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a sub-division modelers primer

Subdivision Modeling > Modeling & Sculpting > Sharing Technique

**The Pole - revised**

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07-12-2008, 04:31 PM #1

**mister3d**   
SDM User Join Date: Apr 2008  
Posts: 18

**The Pole - revised**

**You have not much time left before this site will be closed for good, I suggest you saving this info on your hard drive. 😞**  
<http://www.subdivisionmodeling.com/forumdisplay.php?f=49>

Ok guys, I'm glad I was so at time to make this thread as long as it's one week left before we lose this site. I even didn't know about that and stumbled across browsing Wayne profile... Actually this sounds so sad to me.

The point of this thread is to summarise the information from the original thread, and make it updated, as long as some early posts were concluded obsolete by the authors.  
Toontje already created a more condensed thread, though it is software-specific and also was flooded.

I would like to organise in into pdf a bit later. If you are a web-designer or something, please welcome to contribute! 😊

Note: this thread is not good for beginners in organic modelling. If you have never modeled any organic model, I strongly recommend you reading the Form thread first <http://www.subdivisionmodeling.com/forumdisplay.php?t=482>, then these DVD's: digital tutors "creating digital humans"(basic modeling), and later a more advanced freedom-of-teach "human anatomy"(detailed muscle modeling) and many others. Only then move on to studying this thread, otherwise you won't get any clear practical point. When you finish studying this Pole thread, it is a good idea to study anatomy <http://forums.cgsociety.org/forumdisplay.php?f=177> and proportions (proportions are even more important at the start <http://www.subdivisionmodeling.com/forumdisplay.php?t=6701>) alongside with a topology research and a character design.

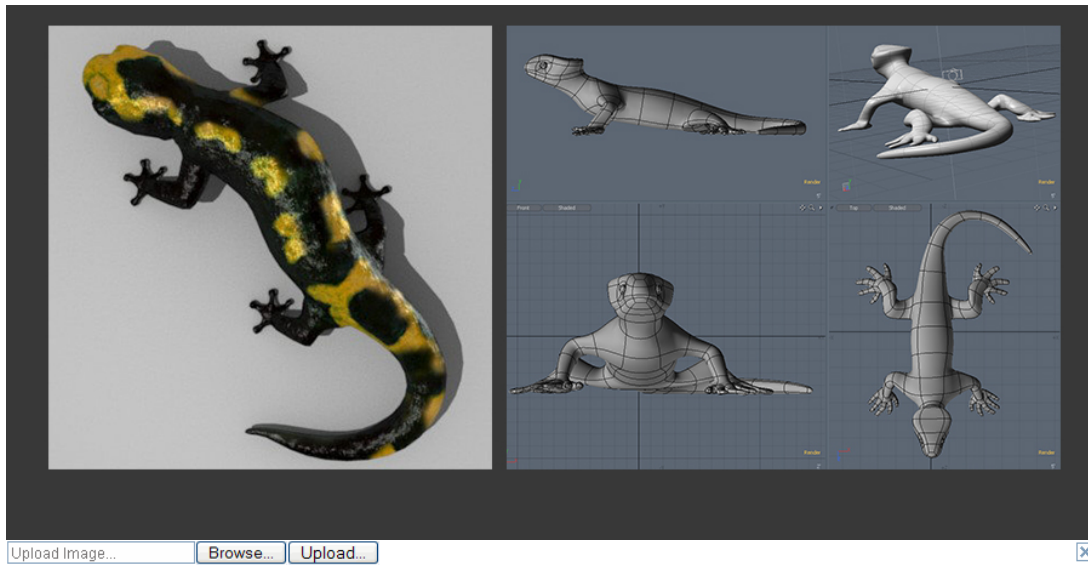
I'm not the author of this material, those are Someartist and Toontje and others.

*Last edited by mister3d : 07-23-2008 at 10:37 PM.* QUOTE    QUICK

07-12-2008, 04:33 PM #2

**mister3d**   
SDM User Join Date: Apr 2008  
Posts: 18

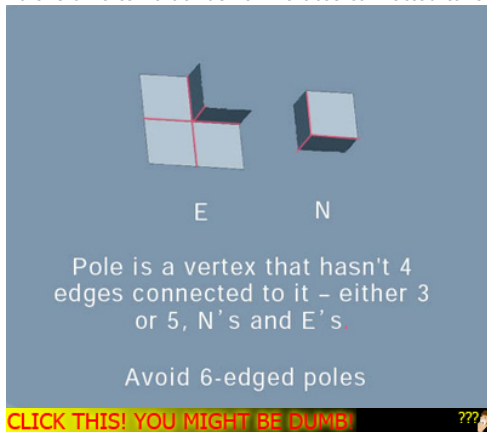
There are two things required: understanding of mesh and the ability to control it. This is what this thread for.  
If you model a lizard for example, collect not only references but also try to find wireframes or at least of similar creatures and explore it (pic1b)



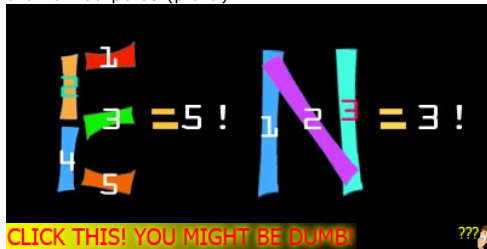
(the meshes represented in this thread are not perfect and used just to illustrate the concepts)

KEY CONCEPTS

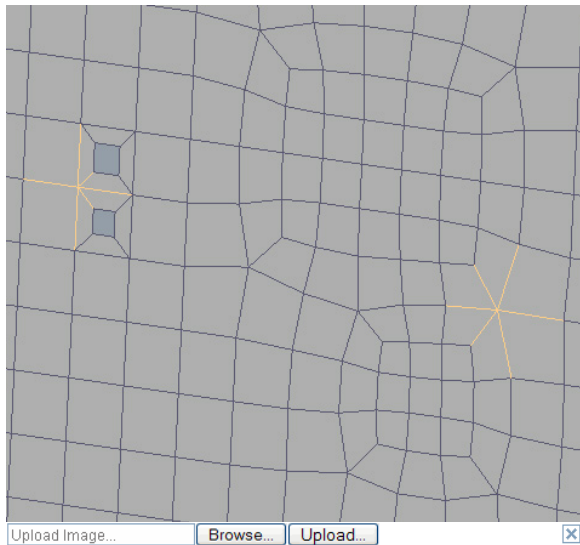
Pole is a vertex that hasn't 4 vertices connected to it – either 3 or 5.(pic)



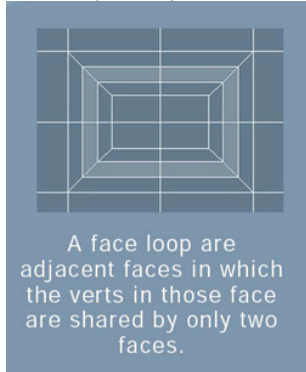
Let's assume the names stand for a number of "matches" from which those letters consist and they are the same number of edges as in the named poles.(pic1a)



Avoid 6-edged poles because they produce pinching. They often appear on mirroring borders. Keeping them most of the time makes no sense, because you have a high density area that can only be controlled by that single 6-pole. Avoid 6-edged poles on extrude loops (and holes), e.g eyes and mouth, touching each other because it will lead to 6-poles. But loops can overlap without problems.(pic)

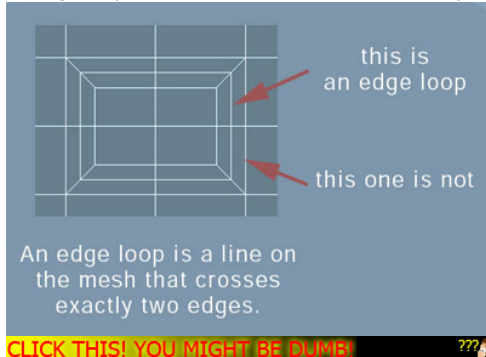


A face loop are adjacent faces which verts share only 2 faces.(pic)



