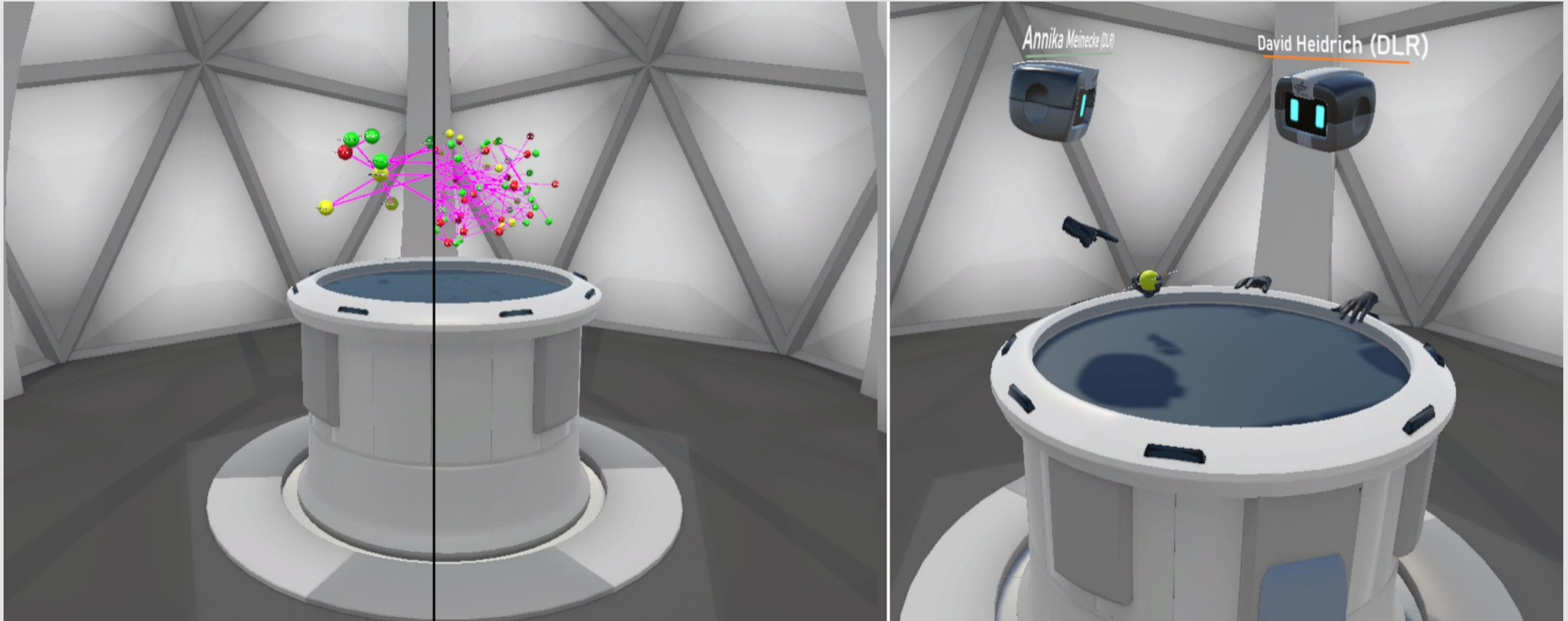# Towards a Collaborative Experimental Environment for Graph Visualization Research in Virtual Reality

The work-in-progress collaborative experimental environment for graph visualization research in virtual reality; Left: The table with the graph visualization floating above it; Right: Virtual avatars placed around the table talking to each other.

Experimental Environment

Our work-in-progress collaborative experimental environment for graph visualization research in VR supports the creation of comparable graph visualizations.

- Utilize the same environment for different experiments.
- Only change individual modules.
- → Minimize the number of independent variables.

Research Modules

A modular approach lets developers concentrate on visualizing their graphs.

