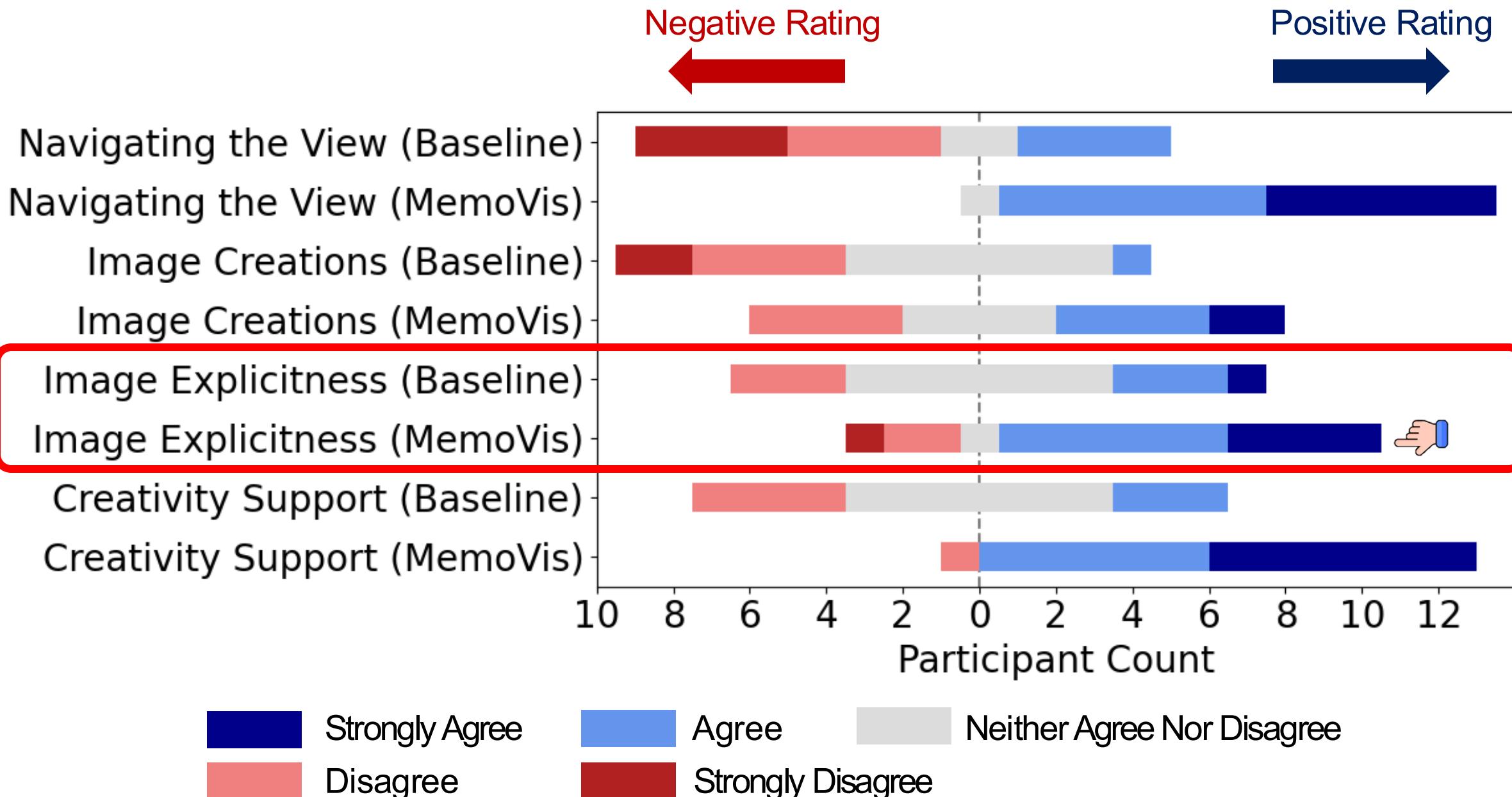
Study 1: Experience of Creating Reference Images



