

Emerging Technologies

What's Next in Lighting & Tech

Connective Innovation

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Connecting to the Future

Clifton Lemon

Founder, Clifton Lemon Associates,
LightPlace Advisors



Questions?

What's Connective Innovation?

What's all this IOT and Smart City stuff anyway?

What (and how) do we Build?

How do we hold spec?

What is Illumigeddon & when will it happen?

Will a robot eat my job?

What about MY future?

This presentation will attempt to answer some of the questions you may have, but probably won't answer them all. There is much discussion of IoT, Smart City, and rapidly advancing technology. All these things impact not just the lighting industry but the building industry as a whole and pretty much everything else in civilization. I think it's important and very useful to see things in a historical context because even though the past will not predict the future, it often rhymes with it- not only that, there's really nowhere else to look. Patterns and connections are more useful than proceeding without any guidelines at all, and most of us face difficult decision on an almost daily basis that involve dealing with increasing complexity and uncertainty. In the lighting industry specifically, we fear what Chris Brown refers to as [Illumigeddon](#)- the collapse or rapid transformation of the industry as we know it. Seeing your role in the larger context of the environment, the economy, and historical patterns can help you deal with change and uncertainty.

11 Biggest Lighting Trends - Lux Magazine

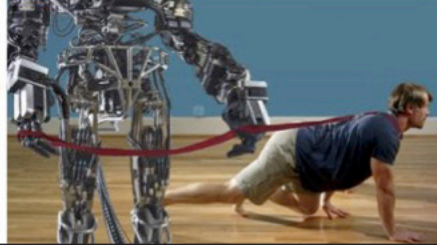
1. Connectivity
2. IOT
3. Integrated vs lamp/ fixture
4. New Power Tech
5. Decline of Retrofit
6. Wireless
7. Lighting & Health
8. New Materials
9. Full LED Penetration
10. Flight to Quality
11. Beyond Light(ing)

As far as trends in the lighting industry go, I think [Lux Magazine](#) does a good job of breaking down what's on our minds now and in the near future. But we need to look deeper than this for answers to larger questions.

How Are YOU Feeling about Tech?



Overwhelmed?
Self-Obsessed?
Terrified?
Enslaved?
Addicted?



I think we'd all agree that technology has undergone a transformation unimaginably rapid and complex in recent decades. Our reactions to this are varied and include a full range of emotions- we're resistant to change then suddenly embrace it, then can't imagine life without the changes. Complexity in technology gives us many wonderful benefits but does not come without costs- to the environment, to society, and to our own bodies and sense of well being. We also simply cannot predict what many of these costs and benefits will be, as cultural evolution, like biological evolution, behaves a lot more randomly than we like to believe.

How Are YOU Feeling about Tech?

...Connected?



We can also agree that technology today is making most of us feel more connected to each other- to our families, friends, co-workers, and to new friends and collaborators all over the planet. Almost all of us will willingly trade the frustration, befuddlement, and rapid change for the increased connectivity alone.



We Shape Our Tools [& Environments] & They Shape Us:
Biological Evolution Drives Cultural Evolution

Part of our being periodically overwhelmed by technology is our conveniently forgetting that we don't rule nature, especially including our own natures. Cultural evolution, which is largely but not exclusively the provenance of technology, often seems to have overtaken biological evolution, but this is impossible. Even though we have skyscrapers and Uber, we're still animals with brains whose basic functions evolved for life on the savanna and haven't quite caught up with the skyscrapers and the Ubers yet.

We're Not the Only Species with



Architecture



Language



Emotions



Eusocial Organization



Reciprocal Altruism



Technology

I'm kind of constitutionally opposed to the view that we humans represent the pinnacle of evolution simply because we have big brains, Uber, and skyscrapers. Part of our living sustainably on the planet means recognizing our similarities with our fellow species and learning from them. They're not just decorative and nice to have: we've co-evolved closely with many of them.

Electrification: Smart Home, Smart City Then



Electrification is the defining technology of what we think of as the modern era. Back around the turn of the 20th century, the infrastructure and groundwork was laid for a culture and an economy based on distributed electrical power.

