

Len Goldman on Panoramic Photography for Real Estate Part 1 of 2

Transcript of Interview 11 December 2008

Len Goldman (LG) interviewed by Denis Knight (DK)

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This edition released: 13 October 2009

Len Goldman is a professional real estate photographer from Canada who specializes in high resolution virtual property tours using 360° panoramas.

Len's indoor panoramas are notable for their elegant lighting and for the clean straight horizontal and vertical lines that he's able to achieve.

Visit Len's website at customvirtualtours.ca or email info@customvirtualtours.ca

DK: Let's talk a little bit about the equipment you use. So you have a Nikon D60 digital SLR camera. What type of lens do you use?

LG: Well I use a standard lens on it, which is an 18-55mm VR, which is a vibration reduction lens.

DK: Yep, and when you're shooting your virtual tours, do you zoom right out to the 18mm?

LG: Yes I do. That's the only way to do it.

DK: So with that camera, what made you choose that particular make and model?

LG: Well, we had Olympus originally. And my wife who does the photos, not the panos, was using a point and shoot digital SLR, a Fuji. And we decided we were going to upgrade, and looked around at different cameras and different price ranges, and felt for what we could see, that it was a toss up between a Nikon or a Canon, and it was just really more what we could get dollars and cents and features at the time for the money, and we don't expect that the D60 will be our last Nikon. We expect to upgrade from there as well, but for the features and the dollars it was a really good camera.

DK: So basically you were just looking, generally speaking for the quality of the photos. You just wanted the best quality for a reasonable price.

LG: That's right, and we wanted something with, somewhere at least, and it's not necessary, but to get the higher resolution that we shoot, we wanted to have something with about 10 megapixels, and this camera fit the bill. It also had some standard, it's got a lighting feature in it called D lighting, which actually for doing real estate photography, where you've got so many different kinds of lights and shadows within a room where you're doing a 360, the D lighting, basically what it does automatically, it is kind of blend the different lightings that you have within a particular area of the shot. My wife had a D40 Nikon before we upgraded hers, and it didn't have the active D lighting as standard, and it just didn't work as well as the D lighting, and that's a really nice feature of this camera.

DK: That's great. That sounds really good.

Now, your tripod. You have a Manfrotto tripod. Was there any particular features that you needed in a tripod for this type of work?

LG: It was heavy! And actually the first couple of months I used it, I think I built up the muscles and had a bit of trouble dragging it around, because it is a heavy tripod, but learning this business at the beginning from someone who had been in

the business previously, who I actually bought the tripod from, says you need a heavy tripod. And the reason being is that you might be in a home, and the floor might not be that solid. I mean you can actually go around it and you can have a little bit of spring in the floor.

Having a very lightweight tripod would not be really good for taking your panos, so having a really heavy tripod keeps it solid when you're doing your pano.

DK: So, with the panoramic head. For beginners who might not know what that is, can you tell us a bit about what that is?

LG: Well, the panorama head is attached to your tripod, and it has different increments as you're going around in a three hundred and sixty degree circle, that it will stop at different increments so that you can take a series of pictures that you will stitch together to make your panorama. So an example, the head I have stops at increments of 30 degrees, so I'm able to take 12 shots, to make a complete 360 degree circle or panorama that I was able to stitch together.

Now there are other pano heads that you can use that you can adjust so that you're only taking eight pictures, or ten pictures, or six pictures. It really depends what you want to do, and also what kind of a lens you're using will have a difference on how many increments or how many pictures you may need to take to get your full panorama.

DK: And the camera is mounted in the head vertically, so you turn it 90 degrees?

Well the camera is actually in what they call the portrait position, which is the up and down position, versus the horizontal position or the landscape position.

So this way, when you're taking your shots, you're getting a more higher and lower end. Otherwise if you're shooting the other way, you'd be getting a wider picture, but you wouldn't get the height that you would need.

DK: And I think you told me before that your panorama head is a custom made head. What does that mean?

LG: Well, basically you couldn't go out to your local store or stores that sell panorama heads and be able to get one the way we have it. The company we originally learned how to do our, or buying our stitching software from, sold the heads and the nice thing about them is you can line them up so what's called the nodal point or the center where everything comes in, so that when you're going around and doing a panorama, that everything sort of is equalized. You asked me one time about why our horizons and such seem so straight and it's important to have a correct nodal point in which your camera and your lens on your pano head so that you can achieve that type of quality.

