

Human skin

On the topic of human skin. At the present time I am currently unaware of any software that can render skin as it should be.

These are the difficulties as I see them, in order of importance:

1. Translucency. The fact is that skin and flesh are extremely translucent, and that the top layers have a different color to the lower layers. (In real life transparency and translucency are closely related, but not in computer graphics.) Basically it looks like a layer of white tracing paper on top of ketchup (for people low on melanin). Depending on the strength of the light, more or less will penetrate into the red (in sunlight roughly 4 - 5 mm down), bounce around and light it up. (Also, the teeth and the eyeballs are about as translucent as skin.) This has several effects: to make shadows lighter overall, to increase the range of shadows, to make the lit side darker, to decrease the range in the lit side, and to increase Saturation in the border between light and shadow. (Here I'm using the terms Saturation, Hue and Blackness or Value as they are used in the Alias and Photoshop® colorpickers.) Look at this image: here are two cylinders with a single strong light source coming from the left, one totally opaque like painted metal or concrete, and the other similar to flesh.



So on each we have the lit side, the border, and the dark side. On the opaque cylinder (the left one) we see a wider border, further to the left, and the lit side shows more of a gradation. Saturation drops at the terminator, and Saturation rises and Hue turns yellow in the highlight. (This is what cg skin quite often looks like.) On the "fleshy" cylinder we see a narrower border, further to the right and with a different distribution of its tones, with the lit side flatter, darker. Saturation increases and Hue shifts to red towards the terminator, especially in strong lighting conditions, and Saturation drops in the highlight.

You can see some of these effects if you look at a face with heavy makeup on it, or a latex appliance (as in motion picture sfx). All these details mentioned above are noticed by our subconscious, and we won't confuse skin with makeup, if we get a good look at it in strong light. (This is why the "invisible makeup" is such an elusive goal; any pigment applied to skin will lower it's translucency.)

2. Radiosity. Not being able to use a global illumination model to render skin contributes to the artificial feeling of it. Radiosity effects can be "faked" though, by placing lights or textures specifically to this end, if you have a fair idea of the effect you're trying to get.

3. The highlight. (Skin varies a lot from person to person, and even from one spot on the body to another, but let's focus on average healthy, young facial skin.) What gives us the very special, almost velvety, range of highlights that almost only human skin has, that makes us able to recognize it in blurry black and white photos? Translucency, yes, and apart from that, the texture, of course, but what exactly is it about it? I think "velvety" is a key word here - it is a bit like velvet, except the effect is less pronounced because where velvet has long regularly spaced and sized hairs skin has low regularly spaced and sized bumps (lets call it grain). The grain also helps to increase the strength of the highlight a lot when the light source moves to almost face the camera. Try it with your hand - put a strong light behind you, look at the highlights on your hand (very faint now), then follow it with your eyes as you slowly turn around, until your hand is almost a silhouette. Many other materials show this effect as well, such as wood, rubber, anodized metals, velvet... This effect calls for the Blinn-shader, of course, with its Spec. Rolloff, but it's still not enough to reach full realism on skin.

4. Peachfuzz. Some people have more "peachfuzz" than others, and it will give a "dusty" look to obliquely angled surfaces, and in certain types of light create a thin line of light along the contour of the body or face.

So what can we do to try fake all this? Luckily, Alias has translucency capabilities... unluckily, not in a specifiable color. If you try just making a nice skin color and then crank up the translucence, you'll get a grayish terminator, very ugly.

So I cheat by using a bluish very wide highlight over a very orangy skin tone: Blinn, Diffuse 0.7, Spec HSV 201 1 0.24, Rolloff and Refl 0, Ecc 0.68, Color HSV 21 0.74 0.9, Translucence 0.2, Transl. Depth 0.001 (depends on the scale of your model). This makes the shadow border "hotter" than both the lit and dark sides. Sometimes, for some scenes, using a slight reddish incandescence (but be careful not to get a glow in the shadows), and putting a reddish color in the spotlight's shadow color maybe. Experiment!

On it's own this puts a too orangy edge along the side closest to the highlight, so let's add a layer that tones the saturation of the edges down: another Blinn, same Diffuse, Spec HSV 201 0.43 0.9, Rolloff 0.26, Ecc 0.35, Refl 0, Color HSV 21 0.2 1, Translucence 0.16, Transparency mapped with sCloud: Color1 0, Color2 1, Contrast 0.3, Soft_edges on, Transp_range 0.186, Center_thresh -0.465, Edge_thresh 0.53, Noise Amp, Ratio and Solid Noise Freq all zero (to make it smooth), Rgbmult V 1, Rgboffset V 0.3.

By the way - A good color and bump map won't help as much as you might think... and adding bumps will only show up the lack of translucence - unless they're added on a more or less transparent higher layer.

Skin shader examples



Here are just a couple of examples of what can be done with skin shaders. For example, notice the image on the above left -- this is a typical example of normal, healthy human skin. In the image on the above right is the same 2 skin layers (as in the image at left) however, this time with an additional layer that gives the effect of black nylon stockings, a Blinn with Diffuse 0.55, Spec V 0.1. Rolloff and Refl 0, Ecc 0.3, Color V 0.15, Transparency mapped with sCloud: Contrast 0.4, Soft_edges on, Transp_range 0.3, Center_thresh -0.14, Edge_thresh 0.5.

Notes

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