Simplifying 3D modeling through sketch based interfaces

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Helping create virtual worlds

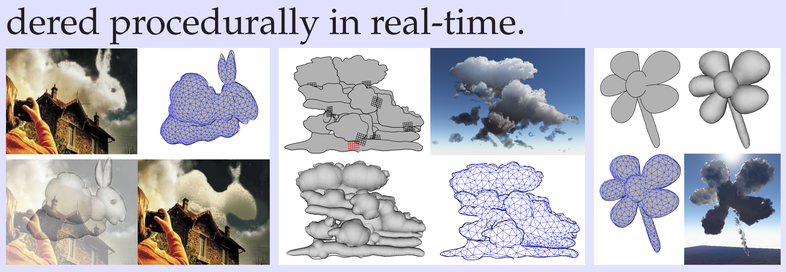
Films, computer games and virtual worlds all require compelling digital content. From the lead characters through to the background details like trees and clouds; all content must be crafted manually by computer artists - a time consuming process. Our work reduces the time and effort required for 3D modeling by introducing sketching tools for modeling complex shapes such as clothes, hair, trees and clouds.

Hiding underlying complexity

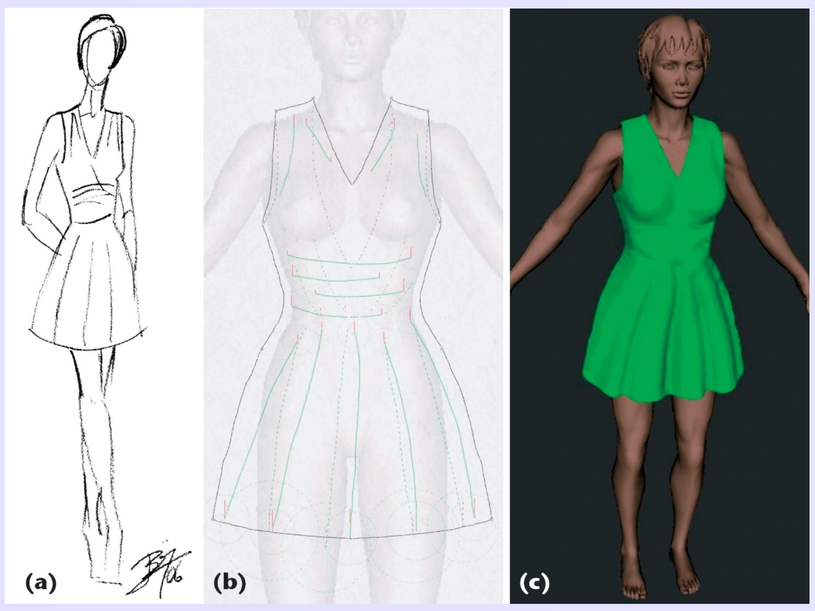
Our basic approach is to use prior knowledge of the object being modeled in order to extract parameters which drive a procedural model. Procedural models generate objects by following a set of rules which embed some knowledge of the nature of the object (for example: a head of hair consists of clumps of strands, where each strand may be represented by a sequence of helices). Using a procedural model requires a detailed understanding of the parameters which control the model. Our approach hides the detail of the underlying procedural model - the user interacts using strokes with an intuitive meaning, rather than abstract parameters.

Sketching Cumulus Clouds[1]

Cumulus clouds are easy to sketch in 2D, but hard to model in 3D. We developed a real-time cumulus cloud modeling system. The artist sketches the rough outlines and lobes of a cloud from any viewpoint, typically building the cloud in layers from back to front. There is a tool to automatically identify 2D lobes in the outline and create similar 3D detail which respects the given outlines. Sections of the cloud can be scaled and copied and a flat section (such as the typical flat bottom of a cumulus cloud) can be created using a cutting stroke. A surface mesh is created and the fine cloud detail is rendered procedurally in real-time.

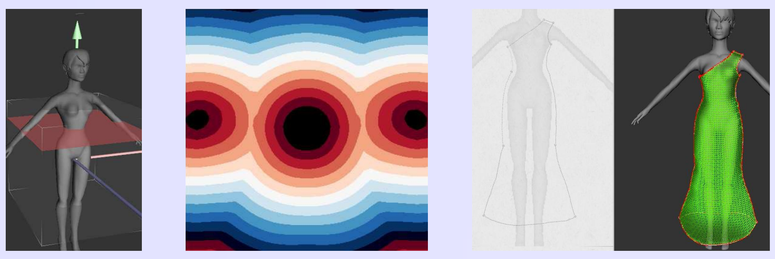


Sketching Garments[3, 4]



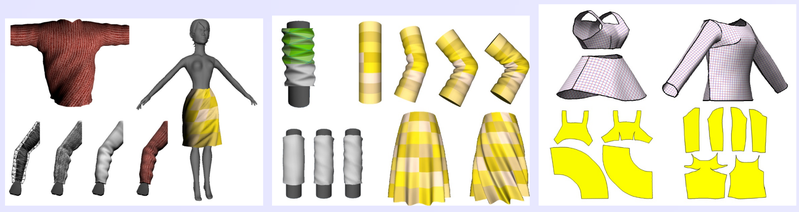
a) Concept sketch b) Interface c) Result

Large crowds in films, characters in games and virtual worlds. They all need to be clothed, and they shouldn't all be wearing the same thing! Our sketch based clothing design system allows an artist to quickly create a variety of clothing by sketching in 2D over the 3D character model. The sketched lines form the boundaries of the cloth, and the required depth within the boundaries is inferred using a distance field calculated from the character model.



Distance Fields: A distance field is a scalar field recording the nearest distance to a surface. We use a distance field around the character to assign depth to the borders of the drawn garment. These depths are then propagated within the interior of the garment using a diffusion process. This allows us to place the whole garment surface in 3D.