- Modules can be changed or added.
- Multiple modules of the same type can be enabled at the same time.
- The environment contains implemented example modules.
- Reusing modules reduces development overhead.
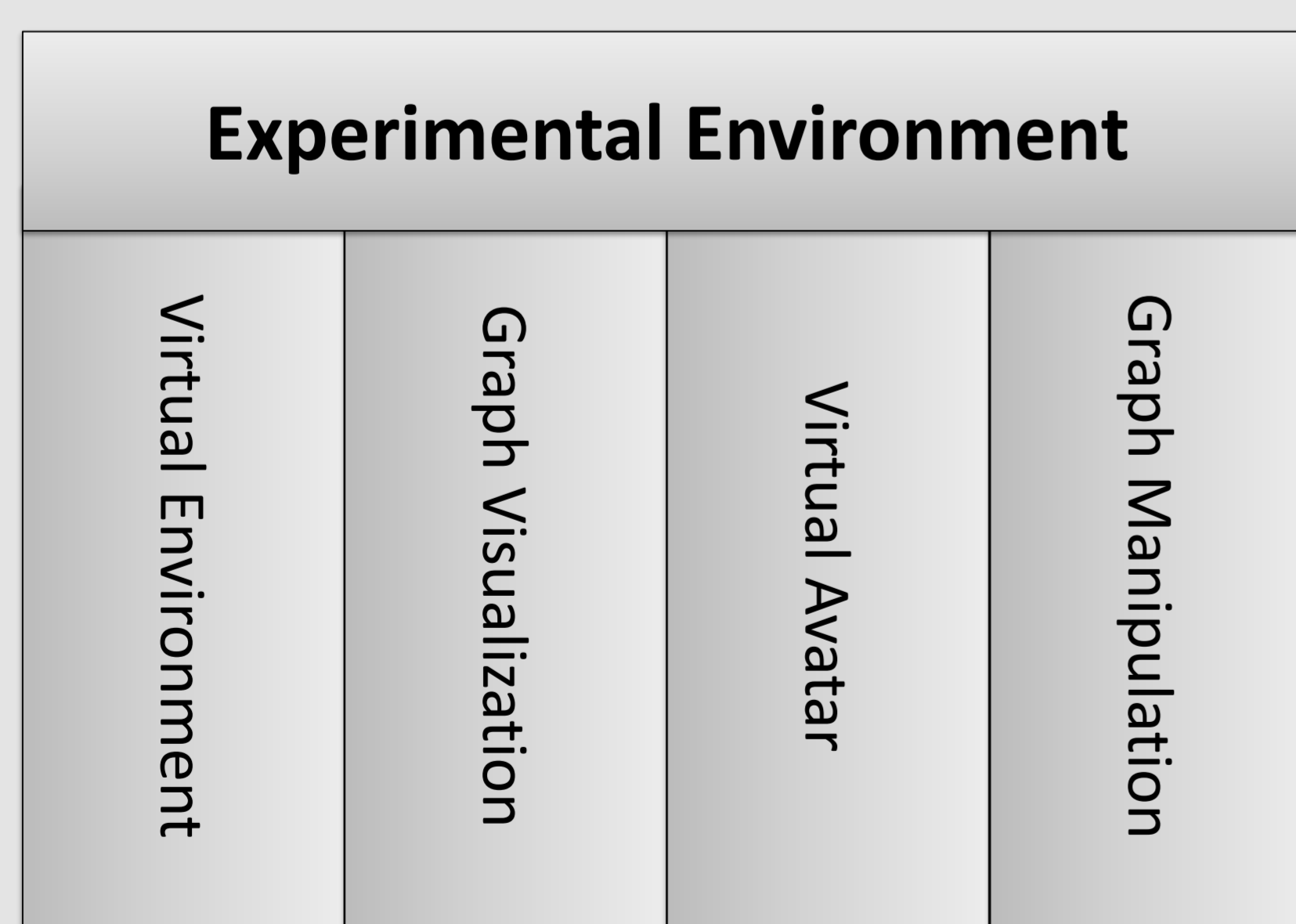
The four different module types of the environment.

Module: Virtual Environment

We created a basic Virtual Environment for the graph visualization consisting of:

- Minimalistic room (3×3 meters) to allow for natural walking in room scale VR.
- Table to encourages collaboration and provide a stable frame of reference.
- Narrow table to allow users to reach everything displayed on or above it.

Module: Graph Visualization

We implemented a very simple graph visualization. The module imports a graph database on application start.

- Nodes are floating colored spheres.
- Sphere colors differ depending on the node label.
- Sphere positions are controlled by a force-directed layout algorithm.
- Relationships are magenta lines which connect the spheres.

Module: Virtual Avatar

We designed the experimental environment to be explored by multiple users at the same time in synchronous sessions.

- A floating head indicates the user's viewing direction.
- Floating hands with finger tracking allow for non-verbal communication.
- Each user receives a name and a specific color to support recognizability.

Module: Graph Manipulation

Users interact with the graph using virtual hands and virtual ray pointers.
A radial user interface appears around a selected node, giving the following options for the node:

- Highlight the node.
- Show and hide the node's relationships.
- Show and hide the node's properties.

A virtual avatar interacting with a node.

Future Work

- Refine and evaluate existing modules.
- Optimize performance to ensure scalability for very large graphs.
- Make the environment open source.
- Use the environment to create and evaluate multiple graph visualization approaches.

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