

How Bright is our Future?

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In this paper, I will present my research on the worldwide evolution of 21st century nightscapes, by looking at the lighting systems that are integral to urban processes and typologies. Still a novel field, Lighting Design is emerging today as a unique platform which not only blurs the boundaries of design disciplines, but is an integral building block of the constructed environment.

Historically, the social geography of Western urban lighting followed topologies laid out by converging political and private interests. The robust infrastructural model which ensued has greatly evolved, as cultures and societies developed a wide range of lighting practices. Today, the fluctuation of competitive and collaborative models of formal policy and commercial enterprise bring an unprecedented light diversity to a large variety of urban public typologies. Temporal or permanent, lighting delivers identities to cities as urban wholes or as sums of nested parts. Moreover, incremental light forms follow ad-hoc functions, and additive and pervasive systems of lighting inconspicuously assemble into discrete local and global ecologies which remain largely under-studied.

The relevance of more systematic research on the super context of global nightscapes is tripartite. First, energy efficiency motives are leading to the global rewriting of code requirements, and lighting is the most visible and targeted output of electrical energy. Today's global post-fossil fuel sustainable narrative meets the limitations of post-industrial urban infrastructures. Secondly, the world's majority lives in the developing world, and vast new nightscapes are on the horizon. Significantly, informal settlements collectively represent the largest construction program. Finally, the global urban population has now outnumbered the rural population, and metropolises are bursting with unprecedented expansion rates due to formidable migration forces.

New research methodologies are needed to gain foresight in developing the roadmaps for the nightscapes of the 21st century beyond singular and reductive issues of appearance or performance. Global urban models require that inclusive multi-disciplinary research be undertaken. An investigative approach to technical research and development and design practices at a global scale could be generative of non-linear explorations of lighting masterplanning in tune with today's urban complexities. This presentation, descriptive rather than prescriptive, is indicative that the urban future will be bright: more importantly, it asks how smart it will be.

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“We now think a candle is very dim. A hundred and fifty years ago, there was practically nothing better” [28].



Fig. 1. Light Population: Who is Counting? Composite Illustration, Nathalie Rozot

INTRODUCTION

In this paper, I will present my research on the worldwide evolution of 21st century nightscapes, by looking at urban public lighting as an index of political powers and relationships, as well as the lighting systems that are integral to urban processes and typologies, which embody technical, social and cultural dimensions. Under-studied, our anthropogenic systems of lighting are seldom described in terms of ecology, yet a survey of local and global lighting archetypes reveal non-linear and adaptive distributions in which socio-politico-cultural forces factor technological advances. The poles of global urban lighting density are thought provoking. Even though Lighting Design is a novel field, it is emerging today as a unique platform which not only blurs the boundaries of design disciplines, but is an integral building block of the constructed environment. However, lighting design has been reduced to singular and simplified issues of performance (e.g. efficacy and efficiency) or appearance (e.g. electronic artistry); meanwhile, most light are applied without design. Whereas the baroque exuberance of brightly-lit contemporary cities has lead to the denunciation of light pollution, the dire needs for basic lighting among under-privileged populations are not met, such as in illegal urban settlements. As today's quest for sustainability is contemporaneous with both great social disparities and post-fossil fuel energy challenges, it invites us to explore new dimensions of artificial light beyond our familiar grounds of design practice. This presentation, descriptive rather than prescriptive, is indicative that the urban future will be bright: more importantly, it asks how smart it will be.

I. SEEING THE LIGHT

Cities have arisen as places to create wealth, with commerce acting as a strong growth factor [19] (Fig. 2, Fig. 3, Fig.4).



Fig. 2. Phoenix, Arizona. USA (*Google Earth*)



Fig. 3. Gongqing, China (*Google Earth*)



Fig. 4. Caracas, Venezuela (*Google Earth*)

Overtime, micro-economies have emerged within larger macro-industries. The adjacencies that cities have created largely contrast with the historical separation of power from labor, and have presented collective living conditions that went against cultures of social separation. At medieval times and when justice was uncertain and violence pervasive, cities both brewed and embodied danger and inspired fear. In these alienating nocturnal circumstances, curfew was a collective rule established for the individual survival. As Schivelbush indicates “The town as a whole, as well as the individual houses, prepared for the night not unlike a ship that prepares for

the storm” [33, 61]. The implementation of outdoor lighting in cities occurred incrementally. In addition to the mobile lanterns that urban dwellers and visitors would carry or hire, stationary lanterns appeared on facades, first spontaneously, then required by law. These initial private initiatives to bring light into the public realm were promptly substituted with state-owned public lanterns, and before long, public lighting came to symbolize control over shared urban space. Lighting in public space originated in France, and it was political:

“ The early process of introducing law and order in the streets – as in so many other developments of this nature - can most clearly be observed in the capital of classical European absolutism, Paris. It was in Paris, at the end of the seventeenth century, that administrative public lighting was introduced” [33, 62].

