

ELSE, Experience of Lighting Sustainability in the Environment

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Abstract

Sustainability calls for a social, environmental and economical approach. On the contrary, the traditional idea of sustainable urban lighting is based just on economical and environmental-technical aspects. Because lighting is primarily intended for people, urban lighting should be focused on the human experience with a qualitative social engaging role. The analytical phase of the research is based on a multiple-method survey strategy: ELSE is a virtual, indirect visual survey based on the observation of lighting stimuli in order to evaluate, from a collective point of view, the social sustainability of the public urban lighting. This paper presents the starting results of the on-going study about the social sustainable lighting: data shows that people demands for a deeper experience of social participation, safety perception and energy savings with the meaningful use of interactive and colourful layered lighting effects.

KEYWORDS: urban lighting, social sustainability, lighting experience, environmental quality

Introduction

The traditional idea of sustainability of urban public lighting is based on a double rational approach related to economical savings and technical performances: lighting regulations, public administrations and lighting companies focus on quantitative data and measurements for energetic savings while designing urban lighting fixtures and plants. In particular, the available lighting standards for areas of public use mainly give rules about lighting performances, defining the quantitative medium levels of luminance and illuminance, defining the methods to achieve these lighting requirements, establishing standardized lighting categories based on physical and territorial features of the urban space and focusing on power consumption (UNI EN 13201 - May 2004; UNI 11248 – October 2007). In addition to this, public administrations use P.R.I.C. (Piano Regolatore dell'Illuminazione Comunale standing for Urban Lighting Masterplan) that is a traditional tool aimed to design

coherent and homogeneous lighting interventions in the urban territory starting from the analytical phase of quantitative lighting measurements in the city.

Conversely, several studies and recommendation from the CIE (Commission Internationale de l'Eclairage standing for International Commission on Illumination) supported by the lighting design practice, agree that urban lighting is more than energetic statistics about savings and quantitative lighting performances: lighting is primarily intended for people's experience and perception of the urban space and, for this reason, should also consider the beautification of the spaces, the safety and security perception, the establishment of social engagement and well-being of its inhabitants. (CIE 136 – 2000; CIE 115 – 2010; Narboni, 2004; Brandi U. & Geissmar-Brandi, 2007; Raynham & Gardner, 2001; Raynham, 2007;) According to this view, urban lighting sustainability calls for a balanced social, environmental and economic approach (Figure 1). The today's lighting methods of analysis and design should shift their focus on human-oriented lighting performances rather than putting all the efforts on energetic issues and economic affordability achieved by technical performance.

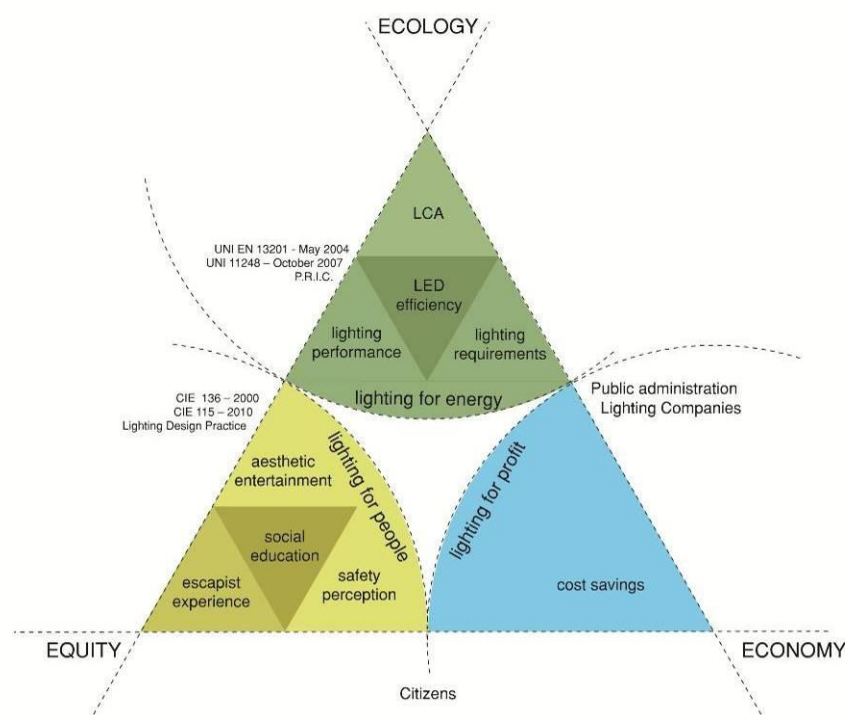


Figure 1. Three-part approach: social, environmental and economic

In comparison to energetic and economic issues, it is more difficult to estimate and measure the contribution of public lighting from the social perspective both because of the subjectivity of the issue and because of the tools available. Despite of this, theories and models from the social studies, behavioural sciences and environmental psychology can be useful to understand the collective needs of people about the urban lit environment and ensure that the focus on the reduction of energy use is not detrimental to the human experience of the cities after dark (Tillet, 2006, 2011; Bordonaro & Aghemo, 2006; Amendola, 2009; Major, Speirs & Tischhauser, 2005).

