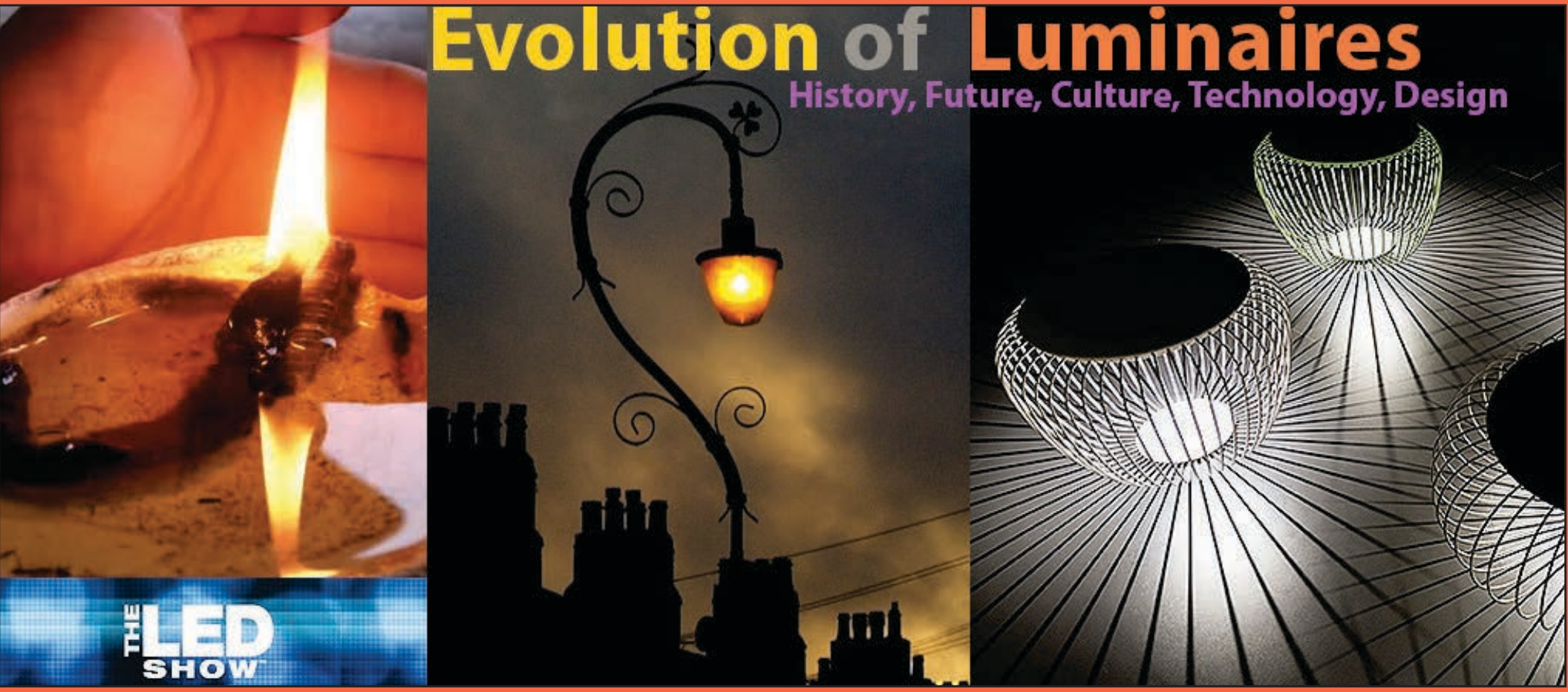


The Summary Report on Our Workshop
on February 28, 2017 at The LED Show/Strategies in Light
How 50 people + 4 hours = Awesome Ideas

Evolution of Luminaires
Workshop Format & Results

Clifton Lemon

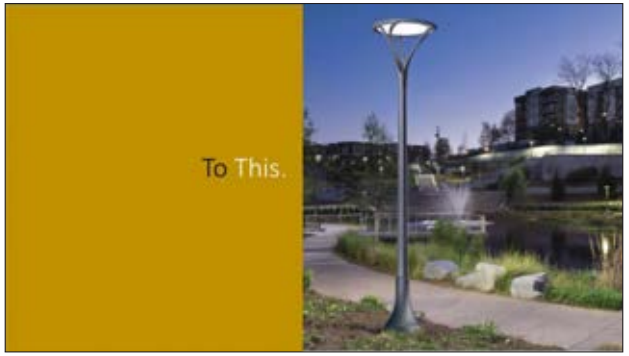
"Eventually everything connects–people, ideas, objects. . .the quality of the connections is the key to quality per se."

– Charles Eames

Our four hour workshop session at The LED Show at the end of February 2017 was something of an experiment in program format. Professional conferences usually consist only of powerpoint presentations with not enough time for audience participation. I always want to ask a lot of questions and beat the subject at hand to death in a very public way, so I wanted something different.

So I decided to do a design charrette, which would start by giving everyone lots of background in history, design, and new technology, from a host of fabulous experts, some of the top people in the industry. I then delivered a design brief, had people divide up into teams, and gave them an hour to develop competing proposals for task lighting. Each team prepared a concept pitch, with a hypothetical ask for seed funding to move forward with prototypes. The speaker panel then posed as investors who would provide feedback and vote to fund or pass.

The results were surprisingly great. Right up to a few minutes before presentations were due, I thought people would struggle and not come up with much. But they suddenly pulled their different acts together, working *en charrette* (on the cart, P4) and presented some very cool stuff. Very rough concepts of course (I intentionally kept the tools to Sharpies, Post-its, and paper), but showing some very original thinking. I realized I had greatly underestimated the creativity that can be unleashed by any team given a certain level of understanding, a clear design brief, a limited amount of time, and some competition. The quality of ideas we generated exceeded my expectations by a long shot, and the best part was the social interaction – plus something that's at the core of design: the feeling of accomplishing something unique and exciting as a team.



Evolution of Luminaires
Workshop Background

Clifton Lemon

"Any sufficiently advanced technology is indistinguishable from magic."

– Arthur C. Clarke

Far too often discourse about the future of lighting is focused only on new technologies emerging, evolving, and multiplying at a dizzying rate, and on a relentless news feed of mergers, acquisitions and market projections. We forget that "disruptive" transitions to new technologies in the past closely mirror those in the present and that we can look to history as a rich source of design ideas for the future. We also forget that design, very much including lighting design, is not always about technology first.

Today new technologies offer unlimited opportunities to use light in ways never before possible. But to date the prevalent approach to design of luminaires has been mostly to replace incandescent and fluorescent light sources with LED in fixtures that were designed around the limitations of those earlier technologies. As the lines between lamps, fixtures, and other components and building systems are steadily blurring and being redefined, we remain constrained by our cognitive grasp of what constitutes a light source in the first place. And our entire electrical infrastructure, originally designed for incandescent lighting, must be gradually upgraded and evolve into an ecosystem suitable for new technologies and especially new combinations of technologies such as LED, IoT, POE, AI, and other magic acronym things. This presents a wide set of unique challenges to designers of luminaires and the power and control systems behind them.

Many trends in the lighting industry impact luminaire design today, including miniaturization; consolidation of functions; simplification; digitization; sensorization; "LEDification"; LiFI; embedded intelligence; connectivity; and supply chain compression. And as technologies multiply and combine, we find ourselves redefining our fundamental relationship with light.

Questions I wanted the workshop to address included:

- How can we adapt to the fundamental directional nature of LEDs when we're so used to omnidirectional sources?
- How can we manage our product roadmap, and how can we figure out what the market really needs?
- How can we manage a crushing proliferation of SKUs?
- How can we plan for products that meet the needs of retrofit vs new construction?
- How can we insure that non-lighting functions and stakeholders don't exert undue influence on lighting decisions?
- Who do we partner with, when and why?
- Are we designing to solve the right problem in the first place?

Workshop Speakers

Clifton Lemon works with manufacturers and design organizations in strategy, product development, marketing, and customer experience. He was formerly the Marketing Communications Manager for Soraa, an innovative LED startup company founded by Shuji Nakamura, 2014 Nobel laureate in physics for his work on inventing the LED. Before Soraa he was Director of Business Development for Integral Group, a deep green engineering firm headquartered in Oakland, CA. He is Marketing Chair for IES San Francisco Section, and is on the advisory Boards of Strategies in Light/The LED Show, Lightspace CA and LightShow West.

Susan Larson joined Soraa in 2010 as Director of Sales and helped to start the Lamps Division. She brings extensive lighting industry experience, with key roles in LED companies such as Lynk Labs, Led Engin, Exclara, and Neo Neon. She is also the former CEO of iLight Technologies, a leader in innovative LED solutions. Susan received her MBA in Finance from the University of Chicago Booth School of Business and a BA in Psychology and Neurobiology from Northwestern University.

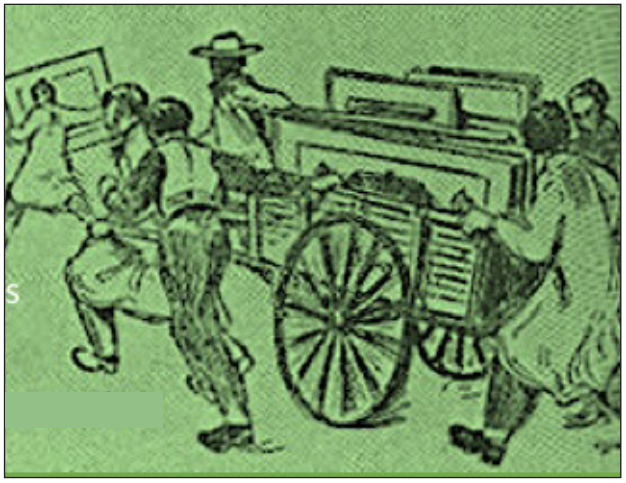
Scott Hershman is a leading architectural lighting designer with more than 20 years in the field and several national product lighting awards for his designs, as well as industry recognition from both the IALD and IES. He has worked on a wide range of prestigious projects that includes museums, libraries, hotels, residences, airports, retail, office towers, and more. Scott trained in stage lighting and earned a Master of Fine Arts degree in architectural lighting design from Parsons, where he now teaches a master's degree course in luminaire design. Scott is active in many industry organizations and currently serves the IALD as Co-Chair of Steering Committee for the LIRC.

Scott Yu is an award-winning industrial designer known worldwide for his innovative transportation and consumer electronics designs. With more than 27 years of experience, he's known for taking the best ideas from the worlds of marketing, engineering and manufacturing, and applying them to exciting product solutions. Scott co-founded Gingko Design in San Francisco in 1990 and led the industrial design firm to many awards, including IDEA, CES, iF, Good Design, ID Magazine and Singapore Design awards. He graduated from the Art Center College of Design and has held positions at Ford Motor Company, Peugeot SA, and Volvo A.B. He served as lead designer for Citroen's ECO 2000 – a test vehicle – which achieved an impressive 90 mpg. As the youngest manager at Ford Motor Company, Scott oversaw the small car studio responsible for developing the Probe, Escort and Festiva.

Jason Posselt is a marketing executive with over sixteen years of experience and a strong technical background in high power LEDs. He has a successful track record in managing product portfolios from initial market penetration to sustained growth, and a strong ability to interact both commercially and technically with customers to understand and align product attributes with product requirements. He has broad exposure to multiple solid-state lighting market segments with experience in developing market specific products and marketing strategies. He also has extensive international work experience including customer focused activities and interaction with offshore manufacturing.

Jeremy Steinmeier is a modernist architect and lighting designer with a passion for design and construction. His award-winning projects include single and multi-unit housing, retail facilities, and commercial projects. Evident in his work is an underlying commitment to thoughtful design, environmental stewardship, leadership through consensus building, and an appeal to the emotional experience of the user. He was a Senior Architect and Lighting Designer with Architecture and Light in San Francisco, and completed several projects with prominent architects providing conceptual design, renderings, calculations and specifications for such award-winning architects as Studios Architecture, Tigerman McCurry, Wong Logan Architects, and Tom Elliot Fisch, and Heidi Richardson.

The Design Charrette
Creative Collaboration is Inherently Social



The design charrette is something I have always done in situations where we had a team trying to solve a design challenge. It seems to have rather fallen out of favor lately, partly because we've reverted to individual designers making perfect stuff on their individual computing devices and hi-def monitors, with powerful software that can configure and 3D print anything we can imagine, with infinite permutations. Just because we can, we rush to perfect solutions as disconnected individuals rather than designing socially, with ideas up on a big wall so that everyone can see the same thing and share perspectives. Designing this way is just second nature to me.

The word charrette is French for "cart" or "chariot." Its use in the sense of design and planning arose in the 19th century at the École des Beaux-Arts in Paris, where it was not unusual at the end of a term for teams of student architects to work right up to the a deadline, furiously applying finishing touches to their creations as the *charrette* was wheeled among them to collect up their scale models and other work for review. This frenetic process came to be referred to as working *en charrette*, "on the cart."

You might think it's a "brainstorming" session, but there crucial differences. First, there is extensive preparation and background given to participants. Next, a clear and simple design brief is given. Third, not all ideas are considered useful, critique is essential to the outcome. Fourth, ideas are all pinned up on a wall where they can all be seen by everyone- sharing and stealing are encouraged. And last, this session was "gamified" with a *frisson* of competition thrown into the mix that provided incentive to win "funding" from "investors," a situation quite close to real life in its social dynamics.

Background- The Design Brief

The Design Brief
Stating the Problem Clearly

The design brief is a valuable tool to assess whether you're solving the right problem in the first place. Far too often today, we start a design project without adequate preparation. This is becoming easier all the time as we have powerful, interconnected design visualization and fabrication tools that let us make anything we can imagine really quickly. Also, we often start by trying to find a use for some exciting and disruptive technology that has just been cooked up. This isn't always the wrong thing to do, but it's putting the cart before the horse. For one thing, we simply have too many new technologies to choose from, and not enough cognitive bandwidth to assess all of them, let alone explore commercializing them.

When I formulated the workshop design brief, I wanted it to be as specific as possible so that the requirements were very clear, but I also wanted to leave room for surprises and new ideas. In retrospect I notice that I did not include a maximum BOM (Bill of Materials) cost or average selling price. A real design brief for a new product of course always includes that, and we did address this in the charrette.

On the technical side, the basic performance requirements for task lighting are fairly well understood, in terms of delivered lumens, energy efficiency, communications protocols, controls, and distribution.

What I introduced into the brief were some requirements that went beyond detailed technical specs.
A new task luminaire or system today necessarily must work as part of a larger ecosystem, hence the requirement to create a "microambience, " a great term that Jeremy Steinmeier coined to describe a personal "light space." Building systems today are becoming more efficient, more decentralized, modular, and distributed – lighting has to follow suit. We are, thankfully, re-thinking the flat ceiling of bland general ambient lighting, and the task solution (below the Sky/Fire Line, see P8)

has to take this into consideration. The historical perspective presented by Jeremy and me, I think, contributed a useful background for this requirement.

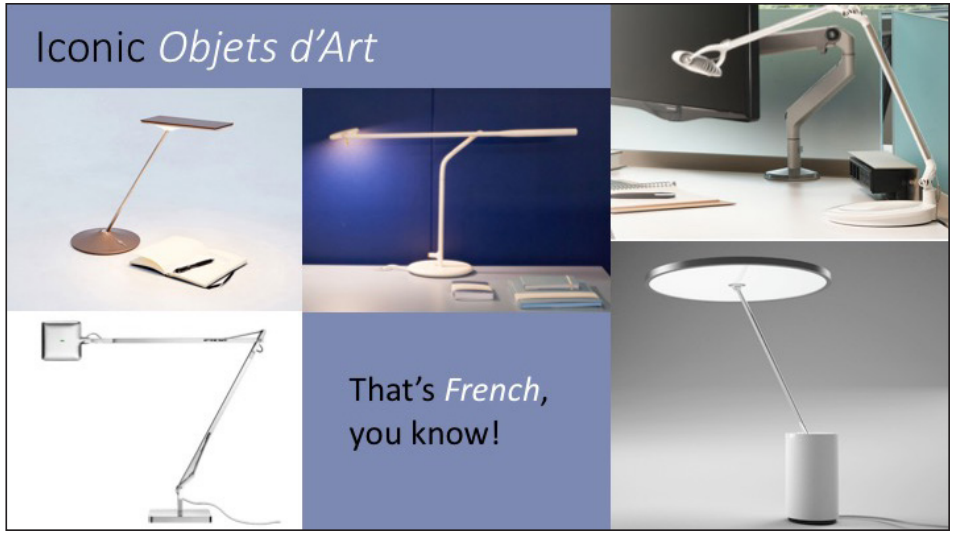
Susan Larson in her presentation outlines a process for "finding a home" for your technology. This involves a clear assessment of how it fits in different markets and ecosystems and what problems it can solve.

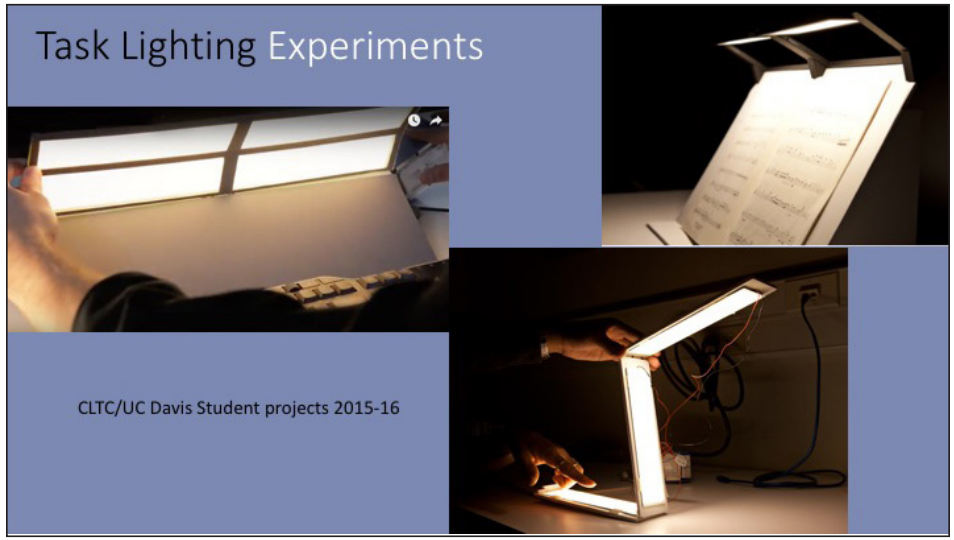
Per Scott Yu's advice, design for disassembly, re-use and recycling can be a successful strategy for organizing not just a design project, but an entire company.
Many times, when we focus on one important goal like efficiency or cradle-to-cradle manufacturing, we end up with a much higher quality, more beautiful product, even if we're not starting with beauty or quality as key design requirements per se.

