

Gesture-free 3D Manipulation with Finger Tracking

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ABSTRACT

We define a new modeling technique called 3D touch-and-drag, wherein users select vertices by **simply approaching** them with a 3D cursor such as a forefinger. Operations are finished by removing the 3D cursor from a line or plane in 3D space. These lines or **planes constrain** the modeling operations, as is the case when using 3D widgets.

BACKGROUND

2D:

- Current geometric modeling tools are usually controlled by mouse and keyboard.
 - 2D operations are projected onto 3D planes
 - Modeling tools often use 3D widgets

VR:

- Selection is done by pinch or grasp gestures
 - Gestures slow down operations
 - Gestures reduce precision
- It is difficult to perform interactions in a 3D space
 - adding constraints can improve usability

Transfer from 2D to VR is complex.

3D TOUCH-AND-DRAG

- Select vertices by approaching them
 - Easy in 3D space
 - (Difficult in 2D since user must hover over mesh)
- Move vertices on planes or lines
 - Constraining planes are determined implicitly
 - 3D distance must remain below threshold
- Finish operation
 - Release vertex by exceeding the threshold
 - Similar to lifting finger from touchscreen (2D)
 - Final position is the projected 3D position onto the plane when the user starts to end operation

ADVANTAGES

- **Can be adapted with only moderate effort** to modeling systems which use **constraints**
- Selection **gestures can be avoided**, which **increases performance**, especially when starting an operation
- **Knowledge** can easily be **transferred** and the **learning effort reduced**

PATENT PENDING: WO2017080579A1

TRANSFER FROM 2D TO VR

2D touch-and-drag:

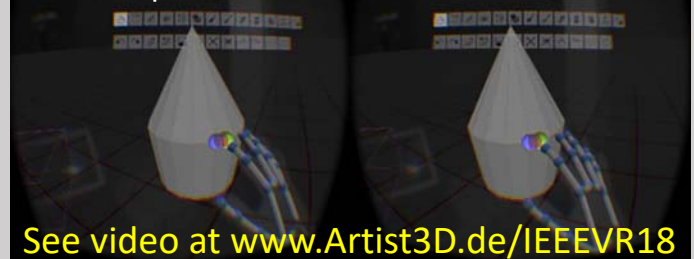
- 1.) User touches vertex on screen → selection by raycasting
- 2.) User moves vertex in modeling plane (finger on screen)
- 3.) User lifts finger from screen

3D touch-and-drag:

- 1.) User approaches vertex in 3D → selection by 3D distance
- 2.) User moves vertex in modeling plane (in 3D)
- 3.) User ends operation by removing finger from plane

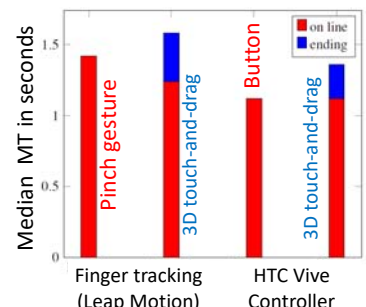


3D touch-and-drag with Oculus Rift DK2 and Leap Motion



USER TEST (MOVE A SPHERE ON A LINE)

- We found that the method is **as fast as a pinch-gesture-based method** while being **easier to start**.



- The precision of 3D touch-and-drag is even as high as using a button on a controller.