So then, they had probably 50 or 60 different cameras already in, with the points already set, so when I got this tripod head, having a Nikon D60 I knew exactly where to set it on the head. So I didn't even have to do any computing to figure out where the nodal point was. There are other heads that you can certainly get, there's a lot of good ones and professional ones. There's even motorized ones now that you could use, and basically they are not that expensive to get a hold of. You can probably get one for about 99 dollars US and up from there that can do a fairly good job, and I've heard of people who are making their own out of wood, too.

DK: Ok, let's talk about lighting for a minute. You use a Nikon Speedlite 600.

LG: That's correct.

DK: And what's the other special attachment that you use for that?

LG: It's called a Lightsphere. And it was developed by a gentleman named Gary Fong. He's got a web site, it's garyfong.com I believe. And he basically is a young guy who retired early and started making gadgets. He was a wedding photographer for the rich and famous. And basically he came up ... he's got a few different things, but this Lightsphere, what it does is it's almost like an inverted bowl. And it attaches to the top of your flash. And as he explains it, without the bowl on the top, without the Lightsphere, your flash is almost like a flashlight. It's got a very small range of where it actually shoots the light. With the bowl on the top, or the Lightsphere, it actually disperses the light to give you a much more even lighting wherever you're shooting. And I mean I've got a portable photography studio, with all the umbrellas and lights and such. I don't even use it any more, because the quality that I can get using the Lightsphere for still photography is as good as you could get with the whole studio.

DK: OK, now if we can talk about software for a minute. The software that you use?

LG: Well, I use two softwares. The primary one that I use is called Autopano Pro, and it's from a company out of France, and this particular software will batch upload your pictures to make your panos. For example, let's say I shot 10 panoramas, which is 120 still pictures. The software will upload all 120 of those still pictures and will detect all 10 of the panos separately and be able to put them together as 10 separate panos without me doing each one manually.

DK: That must be quite a time saver for you.

LG: Well, it certainly is. In a lot of cases I don't bother using that batch because a lot of times I like to take a look at each one separately, but all I need to do is upload, even if I do one at a time, is just upload 12 pictures, it detects everything

and puts it together. At that point I can crop it or resize it, I can optimize it, I can also ... it's also capable of HDR, which is high Dynamic Range, which is taking 3 photos, one at the zero point, one overexposed by two lets say, and one underexposed by two, and taking the three together, and the high dynamic range what it does is it blends the three together for the best optimized shot. For example, in case you have trouble getting a shot out the window. So you can actually take three shots, one that's under, one over and one right in the middle as far as exposure and expose it for the window and expose it for the inside of the room, and the software will blend it all together to give you a really nice shot with the exterior window shot being able to see out it as well as the inside not being too dark.

DK: Do you use that HDR very much in your work?

LG: Well, I haven't been using a lot of it. I do use it in situations in a particular room, it might be that I'm not getting out the window the way I want it to, so I will use the three exposures. But I don't use it on every panorama. But I am now getting to the point where I'm getting more into the HDR. And before I start using it with my clients more on a regular basis, I'm experimenting with using the HDR and doing the three exposure shots in a panorama and getting a little better acquainted with it. The nice thing about it is you don't need to use any flash if you're going to use that method of taking a panorama or still pictures. And you can get a very very magazine sort of look to the photo or the panorama, more professional looking in a sense, if you're not using any type of flash. Those are the only two methods really to do the panos, is either using flash or using HDR, it's really the only two ways you can really do it properly.

DK: And the other piece of software that you use?

LG: I use something called Panorama Studio. And the one thing about Autopano Pro, and they've got a new version coming out in January or February. If it stitches well, it really stitches well. And you don't see any seams, and it blends everything beautifully. But there is the odd occasion for whatever reason the pano does not stitch well and if I've played with the adjustments on the program, or I don't want to spend a lot of time playing with it, I use Panorama Studio, which uses a different method of detecting the 12 pictures and stitching them together. And it's a much easier program, and one that I'd recommend for a beginner to use before they would use Autopano Pro.

DK: So Panorama Studio is the easier one, and Autopano Pro is the main one that you would use to start with but if that doesn't work you can try the other one and you might...

LG: I use the other one to save time. Because I can easily do it with the other program. There are things that it doesn't do as well as Autopano Pro. And in some cases if you need to catch that panorama, and I don't want to spend a couple of hours trying to tweak it, if it becomes a real major problem, then what I will do is just use the Pano Factory and see if it works well in that, do my adjustments there and use that pano if that's what I'm doing.

