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Envisioning Community Engagement in Smart Lighting Design

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Abstract. Smart Lighting is widely viewed as a means to reduce energy use, streamline city services and lower maintenance costs of public lighting. These are valid perspectives and useful pursuits, but they leave a blind spot that needs urgent attention: how the application of Smart Lighting technologies could affect and benefit people in public space. Illumination as it is currently deployed is mostly utilitarian. Creative and innovative opportunities are often overlooked. It is critical for designers to reclaim their role in this technological sea-change to combine the operational benefits of Smart Lighting with benefits for people on the ground. Involving the community should in our view be part of this process. Our goal is to unearth techniques and design approaches so that Smart Lighting becomes a flexible tool for community-informed night experiences.

1. Background and questions

What if citizens' nighttime public-space use—whether night-shift workers and/or a mother traversing the high street after dark—was the highest consideration when designing a Smart Lighting system? What would the system look like if illuminated scenography echoed and enhanced night-use zones such as transit hubs, markets, parks, institutional, cultural, and hospitality districts? What techniques could help designers include a citizens' perspective in a Smart Lighting design process? Here, these questions are examined. And based on our experience in practice and examples from literature, we highlight techniques, concepts, and capabilities that are instrumental in bringing the citizens' perspective into the Smart Lighting design process.

1.1. Who is the “community”

This paper focuses on community engagement to ascertain who has a stake in the nighttime environment and who makes final decisions. Community involvement increases local support, reduces complaints, and provides a sense of accomplishment and ownership of the lighting project. In parallel, a sense of neighborhood belonging is developed.

A series of questions is proposed to define the project community's population.

Is the community the same as stakeholders? Are they composed of residents? Business owners? Elected officials? Local NGO organizations and associations? Who makes decisions, influences decisions and/or participates in decision-making? When it comes down to funding and implementing design outcomes, which are installed? *Who Represents “The Community”* elaborates further [1].

Throwing a wider net, *Urban Learning* [2], a European Union's Horizon project is centered on energy programs. They indicate that stakeholders are “administrative departments, utilities, enterprises, scientific institutions, and civil society representatives”.



This paper makes a distinction between **stakeholders** – authorities; decision-makers with power, such as elected officials and business owners – and **community** – on the ground residents, shop employees, and local associations.

Smart Lighting design teams should implement participatory local research to understand the composition of both stakeholders and community in the project district – to make equitable choices to involve citizens and officials.

2. Techniques and approaches

The authors highlight several techniques and approaches that contribute to a community-informed Smart Lighting design process. These approaches are derived primarily from our practices and research, supplemented with the *Guidance Ethics Approach* [3]. New and speculative elements are posited to fit the demands and opportunities of Smart Lighting.

2.1. Uncover existing conditions: Shades of Night

An “existing conditions” survey by engineers, architects, and landscape architects, among others, is a standard phase that launches a public space project. Similarly, a Shades of Night (SoN) study [4] underpins lighting strategy. Through mixed methods, night fears and after-dark assets, desires for the future, and city data (transportation, transit, crime, open/shut commercial hours, etc.) are addressed and analyzed. See Figure 1.

The SoN methodology is conducted throughout the night, from dusk to dawn. Small teams document observations and conduct interviews that are time stamped.

Quantitative: SoN loosely follows the Gehl protocol [5] to measure the circulation of people, bikes, and motor vehicles as well as their behavior, such as lingering, walking with shopping or strollers, and directionality. Other examples are time-based measures like business’s open and closing hours. Lighting measures include light levels from both public and privately provided light and identifying illuminated shop windows.

Qualitative: Intercept interviews are conducted throughout the night to ascertain people’s destinations, for example, heading toward a bar, transit, or nightshift work, and their perceptions of the illuminated area.

The Product: A basis for lighting improvements including Smart Lighting is produced, which is a living schedule of lighting control in the area. “Living” emphasizes that the control schedule is instituted with evaluative review periods and changed if/when needed.