The presented inquiry about the social sustainability of urban lighting put in evidence the lighting performances and features that can improve the use of public spaces and the engagement between people and the city at night through artificial lighting. The paper would focus on addressing the following questions: what are the socially impactful features of urban lighting and what kind of methods and investigation tools can be used in order to achieve an holistic sustainability for urban lighting projects?

The social nature of the contemporary city

The contemporary city has lost its physical boundaries and is now structured as a network of social interactions: the city is mainly an entity perceived by its inhabitants, a communicative field of sensations, emotions and gestures that happens between people and space and people with people (Goffman, 1967). According to this, the urban design literature stresses the need for meaningful public spaces able to build public experiences of social interaction: urban public spaces are no longer useful for the survival needs of urban societies. They are required for the social and psychological health of modern communities in supporting and promoting public life. (Jacobs 1961; Oldenburg 1981; Lynch 1984; Gehl 1987). Many scholars suggest that sociality is an important element to be considered in designing a public space, arguing that the social affordances offered by the presence of people in urban public spaces are more important than the physical ones offered by the environment (Gibson 1979; Stokols 1995). Urban public spaces should support the social activities of people, creating opportunities for short-term and low-intensity contacts that can contribute to engage people in easy and informal interactions, reintroducing the trust relationship with the other citizens and the city (Jacobs 1961; Gehl 1987). People feel more happy and free in convivial communities (Illich, 1973) during collective experiences made of social interactions that can be used as a measure of the city's liveliness and as an indicator of the satisfaction of people with their surroundings. (Banerjee, 2001; Mehta, 2007; Amin, 2008; Florida, Melland & Stolarick 2011).

The new role of public urban lighting

The increased interest about urban lighting in the last few years is mainly due to changes in the way the public spaces are used at night. Urban lighting makes the contemporary city alive and vital after dark, ensuring the basic requirements of safety and security for people, but also allowing social inclusion and integration in the use of the city. Lighting should guarantee an equal and free use of the city for all the citizens, regardless of their social status and physical conditions (LUCI, 2007). The urban lighting embodies new human-oriented roles aimed to:

- City Ambiance: shaping the identity of the city, adapting to its inhabitants' activities, perceptions and patterns of use (Peters, 1992; Raynham & Gardner, 2001); increasing the attractiveness of the city and the comfort of people within it, enhancing the "urban beautification", "pleasantness" and "amenity" and providing a general feeling of well being (Hargroves, 2001).
- Communication: codifying messages, supporting information and simplifying the readability of the space with a cognitive, aesthetic and symbolic rule (Kepes, 1966).
- Social engagement: supporting the collective and interactive use of the city, increasing the participative and experiential fruition; encouraging and reinforcing the trust relationship between individuals and their urban environment (Burkhardt, 1999).
- Architectural enhancement: emphasizing the surfaces of the city, architectural details and facades in relation to the materials and lighting fixture disposition and style. (Schwendinger, 2009)
- Attention marking and way-finding: creating a focal glow, commanding attention, creating interest and separating the important details to the unimportant ones; improving orientation, guiding the eye of unfamiliar users in the urban environment. (Peters, 1992)

From this point of view, public urban lighting has a growing potential of changing the human experience of the urban nightscape (Ginthner, 2002), contributing positively to build sustainable cities by reflecting more on the relationship between people-light-city.

Measuring the urban environmental experience

If the public urban lighting is more than technical requirements toward efficiency and safety, the research should focus on how the lit urban environment is perceived and used by the citizens, trying to understand this social impact of lighting and translate it in the lighting design process. In order to answer this questions about perceptive, cognitive, behavioural and emotional impact of nocturnal lit spaces on the individuals, this research has been using models and theories derived from environmental psychology. Starting from the notion of "environmental experience" by David Canter (1977) that describes the space as a unit of physical attributes, emotional cognitions and human activities, the research is based on the model of Mehrabian and Russell (1974) useful to investigate how the physical-spatial features of the urban environment can influence the subjective pleasure, arousal and dominance that determine behaviour. The relationship between environmental variables and human behaviours can be modelled as a stimulus-organism-response (SOR) paradigm:

- S = Stimulus: all environmental aspects that determines particular evaluation.
- O = Organism: emotional reactions on the basis of pleasure, arousal and dominance.
- R = Response: the consequent people behaviour that could be positive (desire) or negative (avoidance).