But that's the one, if somebody was going to use one to start with, and they're not concerned about the professional aspects, as much as I am with Autopano Pro, then I would use the other program first. And it's much less expensive to start with too.

***DK:** And you mentioned before another piece of software that you use for editing the images?*

LG: I use something, I mean there's so many different things you could use. You could use Photoshop, and you can use a whole bunch of, Lightroom, but I found ... I mean I use those programs for other things, but for ease of use and a really easy learning curve and a great program for adjusting the pictures, I use something called ACDSsee. And I believe it's somewhere around the 100 dollar mark to get that piece of software, but it is so easy to use, and very easy to edit any of the pictures. Much easier than using the others, and the learning curve is like, you have it for an hour or two and you'll be using it OK.

***DK:** OK, that's terrific. Now let's talk a bit about how you might, in a typical job, how you might approach a shoot. Say a client's called you up, and they want you to come out and shoot some panoramas, do a virtual tour in their home, what's the first thing that you'd do?*

LG: Well, basically the first question, and we deal mostly with the real estate agent, but the first thing I try to find out is how large the home is, what kind of a home it is, if it's a split level, a bungalow, two storey, if there's some acres involved with the property or is it just in a subdivision or a lot. You know, there's just a couple of questions I'll ask. And basically we just go out and when we're there, assess the rest of the home. What I like to do when we get to the home, is go through it and sort of give myself in my own mind, what I'm planning to do as far as the panoramas and the rooms that I'm planning to do. And I don't necessarily shoot the whole house. You know, there's main areas that you will do, and unless the client or the real estate agent has asked for specific areas that I hadn't thought of doing or I wasn't planning to do, then I sort of walk the house and decide what we're doing.

In most cases there's different packages that we offer, being that if we're going to offer four panoramas and let's say 25 still pictures, or there might be 6 panoramas

and 35 still pictures. If I'm in a situation where I need to do a four panorama shoot, then I've got to figure out which four panoramas, which are the best areas to highlight that house in the panoramas that we're going to do. And so what I'll do at that point is once I've gone through the house once, I've had a chance to talk to the real estate agent or the client who owns the house, it gives me a feel for what I want to do and what they want to see in the virtual tour, and that's how I go about getting myself started.

***DK:** Let's talk about getting the home prepared. I saw on your web site, you talk about a home staging service. Do you want to talk about that a little bit?*

LG: Well, Karen, my wife, has had an eye for homes and decorating and that type of stuff, and what we do on every time we went out, is she would end up de-cluttering the house, I mean it would be nothing for her to take all the appliances that were sitting on the counter in the kitchen and throw them in the oven – well, not throw them but you know, put them in the oven so that the counter is nice and clean and neat, and it's de-cluttered. She could also, I mean we've ended up moving furniture around at her suggestion, to make the room look more appealing in the photos and the panoramas. We've removed furniture from rooms. There's a lot of things that the home owner doesn't see because they live in the home every day. And again the real estate agent's good at what they do, but there's not too many who are inclined to be decorators or who could redesign homes to make them look better. So with our panoramas and our tour, we offer that service free of charge, so if somebody wanted to just have their home staged, and a consultation on staging before we come in and do it, or even if we weren't going to do it, then Karen will go in and she'll spend an hour or two and put a report together on what suggestions to make the house look its best for sale.

***DK:** OK, so now you're getting ready to do your shoot. You've selected your first location inside the home, how do you then, what do you need to do to get set?*

LG: Well basically I set the tripod up – in most cases I've actually got the camera on the pano head and on the tripod folded when I go into the home anyway, and I just kind of quickly set up the tripod, not necessarily where it's going to be, just to have everything ready. So basically all I do is set the tripod up in the particular area of the room where I want to shoot, and it's not necessarily that I shoot the panorama from the middle of the room. Sometimes it's better to shoot it from the doorway. Sometimes it's better to shoot it ... and generally what ends up happening, I may take three panoramas within let's say a living room or dining room from different places in that room, because until I've put the final pano together back in the office, I'm not sure which is the one I really want to use, so I'll take them from different areas. It's quite different from taking a still photo and looking at it in the camera and having a pretty good idea of what that's going to look like. When you're doing the twelve shots for a panorama, although in your