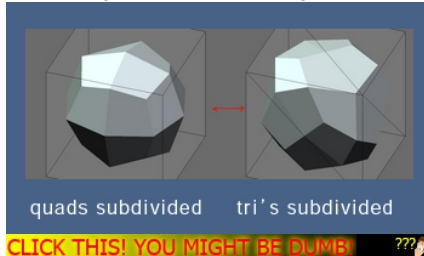
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An edge loop is a line on a mesh that crosses only 2 edges.(pic)



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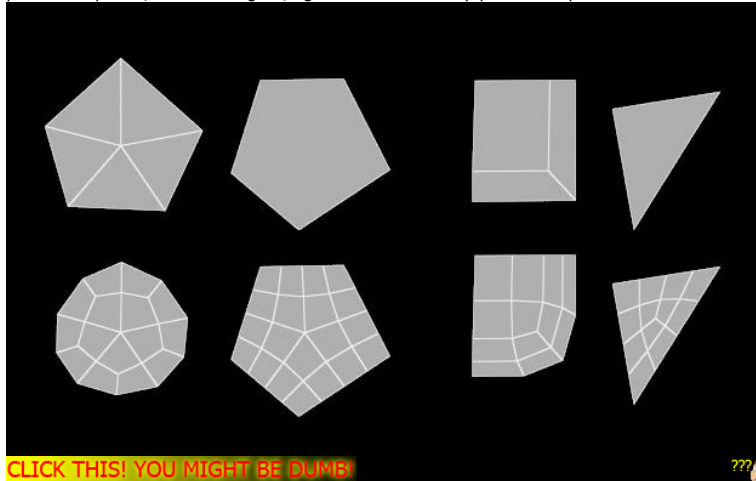
Avoid triangles in sub-d modeling because they produce uneven topology(pic)



**CLICK THIS! YOU MIGHT BE DUMBE!** ???

Why we refrain from using triangles and n-gons?

3 point poles are similar to tris and 5 edge poles are similar to 5gons when using catmul clark, which seems to be the most popular for sub-d modelling. The fundamental difference between using triangles/ngons and using all-quads is that you have slightly more control over where the poles go when you model with all-quads, as long as you can manipulate them directly. So all-quad modelling lets you place the poles, while triangles/ngons automatically place the poles in the next subdivision level. (pic tri's vs N's)



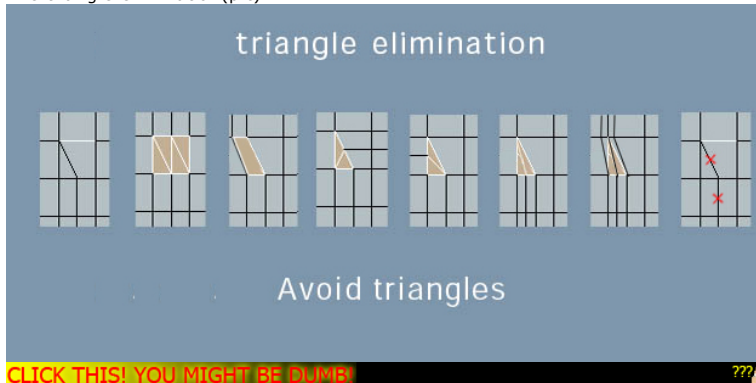
The biggest problems with both are texture warping and pinching in areas with deformations. When we step into these aspects we start running into problems.

If you don't care about triangles, you produce many poles. If you care - less. That is the second reason.

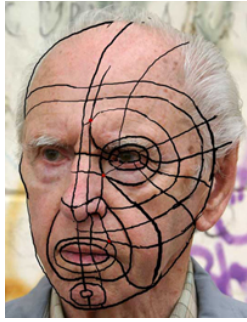
A hard-surface modelling is not strict about n-gons and tri's because subdivision is not used and it won't deform. But sub-d is good for modeling different complex non-organic things like cars and so on with further subdivision, so the concepts can be used not only for organic models.(pic of a car)



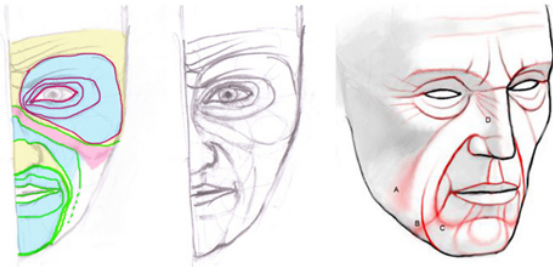
The triangle elimination(pic)



The flow is the direction of loops.(pic)



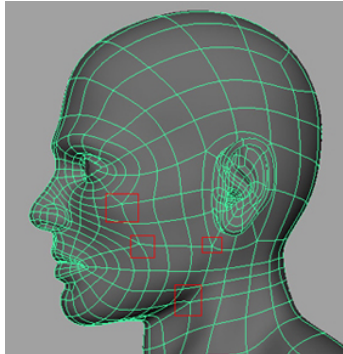
Flows should follow muscle flow and bone structure.(pic)



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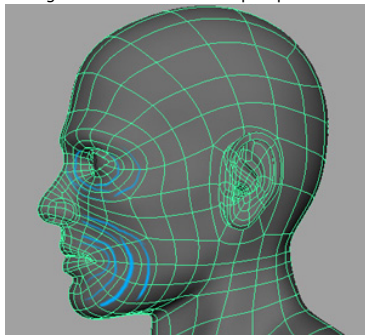
Study anatomical charts of the muscles of the face. Further you should study other reference materials like wireframes. There are some wireframes kindly provided by Toontje. (by the way, if somebody has a rapidshare account, pm me, I have some references too, but can't upload so they keep them for a long time).<http://rapidshare.com/files/104172001/topology.7z.html>

Poles also control the form and create bumps which often are necessary.(pic)



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The general rule is: don't put poles in areas that deform.(pic)

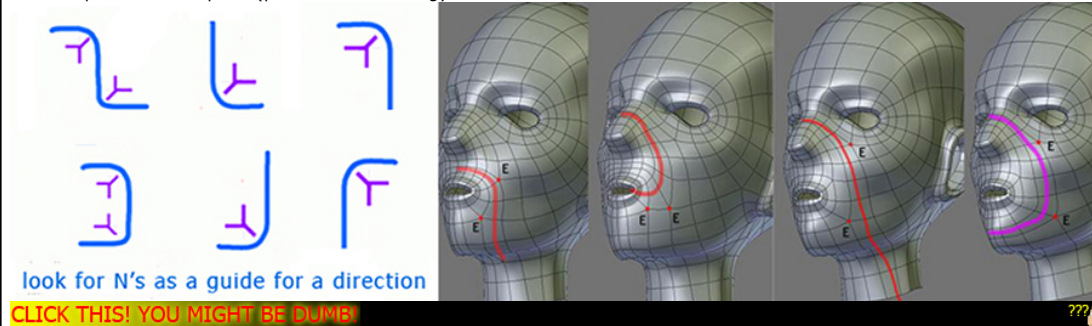


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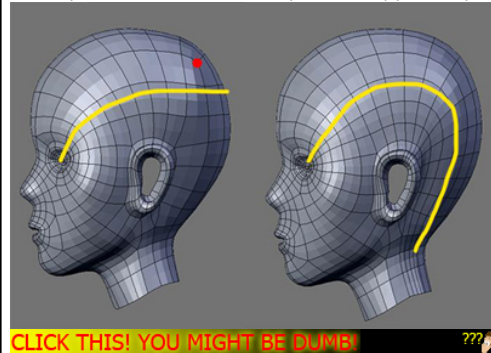
The best practice is to minimize the number of poles that are not intentional bumps, placing them in flat, unimportant areas away from any moving parts.

If to think about how you would stroke muscles and form if you draw it, you wouldn't put poles inside a stroke. You could go left and right OR up and down stroking but you cannot go up/down and left/right at the same time. This is a conception of a flow.