Not that starting with aesthetics is necessarily a bad idea either. As those of us in manufacturing know well, marketing considerations are paramount. People won't buy a product that is ugly in the wrong way. A well engineered luminaire may prominently feature some technical detail, say a heat sink or optic element, that to even uninitiated people simply looks like it performs well. A perfectly engineered (designed) tool or product elicits delight – its appearance telegraphs much more than fine materials or craftsmanship.

I am grateful to Scott Hershman for pointing out in his presentation important design considerations for any luminaire, how it's installed, protected, maintained, serviced, and replaced.

These all can seem like a lot of constraints, but I believe that design thrives on constraints. Articulating the constraints – and their interconnections – well, and then transcending them is the most important part of the design process.





The Design Brief
Another Task Lamp?

Examining all the different forms of task lamps I could find yielded a curious association: they all began to remind me of construction cranes. I thought that the only thing that gives an architect more joy than a construction crane is the sparkling glass and steel Power Tower he had designed that the crane is assembling. Could the continuity of form between cranes and task lamps be a coincidence?

The granddaddy of all task lamps is of course the Tolomeo and it is gorgeous and yes I have one (two actually). The Tolomeo (left) is Italian and the Italians, all architects at heart, set the design style in high end lighting many decades ago. So yes, a difficult act to follow to say the least.

But they all began to look the same, rather finicky and stork-like – crane-like actually, pun intended – and masculine, maybe even boyish, in an Erector Set way.
Here we encounter the "Design for style, de-style: paradox that Scott Yu talked about. Even Frank Lloyd Wright, über architect, had crane-like lamp designs (more on this on P8).

Notice that I indicated in the design brief that the requirement was a task lamp, luminaire, device or system –this was a deliberate nudge to get people away from the forms we currently recognize as task lights.

The students of Michael Siminovitch at UC Davis explored some different ideas with OLED that I include because they start to push in a different direction. Illuminating the keyboard is actually kind of a strag=nge problem – since we don't use as much paper anymore, the main thing we seem to want illuminated is our keyboard, which is attached directly to a light emitting device, the monitor. Hmm.

The Design Brief
The Sky/Fire Line

Recently researchers, manufacturers and lighting designers have been talking about the Sky/Fire Line as part of the theoretical framework behind dynamic circadian lighting. This paradigm, as I understand it, looks to evolutionary biology to explain our innate preferences for light color, distribution, and location. The reasoning is that as we evolved on the African savanna we became entrained to daylight (at what we now call high CCT) coming from above the horizon line, and firelight (low CCT) from below the horizon line. Evolutionary biology also seems to offer a useful explanation for the three modes of vision- photopic, mesopic, and scotopic – that as darkness began to fall, we switched vision modes in order to allow us to see better and protect ourselves from predators, while seeking safety by gathering around the fire.

The rough simulation comparisons at left illustrate how this paradigm can be applied in a typical commercial space today- bluer, brighter light in the ceiling during the day, with warmer task light on desks later in the day. Of course it's relatively easy to accomplish this when the office has abundant daylight like the one pictured – as we know, many do not, and the bland, shadowless high CCT troffer-lit office seems more and more to violatesnot just good aesthetics but considerations of health and wellness.

The purpose of discussing the Sky/Fire line is to consider task lighting in its appropriate, larger context, and to ask important questions. For instance, if we need more task light as ambient conditions become dimmer, and we are hardwired for warmer light below the horizon, does it make sense to provide color tuning in task lighting, for instance? Or, how does this affect the need for mobile task light, so that we can take our "microambience" with us wherever we want?

The Design Brief
Part of the Whole Building

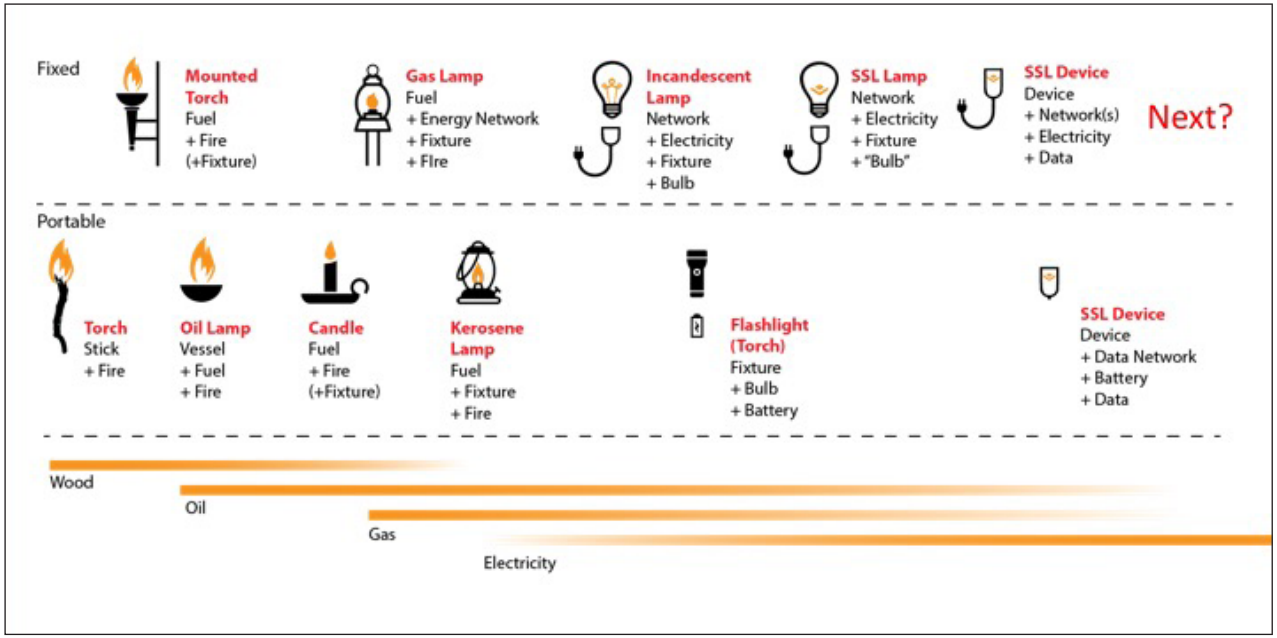
With increasing technical specialization in building, we've lost the sense of whole building design as practiced by the lone genius with ultimate aesthetic control over every last detail, best exemplified of course by Frank Lloyd Wright, not to mention Ayn Rand's Howard Roark. As with many great architects, Wright's relationship with light was fundamental and visceral. I believe he saw light as a basic building material, and his architecture was usually calculated to make the best use of natural light.

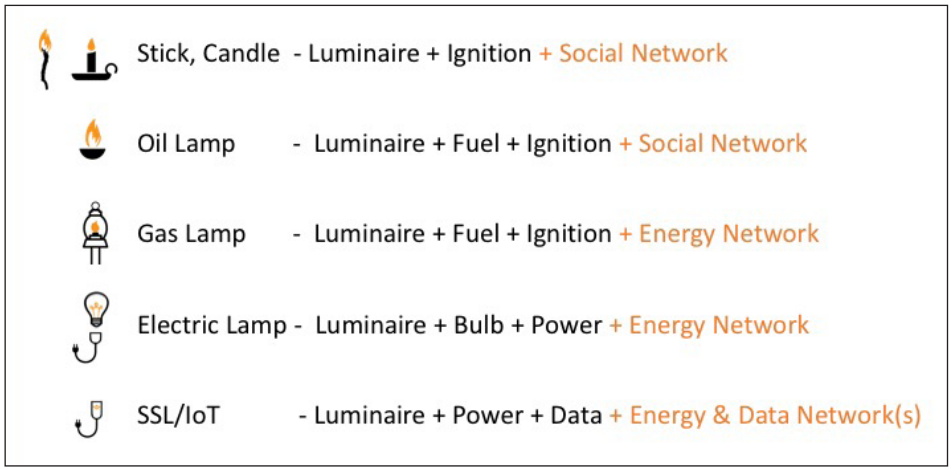
This viewpoint obviously influenced his design of fixtures for interior lighting, which were at once very craftsman-like and often decidedly architectonic. His fixtures are both functional and decorative and relied heavily on art glass shades in a similar way to glass window and skylight designs. His sense of scale is intriguing, as he seems to have seen some lamps as full-blown architectural events in miniature.

But what Wight and many other architects developed instinctively – a deep understanding of the relationship between the building and light, natural or electric – needs to be revived and integrated into not just lighting design, but architecture. This too is part of the design brief for task lighting.

Today new requirements and knowledge impact our understanding of task illumination. I love the term "microambience" – it reminds me of micro-climates. I think it's a perfect way to describe how we may begin to take more personal control of task lighting while reducing the over-lit general lighting common in office environments. This is completely consistent with the trends in building systems becoming decentralized, smaller, more efficient, smarter, and more integrated.

Background- Presentation Summaries





Evolution of Luminaires
Network Ecosystems

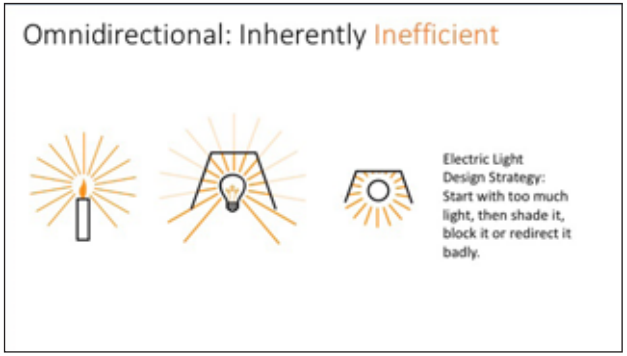
Clifton Lemon

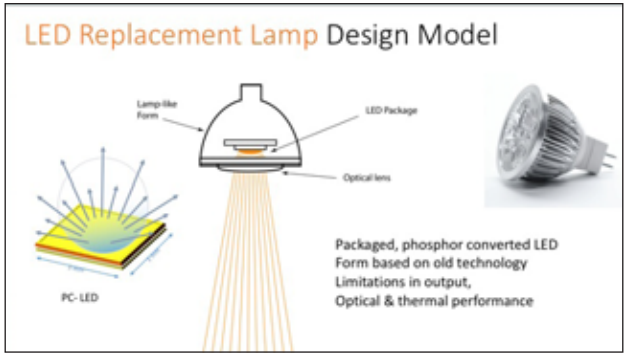
When I looked across human history and broke down the fundamental requirements of luminaires in all their forms, I noticed two patterns.

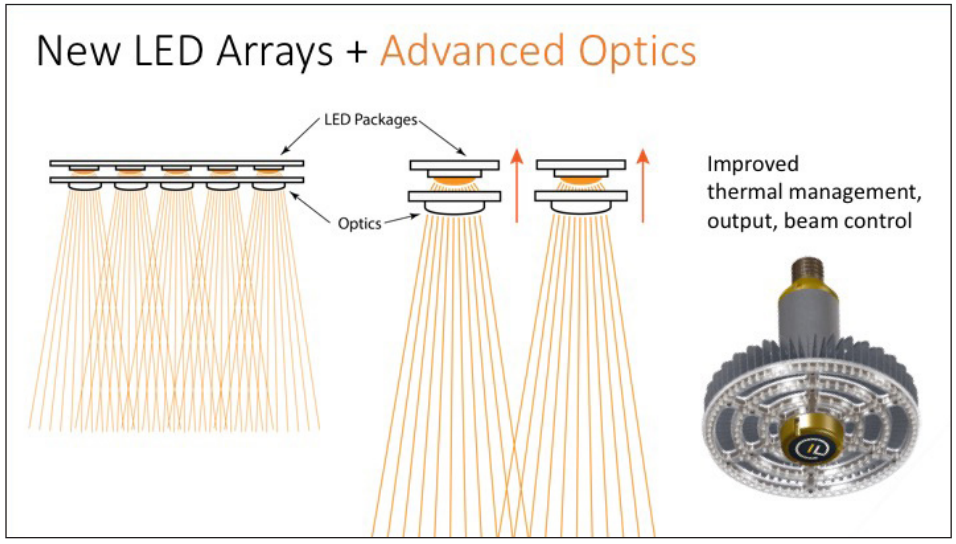
The first was the "revolving door," the fluidity in form and function between fixed and mobile devices. A torch to combat the night was the first personal, portable source of light. The "fixture" was both luminaire and fuel. Later when dwellings were more fixed, light sources also became fixed and hence shared public resources. Lamp forms from fixed gas lighting were reflected in portable oil and kerosene lamps, then in the glass bulbs for the first electric lamps. The electric flashlight (also called a "torch") emerged, continuing the parallel development of portable and fixed luminaires. Today as SSL sources become cheaper, lighter, more powerful and intelligent, mobile luminaires may yet play a new role in lighting. This was something I definitely wanted to explore in the workshop and is reflected in the design brief for task lighting.

The second pattern I saw was that no matter what technology system prevails, lighting has depended on social networks - light has always been shared between people. Even in its most basic form, fire, both knowledge of how to start fire and the fire itself are almost always shared. In today's more complex technological environment, information shared across lighting networks is becoming a more integral part of lighting systems.

And as functions converge, the fixture is becoming the luminaire again, like the original prehistoric torch. We'll see this theme emerge several times in the presentations.







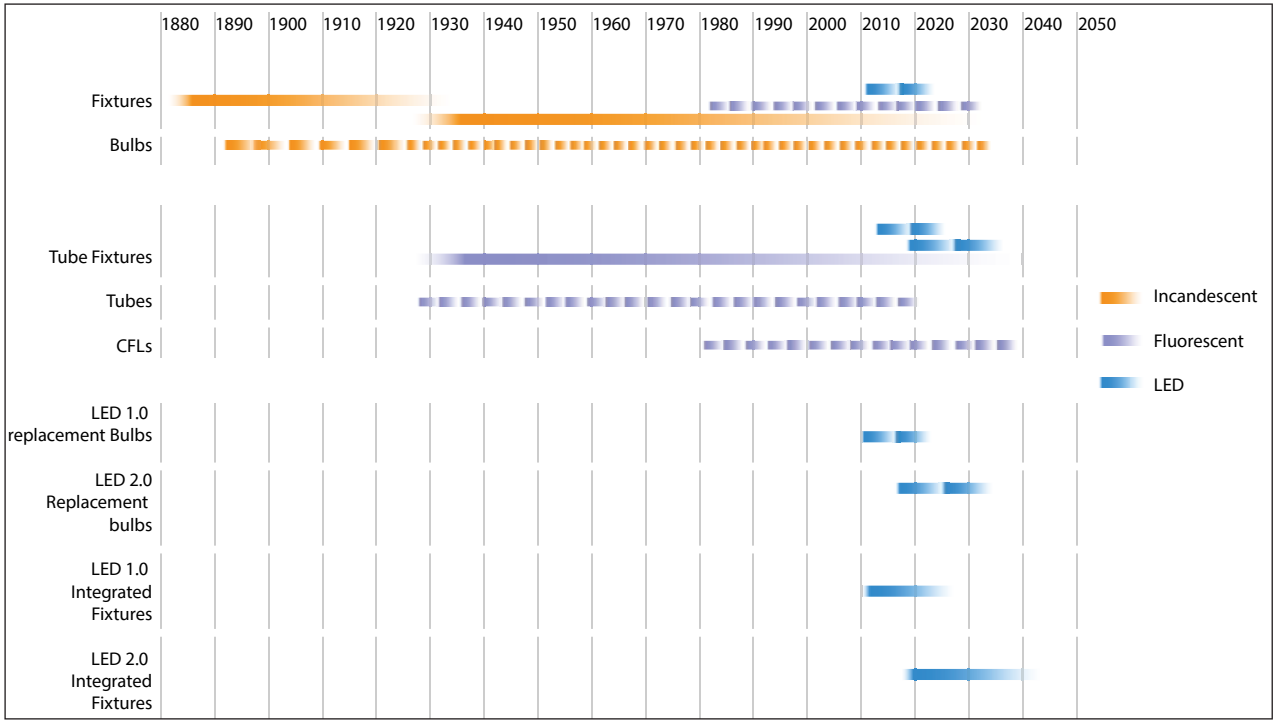
Evolution of Luminaires
Interdependence of Technology and Form

Clifton Lemon

Edison modeled his bulb after preceding light sources: gas lamps and candles. These were all omnidirectional, light was thrown everywhere, so when electric lighting for general interior use was developed one of the first requirements was to control and mitigate glare with shading devices, which became objects of decoration and delight on their own. Compared to LEDs today, incandescent light seems highly inefficient, as only 5% of power gets converted to usable light. The old design paradigm was to make too much light in the first place, then mitigate it with shading devices. This strategy has driven luminaire design for roughly the last 125 years, the advent of LEDs means that it's definitely time to change.

Fluorescent lamps were more efficient, but still omnidirectional. They enjoyed widespread use in institutional and commercial applications but not in residential use. Few think of them as being delightful.

LED light sources are fundamentally different from incandescent and fluorescent sources in that they are inherently directional rather than omnidirectional. Not only are they dramatically more energy efficient, they're also very efficient in putting light only where it is needed. This means that luminaire forms need to be very different. New device and luminaire architectures are emerging that are completely redefining lighting technology.



