tangible workbench "TW" – with changeable markers

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1   Introduction

Changeable markers afford completely new possibilities of interaction on a tangible user interface.
The heart of the solution are changeable markers, which enable new, complex possibilities of interaction design, which upgrades a TUI from a classic presentation tool to a work tool.
Applications on the TW become of interest to non-users and professionals due to the mix of intuitive and exact work. Thus, an interface is developed between designers/customers, managers and experts.
This tool can be used in virtual factory planning, the planning of infrastructure projects and as a product configurator.
A conventional TUI allows for 3 degrees of freedom (x/y, rotation and z). The appearance of the marker is changed by manipulating (pushing, rotating etc.) a controller object, and this creates additional levels of interaction. The design of the controller objects is based on normal everyday tools, such as an eraser, a button, pliers, a tool bar etc.
The set up consists of a table (frosted glass tabletop with a projector and camera underneath), a separate monitor with realtime 3D application and the controller objects.
A demo application awaits visitors, which allows them to construct a completely furnished flat.

2   Exposition

The system provides the following advantages:

1. Intuitive and exact work, using normal tool analogies.
2. Simple presentation and complex constructing.
3. Suited for everyday use, sturdy, no electronics in the controller objects
4. Involvement of managers and customers in the planning work.
5. Possibility to collaborate – simultaneous work on a project from separate locations.

The MRI (mixed reality interface) serves as the basis of the system, which is augmented by changeable markers.

3   Build a fully furnished flat only using tangible controller objects.

1. Construct: toolbar – selection of mode: new object, position object or change attributes. Change the dimensions: x,y,z and the height as well as other parameters.
2. Controller object with button or in pliers design.
3. view - Walk through: (my point of view), UD camera (to look up and down)
4. view - Walk through: camera with capture und pull function (my point of view - pull the floor plan)
5. Zoom/pan: Scroll wheel to zoom and pan the floor plan
6. Delete: eraser

Realtime 3D Application

1. First, the user selects a wall from the menu, puts this on the navigation surface (as a projected object) and looks at the wall as a 3D object on the monitor. Then the user changes the dimensions and position, and chooses materials until the construction of the flat is finished.
2. The next step is to select and position the furniture, lamps and pictures on the wall.
3. All of the elements put down can be activated afterwards and adapted or changed according to dimensions, material etc. (change attributes)
4. The eraser makes completely deleting objects as easy as possible.
5. The user can use the scroll wheel to zoom or pan. If the user places it on the tabletop, then the user pans the floor plan, and if the user rotates the scroll wheel, the user zooms the floor plan.
6. view - Walk through: The user uses a camera or the UD camera to walk through the flat.

4   Conclusion

The TW is a novel input device for providing control and constructing complex 3D visualization applications for a wide variety of applications and user groups, in particular untrained people as well as professionals. The system does not require any training or experience, and you can learn to operate it by watching other people use it.