

Proper Avian Lighting for Health and Happiness

The Importance of Avian Lighting

Birds may be the most visually-oriented animals in nature. They have one of the most sophisticated visual systems, the largest eyes of any animal (relative to body size) and the highest proportion of brain power devoted to vision. They have often been described as "a pair of eyes with wings".

Birds' ability to see color far surpasses that of humans, as does their visual acuity and the speed with which they process images. In almost all aspects of the visual experience, birds see a world that we can scarcely imagine.

Yet our companion birds often exist in an environment that is unable to support this spectacular visual machinery. Our human homes are lit for our comparatively unsophisticated eyes, and they often leave our feathered companions ... if not "in the dark", then something relatively close to it.



Birds need proper light to find and analyze food; to identify flock mates; to detect predators and other dangers; to regulate daily cycles (sleep, feeding); and to regulate seasonal cycles (migration, reproduction). Yet standard home lighting is inadequate for several reasons. It is far too dim, has poor color spectrum, is often too red, has little-to-no ultraviolet, and is usually placed too low to effectively illuminate a bird's environment. These deficiencies can lead to health and behavior problems such as lethargy (inadequate brightness to fully trigger wakefulness), poor appetite (food may not "look right"), phobias (difficulty identifying objects and detecting dangers), and aggression (cannot recognizing flock mates), stress (from color imbalance), and reproductive behavior (too much red light indicating breeding season).

Moreover, birds actually have extraocular vision, meaning that they are affected by light in ways other than through their eyes (vision). Birds have two glands: the harderian gland and the pineal gland, which respond to light and are, thereby, thought to control things like migration/molting, reproduction, and sleep cycles. And, their visual acuity is superior; avian photoreceptors are 8 times denser than the human eye, allowing them to focus on the entire field of view, all at once.

To address the shortcomings of home lighting for birds, we need to consider the lighting equipment that our birds evolved under: the sun. While most of us can't realistically offer our birds full access to natural, unfiltered sunlight, many options exist to bring some of the key qualities of the sun into our living areas. We simply need to understand which characteristics of sunlight are most important to our birds' visual experience.

Brightness

The most important aspect of avian lighting is adequate brightness. The lighting that humans use in their homes is often hundreds—or thousands—of times dimmer than the tropical sun that our companion birds are used to. Recent studies have shown that birds require five-to-twenty times the light humans do in order to see in color. In general, this means that birds have severely limited color vision in lighting conditions dimmer than those of a clear sunrise or sunset.



Most human homes are not lit to nearly this brightness level. Standard living room lighting is about eight times dimmer than sunrise or sunset. Even the most brightly-lit rooms in our homes—the kitchen and bathroom—are rarely bright enough to fully support avian vision. To make matters worse, humans are generally poor at noticing differences in brightness. Our eyes quickly adjust to low light conditions, giving us the impression that our indoor lighting is much brighter than it actually is.

When buying bulbs, know that the brightness of a light source is measured in lumens and the brightness of light over an area, as perceived by humans, is measured in lux. To give you some perspective: the brightness of the sun at sunrise is 400 lux; the brightest room in your house, your kitchen, is about 300 lux; the brightness of the sun in the tropics at mid-day is about 130,000 lux.

Currently, fluorescent tubes offer the best solution for providing adequate brightness. They can greatly increase the brightness of a room with a minimum of cost or electricity use. They also provide a diffuse light source that mimics the general diffuse, bright lighting of a tropical forest.

Spectrum

Bird's visual ability exceeds ours in many ways, and nowhere is this truer than in the area of color vision. Birds' eyes have four different color receptors compared to our three, giving them an extra

dimension of color perception. Each color receptor is also much more precise than ours, and tests have shown that birds are able to distinguish between colors that look identical to humans.

These visual "superpowers" give birds the potential to see billions of colors, whereas human color perception maxes out at around seven million. This makes birds much more sensitive to differences in the color spectrum of light. Lights that seem adequate for human purposes will likely be seen by our avian friends as quite different from natural sunlight.