mind's eye you have a pretty good idea of what it's going to look like, until you've actually seen it on the computer you're not sure how it's going to come out, and if it's what you're going to be wanting to offer as the best appealing part of that particular room. So I will end up taking three or four panos of particular rooms, even though I may end up using only one. And basically I'm just setting up the camera and making sure it's zoomed out totally. I've made mistakes in the beginning and forgot to make sure that it was totally out, and then the pano is not going to work. I make sure the flash is on. I don't shoot in automatic, but I don't shoot in totally manual either. I've got a mode most digital cameras have that's called a P mode. And so it's a priority setting. So really I don't have a lot to do, it's really make sure it's focused, and the camera will automatically focus. The flash is set for that camera, and it's a through the lens flash, so if it needs more of the flash or less it automatically adjusts, so I don't have to be that much of an expert on doing those things to get the shot to come out quite nicely. Having the nice camera and the Lightsphere helps a lot, but somebody could use a point and shoot digital camera with 4 or 6 megapixels and some kind of a hood over the built in flash to give them a fairly decent looking panorama as well.

DK: OK, so just quickly on that P mode, the Priority mode, is that where you set the aperture that you want and let the camera do the rest?

LG: No. The camera, in the P mode, it's a priority mode, the camera decides what it's doing. I'm not deciding on the aperture of it at all, or the speed or the ISO, it does it almost on an automatic. It's hard to kind of explain the difference between it. On Automatic you have absolutely no control. The camera adjusts everything and if you don't like the way it kind of adjusts, it's how it is. An normally automatic can work, but not as well as the P. If you set it to Aperture priority, then it will, if you set the other things than the aperture will automatically be set by the camera, so on Priority mode, it decides if the aperture should be the priority, or an ISO should be a priority. It decides on it, but not quite as restricted as the automatic mode.

DK: OK, let's talk a little bit about lighting. Now you've mentioned that you're using the flash with the Lightsphere. What about the lighting in the room itself. The room lights, natural light coming through the windows, etc.

LG: Well, the one thing I don't light to do is use interior lights at all. Being lights on the ceiling, or lamps. We have on occasion, but 99 percent of the time I do not. And the reason being is that you end up with lighting that's yellow. Even if you're using a flash with it, you end up the lights ... because every type of lighting is different. Fluorescent lighting is different, and incandescent lighting is different, and the new energy efficient bulbs are different. And so what you end up with, is lighting that turns out to be too yellow. And the yellow lighting looks horrible in a virtual tour. So I use no lighting. I use the Lightsphere and fortunately, the

Lightsphere has a lot of power so even in dark rooms, it lights up the room to give you a very natural looking kind of light. The other thing is, is that if you want to get a shot out the window, again using the proper lighting with enough power, to be able to give you lighting that you can see out the window. That's what the flash will do, is if you're using the proper flash with it, is that you're getting enough light inside the room to offset the sun that's coming in from the outside, so that you don't blow out, they call it blowing out the windows, which gives a white in the windows that you can't really see outside.

***DK:** So if you were in a room that had windows looking outside, you would normally have the curtains open so that you could include that view in the finished product?*

LG: In most of the cases, unless it doesn't have a really nice view outside, or it doesn't have a view. I mean, it could have a view of a construction dump somewhere – we obviously don't want to show that so we will close the curtains. And not worry about seeing it. But again you're going to do a waterfront or you're going to do something that has a mountain view or has a view of a park or whatever outside, or you know even if it's a subdivision, you want to let people know what kind of an area it is, you certainly want to still get the views out the window. Our rule of thumb is, we want to get out the windows unless it's something you don't want to see out the window.

***DK:** Are there any particular locations within a room that you've learned to avoid shooting from?*

LG: Every house and every room is different. We tend to not shoot bathrooms – unless they're big. You don't want to shoot those. I tend to stay away from doing panos in any type of small room. They just don't seem to work, and doing what we call a 180, which is a half a pano, can be done but in a lot of cases they don't come out as well either. I leave that to the still shots, for Karen to do, and get a nice shot of that. Again, we're also restricted – nobody gives me carte blanche to say, Len go in and do 12 panoramas of this house. We're generally restricted to four or six, and sometimes with a bigger house eight, so you've got to choose your panos wisely in a situation like that, to show off the house to the best of its ability. But I don't sort of discount any area of a room. I never know, I mean through experience you learn that sometimes taking a shot from a corner of a room if it's a large one doing a pano, will give you the nicer view than sitting in the middle of the room. So that's why I said earlier in the beginning, I will take you know, three or four panos of a particular area, and then figure out what's going to look the best.