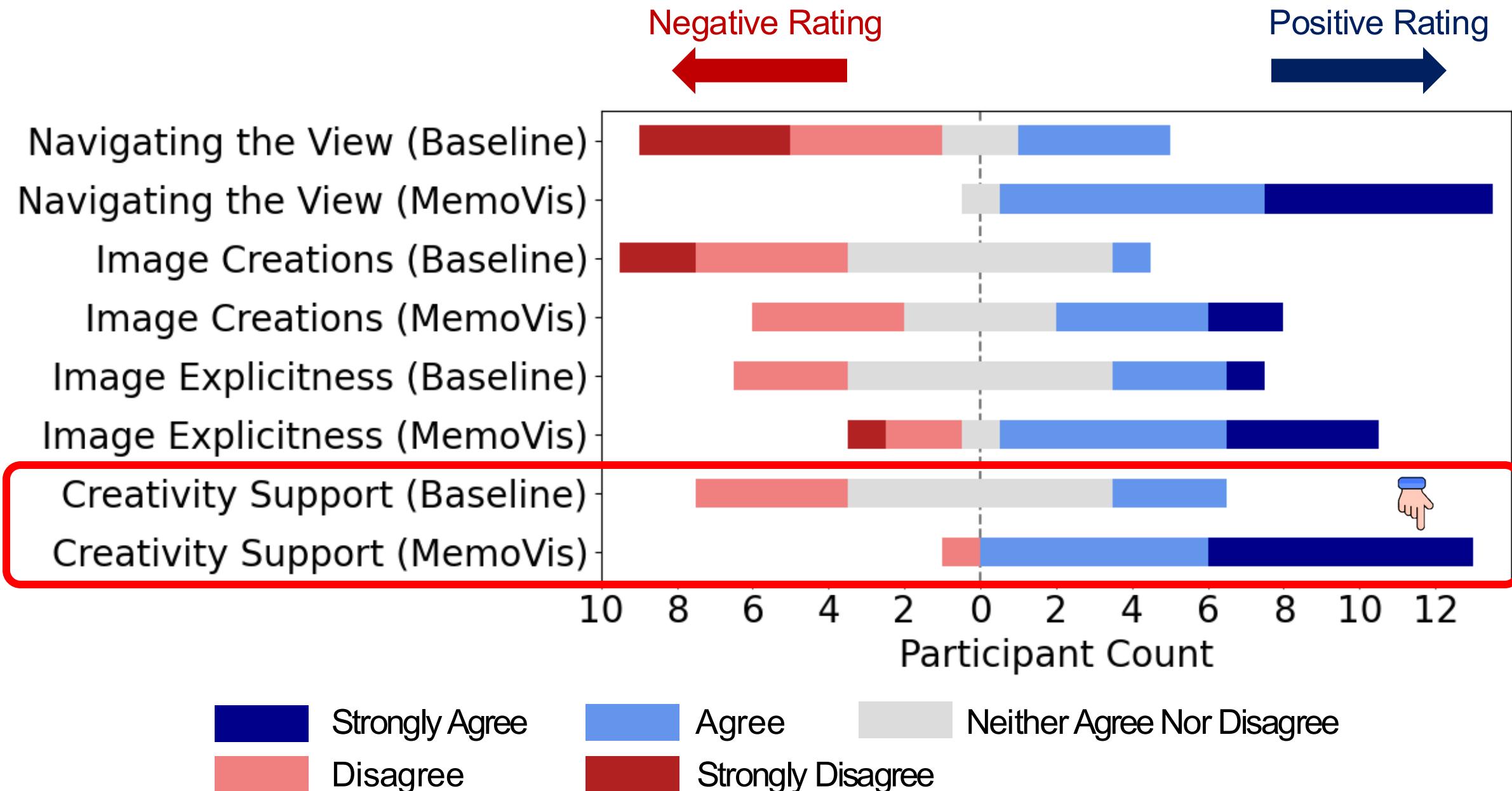
Study 1: Experience of Creating Reference Images