The accuracy of a light's color spectrum is often expressed in Color Rendering Index (CRI). A perfect CRI is 100, reflecting the color of midday sunlight. Most indoor lighting has CRIs in the 60s and 70s. Even so-called full-spectrum lights can be rated as low as 85 CRI.

At first glance, large windows seem like a great solution to the problem of accurate spectrum. Windows certainly provide the high CRI of minimally-filtered sunlight, but they also present some problems. Large windows can leave birds feeling exposed, adding to their stress levels. Windows may also lead to overheating if a cage is left in direct sun for too long.

Again, fluorescent tube lighting comes to our rescue. Many manufacturers produce specialty fluorescent bulbs that have a rating of 95 CRI or above. These bulbs tend to produce the most accurate and longest-lived color output.

Color Temperature

The temperature rating follows the color progression that hot objects exhibit as they start to glow from heat. As an object heats up, it first gives off dull red and then orange. These are examples of lower-temperature colors (note that this is the opposite of the cool/warm ratings that artists use). As an object grows hotter, its light becomes orange, then yellow and finally white and blue. (The flame on a gas stove is a great example of a very hot color spectrum.) Thus, "cooler" light is red (long wavelength), "hotter" light is blue (short wavelength).

For lighting, color temperature is measured on the Kelvin (K) temperature scale. You'll find ratings of "4700° K" or "6000° K", where the "K" stands for "Kelvin." This does NOT mean that the bulb gives off 6000 degrees of heat! It is simply a convenient way to refer to the hot/cold balance of colors in a light's spectrum.

Our companion birds do best under the color temperature of the sun (as experienced on earth), which is 5000° K in the tropical latitudes. Color temperatures lower than this (more red) can lead to breeding behavior, while higher color temperatures (more blue) have been shown to produce more stress and feather destruction. For tropical birds, look for a light that has a temperature of at least 5000° K and not more than 5700° K.

Specialty fluorescent tubes, like the Philips TL-950, give the best color temperature (5000° K) and have a of 98 CRI rating, offering a great option for basic supplemental lighting for your birds.

Ultraviolet Support

In addition to seeing more color detail, birds are also capable of seeing ultraviolet light. Birds likely perceive UV as an additional set of colors, which combine with the other colors in their visual spectrum. These extra color combinations are what allow birds to see around 200 times the number of colors that humans perceive.

Human vision stops around wavelengths of 380 nm, or just below ultraviolet. Birds can see wavelengths as low as 315 nm, thus into the near UV-A. UV-A is the closest to human visible light, and occurs in wavelengths of 315 to 400 nm, or approximately the limit of bird vision at the low end of the spectrum.

UV-A is further divided into:

- Near UV-A (345-400 nm), which enhances bird vision of food, feathers, and so on.
- Far UV-A (315-345 nm), which produces suntan and vitamin D production in humans.

Birds' ultraviolet vision is likely useful in recognizing their flock mates. Most parrots have feathers that reflect UV light, meaning that parrot eyes are likely tuned to notice those reflections. Some parrots may even display sexual dimorphism in their UV coloration.



Birds can also use their UV vision to see the nutrients in their food. Flowers, berries, and fruits reflect UV light, as do many key nutrients and toxins. This is not unlike humans' ability to detect sugar content simply by looking at the amount of green or yellow in a banana's skin. For birds, their UV-sensitive eyes allow them to see oils, sugars, vitamins, minerals and amino acids that are invisible to us. Without UV light, birds cannot identify whether food looks nutritious and enticing, or rancid, moldy, and toxic. Thus, food may simply not "look right" to birds and may lead to problems with appetite.

Most of our household lighting is well-shielded against UV output. In addition, modern window glass blocks practically all UV. Mix in UV-absorbing interior paint and our living rooms are very UV-poor environments indeed.

Luckily, birds do not need much UV light to support their full vision. Natural sunlight has no more than 5% total UV content, of which only .1%—that is, 1/10 of 1 percent—is UV-B. Also, birds are not capable of seeing the powerful ultraviolet-B light, which is a high-energy, short wavelength of 280-315 nm. This light produces sunburn, skin cancer, and cataracts in humans and animals. Fortunately, in nature we are shielded from most UV-B, which is largely absorbed by the atmosphere. Thus, the UV-B that most reptile bulbs put out—and which have been repackaged as

Avian lights—are not unnecessary to support your bird's vision and, in fact, can be dangerous.