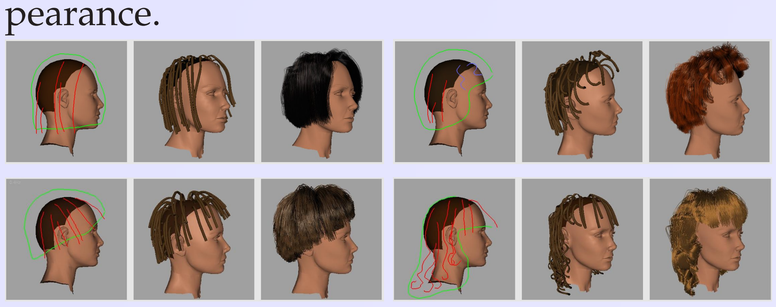
Sketching folds: The artist may sketch folds directly onto the generated garment model using gestures. The garment mesh is deformed along the sketch lines according to the parameters (width, depth, direction) defined by the gesture.



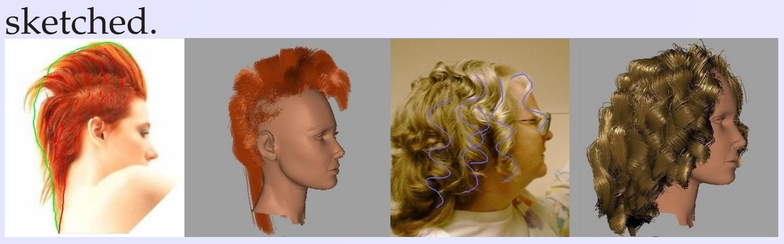
Automatic folds: Alternatively our automatic method creates folds based on the diamond patterns observed in fabric. We approximate the garment using a developable surface (a surface which can be unfolded on a plane). This means we can also produce printed patterns.

Sketching Hairstyles[2]

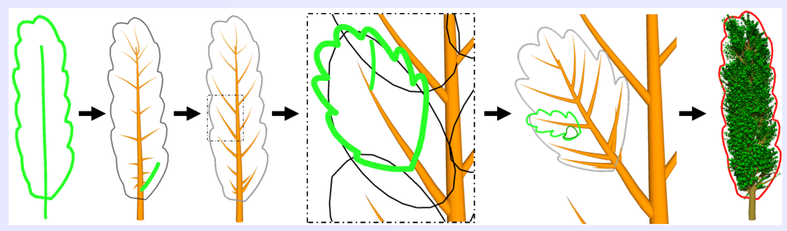
After clothing, the next most distinctive visual feature of a character is the hair style. Hair is particularly difficult to model as it requires many thousands of strands for a realistic appearance.



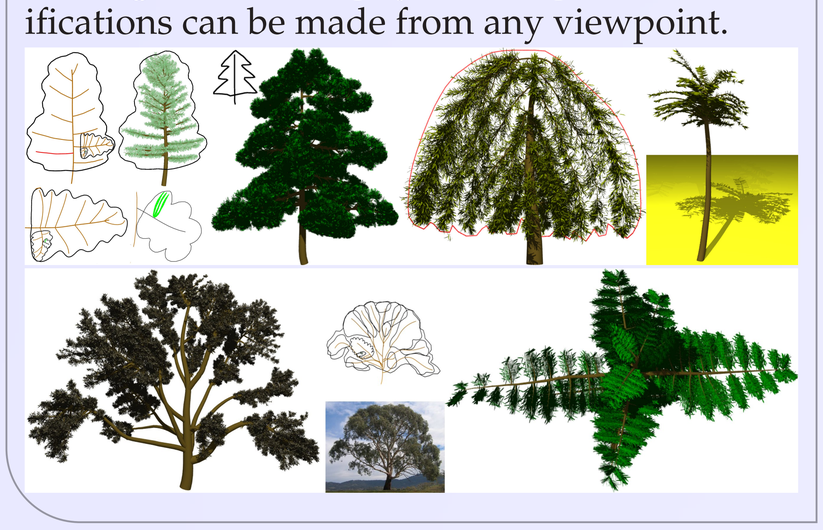
The artist sketches the scalp line, the rough outline of the hairstyle and example strands within the scalp (all from a side view). Parameters such as curvature and length are measured from the examples strands and used to infer seven parameters required to control an underlying procedural model describing a wisp of hair. Parameters are interpolated between examples to derive a full hairstyle. Photos can be over-sketched.



Sketching Trees[5]



Trees have complex forms which are hard to model in traditional modeling packages. Powerful procedural methods exist for creating trees automatically, but controlling the final form is difficult even when the underlying models are understood. Our multi-scale sketching interface for trees removes the tedium of specifying many branches by inferring branch shapes from sketched silhouettes. Silhouettes are sketched at different scales within the tree. Multiple branches can be reshaped as a result of one stroke operation. Branches may be arranged according to common phyllotactic patterns. Modifications can be made from any viewpoint.



References

[1] J. Wither, A. Bouthers, M-P. Cani. Rapid sketch modeling of clouds In *Sketch-based interfaces and modeling 2008*

[2] J. Wither, F. Bertails, M-P. Cani Realistic Hair from a Sketch In *Shape Modeling International 2007*

[3] P. Decaudin, D. Julius, J. Wither, L. Boissieux, A. Sheffer, M-P. Cani Virtual Garments: A Fully Geometric Approach for Clothing Design In *Eurographics 2006*

[4] E. Turquin, J. Wither, L. Boissieux, M-P. Cani, J. Hughes A sketch-based interface for clothing virtual characters *IEEE CG&A 2006*

[5] J. Wither, F. Boudon, M-P. Cani, C. Godin Seamless multi-scale sketch-based design of trees *Submitted for publication*

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