2013


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Abstract
The advent of advanced electrical technology by the mid 20th allowed for an architectural fusion with what was once a secondary consideration for builders, ultimately culminating in lighting design as a profession. The development of electric light, and later, lighting design in America had many influences which drew from the realms of architectural design, engineering and the theatre and performing arts. The selected case studies characterize the overall progression occurring in the realm of integrated architectural lighting, as the architects utilized electric light as a building material. With a case study from the 1930s, one from the 1940s and one from the 1950s, the lighting goals, early intent of the lighting design, installation and technical considerations of each are presented. As a secondary component to the case studies, their later (and more present day) renovations or restorations are evaluated for their relative success or failures in regards to the care and consideration of the original lighting schemes.

In the revisiting of many of the interiors of this era, the now-fugitive lighting systems have been disregarded or replaced with less compatible, less complementary systems, thus destroying the ambience of the original space. If we are to accurately restore or renovate these unique American interiors, the process of researching, specifying and applying the original integrity through lighting must be achieved. Addressing these in further detail, the author has developed a series of criteria for guidelines for the preservation of early twentieth century lighting systems, which are a confluence of the previous mentioned historical research, in-depth case studies and an analysis of existing relevant guidelines.

Keywords
mid century, electric light, retrofit, lighting guidelines, lighting design

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Comments
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TERMINOLOGY, TECHNOLOGY AND DESIGN INTENT OF 20TH CENTURY ARCHITECTURAL LIGHTING AND ESTABLISHING CRITERIA FOR GUIDELINES FOR ITS PRESERVATION

Alison Joanna Garcia Kellar

A THESIS

in

Historic Preservation

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements of the Degree of

MASTER OF SCIENCE IN HISTORIC PRESERVATION

2013

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Dedication

“Vision is the art of seeing what is invisible to others.”
- Jonathan Swift

I dedicate this thesis to the gift of eyesight.
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**Introduction**

Conservators, material scientists and building practitioners have spent decades researching, establishing, and adopting universal sets of guidelines and treatments to inform the methods and materials used to maintain buildings of historical significance. We regard traditional building materials like wood, masonry, stone, and metal as informing the history of a structure and our sense of place in it today. In the same way preservationists have considered the importance of traditional building materials in this manner, they now include more modern building materials like concrete, glass, and plastics into the preservationist mindset as well, carefully deliberating the effects of new construction techniques and fabrication methods on the historical significance of a structure and how these methods may be conserved in the future. As we have pressed into the 21st century, the qualifications that constitute a “building material” have evolved from the traditional sense. In the same way machine-made brick and steel were at one point revolutionary materials to build with, so too is electric light today. When preservationists approach maintaining a building, they must now take into account not only numerical measurements of light, including lumens, color spectrums, and number and placement of fixtures, but the total effect of a lighting plan on an interior in addition to energy efficiency considerations. The ambience and definition of space a lighting system can create is as important to restore and maintain as the wooden floors and marble walls they shine down on. So it follows if light is a building material, professionals should be able to refer to a universal set of guidelines that inform the methods and materials we use to maintain them.

Rather than simply illuminating a hallway, or another task-specific area, modernist architecture began integrating components of electric lighting into structures in the second
quarter of the twentieth century. The advent of advanced electrical technology allowed for an architectural fusion with what was once a secondary consideration for builders, ultimately culminating in lighting design as a profession. Architects concealed unique lamps within the walls and ceilings, positioned just so the light emitted would reflect powerfully against carefully selected building materials, angled to highlight building features in ways that had previously gone unexplored. This new cooperative pairing offered the visitor a more stylized and impressionable experience within an already carefully designed interior space. As these lighting schemes became integral to experiencing a building or a room, architects and designers alike treated lighting as simply another layer of building material. Lighting systems removed, these early 20th century spaces would lose their character. It would detract from the overall programming to the point where they would no longer “read” as unique as originally intended or as authentic as when first built.

The development of electric light, and later, lighting design in America had many influences which drew from the realms of architectural design, engineering and the theatre and performing arts. In 1932 theatrical lighting designer Stanley McCandless wrote, “The art of lighting is not measured by ingenuity, although the complicated technical nature of the subject often leads people to applaud an exhibition of technical mastery, which in terms of the other visual arts might be considered merely a mechanical trick.” In this, we will graciously adopt the phrase “the others visual arts,” and apply it to the art of interior architectural lighting. During this era of American growth, the communication of ideas and new technologies were now able to be spread and shared faster than ever, with the aid of the telephone, jet plane and new concepts of mass marketing and advertising. Various fields with a need for new electric lighting application were able to draw from one another in
terms of effect and technical installation during this time, which will be exemplified in the three case studies the author has explored.

To further establishing significance, the lighting terms used in the early 20th century warrant definitions of concepts and terminology, to both prove them as unique to the era, and to allow for full understanding of the concepts that are to be presented in this thesis. The ambiguous nature of illuminance, luminance and the overall intentions of these new applications of electrical light will be explored as illustrated through early technical journals, professional lighting and architectural publications and newspaper articles.

The selected case studies characterize the overall progression occurring in the realm of integrated architectural lighting. With a case study from the 1930s, one from the 1940s and one from the 1950s, the lighting goals, early intent of the lighting design, installation and technical considerations of each will be presented. Through in-depth historical and archival research including original schematic, shop and final drawings, stakeholder correspondence, billing and public response, the lighting schemes of each of these interior projects will come to life. As a secondary component to the case studies, their later (and more present day) renovations or restorations will be evaluated for their relative success or failures in regards to the care and consideration of the original lighting schemes. In the revisiting of many of the interiors of this era, the now-fugitive lighting systems have been disregarded or replaced with less compatible, less complementary systems, thus destroying the ambience of the original space.

