The Low Down for Reddit Users. i.e. What is i-AMP technology?

In response to the poster diggexpat, I figured I'd get you guys a "white paper" about the technology behind GUNNAR. First off, this isn't your traditional white paper, it's just a collection of facts and figures for the purpose of getting something out to you guys quickly. Apologies for all typos and grammatical errors. Second off, I am a technician for the company and I'm also one of the co-founders with a background in optics (i.e. engineering degree from Stanford with studies in optics and almost a decade at Oakley afterward), but we've got optical resources that are way better and deeper than what my personal background belies. We've aligned ourselves with the Uof A, who has the best optics program in the world. We rely on them extensively for lens design and optical engineering. http://www.optics.arizona.edu/ We also test all products, lenses, and frame components with the largest optical laboratory in the world. Colts Laboratories http://www.colts-laboratories.com/
We have partnered with Pacific University Vision Performance Institute, one of the only labs in the world that studies visual ergonomics and computer visual ergonomics in particular: http://www.pacificu.edu/optometry/research/ergonomics.cfm
They actually do a fair amount of research with Microsoft in how to render text better (i.e. Clear Type and other projects). There's a fascinating amount of info that we've gotten from them and they've been very successful at helping us tailor our i-AMP technology based on controlled clinical trials.

Back to the Oakley reference and i-AMP technology. The term "sunglasses for computers" isn't a bad analogy. It just doesn't go as deep as it should. While everyone is familiar with the problems of being out in the sun, not everyone is familiar with the problems of sitting at a computer for extended periods of time. Let's start there. Most of this data is from the AOA, the American Optometric Association. For some current information straight from the source, check the following link.
http://www.aoa.org/x5374.xml

For a warning from the AOA to parents of school children who spend time on a computer see the following:
http://ohsonline.com/Articles/2007/08/American-Optometric-Association-Computer-Vision-Syndrome-Threatens-Returning-Students.aspx

The Vision Council, an optical industry organization (with the help of the AOA) does put together a site that is for educating the public. It's called allaboutvision.com and they have a specific section related to computer eyewear. I suggest that you take some time to read up there:
http://www.allaboutvision.com/v cvs/

Do take note about the GUNNAR Optiks mention in the glasses section. It's not a paid advert. They just like us and respect the fact that someone has finally taken the time to research and address the problem specifically.
http://www.allaboutvision.com/cvs/computer_glasses.htm

For those that don't like to follow links, a few details of note are the following.

- 50-90% of VDT (Visual Display Terminal) users have some symptoms of Computer Vision Syndrome.
- 10 Million eye exams are performed annually in the US where CVS is the primary complaint. (FYI, one of the doctors on our medical board is Dr. Jeffrey Anshel, and he said that the actual stat is way higher. This is an old statistic from the late '90s)
- Worker productivity can suffer by as much as 20 percent due to vision problems, even when no symptoms are reported by the user. (this is for all you out there that say "there's nothing wrong with my eyes!)

If you want the sources, then you'll have to jump into the links, but to summarize, Dr. Daum from U of Alabama did the research on the productivity work. The AOA is the source for the other two.

So… back to the question. What's so bad about staring at a computer screen? For a long version, you can buy the book below.

http://www.amazon.com/Visual-Ergonomics-Handbook-Jeffrey-Anshel/dp/1566706823

For a short version summary, I'll hit a couple of highlights.