Evolution of Luminaires
Overlapping Adoption Cycles

The cycles of adoption and replacement for SSL that are emerging are distinctly different from the historical cycles of incandescent and fluorescent light sources and luminaires. These cycles are largely impacted by the longer lifetimes of solid state lighting devices.

But there's a twist to history of incandescent lighting. Many early light bulbs were built to last – in fact one, the famous bulb in the Livermore/Pleasanton firehouse in Livermore, California, is still burning after over a century of continuous operation. But in the early 1920s, the lightbulb industry was one of the first to organize itself around planned obsolescence as an economic model, even though lightbulbs like the Livermore one were the norm. Planned obsolescence can rightly seem like a great evil of industrial capitalism to us now, but it was all the rage when it was introduced, and it permeated (and shaped) the economic structure of many industrial economies. Because of planned obsolescence, we see a steady stream of fabulous new products, typically new "shells" around old cores. William McDonough's Cradle-to-cradle model is in direct opposition to this.

SSL fundamentally destroys the incumbent component replacement economic model. Yet we're in a transition period where we're still thinking mostly about replacement light bulbs, even while realizing that there's no replacement business for bulbs that last ten to twenty times as long as the old ones. Also, technology is moving so fast that we will almost certainly have SSL products that are significantly better than the current ones long before the lifetimes of the current products (probably vastly overrated in the first place) expire.

It's difficult to visualize and build predictive models of these cycles to use in planning product roadmaps, but it's essential. I started by making the totally speculative graph you see at left (not based on real data), just to begin to imagine what it might look like.

Evolution of Luminaires
Beauty, Delight, and Performance: Yes, Please

Since the advent of electricity, lighting has always been a highly technical profession. David E. Nye, in his excellent history *Electrifying America*, describes the emergence of the professional engineer as a driving force for the modern world. Electrification was perhaps the single most transformational (I hate the "D" word disruptive) technology in our modern world, and it necessitated an entirely new class of skilled workers who understood the physics and mechanics behind this powerful new force. Since lighting, along with telegraphy, was the first widespread networked application of electricity, lighting professionals had to be electrical engineers, and the Illuminating Engineering Society was formed in New York in 1905 to define lighting practice as an engineering discipline.

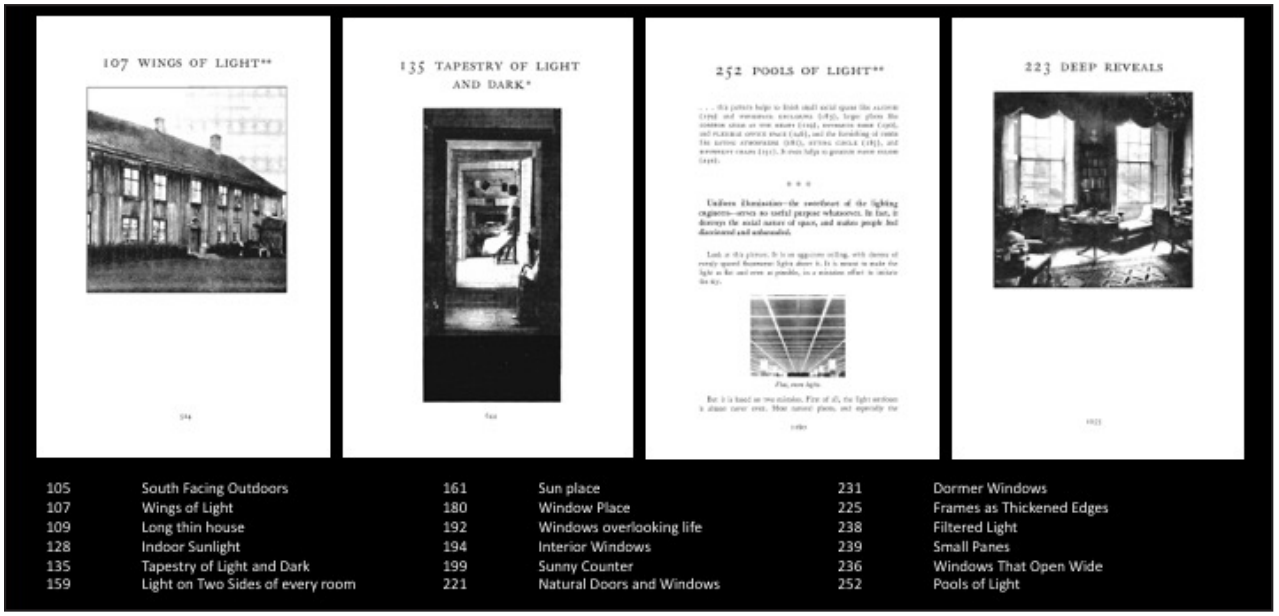
A countervailing angle to lighting history is that many of its best practitioners come from fields where beauty and emotion are as important, if not more so, than technology: notably theater and architecture.

We often over-engineer lighting today, focusing on single metrics and ignoring beauty, behavior, health and wellness, all the squishy stuff that seems to be so difficult to quantify. Hence our fascination with "Human Centric," circadian, natural light, and dynamic tuning.

But there is no inherent conflict between beauty and performance. Highly efficient, well engineered, well designed luminaires (and buildings of course) are often quite beautiful, if accidentally. Technology no longer presents the limitations to design that hobbled us in the past. We can start with beauty as the primary requirement today, and find a way to make it elegantly engineered and efficient (pretty much the same thing). Now we can have it all, what's limiting us is only a lack of imagination.

Building as Luminaire
Patterns of Light

Jeremy Steinmeier

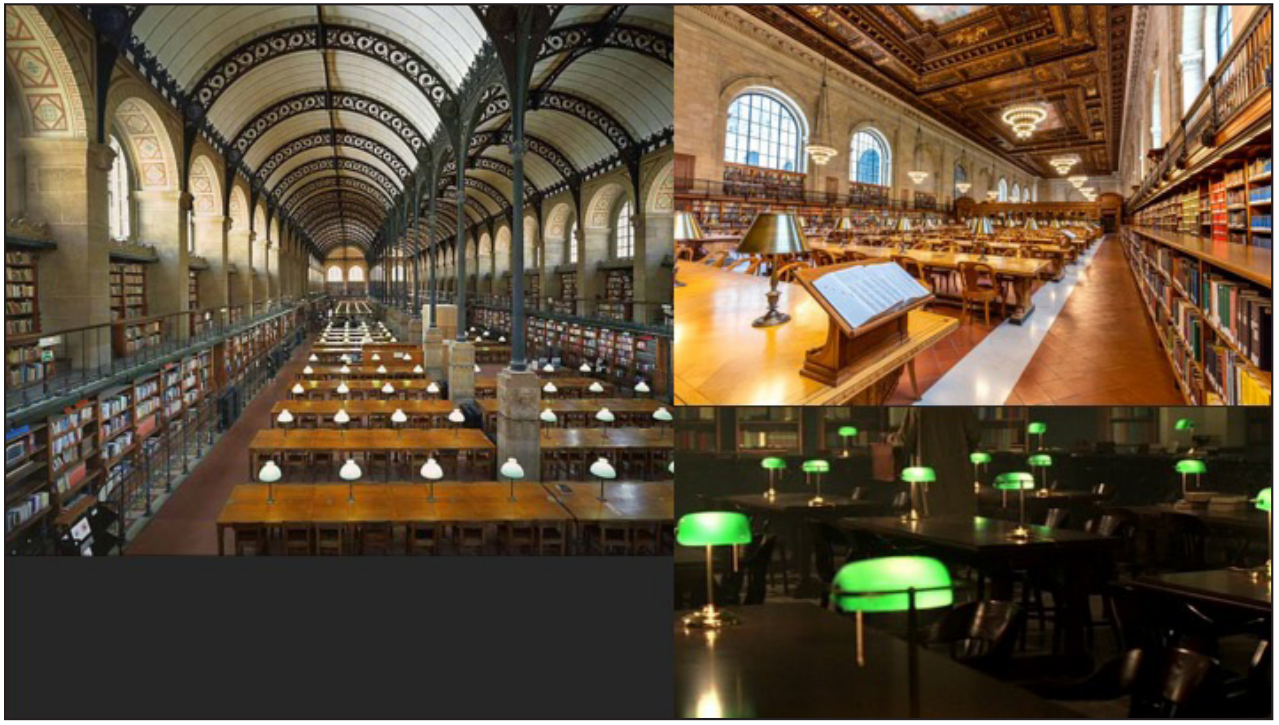


For several years, Clifton and I have been exploring the notion of turning the current design practice of architecture and lighting on its head. Rather than creating a building, then adding lighting to it after the fact, what might happen if we started with providing optimal lighting as the basis for the building from the very beginning? We started our exploration by looking at historical precedents consonant with this idea.

Before the era of electrification, lighting – along with natural ventilation and passive heating and cooling – used to be thought of as a key service that the architecture itself was meant to provide. So naturally there is a rich and instructive cultural, technical, and design history from which to draw from when thinking about the future of lighting and architecture.

Someone who had cataloged this as part of a holistic look at building was Christopher Alexander. Professor emeritus of Architecture at UC Berkeley, Alexander was born in Vienna in 1936, raised in England, and won a prestigious scholarship to Cambridge, where he studied architecture and mathematics. He went on to receive Harvard's first architecture Ph.D.

His landmark book of historic precedents in architecture and urban design called **A Pattern Language** was published in 1977. Of 253 patterns (from macro to micro) that he illustrates,18 deal directly with light.

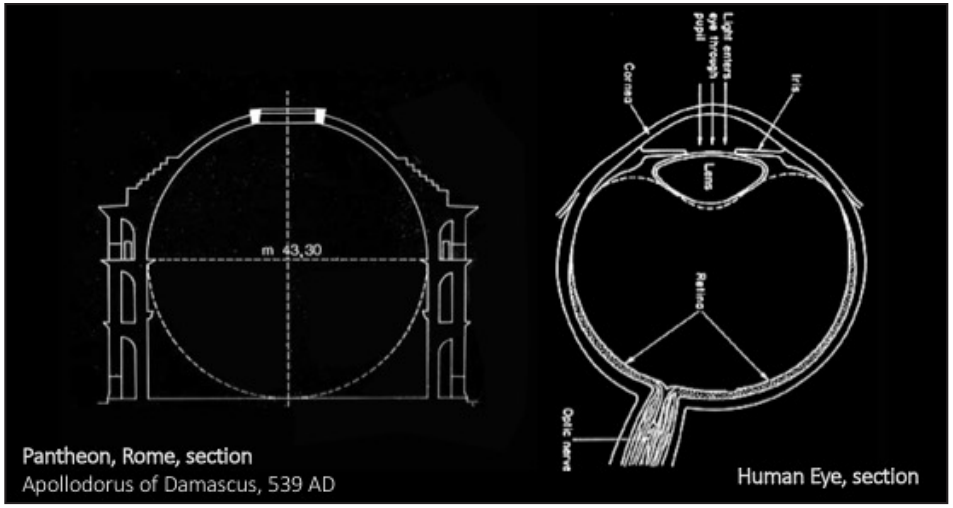


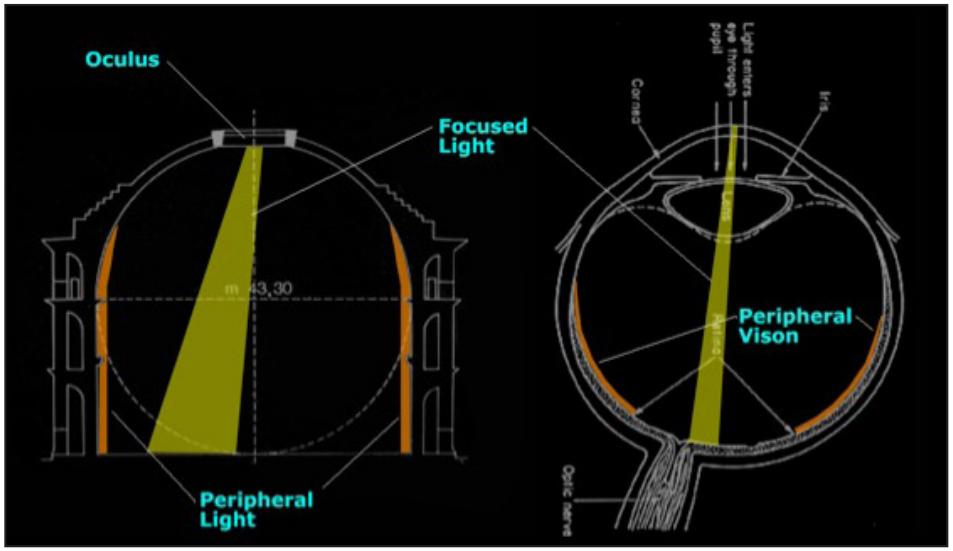
Building as Luminaire
Patterns of Delight

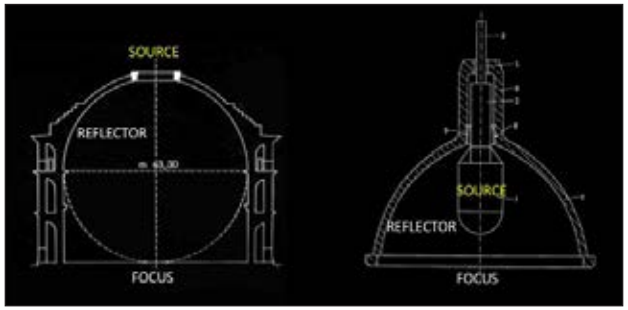
I like to think Alexander would point out that similarities between the quality of light of well loved grand public spaces have varied little over the years. Although more than 13 centuries separate the building of Istanbul's Hagia Sofia and New York's Grand central Station the same sun presides over both buildings, seeping through the shell at various levels, penetrating the walls with streaming natural daylight, judiciously metered out to provide optimal pools of light that organize the spaces. Because of their carefully considered use of daylight, it's easy to see each of these magnificent buildings as a luminaire on a grand scale.

Among architectural examples from the era of pre-electric lighting, libraries and monasteries are some of the most beautiful. (And like today's office buildings they are also purpose-built for information work). Arched ceilings and ample clerestory windows provide wonderful ambient light, while the modern addition of small, efficient reading lamps provides excellent, low glare task lighting: a perfect formula for today's office environment.

The arrangement and purposes of light sources in these spaces clearly fits into the Sky/Fire design scheme described on P6.







Building as Luminaire
Recurring Geometries

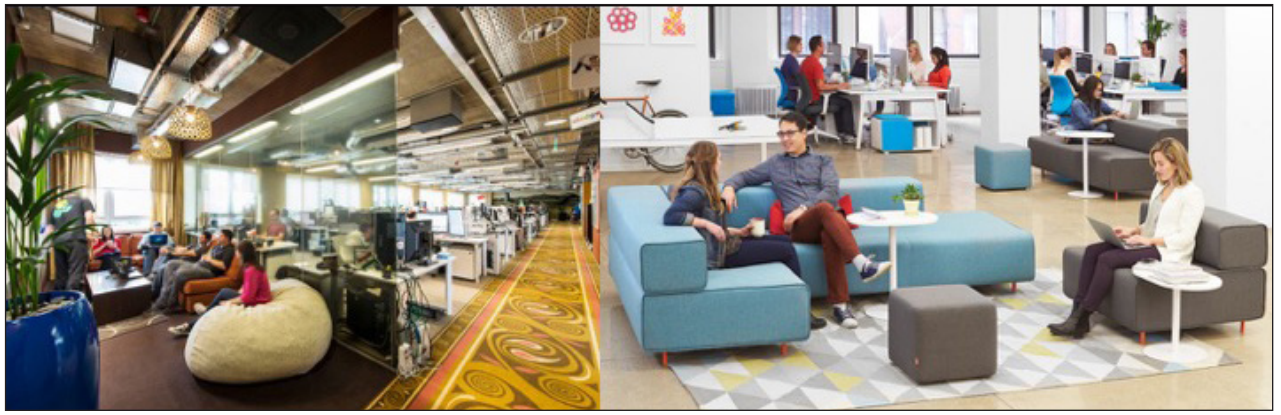
This is a story of geometries, from secular to sacred, from mundane to transcendent. Let's go back even further to an era of that was ahead of its time in understanding the technical and abstract. Let's look at geometries that recur in light.

Compare the section of the Pantheon, completed in Rome in 129AD and still standing today, with the cross section of the human eye, which occurs in this recognizable template in 97% of all animals.

Notice that they share many of the same geometries. An oculus or iris is used to control the amount of light admitted to the interior. While an animal may have the ability to move and control the focus of the beam through its lens, architecture merely accepts the parallel beams of the sun. As the light enters, a surface is stuck at a small angle of incidence. Both diffusion and diffraction ensue, filling the space with low intensity fill light to augment the drastic strike of the direct beam, thereby providing a balance of different types of light. This seems to mimic spatially how the eye mechanism handles different types of light. It's also worth noting here that a classical term for windows in architecture is "lights."

As we view the Pantheon section against another form at a very different scale – the light-emitting electric parabolic lamp – we see how even when comparing the generating to the receiving and amplifying functions that many of the same fundamental geometries are at work.

Does light - the wave that behaves like matter- manifest its language in all structures that interact with it?



Building as Luminaire
Universal Industrial Light

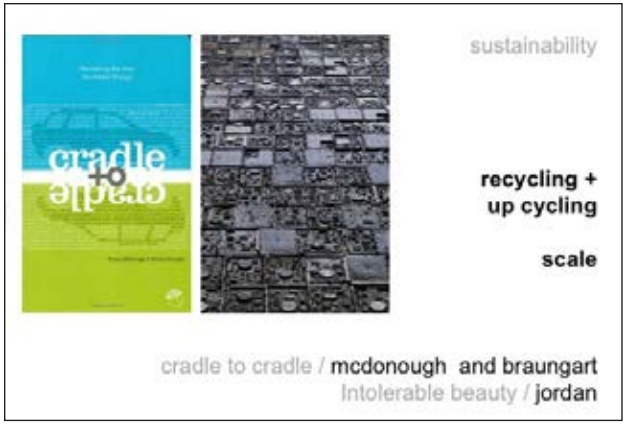
Before industrialization, outdoor work, piece work done at home, and work at small local mills dominated humanity's waking hours.