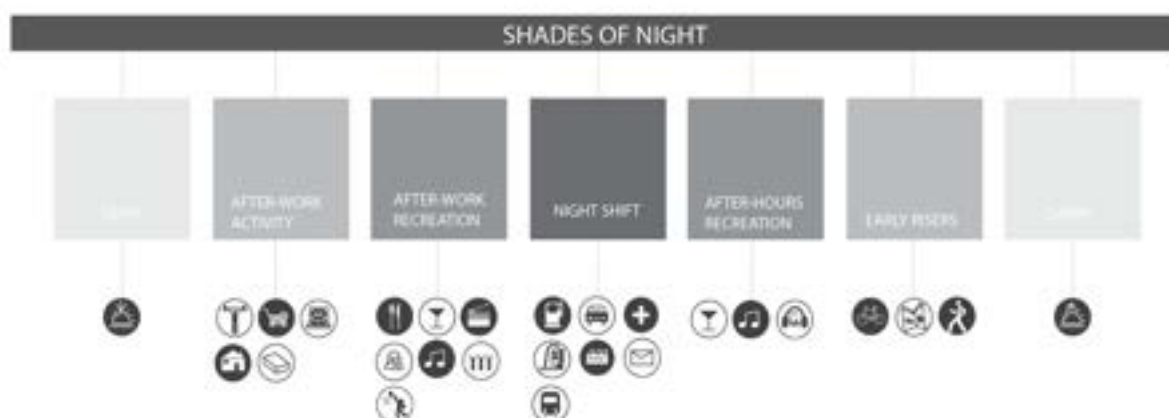


Figure 1. Shades of Night Analysis Diagram. For existing conditions studies, this diagram illustrates a broad framework with which to measure lighting and human activities from dusk to dawn

2.2 Co-design and local participation

There are many levels of community engagement and consultation—from presentations to side-by-side collaborative design.

A co-design imaginary for a social housing complex is proposed. This section describes a methodology for full community engagement using a site modeled from a courtyard. The purpose: to guide area design scenarios based on local needs and desires for the future. The engagement program would include capacity-building by teaching skills and hands-on activities. A Citizen Advisory Lighting Corps (CALC) is envisaged. The CALC working party would be composed of a variety of ages, interests, and other diverse demographics that mirror the subject area. This citizens' group would work alongside the Design Team. The local city council, municipal representatives, and a university research/planning division would be instrumental in this effort.

Here an added skill set is employed: community-based planning and design, which necessitates collaboration between design professionals, locals, and stakeholders. Specific literature is available for lighting designers to explore co-design and connectivity to layers of society [6]. Benefits include:

- Spatial character is identified: existing and aspirational conditions
- Capacity building: professionals and community members plan “scenarios” together
- Engagement of community in creative decision making
- Community co-evaluation of lighting success over time to underpin future programming adjustments

Figure 2 illustrates a before and after scenario sited on a public housing campus. Qualitative social research has already taken place through interviews, workshops, and discussions. It is revealed that after dark, women are afraid to use the diagonal path although it is a practical shortcut to the corner grocery store. The basketball court, although it has functional lighting, it is never switched on because of the nuisance: noise and congregation. Additionally, the entire plaza is empty of amenities such as quality lighting, greenery, comfortable seating, path paving, or cultural amenities. A Smart Lighting pilot is proposed, which, is co-designed by community and professionals to include new landscape and lighting.

For the duration of the pilot, a full-on evaluation of the site design, testing of timed basketball illumination, and other programmed lighting are agreed upon by CALC. Prospective areas for evaluation after the new design is implemented are listed below.

Path: Evaluation is undertaken of path usage during times of day and night after new paving and lighting are installed.

Basketball Court: Testing would include trial periods for illumination. For example, for one or two weekend nights lights would be turned on for a certain duration with assessments taking place at regular meetings. The lighting is programmed and can be changed.

Poet's Corner and Sitting area: Other timed experiments and evaluations are conducted for the Poet's Corner and Sitting Area, with varied times of brightness, color and on-off as part of the test process.

Community informed public design generally requires multiple disciplines. In the example of Figure 2, we argue for the incorporation of street and landscape design.