If we are to accurately restore or renovate these unique American interiors, the process of researching, specifying and applying the original integrity through lighting must
be achieved. Addressing these in further detail, the author has developed a series of criteria for preservation guidelines for the preservation of early twentieth century lighting, which are a confluence of the previous mentioned historical research and in-depth case studies. These suggested standards are intended for architects, interior designers, contractors, and built environment professionals to serve as a guide for how to approach the recreation of appropriate original lighting schemes, outlining the steps to conduct necessary research, how to evaluate the findings, and detail how to go about the process of a lighting renovation of a mid-twentieth century lighting scheme.
Chapter 1: Electric Light in America in the 20th Century

In the second and third quarters of the 20th century, America’s built landscape underwent rapid, progressive changes made possible by the post-industrial revolution, the end of World Wars I & II, and various nonspecific rebuilding after the Great Depression. With the advent of communicative technologies made possible by electricity, great cross-country spans of distance seemed to shorten, and new ideas could rapidly be shared, discussed and applied among researchers and consumers across our nation. The concept of a “flameless light” brought about by electricity was becoming accepted in the American mindset and it is during this era of great progress that the light bulb and the light it produced was experimented with and refined by scientists, engineers and designers in architectural space like never before.

All of this fanfare regarding electricity, however, did not come without skepticism. In an effort to retain customers and lessen the threat of electricity to their industries, gas companies created marketing campaigns in the 1880s which touted “electric light without the electricity.”1 Additionally, the lighting market was extremely unorganized, as electric companies installed isolated electrical systems directly into the interiors of individual homes. Although gas lighting had its own inherent dangers, the fear of electrocution and the possibility of entire neighborhoods being without any power created an atmosphere of hesitation around early electric light. To counter this fear and promote acceptance of these new technologies, some early lamps were created by newly established experimental lighting companies allowing for both a gas light source and electric light bulb to co-exist in one unit.

1 Jane Bronx, Brilliant: The Evolution of Artificial Light. (Boston: Houghton Mifflin
The success of the 1893 World’s Columbian Exposition offered millions of Americans a glimpse at a life of controlled electric power and light. The exposition promoted electric light in the Electricity Building with a massive tribute to Thomas Edison comprised of an array of dissimilar experimental light bulb prototypes. The entire exposition grounds featured nocturnal exterior illumination by means of floodlights “and more lights than any real city in the country.”

Well past the turn of the century, the bare bulb and wall socket, or bare bulb hanging from the ceiling on a wire initially remained the normal application of electric light. For early electric luminaires or electroliers, designers mimicked the physical style of oil and gas lamps. Light sources positioned in an upward manner, shrouded with clear glass or porcelain and featuring metal fixtures all harken back to earlier, more familiar forms of lighting interior spaces. Early fascination with the promise of electricity created the perfect atmosphere for lighting experimentation. Incandescent technological developments at the turn of the century allowed for safer, easier to maintain, and more controllable utilization of electric light for utilitarian purposes, including factories and offices. The development of street lighting and later overhead interior lighting led to extensive lighting studies involving visual perception, luminance levels and lighting type effects on human production and efficiency in the workplace.

Many engineers at the turn of the twentieth century considered that electric lighting “in most instances...must be subordinated to features of architecture and decorative

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2 (Bronx, 138)
3 (Bronx, 129)
treatments,” and was not yet regarded its own stand-alone architectural element.\(^5\) This hesitant, practical language was reflective of an indecisive consumer amongst a still largely chaotic electric market, yet was telling of the innovative and optimistic viewpoint that those involved and invested in electricity could foresee. It is during this time that engineers specializing in “illumination” began to take on more theoretical ideas about implementing electric light as a design feature of a building. It is only after brightness levels were tamed comparable to those of gas lighting from the 1880s and 90s that electric illumination became widely accepted by both domestic and commercial consumers for application in new buildings.\(^6\) Electric light was beginning to take on its own identity as an architectural element, rather than simply serving as a pragmatic necessity, which was secondary to the structure and furnishings of an interior space. Additionally, the strides in lighting technology and the professionalization of the lighting field that occurred in the following decades encouraged unprecedented experimentation and the application of light an intrinsic building material. The theoretical concepts behind mid 20\(^{th}\) century lighting design and the emergence of the lighting profession will be discussed in depth in Chapter 2 of this thesis.

As the practice of lighting buildings with electricity was becoming more commonplace, many were utterly fascinated by the swift pace of changes occurring in the new cityscape. A 1925 New York Times article illustrates a turn of the century New York where the skyline was lit with such impressive technology that the writer suggested


training for European tourists in an effort to help them understand what their eyes were seeing. Tall modern structures were such a novelty, that it seemed as though people viewing these buildings required lessons in appropriate viewing posture. The language conveyed in articles of the time expressed an awe for electrified skyscrapers, comparing them to monuments built of precious metals as “Silver and golden temples...” Further, since the cityscape at night was slowly brightening up, as interior office electric lights would stay on through out the night, buildings would be considered as “dazing, soaring shafts and spires of light, and giant steps of light that scale the skies.” Also at this time, interior frosting was applied by light fixture manufacturers to globes which offered diffused light, and led to the development and use of more concealed diffusers, globes and lenses, showing consideration for control of light intensity, direction and source glare. Reflectors allowed for more efficient direction of light distribution, and reached their peak in popularity with indirect lighting between 1910 and 1930, as ceilings and walls could now be illuminated by lamps and reflectors completely concealed within fixtures or architectural elements. A new freedom in the use of incandescent light, downlighting and other forms of electric light encouraged experimentation in combining light and spatial elements to achieve new architectonic effects. These explorations lead to the use of electric light as a structural element in space. Architects and builders were able to apply this concept most prevalently to commercial mid-century buildings.