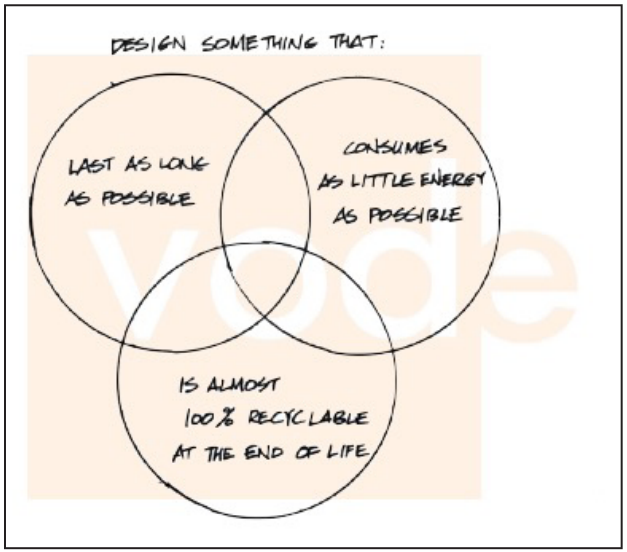
The industrial revolution began the drive towards the development of larger building volumes. Building designers needed to bring natural light into the building core for demanding tasks. Fuel and fat based lighting was expensive, inadequate, and provided continuing fire risk. Electric lighting provided a safer source, but also dramatically increased demands for different fossil fuels – coal and oil – at much larger scales. Floor layouts evolved from the need for the Boss to be able to see and supervise many workers at once, an arrangement we still see in today's offices.

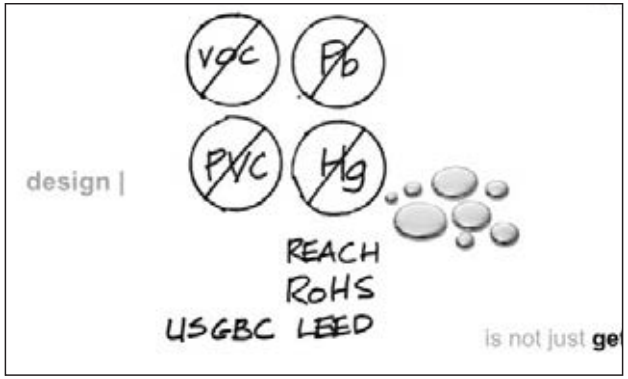
Two Frank Lloyd Wright buildings exemplify the optimal use of daylight for office environments: The Larkin Building and the Johnson Wax Headquarters, with its biomimetic design inspired by lily pads on a pond.

The open office of today is evolving as well. Assigned personal spaces are turning into temporary work desks, soft seating meeting spaces blend with other office functions. Sound controlled rooms huddle in the middle of buildings providing a needed retreat. Grand gestures of designing a unified way to work are unwelcome.

Yet the basic problem of lighting surfaces in work environments hasn't changed all that much over the millenia. Whether the work is running machinery or processing information, what schemes for factories, libraries, offices, and many other building types have in common is abundant ambient light supplemented in varying degrees by task lighting.







Design Language

Cradle to Cradle as an Organizing Principle

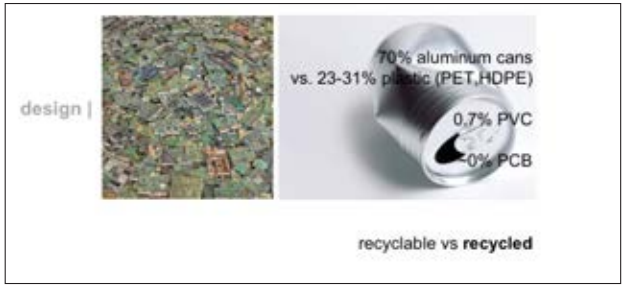
Scott Yu

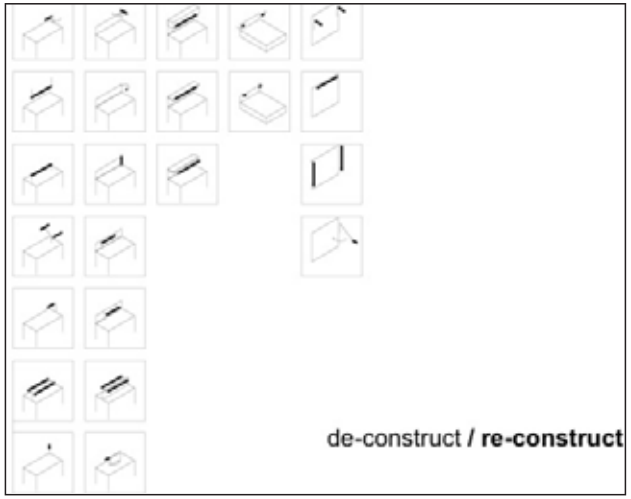
Vode began as a vision for change—the vision of three people who wanted to create a company that combined business innovation, minimalistic and responsible design and manufacturing practices for everyone's benefit.

In 2005, I was interested in creating long-lasting and environmentally mindful products. I was intrigued by the growing need for energy-efficiency and began hosting meetings with design, technology and business thinkers, to hatch a plan for the perfect product company.

At the same time, lighting industry entrepreneur Tom Warton was also envisioning better ways to approach architectural lighting and a more principled way to run a lighting manufacturing company. Tom and I met, ideas were sparked and before long, we generated a plan to create minimalistic and responsible lighting. We realized that the greatest need was for modular linear architectural lighting systems. We founded Vode with a steadfast commitment to be the epitome of environmental responsibility. We have fulfilled that obligation by doing the most with the least - our unspoken mission.

I was inspired by William McDonaugh's *Cradle to Cradle,* which dared to imagine a completely different way of thinking about how we make and use materials and products. I was also deeply moved by the work of photographer Chris Jordan, whose book *Intolerable Beauty* documents the unimaginable environmental devastation visited upon the planet by industrialization.





Design Language
Design for Deep Sustainability

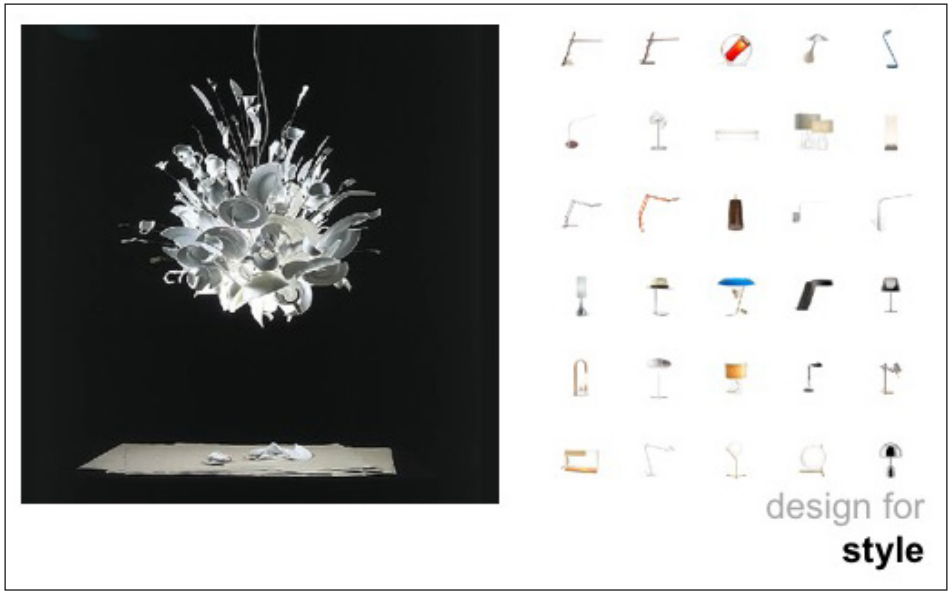
In practicing our design language at Vode, we follow some basic principles:

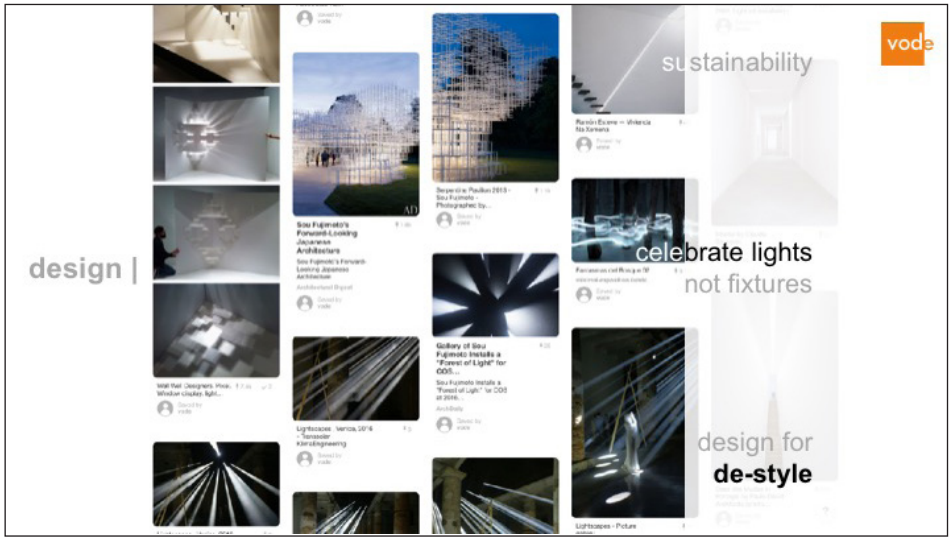
Design for Disassembly means thinking about not only how something will assemble, but how it will be taken apart, or indeed, whether it can or will be taken apart. The dark side of our highly advanced civilization with wonderful IT and rapid communication is mountains of electronic waste poisoning children scavenging for a living in the waste dumps of developing countries.

Design for Dematerialization means finding a way to use less material. Ultimately this is the essence of good engineering, and there are many ways to do this, including advanced modeling or biomimicry. But often it's simply constantly asking "can we do this with less material?" Our highly technocentric culture is entranced with glass and metal, and manufacturing often defaults to what Janine Benyus calls the "heat beat and treat" paradigm. We waste tremendous amounts of unseen energy and material with our traditional manufacturing mindset and methods.

Design for One Pixel Thick is when you have reduced a design to such a point that sometimes you have to add something back in so that it has a cognitive dimension, like a light fixture that is so thin you can't even see it unless there is a bit more material.

Deconstruct/Reconstruct is about a kind of kit-of-parts approach, which allows you to reconfigure systems to accommodate change in the size of companies or the function of spaces. This is inherently more sustainable than tearing out all the old equipment, throwing it away, and putting in new gear. It also means designing for a much longer product life cycle.



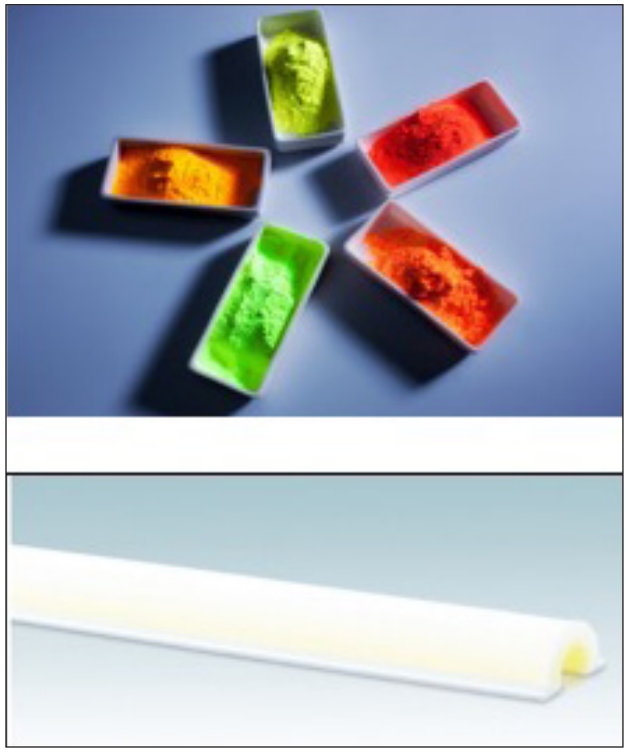


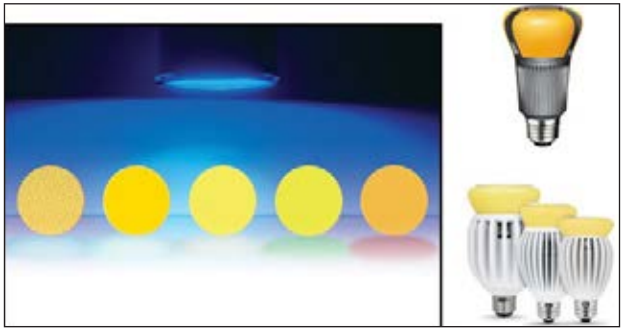
Design Language
Style and Scale

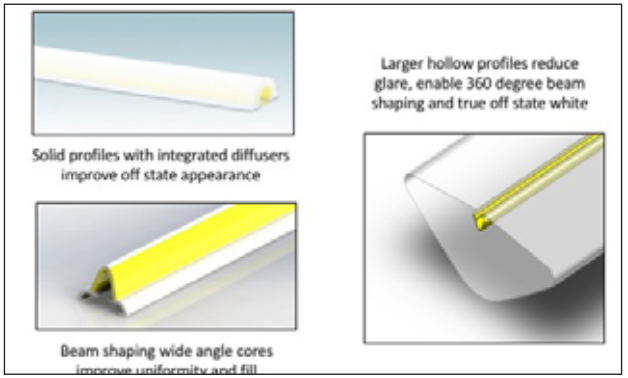
When Clifton told me about the design brief for the workshop being to design a task lamp I immediately thought "but there are already thousands of desk lamps in different styles!" Clifton replied "yes, but I can't find any I like." This points to a perennial problem in our culture – actually several overlapping problems. Because most industrial products are designed from the outside in, adding a shell of style to a core that is fundamentally unchanged, we are constantly kept in anticipation of the next new model, which is only superficially different from the old one. This contributes to cognitive overload- in some product categories there are so many choices that we are paralyzed and sometimes just don't buy at all. Or, like Clifton, we just can't find something we like, perhaps because most of what's out there is just crappy.

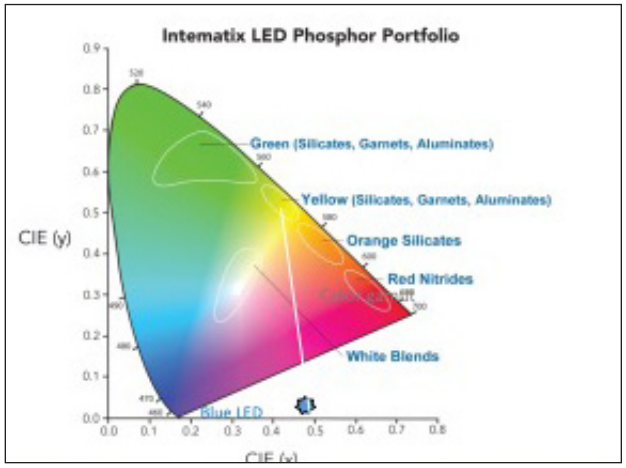
Design For Style means that we have to consider people's (often contradictory) emotional need to feel stylish. We need to recognize the paradox inherent in design of luminaire, which in a way is the central paradox of modernism, which is that we don't want to design for style, but we want iconic (read stylish) designs. We don't want to see the fixtures, but we want them to be beautiful and elegant.

Design For De-Style is the yin to the yang, and means to let the design evolve naturally from its simple function, or from concerns other than superficial visual style– concerns like product life cycle, impact on the environment, energy efficiency, and global citizenship. Often we find to our delight that when the design proceeds from entirely non-stylish place it ends up becoming elegant and, well...stylish.









New Materials

Phosphors and Remote Phosphor Designs

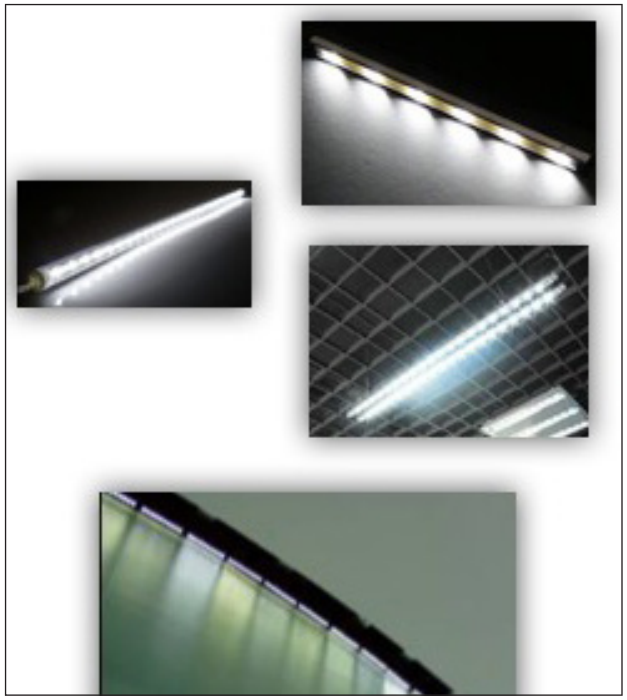
Jason Posselt

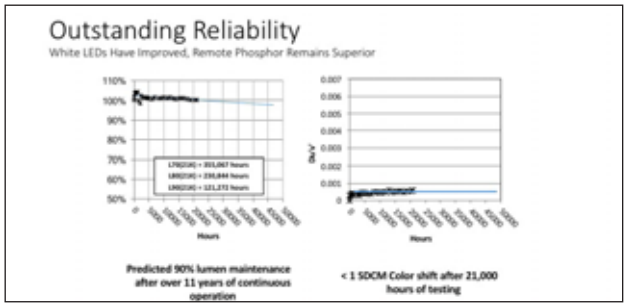
When Clifton first asked me to participate in the workshop, neither of us were quite sure how phosphors fit into the big picture. But as we explored the idea it didn't take long to see how remote phosphors enable innovative approaches to luminaire design. I felt that by explaining how our products work and showing physical examples of them, workshop participants might be stimulated to think of applications that they never would have imagined.