(There's also little evidence that UV-B is useful for generating vitamin D, but that's a topic for another day.) A small fluorescent tube labeled "black light" should provide enough UV to support your birds' vision. Make sure that it only outputs the lower-energy ultraviolet-A, and try to find a bulb that also puts out some visible light. The Sylvania 21623 or Philips 13036 models are both good choices for UV supplementation.

While humans and other land vertebrates require some ultraviolet to produce vitamin D in the skin, birds produce vitamin D in oils secreted onto their feathers while preening. Birds can manufacture vitamin D with UV-A. UV-B is not required for birds and should only be used under explicit directions from your avian vet.

Placement

Proper positioning of a light source is often an afterthought, but it is a critical consideration when setting up your bird's lights. Placing a light directly over the cage (or on the cage) can lead to stress as a bird adjusts to a large new object looming over them. Also, placing a light too close to the cage can lead to big differences in light levels in different parts of the cage. That's because brightness is the measure of the amount of light at a certain location; and drops off as the square of the distance from the light source. Thus, if you move your light 2 feet further away from your bird cage, the brightness decreases 4 times. Conversely, if you move the light 3 feet closer, the brightness increases 9 times! So, don't place the light too close or too far from the cage.

Placing a light too low will also negate many benefits of proper lighting. Food dishes will still be in shadow, as will many toys and cage mates. Also, light coming from below or from the side may defeat a bird's natural eye shading, reducing visual acuity and causing stress. For best results, place your bird's lights well above the cage and offset from the top. This will give good, consistent illumination without adding a potential new stressor to your bird's environment.

Summary

As with most parrot-related topics, there is more to learn and new information constantly being discovered. But, at present, you can give your birds a decent indoor visual experience using specialty fluorescents like the Philips TL-950 or a Blue Max compact fluorescent (93+ CRI and no more than 5500k), supplemented with a small UV-A bulb like the Sylvania 21623. Make sure that the bulbs are placed in open fixtures (glass or plastic enclosures will ruin the full-spectrum and UV output) mounted above the cage, but offset from the top.

One more thing: make sure that any fluorescent fixtures you buy have electronic ballasts. Older, cheaper fixtures use magnetic ballasts, causing an annoying flicker that may lead to stress and feather destruction. Flicker perception is the speed at which a flickering light appears continuous. Human flicker rate maxes out at about 50 flashes per second. So, for humans, a light with more than 50 flashes per second looks continuous. Birds, however, have flicker rates exceeding 100 flashes per second. A light with a low flicker rate, in which your bird can see the flashes, will be annoying, if not seriously stressful.

Mickaboo offers a free class that covers these topics in much greater detail. You'll learn about light, avian vision, the properties of sunlight and how to select and set up proper lighting for your bird. Check our website under Advanced Classes for the next time this class will be offered.

Reference

What do birds need to best simulate their natural experience in nature under the sun?

Adequate brightness: Try to provide 400 lux as a minimum, 1000 lux or more is preferable.

Concentration: Use mostly diffuse light, accented by a few brightly-lit areas. Color spectrum: The ideal CRI (Color Rendering Index) is 100, which is the spectrum of the midday sun. Use 93 CRI or above, 95 and above, if possible.

Color temperature: 5000 degrees K is perfect, up to 5700 degrees K is ok.

Ultraviolet: Provide UV-A supplemental light only and remember, you don't need much. Our atmosphere filters most of the UV from the sun. Placement: Placement is critical to proper lighting. To mimic sunlight, place the brightest lights above the cage and to the side, not directly overhead.

Distance: Place lights a few feet from the cage, remember the inverse square law. Create variable lighted area. In nature, birds fly in and out of direct sunlight and spend much of their day in the filtered light of trees. Provide areas (in or out of the cage) where your bird can get away from light.