Poles control the flow. Two N's on the same line will form a Circular Loop. Pay attention to N's because by shifting one back and forth you can achieve "predictable" flows! There are no guesswork here. If you have isolated E's they are your guides for a flow, but if you have EN's it's easier to visualise the direction by N's.  
Face loops bend at N-poles(pic with N's bending)

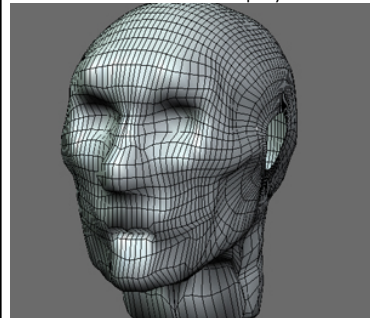


Poles also define topology.  
Topology in 3d means how the lines of the mesh flow on the model.  
When you look at a wireframe you can copy the topology using poles as a guide since poles define a topology.(pic)

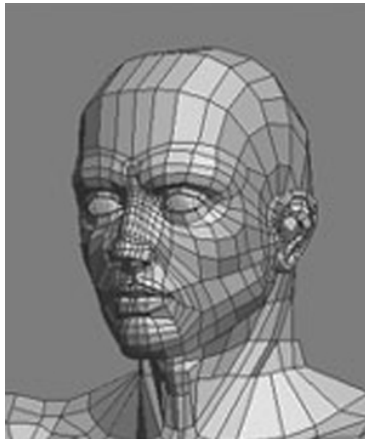


Why is topology so important? Because you can model with great detail (geometry) with a minimum of polygons.

This head was modelled by Toontje years back: just subdivide a cube away and then with proportional edit, pushing and pulling verts. In this case it was left with a polycount of 1750 faces and an ugly model.(wrong topology pic)

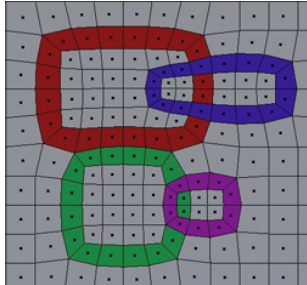


By mastering poles and loops you are able to build light models that are very detailed and suitable for animation. (good topology pic)



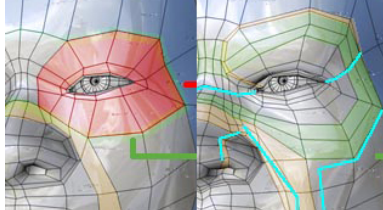
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Edge and faceloops can coexist. In this way you don't have to be afraid that there might be some dire consequences that edgeloops you create might disrupt edgeloops that are already present. As you can see, loops can touch each other, intersect or be a part of each other loop, which is cool. So this means that you can form your eyes loop, a mouth loop and pull a nose loop that intersect the mouth (or mouth-nosetip loop) without a hassle.(pic)



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A keyloop is a base to fill loops, that are added later and increase density.(pic)



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A Fill is an edgeloop that is not connected to a Pole in any way, if it's connected to a pole then it's a Key loop.

There is a technique of creating a low-poly from high poly by deleting fills. Of course leave some fills to define the form.

*Last edited by mister3d : 07-22-2008 at 11:30 AM.*

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07-12-2008, 05:11 PM

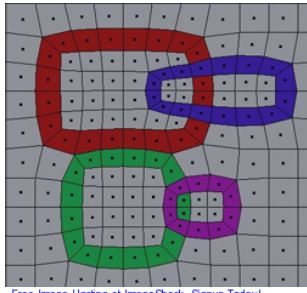
#3

**mister3d**

Join Date: Apr 2008  
Posts: 18

TYPES OF LOOPS

C-loop(extrude loop)is very frequent and used 90% of the time. Most of the time you just extrude and then tweak.(pic1)

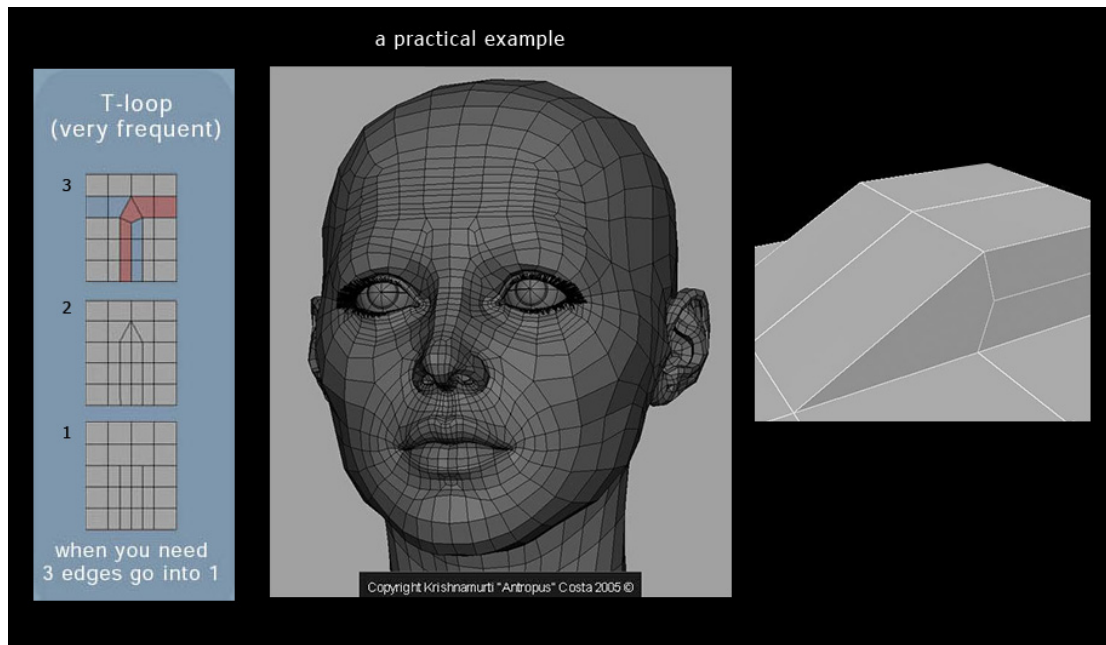


Spin loop is also very frequent, especially when creating a more natural muscle flow by spinning its border edges.(pic2)

### A SPIN LOOP

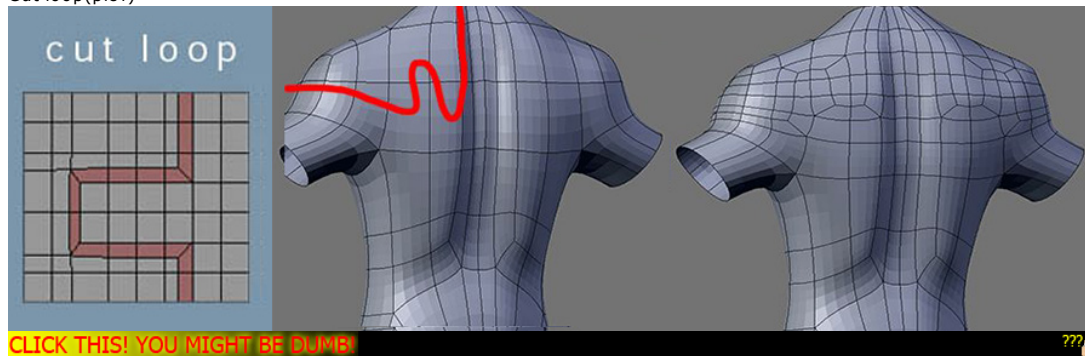
T-loop is very frequent and happens often when you need 3 edges go into 1, but also for wrinkles, folds and so on. Use t-loop If you need a triangle somewhere, so you use the N-pole, since you can shape it in a triangular fashion, but is still a quad. And that is what makes T-loops so powerful: the triangle like quad is aligned on the grid.(pic3)