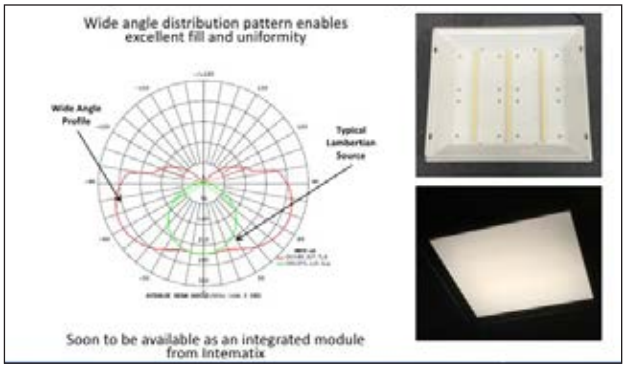
Not everyone realizes the fundamental role that phosphors play in lighting today. All fluorescent and LED light sources create light by exciting phosphors that convert narrow bandwidth light to full spectrum white light, in a range of different device designs. Phosphors make high quality solid state lighting possible.

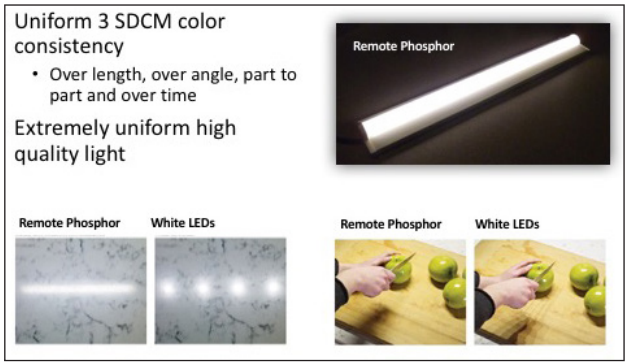
Remote phosphor LED designs locate the phosphor-impregnated material in the "package" away from the LED dies themselves. This arrangement has several key advantages, including less degradation from heat. Early remote phosphor bulbs are known for their strange yellow shapes, which were confusing to customers because they light they produce isn't yellow. We've moved beyond the weird yellow coatings with new versions of remote phosphor materials.

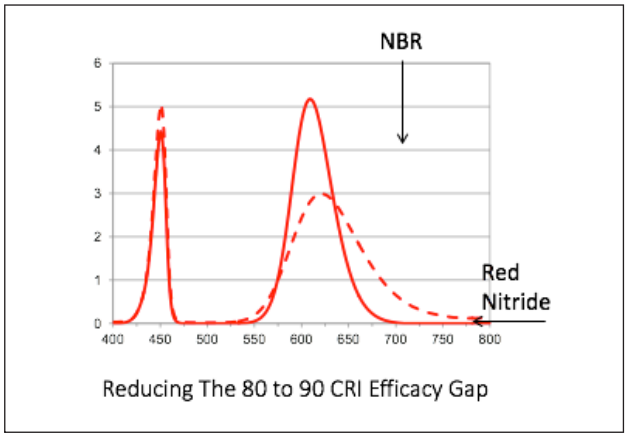
Intematix makes a range of products with integrated phosphors that can be extruded in an endless variety of shapes and give designers great flexibility in luminaire design. Remote phosphor designs address many significant challenges in luminaire design today and ultimately enhance efficacy and quality of light.











New Materials

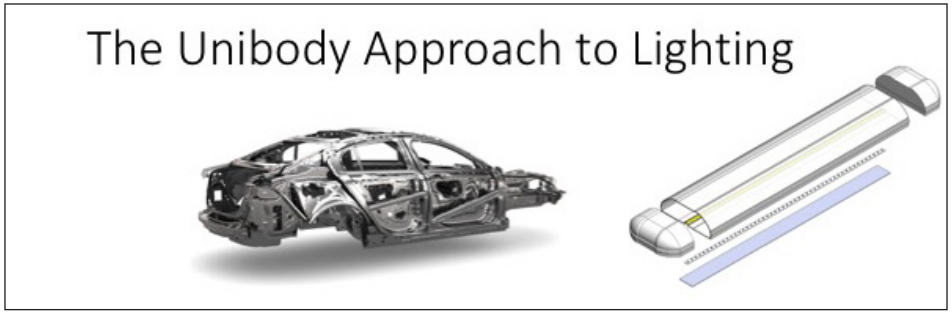
Key Advantages of Remote Phosphor Designs

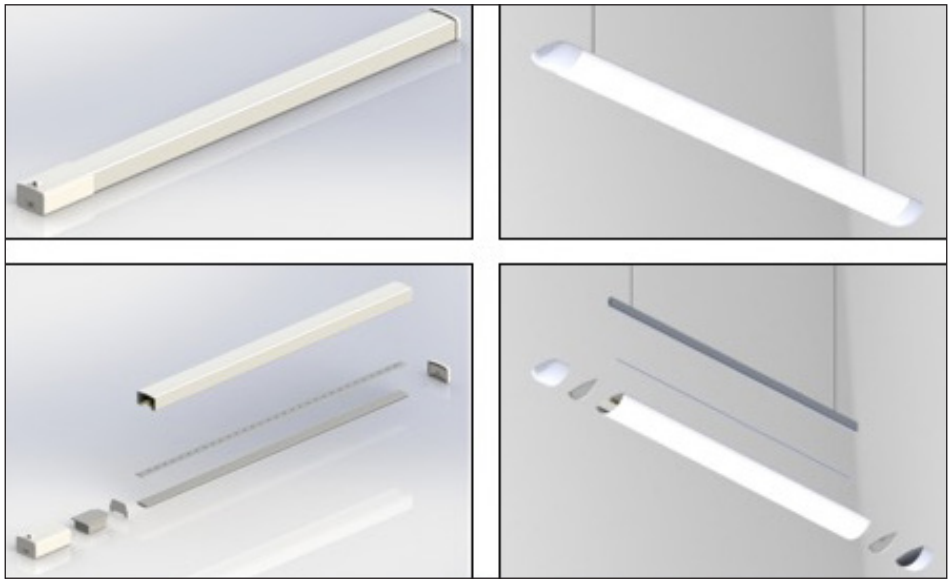
LEDs are directional sources, while traditional linear light sources are not. Linear LEDs face several design challenges, including glare, pixilation, light uniformity, optical fill of the lighting fixture, and color uniformity and consistency. Color uniformity problems are (unfortunately) extremely visible in linear installations.

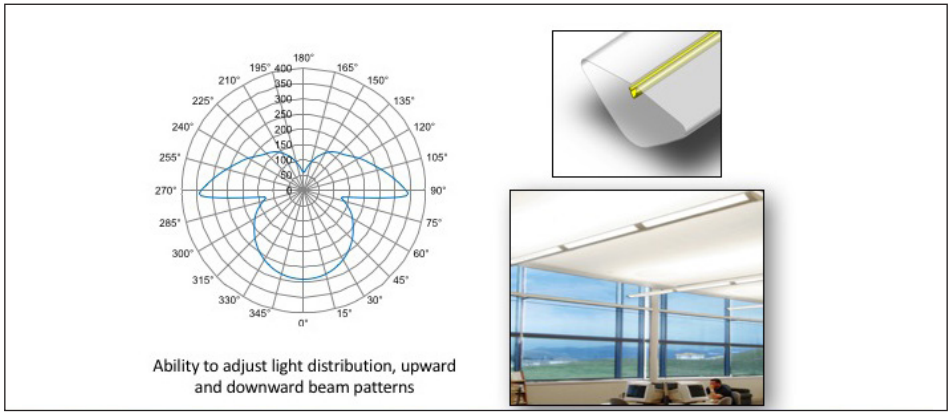
Remote phosphor materials can alleviate many of these problems, providing extremely uniform high quality light, with 3 SDCM color consistency, over length, over angle, part to part, and over time. While white LEDs have improved, the reliability of remote phosphors remains superior, with extremely high lumen and color maintenance.

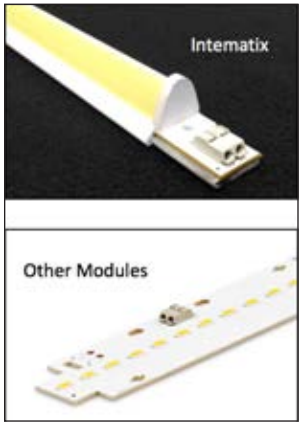
Remote phosphor material can also enable wide angle distribution patterns providing excellent fill and uniformity. A product with this capability will soon be available as an integrated module from Intematix.

A persistent problem in LED light quality is the efficiency gap between 80 and 90 CRI. Intematix is developing narrow band phosphors that may be able to achieve efficacy gains of 10-15% in 90 CRI, potentially reducing energy and improving light quality, and boosting LED adoption rates. This new technology may first be realized in remote phosphor products.









New Materials
Design Possibilities

Integrated phosphors play a role in one of the bigger trends in luminaire design- the evolution of integrated functions. I call it the unibody approach. Similar to the innovation in the auto industry, where chassis and bodywork became an integrated unit, luminaires are seeing integrated designs facilitated by the light emitting forms (extruded integrated phosphor materials) becoming the fixtures themselves, rather than separate components.

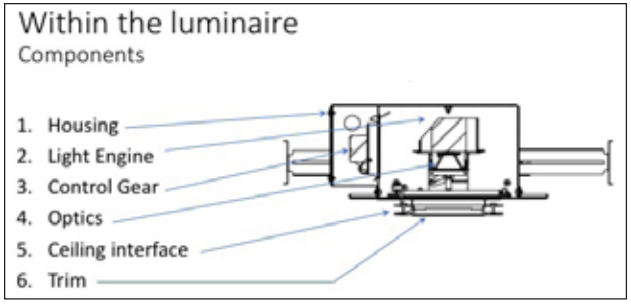
This synergy and component integration has several advantages: fewer components; lower production and tooling costs; design simplicity; increased flexibility; and accelerated time to market.

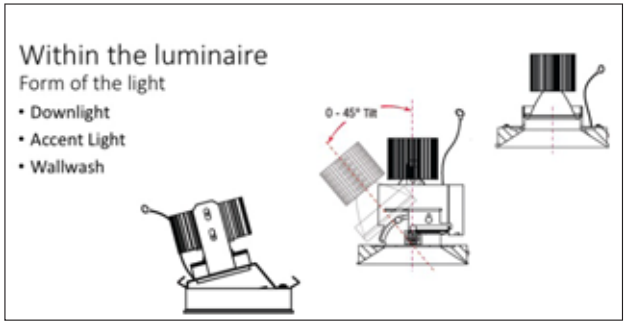
Integrated Design with integrated phosphor materials also eliminates binning and uniformity issues; facilitates plug-and-play solutions; reduces LED sourcing challenges; and simplifies assembly for lighting systems. Robust polycarbonate covers protect LEDs and electronics during installation, and custom spectral tuning and color points possible.

Direct/Indirect luminaire designs are facilitated by the flexibility of material and even light distribution that integrated phosphor materials provide

Remote phosphor materials allow designers to shape light in new ways. They address many key challenges with linear lighting; enable modular solutions; accelerate time to market; and allow new integrated design concepts.

Integrated phosphors are helping to drive the evolution on luminiares by erasing the boundary between fixtures and light sources. Next generation phosphor technology will enhance the efficacy and quality of light.





Visible/Invisible
Beyond the Ceiling

Scott Hershman

There's a lot more to an integrated luminaire design than meets the eye. While it's natural to focus on the most visible parts of luminaires when we design or specify them, I'd like to start my discussion of luminaire design by talking about the less visible or invisible aspects of luminaires.

Within the luminaire itself there are many components that must work together: housing, light engine, controls, optics, ceiling interface, and trim. The function of the luminaire itself – whether it's a wall wash, accent or downlight must be considered.

Inside the luminaire there are many other considerations that drive design and may not always be immediately apparent: safety; code compliance; inspection; and energy use are all prime examples. Then there are the unknown factors that always appear at unexpected times in what you thought was a simple design or installation.

Luminaire designers, like designers of any product, need to remember that maintenance is a vital but often overlooked requirement for the lifetime of the product. Dirt and dust accumulate on everything in a building, and physical access to the luminaire and other components is important to design in to facilitate periodic cleaning, upgrades and maintenance.

Modularity is important to consider, as reconfigurable systems can add value to the owner and end user. Modularity can change the business model, because instead of selling one basic system and counting on a very long cycle of selling cheap replacement parts in the form of lightbulbs, lighting systems in particular today are faced with a lot of uncertainty about what upgradeable options and future enhancements might actually be required. Sensors? Cameras? Wireless hubs? Intelligent adaptive controls? Most of these are out of the typical expertise of lighting specifiers, but they're becoming increasingly important factors in system and component design. Are future additions, replacements, or reconfigurations able to be done by the end user without needing expensive electricians on the job?

As Scott Yu pointed out, minimizing waste and considering recyclability of components and materials is not just a nice-to-have feature, It's something that you can build an entire company upon. And being efficient with materials, energy, and processes is simply good engineering.

It's crucial to consider installation when designing any luminaire- specifically the sequencing and coordination of trades. A typical job will start with installation of electrical, mechanical, and plumbing systems before the walls and ceiling goes up. Electronics and interfaces in luminaires need to be protected from dust and damage during the rest of the construction sequence before the ceiling and lamps are installed.

Understanding what's in the ceiling is important- spray foam insulation used in some ceilings is great for retaining heat, but also retains heat from luminaires, which can impact their performance. Separating the housing from the luminaire is usually a good idea here.

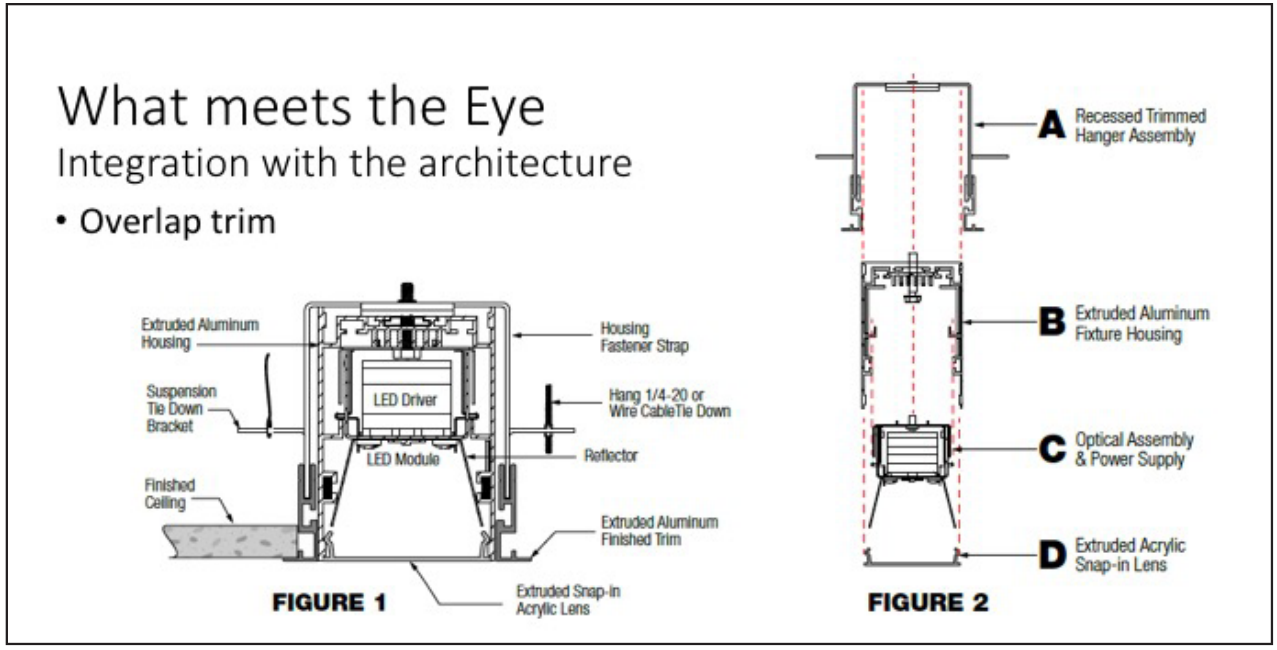
Finally, details like access to the luminaire and even being able to read labels on fixtures are also important considerations in luminaire design.