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The development of fluorescent light was publically debuted by General Electric at the 1939 New York World’s Fair, and was displayed throughout the grounds backlighting murals, illuminating signs and highlighting walls. The Fair revealed for the first time the progressive effects of the fluorescent bulb, that it offered lower radiant heating, longer life ratings, and high luminous efficiency. This fluorescent bulb’s color range was much “cooler” than the filament or incandescent bulb, which were closer to the warm color temperature of sunlight meaning they could be used to “not only enhance and punctuate details of the buildings but also grant structures a distinct appearance at night, completely different from the way they appeared during the day.”\(^\text{11}\) The Fair’s presenting panel claimed that the increased luminous efficiency and lower percentage of radiant energy made these fluorescent bulbs far more suitable for eye comfort while maintaining high levels of illumination. Scientists were hopeful for the survival of fluorescent techniques, and in this forward thinking vein, one innovative president of an electrical testing laboratory went so far as to compare the developmental time-line of this new technology to the twenty-five years of study and toil that it took to refine the gas-filled incandescent lamp.\(^\text{12}\)

Although some of the experimentation in electric lighting was halted during the war due to funding, manpower and resources, the enthusiasm surrounding it continued amongst practitioners. In a 1943 war-time article titled, “What’s Ahead in Lighting,” the author predicted that as designers innovated new equipment, that the fluorescent lamps of the future would have substantially longer life spans.\(^\text{13}\) Obviously mere conjecture at the time written, the author seemed to be tapping into the war-time fear of the dark, hearkening

\(^\text{11}\) (Bronx, 211)
both a literal and a figurative brighter future for the American public.\textsuperscript{14} With America’s eyes looking toward this post-war future, they saw in the distance a more revered, domestic, suburban life, fueled by mass-produced and widely available electric machines for the home. The novel notion of mass-marketing campaigns of the period promoted the acceptance of every-day electric lighting in the home. Experimentation with light sources and their effects in commercial buildings during the early part of the twentieth century translated seamlessly into domestic spaces. In 1945, Mary Roche, the New York Times House and Garden editor conveyed a widely accepted palate of lighting techniques offering complementary visual depth to the inhabitants of the home, with a “...balance of local lighting with general, direct with indirect, in a way that will enhance the room and its contents, highlight the lines of furniture, accent the colors.”\textsuperscript{15}

Considering how the effects of how light were being applied to the domestic realm to enhance space in the 1940s, by the 1950s, architects, engineers and designers alike considered the lighting profession to be defined as the confluence of art and science where light itself could be utilized as a building material. Lighting designer Stanley McCandless’ writing was published in a 1951 edition of the Illuminating Society of Engineers Magazine. Having been in practice for decades, the appearance of McCandless’ writing in the 1951 edition of the Illuminating Society of Engineers Magazine reveals a growing acceptance and appreciation for theatrical lighting in the architectural realm. McCandless expressed the importance of controlling and manipulating the audience throughout a performance by means of lighting. No one lighting professional has made the connection stronger than McCandless when he noted:

\begin{itemize}
\item \textsuperscript{14} (Williams, 420)
\item \textsuperscript{15} Mary Roche, "Ceiling Lighting Due to Come Back." New York Times (06 June 1945. Web. 17 Feb. 2013)
\end{itemize}
“While artificial light is one of the obvious tools of the designer in the theatre (including motion pictures and more recently television) and consequently is more extensively used than in any other field, display men, interior decorators, and architects are beginning to think of light as a plastic medium that can be designed wherever appearance and dramatic effect under artificial light are important. It is something more than just fixtures and instruments. It is visibility, comfort, composition and atmosphere – the fundamental objectives that deal with individual visual reactions.”

Though the notion of light as a plastic medium had been coined in the early 1920s, by Joachim Teichmuller, McCandless’ well-stated revelation set the stage for what was to follow later in the decade. Both architects and lighting designers began finessing new practices like modeling of forms and architectural features using the production of adequate vertical surface illumination. With the incorporation of these vertical surface elements, designers began actively promoting the ease of seeing. The aesthetic quality of light took on a new dimension. A 1956 Illuminating Engineering Society article titled “Public Building Lighting- 1906 to 1956,” takes an informed look back, categorizing important intentions and considerations for lighting schemes particular to public buildings, organizing it in such a way to illustrate the wide acceptance by practitioners, designers, and those involved with the design and implementation of complex systems into new buildings.

A 1959 IES Magazine’s celebratory “look back” on the previous ten years of lighting technology development noted that the “growing extent of [light’s] acceptance as an element of design” as the most significant advance in lighting over the decade. The feature continued that the combination of function and decoration had gone from an understood concept to a widely accepted and applicable fact in the architecture world within the scope

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16 Stanley McCandless, "Lighting for the Audience." Transactions of the Illuminating Engineering Society (Jul. 1951)
of ten years. Hearkening back to 1949 when the idea of jet planes from coast-to-coast and earth satellites seemed inconceivable to imagine, the developments in technology since had lead to the creation of buildings that were as much admired by architects, architectural critics and the public for their lighting design as much as for their architectural design.19

It is with this recognition of the emergence, development, and execution of custom-designed architectural lighting schemes in the second and third quarters of the twentieth century that we can begin to appreciate just how unique our systems are today. As buildings from this era begin needing conservation treatments, strategic maintenance plans, and restoration, it is crucial that practitioners working on buildings that feature these architecturally integrated lighting schemes take into careful consideration the revival of the lighting effects as well as the physical building materials. Technical innovations that create or maintain an essential ambience make a restoration accurate and in the spirit of the original design. Without the consideration for the technical prowess and the essential ambience, a restoration wouldn’t be accurate or in the spirit of the original design.