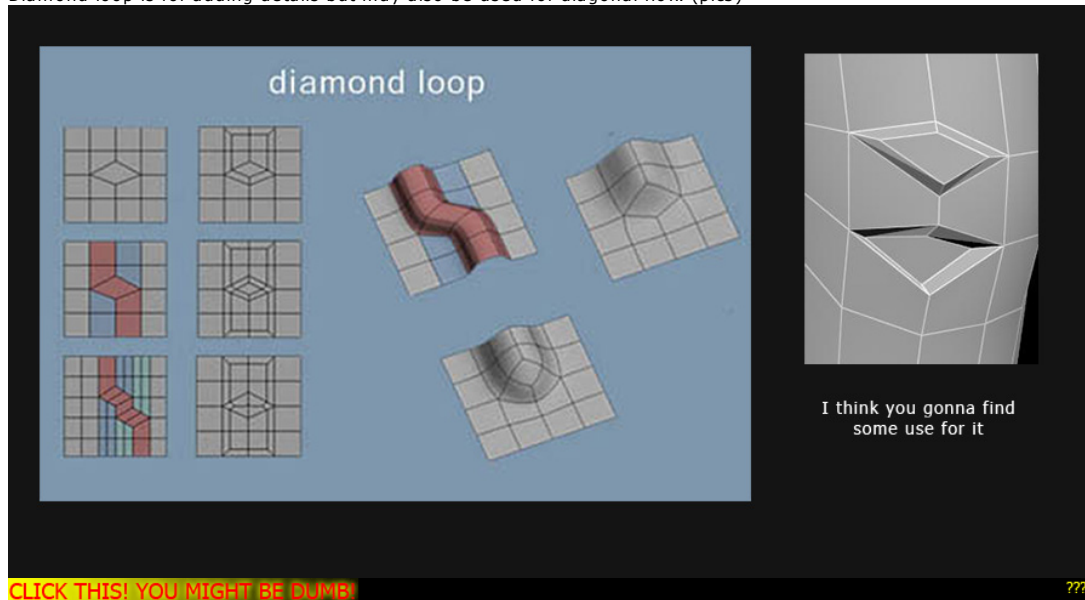


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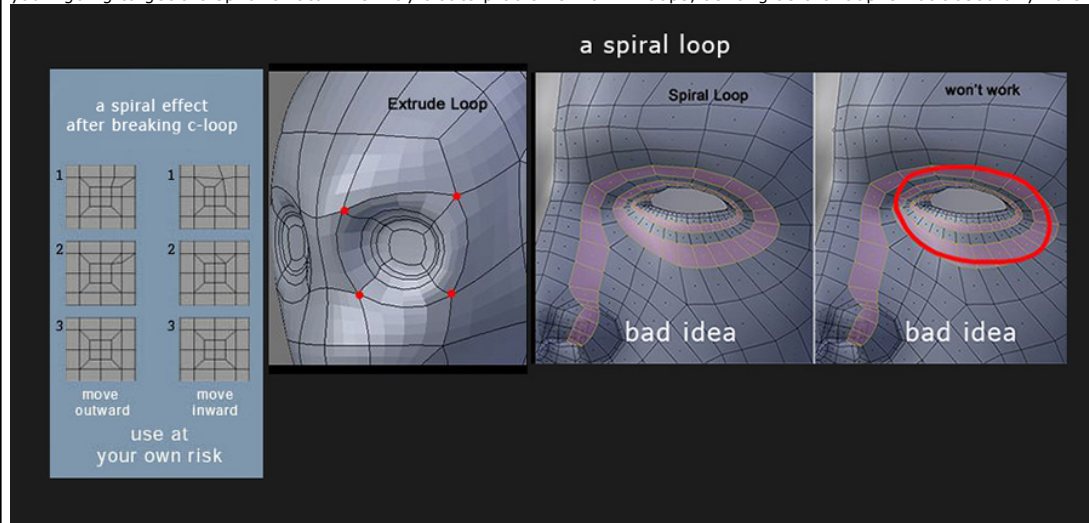
Cut loop(pic4)



Diamond loop is for adding details but may also be used for diagonal flow. (pic5)

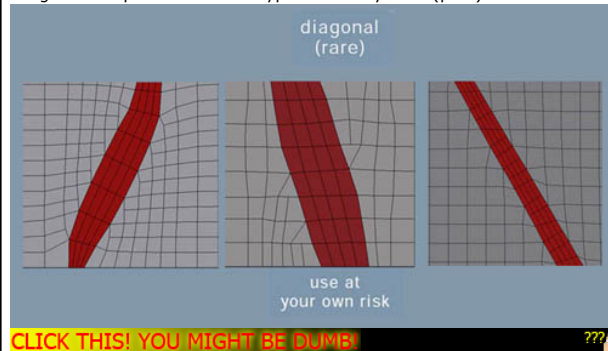


Spiral loop. It is so rare that you hardly will see it anywhere. Maybe it is cool for spiral horns or something. But not for circular edgeloops. Deforming the area could be a problem. There's not a type of muscles that travel in spirals in reality. Once you break the extrude Loop you'll going to get the spiral effect. This may create problems with fill loops, as long as the loop is not closed anymore. (pic6)



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Diagonal loop. There are 3 types of. Very rare. (pic7)



Last edited by mister3d : 07-21-2008 at 07:47 PM.

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07-12-2008, 05:21 PM

#4

mister3d   
SDM User

Join Date: Apr 2008  
Posts: 18

MOVING POLES

This is the heart of this thread as long as it teaches you how to manipulate the poles. To be a good organic modeler, it is imperative to know how to move poles around, change their direction and remove them.

Moving poles is not a detailing technique, but a cleanup and flow-directing technique. Instead of saying "Now where should I move the pole?" you say "Now where should I EN the grid?" because that's what you are doing.

The way to eliminate a pole is to move it next to another pole of the same type (pole or face) and eliminate both at once.

One way to eliminate a pole on a symmetric mesh is to move it to the line of symmetry, then merge it with its twin.

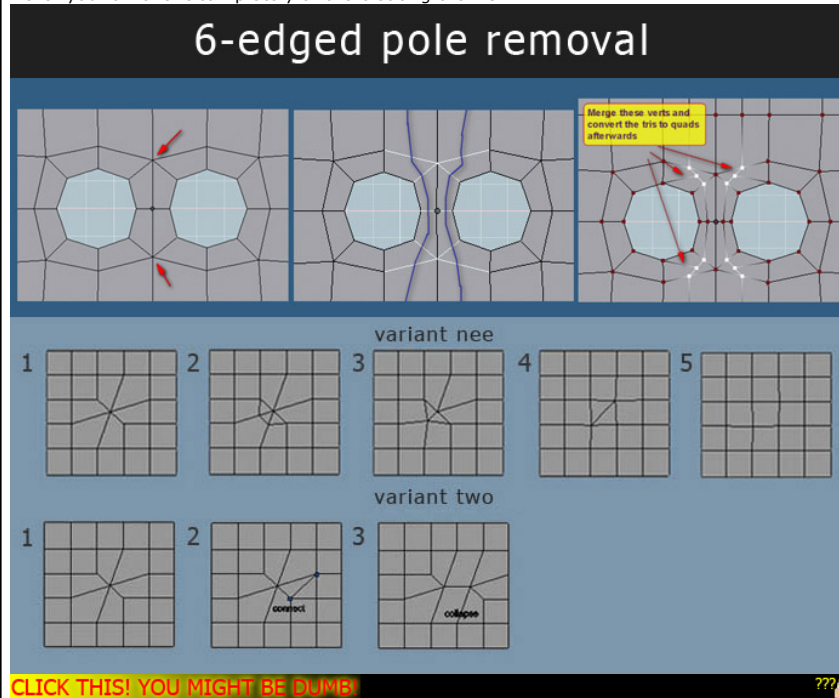
Another way to eliminate a pole on a symmetric mesh is to start a new pole on the line of symmetry and move it to the pole you are trying to eliminate, then eliminate them together. (provide an example)

After this thread you should be able:

- Eliminating 6-sided poles v
- Moving, flipping, bending, removing EN's (a pair that comes in extrude loops\cut loops) in 4 directions and diagonally (flip N's) v
- Moving and removing single (isolated) E's (e.g a pole of a mouth) v
- Moving and removing single (isolated) N's (e.g a box corner) v
- Creating cut loop for detailing and correcting it (Flipping N's of EN's is the same), and using the diagram for changing it's direction v
- Moving spin loops, spin loop mirror effect removal, removing spin loops v

