

# Modeling Expressive 3D Caricatures

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## Introduction and Motivation

The concepts of abstraction, simplification and exaggeration, which are very common in traditional art and caricature, can directly be applied to the 3D modeling process. Therefore, the development of methods to teach these concepts is essential for 3D computer art and design education. In this work, we present an educational method to teach students these artistic concepts by modeling expressive 3D caricatures. This method has been successfully used in a geometric modeling course that combines artistic and scientific aspects of 3D modeling. Using the method, all the students, regardless of their artistic abilities, can create convincing 3D caricatures.

## Methodology

Our method consists of four stages:

1. **Data collection.** In this stage, students choose a well known person with an easily recognizable face. For caricatures, we usually use movie stars. In addition to being easily recognizable, the faces of most movie stars include some unique features that help creating caricatures. During this stage, students collect photographs and caricatures of the person from a wide variety of sources such as movie clips and magazines.
2. **Unique (Exaggerated) Feature Identification.** A feature is called unique if it is different than average. Identification of the unique features is essential for creating caricatures since those features are the ones that will eventually be exaggerated. Students identify the unique features of a given face by using a procedure developed by one of the authors [1]. The procedure based on the image morphing consists of five stages.
  - (a) Start with a representative image of the person.
  - (b) Create a very simple template for image morphing.
  - (c) Exaggerate only one feature at a time.
  - (d) If exaggeration creates a likeness, continue to exaggerate. If it does not create a likeness, make the exaggeration in the opposite direction. If neither direction gives a likeness, return the feature to its original position.
  - (e) Continue with another feature until all unique features are identified.
3. **Abstract Caricature Creation.** In this stage, students create abstract caricatures using disconnected pieces. Using disconnected pieces is partly motivated by cubist sculptures such as Pablo Picasso's Reclining Bather. Individual pieces also allow faster shape modification. Each unique feature is represented by at least one disconnected 3D surface. Therefore, it is easy to improve 3D recognizability of the caricature shapes by changing the position, shape and size of each feature. Figures 1 and 2 show two examples of 3D caricature created with disconnected pieces. These examples show two completely different approaches to create abstract caricatures. In Sylvester Stallone's caricature, all the detailed features are modeled. On the other hand, in the Julia Roberts case, only a few unique features are modeled and an important feature (hair) is completely omitted. Despite the differences, both provided likeness, which is useful for the next stage. As a side note: In both cases, disconnected pieces are modeled by using

NURBS, but this is not a necessity. Subdivision surfaces can also be used to model individual pieces.

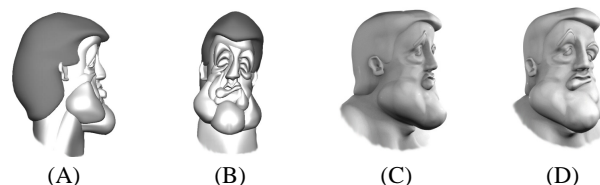


Figure 1: Sylvester Stallone by Jacob Brooks. (A) and (B) show modeling with disconnected pieces. (C) and (D) show final 3D caricature.

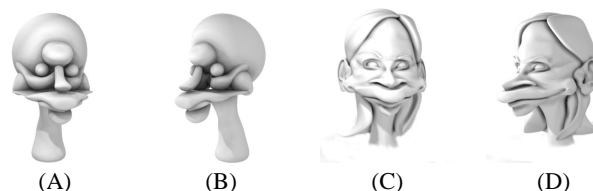


Figure 2: Julia Roberts by Jon Reisch: (A) and (B) show modeling with disconnected pieces. (C) and (D) show final 3D caricature. (This particular facial expression is motivated from her performance in Notting Hill, when she said "I am just a girl standing in front of a boy asking him to love her".)

4. **Final Modeling and Rendering.** Once the shape that is constructed with disconnected pieces is confirmed to be a likeness of the person, the students create a subdivision surface that closely approximates the confirmed shape. Figures 1 and 2 show two examples of 3D caricatures created with subdivision surfaces.

In order to render our caricatures, we have developed an Ambient Occlusion shader for Maya, using C++ and the Maya API. The Ambient Occlusion shader reinforces areas of subtle relief on the models and provides a clean, consistent look to the final images. By omitting the use of textures and color, we ensure that the shapes alone provide the recognizability of the caricature.

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## Bibliography

- [1] E. Akleman. Making Caricatures with Morphing. *Visual Proceedings of ACM SIGGRAPH'97*, 134, Aug. 1997.