Other researches on emotions use the circumflex model of Affect elaborated by Russell et Al. (1980) useful to describe the affective quality of the environment and analyze the experiential emotions using a geometrical space made of two orthogonal dimensions: "Positive Affect" (PA) and "Negative Affect" (NA).

More than this, the evaluation of the pleasantness of a place is also based on the model elaborated by Kaplan & Kaplan (1989). It assumes that the drivers of interaction of people with the environment are the possibility of understanding the space and the possibility of exploring it. The evaluation of pleasantness is linked to the direct or indirect provided information: depending on the individual needs and the availability of information, the places can be perceived as coherent, readable, complex or mysterious.

The research question

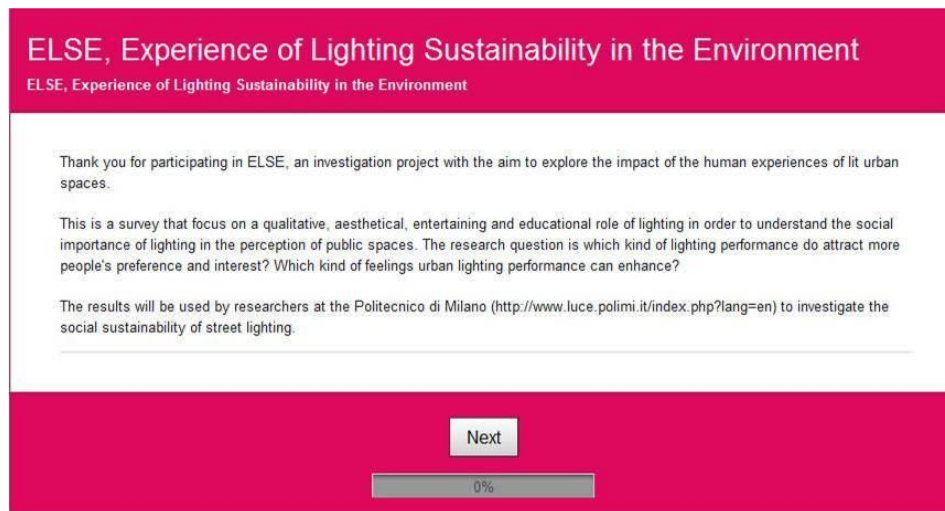
The background statement is that urban lighting is a positive tool for people engagement, relational trust and people-city relationship restoration but there are few applied methods and poor studies available to support this general understanding. This research about the social importance of lighting in the experience of public spaces claims at investigating what kind of lighting performances do meet people's preference and interest and what kind of feelings these elicit. The hypothesis is that urban lighting analysis should be focused more on qualitative lighting aspects in order to satisfy the collective perception of the city at night; the achievements of this qualitative methods of analysis can be transferred into lighting design strategies in order to support the design process for the creation of social sustainable cities.

Method

This investigation was part of a wider study based on a multiple-method survey mediated with the web. The indirect visual survey was used to fulfil both the exploratory and experimental characteristics of the study and provided data that were analyzed using quantitative methods. The survey is an on-going and continuously upgraded tool useful to deepen the research about the social impact and sustainability of urban lighting.

Procedure

ELSE, Environmental Lighting Sustainability in the Environment, was an experimental on-line survey (Figure 2) open to a wider participation and aimed to examine the individual experience (perception) of several preselected urban lighting settings (stimuli). Eight lighting stimuli were presented through images and videos for an indirect observation. The survey was structured in two phases: in the first one, participants were directed to pay attention to some relevant lighting features showed in the pictures and in the videos and they were invited to express their perceptions using Likert scaling questions. The second phase of the survey was constituted of a set of questions about the level of satisfaction and the values considered most important in urban lighting: this part of the survey was aimed to confirm /deny the previous portion of the survey.



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Thank you for participating in ELSE, an investigation project with the aim to explore the impact of the human experiences of lit urban spaces.

This is a survey that focus on a qualitative, aesthetical, entertaining and educational role of lighting in order to understand the social importance of lighting in the perception of public spaces. The research question is which kind of lighting performance do attract more people's preference and interest? Which kind of feelings urban lighting performance can enhance?

The results will be used by researchers at the Politecnico di Milano (<http://www.luce.polimi.it/index.php?lang=en>) to investigate the social sustainability of street lighting.

Next

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Figure 2. ELSE survey

Participant

For this study, 121 respondents (62 male 51.2% and 59 female 48.8%) took part in the survey. The average age of participants was 30.6 years old (18-24, 7.4%; 25-34, 52.9%; 35-54, 29.8%; 55-64, 8.3%; 65+, 1.7%) and the average level of education was post-graduate degree (62%). The highest majority of participant was from Italy (75.2%).