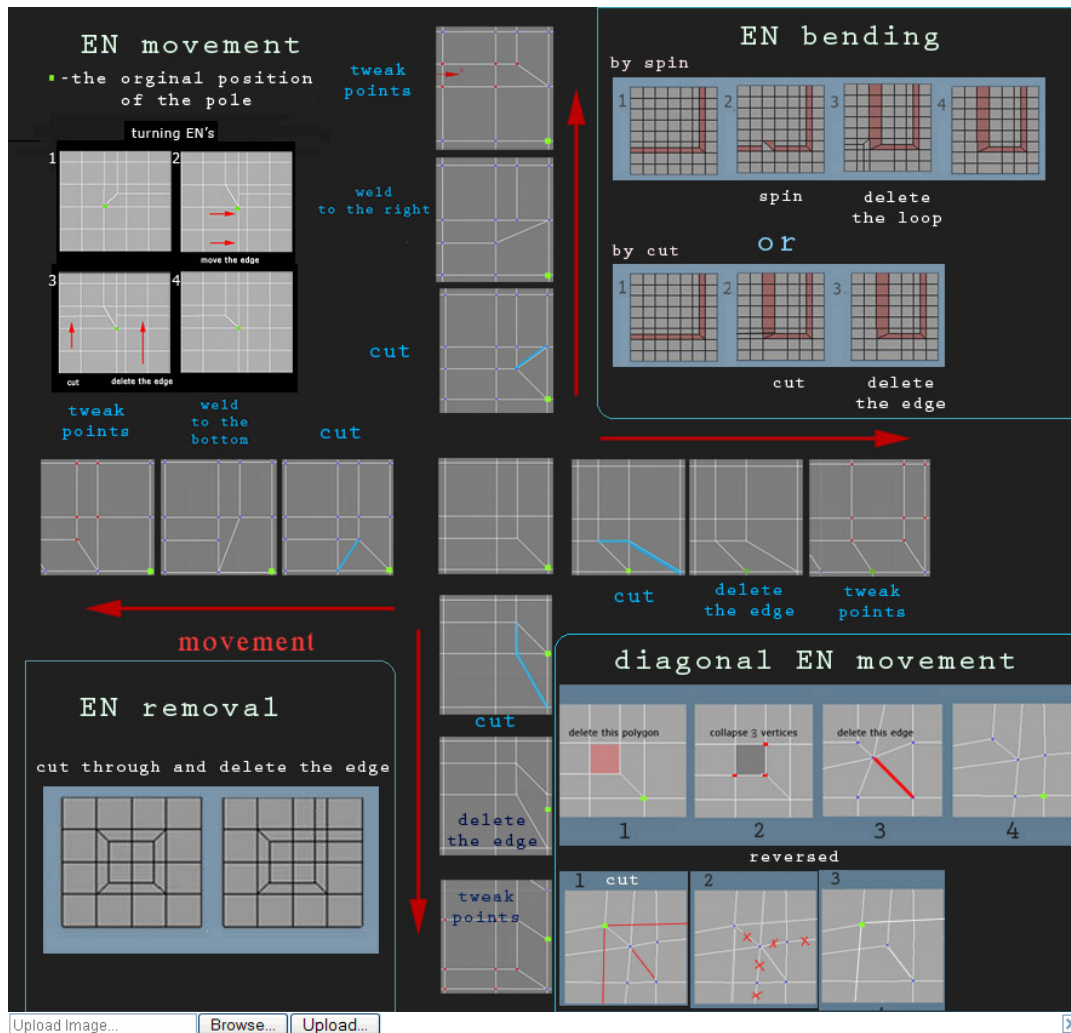
6-edged pole

Either you remove it completely or are creating two E's.



EN's

C-loops are very common, but you can create another types by turning them, and therefore changing their flow. You need to spin an edge and delete some, or cut through.(pic)



**Moving single E's and N's is more complex than EN's.**

It is quite hard to put just one single N-pole or E-pole where you want it. Maybe with the poly by poly method it could be quite possible, but it is virtually impossible to place either as a single pole.

**Moving E's**

Pay attention to the Es because by shifting one back and forth you can achieve predictable flows. There is no guesswork here(see Key concepts - "poles control the flow").

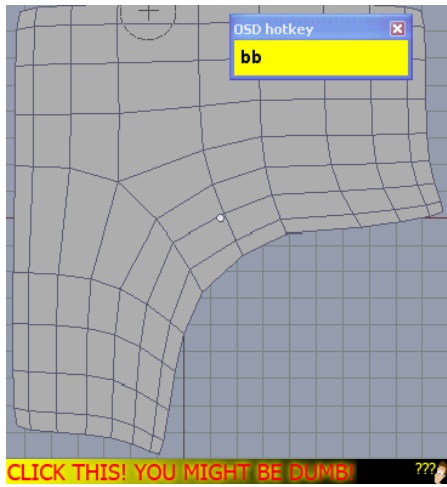
The Es often form the structure for an extrusion or maintain loops, so I'm not sure why would you need to completely remove a single E, but if you need you can move it to the border of the hole, though many edges will be added.

An E Pole has 5 edges and all you need to do is take one of the 5 edges and rotate it, that is in theory. In practice what you do is delete it which will remove the E pole and you are left with an Ngon. Rebuild the Ngon and there you have it. Literally you can move the E in any of 5 points of Ngon now. The choice is up to you

You can also turn the quad into 2 triangles and after this the combinations are endless

The same key idea can be used in reversed, as long as cutting through we treat the 2 triangles.

If you need 2 E's on one line, simply delete the ring between them.(pic)