A Better Theory for Innovation

Disruptive Innovation

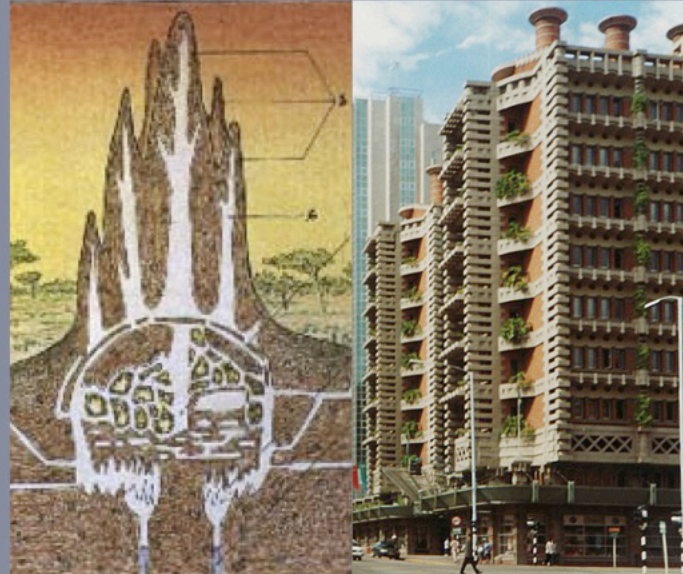
Scrappy startups overtake entrenched players and industries-
True innovation is transformative, not incremental

Connective Innovation

Transformative innovation happens when many technologies,
inventions, and social organizations combine and connect in
new ways

Recently Clayton Christensen's theory of disruption has rightly come under attack- most eloquently by Jill Lapore, a historian and New Yorker writer. While Christensen's intentions are honorable- to provide a theoretical framework for understanding economic systems- the theory itself has become widely misinterpreted, which is not his fault necessarily but still doesn't help his case. He's recently been arguing that Uber is not disruptive according to the theory. It's also worth noting that he claimed the iPhone would never be a success because it too was not quite disruptive. Disruption theory is not that useful because it's a bit too narrow and not particularly prescriptive. I prefer what I call the theory of Connective Innovation, also called Combinatorial Innovation by futurists like Frank Diana and others. This draws on a more complete view of history typified by the work of James Burke, whose TV show and book [Connections](#) explores the cumulative, complex, accidental, and surprising ways in which our modern world came about.

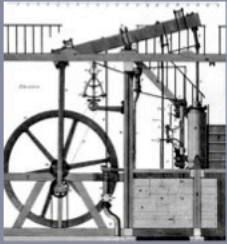
Forget Disruption- Connect!



Examples from architecture illustrate the popular idea of disruption, which appears to be making buildings look like they're falling apart just because you can. I call this techno-narcissism. Silicon Valley and its imitators have taken the disruption meme to heart with a somewhat idealistic and occasionally nihilistic imperative to reinventing and re-engineer everything in the interest of removing "friction."

The large building on the right is the [Eastgate Center](#) in Harare, Zimbabwe, a highly efficient biomimetic design modeled after thermal management and ventilation techniques evolved by African termites in their mound colonies. This design connects innovatively with nature in surprising ways, rather than simply attempting to "disrupt" traditional architectural fads for the sake of novelty.

Connective Innovation circa 1870-1910



+



+



+



+



Looking at history, it's easy to fool ourselves into assigning massive change to a single invention, like Edison's lightbulb or Watt's steam engine. But all innovations are built upon many prior discoveries. To quote Steven Johnson in the Wall Street Journal: "...new ideas are bricolage. They are, almost inevitably, networks of other ideas." The theory of combinatorial innovation is a more complex and useful way of looking at how the biggest changes happen when technologies or innovations combine, usually in unexpected ways.