Specific Recommendations

Windows: Use natural windows to raise illumination (brightness) and improve CRI (color). DO NOT leave your bird in front of a window in direct sun!

Fluorescent tubes: Use high-CRI fluorescent tubes as a good source of diffuse light. The 5000 degree K models (Philips TL-950s) are the right temperature. In addition, these bulbs are not expensive. However, because they use mercury, be careful to mount them well so that they do not fall in an earthquake.

Proper ballasts (fixtures): Use electronic ballasts (fixtures) with fittings.

Blacklights: High-CRI is shielded against UV. Use fluorescent tubes labeled blacklight to provide UV-A supplemental light. These lights peak out at 345-380 nm (near UV-A). Put these bulbs on a timer to reduce the chance of over-exposure. Remember, you don't need much UV. And, be sure use a reflective, unpainted fixture. The paint used in most fixtures now absorbs UV, which will completely defeat the purpose of using these bulbs. When including a blacklight with fluorescent tubes, use one blacklight for every four tubes, to accomplish a correct balance of UV that simulates sunlight.

Halogen solux: Use high-CRI, 5000 degree K, halogen bulbs (Solux makes them) for concentrated light. These lights can be put on a dim timer and you can use a diffuser so that the light is not as intense. Always mount these lights on the ceiling, since you do not want people or birds looking directly into them. Shine them on a playstand or some play area that birds can get away from if they want. These bulbs will not provide the base, overall lighting solution. They should be considered as a supplement that provides concentrated light on a few areas.

Compact fluorescent full-spectrum: Blue Max makes compact fluorescent bulbs with a 93+ CRI and 5500k. Most other compact fluorescent bulbs are only 91 CRI, which is on the low end for avian applications; and the temperature is 5500 K, so they are a bit too blue, but still within the acceptable range. Because they are a bent tube, they will develop hot spots causing the CRI to degrade, so you need to replace them often. However, if you cannot mount tubes, these are probably better than standard, incandescent home lighting.

DO NOT USE AVIAN SPECIALTY BULBS!! These are largely repackaged, reptile bulbs with a UV-B content that is far too high, and possibly dangerous, for birds. In addition, the CRI is

far too low, and the temperature is far too blue, they degrade quickly, and the placement instructions are ridiculous and dangerous.

Where to Purchase and How to Install

When installing tubes, mount them on a wall, ceiling, or at the corner where the wall and ceiling meet. You can run electrical cords down to an outlet, or you can have a contractor wire them to a wall switch. You can also connect several fixtures together and run a single electrical cord to a switch or outlet. Fluorescents take very little wattage relative to standard incandescent lights. Be sure that when you wire them that you ground them properly. For help, contact Mickaboo.

Fluorescent Tubes

Philips TL-950 bulbs can be purchased in lengths of 2 feet, 3 feet, or 4 feet. Currently the 2 and 3 foot bulbs can be purchased singly; the 4 foot bulbs must be purchased in packs of 25. Check when you receive them that you got the correct bulbs. Occasionally they have sent a Sylvania, which does not have the same specs. Do not put fluorescent tube lights on a dimmer. They dim by changing the flicker rate.

Below are the item numbers and links to purchase these tube bulbs. The item number differences signify the watts for each.

The item number on the 4-foot bulbs is F32T8/TL950 and the link to purchase them is:
http://www.topbulb.com/find/Product_Description.asp?intProductID=44259

The item number on the 3-foot bulbs is F25T8/TL950 and the link to purchase them is:
http://www.topbulb.com/find/Product_Description.asp?intProductID=50961

The item number on the 2-foot bulbs is F17T8/TL950 and the link to purchase them is:
http://www.topbulb.com/find/Product_Description.asp?intProductID=44126

Proper Fixtures

Always use electronic ballasts (fixtures). **Brodwax Lighting** sells appropriate fixtures for the fluorescent tube bulbs. You want the open channel strips, available on this page:
<http://www.brodwax.com/strips.html>

The **SP Series** is a flat mount (vs. the right-angle **SF Series**) offers 1 or 2 light strips (meaning, for use with 1 or 2 bulbs). These work with the T8 bulbs, like the Philips. These are available in 2 feet, 3 feet, or 4 feet lengths. We recommend that you get the ones that take 2 bulbs to provide more light in a single mounted area.