Stimuli

The selected stimuli of lit urban settings were photographs whose aim was to represent previously identified variables of lighting attributes: images were supported by videos when was needed to represent interactive and dynamic lighting performances. The eight stimuli, (Table 1), were selected in order to test combined lighting attributes (distribution, colour, intensity and dynamics of light) of conventional and unconventional lighting settings.

Name of the project Designer City, Year	Stimuli (images)	Stimuli (video)	Variable	Attributes of lighting
SIUR PROJECT, - Barcelona, 2011		Yes	Safety	Distribution Intensity Interaction and dynamics
PEDESTRIAN CROSSING Philips Design Strip-S District, Eindhoven, 2011	 	No	Safety	Intensity Interaction and dynamics Colours
Broken Light, Rudolf Teunissen Rotterdam 2010		Yes	Aesthetics	Distribution Intensity
Buchanan Street, Speirs and Major Glasgow 1999		No	Aesthetics	Intensity Colours
Power Flower, Antenna Design Lexington Avenue, New York 2002		Yes	Entertainment	Distribution Intensity Colours Interaction and dynamics
Hopscotch Meinhardt Sydney 2011		Yes	Entertainment	Intensity Colours Interaction and dynamics
Ultra-NATURE, Michel Chevalier Eindhoven, 2007		Yes	Social engagement	Distribution Intensity Colours Interaction and dynamics
Great Street Games,KMA Gateshead, Sunderland, Middlesbrough (Nord East UK) October 2009		Yes	Social engagement	Distribution Intensity Colours Interaction and dynamics

Table 1. Stimuli, lighting attributes, variables

Stimuli are also grouped in categories identified with the following variables:

- Safety and security: the lighting setting is felt as crime preventing.
- Aesthetics: the lighting setting enhance the identity of the city.
- Entertainment: the lighting setting increase the relationship between people and the city.
- Social engagement: the lighting setting increase the relationship between people.

Data collection

The data (average of the results and the frequency of agreement and disagreement) derived from the survey were elaborated using the models of environmental psychology previously described: in particular, the circumflex model of Russell was used to understand emotions, feelings and perceptions from the stimuli while the SOR paradigm was used to understand the relationship between positive and negative reactions (behaviours) in relation to the stimulant attributes of lighting.

Results

The first elaboration of data was based on the circumflex model of Russell in order to describe, graphically, the affective effects evoked by urban lighting stimuli on people. The negative-positive arousal and pleasure dimensions were tested through questions that measured participants level of agreement or disagreement about likeness/pleasantness and surprise/excitement of lighting stimuli (the statements were ranked with Likert Scaling with -2 "strongly disagree", -1 "disagree", 0 "neutral" answer, +1 "agree", +2 "strongly agree"). The pleasantness is subjective and depends on how much the individual likes or dislikes the environment (answering to the statement: I like the appearance of the space); the arousal quality of the stimuli is dependent on information load and complexity (answering to the statement: I would feel surprised and excited in this space).

The results of the survey showed clearly that only few stimuli were positively activating and pleasant for people. In particular, the most activating and pleasurable stimuli were located in the highest part of the dark grey zone of the graph (Figure 3): Great Street Games, Power Flower and Ultra-Nature showed that the creative use of artificial lighting determines a positive arousal that amplifies the basic effects of the positive pleasure perceived in the environment, leading to excitement and a positive behaviour. These three high pleasant and activating lighting settings were categorized previously as socially engaging and entertaining. They present an interactive use of coloured lighting systems, in addition to the existing traditional lamp posts: this extra lighting system defines a pleasant and more complex scene, leaving untouched the readability and the coherence of the space. The arousal is probably favourably enhanced by the unexpected, unconventional and surprising ways of using light within a complex interplay of elements: complexity and richness of stimuli are able to satisfy the human needs of exploration. As other researches reveal, in fact, human beings require a balance of unity and complexity in the built-environment in relation to colour and light: the human natural condition is the balance of changing variables and the unnatural condition is the static or too chaotic situation. (Birren, 1983). Moreover the interactivity and low intensity of lighting contributes to the effect of mystery, driving people in the lit scene with the promise of obtaining more information or interactions while exploring the space.

The project Strijp-S was evaluated pleasant but less activating than the other three ones: the interactive flashing red and green colours of light are used to signal dangers and gather the attention of passersby. It is an interesting extra lighting system for safety communication that results in a lower perceived level of engagement and excitement.