Chapter 2: Emergence of Architectural Lighting Profession

The history of mid-twentieth century electric lighting would be incomplete without discussing the professionalization of the lighting design practice. Understanding the development and establishment of the profession between the late 1880s to the 1950s reinforces the underlying promise of this thesis, that design of electric lighting and its resultant rendering of architecture had evolved as engineers, designers and consultants began to work and earn their living exclusively by manipulating electric light. As a result of the organization and acceptance of the lighting design profession, its practitioners were sought for their unique design applications of the new electric light medium.

Beginning in the early 1800s, scientists and mechanical engineers made many attempts to create a viable electric light source. Early crude prototypes created in subsequent decades delivered electric current through slivers of high heat resistant metals, which heated until they glowed. By 1860, British chemist and physicist, Joseph Swan created the incandescent light bulb with a partial vacuum system. The Savoy Museum, the first known building to be entirely illuminated with electric light, used Swan’s light bulbs. The highly anticipated Savoy Theatre in London opened in 1881 using 12,000 Swan incandescent bulbs powered by a large steam engine-driven generator located just outside the theatre.\(^\text{20}\) An article about the theatre’s opening from the English Times during the same year concluded, “The success of the new mode of illumination…” was “pictorially superior to

gas.” Despite this monumental advancement in the lighting world, the Swan incandescent bulb’s short filament lifespan warranted generations of further development.21

In North America, in 1880, Thomas Edison patented the first carbon filament bulb by sealing thin filament threads in a glass bulb completely void of air. In an article titled The Success of the Electric Light, published the same year his light bulb was patented, Edison wrote of the “vast gulf between the most successful laboratory experiment[s] in a commercial sense.”22 In eloquent form, the article went on to enumerate the benefits of electric light not only as a convenient substitute for gaslight, but perhaps even a potential replacement. To Edison, the effort to convince the public that the quality, safety, and economy of electric light was a noble cause.23 Subsequently by the fall of 1882, the fast paced nature of electrical light development had created the need for higher education instruction of the material, and the country’s first electrical engineering curriculum was established at the Massachusetts Institute of Technology, later followed by the first electrical engineering department at the University of Missouri in 1886.24 Edison helped to establish the General Electric Company in 1892, which offered expert lighting and power services to building practitioners for “buildings of every description.” Their Illuminating Engineering Department solicited much needed lighting consultations and advice to architects, engineers and builders.

23 Ibid. 296
The Illuminating Engineering Society was formed in 1906 to establish a group of occupational lighting specialists, men with strong technical educations in the field and business mindsets who were coming off the heels of an economic depression. Their formation of this new organization stemmed from “...a combination of practical need and scientific acceptance of an increasingly quantitative subject.”

The profession of “illuminating engineers” first came into contact with architects while establishing daylighting rules and principals, which were the solution to investigations of lighting problems affecting physiology, psychology and ophthalmology. However, the society was not exclusive to engineers as its title suggests. The founding members were comprised of individuals who worked as electric supplier operators, lamp manufacturers, employees of gas companies and companies that manufactured lighting appliances. Ironically, the smallest occupational group of these founding members, which included consultants, designers and academics, became the most instrumental in the founding of the society. In a historical moment when disparate practitioners were finally able to consider and discuss all aspects of illumination measurement, the profession of illuminating engineer evolved from an essentially non-existent occupation to a transparent profession in high demand. As a vehicle for their technical information and knowledge, a monthly IES journal began two publications. Transactions, a technical journal, was created by the IES with the goal of spreading the knowledge of illumination within the scientific and engineering communities to introduce concepts and to establish acceptable measurement methods. Light in Architecture and Decoration was created as a visual journal, which featured elegant

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26 (Kohler, 113)
28 (Johnston, 81)
photographs of innovative lighting projects and short descriptions of the goals and technology used to achieve the lighting effects in order to promote the technology. The Society's 1909, “Summary of the Present State of Lighting,” was mostly concerned with the visual discomfort and disorientation of glare and with providing “better value for the customer's dollar.”

In 1922, German electric scientist Joachim Teichmuller founded the first academic lighting institute of its kind, the Institute for Lighting Technology in Karlsruhe, Germany. Teichmuller earned his PhD in 1898 in an early electrical engineering program. Teichmuller advocated that structures could incorporate definite intentional effects by means of planned lighting. He coined the term German term, “Lightarchitektur,” meaning light in architecture, noting the important space-shaping influence of light. It was through his early teachings and writings considering light as a building material and purposefully part of the overall design, that light began to be considered an instrument of the architect.

By 1911, General Electric was heavily involved in electric lighting research, yet only a few architects were interested in collaborations. GE tested many aspects of architectural lighting installations on various building materials and published the results. In an effort to enlighten its still widely hesitant colleagues, GE published Architecture of the Night, a 1930 company bulletin filled with essays written by prominent men in the field. The bulletin laid

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30 (Kohler, 110)
32 (Neumann, 28)
out a philosophy for nocturnal lighting, expressing it as an art form. 33 American architect and lighting designer, architect and lighting designer Raymond Hood, predicted a future development of architectural lighting as “...even more fantastic than anything that has ever been accomplished on the stage...” citing the importance of two prevalent lighting techniques used in the theatre, cross lighting and shadows. Hood explained that eventually the illumination of buildings at night would be studied “exactly as Gordon Craig and Noman Bel Geddes have studied stage lighting,” showing a deliberate interest in the lighting techniques of another media. To obtain effect, Hood suggested that light sources be varied in color, direction, pattern and movement. 34 This GE publication also identifies the concern that lighting schemes for buildings were not being considered widely by architects during the design of a building, and were instead being implemented by practitioners as an after thought. Hood pushed for integration of lighting during building design, noting that, “The architect finds that spaces on which illumination is possible are not necessarily pleasing in mass and proportion, whereas with the thought in mind of planning these spaces for illumination, simple modification in the plans would have made these same spaces pleasing in proportion.” At this time, buildings that had been electrified often featured already outdated systems, as the invention of the tungsten bulb in 1910 proved to be less costly to install and significantly more effective than incandescent bulbs. 35 The language in Architecture of the Night provocatively suggests a more sensitive and thoughtful approach to the lighting systems of everyday buildings.

