Automatic Creation of Expressive Caricatures: A Grand Challenge For Computer Graphics

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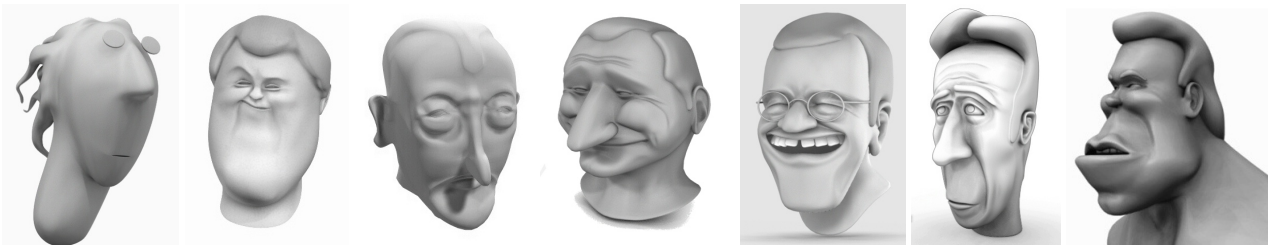


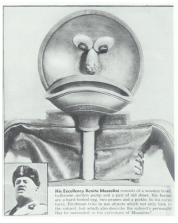
Examples of Expressive 3D Caricatures Created in my *Computer Aided Sculpting* Course

1. Motivation

One of the ultimate goals of computer graphics is to develop representational techniques to create wide variety of artworks such as drawings, paintings, sculptures and animations. Development of these representational techniques requires a good understanding of abstraction, simplification and exaggeration.

Salvador Dali
by Sebastian Kruger

Pablo Picasso
by Lenn Redman



Benito Mussolini
by Lou Hishman

Bob Hope
by Al Hirschfeld

George W. Bush
by David Cowles

Barbara Streisand
by Hanoch Piven

Figure 1: Examples of caricatures of some great caricaturists.

The concepts of abstraction, simplification and exaggeration are essential parts of visual arts. These concepts are always employed even in creation of drawings, paintings, sculptures and animations. The close examination of very realistic looking artworks reveals that abstraction, simplification and exaggeration are widely used in creation of even such realistic works [2].

Fine artists always ignore unnecessary details and focus on the characteristic features of their subjects. For instance, no classically trained painter will draw every visible detail in a still life. Caricaturists not only ignore unimportant details, but also selectively exaggerate the features that makes their subjects unique.

Although abstraction, simplification and exaggeration are very common tools used in visual arts, only in caricature we consciously learn to apply them. Unfortunately, caricature is one of the orphan fields in fine arts. In United States, caricature is not considered high level of art and disregarded in academic circles.

Even public view caricature as a consumer product[1]. Caricature is consumed and forgotten. But, we have so many things to learn from Caricature process.

Figure 1 shows the ingenuity of great caricaturists. As it can be seen in the figure, there are a wide variety of ways for abstraction, simplification and exaggeration. For instance, Hanoch Piven's Barbara Streisand is just a microphone. Lou Hishman's Mussolini consists of a plunger and a shoe. Hirschfeld can draw an arm with a simple S shape. In all these examples, the level of abstraction and simplification is so high that it is easy to see **to automatically create such caricatures is a great challenge.** However, I call automatic caricature creation a grand challenge not only because of abstraction and simplification aspects of the caricature process. Even exaggeration is extremely hard.

2. Exaggeration

I have seen and reviewed many caricature papers that attempts to automatically exaggerate from frontal face images and all of them were unsuccessful. I am not saying this as a computer scientist but as a caricaturist[2] In fact, I also failed miserably in terms of my pre-

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[1] Not many people know the names of more than one or two great caricaturists. To prove my point, I will list the names of some of great caricaturists: Thomas Nast, Al Hirschfeld, Daniel Adel, Steve Brodner, Joe Ciardiello, Paul Conrad, David Cowles, Jack Davis, Thomas Fluharty, Mark Fredrickson, Drew Friedman, Robert Grossman, Lou Hirshman, Ori Hofmekler, Taylor Jones, John Kascht, Sebastian Kruger, David Levine, George Lundy, Rick Meyerowitz, Ranan Lurie, Jan Op De Beeck, Roberto Parada, C. F. Payne, Hanoc Piven, Lenn Redman, Robert Risko, Ronald Searle, Gerald Scarfe, Edward Sorel, Ralph Steadman, Sam Viviano, Nikolaus Wahl. There may be some people who know Nast or Hirschfeld, but the rest are all unknown.