So effective was this panoptic mechanism that as early as in the eighteenth century and throughout the nineteenth and twentieth centuries, individual and collective acts of rebellion against the authority of the state have included the destruction of public lights, also described as “lantern smashing” [32, 97-113].

More widespread and more systematic, large-scale public lighting systems gradually appeared at the end of the eighteenth century. In the nineteenth-century’s booming industrial cities, profit-based networking of gas infrastructure and utilities that distributed lighting was not a linear and egalitarian process. Before political shifts unified the distribution of gas and electricity as a public service, the social geography of lighting in Europe and America alike reflected the somber segregation of the prosperous and the precarious [12; 28]. Yet, by the end of the nineteenth century, urban public lighting was universally desired, and electrical lighting meant progress. Arc lighting was the brightest lighting technology of the times, and was used in factories and industrial applications where a night-shift required high light levels [30]. Many cities designed ambitious macro-schemes of public lighting, and over one hundred two-hundred foot light towers were notoriously installed in Detroit. However, the light distribution and calibration left much to be desired: as one observer commented: “A twilight glow was shed over a wide area, but there was no effective lighting anywhere” [15, 50]. Lamp posts, of more modest proportions and integral to the streetscape, subsequently became the paradigm of urban public lighting. Meanwhile, the enthusiasm for lighting was spreading rapidly, and other forms of light were emerging within urban functions. As the electrical network expanded, the use of spectacular illumination spread. Commerce and municipalities alike used

artificial lighting as a visual attractor. Shop windows and whole façades of private buildings and public monuments provided canvases for urban spectacle, and assembled in varied patchworks of lights. As noted by Neumann, the architects of the twentieth century fully embraced light “as a new building material” [24, 7]:

“No other artistic medium of the twentieth century has crossed the boundaries between art and commerce, technological display and utopian vision, easy entertainment and demagogic politics as effortlessly as this” [24, 37].

With the same enthusiasm as their expressionist and Bauhaus predecessors, today’s “starchitects” are attracted to the latest light technologies, and are prone to dress-up their building commissions, whether commercial or institutional, in dynamic and high-tech light and media facades [25].

Post-war modernist urban renewal operations divided up communities and micro-economies, and built social and economic segregation while urban centers fell into the shadows. In New York, Robert Moses orchestrated these highly visible and well documented new typologies, until Jane Jacobs and urban activists put an end to his methodical erasure of the past [4; 18]. The era was focused on infrastructural and engineering prowess, and public space too was engineered. Lighting was no exception, and typically reduced to metrics and code requirements. A robust model of parallel lighting systems for the safety of both pedestrian and vehicular flows prevailed, which symbolized city planning as much as it suggested authority, surveillance and safety, and has remained to-date [21, 65]. However, based on unassuming pictures of American cities taken at night, we can observe that in the 1950s advertising signs already dominated the American commercial streetscape [14]. Moreover, and as Denise Scott Brown and Robert Venturi argued, commercial strips with their oversized illuminated signs are a genuine vernacular which originated in the days and nightscapes of the automobile city [39]. In the post-modern era that ensued, marked by “pedestrian-friendly” downtown revivals and “New Urbanist” developments (or urban fake, as eloquently argued by Marshall [19]), light aesthetics were used as a means to reinforce the identity of the city as a whole, as well as to bring a sense of place in its nested parts. In other words, public lighting signifies added value. In the lineage of these revitalization efforts, public light art and lit public art now adorn many public spaces, and blend with architectural and commercial lights in spaces that can be saturated with light effects. “Blade Runner” is history: the lights it depicted may have seemed like a believable glimpse into the future for in the 1990s, but

now seem pale in comparison to today's electronic cities (Fig. 5).¹



Fig. 5. Electronics Aboard. The Bund, Shanghai.
Photograph Nathalie Rozot, 2008

II. TOO MANY LIGHTS, TOO MUCH LIGHT?

Electronic advertisements, with varying degrees of brightness or animation, make neurophysiological sense: we are a predominantly visual species, evolved to pay attention to light and motion, and our awe for contrast, both visual and cognitive, is wired. As the cost of electronics decreases, products and light features prosper: these technologies and their markets seem to face a bright future. Today, an unprecedented light diversity in public space results from the fluctuation of competitive models and collaborative models of formal political control and commercial enterprise. Las Vegas and other cities such as Tokyo and New York appear to be evolutionary light aberrations.

