Multi-touch interaction has the potential to be an important input method for realistic training in 3D environments. However, multi-touch interaction has not been explored much in 3D tasks, especially when trying to leverage realistic, real-world interaction paradigms. A systematic inquiry into what realistic gestures look like for 3D environments is required to understand how users translate real-world motions to multi-touch motions. Once those gestures are defined, it is important to see how we can leverage those gestures to enhance training tasks.

In order to explore the interaction design space for 3D virtual objects, we began by conducting our first study exploring user-defined gestures. From this work we identified a taxonomy and design guidelines for 3D multi-touch gestures and how perspective view plays a role in the chosen gesture. We also identified a desire to use pressure on capacitive touch screens. Since the best way to implement pressure still required some investigation, our second study evaluated two different pressure estimation techniques in two different scenarios.

Once we had a taxonomy of gestures we wanted to examine whether implementing these realistic multi-touch interactions in a training environment provided training benefits. Our third study compared multi-touch interaction to standard 2D mouse interaction and to actual physical training and found that multi-touch interaction performed better than 2D mouse and as well as physical training. This study showed us that multi-touch training using a realistic gesture set can perform as well as training on the actual apparatus.

One limitation of the first training study was that the user had constrained perspective to allow for us to focus on isolating the gestures. Since users can change their perspective in a real life training scenario and therefore gain spatial knowledge of components, we wanted to see if allowing users to alter their perspective helped or hindered training. Our final study compared training with Unconstrained multi-touch interaction, Constrained multi-touch interaction, or training on the actual physical apparatus. Results show that the Unconstrained multi-touch interaction and the Physical groups had significantly better performance scores than the Constrained multi-touch interaction group, with no significant difference between the Unconstrained multi-touch and Physical groups. Our results demonstrate that allowing users more freedom to manipulate objects as they would in the real world benefits training.

In addition to the research already performed, we propose several avenues for future research into the interaction design space for 3D virtual objects that we believe will be of value to researchers and designers of 3D multi-touch training environments.

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The public is welcome to attend.