***DK:** Is there any general rule of thumb about what would be the minimum distance that you need to be away from a wall?*

LG: Well, I've been a foot away from the wall and done a pano. Now what ends up happening is most of the rest of the room looks good, but obviously when you get around to the [?] and I'm in the corner, that particular area obviously is just a piece of wall, you're not seeing anything else. But if it's going to help the sale of the house and the look of the panorama by being into that corner, because it's giving you a beautiful view of everything else around you then you don't worry about the foot. But in general rules, you want to be close to the middle of the room if you can. But what I do as well, I will look through the viewfinder and go around and do a total 360 without snapping any pictures, to see what I'm going to get in the view from my camera through the lens. For instance, you don't want to get a quarter of a couch. You want to at least get a good portion of that sofa. But if you're in the wrong place in the room and you're only going to get a piece of the back of the sofa when you go around, then the room's not going to look right. It's going to look too small, and you're going to say, why is there a panorama here, you know, it looks weird because you're not seeing any of the furniture, or just the top half of the sofa. So going around and doing a 'spin' as I call it, or a 360, without shooting anything real quick, gives me a pretty good idea of what I'm going to get in the room when I go to actually shoot the shots.

And the nice thing with digital is, you can just erase it if you're not happy with it.

***DK:** When you're setting up the tripod, are you normally just shooting at normal height, like head height?*

LG: What's considered the correct approximate height is four feet. And fortunately I'm only five foot tall so it's almost my height. My eye is almost perfect into the lens.

***DK:** So four feet, is that what's been found to give the most natural looking results?*

LG: Yeah, the rule of thumb is four feet. Don't forget, when you've got the camera lens wide open, it's getting more than four feet. So in most cases if I set the tripod up correctly and it's four feet, I can manage to get a ceiling height of eight or nine feet within my panorama. I've also been able to get, sitting in the right place, vaulted ceilings of 12 feet. Because of the size of the room and where I'm standing, and the camera is still at four feet on my tripod.

***DK:** I think we know that when you're setting up the tripod, everything has to be perfectly level. Does your tripod have features built into it to help with that?*

LG: Well, the tripod does, but I don't use the ones on the tripod. I do have two settings on my pano head, so when I'm adjusting the tripod I don't have to look at the tripod. People look at me kind of funny because I put the legs of the tripod out,

the tripod looks crooked. But I don't worry about if the tripod is level – I have the good fortune of having the pano head with two levels on it for vertical and horizontal that I can adjust to get the camera perfectly level, and yet the tripod doesn't look level. A lot of people look at me strangely, 'How can you be doing that, the thing's not straight'. And they say, 'You're a professional, I don't want to know', but I do tell them that it's the two levels right on the pano head and I'm able to adjust them and that's great.

DK: Are those level, they're just like little bubble levels like a builder's level?

LG: Yeah, they're just like on your levels that you have for a workshop. They're the long ones and they've got the bubble in the middle. That's all they are. The ones I don't like on the tripod have just a very small circle with the bubble within it. And if you have to work with that, it would take you forever to set it up. We don't have the luxury of a lot of time. Especially agents don't want to be spending a lot of time in a home allowing us to get things as perfect as we want them. They have another appointment, or they want to get out or whatever the case may be. We're also fortunate that a lot of our clients now just send us to the house and they don't even go because they trust what we do, and we just go out and do it and they're happy they don't even have to be here. If you have any students or your subscribers, I would suggest to them that if they're going to buy a pano head, try to find one that's got the vertical and horizontal levels built into the pano head, rather than relying on your tripod.

DK: OK, another question about lighting. How do you check the available light in the room? Do you need to check that before you get started with the shooting?

LG: I don't. For portrait photography in our studio we used to use a light meter. I don't use a light meter at all because it's not going to help me. I don't have the time as mentioned, and I don't have time as mentioned and I don't have the luxury of setting things up in the studio. That's the one thing about they talk about and it's not just me ... Real estate photography is probably the most challenging and difficult forms of photography that you can do, because you ... control, and every situation is different so having the right equipment, and having a good flash is essential ... or now I'm getting into the HDR where I'm not going to depend on the flash will allow me to do a good job and not worry about that because you can go around the room and you can get sun coming in the window and a totally dark corner of the room that ... what can you do? When you get there you can't sit there and start adjusting every single picture and every single part of that pano when you're shooting let's say 12 pictures which I do. And that's why I spend time on the computer with ACDSee for example if I find that I need to do some adjustments on the pictures.