[2] In my first life (much before I got my PhD in Electrical & Computer Engineering) I was professional cartoonist and caricaturist starting from high

Figure 2: More Examples of Expressive 3D Caricatures Created in my *Computer Aided Sculpting* Course.

diction on how easy it is to identify the features to be exaggerated. In 1997, I had a Siggraph sketch [1]. In my presentation, I claimed that anybody can identify what to be exaggerate by using morphing. Identification of the unique features is essential for creating caricatures since those features are the ones that will eventually be exaggerated. The procedure based on the image morphing that consisted of five stages and it was really simple.

I also had a paper on morphing that shows extreme exaggerations with deformation using simplicial complexes. One graduate student developed a thesis on caricature interface. But, the fact of the matter is that I was still the only one who can do caricature using these interfaces.

Based on my experience and claim, I slowly made caricature as a part of the curriculum of some courses. Unfortunately, it never worked unless I am heavily involved with the process. (Our students are not artistically untalented programmers, We choose our graduate students partly based on their portfolio. They are coming from a wide variety of background such as CS, Architecture and Art but all have a basic art talent and education. Despite that they were not able to do it.)

The last two years, I spent much more time for caricature homework. I worked with each student. I draw them sketches. I made them to create shapes using disconnected NURBS models such that I can make changes easily. Eventually they converted models to subdivision. This time, almost all were successful. Some examples are shown under the title Figure. Based on this experience , I had a Siggraph sketch in 2004 that explain this experience [2]. The real moral of this sketch was that we cannot really automatize the caricature process in the near future.

One of my points on sketch presentation was that it is extremely hard to make identify features to be exaggerated. It is impossible to identify features from a single photograph since a face ic changing dynamically. For instance, our mouth moves up when we smile. If we use a frontal picture of a person smiling and disregard the fact that she is smiling, we may mistakenly identify her chin as a long chin. We may think that the distance between his nose and lips is short.

3D scanning is better but it is still not enough since it capture only static face. To identify the unique features we need to capture a dynamic 3D face by combining video with 3D scanning. Moreover, some features can be almost un-measurable. A good example is George W. Bush's face. If you look at his neutral photo, it is almost impossible to find out his right and left side is not symmetric. But, I know this fact from his father's face and only when I include this asymmetry to his face his caricature become recognizable.

Caricature is really like science. Each person is an unknown to be discovered. Each caricature of the person is like a science paper that provides us another information about the person. The caricaturists collectively discover the truth. We, caricaturists, have our Newtons or Einsteins like Kruger or Piven, but most of us are like average talented scientists. We learn from each other. We perfect each other. Caricaturing is a collective process. You can see this collective process is in action as soon as a new president is elected. For instance, George W. Bush's eyes are smaller than normal. But, the caricaturists did not discover it as soon as he was elected president. But, after six months, every caricaturist was able to draw a good likeness.

3. Measure of Success

Automatic creation of very extreme caricatures such as Hanoch Piven's is a grand challenge or Turing test to me. However, unless we develop a community that realize the difficulty of the problem, it will be hard to progress and it will even be harder to measure the progress.

To measure the progress, we have to be very careful about people's tolerance is so high that it is easy to make people accept unsuccessful caricatures as successful ones. There are several tricks of trade, we need to be careful to avoid.

1. **Line Drawings.** Changing a photograph to a line drawing can be acceptable to many people as caricature. In fact, several research papers first convert the photographs to line drawings to exploit this fact.
2. **Deformations.** Most people tend to accept even wrong exaggerations, which I will call deformation. Deformations look funny and since people think caricatures must be funny, mistakes become acceptable.
3. **Giving hints.** If a caricaturist could not manage a caricature, s/he can just simply write the name of the person and people accept it.

I have very simple litmus test to measure the success of caricature. If caricature is good, the original image should not look like the person. In other words, the caricature must blow out our common sense. Although, we know that which one is real, we should still feel that the caricature is better likeness (see [3] for an example).

Bibliography

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

[2] E. Akleman & J. Reisch "Modeling Expressive 3D Caricatures" *ACM SIGGRAPH'04 Sketch*, Aug. 2004.

[3] http://www-viz.tamu.edu/faculty/ergun/research/artisticdepiction/caricature/morphing/talk/akleman150.html

school in 1976.