

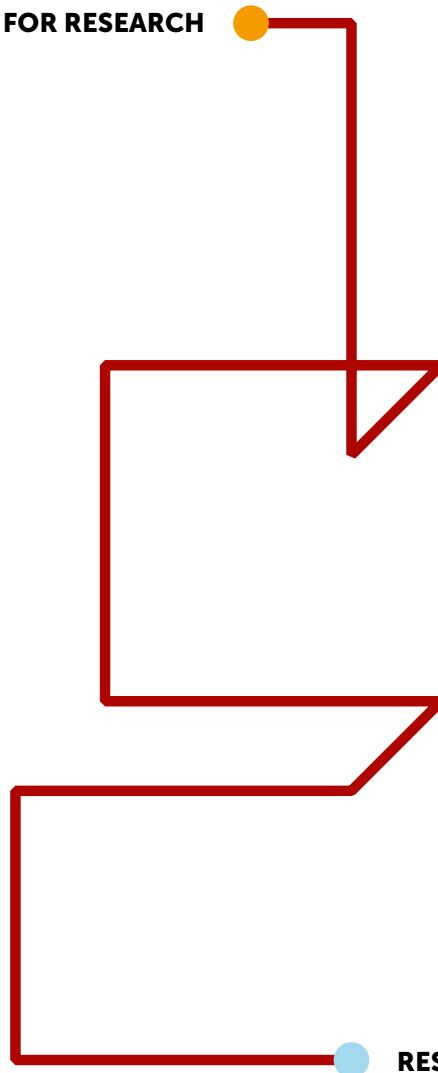
**EDUCATION FOR RESEARCH**



**RESEACH FOR CREATIVITY**

Edited by Jan Styk and Lia Bezerra

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## **RESEARCH-BY-DESIGN BEST PRACTICES IN ARCHITECTURAL LIGHTING DESIGN: DEFRAGMENTING RESEARCH THEORIES FOR THEIR EFFECTIVE USE IN THE PRACTICE OF ARCHITECTURAL AND SPATIAL DESIGN AFTER DARK**

This paper aims to combine theory and applied science; academia and practice for the creative transformation of spaces after dark taking into account a consistent environmental awareness. It is based on the premise that design research in the realm of architectural lighting design should function as a development of practice, instead of being a distraction to it. Architectural lighting design is a field within architecture and spatial design that concerns itself primarily with the illumination of architecture, including academic/institutional, corporate, hospitality, monumental structures, residential, retail/entertainment and site/facade projects after dark.

### **INTRODUCTION**

Keywords:

Architectural Lighting,  
Research Theories, Spatial  
Design, Design Research,  
Research-by-design.

Design research refers to the scholarly inquiry that seeks to advance design by studying and improving it in systematic and scientific ways by expanding, testing and operationalizing the findings of design science; in the context of transferring general fields of research to practice, design research impacts practice in a variety of ways [1]. It includes both art and science, in clearly identifiable fields related to the applied sciences and the social sciences [2].

Literature reveals that design research from diverse realms have relevant implications in the practice of architectural lighting design. For example, medical studies on the 'biophilia hypothesis: human preference for nature and natural settings' is finding several applications in modern architectural lighting; environmental studies on seasonal migratory patterns is resulting in lesser death rates of birds by collision with architecturally lit building facades and turtles by disorientation from glary urban skylines. Boyce [3] however, argues that research plays little or no role in the design process, as designers are confident in their ability, creativity, and judgment and seldom require inspiration from research results. Popovic [4] further argues that research has not been very common among designers because of its nature and the way that professional practice operates. Additionally, the connections between design research and practice has not been well defined in the realm of architectural lighting design. Therefore, the need is for a collaborative culture between design research and practice, and a relevant research knowledge base that can be utilised in practice.

Defragmentation is a process used in the realm of computing to reduce the fragmentation of a file by concatenating parts stored in separate locations on a disk. Building upon this analogy, the paper argues that a similar defragmentation process can be used to concatenate design research from

different realms for its effective use in the practice of architectural lighting design. By exploring the role of state-of-the-art research in the evolution of innovative approaches towards design and implementation, it will showcase best practices in architectural lighting design.

## **METHOD**

Popovic [5] has proposed an applied research and innovation framework that situates design research within a social structure constituting people, activity, context and culture to generate new knowledge and support innovation through the following four modes: (1) research conducted before design commences (2) research conducted concurrently during the early design stage (3) research conducted concurrently during the design development stage (4) research conducted when the completed design is in the market. The paper draws inspiration from this framework to develop a defragmentation framework. It also utilises the three modes of engaging with research listed by Lee et al. [6] as a defragmentation tool: (1) knowledge – the subject of the research, (2) process – ways of researching and finding knowledge and (3) resources – ways of accessing knowledge.

## **THE DEFRAGMENTATION FRAMEWORK**

The defragmentation framework consists of three modes: (1) research conducted before the design commences, (2) research conducted concurrently during the design stage, and (3) research conducted when the constructed design is in use.