### moving single(isolated)E's

**1**

delete the edge

**2**

now move wherever you like

### moving 2 single(isolated)E's to one edge

**1**

delete the ring between them

**2**

### moving single E's diagonally

connect the vertices

the two triangles appear

... and then you can

delete edges

moving down

moving down

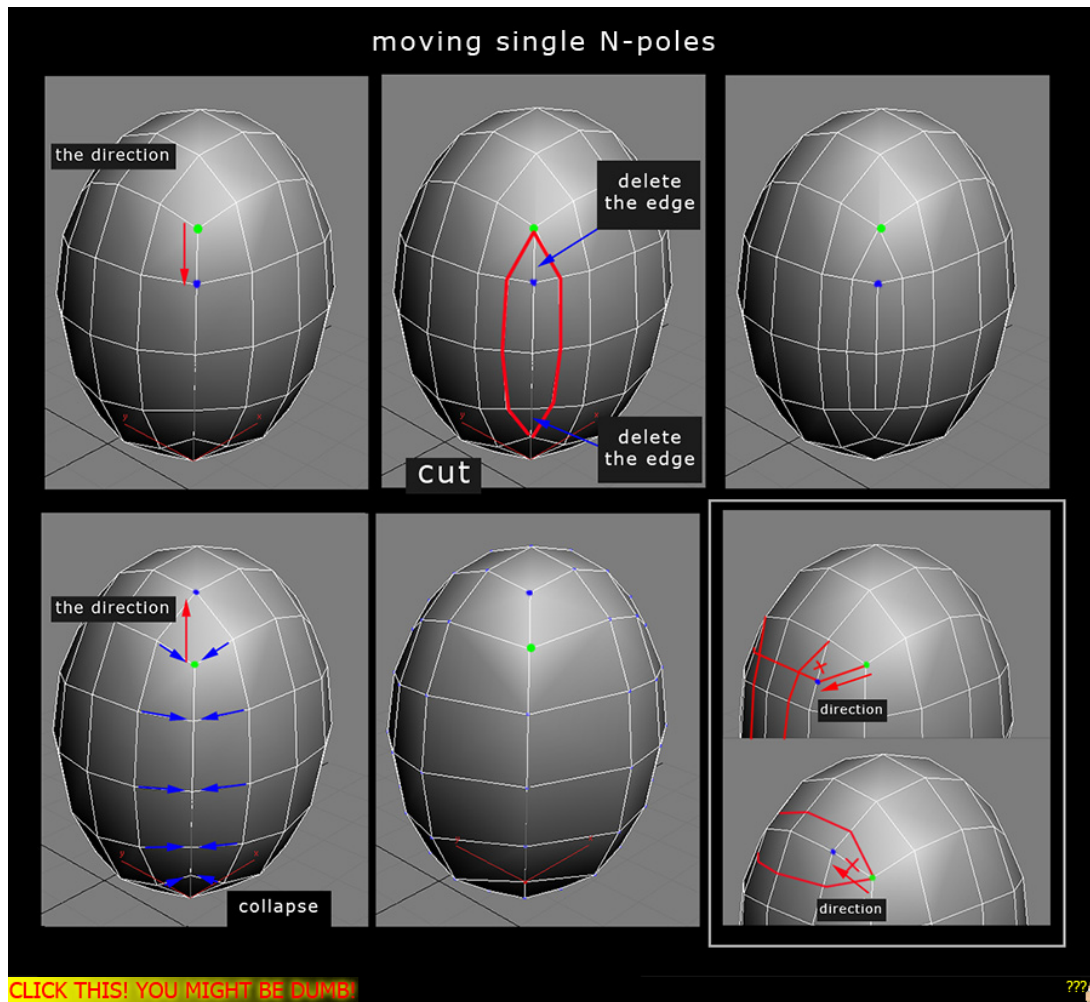
### reversed

the 2 triangles appear once again

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Moving single N's

A good example of this is the N Poles for the forehead and the back (if you started with a Box that is). For the forehead you hide it inside the eye and for the back you hide it inside the ear. The way to remove it is to move it to a hole (terminator). The single Ns can be moved to where they are unimportant.(pic)



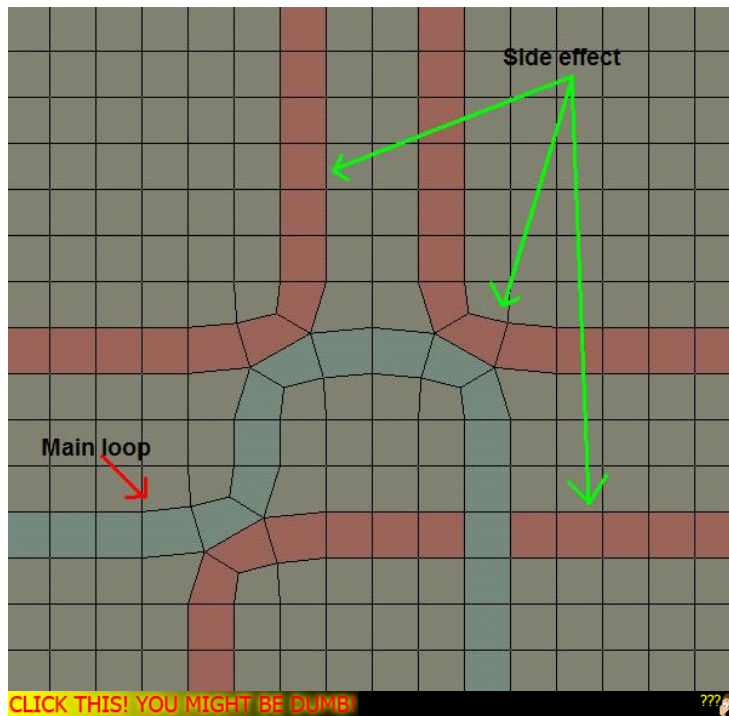
Spin edge loop

There are 2 examples of moving spin poles, I'm not sure about moving in 4 directions, maybe it's easier to revert it and create where you need it.

They can be moved by spinning the green edges (see the pic) or by collapsing points, and are moved by one row down and left or by one row down.

There are two problems to this spin pole technique and they are:

- 1: The mirror effect.
- 2: The NPole



These two problems can be solved by unpoling the Npole and once that Npole is gone the rest will be gone.

Spin loop (can be closed, though produces additional poles, which can be deleted by collapsing. So you get an extrusion loop without an actual extrusion.

**moving spin edge loops**

variant one

spin any green edge

variant two

connect

collapse

**spin edge mirror effect removal**

...one more time

Cut through the red and blue. These join the blue corner afterwards.

Just move loop left

Let's assume that this is the main loop that should be marked by spinning.

**spin edge removal**

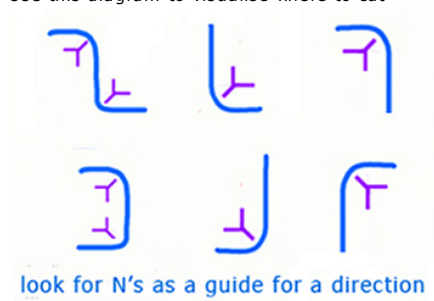
spin again till you revert it

or delete the edge with N

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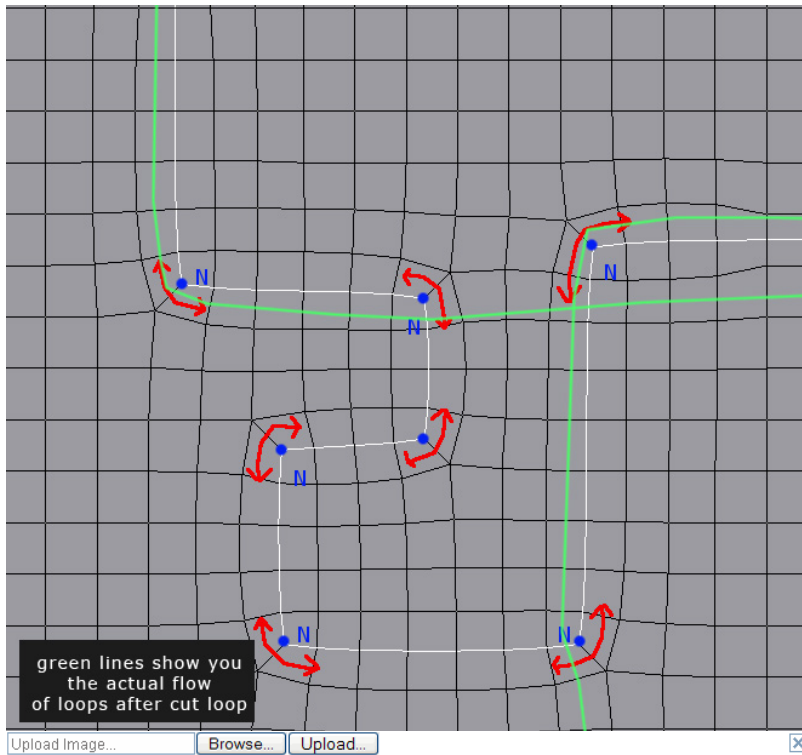
**Cut loop**

Use this diagram to visualise where to cut



Cut loop is good for loops other than c-loops, but needs a correction as long as it is not "real" loops by default - it is discontinuous. The center edge loop is not really a continuous loop because it terminates at each N-pole.(pic)





So it needs to be corrected, and that's how it's done(pic)

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### cut loop correction

1 2 3 4

collapse delete

flip N's  
(with this technique you can move poles)

the desired result first you extrude then flip the N's

There is a dirty way of correcting topology with cutting through, triangulating, whatever that works, and then cleaning up It's just

important to visualize(in your head at least) how you want it to be, cut through, and then clean up. Of course it's better to plan the topology ahead, but who cares, the result is what matters, planning will come with experience,. See <http://blenderartists.org/forum/show...t=93651&page=2> for practical examples.

Last edited by mister3d : 07-22-2008 at 12:07 PM.