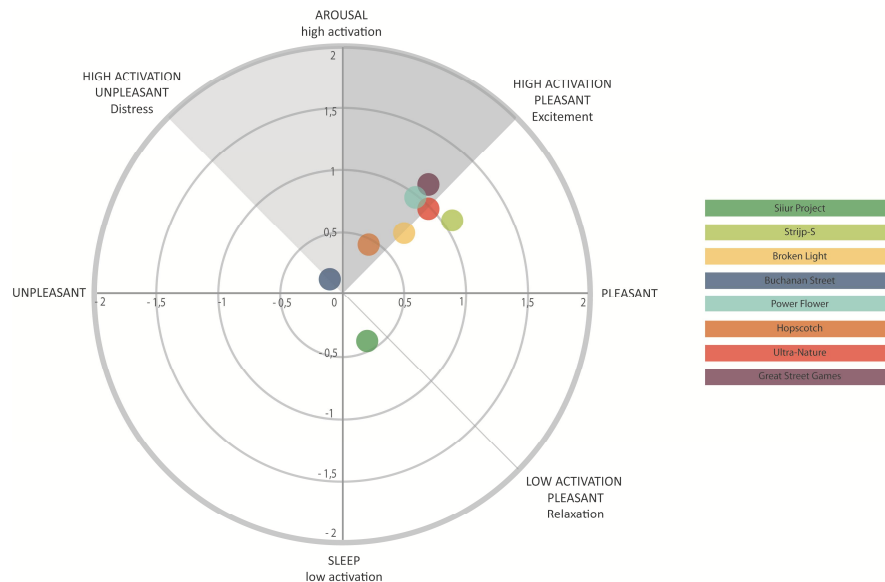


Figure 3. ELSE survey: Arousal-Pleasure model

Conversely, Siur Project is located in the low activating pleasant quadrant (Figure 3), meaning that it was perceived as a pleasurable, coherent and readable lighting setting that satisfy the cognitive effort of people of moving into the space but without any surprising or engaging effect. The low level of activation is probably determined by the absence of novelty in the scene: the lighting setting is interactive but conventional, showing a low level of complexity and without particular arousing elements of colours and distribution of lighting. When the environment is unpleasant, the increasing arousal level will move people into a situation of distress: it was the case of Buchanan Street whose results of the survey showed a low perception of pleasantness and a low arousing effect. The reason of this negative approach can be explained by the cultural difficulty to categorize the environment that is completely lit in a uniform blue coloured lighting: this lighting setting was probably perceived as too unconventional and too far from cognitive schemes and expectations.

A second elaboration of data was based on understanding the reaction of people compared with the activating lighting settings: Great Street Games, Ultra-Nature, Power Flower, Stripp-S and Broken Light. The hypothesis to be demonstrated was: perceived pleasurable and activating lighting settings are correlated to more positive human behaviours. People were asked to evaluate with Likert Scaling questions their agreement or disagreement about the following statements (in relation to images and videos):

- I would like to experience lighting projects like this one in my city.
- I would get out more often if my city was illuminated in this way.
- I would meet and interact with more people if my city was illuminated in this way.

As showed in the Figure 4, there is a correlation between positive arousal-pleasure and positive reaction: as scholars describes, people in a positive emotional status are more inclined to deepen their exploration of the space and they show a desire for staying more, affiliating with others in the environment (Booms and Bitner, 1980).

The results showed that people express the desire to experience similar lighting settings in their own city as the following: Strijp-S (76%), Great Street Games (63.6%), Power Flower (61.2%), Ultra-Nature (54.5%), Broken Light (50%). The neutrality (24.8% for Broken Light and 14% for Strijp-S) and the disagreement was very low (27.3% for Broken light and 10% for Strijp-S). The ranking of the results put Strijp-S and Great Street Games as the preferred stimuli: this suggested that people desire situations in which interactive lighting is a meaningful extra element for social engagement.



Figure 4. ELSE survey: Behavioural reactions

In expressing their level of agreement in engaging with others in the urban environment, people showed a less strong positive attitude with more neutral answers and a different ranking: Great Street Games (55.4%), Ultra-Nature (43%), Strijp-S (40.5%), Power Flower (35.5%), Broken Light (29.8%). These results showed that meaningful interactive lighting effects are conceived as a real engaging tool between people.

In expressing their level of agreement with the desire of staying longer in the city and getting out more, the results showed again a less strong positive attitude and a different ranking: Great Street Games (48.7%), Strijp-S (46.3%), Ultra-Nature (42.2%), Power Flower (40.5%), Broken Light (33%). Neutral answers increased with two exceptions: Strijp-S and Great Street Games showed a very minimal disagreement, meaning that the unconventional safety

lighting (Strijp-S) and the social engaging lighting (Great Street Games) were considered a positive reason to stay longer and use the urban space.

The third elaboration of data was based on the S-O-R paradigm in order to understand the correlation between lighting attributes, the positive emotional status of pleasure-arousal and, consequently, the positive behaviours. Only the pleasant and activating stimuli were selected for this analysis.