A founding member of the IES was Basset Jones, an inventor, technological planner, and consulting engineer. Jones contributed to the lighting design and elevator

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33 (Neumann, 57)
35 Ibid.
configurations for the American Radiator Building (1924), Chrysler Building (1930), and the Empire State Building (1931). Jones wrote and lectured about the application of electric light to architecture, and was a strong advocate for communication and consultation between architects and electrical engineers. Determined to mitigate uncomfortable glare created by light fixtures with bare bulbs, Jones created, several modern glare-free lighting fixtures, one such example consisting of a single suspended bulb housed in a series of three-tiered concave reflectors.\textsuperscript{36} It is around this time that professionals began to use terms like “lighting consultant,” “architectural lighting designer,” and “lighting designer,” interchangeably in industry publications and when crediting specialists for their lighting work in new construction.

As these illuminating engineers perfected more “signature” styles of applying light, lighting designers began similarly receiving acknowledgement for their work on stage and in the theatre environment. By the 1920s theatrical lighting designers were receiving credit for their work in the printed performance programs, creating a new niche for the application of their study.\textsuperscript{37} Particularly for early electrical theatrical lighting designer Norman Bell Geddes, lighting was the unifying force that wove together the distinct components of script, performer, and scenery into a unified concept of “mood and idea.” Through varying the intensity, color and area, corresponding to the “emotional rhythms of the play,” Geddes used light to create an ambience demanded by the performance in both the “atmosphere of place and that of the emotional quality of the scene.”\textsuperscript{38} These basic


\textsuperscript{37} (Neumann and Addington, 12)

principles of theatrical light were developed during a theatrical movement known as the “modern reform theatre movement,” spearheaded by Adolphe Appia and Edward Gordon Craig. The movement focused on a shift from illusionistic (or loosely based) representation of form, to an abstract representation of form, which moved away from specific, literal, scenery objects to more generalized forms to create the setting on stage. The abstraction of form involved doing away with traditional scenic elements and abstracting the notion of them into basic unadorned geometrical forms with prominent vertical and horizontal surfaces.39

In 1923, theatrical lighting designer Stanley McCandless became the first chair of the first theatre lighting design program in America at Yale University’s Department of Drama.40 At Yale, McCandless taught and refined the primary characteristics of light for theatre, which included, intensity, color, form and movement, to many mentees who went on to become world famous lighting designers both in theatre and in architecture. Although not commonly credited, McCandless worked on the lighting schemes for Radio City Music Hall (1932) and the TWA Terminal (1962). McCandless’ technical articles often evoked the importance of connecting the theatrical arts to the built environment:

“If we turn to the theatre to see how effectively light is used to produce mood, it gives us some hope that perhaps before long we can achieve the proper atmosphere in our houses, where it is even more important than in the theatre.”41

Innovators like Jones, Geddes and McCandless were among the first to translate and apply these ideas of stage light application directly into an architecture appropriate to the

40 (Neumann and Addington, 15)
conditions and materials of the modern age. McCandless was also concerned with applying the ideas of the plasticity of light to interior spaces, "It is something more than just fixtures and instruments. It is visibility, comfort composition and atmosphere – the fundamental objectives that deal with individual visual reactions."42 In this, lighting designers were not only creating interiors, but were also practicing in the performing arts. This confluence of ideas between architectural and theatrical lighting professionals in the early decades of the 20th century was crucial to the development of a new realm of spacial lighting.43

The Hollywood film industry was rapidly developing in the 1930s and the glamorous medium of the silver screen allowed for scenic designers to experiment with electric light in indoor studios to create exotic, distant and intangible movie scenes which were transmitted and shared with mass audiences like never before. McCandless, an advocate for the arts, published an article in a 1930 Yale Scientific Magazine titled, "The Problem of Lighting and Illumination: With the Aid of the Illuminating Engineer and Designer, Lighting is Gradually Assuming an Artistic Quality." Here, he argues that building practitioners could use his "method" of theatrical lighting techniques to create elegant schemes enhancing interiors for inhabitants' use.44 Developments in theatrical stage lighting such as the Fresnel spotlight in 1932 allowed for more flexibility and control of direct, concentrated light on actors during performances. In 1932, Stanley McCandless distributed his manuscript A Method of Lighting the Stage to his Yale theatrical lighting design class. It highlighted the key objectives for lighting regardless of the "form of theatre

43 (Maile Petty, 197)
44 (McCandless, Yale Scientific Magazine, 13)
or type of production,” including “visibility, naturalism, composition and atmosphere.”

Today, these aesthetic light qualities produced from McCandless’ stage lighting methods are universally recognized by architects and lighting designers as benchmarks in electrical lighting design.

Similarly, a 1941 Illuminating Society of Engineering article titled “The Twentieth Century Evolution of Lighting Practice,” highlighted the main intentions of good electrical illumination of the era and the importance of formulating lighting ideals for a various applications. In a very forward thinking notion, the principles of “illuminating art” were seen as fixed and that as the art were to advance, new aspects of these principles would be “uncovered and recognized,” in years to come.

It was during this time in the 1940s that the career of Richard Kelly, one of Stanley McCandless’ protégé students, began to flourish. After receiving theatrical lighting training at Columbia University, Kelly opened his own lighting design office in New York in 1935. Although he was able to sell his lighting fixtures, he was dissatisfied with the lack of exposure of lighting consulting as a profession, so in 1944 Kelly enrolled in the Yale School of Architecture. With an aspiration to legitimize his lighting ideas as an architect, his experiences at Yale allowed him to develop the core of his highly influential philosophy and approach to lighting design, which brought his skill lighting the theater into interior spaces.