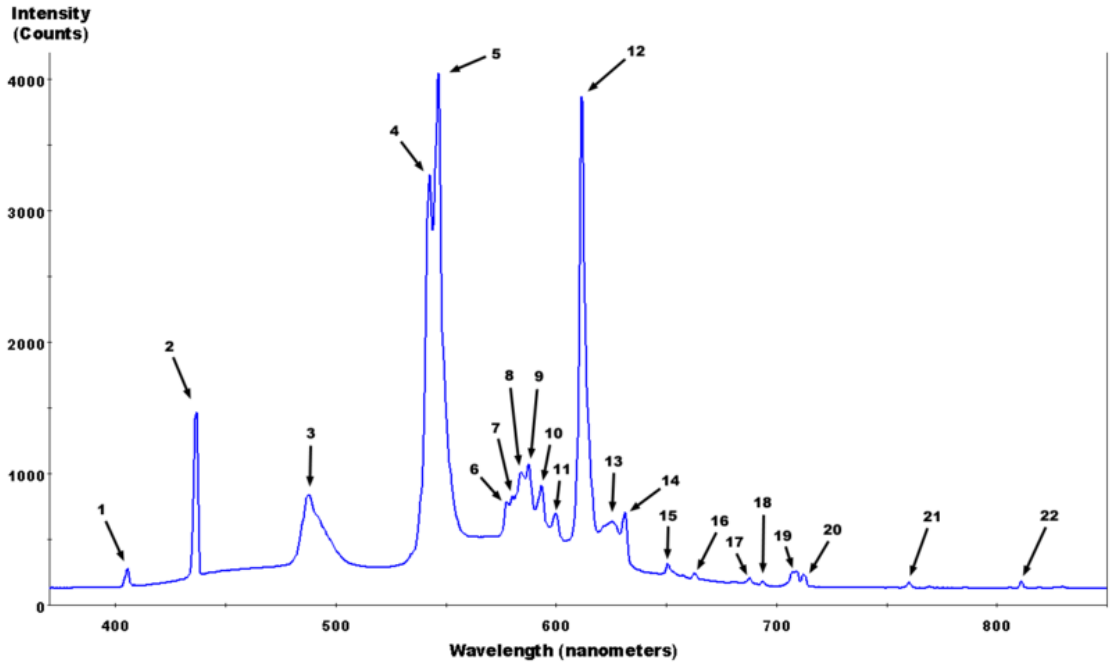
1- Focusing distance - Your eyes aren't designed to hold a near vision focus for extended periods of time. The optical muscles are in a state of flexion when you're looking at things that are close by. As with any muscle required to hold in a state of flexion over extended periods, the muscle tires, and the strain is transmitted to the brain as pain or discomfort. Near work over extended periods of time can cause near point stress syndrome (asthenopia) and over extended periods of time induce myopia or nearsightedness. For sources here, do a search on any of the terms and you'll get more info… they're widely accepted optometric principles and any doctor will back them up. FYI, near point stress syndrome relates to any near work…manual or just reading. But the rest of the points are more specialized for computer.

2- Computer users have a reduced blink rate - This is a well documented fact. Blink rates can drop as low to as low as 20% of their normal.
http://www.springerlink.com/content/9754362172h83t57/
http://www.nes2008.is/media/files/MagneHellandReducedeyeblinkingwhileperformingvisuallydemandingVDUwork.pdf

The more intense the visual task, the lower the blink rate. GUNNAR sponsors a variety of professional video gamers/gaming teams. In practice and competition we've observed them to go up to 3 minutes without blinking. Eye drops are a normal part of the pro gamer's equipment.

3- Typical computing environments have bad lighting. Your eye likes to see a nice balanced spectrum without competing light sources. However, your typical working environment has the opposite… Ambient light provided by fluorescent bulbs with an imbalanced spectrum of light. Harsh glare off the screen from other light sources, and imbalanced spectrum coming from the screen itself.

I'll hit these one by one…to start, check the CRI (color rendering index) of the bulb that your office or property manager uses. Chances are that it's below 80. (100 represents a balanced spectrum) Balanced light costs more money (i.e. more phosphors in the bulb, and less power efficiency), and everyone is trying to save money. Office light is one way that they do it. As a result, the worker in the office suffers with economy fluorescent bulbs that have a typical color spectrum represented below:



(sorry for the wikipedia ref here…you can actually go to mfgs sites to get bulb by bulb spectra). Note, each of those spikes represents a phosphor in the bulb that is being excited. Remember…more phosphors means more expensive bulb and easier on the eyes. However, not only is the bulb more expensive it also means lower energy efficiency… hence the fact that almost no commercial locations use balanced spectrum bulbs.

