Clothing Manipulation

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1 Introduction

Putting clothes on a 3D character is often a tedious, time-consuming task. A typical approach is to place parts of the clothes around the target body as rigid thin plates and use a simulation to enforce "stitch-together" constraints and show the effects of gravity [Volino and Magnenat-Thalmann 2000]. The 3D character may be placed in a particular pose (e.g., arms outstretched) and then some "throwaway" animation may be used to get the character into a desired pose. However, placing thin plates in free 3D space using a 2D input device is difficult, and it is not very flexible for exploring various nonstandard ways of wearing clothes. Recent fast cloth simulation systems enable real-time manipulation of clothes: the user can grab a piece of clothing and drag it around in 3D space [Desbrun et al. 1999]. But this is like manipulating clothes with chopsticks; it's not ideal for putting clothes on a 3D character.

We are developing a set of interaction techniques for putting clothes on a 3D character (here called the body) quickly and intuitively using 2D input devices [Igarashi and Hughes 2002]. The techniques are designed for specifying an approximate initial cloth configuration before applying a high-quality cloth simulation to obtain a final, good-looking cloth shape or animation. The intention is that the interface should also be useful for exploring various cloth configurations quickly during the design process, both in 3D character design and real-world fashion design. A demonstration video and the prototype software are available at http://www-ui.is.s.u-tokyo.ac.jp/~takeo.

2 The User Interface

The first technique, wrapping, is for putting the clothes on the body from scratch. The user paints freeform marks on the clothes and corresponding marks on the body, and in a few seconds the system places the clothes on the body so that the corresponding marks match, to the degree possible (Figure 1). Internally, the system grows the clothes on the body surface around the marks while maintaining basic cloth constraints via simple relaxation steps. The entire computation takes a few seconds.

The second technique, surface dragging, is for adjusting the configuration of clothes already on the body. While a typical cloth-dragging operation moves a set of vertices in a single direction in 3D space, our dragging operation propagates this motion-direction along the surface, and thus moves the whole cloth (rather than just a local piece) along the body surface (Figure 2). The user can also place pushpins to hold some clothing parts fixed during dragging.

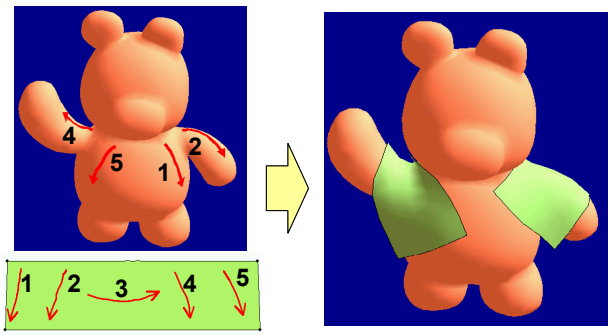
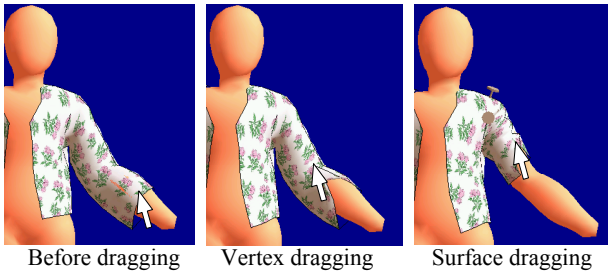


Figure 1: Wrapping. The user paints pairs of freeform marks on the target body and on the clothes (left); the system places the clothes on the body so that the corresponding marks match (right). The result appears almost instantly. (The mark numbering has been added by hand to clarify the correspondences.)



Before dragging | Vertex dragging | Surface dragging

Figure 2: Surface dragging. A typical vertex-dragging operation moves only one vertex explicitly, causing large local distortion. Surface dragging explicitly propagates motion across the clothes, enabling global manipulation. The pushpin on the shoulder blocks further propagation.

3 Results

We have begun an informal user study. It took approximately 20 minutes before a user started using the system fluently under our supervision. It took a while for the user to learn the peculiar behavior of the clothes in our system. The user tended to drag the clothes a long way in a single interaction step, making the system unstable; clothes must be moved gradually towards the goal position instead. It's also necessary to release the mouse occasionally during the dragging so that relaxation steps can dissolve the accumulated distortion.

References

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