### **Research conducted before the design commences**

Research conducted before the design commences is a mode that acquires knowledge utilising relevant research methods to be applied in designing architecturally lit spaces. Architectural lighting design teams can perform various activities such as literature reviews, feasibility studies, user surveys, and site analysis to be well equipped for the design process. The project example used for describing this mode is the Harbour Crane at Kotor Bay in Montenegro [Fig.1a]. Before proposing a lighting design concept, the design team had to undertake an extensive site analysis of the bay, which is a UNESCO World Heritage Site. The crane, being the tallest and most visible element, became the automatic choice for highlighting its history [Fig.1b]. However, special care had to be taken so as to cause minimal disturbance to its nighttime natural beauty as well as the adjacent residential development. Therefore a dual-scene lighting concept was proposed that evokes the memory of the crane function, and reduces light-spill as well as its associated energy consumption as the night progresses: Early- and Late-night scenes [Fig.1c & 1d].

Fig.1b. Harbour Crane.  
Source: Light Bureau

Fig.1c+1d. Early- and Late-night scenes.  
Source: Light Bureau

Fig.1e. Rays of light create

a 3D form of the Twin Towers.  
Source: K.M.Zielinska-Dabkowska

Fig.1f. Tribute in Light.

Source: Schutterstock/ Sean Pavone

Fig.1g. Sundial Bridge

- floodlights directed

upwards and downwards

towards water.

Source: Fotolia/Leah

McDaniel



### Research conducted concurrently during the design stage

Research conducted concurrently during the design stage is a mode that exemplifies research-by-design. The early design stage is crucial to the innovativeness of the architecturally designed lighting scheme as it encompasses analytical and critical thinking. All designs are conceptualised at this stage and several lighting design concepts usually emerge. Design teams perform several tasks such as sketches, lighting calculations and 3D visualisations to critically evaluate the design. This enables the design team to identify, recall and apply the relevant knowledge required [7]. During the design development stage, additional research may be required to either develop detailed lighting concepts, produce final lighting designs or site-level mock-ups to understand the impact of light. This is a stage where the highest knowledge transfer can occur, as different experts from various realms tend to contribute to the overall design. The project example used for describing this mode is the Tribute in Light in New York City [Fig.1e]. The 9/11 aftermath led to a design team of artists, architects, and lighting designers proposing a symbolic reproduction of the form and image of the WTC Twin Towers using high-power white light [Fig.1f]. However, the team faced several questions during the design stage: How far would it be visible from? Can the air be used as an illuminated surface to reflect light? How powerful, how many and what type of luminaires should be used? How to locate them to create an illusion of a 3D object? Several mock-ups were conducted in the Las Vegas desert and New York City. Additionally, laser measuring devices, digitally controlled instruments and long-range walkie-talkies were used to arrive at the precise location and direction of the searchlights so that the installation could be viewed from anywhere in Manhattan and beyond.

### Research conducted when the constructed design is in use

Research conducted when the constructed design is in use is a mode to evaluate the overall success of the proposed architecturally designed lighting scheme as well as explore new strategic opportunities. The proposed scheme can be evaluated in various ways such as user comfort and

cultural response, visual appeal, human health and productivity based on the overall scope of the project. The research findings can be applied to generate better-lighted environments for the future. The project example used for describing this mode is the Sundial Bridge across the Sacramento River in California [Fig.1g]. While this pedestrian bridge itself is very aesthetically designed, its nighttime lighting with large floodlights directed upwards and towards the water is causing serious environmental issues. Current observations state that the lighting is creating a trap for the migrating wild salmon in the river. Fish usually migrate at night cued by the illumination levels to avoid predators. Predators such as birds and other animals position themselves under these lights to locate and capture the salmon. Post-occupancy survey of the bridge shows that as the bridge is painted white, even reduced illumination levels will not help as the reflected lighting from the bridge causes permanent illumination of the water.

## CONCLUSION

Architectural lighting designers can use these modes as guidelines to systematically search, collate and apply research in their design projects, as well as document these projects for future reference. As a broader goal, more and more architectural lighting designers can be involved in the development of these guidelines. Involvement in guideline development provides experience and insight into the process of identifying, appraising and analysing available research and developing recommendations for practice [8]. In doing so, the paper attempts to bridge the long-standing divide between researchers and designers who consistently work towards the betterment of architecture and spatial design after dark.

## References

- [1] Telenko, C., Sosa, R. & Wood, K. L. (2013). *Impact of Design Research on Practice*. Springer-Verlag, London, UK.
- [2] Frankel, L. & Racine, M. (2010). *The Complex Field of Research: for Design, through Design, and about Design*.
- [3] Boyce, P. R. (1987). *Lighting Research and Lighting Design – Bridging the Gap*. *Lighting Design + Application*. New York, USA, IES. 17: 38-44.
- [4] Popovic, V. (2003). *An Approach to Knowledge Generation by Research and its Utilisation in Practice - Situating Doctoral Research around Artifacts*. In: Durling, D. & Shigoyama, K. *3DED Proceedings*. Tsukuba, JAPAN. 133-143.
- [5] Popovic, V. (2005). *Applied Research and Innovation Framework. Joining Forces*. University of Art and Design, Helsinki, FINLAND.
- [6] Lee, C., Nettley, A, Prin, M & Owens, P. (2014). *How architects use research – case studies from practice*. RIBA, London, UK.
- [7] Cross, N. (1999). *Natural Intelligence in Design*. *Design Studies*. 20(1): 25-39
- [8] Gordon J. & Watts, C. (2011). *Applying skills and knowledge: Principle of Nursing Practice F*. *Nursing Standard*. 25 (33): 35-37.