So…on to your computer. For most screens today, the backlight is provided by a CCFL. Cold Cathode Fluorescent Light. No need to get into the details here, but it's the same fluorescent technology as stated above. So, when you start with the same sort of fluorescent backlight with a limited number of phosphors and then shutter it with LCD technology into RGB, you've got even more of a fragmented spectrum of energy emitted. Here's a link with a good discussion of the weaknesses of your typical CCFL LCD screen (granted it's done by an LED mfg so it's not totally unbiased, but I liked their graphs). http://catalog.osram-

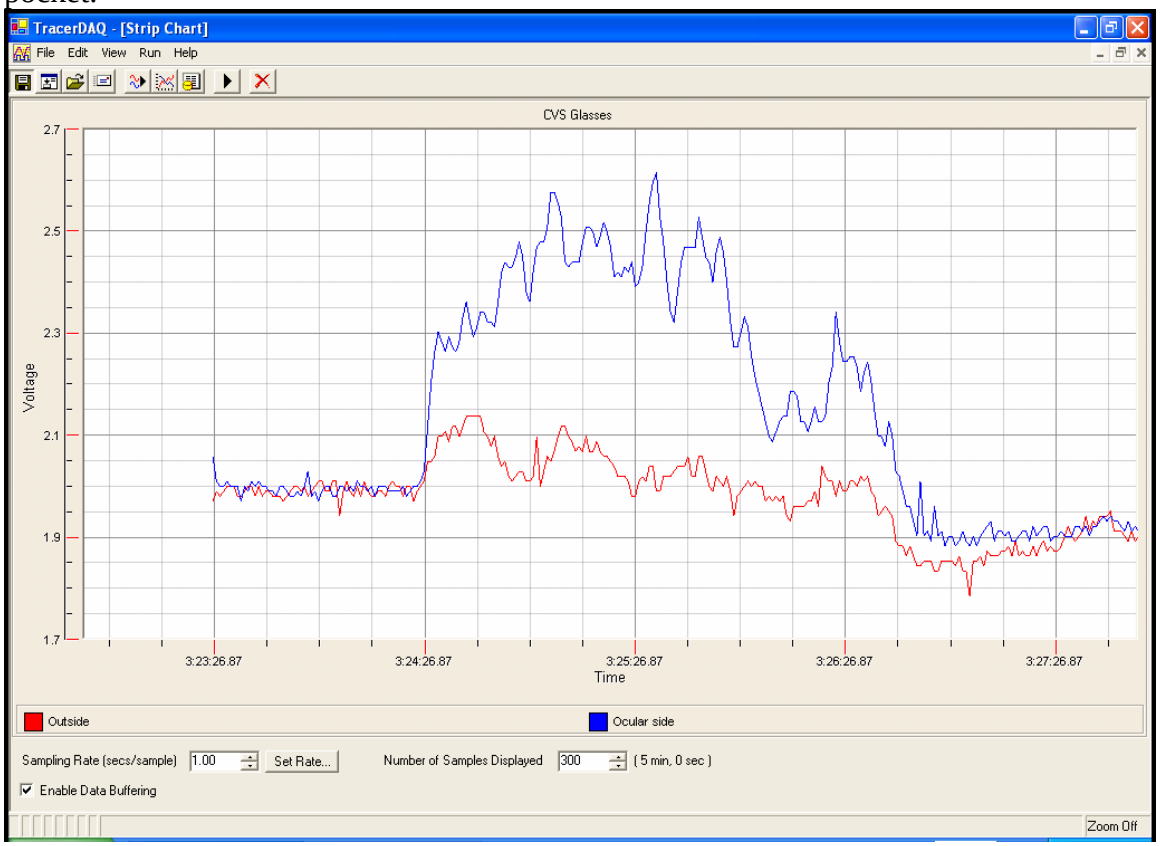
os.com/catalogue/catalogue.do;jsessionid=544A95874B2FD123261D25AF06E50FA1?act=downloadFile&favOid=02000002000011d6000100b6 FYI, I do like LED backlighting quite a bit more. They're a bit easier on the eyes, but the downside is that most LED screens don't come with an anti-glare option. The overall effect is actually harsher on the eyes because of all the competing light from reflections. Bottom line on all of this… your computer screen is a self illuminated object. Looking at a light bulb all day isn't what your eyes were built to do.

It's possible to go on and on about the issues of extended computer use with visual health. I do suggest Dr. Anshel's book, if anyone is really interested. The number of hard-core computer users out there with glasses shouldn't surprise anyone, either. (Please note that GUNNAR does offer prescription eyewear).

So, what does i-AMP technology do to fix the issues mentioned above?