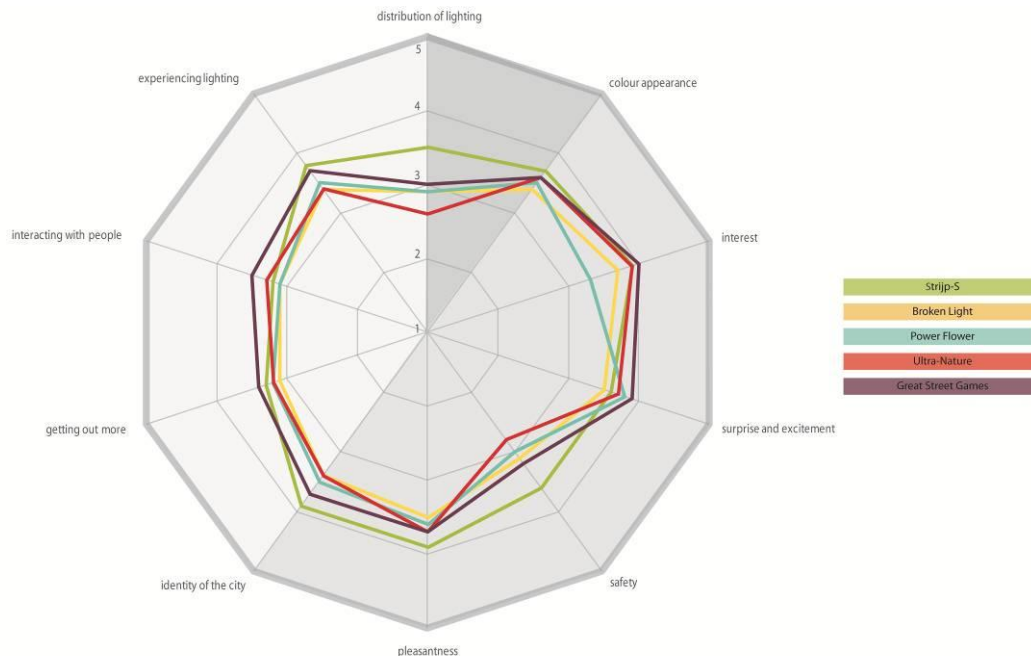


Figure 5. ELSE survey: Lighting attributes, positive arousal-pleasure, behaviours

From the Figure 5, it is evident that the stimuli presented a common trend: the high level of interest, linked with the emotional status of surprise and excitement is determined by the chromatic appearance of light: colour appearance is the correlated attributes of lighting, both defining a pleasurable and activating experience while enhancing a positive and characterizing perception of the city. The distribution of lighting was evaluated in a worst way and it is probably the reason of the low perception of safety: this trend was different only in the case of Strijp-S, where an higher perception of safety was assured by a better distribution of lighting (the scene is highly illuminated) with the addition of the coloured signalling lighting systems properly aimed to assure safety.

More than this, a positive emotional status and behaviours of engagement with the city are determined by the use of playful, unconventional, interactive system of lighting represented in four of the five lighting stimuli: dynamic projections of shapes and colours, variable flashes of coloured lighting and lighting flows with a communicative and signalling meaning were preferred when added to the traditional lighting settings. Researches show that, using the metrics of lightness, attractiveness and overall impression, people prefer lighting schemes with a layered approach constituted of a good general uniform luminance coupled with visual accents and decorative elements (Hargroves, R.A. 2001). Other scholars describe the experience of a dark space pierced or pinpointed with light as something creating a sensation of mystery that invites examination and offer the opportunity for discovery (Peters, 1992).

A forth elaboration of the survey was focused on exploring how much people are inclined to spend in terms of energy and money to have more pleasurable and engaging lighting settings in their neighbourhood. When people were asked to choose the way of financing their preferred lighting settings, just a slightly half of all the respondents (about 55%) wouldn't

like to spend public money and would like to use the private investments (about 57.5%). Differently, when people were asked about the energy consumption of their preferred lighting settings, the responses completely agreed to have it only if energetically sustainable (86%). In addition to this, the majority (63.9%) would like to have the preferred lighting settings permanently installed in their cities. People expect social interactive experiences of lighting in their cities in a permanent and sustainable way.

On the other hand, when people were asked openly to rank the values of lighting that should be taken into account in the lighting urban setting for their cities, they indicated the safety perception, the energy efficiency and the increasing of social engagement at the top of the list. These results seem to agree with the previous part of the survey where safety and social engaging aspects were the best valued features of the lighting settings. Social engagement and safety are intrinsically linked: more people use the space, more people are observing the scene and more crimes are prevented (CPTED, 2000). The presence of energy efficiency suggests a general declared and conscious inclination toward environmental issues and energy consumption reduction: it means to design a qualitative lighting setting with a focused social performance that take into account the energy savings. Low costs were not considered so important in ranking the values: people seemed to be open to spend more money to have more quality in their lit neighbourhood in order to assure safety, an increasing social use and a comfortable experience. Conversely, people showed to be not inclined to spend money for solely entertaining lighting settings.

