Turn: A Virtual Pottery by Real Spinning Wheel

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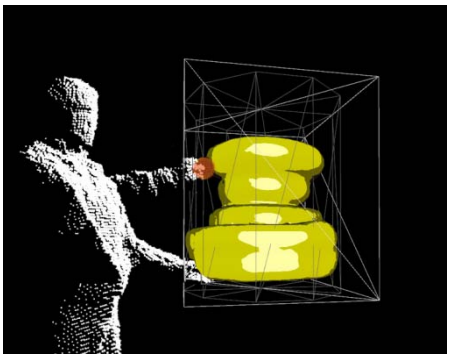


Figure 1(a)Virtual pottery making (b)Image seen by the depth camera and rendition of virtual clay (c)output samples

1. Introduction

Is it possible to transfer real-world sculpting expertise to a virtual space? Through digital pottery, the answer is yes. Digital pottery is a collection of systems that makes it convenient to make pottery in 3D space. In this study, we present a natural & tangible user interface system that fluently connects users' real-world sculpting experience to virtual pottery making. Introducing a real spinning wheel, we could extend the physical concept of making pottery into 3D space without the burden of bridging the gaps between real & virtual worlds. As a result, we could also retain its unique characteristics of pottery by preserving its essential mechanism of shape formation: Turn.

2. Interaction

A wooden rotating wheel is placed in front of an LED display panel. When you spin the wheel, an imaginary spinning wheel in the virtual world also revolves correspondingly. As you move your other hand over the wheel, you can see a digital rendition of clay that smears out from the tip of your fingers like toothpaste on the screen(Figure1-a). As we designed this virtual space, you can put, add, subtract & modify clay at anywhere you want without considering real world constraints like gravity. This gives you another level of freedom to create unique shapes shown on the images above while preserving the tangibility of real world pottery.

3. Implementation

The Kinect sensor from Microsoft installed on top of the display panel traces your hand in 3D space. The position of your hand is calibrated in real time based on the relative position from the top plate of the spinning wheel. A wireless mouse is installed upside down beneath the spinning plate sensing the speed of rotation with its optical sensor without giving any friction to the moving parts.

Raw depth information obtained from the Kinect sensor is processed & transformed to construct 3D points cloud above the imaginary spinning wheel in the virtual space. A graphical sculpting tool gizmo gives you the clue where your hand is at and what you're doing now. The imaginary cylinder above the spinning wheel constructs a control volume that limits the span of your gestural inputs where a volumetric rendering of processed points cloud is drawn as a sculpted pottery(Figure1-b). This volumetric data is computed as iso-surfaces by employing the marching cubes algorithms for 3D arrays. This algorithm allows the final 3D model to be a free-from surface whose surface continuity is maintained. We used OpenGL with GLSL for the 3D visualizations.

4. Conclusion

In this study, we propose a digital pottery system that successfully reflects real-world gestures to their virtual counterparts. By introducing a tangible user interface that extends real-world experiences, "Turn" offers a natural, intuitive and interactive virtual 3D modeling method. Acting out the sculpting experience on virtual space, users can easily create organic forms of virtual pottery that can hardly be made in real-world circumstances (Figure1-c). In addition, this spinning-wheel metaphor can be extended to various design interfaces including architectural modeling, product designs and fine art sculptures. Digital pottery is a good example for utilizing our technique but it is not the last stop of this interface. "Turn" opens a new way of modeling method feasible for making intuitive virtual 3D modeling environments. It will offer a revolutionary way to extend users' expertise of real-world sculpting to its virtual counterpart.

5. Reference

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