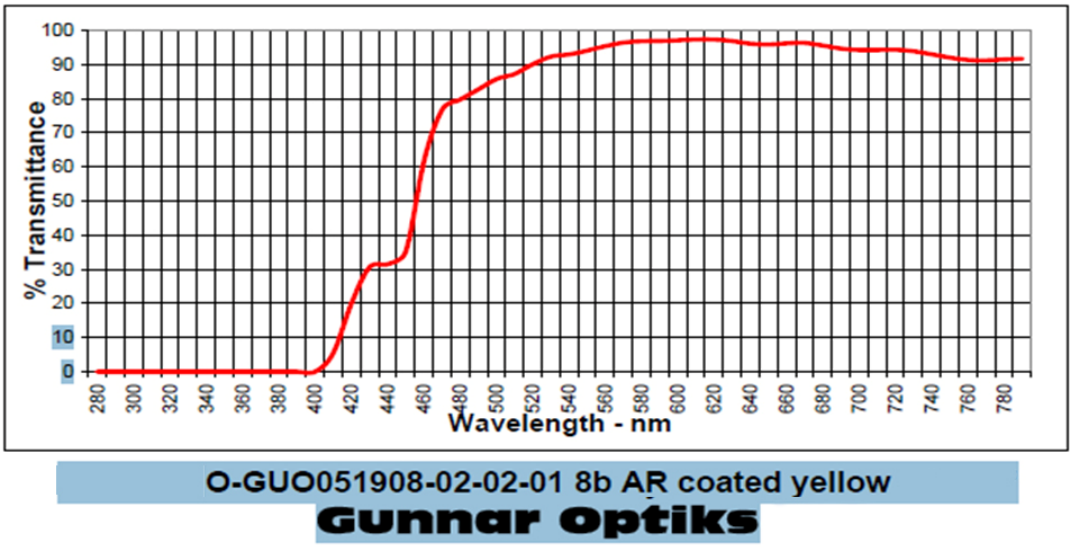
1- Focusing Distance - GUNNAR makes a lens that does a bit of the focusing for you. The NEOscopic lens in our collection has a low focusing power that bends light prior to it hitting the eye. For a 20/20 user, this allows the eye muscle to relax and takes some of the strain off. I mention 20/20 users because for someone that is already nearsighted, we're bending light in the wrong direction….However we do prescription eyewear for people that aren't 20/20. Regarding the low "plus" power (technical term focusing light in a converging fashion).. this is actually something that doctors have done for years and that even the military knows is critical (i.e. my brother was given standard issue low plus power reading glasses at the US Air Force Academy despite having 20/20 vision…they want to keep their cadets' vision in shape and pilot qualified). I'm sure I can dig up some studies on this, but it's just such a common practice in the ECP (Eye Care Professional) world that there may not be any studies for something that's been done with success for the last two centuries.
2- GUNNARs help dry eye. This is something that we've been able to study and document. Apologies to anyone that doesn't like our marketing speak…i.e. "preferential ocular microclimate". It's actually a very descriptive term. What happens is that by wrapping the lens into a very curved, close fitting format (I can already hear the comments about goggles), some of the humidity from the face/eye is preserved, and more importantly, the drying air currents are blocked. The way we've measured this and dialed in the geometry is by using humidity sensors mounted on the inside and outside of the lens (i.e. measuring the relative humidity on the ocular side vs. the ambient on the external side). The delta between the two increased as we increased the curvature of the lens (in optical terms, a higher base curve). Typical prescription eyewear is done in low base curve lenses that sit far away from the face. It's more difficult to get optics that work in high base curve (i.e. highly wrapped) configurations that sit close to the face. But that's some of the magic of the iAMP technology and it's also one of our patent pending claims that the USPTO saw as a great step forward in optics. It seems simple enough, but there just isn't anyone else out there that's doing it. i.e. combining the high wrap with a low "plus". FYI. I'll put in the results of our

study later on, but the graph below is a good one. It shows a typical subject donning and then removing a pair of GUNNARs. The two curves represent the voltage across our Honeywell humidity sensors. When using the conversion calcs, you get a max differential of 16% increase in relative humidity in the ocular pocket.



With a bit of time, I could slice and dice our data to show some info on the difference between 4 base, 6 base and 8 base lenses (i.e. flatter, curved, and highly curved lenses) but I'm trying to get all this commentary out to you guys today!

3- GUNNARs help cut off some of the harsher parts of the visible spectrum and allow more of the "preferred" part of the visible spectrum to pass. Below is a light transmittance graph for the custom tuned tint that we've developed. As you can see there are some particular limits and plateaus that correspond to the bands that are particularly "hot" in the fluorescent/CCFL world. The overabundance of high energy blue at 450nm is one in particular that we've paid attention to.



