



Can Kodak really predict how long my photograph will last?

Measuring image stability is a complex science. Making predictions from those measurements is tougher yet. But no organization has spent more time and money in understanding how pictures fade and applying that scientific knowledge to predicting image lifetime than Eastman Kodak Company. Because the best dyes are extremely stable, Kodak, like most companies, uses accelerated testing techniques—such as high intensity light and elevated temperatures—to induce image fade on a practical time scale and then applies tested scientific principles to extrapolate these numbers to the conditions under which images are typically used. But Kodak goes one step further: it also hangs photographs in real homes and offices and places them in albums for long periods of time to make sure that the accelerated test methods really work.

Do those methods always give the right answer?

No. Imaging technologies are continuously evolving, and new technologies often bring with them surprises in how they work. Consumers are using their images in new and diverse ways or may have different expectations on how a product will perform. That's why Kodak regularly talks to its customers, and why Kodak scientists have enhanced and evolved their test methods to take into account both changes in technology and changes in the way people display and store their photographs today.

I've read that Kodak uses different test methods than some other manufacturers. Is that true?

Yes, but let's make sure we're not confusing two different things. The *lower* the intensity of the light used during accelerated testing the better, because that's closer to real world display conditions.

Kodak, like most companies, uses very high light levels for accelerated testing to assess picture lifetimes as quickly as possible. But Kodak also follows this up with longer, lower light level accelerated testing to make sure that the higher levels didn't give misleading values, a problem that photographic scientists call "reciprocity failure." Some companies skip this test because it takes a long time. Kodak runs this test for up to two years to insure data integrity.

But what I think what you are really asking about is not the light level for testing, but the extrapolated light level in the home. In other words, what the pictures would actually experience. And, yes, Kodak uses a lower light intensity than do some other companies, based on decades of research into typical home display conditions.

Why did Kodak choose to use this lower light level for home display?

The simple answer—though it wasn't simple to get—is that Kodak went out and measured it. Since 1987, Kodak has been going to homes like yours, in cities around the world and measuring the illumination in places where people actually display their photographs. By now, Kodak scientists have made over 200,000 discrete light measurements and have a pretty good idea how you display your pictures.

Kodak then chose a value for the light level that represented the 90th percentile—that is, one where only 10 per cent of the home measurements were greater. Said the other way, 90 percent of the home measurements were lower than this value—and your home probably is too (we choose to be conservative in our measurements for the good of our customers). In technical terms, that light level is 120 lux.

But haven't other people measured much higher values, say 450 lux?

Yes, and so has Kodak. But those very bright homes were far from typical. Even 120 lux is considerably brighter on average than most homes surveyed over the years.

There's another problem: many of those very bright measurements made by others were "spot values", that is, one-time readings taken at a particular time of day or season of the year. Spot measurements can vary by five times or more, depending on when you take your reading. Kodak measured its values continuously throughout the day and over many months to include seasonality as well. That's because the light your pictures are exposed to varies in the same way. For instance, is your home brighter or less bright in the winter than summer? To answer that question requires long-term measurements that reflect multiple seasons. Even Kodak scientists were surprised by some readings, but that's why we made measurements, not guesses.

Additionally, Kodak was careful to measure the *kind* of light that pictures were "seeing", because that's very important to fading as well. We used a sophisticated instrument called a recording spectroradiometer. Most other studies have not.

But why not use the very worst-case condition that a print is likely to ever see?

That's a good question and one that gets at the root of Kodak's holistic philosophy of image permanence. Light is far from the only factor that influences how long your pictures will last. In fact, the vast majority of images—greater than 90 percent of them—are stored in the dark, in albums, shoeboxes and the like. What causes them to fade under those conditions is heat or thermal energy. Thermal fade also goes on while prints are on display. Unless you store your prints in a freezer, you can't get away from it. Other important factors that can cause prints to fade are polluting gases, such as ozone and humidity. These can be even more destructive than light.

If you use the worst case condition for light—one that very rarely occurs in homes—you'll not only get the wrong prediction, you can mask other fading reactions that will be far more important in real consumer use. You could even pick the wrong product based on an extreme light fade claim.

That's why, while others were talking about light fade only, Kodak pioneered testing for the full range of environmental factors to which your pictures will be exposed and why our scientists continue to improve testing techniques as new discoveries are made. That's also why, when Kodak scientists were measuring those lighting conditions in homes around the world, they also measured temperature, ozone, and humidity.