DK: *OK so with the flash, you've mentioned before it's metering through the lens, so basically the camera works out whether it needs more or less flash. Is there any other settings relating to the flash?*

LG: No, I just set that onto TTL, which is Through The Lens, and that's it. I don't do any other adjustments to it because it's pretty automatic with what it's seeing through the lens. I don't suggest for anyone to use the flash that's on the camera. If you don't have a camera where you can add an external flash to a shoe on the top then you're pretty well stuck with what's there, and then again I've mentioned getting some type of diffuser for the top of that to give a little bit better balanced lighting. But if you have a choice to get a flash that you can put on a hot shoe, or some cameras may not have a hot shoe but it has a connection on the camera where you can connect a wire to a flash, then you're better off using external flash, you're going to get much better lighting than you're going to get with something on the camera. Plus, eventually the one on the camera's going to burn out.

DK: *So that would be an important feature obviously when choosing a camera, if it's got a hot shoe or some kind of other connector for an external flash.*

LG: Absolutely.

DK: *With the Lightsphere, I've never actually used one of those myself but I've seen some videos of it on Garry's site. From what I gather there's different ways you can deploy that – you can have it aiming straight ahead or aiming up at the ceiling, and it's got a dome that can be on or off. Can you tell us a bit more about what's the best way you've found for using that for this purpose?*

LG: I always have the sphere pointing upwards. Straight up. And so if I have my camera on the tripod and it's in portrait mode and the camera's kind of sideways so the hot shoe is actually on my right, I will put the flash on and turn the head with the sphere facing straight up. I leave the plastic dome on the top, unless I've got ceilings over ten feet high, then I will take it off. Because it does distribute the light much further into higher areas, as you may have seen on his videos, with the dome off. And when people ask me what it is, what's that dome there, and I say it's for collecting donations!

DK: *I think that's a really clever gadget, and I guess because you've got the dome on top and it diffuses the light around in a circle so if it's pointing straight up, basically the effect is, no matter which direction your camera is pointing, the flash is giving out the same light in all directions, which makes it perfect I guess for panoramas.*

LG: Well it does. Nothing's ever 100 percent but I find, and anybody who's ever looked at our stuff says 'Your lighting is really really good, how do you do it?'

and I can only say that since the Lightsphere, it's probably the best \$50 I ever spent.

DK: OK, so the resolution that you use for shooting?

LG: The camera is capable of 10 megapixels. I set it at what's called the Fine mode, which gives me about 4.3 megapixels, and when I actually look at the properties of each shot, it's probably about 3 meg. So it's using a high resolution but not the highest resolution of the camera I have. So again, if somebody's buying a point and shoot camera, if they've got at least 4 to 6 megapixels, which is pretty inexpensive today, they're going to be able to get a really nice quality and a high resolution as far as the pictures are concerned.

DK: And you're just shooting in normal JPEG mode?

LG: Yes. There was no reason at this point to consider shooting in RAW. I shoot portraits and such and I've done that in RAW because it gives you more control over what you're going to do afterwards on the computer, but for shooting these types of shots a JPEG is just fine. Otherwise you're spending too much time afterwards you'd be spending too much time on the computer adjusting everything, versus in JPEG a lot of stuff is there and it's just some minor tweaking. Don't forget, in most cases what we shoot is being shown on the internet and going into too much detail like that is not really going to show up any better than what we've got right now.

DK: So you said before that you shoot 12 frames. I guess that would vary from one camera to another depending on how wide an angle your lens had. With your particular lens, how much do they end up overlapping?

LG: Well, that's a good question. We're shooting at 30 percent ... I would say we probably overlap somewhere around 20 percent.

DK: So if it's 12 frames that means you're rotating 30 degrees each time.

LG: Every 30 degrees, yes. But don't forget there's also an overlap between the 12 pictures when it stitches them together.

DK: Yes. And when you're doing the rotations, that's all marked out on your panorama head, is that right?

LG: Well, it's not by marking. You see, the nice thing about the head I'm using is, you can feel the stop at each 30 degrees.

DK: So it's like a little click?

LG: Yeah, there's almost a click. There's ball bearings in it, and when it's turning it sort of stops at the next position. And that's a nice thing, I don't have to worry about marking it or doing anything with this particular head. But I'm pretty sure that most of the ones now that you can buy have a very similar kind of feature on it.