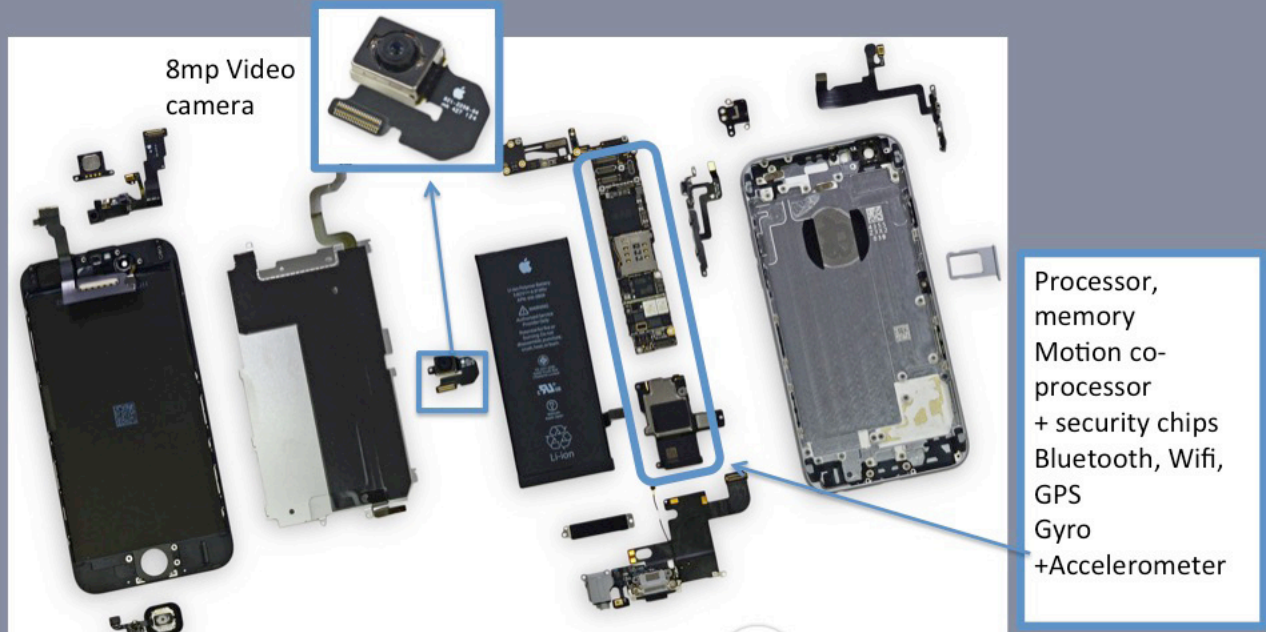
While today the pace of innovation is increasing exponentially, we have necessarily lost our perspective on just how relatively transformative connective innovations of this period were. It was the steam engine plus railroads plus telegraph plus transoceanic cables plus international time zones that created the foundations of today's global economy. And of course electric lighting plus long distance power transmission plus dozens of other innovations in manufacturing and communications extended the day and increased production exponentially. These combinations changed the world more fundamentally for a much bigger percentage of the population than did the internet and cell phones.

Connective Innovation: More than Tech

- Fundamentals
- Ecosystem Platforms
- Social Movements
- Mega Design Trends
- Delayed tech that finds new combinations or conducive conditions

It's almost impossible for us to think of innovation without a strong component of technology. But many things operating today that are usefully classified as innovation are not technology per se but social or economic forms of organization, like the sharing economy or crowdsourcing. These are greatly aided and disseminated by advanced communication and data technology, but also evidence much historical precedence in older forms of organization like barter, guilds, and medieval shipping insurance. Design strategies also play a key role in innovation, and are undeniable aided by advanced technology. But design is fundamentally a social, adaptive behavior and functions interdependently with technology.

Apple iPhone 6 Guts: \$60-100 in parts



The ultimate example of connective innovation for most of us today of course is the iPhone and its many spinoffs and competitors. Each discreet component of mobile computing devices is built upon key breakthroughs in a diverse array of fundamental technologies and materials, most of which were much larger, slower and more expensive before they became integrated into a single tiny device. This phenomena of connective innovation is consistent with the emergence of other key inventions in history: the telescope, steam engine, compass, cannon, or clock.

Appification

DISCRETE FUNDAMENTALS



ECOSYSTEM PLATFORMS



SOCIAL MOVEMENTS



MEGA DESIGN TRENDS



This chart represents a mere fraction of the connective innovations that continually feed into the evolution of more innovations. Compiling a chart like this is at best a shot in the dark, as there are dozens of classes of technology and innovations that are omitted here, perhaps most conspicuously biotech. I call viewing technology this way “appification” as we are presented with a nearly limitless suite of brightly colored little buttons that all are utterly devoted to utility—they all DO things for us. If we were to “gamify” problem solving, it might look like picking any number of “apps” from the menu, plugging them together, and watching what happens, repeating the process until we get the desired results. This kind of infinite modularity was also a hallmark of the industrial era, where machines made machines and interchangeable components resulted in vast efficiency gains and new design freedom. Today we have all of that overlaid with a data, information and communication layer that enable much higher levels of successive complexity.

Net-Zero & Non-Zero

Net-Zero

Buildings/Cities make as much energy as they consume

Non-Zero

Both parties have a fundamental basis for doing business & benefit from transaction - Moral progress is made

I see design of the future as proceeding from the connection between two very different but compatible imperatives. Net-Zero is the efficiency imperative— we largely understand this, even if we haven't yet turned the tide on global implementation. Efficiency is a strong evolutionary selector and guides the structure and processes of most life forms— it's clearly a key part of our cultural and moral framework. But it's not enough: we need to move beyond it, while still including it, to encompass non-zero thinking. In lighting, it's about knowing what makes people feel better in spaces and using that knowledge along with new technology to enable better transactions with each other and the built environment, all while saving energy. The good news is that efficiency is almost always very compatible with increased quality and facilitating non-zero transactions anyway, we're just not deliberately conscious of it yet.