By the way, contrary to what you may have read, Kodak *does* report fading at 450 lux light levels—for those products that are likely to be used under those conditions, such as those displayed in commercial or office environments. Kodak also uses a different kind of light for those tests, because office lighting isn't the same as home lighting. Kodak knows that one size does *not* fit all.

Isn't Kodak using some special filter to screen out UV light when it tests?

Yes, as do others. It's just a different filter. Kodak has used a polycarbonate filter (one very similar to Plexiglas ®) to simulate the home environment it measured in the real world. Others use the same light source as Kodak, but with a glass filter. While both filter out UV light, polycarbonate removes more UV and has proved to be a good match to the fade of real photographs hanging in people's homes over the years.

I read that Kodak uses a lower humidity in its testing, but I thought you said humidity was important.

It is. Kodak has always used 50 percent relative humidity in doing its light stability tests, which is consistent with the current photographic standard for image stability testing. That's because those tests are trying to isolate the effect of light alone, and it is a basic principle of good testing to try to separate confounding factors so you know what's causing what.

Kodak also does humidity testing at higher levels to check the specific impact that varying levels of humidity can have on the image, independent of light. Doing multiple tests takes more work, but it gives better answers. The 50 percent relative humidity level is very representative of the average conditions found in the typical home based on our ongoing studies.

Are there other things that Kodak does differently?

Yes, to help provide the most accurate test results possible. For example, Kodak does its testing for ozone stability without putting the picture in a frame or covering it with glass, which can keep harmful gases from reaching the print during testing. That's because we know many of our consumers display at least some of their photos without glass, like posting a family picture on your refrigerator door. That's a tougher test than protecting the picture in a frame, but it's what people really do.

Speaking of ozone, we also perform light stability testing differently than most other companies by specifically making sure that even trace amounts of ozone are excluded from the light fade chamber. Separating confounding factors is especially important with inkjet materials and we've learned that even trace amounts of ozone can give misleading results in the light fade test. We now make sure there is no ozone in the light fade test (or any other polluting gases for that matter) so that we can clearly see the effects of light fade only when running a light fade test.

When you say that my picture will last for a certain number of years, just what does that mean? Will it just suddenly go bad?

No, but that's a very complicated question because the answer depends on what people perceive and what they expect. A museum curator might be alarmed if there is a just noticeable difference between the original and displayed photo. But many of us would be happy as long as the picture still looks good hanging on our wall.

When faced with a complicated question like that, Kodak scientists do what they've always done: they show people real photos, and ask their opinions. In this case, we showed 320 people more than 3,300 pictures each and asked what they thought. No other organization has done such extensive testing, and some of the answers proved surprising.

Kodak researchers then used these results to develop a scientifically rigorous set of criteria to determine when a picture is no longer acceptable to consumers. Because the scientists wanted to be cautious, they proposed backing off a bit and adding even tougher requirements to take into account the different ways some new technologies fade.

Do other companies use different criteria? Why?

Yes. Some cite research that dates back to 1942—but a lot has happened since then, both in how we understand human perception and how new technologies work. Other companies—including Kodak—have used a set of “illustrative” criteria, that is, ones that were written to illustrate how the methods work, but not based on rigorous tests. They're not necessarily wrong, but we can do better with real data available today.

Should there be some kind of a standard so everyone tests the same way?

Yes, although testing for image stability as well as predicting print longevity is very complicated. Because of this, it cannot be simply boiled down to one single number based on one environmental factor such as light fade. ANSI and ISO are the two independent organizations that are looked to for standards in this industry, and work is ongoing – led in part by Kodak scientists – to produce new standards applicable to the new digital print technologies.

Do you have an idea how long it will be before a new standard is completed?

That is difficult to predict because the new digital printing technologies are changing quite rapidly. One thing is clear to Kodak, however. We support standards that are backed by scientifically derived studies and reflect how consumers actually use their pictures. It may take a little longer to get the right answers to create the right standard, but that is the technically and scientifically correct way to do it.

If Kodak has made all these measurements in real homes with real people over all these years, why do other companies continue to use different tests?

That's another good question, but one you'll have to ask them. For years Kodak has published its data in leading technical journals where it has been subject to careful review by image scientists, so other companies are welcome to share Kodak's measurements and testing techniques. Not all companies take the time to publish their findings and to learn from peer reviews.

Kodak wants to give you the information you need to choose the products that will work best for you. We provide this by basing our tests on real world measurements and reporting all the important factors that could affect the lifetime of prints. It's also the right thing to do, and one of the reasons that people have trusted their images to Kodak products for well over a century.