His core lighting philosophy included three “types of light” that were to work in

harmony with one another in a concealed manner to establish mood in an interior space. These types included “ambient luminescence,” or general graded washes, “focal glow,” or highlight, and lastly a “play of brilliants,” or focusing sharp light on particular objects or spaces to illuminate their details. Kelly's later lighting design collaborations with prominent architects allowed him to “realize his goal of fostering a true integration of light and architecture,” by utilizing light as an architectural material which was embedded directly into the architecture itself.

Later in the decade in 1949, the IES Transactions publication became the Illuminating Engineering Magazine, harkening a broader lighting audience, greater interest in electric light and allowing for wider distribution of the IES publication. When the magazine celebrated its first decade of publication, in 1959, a seminal one-page summary of the past ten years of development, titled "Today We Are Ten," was written by current IES President, R. Redford. Noting that the largest advance in the industry within the past ten years had been the growing acceptance of lighting as an element of design, Redford went on to mention that the notion that the professional lighting consultant had developed “almost beyond belief,” within the period, stating that the profession was not only accepted amongst building practitioners but would continuously be developed and redefined in years to come.

New mid 20th century ideals in architectural and theatrical lighting perpetuated by innovations in electric lighting technology, allowed practitioners to intentionally use luminous lighting effects to create and define space. By 1965, a New York Times article

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48 (Dietrich and Addington, 28)
49 (Maile Petty, "Richard Kelly: Defining a Modern Architecture of Light," 18)
50 (Redford, 55)
declared "lighting [as] an art that combines function and decoration" to be "one of the big advances in recent years in architecture," signaling an acceptance in the mainstream American design conscious.\textsuperscript{51} The experimentation and implementation discussed in this chapter gave birth to the luminous effects inextricably characteristic of modern architecture.

Chapter 3: Case Studies

The author selected The PSFS/Loews Hotel, the Cranbrook Art Museum, and the Four Seasons Restaurant as case studies to chronologically exemplify the evolution of electrical light alongside the development of lighting design as a profession. Each one of these case studies exemplifies both the technological and professional developments in the realm of integrated architectural lighting from the 1930s to 1950s. These buildings were monumental in scale, designed by prominent architects, and are still deemed as some of the most significant architectural works of the modern era. The importance of utilizing light as an architectural material integrated into interior surfaces for both function and aesthetics had an incalculable impact on our understanding of these original interiors. Through each of these interior projects, Eliel Saarinen, William Howe, George Lescaze, Phillip Johnson and Richard Kelly were intentionally establishing mood by exploring new electric light techniques and technologies to project their modern designs.
Case Study 1: Lighting the Philadelphia Savings Fund Society Building

The Philadelphia Savings Fund Society building stands today as the world’s first International Modernist skyscraper. American architect George Howe and Swiss architect William Lescaze designed the building in collaboration with the bank’s relentlessly enthusiastic president, James M. Wilcox. On the exterior, the building’s innovative massing, arrangement of horizontal and vertical elements, and its cantilever characterized the modernist movement of the 1930s (Fig. 1). Architectural innovation continued into the building as an elegant play of proportion, scale and materiality supplemented the introduction of several cutting-edge electrical systems. The PSFS building’s custom lighting scheme contributed greatly to the acceptance of its modern interiors, as they were at once intended to be functional and aesthetically timely. Despite the immense planning and incorporation of modern electrical systems into the building’s construction, the fast-paced nature of lighting developments after the 1930s resulted in the need for frequent lighting upgrades throughout the building’s operation as a bank. When the building ceased bank operations in 1990, it was converted into a luxury Loews Hotel in 2000. In a deliberate effort to maintain some of the interior’s historical character, real estate developers Dranoff Corporation revitalized several of the bank’s public spaces, memorializing the innovative 1930s lighting system in its reuse scheme.

Figure 1. *Philadelphia Savings Fund Society*, c. 1932. Courtesy of the Hagley Museum and Library.
Overview of Mechanical Systems

“The forward strides of electrical development are rapidly opening new fields to architectural possibilities,” stated an anticipatory 1932 T-Square article written about the electrical innovations to be found at in the PSFS building. As the second fully-air conditioned commercial building to be constructed in the United States, the design of a unified, centralized HVAC system required careful and cumbersome planning. The PSFS building was designed to have individual room thermostats in each of the respective first floor shops, single offices, banking spaces, and recreation areas. Due to the high volume of customers entering and leaving the bank, electric lights, solar heat gain, and sunlight throughout the day, the base cooling load of the building was exceptionally high, and required a centralized cooling system. The architects collaborated with mechanical and electrical engineers to perform a series of sun light studies, which resulted in programming the twenty-five floors into three distinctive zones, each with its own cooling system according to the amount and intensity of sun exposure throughout the day. With a “differential thermostat” in each zone, as the sun shifted from east to west during the day, separate fans serving the east and west zones of the building would automatically turn on to compensate for the variation of temperature due to solar gain.