QUOTE QUICK

07-13-2008, 03:21 AM

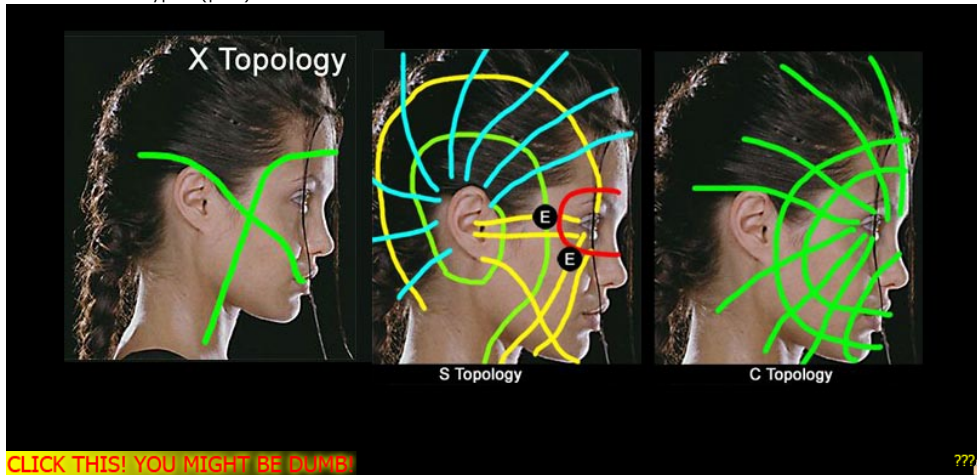
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mister3d  
SDM User

Join Date: Apr 2008  
Posts: 18

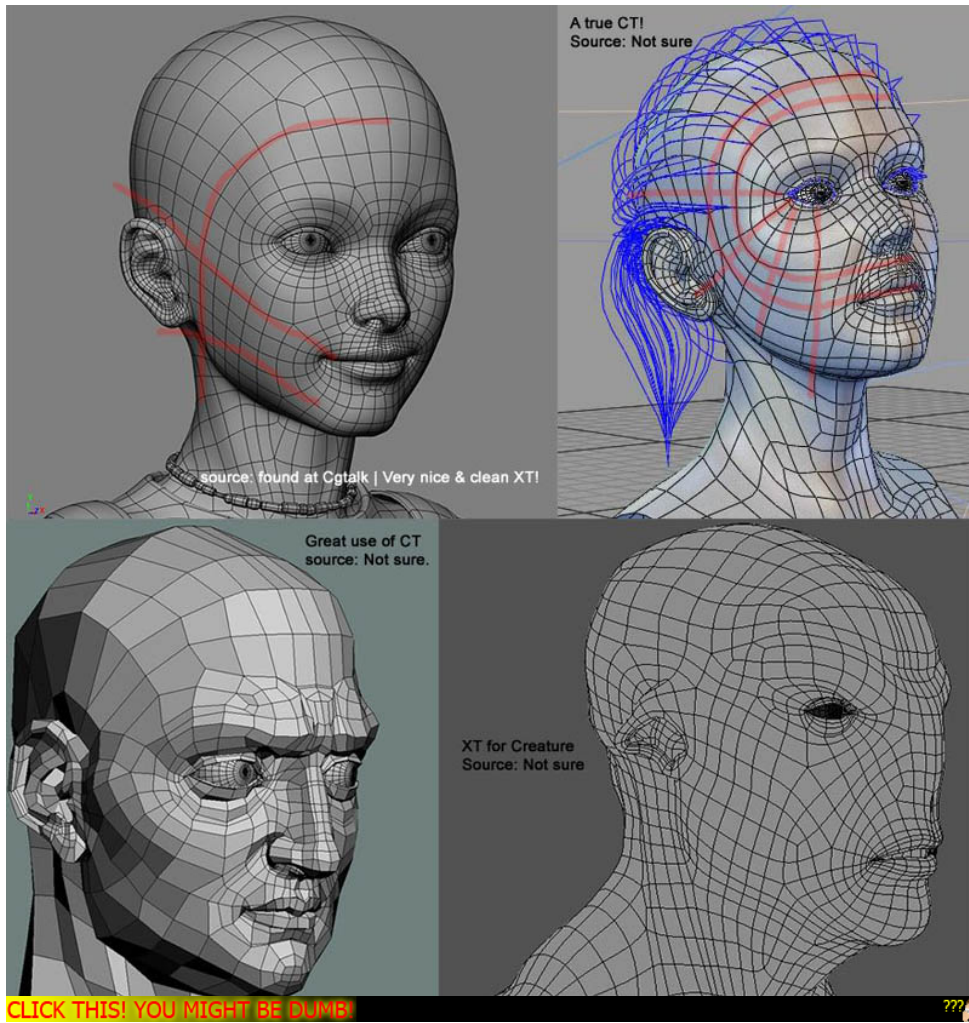
TYPES OF TOPOLOGY

Loops should follow muscle structure, but also depend on a character's features - less or more pronounced and so on. Experiment with these different types.(pic1)



C and X are all you need and from there you can adjust and adapt.

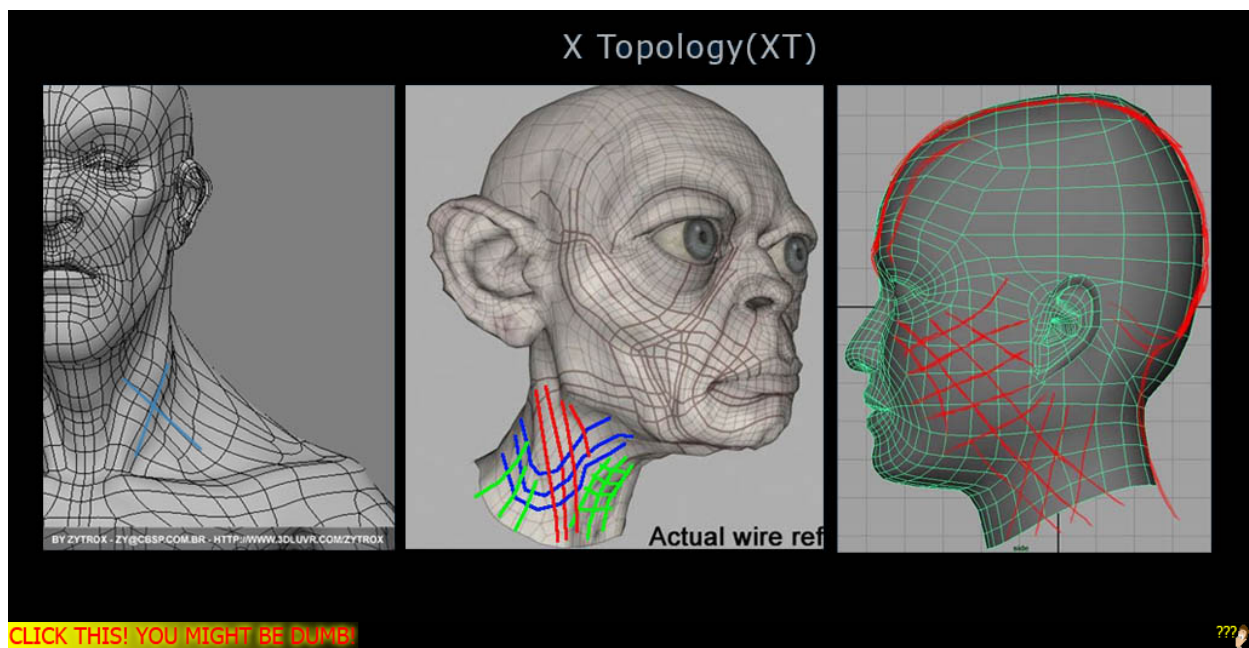
C-Topology is easy, fast and very common, perhaps it is suitable for cartoon\amine models. C has no pole around the cheek and that the X has one Epole between the ear and eye. This is one more example how a pole or poles defines topology.(pic2)



But X-topology better defines the jaw area by its N-pole, and perhaps the general form, and preferable for realistic models. S(spiral) topology is not that common but it's there for anyone who wants to get fancy with Topology. (show how to create)

By moving poles you can create new types.

X-topology is also important in muscle\organic modeling as long as it often follows the muscle flow more naturally. For example, X topology shows its superiority in neck muscles modeling, resulting in a more natural flow. X topology is just a more natural muscle flow than simply cylindrical as long as muscles often don't go straight.(pic3)



Beginner vs pro topology observation:

Even though the form looks correct to the layman, that the beginners mesh lacks the added complexity of the professional mesh. The acid test is when you model a muscular monster. All noobs flunk this test and the professional modelers stands alone here... BUT NO MORE!