I'm cringing at the "blue blocker" comments that are being generated out there, especially because blocking the blue or High Energy Visible (HEV) part of the spectrum is a hotly debated topic out there in the medical community. The basic thesis that is being debated is the relationship to HEV and macular degeneration. See the links below for some discussion:

^ Glazer-Hockstein, C; Dunaief JL (January 2006). "Could blue light-blocking lenses decrease the risk of age-related macular degeneration?". *Retina* **26** (1): 1–4. doi:10.1097/00006982-200601000-00001. PMID 16395131.

^ Margrain, TH; Boulton M, Marshall J, Sliney DH (September 2004). "Do blue light filters confer protection against age-related macular degeneration?". *Progress in Retinal and Eye Research* **23** (5): 523–31. doi:10.1016/j.preteyeres.2004.05.001. PMID 15302349.

^ Roberts, D (September 2005). "Artificial Lighting and the Blue Light Hazard". *Macular Degeneration Support Online Library* **http://www.mdsupport.org/library/hazard.html#blue**.

What isn't debated, however is the distribution of blue light receptors on the retina. And that is the basis of our "See Faster" ad campaign. It's a known fact that blue light receptors (cones) are the lowest number, by proportion, and that blue light receptors are almost non-existent in the fovea centralis.
http://hyperphysics.phy-astr.gsu.edu/hbase/vision/rodcone.html

The fovea is where the nerve endings are most dense, the cones are more tightly packed and where all of the intense visual absorption takes place.
http://hyperphysics.phy-astr.gsu.edu/hbase/vision/retina.html#c2

Shifting the total amount of light entering the eye to the "preferred" part of the spectrum, we're allowing the bandwidth to be used by the cones that matter most (i.e. the non-blue ones). I'll be the first to admit that we're still trying to measure this quantitatively. But we have been very successful with a number of trials (hundreds of subjects) where subjects respond with an overwhelming sense of increased speed and productivity in their work. Add in the anti-reflective, anti-glare coatings that go on all of our glasses, and

you've got a viewing experience that is less cluttered, and better set up for what your eye likes to see.

Regarding other claims that I've seen debated amongst the comments out there, I'd like to address just a few.

1- Cost is a bargain compared to going to your eye doctor and getting a custom pair of glasses. They typical price for a custom pair of digitally ground lenses with AR (anti reflective) coatings is in the 400-600 range. Our custom glasses do cost that much but we're covered by a lot of the typical vision insurance programs. We cost a lot more than drug store reading glasses, but we've already covered the fact that reading glasses are set up for a different distance, they don't have the custom tint, they don't "wrap" and typically the optics are terrible.
2- We do have a prescription program. We emphasize the need to have custom computer eyewear as opposed to progressives or reading glasses. Pr2ogressives have a very narrow field of view that is optimized for the computer distance. Reading glasses are typically optimized for closer viewing distances than the computer. That causes poor posture as people lean into the screen.
3- Oleophobic and hydrophobic coatings are pretty typical in high end eyewear. It's an "upsell" if you go to your eye doc. Here's some industry insider info: http://www.ecpmag.com/1webmagazine/2009/03mar/content/optical_education/AR-coating.asp . This isn't just some marketing fluff. It helps shed water and keep water spots from forming. It also keeps finger prints from clouding the vision. Overall it keeps the lens clean. Clean = clear.
4- Our lens material is called diAMIX in marketing terms. In non-marketing terms it's a long chain polyamid that you can't find in prescriptive eyewear. We're the pioneers of its use and we'll give you lots of data, if needed to show the optical clarity (6% better than polycarbonate), color fidelity (abbe value of 52 vs. an abbe value of 30 on polycarb) along with a variety of other measurements.
5- Optometrists are great and know a lot about how to correct vision, but they're typically not very technical regarding materials, physics, etc. The CVS field has very few specialists. We know them all and consult with them all. It's a new field and it's getting a lot of attention.

Bottom line…I hope you had a good read. I hope you'll give the technology a try. We've found that the people that put them on, love them right away. The ones that don't typically have messed up eyes and need to go to get an eye exam and get a custom pair. With the right prescription, they're back to loving them.

Bring on the bacon!

Joe Croft
Co-founder, EVP of RD&D, and tech geek.