Visual Richness in Virtual Reality – Experiment

Variables:

- **Independent Variable:** State of Visual Richness (States are defined on a table below)
- **Dependent Variable:** Performance of a user (measured in Time, second)

Aim:

To understand the relationship between the state of richness of the virtual environment with the performance of the users in doing object manipulations by using a virtual reality headset along with a motion controller in a simulator.

Hypothesis:

Richness in virtual environments may affect the performance of a user in doing object manipulation tasks.

Prediction:

As the state of richness advances, the time it takes for the user to successfully fitting in correct object through a series of randomized box increases. (Non-proportional)

Possible Experiments:

1) Fitting the right object through the corresponding shaped hole on the box cover.

   Procedures:

   - *The user can start the simulation by pressing the 'Begin' button.*
   - *User is expected to search for the likely objects within the cluster of variety of objects in accordance to the hold visible on top.*
   - *User is then expected to pick an object that he/she perceived to be the one and try fit it through the hole on the box.*
   - *If user successfully able to fit the right object through the whole, the hole on the box is changed and the objects are randomized and re-clustered. The time taken for the user to fit the right object into the box is recorded.*
   - *The procedure is repeat for every state of visual richness (in a random order rather than ascending)*
   - *Time results are recorded onto the result table accordingly*

2) Packing objects into the corresponding boxes based on a given property. (i.e. base geometrical shape)

   Procedures:

   - *The user can start the simulation by pressing the 'Begin' button.*

- *User is expected to observe the 2 boxes of different shape categories and start searching for relevant objects to be put into corresponding box. (Objects that don't fit to any categories can be left on the table)*
- *If the user successfully able to sort all objects into correct boxes, the user then proceed to another situation with different categories in the two boxes and a new cluster of objects. The time taken for the user to sort these objects are recorded.*
- *The procedure is repeat for every state of visual richness (in a random order rather than ascending)*
- *Time results are recorded onto the result table accordingly*

States of Visual Richness:

Factors	State of Richness			
	Full-Flat State	Flat-textured State	Depth-Textured State	Rich State
Background	*Flat single colour Background (Grey)*	*Flat soft textured Wallpaper*	*Soft textured Wallpaper with surface depth and shading. (Static Shading)*	*Soft textured Wallpaper with surface depth, shading and allow shadow castings. (Dynamic Shading)*
Table	*Simple square block with flat single colour (White)*	*Desk shaped block with white texture with flat details.*	*Desk shaped block with white texture including rendered depths of details*	*Full desk model (having visible parts such as drawers, wire holes, structure etc. although non-interact-able) with multi-shadings according to parts.*
Movable Objects	*Flat low polygon objects with flat single colour*	*Objects contain their corresponding texture without any depth. Medium Polygon*	*Objects contain their corresponding texture with depth to it. High Polygon*	*Objects can additionally cast shadows and reflections. Dynamic casting and shading.*

Boxes	*Flat colour box (Grey)*	*Flat colour box (grey) with flat details*	*Box (grey) with depth to details and static grey shading*	*Box contains metallic shading and additionally cast shadows and reflections. Dynamic casting and shading.*

Result Table:

User	Time to Finish the Task (in Seconds, s)			
	Full-Flat State	Flat-Textured State	Depth-Textured State	Rich State
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Constant Factor:

- Each user will be isolated in a room during the simulation, with a conductor who will remain silence unless help is needed by the user.
- Each user will be instructed about the procedures and briefly explained about the environment.
- Each user will only be allowed one run of the simulation (already containing series of repeats).
- User must be prevented from explaining the simulation experience to other users how soon will be taking the simulation.