You keep forming adding form and topology until you hit this wall: anatomic detailing. Here is when most beginners stop, that is why you see so much young female heads only on the net. A young female head is smooth and has little topological complexity. But try to model an old female with wrinkles running across at and angle on her face, certain boney features petruing through her skin, floppy skin, then the beginner is lost here.

*Last edited by mister3d : 07-18-2008 at 02:25 PM.*

QUOTE QUICK

07-13-2008, 04:28 AM

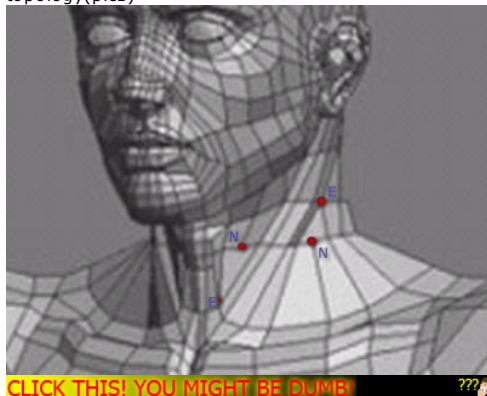
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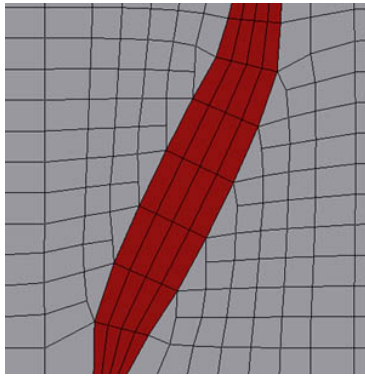
DIAGONAL TOPOLOGY

These diagonal techniques can be avoided with clever tweaking of basic geometry and produce smoother result, and it is preferable. Though for a sake of variety let's take a look at some possibilities. But here's an example of imo reasonably good use of diagonal topology(pic1)



1-st method:

It is achieved by using the spin edge tool performed multiple times like climbing a stair. After each spin edge, you should move one of the E poles to separate the two face loops from each other. Also note that I kept the diagonal edge of each E-pole connected to each other.(pic2)

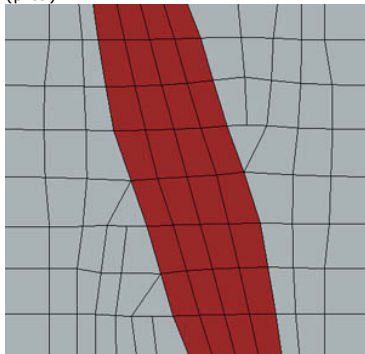


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2-nd method

The following image is done with T-loops. The diagonal topology is hereby achieved by making the N-pole quad look like a triangle and use is to 'paint' the border of the diagonal topology. This method comes with a penalty to the density of your mesh. Maybe it isn't that big a problem to begin with, or maybe it is desirable if you a planning to add detail in the dense area's anyway.... just a point to keep in mind:

I think that this topology is the cleanest of them all because of the orthogonal nature of the T loop. In the example above there are 3 T-loops of course. If this is a little to mystifying, I can explain the procedure, but is far too easy. I think moving pole around is trickier. (pic3)

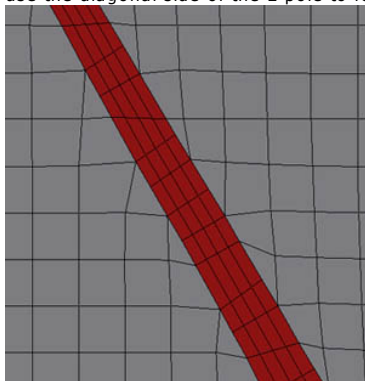


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3-rd method

The last method is quick and dirty, and in my opinion it looks a bit messy. Maybe I should study it a bit more. You can also achieve diagonal topology with loops that almost that are almost aligned with the grid by breaking the grid. It was already explained in this thread. Just make a series of 'diamonds' and you achieved diagonal topology.

As everything else, this method has its advantages and disadvantages. The grid itself is very consistent and not all to distorted, but on the other hand, the internal topology of the diagonal is a mess. use the diagonal side of the E-pole to form the topology,(pic4)



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Last edited by mister3d : 07-18-2008 at 11:30 AM.

[QUOTE](#) [QUICK](#)

07-13-2008, 04:45 AM

#7

mister3d  
SDM User

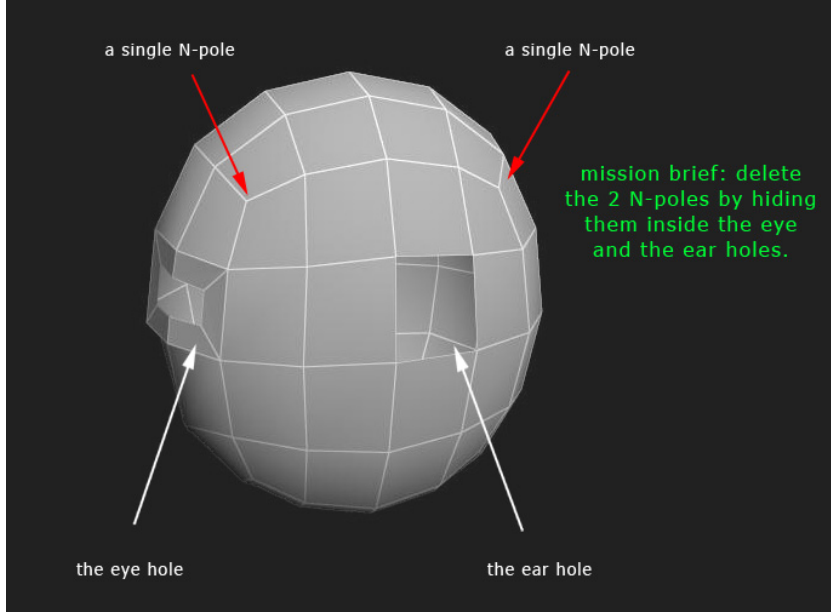


Join Date: Apr 2008  
Posts: 18

TEST YOURSELF

I believe practice is the goal. What's the point if you just read and do nothing? Here's a list of exercises and questions.

Moving a single N-pole: hide a single N-pole of the forehead inside the eye and a single N-pole of the back inside the ear.



Upload Image... Browse... Upload... X

to be continued.

Last edited by mister3d : 07-22-2008 at 09:57 AM.

QUOTE QUICK

07-16-2008, 01:37 PM

#8

TheOutsider  
SDM User



Join Date: Jun 2008  
Posts: 1

Hey ... Very nice idea...Sometime ago I was reading all thread about Pole, and I have liked to have this thread with us ...

I will follow this thread and I will try posting test ( about exercises ).



Thanks for posting.

QUOTE QUICK

07-17-2008, 04:23 PM

#9

mister3d  
SDM User




Join Date: Apr 2008  
Posts: 18

Quote:

Originally Posted by **TheOutsider**  
*Hey ... Very nice idea...Sometime ago I was reading all thread about Pole, and I have liked to have this thread with us ...*

*I will follow this thread and I will try posting test ( about exercises ).*



*Thanks for posting.*

Hi TheOutsider, thank you for encouragement, at least somebody reads this. I currently explore Toontje thread and the original one and

will update soon. It just not very easy to organize it fast. So stay tuned, very soon it will become more detailed, especially about manipulating poles. 😊 The exercises will be mainly about moving\deleting\turning poles. The test will be a number of exercises, but I think it's not to post the results here 😊, as long as if everybody will do, it will be too long. So it will be for practising by yourself, well, not to expand enourmously the thread. 😊

Last edited by mister3d : 07-17-2008 at 05:03 PM.

QUOTE QUICK

07-23-2008, 05:34 PM

#10



Jimtuv  
SDM User



Join Date: Jun 2008  
Location: Sylvania, Ohio  
Posts: 4

I have been working on this at BlenderNewbies I need help understanding this I am trying to simplify for beginners. If you could please contact me or post on my thread over there I don't want all this information lost forever.

[Poles Loops and Flow](#)

QUOTE QUICK

REPLY

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**The Pole - revised**

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