Conclusion

The investigation about the social aspects of lighting based on a qualitative method give the opportunity to understand new positive features of lighting performance and lighting requirements that are completely neglected and ignored by lighting legislations and standards. ELSE contributes in a positive way to make understand that public lighting has an important role in the positive characterization of the city and in the reshaping of the social relationship between people and the urban spaces. The collective and participative survey puts in evidence that the people's perceptions and evaluations matters in the urban lighting planning and design: the unstructured relational city modelled by people is evidently in search for flexibility of the lighting settings in order to enhance the social interaction. Public urban lighting should be designed in a more interesting and variable way with permanent and meaningful lighting performances for a smart nocturnal environment, trying to balance the performances in terms of energy savings and social experience.

In fact, the survey showed that the more positive reactions in terms of emotions and behaviours were expressed by people on projects of lighting that shows openness, dynamicity, interactivity and unconventional exploration of the space: what matters most in the so called Urban Lighting 2.0 (Bessette, 2011) is deepening the experience of people through the use of social meaningful lighting. The city becomes the theatre of individual and collective experiences where the use of interactive lighting results in an escapist experience without losing its original mission (seeing, orienting, walking). Lighting can customize, humanize, beautify and make the city more liveable in agreement with emotions, perceptions, interests and preferences of its inhabitants. In addition to this it is undeniable that the urban lighting has to take into account the energetic issue.

ELSE could be interpreted as an analytical tool to understand the preferred and more interesting features of lighting from people that could be transferred in the lighting design process, giving designers the tool to understand the importance of certain features of light.

From this point of view, the research showed that the definition of positive emotions and reaction of people was correlated to colours and dynamics of lighting in meaningful ways. Coloured lighting can be an attention-getting tool, signalling events for security reasons but it can also define the city ambiance, decoding the city rhythms of night activities. Interactive lighting should be used to enhance the dynamic experience of the lit city: people can customize the city, impacting upon the environment through their interaction with lighting; conversely lighting attributes can completely transform the physical environment and this, in turn, can modify people's emotional perception and experience of the nocturnal city. This kind of lighting settings do not results only in a new set of behaviours, for example people getting out more at night or increasing their social engagement, but can redefine expectations toward a new culture of public spaces.

In conclusion, this study aimed to evidence the emergent strong demand for socio-relational experiences in the city and to exploit the next possible progression of lighting design: lighting as a participative and social tool, lighting as a user focused service, lighting as a tool for crime prevention and safety perception, lighting as a customizable interactive ephemeral material, lighting as an aesthetic and entertaining public phenomena. ELSE can become a useful participating tool in order to add qualitative information based on the collective perception of the city when designing the urban lighting masterplan: it could be used within the P.R.I.C. analysis in order to interpret inhabitants needs of urban areas or entire cities toward a better understanding of people perception and evaluation of the lit nightscape.

Limitations and Suggestions for Future Research

ELSE is a starting explorative research about a complex argument that needs deeper understanding and analysis about the perceptual and experiential aspects of public urban lighting in order to define a collective and social sustainable lighting. This preliminary approach can be implemented by increasing the number of participants in the virtual ethnography in order to gather a higher statistical number of responses and a richer panorama of results. This increment can provide a wider and cross-cultural view about the argument and can also test if lighting attributes and responses vary in accordance to the context, culture, age, and gender of participants.

More than this, in order to better validate some assumption about attributes of lighting that arouse certain emotions and reaction of people, the study should continue using the same stimuli with a qualitative analysis. In addition to this, a deeper analysis about correlations between lighting, people and the city can be conducted passing from the virtual, general ground to the real field: qualitative investigation in situ using ELSE about the impact and experiential relevance of ad-hoc public urban lighting could be useful to understand people perceptions and translate their point of view into social sustainable lighting projects.

References

- Amendola, G. (2009). *Il progettista riflessivo, Scienze sociali e progettazione architettonica*. Laterza, Bari.
- Amin, A. (2008). *Collective culture and urban public space*. City, Volume 12, Issue 1 April 2008 5 – 24. doi: 10.1080/13604810801933495.