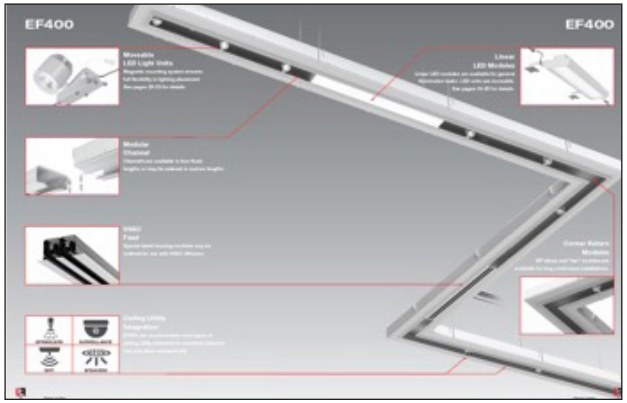
Visible/Invisible
What Meets the Eye

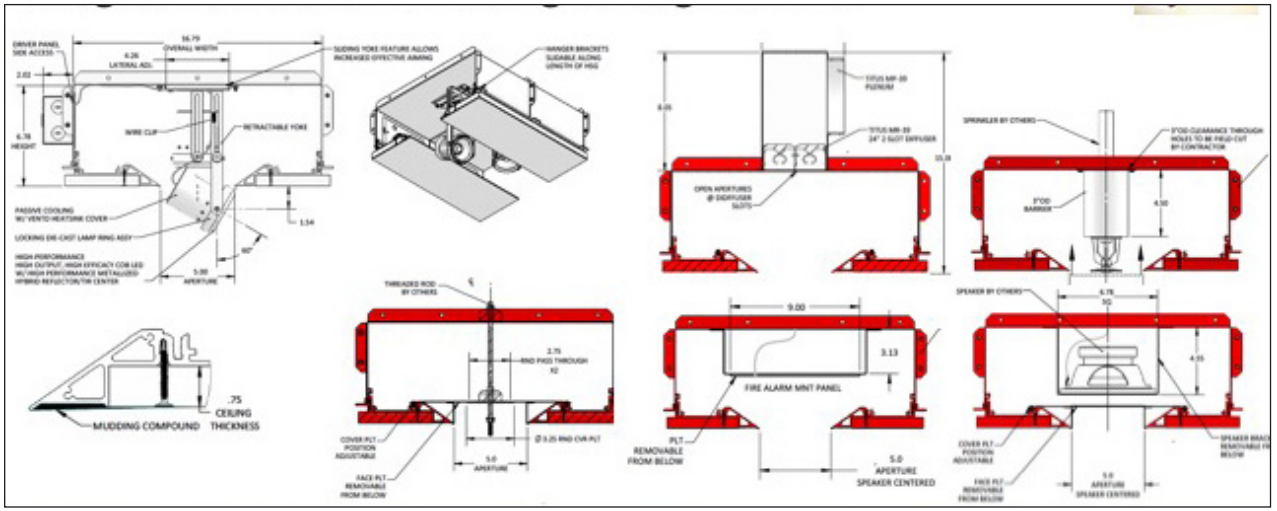
Lighting that is integrated within the architecture is very popular, especially with architects, and as building systems evolve and become increasingly complex, the ceiling is becoming a very busy place.

Systems that have to live and work together in the ceiling now include general or ambient lighting, accent lighting, HVAC, life safety speakers, sensors, cameras, fire sprinklers, signage, IT equipment, and more.
All of these compete for budget, space, energy, operation and maintenance resources.

What meets the eye can start to look pretty busy, as in the photo at left, and everything that's visible has a lot more connected to it above the ceiling that's even more complex.







Visible/Invisible

The Luminaire as an Organizing Element

When we designed our EF400 system, we wanted to enable designers and specifiers to drastically clean up the ceiling plane by incorporating multiple types of architectural LED lighting into one recessed system. The system can be used for linear slots, cove lighting, accent lighting, perimeter lighting and more. We paid a lot of attention to both visible and invisible elements.

The system housing offers a "Zero Edge" opening for an exceptionally clean trimless installation while providing added room to adjust the light units. The lighting equipment may be mounted on either side of the housing using our exclusive magnetic mounting system.

The system also gathers all necessary components of an architectural ceiling into one clean continuous slot. Along with adjustable and linear lighting modules, the channel can also host utility equipment such as HVAC, surveillance, public address, WiFi, fire sprinklers, and more. With the addition of "L", "T", and "X" channel connectors, almost any configuration is possible.

When designing lighting systems and components like luminaires and controls it's more important than ever to see the building as an integrated whole. All the different and increasingly complex systems, including lighting, must operate together within it. Lighting is of course not the only building system, but it's playing an increasingly important role because it's a system with power already routed to it and IT systems are beginning to live symbiotically on top of it. As building becomes more technologically complex, more knowledge and understanding of the different systems can only help your luminaire design practice.

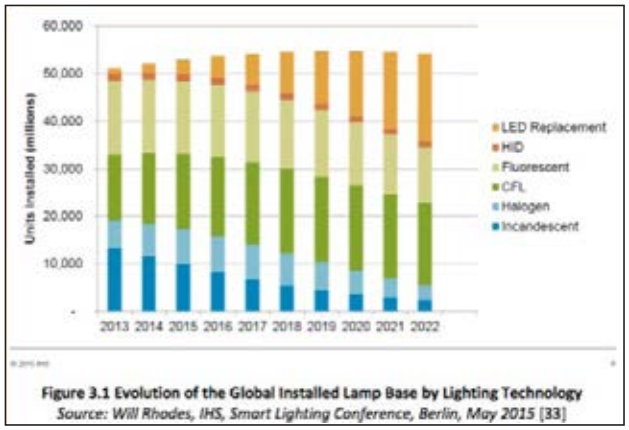


Figure 3.1 Evolution of the Global Installed Lamp Base by Lighting Technology
Source: Will Rhodes, IHS, Smart Lighting Conference, Berlin, May 2015 [33]

The Luminaire Roadmap
Roadmaps, Roadblocks, and Adoption Cycles

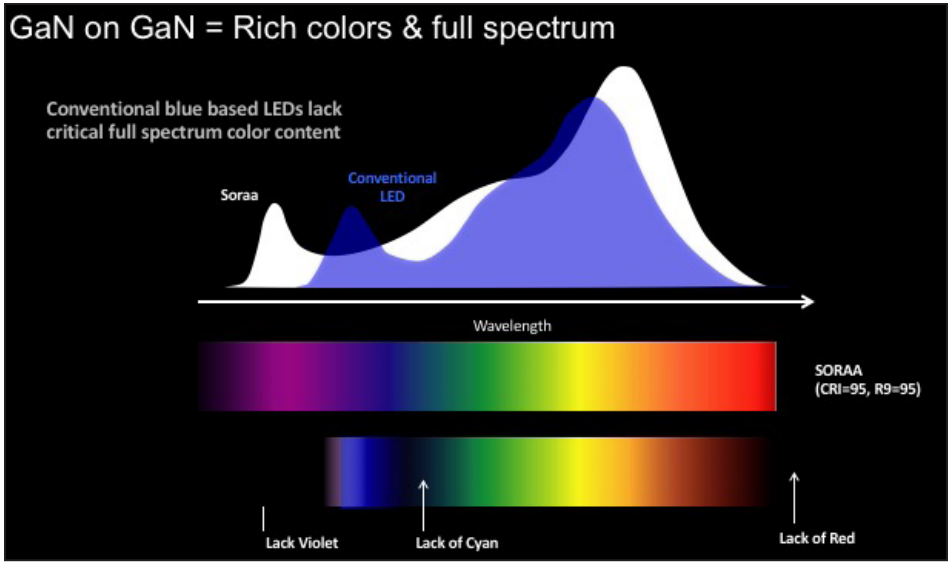
Susan Larson

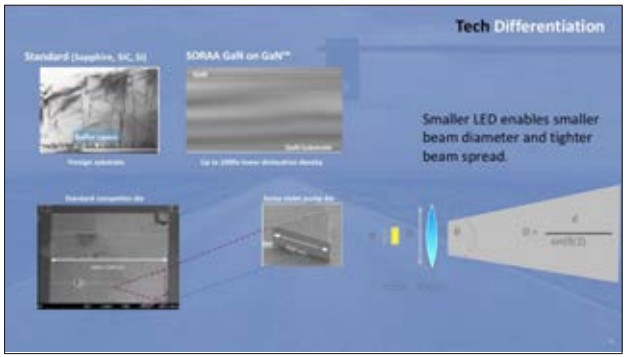
Why do we call it a "roadmap"? I think that it's often because we have no Idea where we're going or how to get there and it makes us feel better to use this label. This is part of what behavioral economists describe as the planning fallacy – being overly optimistic about the amount of time and resources required for any project. In any case, a basic fact about the lighting business now is that the roadmap is really hard and perhaps the biggest overall challenge to your company today.

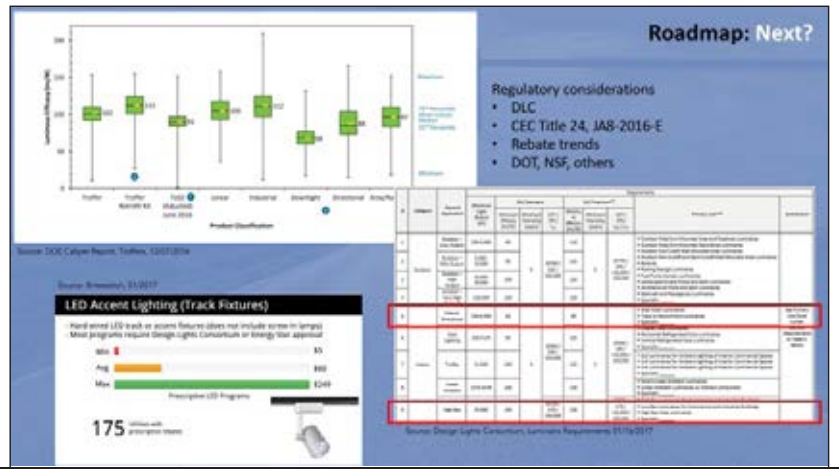
There's also a paradox in play – making strategic plans like roadmaps is much easier for larger entrenched companies with more stability and accountability to shareholders than it is for volatile startups whose horizons are constantly shifting. But it's precisely those companies for whom the game is rapidly changing that need planning the most, and because of the advent of solid state lighting and now IoT, there are more and more of these kinds of companies in the lighting industry.

Even with a roadmap in place, we face many warnings, uncertainties and roadblocks, most of which are driven by the pace and scope of technology change. I'll discuss how I approach technology and roadmaps later on.

We're still in the beginning of the SSL adoption cycle, it's still a small fraction of the total installed lighting base. With longer lifetimes and the demise of a business model based on stable replacement of component parts into the installed base, we're struggling to define new business models.







The Luminaire Roadmap
Understand Your Core Tech, Then Find a Home For It

There are several paths to building a successful product and company, all with their pros and cons. You can simply build what people want - this works if you're able to understand what people want, which can be tricky, but you also run the risk of being behind the curve. You can build it and hope they come, which is risky at best. You can build it and make them want it, which can be costly, although it worked quite well for George Eastman when he invented consumer photography and subsequently founded Kodak. Or you can build what people want before they know they want it, which works well if you're Steve Jobs, which most of us aren't.

What works for me is ultimately a mix of several of the above methods, but the basic idea is to understand how your technology is different, then find (or create) the best application for it.

We launched Soraa in February 2012 with a violet pump 3 phosphor LED technology (GaN on GaN) with two fundamental advantages over blue pump two phosphor LEDs: true full spectrum high quality light and the smallest point source or lumens/area ratio. We needed to understand who cared most about these advantages, as this would this determine our product roadmap, market and channel strategy. We realized that our customers would be specifiers and end customers who use directional light, in retail, hospitality, and residential applications.

We started with what was the hardest lamp type to execute, the MR16. There was no great LED MR16 on the market at the time, so we built it. We built our brand around specifiers and around the highest possible quality of light. Then we extended that to other lamps and are now extending it into luminaires.

The Luminaire Roadmap
Focus and Futureproof

Once you have a realistic and accurate understanding of your technology and have a product, where do you go next? This is where building the roadmap really begins. You must build an internal process that routinely asks, and answers, a long list of difficult questions: What are customers asking for? Are you listening to them? Where are the pain points? What are the barriers to entry and how do you get past them? What is the real competition, how do you compare, and how much does it matter? How many SKUs are required to support the product and can you manage all of them? What are the costs, margins, and 3 year projections? Who do you partner with? One of the hardest things for companies to do is to make the discipline of this questioning process permanent, rather than just a planning exercise meant to placate investors that is done once and forgotten.

With all the shiny new toys that technology throws at us constantly, it seems to be more difficult than ever today to stay focused on your core strengths and avoid distractions, but doing so is critical. Don't make products just because you can – "one-off" products or projects that don't fit your product line, channels, or brand must be stripped from the roadmap, even if they are tempting. You must develop a good internal process to gauge when something is a true opportunity and when it's only a distraction.

Not only are individual technologies constantly presenting themselves, but their endless potential for combination is at times dizzying. Evaluate partnerships that can leverage your tech to fit their products and channels. Does being on their roadmap bring strategic benefits and revenue without diluting your focus?

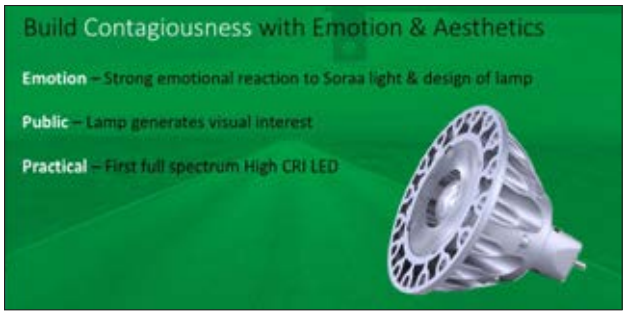
"Future proof" is another term like "roadmap that always gives me pause, but it does speak to the need to plan for an uncertain future. Perhaps because the future seems uncertain is all the more reason to plan for it in order to ensure that there *is* a future.

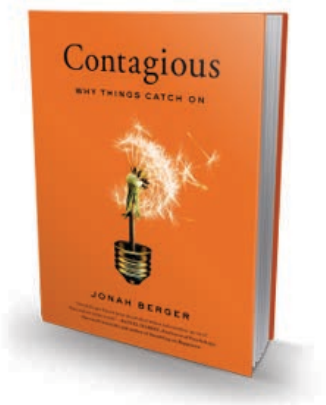
It's particularly important to get this right when it comes to lighting, controls, and IoT. The industry as a whole is not unified in its view of the impact of IoT on lighting, but there is a risk that non lighting functions and companies will exert undue influence on lighting, which is why I like to talk about sticking to lighting basics. One thing all seem to agree on is that flexibility and open source approaches are key – build a roadmap that allows you to add new features to a solid platform, and choose your control partners wisely to protect future options.

Your roadmap needs to build longevity into specifications- specifiers today struggle to control the specification process as products change so rapidly. The roadmap also needs to accommodate successive layers of replacements, upgrades and total replacement as SSL gradually evolves to full adoption.

Your roadmap needs to consider an extension path for successful product that can evolve into "platforms." Specifiers today are moving to integrated fixtures, which means that the replacement lamp business may be in general decline. As customers have been asking for this, it's a natural extension for Soraa to move into integrated fixtures, as this solves a lot of problems for our core market. With Soraa COB LEDs and Soraa Optics, we can leverage our core technology and markets to best advantage.

The Luminaire Roadmap
Sticking with Basics and Building Contagiousness





It's important to understand how and where the new technology that's transforming the lighting industry is having the biggest impacts. Lighting systems are now expected to last longer and longer, but uncertainty about the longevity of platforms and companies contributes to choice paralysis, where buyers don't buy because they're overwhelmed, don't know the future implications of their decisions, and don't have time to assess and compare all the new products and options.

It's also important in all of this to remember where new technology is not having an impact. We need to remind ourselves to stick to lighting basics – providing dependable, affordable, maintainable high quality light where and when you need it. One point of view is that technology should aid, not totally drive our core business.

Another troubling influence of the technocentric Silicon Valley approach to lighting is that we expect single technologies like SSL, IoT, LiFi, POE, or a host of others, to create magical transformation (and spectacular IPOs) at the pace of IT, which is to say overnight. The reality is that the transformation of lighting, part of the slow moving building industry, proceeds in a much more incremental way.

Controls are still far too complicated and need to become simpler, for everyone, not just for consumers. Maintenance and platform continuity are still critical factors in lighting as a building system, and can't be ignored just because we can do circadian lighting on our smartphones (who fixes *that* when it breaks?) We're still stuck in many old ways of thinking when it comes to luminaire design and have only just begun to explore the real possibilities.

In his book *Contagious, Why Things Catch On,* Jonah Berger lays out a fairly simple but complete method for building successful products and companies. Called STEPPS (an acronym for Social Currency, Triggers, Emotion, Public, Practical Value and Stories) it's the result of finding the common factors in a broad range of products across recent history. Looking back and applying this to Soraa, we hit on most of the important qualities when we developed our MR16 lamp program.

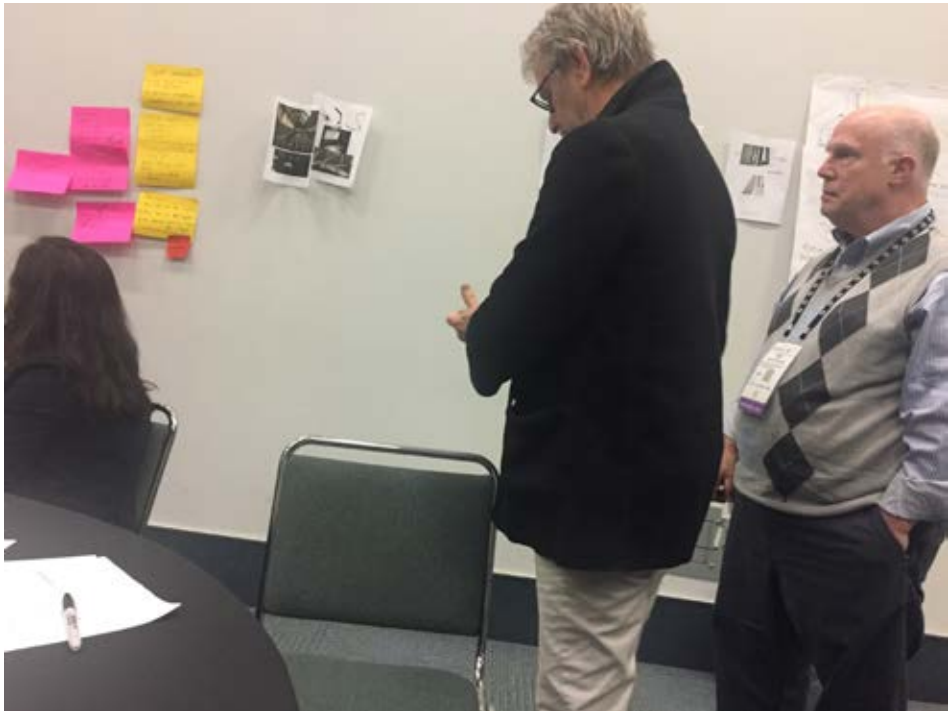
First, we built social currency by focusing on our core market, specifiers. We courted key influencers in the specification community and made sure they knew about our core technology and its benefits to them. We won several prestigious awards early on with our products. We created triggers to awareness by being seen in all the important shows and publications and by developing great case studies of installations in prominent locations by leading designers. We leveraged the emotion felt by customers when they first encountered Soraa light – a feeling that can only be described as delight. Our MR16 lamps were instantly recognizable and publicly visible – "glanceable," in fact. You can instantly identify a Soraa product by its unique, elegant design. We provided great practical value to customers needing to light their products and environments to best advantage. And we had an amazing story to tell that started with Shuji Nakamura, the inventor of the blue LED, and a founder of Soraa.