The PSFS building design also anticipated the need for flexibility to provide for the needs of future tenants. Spare circuits and receptacle outlets allowed the “utmost freedom”

for the “ultimate finishing and furnishing[s],” suggesting that in 1932, it was not yet common to have outlets placed in such common or convenient areas.\(^{56}\) In a hopeful tone, the author of a 1932 *Heating and Air Conditioning* magazine article about the electrical systems employed at the PSFS, envisioned that perhaps “…within a short span of years, facilities will be provided by the aid of television whereby visual broadcasts will be available” suggesting that electrical innovations in the near future could provide interested tenants with a “…view of the entire market situation…,” via “…the transmission of a stock quotation board…” With all of these internal and external factors to consider, the PSFS building’s lighting designers were tasked with creating innovative lighting elements that maximized utility while fulfilling the building’s advertising promise “nothing more modern.”\(^{57}\)

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\(^{56}\) (Dowling, 410)

A Modern Material Palate

Howe and Lescaze designed the interiors of the PSFS building to convey a monumentally grand bank. With the elimination of extraneous surface ornamentation, vertical and horizontal planar projections carried out a sleek language throughout the building. The architects selected building materials for their, "special qualities and future value in use." This included an extensive palate of rich marbles, travertines, and granites from Belgium, France, and Italy which were applied to the escalator lobby, banking room, and public areas. In an expensive undertaking, custom furniture, paneling, and flooring ranged from rosewood to Makassar ebony exported from Australia, Brazil, and India.  

The stainless steel and bronze found in the banking vault, handrails, elevator doors and their surrounds elegantly contrasted the natural marble and wood materials. The building’s partitions, doors, windows, furniture, and lighting fixtures were each specially designed for the space. The windows of the PSFS building played a large role in the building’s notoriety as well as the cooling loads previously mentioned, as they allowed for the building to be exceptionally daylit, a relatively novel concept for office spaces at the time. Howe and Lescaze’s electric light considerations paired with a few fresh daylighting concepts made for one of the most uniquely complementary approaches to interior lighting to date.  

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Establishing Lighting Goals

Professional trade publications including *T-Square Magazine*, the *Magazine of the Illuminating Engineering Society*, and *Architectural Record* best illustrate the general intentions for the PSFS’ lighting program. One of the largest concerns when establishing lighting goals for this building was efficiency and effectiveness in building construction. In this vein, prominent engineer, Leslie Tarleton wrote an article titled, “Electricity and the Architect: What They Have Produced at 1200 Market Street” in the *T-Square Journal* examining the importance of trial fixture examinations and illumination testing within the PSFS building before installation. Tarleton stressed the importance of specially constructed models created to avoid time-consuming corrections after installation. Another consideration was that the lighting fixtures and features be suitably consistent with the modern character of the building. The architects installed an under-floor raceway duct system for electrical wiring, which allowed for flexibility, “so that unlimited facilities for floor lamps, table lamps, or any other effect that may be desired are available.” Additionally, the combination of direct and indirect lighting in the PSFS building provided high levels of illumination without glare, which became a trend more and more prevalent in modern practice by 1936.

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60 (Tarleton, *T-Square Journal*, 26)
61 (Tarleton, *T-Square Journal*, 26)
Illuminated Spaces

Early IES Illuminating Engineer C.D. Fawcett noted in an IES publication that the PSFS building showcased highly advanced thoughts in construction, which should be represented in its lighting scheme. He commented that the lighting considerations “…should follow the same course and be designed from the standpoint of effect rather than mere lumen efficiency.”63 For this case study, the illumination of the main elevator lobbies, main banking floor, and hallway lighting fixtures will be discussed.

Figure 2. PSFS elevator lobby featured in Light In Architecture and Decoration, 1934. Courtesy of the Hagley Museum and Library.

63 (Fawcett, 91)
Elevator Lobby

The lighting of the main elevator lobby was characteristic of the diffused electrical lighting moments throughout the rest of the building. (Fig. 2) At a lighting level of 14 footcandles (fc), this was considered to be sufficient enough to “insure the rapid movement of a large number of people at the more congested periods of the day,” suggesting that this luminance level was adequate for way-finding within the triple-heighted lobby space. For comparison, modern day luminance categories and values for generic indoor activities suggest that a range of 5-10 fc is appropriate for “simple orientation for short temporary visits,” and that a range of 10-20 fc is appropriate for working spaces in which visual tasks are only occasionally performed.64 The main elevator area achieved this general illumination level by means of broad bands of diffused light, extending the entire length of the lobby. Just above the elevator doors, the combination of a “recessed strip lighting unit,”65 with the white marbled honed-finished walls, allowed the light produced to reflect on multiple surfaces, offering little to no glare. A 1934 IES Transactions article explains that, “The illumination [of the elevator lobby] is so inconspicuous and free from shadow that there is no sensation of a higher intensity that is usually found in such areas,” suggesting that this elegant combination of light source, reflectors and materiality was unique and innovative for public spaces of the time.66 Fixtures that extended the entire length of the corridor made of “cylindrical chromium reflectors equipped with 25-watt tubular lamps on 12-inch centers,” were supported 30 inches away from the walls, allowing for broad bands of light to reflect directly above the elevator doors and onto the side walls. These “special”

65 (“A New Shelter for Savings,” 125)
66 (Fawcett, 91)
recessed lighting fixtures in the elevator lobbies and throughout the building’s corridors and were manufactured by the Albrecht Company based in New York City. 67

One large black marble slab was suspended from the elevator lobby ceilings, concealing several mirrored glass reflectors with 60-watt Mazda lamps. The combination of the reflectors, bright light source, and the highly polished surface of the dark marble allowed for the light from concealed sources to emanate onto the adjacent ceiling and upper side-walls. On the ceiling, and unlike the side walls of the lobby, the light directly reflected onto the dark marble, causing the illusion of multiple bands of light, creating an added sense of spaciousness and depth to the elevator lobby. Curtis Lighting Inc. (formerly National X-Ray Reflector Company) of Chicago, Illinois produced the mirrored reflectors in both the side wall and ceiling fixtures. 68

68 Ibid.
Main Banking Floor

The daylighting component of the PSFS building’s main banking floor was the prominent design feature that received many accolades. The entire main floor, including the rentable offices and banking area, was primarily daylit, supplemented by electric lighting. (Fig. 3) The large curved wrap-around double-height glass and marble facade is one of the most characteristic architectural features of the PSFS building (Fig. 4). Because the double-heighted banking area was located behind the large north-east facing window system minimal electric lighting to the space was required. The electric lighting system for the main banking room used the same diffused incandescent light strip system found in the elevator lobbies and corridors. In the banking room, artificial light was reflected onto the light colored ceiling and white marble-covered walls and columns (Fig. 5). The light strip systems were positioned directly above a series of suspended dark marble slabs near the ceiling’s air
conditioning units\textsuperscript{69}. Flanking both the eastern and western sides of the banking room ceiling, the strip lighting supplemented the daylighting and provided necessary light levels in the evening hours. (Fig. 6)

Figure 4. Philadelphia Savings Fund Society building viewed from 12\textsuperscript{th} & Market Streets, 1932. Courtesy of the Hagley Museum and Library.