DK: *OK, so as you're shooting, you check each shot just to make sure it's OK?*

LG: Yeah, basically through the two and a half inch LCD that's on the camera. I'll take the shot, it only takes a second or two then I can see it in the LCD. Again, that's where I figure out if it's too dark, and I'll take a second one and I'll over expose it by two stops, and I might under expose it as well by two to give me an HDR effect, although I can use two to give me an HDR effect as well. So a particular panorama that normally would have 12 frames could actually have 24 frames or it could have 30 frames depending on how many shots I'll take, and the beauty of Autopano Pro is if I've taken 30 shots, it blends them together as if was 12 shots anyway to give me my full 360 because it's putting the two or three that need to be in one frame together.

DK: *And it does that automatically?*

LG: Does it automatically.

DK: *Wow, that's fantastic. All right, so you've finished shooting your 12 shots, you're all set, you take your camera and everything back to your office, to your computer. What's the next step?*

LG: Next step is, obviously I take the card out and put it in the computer and transfer all of it onto my desktop so it's off the card. I don't like taking anything and using it from the card, as generally it's slow, so I put it onto my hard drive, or onto the desktop. And basically what I'll do from there is, I'll quickly open up the file and look at everything overall because I guess from experience now, I can look at everything overall and say, 'Well you know what I can go right to stitching these together in Autopano Pro – or, you know what, maybe I need to adjust some of these pictures, they're still a little dark.' But in a lot of cases it really depends on the panorama. I might adjust the pictures first and then put them into the program. But I would say rule of thumb, a good 80 percent I won't do anything until I've had a chance to put them through Autopano Pro and let Autopano Pro take a look and see how they're going to come out. Once they're into Autopano Pro and I have, let's say got my 10 panoramas that we're going to do I'll click on each one, because at that point I need to click on it, I need to make sure it's blended properly. If it has blended properly at that point, well great, all I do is I have is it's called automatic cropping feature which will just basically takes the edges off and makes them straight. And then from there, if that works, I do what's

called a Render. I adjust the size, because I can leave the size the way it is but it's faster to upload to the server if I adjust it. So a panorama might be in the neighborhood of about 13, could be even higher, meg that we will do, but it's going to be too big. Our server can hold up to 10 megs, even then it takes a while to upload, so we crop it and it'll end up being approximately 3 meg when it's done, which is approximately 7500 wide by 1500 high. Once I've done that, it's Rendered. I will do all ten of those panos. Then I will look at each one individually through ACDSee to decide if I need to bring up certain features of the pano – to make it brighter, or the contrast, or sharpness. Whatever I need to do I'll adjust at that point. Once they're all done, then I'll upload them to the server and take a look at how they actually spin on the server.

DK: OK, that's great. I think we've covered that pretty well. You mentioned that occasionally ... suppose you found that one or two frames were a bit off, they were a bit dark or something. Would you need to give them a bit of fixing up before you stitched them together?

LG: I again mentioned that earlier. I will scan everything just quickly with my eye, and open everything up and have a look at all the frames, and some of them I will adjust beforehand and brighten them up or even them out a little bit. It comes with practice that you can look at a couple of frames and adjust them to see if they're going to look fine with the other ones. The other thing that Autopano Pro has is they've got tone mapping, which can do some blending. You can adjust brightness and a few other things with Autopano Pro without even using a photo editor like ACDSee which is a nice thing to have as well. But the biggest thing that I find is, once I've uploaded it and I know everything is fine, the only time a run into a problem is if Autopano Pro hasn't stitched it properly and there are some manual adjustments I can do with Autopano Pro to see if I can align things better, but I prefer not to spend the time if I don't have to spend adjusting it. That's why I have pano factory which may not be as good but it might put the panorama together with less adjustments. And it will do less but it will certainly do the job for me.

DK: And then once it's stitched together, I think you said you scale it down to about 3 megapixels [NO, WRONG] and then you load it up into ACDSee to have a bit of a look at it. That final step of doing the final adjustments in ACDSee, are there any particular tools that you use for that within the software?