Study 1: Experience of Creating Reference Images

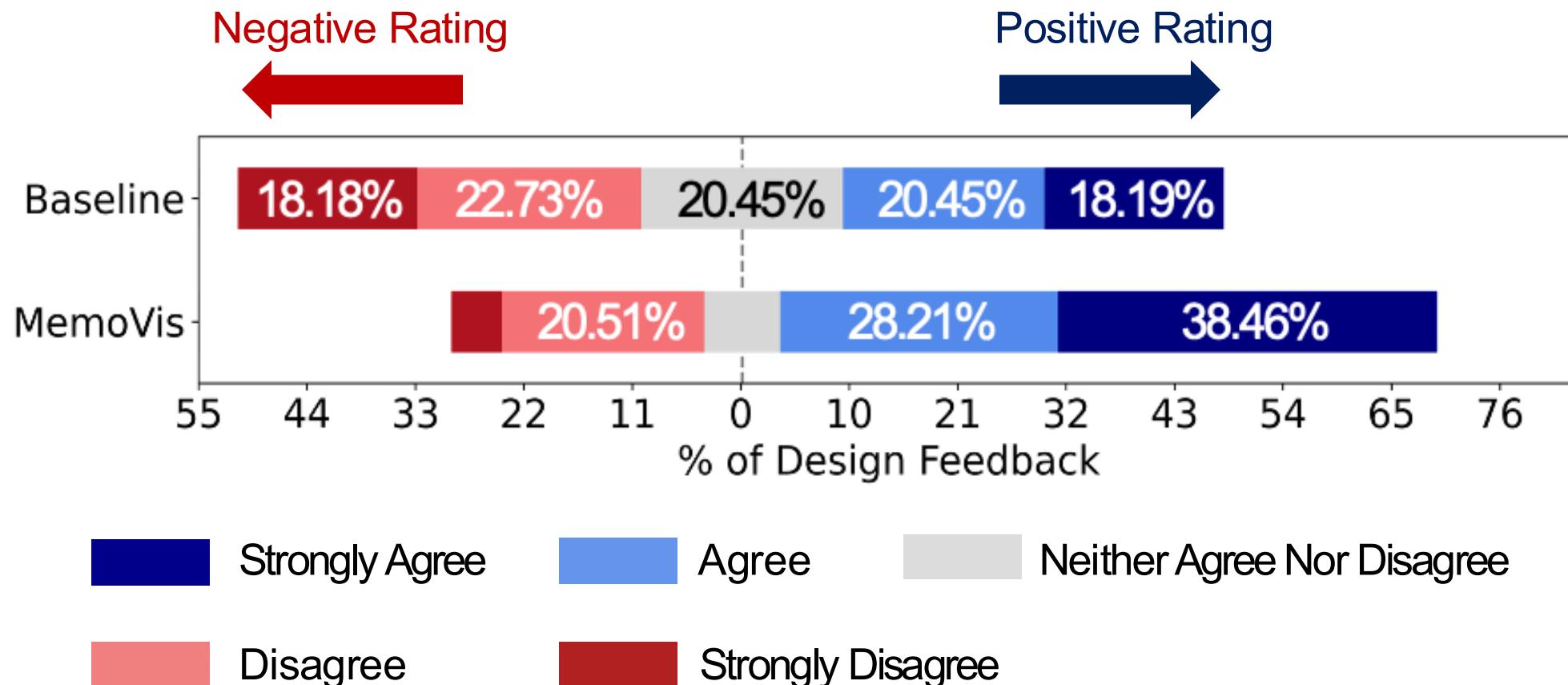


Study 1: Experience of Creating Reference Images



Study 2: Reference Image Assessment (N = 8)

How well the reference image could convey the gist of textual comments?