Worldwide, the racing expansion of artificial light and the increase in fossil fuel energy consumption has led to an unnatural brightness that glows above:

“Assuming average eye functionality, about one-fifth of the World population, more than two-thirds of the United States population and more than one half of the European Union population have already lost naked eye visibility of the Milky Way” [30].

This epiphenomenon did not go unnoticed; rather, it led to a pledge for light abstinence. The 1992 UNESCO conference proposed a resolution for the protection of dark skies as part of global heritage. While it has recently

¹ Blade Runner is a 1982 American science fiction film, directed by Ridley Scott. The screenplay was written by Hampton Fancher and David Peoples.

come into contention, the argument that bright nights compromise astronomical research was already made in the 1950s when Raymond Loewy's “Freedom lights” on the Empire State Building were permanently turned off.² References to the mission of “re-darkening” the skies have now become ubiquitous in professional lighting design and popular culture. Yet, there is more than meets the eye to “light pollution.” Paradoxically, dark skies may become even darker than presently advocated. It is rarely acknowledged, even in the discourse of the “dark sky” movement, that skies are bright in part because of air pollution (Fig.6).



Fig. 6. How Dark is the Sky? Composite Illustration,
Nathalie Rozot

Since our cognition relies on visual cues, our ability to perceive and recognize air pollution would be reduced if lighting were reduced: highlighting pollution – even unintentionally - may be an effective tool to fight it. The strategy of “cut-off optics,” in which all emitted light is directed downwards, generally embraced as the “dark sky” fix, is now being reevaluated. While less light would undoubtedly result in less sky luminance, the lower performance would indirectly increase lighting's energy intake [36]. Turning off the lights will conceal air pollution, but only global politics can clean the air.³ The use of higher-reflectance surface materials in the urban environment may be more relevant to high-performance cities, since they can both reduce the heat island effect (absorption of daylight energy which leads to significant

² The Empire State Building's publicist came up with an idea called “Operation Light Up the Sky,” which was implemented by Raymond Loewy in a light-enthusiastic design: four beacons, installed 1,095 feet above street level, revolved in perfect synchronization and could be seen as far as 300 miles from the air and 80 miles from the ground.

³ For instance, “On June 26 2006, the U.S. Supreme Court announced that it [would] hear a coalition of Environmental Groups, twelve States (California, Connecticut, Illinois, Maine, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, Vermont) and three cities against the federal agency EPA, charged with non-conformity with the atmospheric emissions regulations set by the Clean Air Act”. “On April 2nd 2007, the Supreme Court ruled that the Bush administration failed to follow the requirements of the Clean Air Act when it refused to regulate greenhouse gas emissions from motor vehicles. The 5-4 decision in Massachusetts v EPA ordered the administration to reconsider its decision, a move that could result in the first nationwide regulations aimed at tackling emissions.” J.R. Pegg” Environmental News Service.

temperature increases), and reflect artificial lights more efficiently at night.

The correlation of lighting and safety is equally controversial. Rather than linear, it has revealed an intricate intertwining of psychological, social and cultural constructs. Where darkness concealed danger, the occurrence of high-brightness lights can suggest the presence of danger and induce insecurity. Moreover, being in the light but surrounded by relative darkness can translate into a perceived or a real vulnerability. While studies show correlations between crime rates and illumination levels, other factors such as the frequency of users relative to a diversity of activities in a given place remain to be adequately computed for causality to be established. Coincidentally, higher light levels have been welcome and encouraged by a blooming energy and lighting industry.

Over the past few years, the architecture critic Kenneth Frampton, in talking of sustainability, has unrelentingly reminded us of the ethical essence and political dimension of architecture beyond the aesthetics of its forms. He has observed that critics of modern architecture make too few attempts to analyze what he calls its cultural essence. “The modernist Utopia saw architecture as a vehicle of its mission [...]. Socialism has effectively disappeared in a triumphant capitalist phase, whether it is causal or consequential.”⁴ Per Frampton, when we promote design as a critical practice, we may do so at the expense of sustainable development. This dilemma, which Frampton suggests in another context, extends to lighting design, in particular when we refer to this discipline as a social practice.