LG: There's one nice feature, and one of the things that I really like about the program over anything I've look at, you remember in audio, if you think about audio, and you think about a recording studio, they have all these sliders that go up and down, to adjust the bass and the treble and the mid ranges. Well, ACDSee has that same kind of sliders available for adjusting the photos. And I use 5 sliders for the lighter, and 5 sliders to adjust darker. But they've got more than that. And I

use basically 3 of them. And what happens with the lighter ones, if I want to make it lighter I'll adjust the slider up. If I want to adjust the mids ... further into a room, it's a long room and the back part of the room is kind of dark but the front part of the room is OK. Adjusting the mid range slider allows me to only adjust the dark parts that are in the far part of the room. And I've not found another program, especially as easy, to be able to just play with the sliders and be able to adjust the lighting, and bringing up the contrast and bringing up things without making it look pixelated or not looking right. It also has ... what also happens with digital especially when things are getting dark and you have to lighten up, it has noise reduction which is easy to use and things like photo repair, and that's something I use if I happen to be close to a window and I flash it, you can a lot of times see the flash in the window. Using this clone tool I can get rid of the flash and make it look like the outside part of the window and you would never know that I did that. And that's just another thing, having attention to detail when you're doing a panorama that you don't want to see yourself in the panorama, and you don't want to see your flash in the panorama as well.

***DK:** And do you need to sharpen the image up a bit before you put it up on the server?*

LG: I don't. The reason I don't is because it's high resolution, and the way it's up in a full screen on the internet, if it's sharpened to much you'll see what we call aliasing: it's too sharp. And it ends up ... it shakes a bit for lack of a better word, you can see it shaking a bit because it's too sharp. And the pictures that I get with the Nikon and the way it is, I don't bother sharpening it at all. Sometimes on our stills we will, to give it a bit more, but on the panoramas it seems to be a bit of overkill.

***DK:** OK. So then after you've got it all to your satisfaction, you upload it onto your hosting company's servers. Can you tell us a bit about the hosting?*

LG: Well, there's not many hosting companies that can host high definition tours. And the one thing about the company that we do use is, if you look at my panorama, and you look at any panoramas, the way it's done and it's stitched, everything is not totally straight. Everything's a little bit warped or rounded. And I've tried using other servers and they've uploaded my tour, and we still have that rounded effect. The company that we use, I'm not sure how they do things, but the gentleman who runs it is a programmer, and he's able through mathematics and different things, when that tour is loaded on, there's no rounded walls and there's not any of that type of stuff. And I can adjust that with getting rid of barrel distortion and such, but I look at my own tours before they're loaded up, it's just a JPEG image, they're not totally straight, you can see that it's rounded. It's obvious, you've been around a 360 degree circle that things are not going to be straight when they're put together. But yet when they're put up on the server they

end up being totally straight. I have not been able to find anybody else who can do what this company does.

DK: That's amazing. Do they have to do some manual adjustments on each one that you put up, or is it pretty much taken care of within the software that they use?

LG: Whatever they do, they don't touch anything manually. Once I've loaded it up to the server I can look at it immediately and see exactly how it's going to look. And so nothing is done manually, it's whatever software, the algorithms or whatever they're doing, it's done automatically and it's done instantaneously when I've uploaded the panorama.

DK: What's the name of the company that you use?

LG: It's called TourBuzz. <http://www.tourbuzz.net/> And they only host for photographers and for virtual tours. They don't do individual people. But again, they're a great company and again they're very innovative. Right now we have our stills are not full screen, but that's coming in January or February, our still pictures will be as full screen as our virtual tours are. And they're just keeping on the cutting edge, which is important for my business.

LG: As a matter of fact I should also mention that just as of today, Autopano Pro has a book that they've just come out with, and the book is from the people who use Autopano Pro. They've put together a book with 365 panoramic images from 221 contributors in 58 countries. They had 1600 panoramas submitted and they accepted 365, and I happen to be lucky – I'm one of the contributors in the book so I'm now published in a book.

DK: Fantastic! What's the name of the book, Len?

LG: It's through Autopano Pro. If you enter their website you'll be able to see that. I'm just trying to see here. I just ordered my own book. I don't know if you can get to it direct from their website or not. If you give me half a second here I'll just get the email and see if I can find it. I don't even remember which one I submitted, which is interesting, but that's OK. I'm glad it's there, at least I can say I've been published somewhere.

DK: Well, that's great. I'll definitely find out about that, we can put a link to it somewhere. <http://www.kolor.com/buy/book>

LG: All right. I can't find the email, but if you went to Autopano Pro, their site, I think they're advertising the sale of the book. I think it's like 30 Euros, or something to that effect. It's a hard cover, it's a coffee table book, and it looks pretty neat from what I could see.