- Banerjee, T. (2001). *The future of public space – Beyond invented streets and reinvented places*. Journal of the American Planning Association, 67 (1). 9-24. doi: 10.1177/0739456X07307947
- Bessette, S. (2011) *Urban lighting 2.0: towards a convivial, animated city*. PLDC Conference Madrid, October 2011.
- Birren, F. (1983, December). *Color and Psychotherapy*. Interior Design. 54(12):166-9.
- Booms, BH, Bitner, MJ.(1980) *Marketing services by managing the environment*. Cornell Hotel Restaur. Adm. Q 1980;23(1):35–9.
- Bordonaro, E. & Aghemo, C. (2006). An environmental psychology approach to urban lighting. *International Conference Proceedings, The Urban Nightscape 2006* International Conference, Athens, Greece.
- Brandi, U. & Geissmar-Brandi, C. (2007). *Light for Cities, Lighting Design for Urban Spaces*. A Handbook, Birkhäuser Publishers for Architecture, Switzerland.
- Burkahardt, F.(1998, March). *Uno spazio comune*. Domus 802.
- Canter, D. (1977). *The Psychology of Place*. Architectural Press, London.
- CIE 136 – 2000 Guide to the lighting of urban areas
- CIE 115 – 2010 Lighting of Roads for motor and pedestrian traffic
- CPTED. (2000) *Crime Prevention Through Environmental Design*. General Guidelines For Designing Safer Communities.
- ELSE, (2012 January) *Environmental Lighting Sustainability in the urban Environment*, Retrived 16 03, 2012, from <http://www.surveygizmo.com/s3/784930/ELSE-SURVEY-Experience-of-Lighting-Sustainability-in-the-Environment>.
- Florida, R., Mellande, C., Stolarick, K. (2011) *Beautiful Places: The Role of Perceived Aesthetic Beauty in Community Satisfaction*. Martin Prosperity Research, Regional Studies: The Journal of the Regional Studies Association, 1360-0591, Volume 45, Issue 1, 33 – 48
- Gehl, J. (1987). *Life between buildings*. Van Nostrand Reinhold, New York
- Gibson, J. J. (1979). *An ecological approach to visual perception*. Boston: Houghton Mifflin.
- Ginthner, D. A. (2002) *Lighting: its effect on People and Spaces*. Retrived 16 03, 2012, from http://www.informedesign.org/_news/feb_v02-p.pdf
- Goffman, E. (1967). *Interaction Ritual - Essays in Face-to-Face Interaction*. Chicago. Aldine.
- Hargroves, R. (2001). *Lighting for Pleasantness Outdoor*. CIBSE National Conference 2001 136-141.
- Illich, I. (1973). *Tools for conviviality*. New York, NY. Harper & Row.
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. Random House. New York.
- Kaplan, R & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press, Cambridge.
- Kepes, G. (1966, October). *Light as a creative medium*. Arts and Architecture.
- LUCI (2007) *Charter on Urban Lighting*, Promoting a culture of sustainability in lighting. Retrived 16 03, 2012, from <http://www.luciassociation.org/luci-charter-on-urban-lighting.html>
- Lynch, K. (1984). *Good city form*. Cambridge, MA: MIT Press.
- Major, M., Speirs, J. & Tischhauser A. (2005). *Made of light: the art of light and architecture*. Basel : Birkhauser, ISBN 3764368608
- Mehrabian, A. & Russell, J. A. (1974). *An approach to environmental psychology*. MIT Press Cambridge, MA.
- Mehta, V. (2007). *Lively Streets: Determining Environmental Characteristics to Support Social Behavior*. Journal of Planning Education and Research 27:165-187 doi: 10.1177/0739456X07307947.
- Narboni, R. (2004). *Lighting the landscape, Art Design, Technologies*. Birkhäuser Publishers for Architecture, Basel.
- Oldenburg, R. (1981). *The great good place*. Univ. of California Press, Berkeley.

- Peters, R. C. (1992). *The Language of Light [Light in Place]*. Journal Issue Places, 8(2) Places, College of Environmental Design, UC Berkeley Retrieved 16 03, 2012 from <http://escholarship.org/uc/item/89p3z5w8>.
- Raynham, P. & Gardner, C. (2001). *Urban Lights: Sustainable Urban Lighting for Town Centre Regeneration*. Lux Europa 2001, Reykjavik.
- Raynham, P. (2007). Public Lighting in Cities. International Conference Illuminat 2007. Cluj-Napoca, Romania.
- Russell, J. A & Pratt, G. (1980) *A description of the affective quality attributed to environments*. Journal of Personality and Social Psychology, 38, pp 311-22.
- Schwendinger, L. (2009). *City Beautification: Color and Light*. CIHAC, Mexico City
- Stokols, D. (1995). *The paradox of environmental psychology*. American Psychologist 50:821–37.
- Tillet, L. (2006). A social approach to urban lighting. *International Conference Proceedings, The Urban Nightscape 2006* International Conference, Athens, Greece.
- Tillet, L. (2011). *Grounding Practice: Speculations on Affect and Environment*. PLDC Conference Madrid, October 2011.
- UNI EN 13201 – May 2004
- UNI 11248 – October 2007