III. ON THE DARK SIDE

“Article 1. All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.” *Universal Declaration of Human Rights*, 10 December 1948.

“One billion people do not have access to electricity” (United Nations Environment Programme, 2005).



Fig. 7. Caracas, 2006. Photograph by Katharine Saxby
(Courtesy of Katharine Saxby)

Most of lighting design lies in the “limelight” of Western urbanism (professional lighting design publications such as *Professional Lighting Design*, *Transnational Lighting Detectives*, or *La Lumière Urbaine*, seldom cover developing cities, for example). Yet, today, in the footsteps of both Old and New World slums, dense shantytowns exist throughout Africa, South America, and Asia and one billion people are squatters [5; 8; 25]. By 2030, half of the world's urban population will live in shantytowns. Collectively, squatter communities represent the largest global construction program. While economists provide pertinent analyses and engineers propose practical solutions, the overcrowded, unsanitary living conditions of the developing world have caught the attention of a marginal minority in the design and building community. The lack of drinkable (if any) water and its unsanitary consequences has emerged as a priority. However, less visible but just as pernicious, the lack of healthy and economical alternatives to the widespread use of expensive, inefficient and unhealthy kerosene-based lamps is taking its toll on the developing world. In 1951, the historian and folklorist William T. O’Dea recognized that “[...] the absence of effective, inexpensive artificial illuminants after the day’s work must have had a profound influence [...] on the persistence of illiteracy among the majority even after the introduction of printing” [28, 312]. The core mission of the non-for profit organization “Light Up The World” and of several engineering laboratories including Amy Smith and D-Lab at the Massachusetts Institute of Technology, Vijay Modi at the Columbia University’s Department of Mechanical Engineering, and Sheila Kennedy at the University of Michigan, is to foster education by engineering and procuring low-cost lights.⁵ In one project instituted by Modi, children from homes

4. Kenneth Frampton, keynote at a symposium entitled “Global vs. Local Critical Sustainability in Architecture and Urban Form,” The Architectural League of New York, November 3, 2005.

5. Founded in 2007 by Roger Narboni, “Lighting Designers without Borders” joined these groups, as well as “Electricians without Borders” and “Engineers without Borders” to engage in humanitarian light-related missions.

without electricity take a family battery to school to charge, returning to their homes at night with power for light (and sometimes a voice too, since the batteries can power a radio). While families grow dependent on the energy supply, this ingenious system doubles its efficiency as it also sustains school attendance, which is often jeopardized by the economic need for child labor. These light projects combine off-the grid power (solar or battery-generated) and energy-efficient and efficacious lighting sources (compact fluorescent and LEDs). They gain momentum by creatively utilizing social networks as distribution systems. Their success is conditional on low capital costs and financial incentives for public and private investment such as micro-loans.

The issue of power distribution is of critical relevance in today's illegal settlements where public services are oftentimes pirated, and illegal wiring tapping into streetlights services private use (Fig. 8).



Fig. 8. Caracas, 2006. Photograph by Katharine Saxby
(Courtesy of Katharine Saxby)

In Rocinha in Rio de Janeiro, power companies opted for a paradigm shift, and set a precedent in illegal communities by treating the favela's residents as legal customers, but this is an exception rather than the rule [25, 41]. All over the world and in widely separated communities, the same basic lighting devices and applications are repeated. O'Dea observed this in the 1950s and it holds true in today's light-challenged populations. In Caracas, Venezuela, the formerly-illegal Barrio dwellings (which were legalized under Hugo Chavez) compose their own nightscape. A close-up view reveals that, overall, lighting applications are solely functional. Wealthier households may invest in decorative fixtures from stores in town, but inside the Barrio, electrical lighting comes to and from the local supply store in a single and most economical form: bare bones low-wattage incandescent A-lamps (Fig. 9).



Fig. 9. Caracas, 2006. Photograph by Katharine Saxby
(Courtesy of Katharine Saxby)

A direct descendant of the first electrical lamps distributed for domestic use, incandescent lamps have low-efficiency and low efficacy.⁶ Indoors, bare lamps hang from the ceiling. The resulting illumination is poor and inadequate for reading and writing, but an improvement from fossil-fuel torches. Outdoors, lamps are fitted with cut plastic bottles as a waterproofing measure. Predictable and conservative, accent lights highlight entrances, and floodlights in parking areas mistrustfully suggest surveillance.