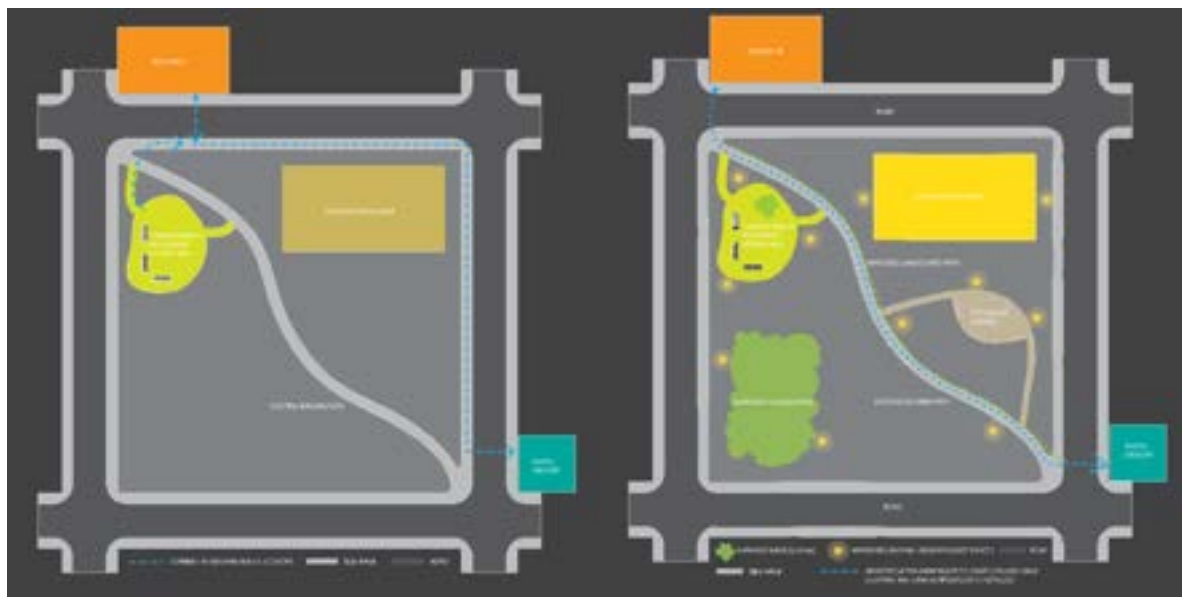


Figure 2. Pilot Site Diagram: Left / Existing, Right / Improved pilot. This example site is a typical US social housing courtyard. Through interdisciplinary design, e.g., lighting, landscape, grocery trips, cultural events and seating after dark are made possible for tenants. Diagrams by Fatima Terin

2.3 Continuous evaluation.

Involving the community does not end when a system is designed and realized. Once a system is installed, interactions take place on a day-to-day basis. People may notice the dimming effects of Smart Lighting, they may learn about the kinds of data that are gathered, and may adapt their behaviours to the enhanced environment. The designer must remain involved in this ‘adoption’ process alert to unanticipated responses, negative opinions, and aware of new opportunities that may surface. How to keep the community engaged in the process of designing, realizing and maintaining a Smart Lighting system?

A helpful technique for a continuous conversation with the community in relation to technology development is the Guidance Ethics approach [3]. Figure 3 shows the three stages of this iterative approach.



Figure 3. The three-step iterative process of the Guidance Ethics approach [3], reprinted with permission.

Stage 1 is about gaining or improving an understanding of the technology in its context, and what its use could mean for people. For example, in the case of a Smart adaptive dimming, this stage would encompass a clear description of what the system senses, how it responds, what the light does, etc.

Stage 2 is about dialogue with the relevant parties and investigating what the possible effects of the technology in its context are. For this, the relevant actors – community and stakeholders -- need to be involved, for example, the residents in a neighborhood, the people biking or walking or driving there, maintenance engineers, law enforcement, etc. Guided conversations uncover important values to underlie the design. This purpose of this discussion is to learn about positive, negative, direct and indirect effects for individual, social and society.

