theory

overview
modeling theory
approaches

process
setup
NURBS
polys / subds
texturing
animation

resources
features close-up
reference / links

gallery
pics and movies

Parameterization the Where and the How

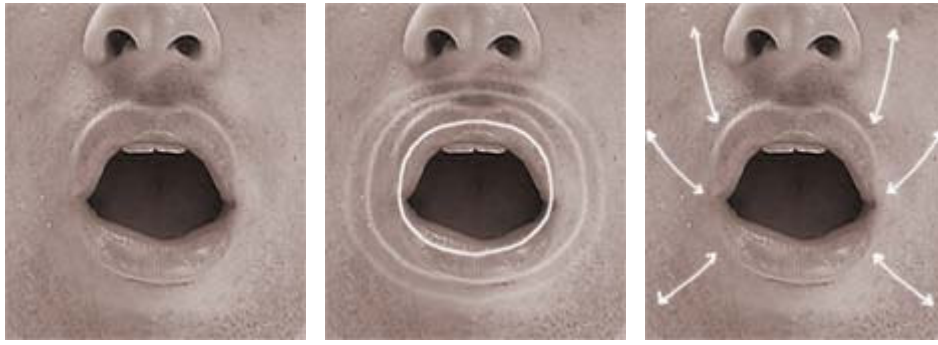*"The most commonly overlooked aspect of a model is its topology."*

1 | **2** | **3**   >

There is more to modeling a head than capturing its exact appearance. The perfect shape can be invalidated by an imperfect structure. In my opinion the single most important, but most commonly overlooked, aspect of modeling a 3D CG head (or any complex model built for animation) is its topology. Both topology and geometry are different aspects of a model's parameterization. Whereas geometry designates the placement of vertices, topology refers to the structure of a model; it is concerned less with **where** vertices are than **how** they are connected together. Topology affects the *economy* and the *capability* of the model. Economy consists of the efficiency and effectiveness of the model. Are there more polygons than absolutely necessary? The capability of the model involves the quality and range of movement it is able to perform.

Ultimately, there are two factors that should determine the flow of a model's parameterization:

1) the direction of the topographical (not to be confused with *topological*) **details, and**

2) the direction of the surface's motion when animated.
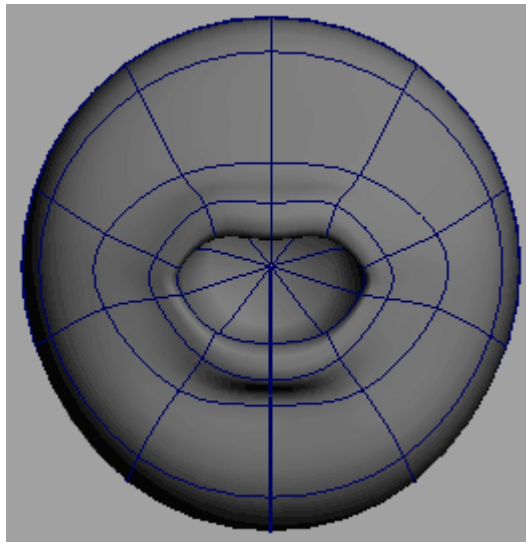
Let's look at the mouth for example:

The characteristic shape of this region of the face is defined by the lips which meet at the corners of the mouth to form a complete circle.
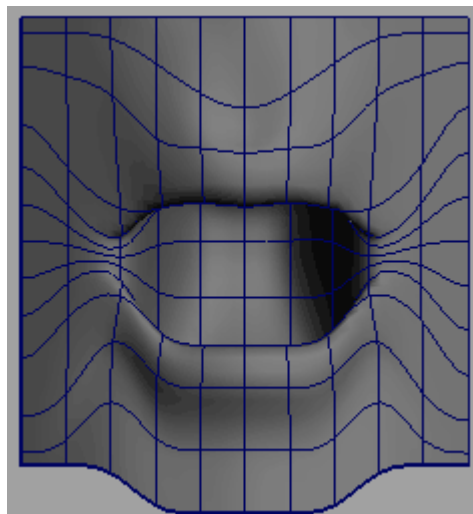
The parameterization therefore should follow the direction of this topography emanating from the center of the mouth as concentric circles.

Furthermore, from kissing to shouting to smiling, the direction of the motion of the mouth radiates from the center of the mouth, mandating a topology that flows out and away from the center of the mouth.

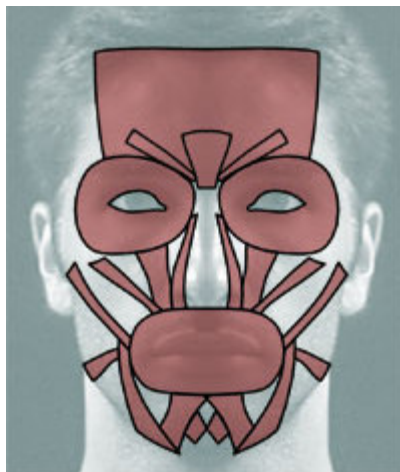The resulting topology would look something like this:

Let's compare this to an improper topology that ignores the direction of surface shapes and the direction of motion.

Note that though this surface has a higher resolution than the first surface it inadequately and awkwardly represents the mouth shape primarily in its dealing with the corners of the mouth.

Now take a look at the primary muscles of the human face.

You'll notice that the flow of their fibers corresponds roughly to the flow of the parameterization in the mouth region. This is an important observation. As you attempt to build more and more subtlety of expression and shape into your character's model you will want to conform your parameterization more and more to the underlying muscles of the face.

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