Whether the result of a war or a natural disaster, light casualties occur, and lights and nightscapes are gradually reconstructed in sites of urban devastation. With for instance Beirut as a post-war case-study, ten years after a war,⁷ we can observe renewed and composite nightscapes that reveal cumulative forces at work. Power was pirated where it had been destroyed. Now obsolete, wires add to urban junk. In reconstruction projects, the old recipe of new "historic" light fixtures betrays the typical complacency of developers and city officials. In commercial areas, light takes a form beyond function: crude lighting "beautifies" historic facades, and colorizes commercial and retail buildings. Here, decorative functions have gradually supplemented basic luminous needs: a nightscape in which designers can find practice opportunities has emerged.

CONCLUSION

The future has taken a bright turn, at least when it

⁶. Just recently, Australia announced a plan to ban incandescent lamps and Europe to phase them out by 2009, due to their high energy consumption. J.R. Pegg, Environmental News Service. Matthew L.Wald, The New York Times (NYT), 14 March 2007. "A U.S. Alliance to Update the Light Bulb".

⁷. These observations are based on pictures taken in June 2006, before the 2006 war.

comes to global lights, but how can we make economic sense of our compulsion to accumulate lights? Will commercial information and civic illumination merge and new models appear? I have argued that Times Square's billboard lighting was civic, since it is in part required by a 1987 city ordinance, and that all light posts should be removed from that area.⁸ Will we question the parallel structure of lighting as a public utility and lighting as a private commodity? In the past decade in China, design practitioners, contractors and manufacturers of many faiths have fought the battle of business-as-usual against high-tech sustainable solutions. The resulting battlefield leaves us struggling between optimism and pessimism — or resignation and hope. What lies ahead for India? What levels of light extravagance can Dubai afford?

The relevance of new and systematic research on the combinatorial applications of light within the super context of global nightscapes is tripartite. First, energy efficiency motives are leading to the global rewriting of code requirements, and lighting is the most visible and targeted output of electrical energy. Today's global post-fossil fuel sustainable narrative meets the limitations of post-industrial urban infrastructures, and may propel the developing urban nightscapes beyond the linear conventions of utility lines. Then, the world's majority lives in the developing world, and vast new nightscapes are on the horizon (significantly, informal settlements collectively represent the largest construction program). Finally, the global urban population has now outnumbered the rural population, and metropolises are bursting with unprecedented expansion rates due to formidable migration forces.⁹ The cultural history of the urban public realm is well documented for the Old and the New Worlds, but it must be synthesized, updated, and expanded to the developing world to gain foresight in the fluctuating jurisdictions of urban lighting. New ethnographic research and research methodology in design and social sciences are critically needed to expand the understanding of the field, and build new intellectual and case-study foundations. New collaborative models and new grounds of design and research studies, or instance in multi-disciplinary think-tanks, will afford lighting practices to develop the relevant roadmaps and blueprints for the sustainable nightscapes of the 21st century.

Today, lighting design's most advanced design strategies are qualitative and artful, as well as efficacious and efficient. Current research on efficiency in lighting scrutinizes the complex and non-linear correlations of spectra, color rendering, and visual efficacy, meanwhile new light forms are emerging in laboratories, from

inorganic light-emitting materials to genetically modified glowing trees and plants [10]. Wireless technologies have revolutionized hardwired telecommunications in the late twentieth-century. To a lesser extent, new systems of lighting, from infrastructure (solar powered lights) to electrical systems (portable battery operated fixtures), freed from both the costs and the linear distribution of utility layouts, may modify the conventions of lighting layouts.¹⁰ The engineering of lights and controls can modulate energy-efficient lighting in architecture and urban spaces alike. An inclusive approach to technical research and development and best design practices at a global scale, from smart controls to novel source distributions and geometries, could be generative of forward-thinking explorations in tune with today's urban complexities.

NASA is planning to introduce colonies on the Moon within forty years, resulting in other extreme lighting challenges (how the endeavor would require the human circadian cycle to adapt to a new chronobiological cycle is yet uncharted, and remains another story). If the slums and the Moon are the new poles of tomorrow's lighting design practices, can we first develop the best new practices here on Earth?

8. "Times Square The Next Century." Workshop organized by the Times Square Alliance in 2007 with a dozen multi-disciplinary design consultants.

9. For instance, Gongqing in China is a city that grows by 500,000 people a year.

10. Groups such as "Engineers without Borders," "Light Up the World," and architects Kiss + Cathcart and Kennedy+ Violich are working with these ideas. Some of these lighting products were on display at the summer 2007 exhibition at the Smithsonian Cooper Hewitt National Design Museum entitled "Design for the Other 90%."

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