Building a successful roadmap in lighting today is much more than having a great technology or a great product. You also need a story, a strategy, a compelling emotional response from customers, and the discipline within your organization to constantly focus, monitor, and modify your plan as you evolve.

The Results

People getting busy being creative.

New materials inspire.



Me with Gere Kavanaugh and her colleague Neal Taylor

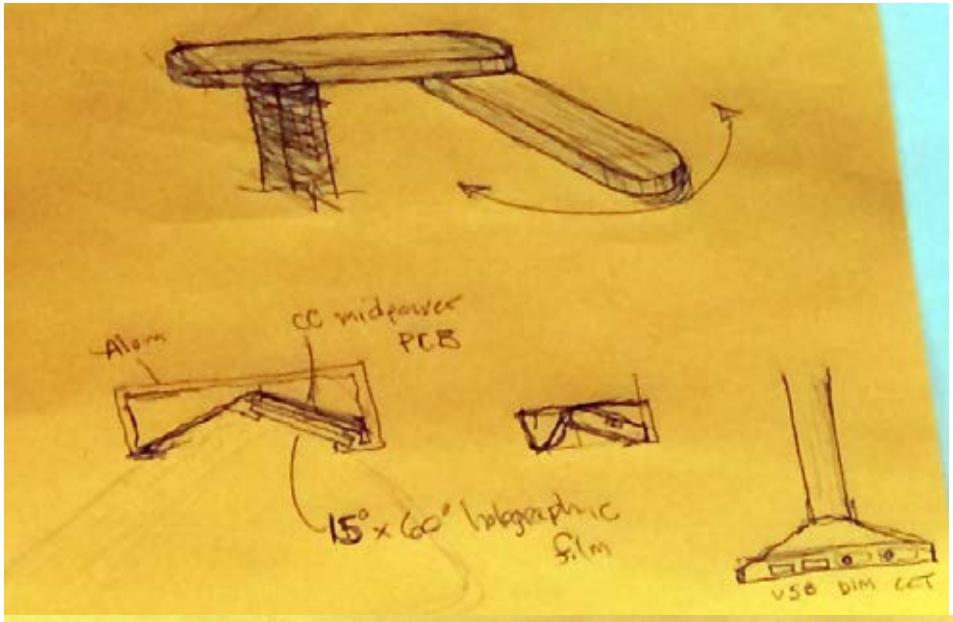
I was honored and delighted to have Gere Kavanaugh, a California design legend and a key design mentor of mine, be a part of the workshop. Gere and I worked together in the 1980s, starting with the 1984 LA Olympics. Here's her Wikipedia entry:

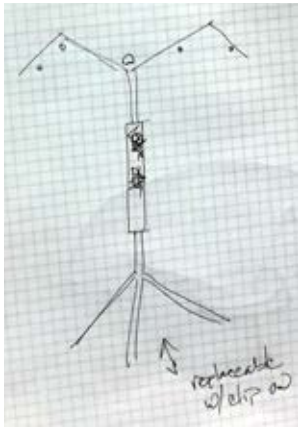
Kavanaugh worked as a stylist for General Motors primarily designing exhibitions to showcase automobiles, but also displays, created model kitchens, and interiors. She was part of the first group of women designers at GM, dubbed the "Damsels of Design" by design director Harley Earl. In 1960, she left GM for a position in the Detroit offices of architect Victor Gruen, known as the father of the shopping mall.There, she designed interiors of retail stores and shopping centers across the country. The firm later moved to Los Angeles where she became friends with Frank Gehry. She later shared studio space with Gehry, Don Chadwick, and Deborah Sussman where she founded Gere Kavanaugh/Designs (GK/D) in 1964.

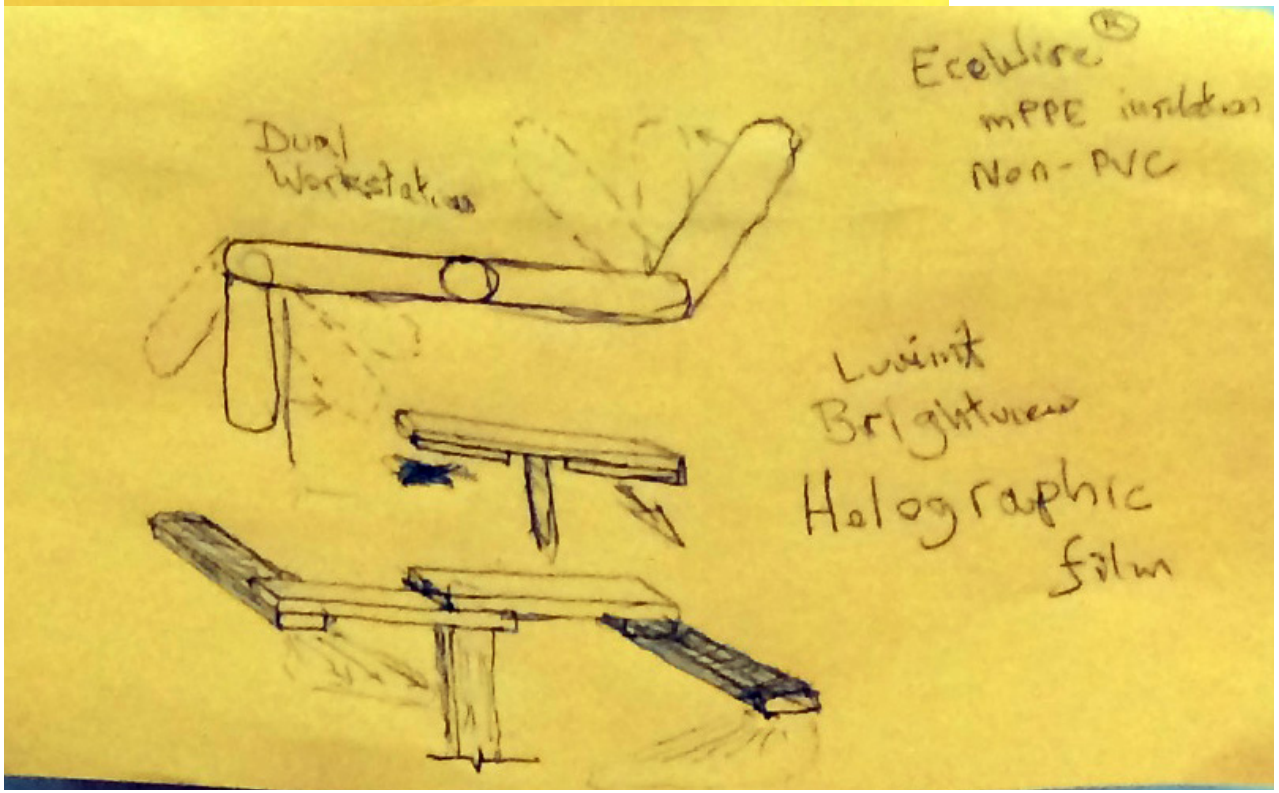
Over the years, Kavanaugh has designed ceramics, light fixtures, homes, store interiors, textiles, town clocks, and furniture.[2] In the 1970s, she worked with furniture company Terra to design the "California umbrella." Unable to patent the design, she started an alumni product archive at Cranbrook where alums could donate work which companies could reproduce and pay royalties directly to the school.

She was the first interior designer to win a COLA grant from the City of Los Angeles Cultural Affairs Department. [4] Her work was included in the Pacific Standard Time: Art in L.A., 1945-1980 exhibit. Kavanaugh also designed a research room and typeface for the Nixon Presidential Library and Museum.

She was awarded the Julia Morgan Icon Award at the Los Angeles Design Festival in 2014.She also received the American Institute of Graphic Arts (AIGA) Medal in 2016.







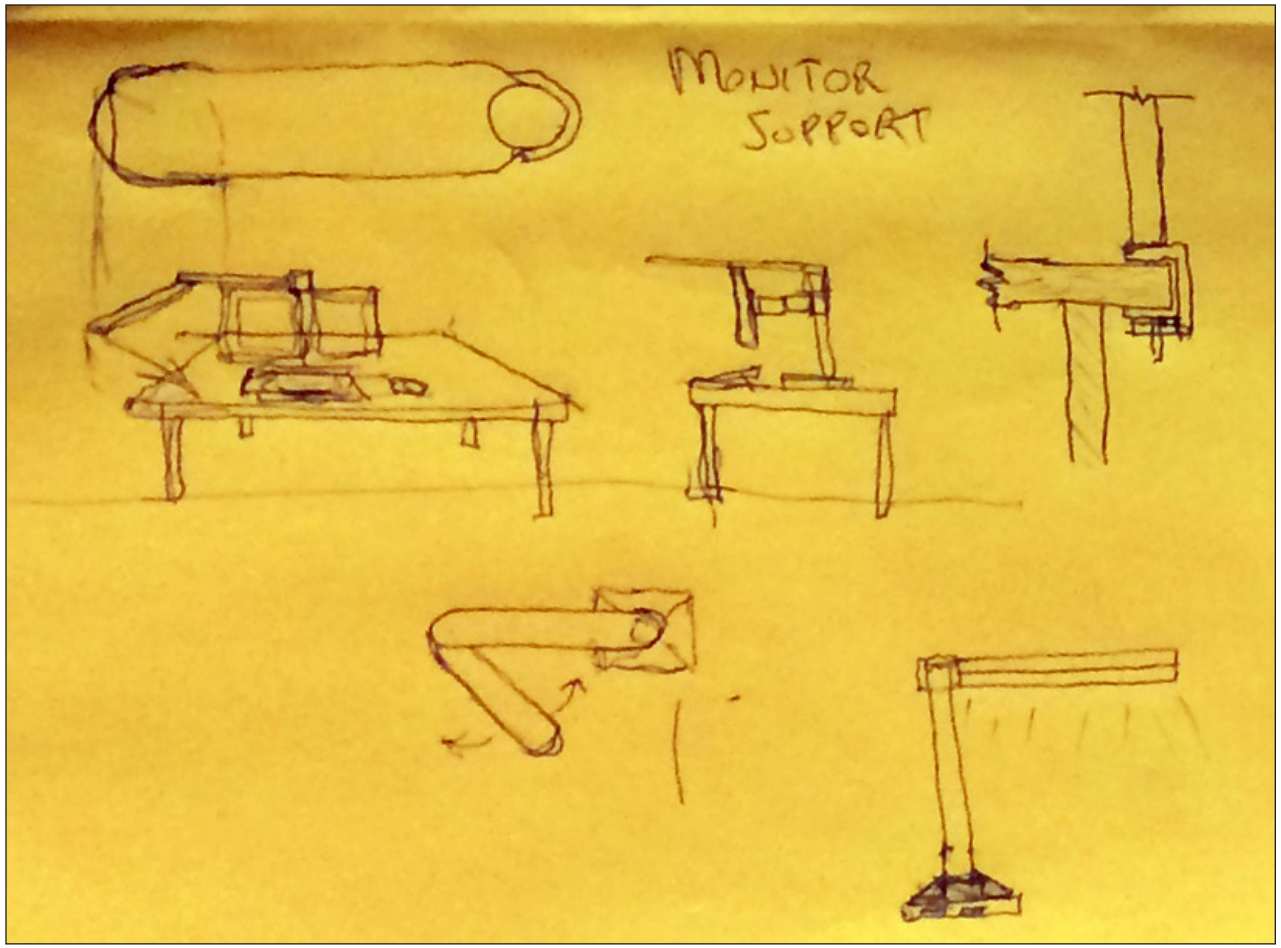
Results
Thinking Made Visible

Workshop participants followed a typical pattern seen in a design charrette – they went back and forth between individual and group focus in their exploration and problem solving. In the rush to agree on a solution to present, some individual doodles and sketches may be overlooked at first, but on later examination show some interesting thinking and useful directions.

I regret that I didn't record more of these doodles – you get so involved in the moment of interacting and sharing ideas that recording kind of gets in the way of the process. But the few things I did grab allow us a unique view into the creative process. It's a bit like archaeology.

The sketches on the yellow paper show thinking about form and function that is a response to the design brief. These directions have been explored before in desk lamp design, but now the designer is also thinking of things like holographic film and Ecowire, which may bring a totally new dimension to the form as well as addressing recyclability and re-purposing. Also, exploration about the interface shows consideration for controls and data and power ports.

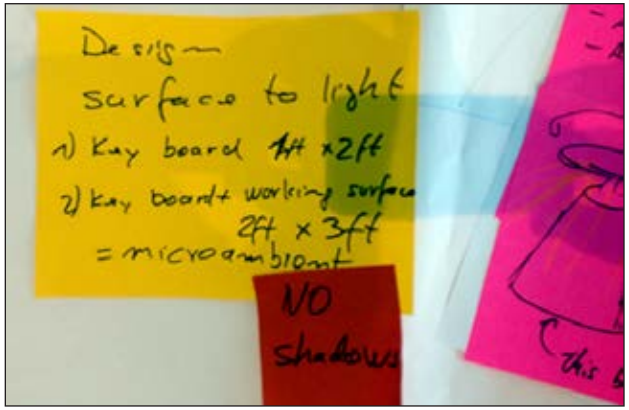
The sketch on the graph paper is a perfect example of a lightly tossed off idea that may or may not be worth examining further, depending on who's looking at it. It appears to be a lamp form that mimics microphone stands and photography gear, but on a smaller scale, with interchangeable units for lighting.

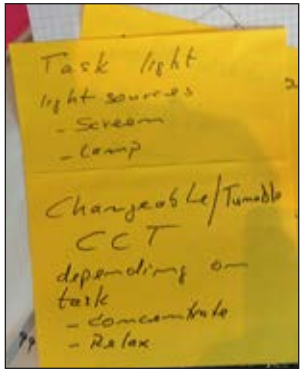


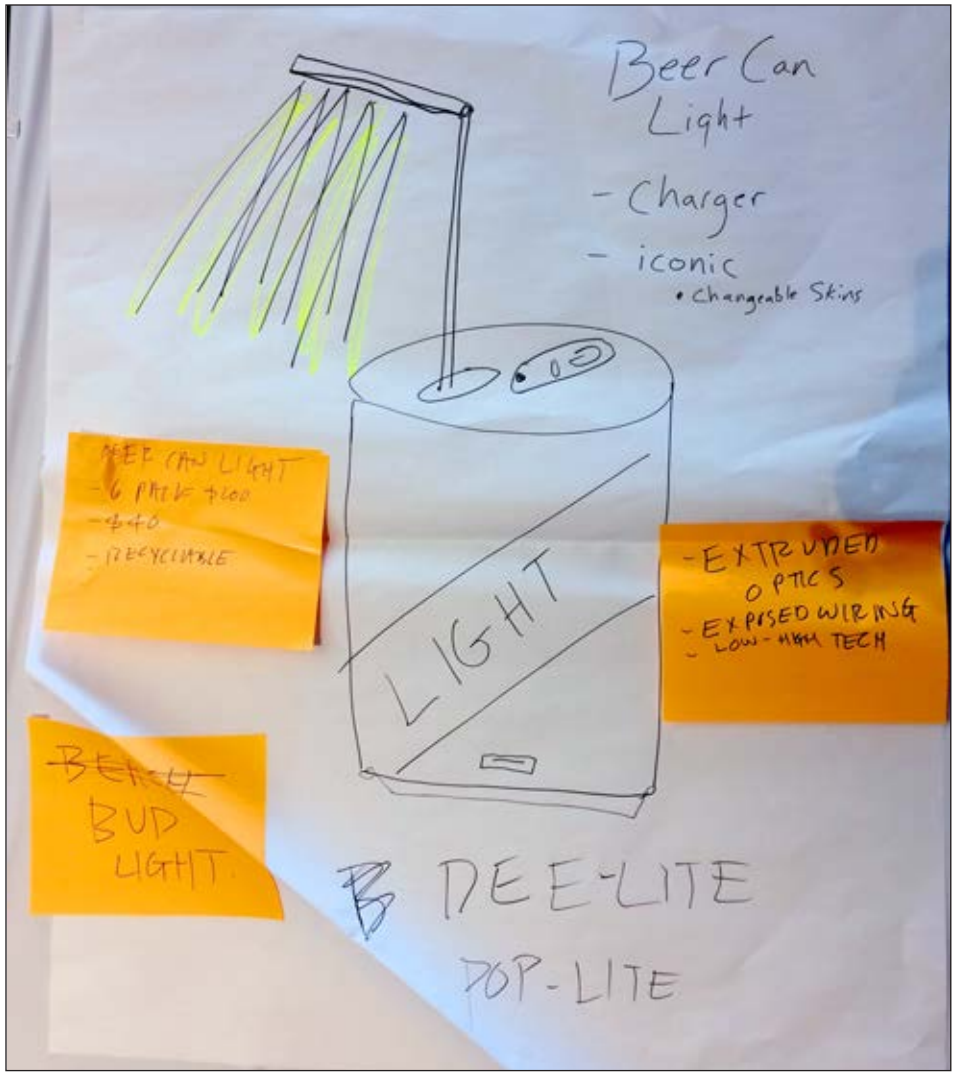
Results
Thinking Made Visible

What I like about these sketches is they show that someone was clearly thinking about the mechanics of the devices on our desktops, looking at the ecosystem of all the stuff that's right in our faces all day every day. This was very much the whole idea of the workshop – rather than jumping right to a form, start thinking about the environment for the product first.