The **SF Series** is a right-angle mount (vs. the flat mount **SP Series**) offers a 2 light strip (meaning, for use with 2 bulbs). These work with the T8 bulbs, like the Philips. These are available in 2 feet, 3 feet, or 4 feet lengths. There is currently a typo on the page—the SF 232 is a 48" fixture, not a 36" fixture. These fixtures are especially nice for mounting where the wall meets the ceiling. You can also mount them on the wall over a cage, since they will still not be directly overhead but, to the side.

Notice that the item numbers, like the Philips tube bulbs, indicate the wattage and the number of bulbs. Thus, SF 217 means the right-angle mount for a fixture that takes two 17-watt bulbs.

Flat-mount:

- SP 117 (flat mount, 1 bulb, 17 watts)
- SP 125 (flat mount, 1 bulb, 25 watts)

- SP 132 (flat mount, 1 bulb, 32 watts)
- SP 217 (flat mount, 2 bulbs, 17 watts)
- SP 225 (flat mount, 2 bulbs, 25 watts)
- SP 232 (flat mount, 2 bulbs, 32 watts)

Right-angle mount:

- SF 217 (right-angle mount, 2 bulbs, 17 watts)
- SF 225 (right-angle mount, 2 bulbs, 25 watts)
- SF 232 (right-angle mount, 2 bulbs, 32 watts)

Blacklights

The F30T8/BLB blacklight peaks at 368nm which, of all the available blacklights, is nearest to where avian vision peaks. It has a total UV output of 6.0 watts. You can purchase this three-foot blacklight at one of the following places:

http://www.topbulb.com/find/Product_Description.asp_Q_intProductID_E_44237
<http://www.amazon.com/F30T8-BLB-Fluorescent-Black-Higuchi/dp/B003YNYU2O>

You can purchase a four-foot blacklight tube here:

<http://www.blacklight.com/items/F32T8BLB>

The high-output version of the four-foot blacklight REQUIRES A DIFFERENT BALAST than the ones suggested in this article. If you purchase this one, you need a special ballast (fixture) for it:

<http://www.blacklight.com/items/WFF32T8BLB>

To get the correct ratio of regular light to UV light using this particular blacklight, mount approximately one of this type of blacklight bulb for every four visible light bulbs. Different blacklight bulbs will require different proportions with the visible light bulbs.

Halogen Solux

The solux bulbs come in 5000K versions, which is what you want. You can purchase them at:

<https://www.solux.net/cgi-bin/tlistore/soluxbulbs.html>

For fixtures, use any 35watt, two-pin halogen fixture. You can put halogen lights on a timer (and on a dimmer). The halogen bulbs will be more comfortable if you use a diffuser, which we recommend.

The diffuser is called a Plano-Convex diffuser, and can be purchased at:

<https://www.solux.net/cgi-bin/tlistore/filterclip.html>

Compact Fluorescent

The compact fluorescent that most closely approximates Avian requirements is the Blue Max Full-Spectrum Compact Fluorescent bulbs that are 93+ CRI and that are not more than 5500k. Some of the Blue Max bulbs are 5900k, which is too high (too blue) for parrots. Purchase them at:

http://www.fullspectrum solutions.com/compact_fluorescent_32_ctg.htm

Another compact fluorescent that is acceptable, but not ideal, is the Natures Sunlite, which is a screw-in compact fluorescent 20-watt, with 5500K and 91 CRI, available at:

http://www.naturallighting.com/web/shop.php?crn=565&rn=3189&action=show_detail

If you purchase a different compact fluorescent bulb, check how close the temperature and CRI are to the specs. And, remember that because of the shape, these bulbs will need to be replaced *OFTEN*. While compact fluorescent bulbs are an inferior solution, if you cannot provide tube fluorescents, they are still preferable to standard incandescent lighting.