3D Design Feedback Examples with MemoVis

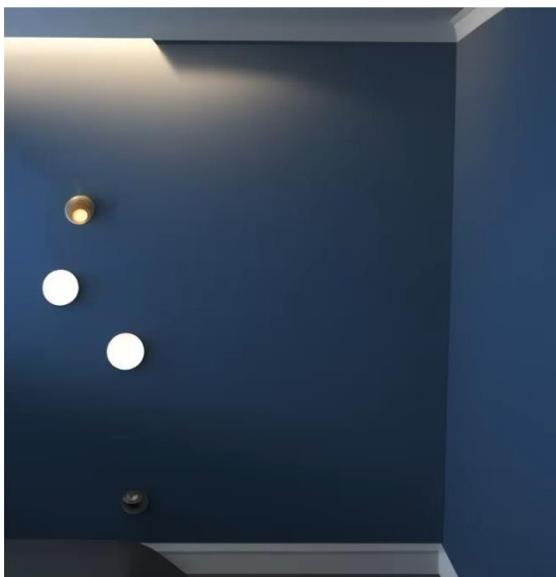
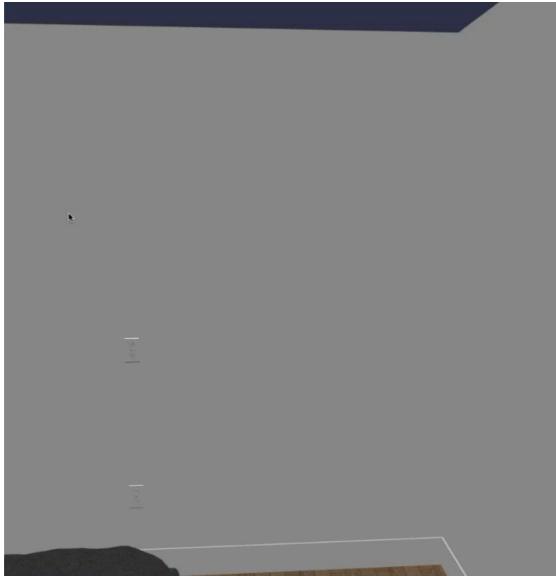
Anchored View of
the Initial Design

Reference Images

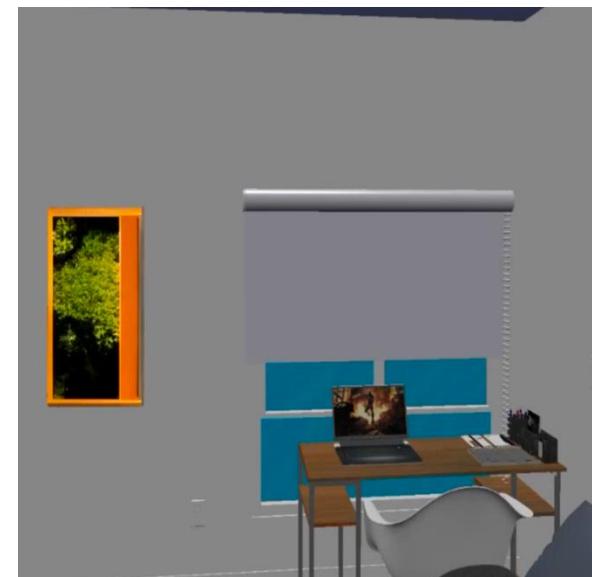
Add an Indoor Plant



Modify the wall design



Add a wall poster



3D Design Feedback Examples without MemoVis

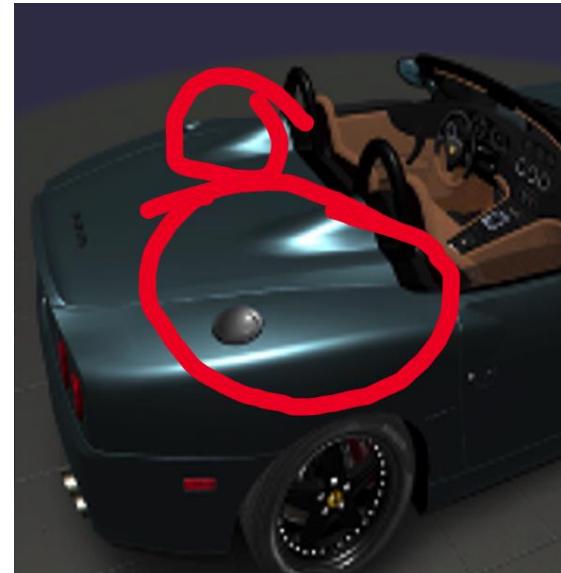
Anchored View of
the Initial Design

Reference Images

Change to suspended bed



*Change the color to be
more metallic*



Add a pet seat



For More Details, Please Refer to Our Paper!

MemoVis

A GenAI-Powered Tool for Creating Companion Reference Images for 3D Design Feedback



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Manuscript



Video