Stage 3 is about action, based on the results of Stages 1 and 2. In some cases the initial design will be adapted to meet principles agreed upon about technology and values. For example, if cameras are deemed too invasive, they could be replaced by infrared sensors. These are initial patches. After the in-depth explorations in Stages 1 and 2, the community realizes changing local traffic rules – like lowering the speed limit, or street design, a “road diet” or asphalt-art painting has higher value than a lighting system adaptation.

The Guidance Ethics approach is iterative. After installing the system, the cycle of Stages 1, 2 and 3 can be revisited over time. The implications and results of the system are clearer at that point, and the community conversations can be more concrete. Additionally, context or community changes may have occurred, requiring specific adjustments. This approach is not about end results, but rather improving a system step by step. Note that such an iterative Smart Lighting design process also requires that maintenance and design grow together.

2.4 Light Sketching

Another illustration of community participation is the Light Sketching for Placemaking method [7]. This project investigates how Smart Lighting could contribute to the quality of public space as experienced by its residents, drawing inspiration from the Placemaking movement [8]. Essentially, community dialogue about light is enabled *through light*. Smart Lighting offers a wide range of inventive lighting possibilities, such as color accents, dynamics and different light distributions. This allows people without training to imagine the potential of these possibilities for their after-dark environment and express what they would prefer.

To enable a creative and nuanced exchange about the fresh Smart Lighting possibilities with residents, the second author created the Light Sketching system. This system’s custom luminaires include numerous individually-controlled RGBWW LED modules that enable a wide variety of light and color patterns. A tablet interface enables people to draw light and color patterns around the luminaires as easily as finger-painting. Each drawing action on the tablet interface translates immediately into cast light. In Light Sketching sessions, the existing public lighting is turned off, and the Light Sketching luminaires take over. Participants are asked to sketch light in their own environment to best support the activities they desire to undertake there.

Figure 4 shows results from a Light Sketching in a small neighborhood square in Eindhoven, Netherlands.