As anyone who has suffered form carpal tunnel or other physical afflictions resulting from our often ergonomically challenged desktop knows, the positions of the monitor and keyboard are important to work out. How does lighting figure into this equation? How much hardware is needed to physically support devices that provide light to this microenvironment? That's the beginning of the real design problem in a way. As you can see, in the case of monitor support, it's not a trivial engineering problem to solve.







Results

Proposal 1: Bud Light

The Big Idea - Recycled aluminum cans hold a small, flexible LED light element that resembles a straw. Driver and electronics are contained in the can, which also features a USB port, and changeable skins. The design might follow a low tech/high tech aesthetic, with exposed components and wiring.

Go-to Market Strategy - The Bud Light would be offered in 6 packs, with an ASP of $40.

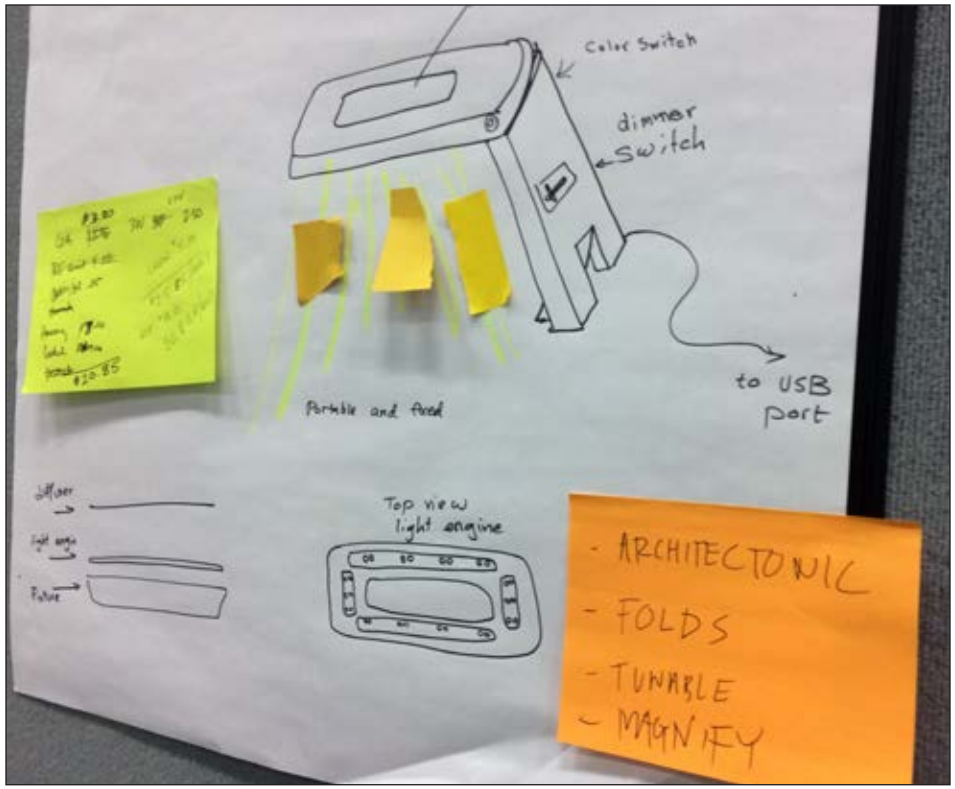
Fabulousness- Honestly, not much at first glance. Recyclable is good. Light distribution might be good if technical challenges are met. They're small and portable. Changeable skins may make a big difference in the appeal of the product.

Challenges - It takes recycling a bit too literally. The very small and thin light bar may pose technical challenges. Getting to an appropriate BOM cost may not be too difficult.

Funding Ask - $50K

Investor Vote - Meh. The small size of the ask showed a lack of confidence in the proposal, We wondered "who drinks beer from a straw?" This rather amplified the cognitive disconnect we encountered with this design. Aluminum cans don't seem appropriate for office lighting.

Parting Thoughts - After the initial lukewarm reaction, several ideas may bear further exploration. If the can could take on a more finished appearance, it would look less like garbage. This may involve appropriating a manufacturing technique for aluminum rather than the exact form of the cans themselves. Exploring the challenges of a very small light bar, possibly looking at extruded integral phosphor designs, may pay off.



Results

Proposal 2: Parthenon

The Big Idea - An LED task lamp that folds, works as a portable and fixed luminaire, has a magnifying panel, tunable dimmable light, and a form that reflects iconic architectural structures.

Go-to Market Strategy - Unclear, although some careful thinking was done on BOM cost, as you can see from the yellow note.

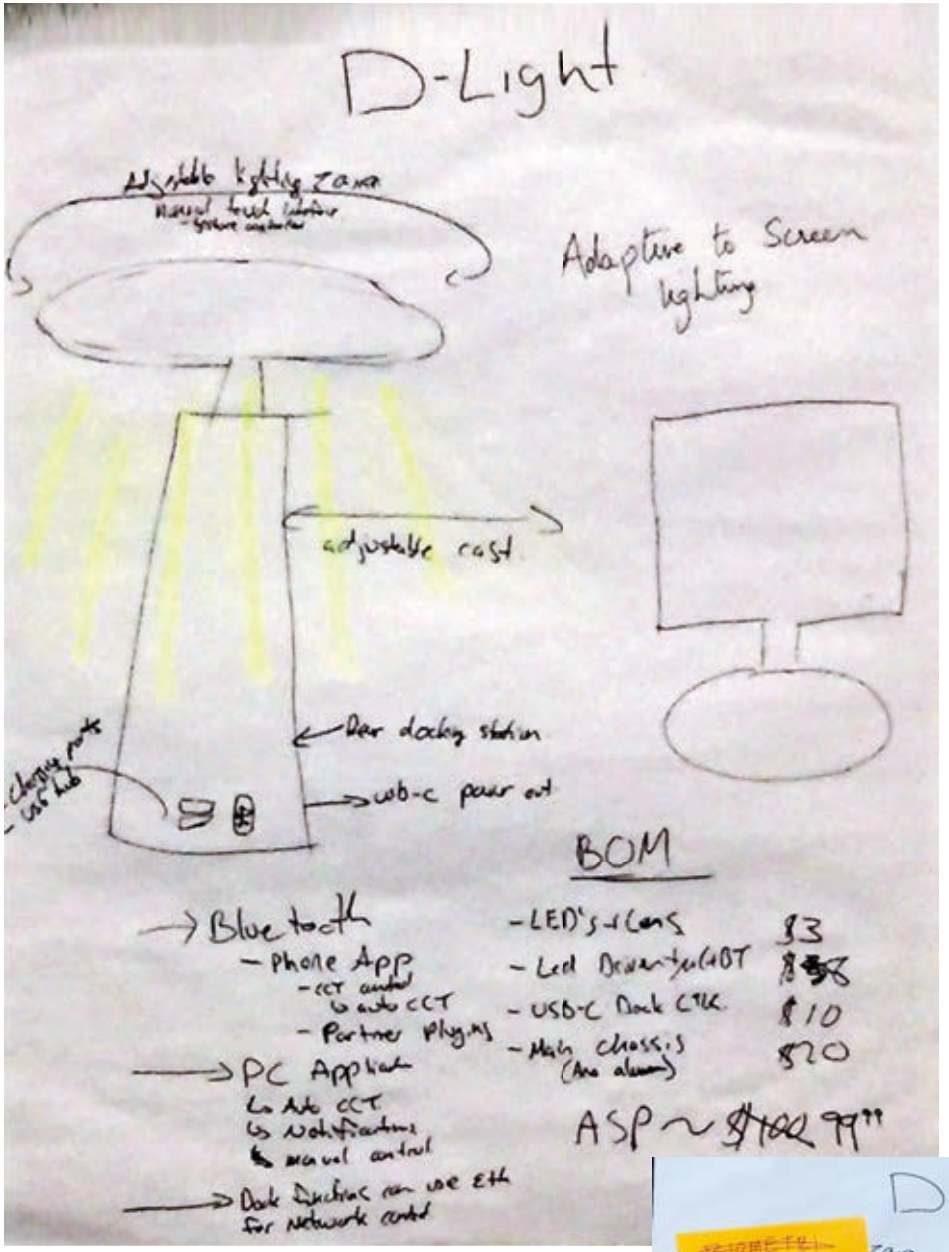
Fabulousness- Multiple functions in one device, good.

Challenges -The drawing shows a design that looks as though it won't stand up on its own. The addition of a magnifying panel is a surprise, although its benefit for general task lighting is unclear. Considering architectonic forms for luminaires may pay off – this design seems to be striving in the right direction but not quite pulling it together.

Funding Ask - $100K

Investor Vote - Pass. Come back with a more defined concept.

Parting Thoughts - In retrospect perhaps the team was thinking of the Pantheon rather than the Parthenon- two very different buildings in their treatment of light. But the idea of looking at larger structures to inform smaller ones was the point. Strangely enough though, the plan view of the lamp with its oblong opening does resemble a Greek temple plan.



Results

Proposal 3: D-Light

The Big Idea - A desk lamp with a mushroom shaped dome light that adapts to the "microambience" in your personal desktop space, has haptic controls (you stroke it gently to adjust the light), is adjustable, smart and upgradeable.

Go-to Market Strategy - ASP of $99. Partner for multiple plug-ins.

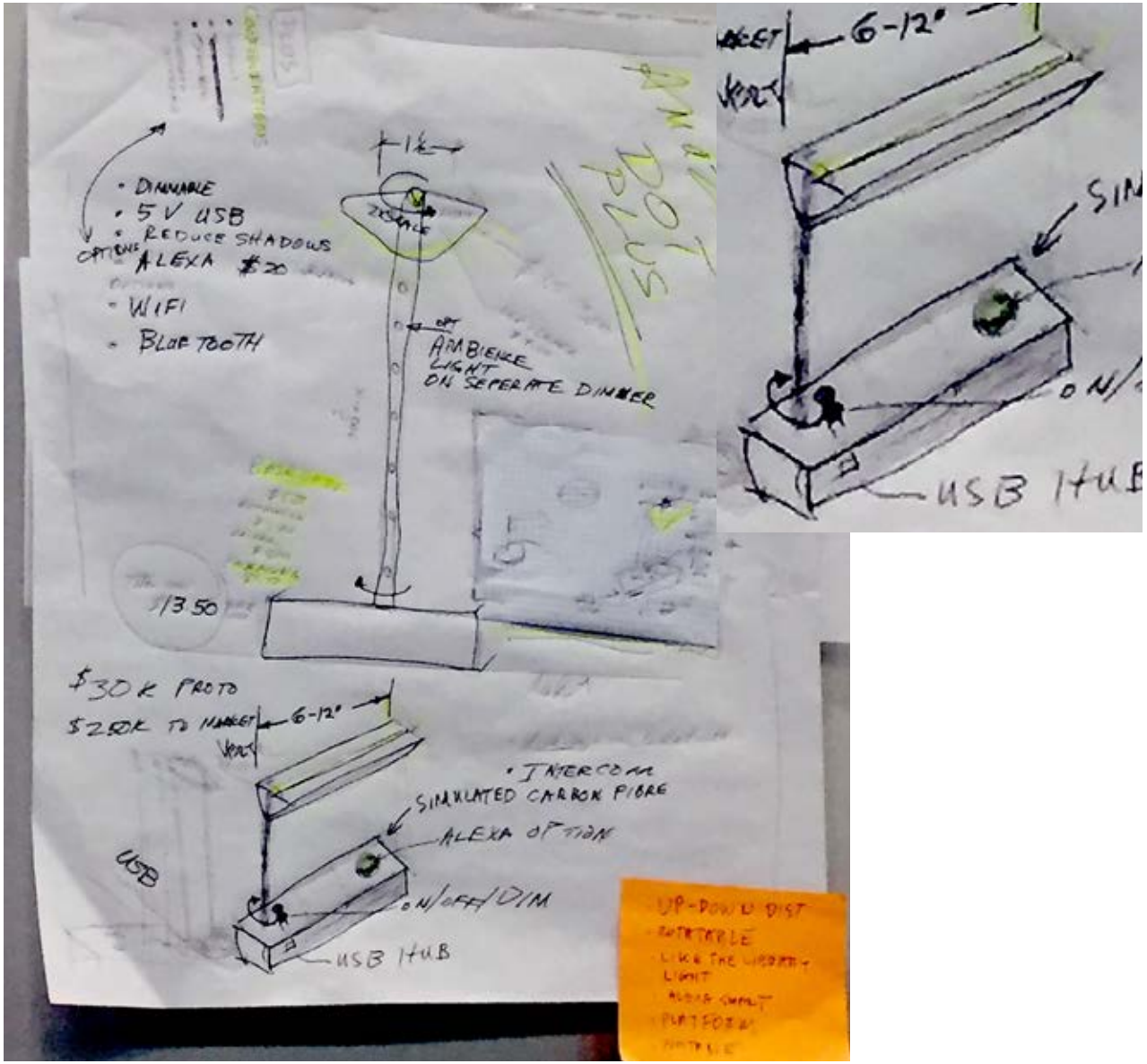
Fabulousness - This proposal had some of the most IoT plug-ins and the possibility of an iconic, biomimetic form. But what really rattled my cage were two concepts- the adaptive control function and the "touch me" interface. Both of these ideas are widely applicable to other luminaires, and maybe other kinds of products.

Challenges - The first issue might be size- the initial sketch seems like it might take up a lot of desk space. And the haptic interface and adaptive control are simple ideas that may take a long time and a lot of research resources to implement.

Funding Ask - $250K

Investor Vote - We voted for full funding because the big ideas behind this proposal were so compelling.

Parting Thoughts - Most interesting to me about this was the fluidity of form in the design. I was so intrigued with the two ideas of haptic interface and adaptive light levels that I almost didn't care too much about the actual shape and size of the design- I was thinking about how it *felt*. This represented what I really wanted to achieve in the workshop- the seeds of concepts that had much bigger future application to lighting.



Results

Proposal 4: Amazon Dot Plus

The Big Idea - A desk lamp that refers back to iconic library reading lamps , but done in new materials like carbon fiber and integrated phosphors; is chargeable and portable, has up/down distribution; is dimmable with separate channels for up and down light; and is a platform for IoT including Alexa, Wifi, and bluetooth.

Go-to Market Strategy - ASP of $99.

Fabulousness - This proposal was the most clearly defined and visualized.

Challenges - Since this concept is more fully realized, you begin to think in terms of engineering details like how the linear LEDs attach to the post; how the switches feel and operate; degree of rotation of the post and light head; selection of power supply. Another higher level question would be "how does the finish product look distinctive and fabulous?"

Funding Ask - $30K for prototyping, $250K to bring to market.

Investor Vote - We voted for full funding because the big ideas behind this proposal were so compelling.

Parting Thoughts - This scheme came about partly because Gere Kavanaugh, one of the designers, happens to be working on some similar designs at present, and her team was obviously curious about the remote phosphor material sample supplied by Jason Posselt. This represents again the kind of result I hoped to achieve by combining a diverse group of people, materials, and ideas.

Summary & Conclusions

Summary
What We Learned

Our predominant cultural narrative of innovation tends to mythologize the lone genius working maniacally through the night in his lab to harness the magic of technology- think Tesla and Edison in particular. Lost in this version of things is the social process of design that is behind most inspiration and implementation. This workshop was an experiment to see how we could get back to this, if even for a brief moment. For me at least, the experiment was a big success. Below are some of the things I noticed during the workshop.

Accidental combinations - Many times we forget how large a role pure chance plays in our decisions. I remember the discussion of finishes for the D-Light. We were looking at a drawing next to someone's MacBook, with its exquisitely milled aluminum finish, so naturally we thought the lamp should be finished like that. This must have given rise to the discussion of haptics (touch interface) which to me is a fascinating direction in lighting controls that has only begun to be explored. Many other things came about simply because one post-it note happened to be next to another one, or one team member happened to start up a conversation with whoever was sitting across the table.

Preparation- The structure of the workshop deliberately prepares people to think beyond routine specifications for a product. My choice of speakers and topics was calibrated to offer the widest possible viewpoint to the problem, and it paid off in getting people to approach solutions from what were probably angles very different from what they were used to. Introducing a gentle competition can really stimulate teams to coalesce and do better than the sum of the parts. And giving people a historical perspective in how similar problems have been solved before can provide inspiration in ways to use new technology.

Ideas Can Come from Anywhere - This is the part where it's easy to say "there are no bad ideas." Of course there are lots of bad ideas, and it's important to weed them out, especially in real life where decisions about allocating resources to projects are crucial. But the logic behind assembling a diverse group of participants to tackle a design problem is that people can usually be counted on to bring a fresh perspective to an area outside their regular expertise. This is the power behind the wisdom of crowds, and harnessing it requires a fine balance of preparation, openness, and critical thinking.

Rough is Better - With all the powerful design tools we have at our disposal today, we seem to be forgetting basic skills like sketching and scribbling. My intention in sticking to paper and pens was to force us to think and talk more and get things up on the wall quickly, before they looked too final. There's a lot of personality in a rough sketch, it communicates on an emotional level in a way that nothing else can.

Get it On the Wall - One of the keys to a successful social design process is putting ideas on large vertical surfaces where they can be viewed by many people at once. I'm always surprised at how people are reluctant to do this, they're just not used to it. I have to grab sketches out of their hands and pin them up and start asking questions about them.

We Underestimate Our Capacity for Creativity - I don't believe creativity is special or genetically determined, it's something everyone can learn. What's crucial to making it happen in groups is preparation, stating the problem clearly, setting limits, fostering competition, and sharing ideas.

Acknowledgements

I want to thank many people who made the workshop possible- first of all, James Highgate, the creator of The LED Show, who is always open to new ideas, and Stephanie Fieldman with Penwell, who was assiduously supportive and helpful in all the important details.
And my speakers; Scott Yu, Scott Hershman, Jeremy Steinmeier, Susan Larson, and Jason Posselt, all brought their A games to the table.

I also am indebted to all the workshop participants who really made it happen with their fresh ideas, personality, and lively interchange of ideas.

If you have more ideas to share or to add to this report, please feel free to contact me per info below.

Thanks again to all for everything! Let's do it again soon.

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