Window-Shaping: 3D Design Ideation in Mixed Reality

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ABSTRACT

We present, *Window-Shaping*, a mobile, markerless, mixed-reality (MR) interface for creative design ideation that allows for the direct creation of 3D shapes on and around physical objects. Using the *sketch-and-inflate* scheme, we present a design workflow where users can create dimensionally consistent and visually coherent 3D models by borrowing visual and dimensional attributes from existing physical objects.

Keywords

Design ideation; sketch-based 3D modeling; mixed reality

1. INTRODUCTION

The physical environment often serves as a means for inspiring, contextualizing, and guiding the designer's thought process for expressing creative ideas through early design objects are frequently used as references to explore the space of novel designs. Recent works have demonstrated that *see-through* augmented (AR) and mixed reality (MR) can play a vital role in *in-situ* geometric design by bridging the gap between physical and digital worlds [1, 2]. However, most of these approaches use the physical environment mainly as a dormant container of digital artifacts rather than a source of inspiration for facilitating quick digital prototyping for design ideation. We present *Window-Shaping*, an AR-based design workflow to explore the idea of re-purposing the physical environment as a reference, context, and sources of inspirations for quick ideation in early design.

2. WINDOW-SHAPING

Window-Shaping integrates sketch- and image-based 3D modeling approaches within a mixed-reality interface to develop a new design workflow (Figure 1). Using the Google Tango device, our approach leverages the RGB-XYZ representation of a scene allowing users to create planar curves on physical surfaces by directly drawing, placing curve template, and capturing contour of existing object. With the
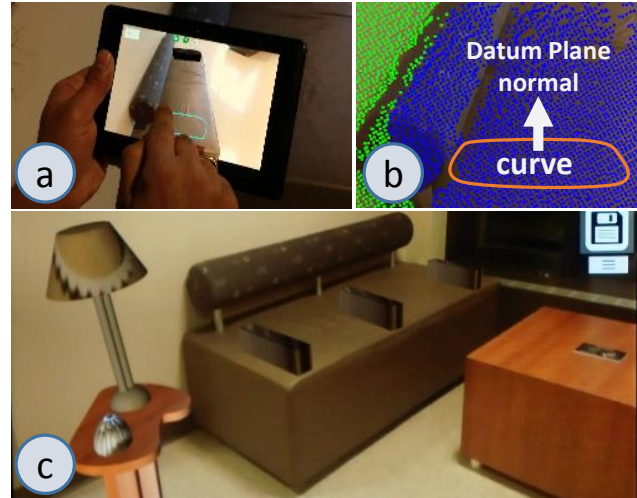
Figure 1: User draws a curve in the screen (a), that is mapped to a 3D planar curve using the point cloud (b). Using the inflation based scheme, *Window-Shaping* enables quick creation of virtual artifacts for augmenting the physical environment (c).

boundary and hole curves, the mesh is computed using constrained delaunay triangulation (CDT) and then *inflated* using certain distance functions. The multi-touch gestures on the screen such as 1-finger drawing, 2 and 3 finger pinching, 2 finger rotating, and tapping, etc., are unprojected on the physical environment and allow for 3D shape creation, editing, and manipulation. We further allow users to capture texture of existing shapes and re-purpose it in the new creations. These shapes can serve as geometric extensions to physical objects or can be completely new virtual assemblies created by re-purposing physical objects as spatial and visual references.

3. REFERENCES

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