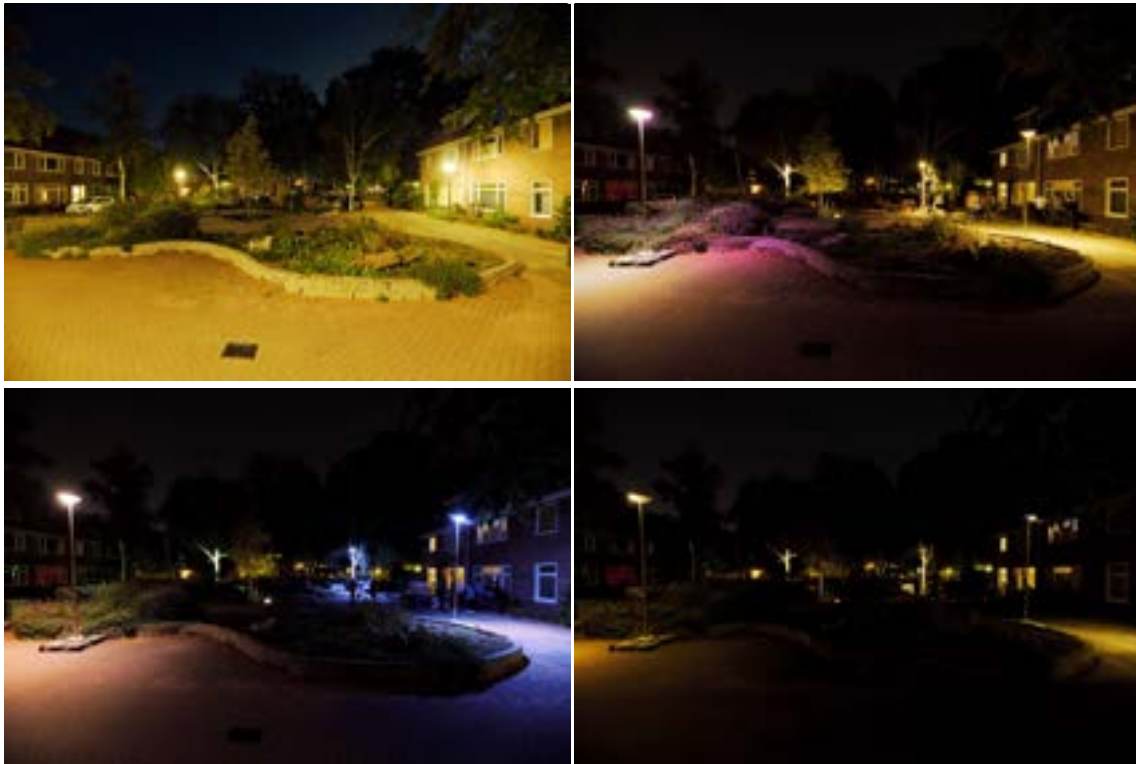


Figure 4. Four light sketches made by residents at their own neighbourhood square. The top left shows the normal street lighting situation. Photos by Bart van Overbeeke.

The Light Sketching for Placemaking project demonstrates a creative, active, visible tool set. Active learning of this sort leads to nuanced discussion. For example, qualities like glare, dynamics, adaptively, color temperature, light distribution were discussed in this example, whether or not the technical terms were known. Surprisingly dynamics and interactive scene selection were brought forward by residents – the basics of Smart Lighting. These results point toward possible benefits of Smart Lighting for local communities. Light Sketching is a way to engage people creatively in a design process.

2.5 Create Urban night scenarios – Learning from theatre

This discourse aims to enthuse the reader about advanced atmospheric, localized, nighttime illumination through LED and intelligent, or Smart, controls in urban settings.

A process is envisioned. The Design and community CALC Team would evolve a timeline for lights on, lights dimmed, lights off. Timing, color usage, and lighting levels would be installed with review periods to evaluate and change as needed.

In staged productions, the illumination designer works with the production team to intensify the scenic design with atmospheric effects. Lighting directs the viewers' gaze for the duration of changing scenes, actor's roles and story.

Additionally, lighting provides time references. This is technically achieved by dimming or in theatrical lingo, "fades" and "cross-fades". Atmospheric transformations such as sunrise, evening's end, inclement or fair-weather fade in and out defining the character of space, time, and narrative.

The play begins when lights fade to black. In comparison, the real-life city scenario night is the dark canvas into which we generate volumes of light to intensify the character of place.

Lived settings, unlike theatre, embrace real people traversing public space. The relatively recent ability to dim outdoor lights is key to translating scenography into city life. Hybridizing time-based technology with urban planning opens up a new approach. Thus, smart and dimmable lighting tools can visually externalize use areas such as town centers, institutional, residential, and entertainment districts.

Subscribing to the notion that urban lighting would be compelling and joyful if it takes a page from theatrical design has several parts:

1. Identifying and characterizing a use area with the full range of brightness, dark and color
2. Making use of temporality—dimming in real time— attracting visitors to linger in public space or signaling the end of active night, for example, through a reduction of lighting
3. Mirroring the collaborative process of theatre by co-design: by incorporating the input of stakeholders and citizen users

Fully utilizing the dimming capacity of Smart/intelligent lighting reinforces placemaking after dark.

Theatre design techniques have been applied to Figure 5, *Dreaming in Color*. This public art installation by the first author is located on the Seattle Center campus. It frames a passageway from the street leading to campus destinations such as a large fountain, sports arena, museums, and parks. The walkway threads between an opera house and a rehearsal hall. The art concept was developed to convey a sense of performance from the indoor stage into the public realm. Illumination is focused on nine vertical screens which intentionally spills onto the ground plane to cast light upon visitors. The result is an immersive, rhythmically changing, 3-dimensional color field. A dimming system facilitates the rhythmic fades and transitions.