Game Theory- Possible Outcomes

Negative Sum:

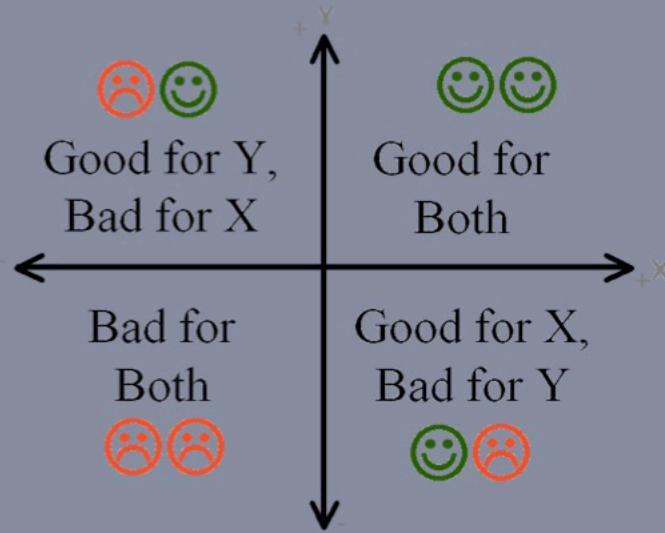
Lose-Lose

Zero Sum:

Win-Lose

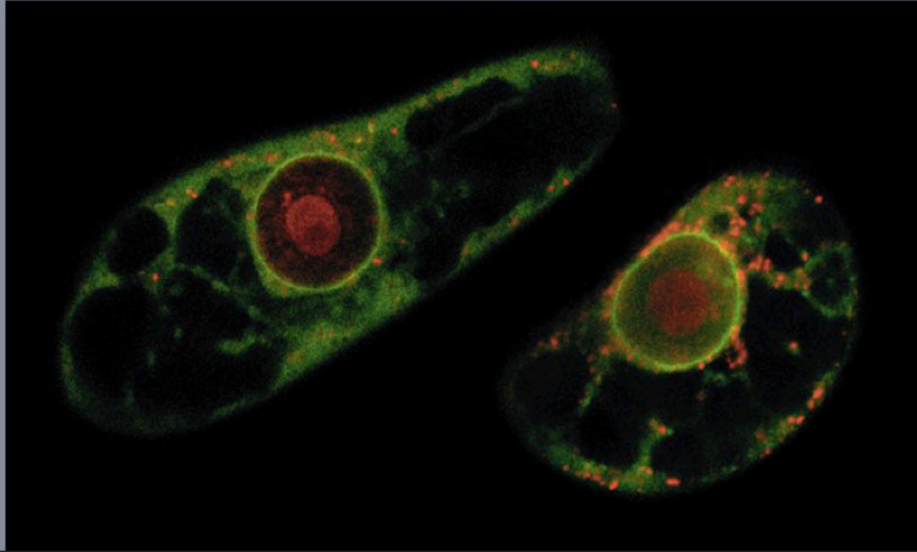
Non-Zero Sum:

Win-Win



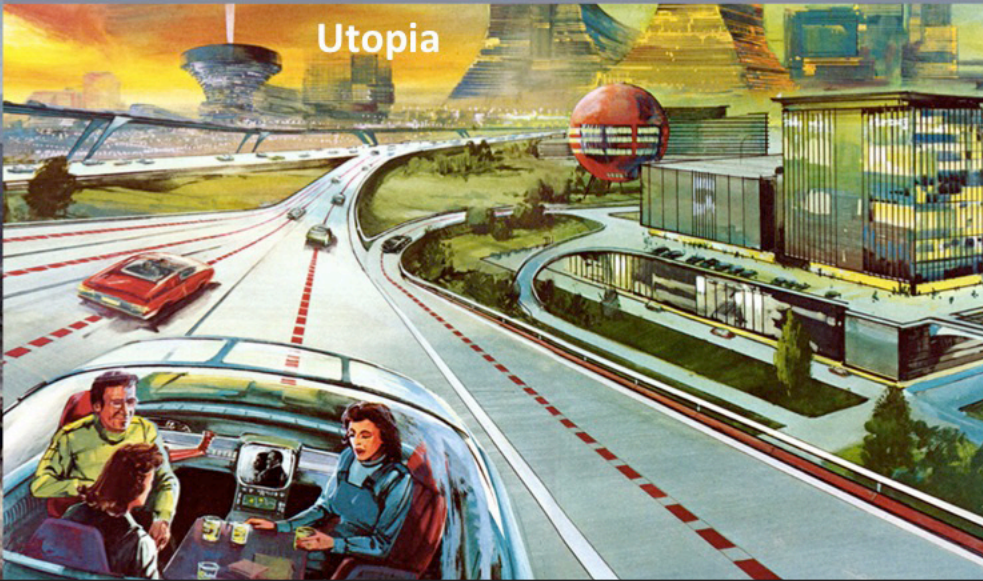
I first started thinking about non-zero after reading the book [Nonzero](#) by Robert Wright. The term comes from game theory, which first emerged as far back as the 1930s and has wide applications in many fields, including mathematics, economics, and biology. From a very simplistic, mechanistic viewpoint, there are three basic outcomes from any transaction: Negative Sum, or lose-lose, which is like when both adversaries in a duel manage to kill each other; Zero Sum, or lose-win, where there's a clear victor and a clear loser; and Non-Zero Sum, where both parties benefit. These three outcomes are not all mutually exclusive, and Non-zero results can always be found in Zero sum outcomes, as when war drives the development of new technologies or other positive outcomes. Negative sum transactions are relatively rare and avoided by most organisms.

