Multitouch Interface Metaphors for 3D Modeling

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Abstract

In the past many researchers and companies have focused on mastering different multitouch interface technologies, yet there are currently still only few applications that are truly using the full capabilities of multitouch. In this paper we describe our vision for new multitouch interaction metaphors based on finger and hand gestures especially suited for 3d conceptual modeling and show some ideas about the context in which such a multitouch system could be useful.

1. Introduction

Recently multitouch interfaces have become widely used. While there has been a lot of research addressed at mastering the interface technology itself, application-wise multitouch is still in its early infancy and we have yet to see how many developers will really take up the challenge and write true multitouch-aware applications. We think the field of 3d modeling and design is particularly suitable for multitouch interaction, especially for quick conceptual 3d visualizations.

In this paper we will present some of our ideas for a multitouch 3d modeling interface and the interaction metaphors that could be useful for such a system. We think that multitouch can be extremely useful because it allows for more degrees of freedom and parallel interaction in a much more natural fashion than any other mainstream input device used today.

The system we propose will be designed with the non-expert user in mind because we think that especially the non-expert user can benefit from an unencumbered and natural interaction. Our system will be geared towards quickly creating conceptual designs, which do not need the level of control provided by existing 3d modeling packages. Furthermore, to our knowledge none of the existing systems has been designed with multitouch or even multipoint interfaces in mind. The system we propose will feature true multitouch based on optical blob tracking. The application will be able to obtain and use the position and number of blobs, i.e. fingertips, but also features like size, shape, proximity, and motion.

2. Related Work

Kim et al. [3] describe a tabletop device employing tracking techniques related to the techniques we plan to use in our system, although they are using a different illumination technique. They also present a basic gesture interface, but they do not apply it to 3d modeling.

Shen et al. [5] discuss many important usability and interface design issues concerning multitouch tabletops, which we plan to take into account for our system.

Rekimoto [4] presents the SmartSkin system, which features two handed freehand manipulation of virtual objects.

Hancock et al. [2] describe some fundamental rotation and translation mechanisms for tabletops.

Gingold et al. [1] present a texture placement algorithm using a multitouch interface.

3. General Interface Considerations

Before we will describe some elemental modeling metaphors, we want to present an idea for the more basic but very important problem of handling different views and transformation constraints in 3d modeling.

Changing the view and constraining transformations and other actions to a certain plane or coordinate axis is very important in the 3d modeling context. We propose to use a cube metaphor in our application. Different views can be attached to the faces of the cube, which can be rotated by the user through simple wipe gestures to obtain a different view.
and to constrain the actions accordingly to a plane parallel to the viewing plane (figure 1). Multiple views could be realized by adding multiple cubes. When rotating the cube, it should snap into certain positions to ensure a dependable and easy interaction and the transition of one view to the next, i.e. of one face to the other, should be made clear by using an appropriate real-time interpolation scheme. By using such a scheme, the user will be able to follow how the old view changes to the new view without losing orientation. When no sweeping gesture is in progress the cube view will be blended into the currently active view/face, so that the cube itself will disappear. When active, the cube or cubes could also be freely moved across the table surface by using additional gestures, thereby providing an easy way to customize the interface to the user's needs and also enabling multi-user interaction.

Another problem with direct hand/finger interaction is the user's finger tips occluding parts of the 3d model. To address this problem we propose a smart virtual magnifying glass in combination with audio feedback. The size of the magnified area depends not only on the blob size but also on movement speed and the interaction context, i.e. which editing tool the user is working with at the moment. Furthermore, the user will be able to use his other hand to manually adjust the zoom area. Audio feedback will further augment the interaction to provide even more precise feedback.

4. Modeling Metaphors

We will now present several ideas for new modeling metaphors that take advantage of the features of a multitouch system as we mentioned above.

The first metaphor we call meta-tips. Depending on the size of the blobs detected by the system for the user’s finger-tips and on the proximity of these blobs, an area of virtual clay is forming under the user’s hand (figure 2). By sweeping the resulting form across the table surface, the user can easily create the basic shape of an object, which can then be refined further with additional tools. This tool could be used to model organic objects but it could also be employed to model terrain or landscapes.

For refining a basic model, we plan to use a brush metaphor. Many 3d modeling packages and tools already include a brush-mode, in which the user can paint on the surface of a 3d object with special brushes, which modify the object’s appearance or shape. We want to extend this metaphor for the multitouch case by allowing the user to use all his fingertips on both hands independently of each other. Not only the speed of the movement over certain regions of an object but also the number of fingertips touching the surface and the proximity of the fingertips will influence the hardness and effect of the used brush. Additionally, the user will be able to edit different unconnected regions simultaneously, in a more natural fashion, much like a sculptor works with physical objects.

Two-handed input allows natural symmetric modeling again very closely resembling the way artists manipulate physical objects. In standard modeling packages it is often very tiresome for the user to choose mirror planes and axes correctly. In the case of two-handed multitouch input, the system could deduce the mirror plane and axis from the relative motion of both hands, thereby providing a very easy and flexible way of modeling symmetric objects.

5. Conclusion and Future Work

We have presented our ideas for multitouch metaphors for 3d modeling developed for intuitive 3d manipulation for non-expert users. As our system is work in progress we still have to implement, test, and evaluate our ideas.

References