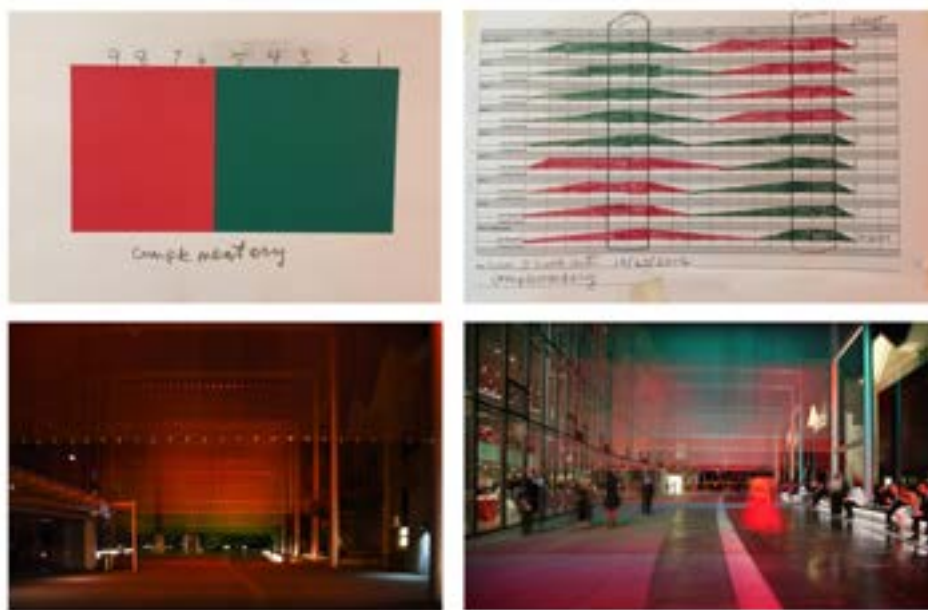


Figure 5. *Dreaming in Color*, a public art installation, Seattle, Washington, United States. **Top right and left:** The artist's working drawings to plan out colour palettes over time. On the left, the colour palette, on the right, borrowing from a musical score structure, the colours simultaneously play out over tempo with fades added. **Bottom right and left:** Moment photos of the light cast onto 9-metal mesh scrims and the ground plane. Photo left by AJ Epstein, Photo right by Gustafson Guthrie Nichol

3. Discussion

The authors posit that today's primary rationale for LED conversion and Smart Lighting — longevity, energy saving, lowered maintenance costs — are not enough. Creative atmospheres are possible in our city streets for citizens' safety and joy. Which atmospheres will they be and by what process will they be designed?

The underlying ambition is to integrate design into Smart. The authors suggest that the objective of Smart Lighting is not merely functional – to consider all-inclusive design. This design vision would meet a range of human needs – spaces for social relationships, creativity, discovery, and a sense of belonging. The richest design is a two-way learning process involving designer and neighborhood.

Several engagement processes from one-time workshops to ongoing participation by locals, designers, and municipalities have been described to underpin a new holistic Smart Lighting design.

The approaches and techniques described in this paper, are primarily drawn from the authors' practice and experience. However, Smart Lighting as a generally accepted *design form* is uncharted territory. Exciting, hard work is needed to develop the approaches further through practical application. The authors have provided points of departure and an invitation for lighting designers to use, evaluate and expand on them in their Smart Lighting practice.

To utilize Smart Lighting's full potential, the lighting designer's awareness and skill set must broaden – ranging from technical to organizational. Illumination designers should acquire basic competencies in IT and grasp the potential of temporal, dynamic layers that Smart Lighting allows. Additionally, for success in the engagement practices suggested here, community involvement and outreach training or consultation with experts may be necessary. These competencies will integrate and enhance specialist collaboration.

Finally, this paper outlines twin approaches: local participation, and time-based creative design. These are often challenging individually, and even more so when combined. Collaborators may include overlapping municipal agencies, which are often siloed, cooperation from electrical engineers who may feel uncomfortable with creative solutions, and other naysayers unable to see beyond traditional street lighting. However, light is malleable, and people are resilient and curious. By harnessing these forces, let's embrace safe and inspiring nights.

Keywords

Co-design, Cities, Citizen Participation, Community Engagement, Smart Lighting, Lighting Design

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