Proposal for a Voodoo Doll Variation as VR Project

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1 Introduction

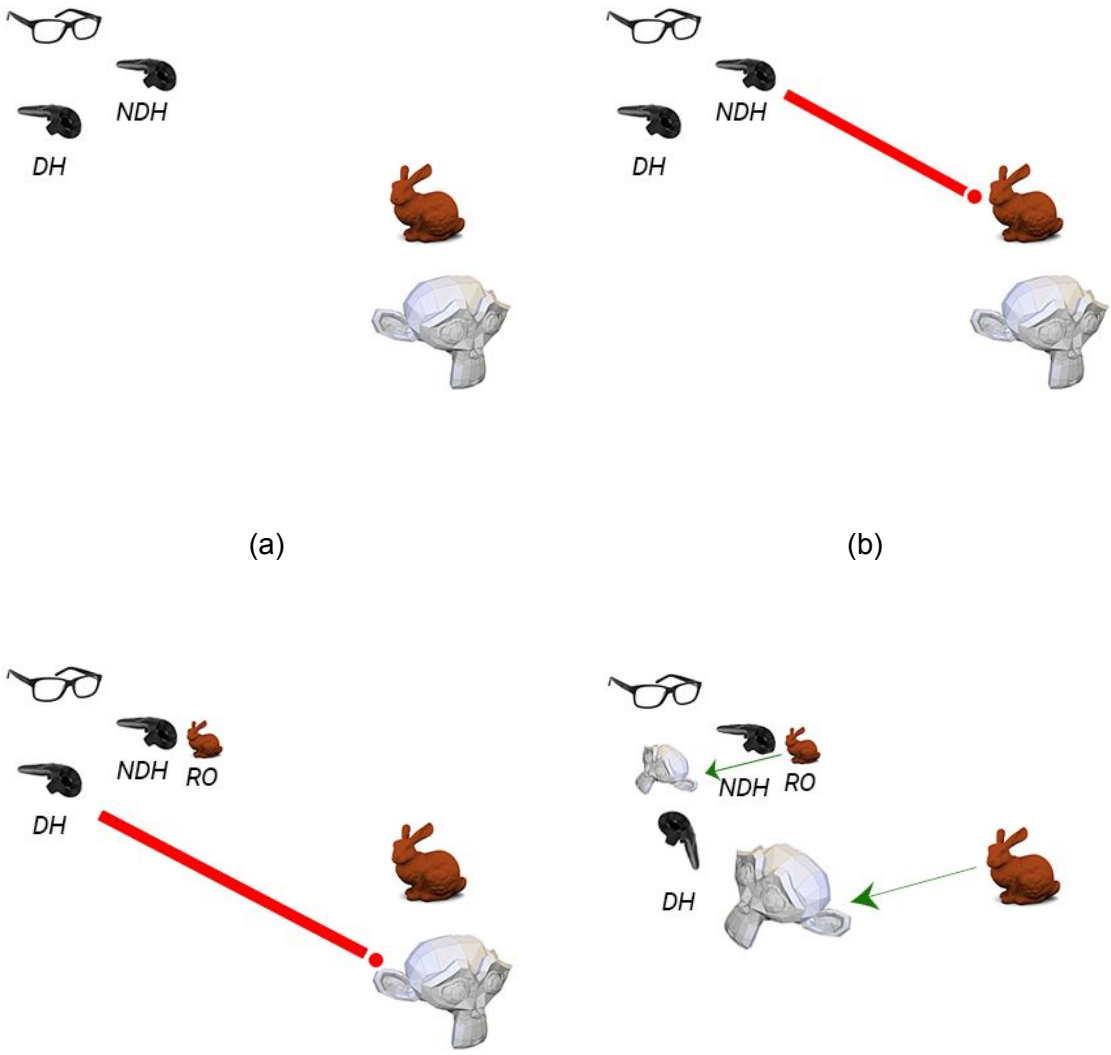
According to the paper by Pierce, Stearns and Pausch[1] we would like to implement a Voodoo Doll manipulation technique. In their paper they describe a bundle of different methods to allow easy and distance independent manipulation of specifically selected objects, exploiting the fact that humans typically have a good sense of their hands positions relative to each other. The selection process involves a hand eye coordinated raycasting to choose one or multiple objects to be placed on the user's hand immediately as local copy. One hand holds the object being the reference frame for the object held by the second hand. Both objects can be freely moved with the corresponding hands, but while the reference object won't be modified in the environment, the second element will change its position, orientation, etc., according to its relative transform to the reference object. Additionally the authors mention considerations about blending in context objects as well to allow better navigation and offer more benefits for exact operations.

Due to the available hardware for this project we will have to change the selection process such way that it works without direct hand tracking, what leads to difficulties concerning for example the scaling of selected objects. In the following we briefly describe challenges and how we plan to overcome them in the project.

2 Technique

The described technique employs raycasting for selection of targets: the reference object (RO, held in non-dominant hand, NDH) and the manipulated object (MO, held in dominant hand, DH).

[1] Jeffrey S. Pierce, Brian C. Stearns, Randy Pausch: Voodoo Dolls: Seamless Interaction at Multiple Scales in Virtual Environments. Carnegie Mellon University, 1999.



(a) (b)

(c) (d)

Fig.1 - (a) initial setting; (b) RO selection; (c) MO selection; (d) MO manipulation;

2.1 Selection of the RO

In the original paper the selected objects will appear on their exact position inside of the user's viewport, so initially the user won't recognise a jump from the original object to the copied one (as long as he only looks at it in a 2D view with one eye closed). But, as this relies on specialised hand tracking devices, which won't be available during the project, and reduces the selection to a 2D operation, not working, if both eyes are left open, we decided

to let the user perform selection using a visible ray from a pointing device. We also include a scaling mechanism taking advantage from hand-body distance coordination.

The RO selection is done through following steps:

a. Raycast with NDH to pick up target object to be RO.
b. Press the button on the pointing device in NDH to activate the reference frame. Initially the object will appear at a fixed and reasonable size on the hand (e.g. 10 cm radial).
c. Move NDH closer or farther in relation to the headset to scale up or down the selected reference frame (target and possibly context objects).
d. Release the button to fix the reference frame to your NDH and start mapping rotation and movement motions from the pointing device onto the miniature.

2.2 Selection of the MO

The MO selection will work quite similar to the RO selection. The only difference is that the initial scaling will be relative to the RO.

The manipulations with MO normally constitute following actions:

a. Raycast with DH to pick up target object to be MO.
b. Press the button on the pointing device in DH to start manipulating the MO in the coordinate system of the RO (MO appears and floats to the position of DH in the coordinate system of RO).
c. Position the MO.
d. Release the button on the pointing device to leave the positioning and go back to target selection.

2.3 Context

The authors point out that in many tasks it might be useful to not only deal with two objects, but also have a certain amount of context - for example placing a book on a bookshelf does not make too much sense if one does not know the other books' positions. Therefore, we imagine a solution like always having a fading sphere rendered around the MO showing the actual surrounding of the corresponding real object. The operational utility of representing

the context and the methods of this representation are to be researched and developed during the experimentation process.