Non-Zero: The Basis for Life



Nonzero transactions go way back to the primordial soup—most organisms gravitate to them naturally, as in co-evolution and symbiosis. The foundation of life is the ability to “do business” with each other.

Future circa 1960



I grew up in the atomic era. In this time two diametrically opposed attitudes about the future mysteriously co-existed: a kind of clueless optimism about the shiny tech future and a relentless existential terror of being vaporized by the bomb at any given moment. Looking back, it was remarkable that we kept it all together, really, and we came very close to losing it a few times. Still, there was probably on balance a much more upbeat view of the future than we seem to have today, and strangely enough, many crazy things people envisioned then came to pass, like self driving cars, monorails, glass tower cities and ubiquitous telecommunications (I love how the TV is black and white in this extravagant rendering. But where is nature? Where are walkable streets? And where is the traffic?

Future Today



From this simple comparison what's noticeable today is at least two things: our apocalyptic fears, while still pretty scary, are a bit more manageable, while the future vision seems virtually unaltered and equally clueless and fantastic. Missing from both these scenarios is environmental apocalypse, the silent killer that may ultimately do far more damage to our species than territorial conflicts driven by ideology, religion, or resource scarcity, although it will undoubtedly exacerbate all of these simultaneously.

BIG Currents

- Decentralization & Smart Grid
- Urbanization
- Hyper Connectivity
- World Governance
- Cognitive Platforms/AI
- Living Model Ecosystem- Design/Build/Operate
- Climate Change & Increasing Risk to Biodiversity

These are some of the overarching currents and trends that I see affecting our future. At the top of the list is the evolving revolution in electrical generation, distribution, and storage. This is another example- perhaps the ultimate- of connective innovation, as it is the combination of decentralize generation of power with advanced storage and distribution that will really revolutionize the infrastructure of civilization in often unpredictable ways. The other trends on this list are in our minds often because of media attention, and because they're technology trends. But while focusing on climate change and energy efficiency, one catastrophic trend we're largely ignoring is that of global loss of habitat and biodiversity. We need to learn to manage all of our technology and resource use in ways that allow us to live harmoniously with the biosphere on Earth that has evolved over billions of years but can be destroyed significantly in a very short time.

Conclusions

- Embrace Change
- Look far outside your field of expertise
- Don't Work for Tech, Make it Work for You
- Focus on Behavior, Emotions, & Experience
- Look for Connections & Combinations & History & Nature
- Only YOU Can Change the World
- Innovate through Illumigeddon: Become a Futurist

Despite the huge challenges we face with global environmental issues and the increasing complexity of technology, it's these very things that will also enable us to meet the challenges. At times it seems that we can't adopt any faster to the changes, but we are remarkably resilient and will do so when they facilitate nonzero transactions and connectivity. The best uses of technology are those which strengthen community, connection, and positive social change, and humans are hardwired to value these things over many other imperatives. We have much to learn from history and nature, and thousands of new tools with which to do so and to share and magnify our learning. Partly because of the increasing availability of technology and partly because of the fundamentally accidental nature of much innovation, normal non-specialist users of technology are still the ones who can drive innovation. This means that every one of us has the ability to make positive change and impact on global problems.

This concludes The American Institute of Architects Continuing
Education Systems Course

Clifton Lemon Associates



cl@cliftonlemon.com

Cliftonlemon.com

Lightplace.net

415 254 7056

@cliftonlemon