

ABSTRACT:

Computers have been used as an aid for product design, architecture, and rapid prototyping for many years. Their ability to handle high levels of complexity and detail, keep track of changes, and reproduce data are some of their key benefits. However, the cognitive load imposed on the user, and the fact they are typically complicated to use often outweighs these advantages. Many computer aided design (CAD) tools require extensive training and constrained design pipelines or methods that hinder the creative process and the flow of ideas. It would therefore be advantageous to have a more 'natural' interface, so designers can focus on content rather than methods.

Conventional CAD packages use WIMP (Windows, Icons, Menus, Pointers) interfaces that tend not to mimic the way we interact with real world objects. This is due to the fact that they use a two-dimensional interface device (mouse) to interact with three-dimensional objects.

We have therefore created a novel system that better approximates 'natural' interaction using a Reachin Technologies Developer Display, which provides collocation, stereovision, haptic interaction, and 6 degrees of freedom (DOF) spatial input.

We designed an experiment to test two systems - a WIMP interface running 3D Studio Max and the 3D haptic environment running prototype 3D modelling software - in a typical task for 3D content creation, combining two objects together. The experiment performed was a 'within subjects' design that tested 12 expert 3D Studio Max™ users. Their task was to place 4 different geometric shapes onto a corresponding non-movable 'target' surface. The shapes were randomly positioned in the task space. The task was performed in both the 3D Studio Max environment and our 3D haptic system.

The results of the experiment showed that the 3D haptic system not only significantly improved task completion time, but also decreased cognitive load and increased the perceived usability. It also drastically decreased the number of mouse clicks needed to perform the task.

All these factors created a faster and more intuitive system and therefore highlight the fundamental role of spatial input for three-dimensional tasks. This suggests that further tasks that are essential to digital content creation can be better implemented on this novel system and therefore could greatly improve 3D modelling systems.