Figure 5. PSFS banking floor from Market Street entrance looking east, 1932. Photo by Richard T. Dooner. Courtesy of the Hagley Museum and Library.

Figure 6. PSFS Banking Manager's desk, 1932. Photo by Richard T. Dooner. Courtesy of the Hagley Museum and Library.
Figure 7. PSFS banking floor viewed from Market Street window, 1932. Photo by Richard. T. Dooner. Courtesy of the Hagley Museum and Library.
The original banking counters featured built-in light fixtures, which were attached to the teller side of the 1-foot high rosewood-framed translucent glass partitions on the desks. This allowed for the curvaceous, sinuous counters to glow to the public side while offering direct light to the clerks standing behind the desks. (Fig. 8)

Figure 8. PSFS banking floor view from 1st mezzanine level, showing curved teller desks with built-in incandescent lamp and translucent glass, 1932. Photo by Richard. T. Dooner. Courtesy of the Hagley Museum and Library.
Office and Hallway Fixtures

Howe and Lescaze commissioned luminaire and lighting designer Kurt Versen “to create an indirect [lighting] system,” for the PSFS.70 Versen installed over 4,000 of his “typical office incandescent fixtures,” into the PSFS offices, and hallways. Each of the three floors of the mezzanine featured 5 built-in recessed circular ceiling fixtures, with opal glass domes that projected 12" from the ceiling. These mezzanine hallway fixtures could be seen from the banking floor. (Fig. 7)

Early Modifications

Tarleton’s 1932 T-Square article about the PSFS’s electrical innovations, published prior to the building’s opening, stated:

“The architect of today, who must keep abreast of so many advances, will find no other phase of his work developing more rapidly than the application of electricity. The scope and variety of these applications is increasing so rapidly that even technically trained electrical men find it difficult to keep up. It is the writer’s hope that the architects’ imagination will continue to devise new applications of this marvelous and modern medium.”71

While Tarleton obviously had his eye to the future of the medium of electricity, he would find the PSFS building’s systems would need to be reimagined many times in the future. In fact, the PSFS building’s lighting system was forced through significant changes “undertaken in the names of progress and maintenance,” almost immediately after it opened. This included not only the addition of additional teller counters, but the introduction of mercury vapor light bulbs to replace the incandescent bulbs in the counter spaces.72 Holophane Lighting developed the fixture and reflector for the mercury vapor lamps, which offered

71 (Tarleton, T-Square Journal, 26)
“high output efficiency...to direct light into useful areas.” Fabric curtains were added to the main banking room in an effort to mitigate direct morning sunlight, and this decreased the amount of daylight penetrating the space, and required more supplementary electric lighting. (Fig. 9) A 1949 advertisement for the Klemm Reflector Company featured their lighting consultant services and equipment used in the recent “Ultra-modern lobby interior” at the PSFS. (Fig. 10) The Klemm Reflector Company significantly altered the original banking room with the installation of a grid downlight system into both the ceiling and flanking suspended dark marble panels to compensate for the loss of daylighting that the curtains caused. (Fig. 11, 12)

Figure 9. PSFS banking floor south wall with curtains drawn, c.1948. Courtesy of the Hagley Museum and Library.
Figure 11. PSFS banking floor looking south, 1966. Photo by PSFS Community Relations Department. Courtesy of the Hagley Museum and Library.
Figure 12. PSFS banking floor looking northeast, 1966. Photo by PSFS Community Relations Department. Courtesy of the Hagley Museum and Library.
Lighting the Loews Hotel

In 1976, the National Park Service placed Howe and Lescaze’s Philadelphia Savings Fund Society building on the National Register of Historic Places, a landmark status that protects the exterior of the building from alterations. The PSFS went bankrupt in 1992 and the iconic building was put up for auction in 1995 along with its furniture and contents. When reuse schemes began to surface on the behalf of developers, architectural aficionados and preservationists alike feared that the bank’s original character would be threatened. However, when developers and stakeholders evaluated economics, development of the surrounding area, and historic preservation considerations including evaluating the building’s significance in American architecture and maintaining its exterior, they decided the PSFS’s dimensions were compatible for reuse and conversion into a hotel.

Conversion from Bank to Hotel: Renovation Considerations

By 1995, developers Carl Dranoff and Ronald Rubin negotiated with Hyatt Hotels that the PSFS would be able to accommodate 500-600 hotel rooms in the office spaces, and the conversion planning began. Five years later, in 2000, the Loews Hotel opened complete with a new registration lobby, ballroom, spa, and hotel rooms in place of the once-bank and offices. In reprogramming the space, Philadelphia-based Bower Lewis Thrower Architects (BLA) converted the main banking room into a ballroom to accommodate for conferences and hotel events. Additionally, BLT Architects restored the exterior of the building and strove to maintain “most” of Howe and Lescaze’s public interior spaces, including the 30-

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75 Suzanne Stephens, “Project Diary: The Landmark PSFS Building by Bower Lewis Thrower Architects and Daroff Design is Reincarnated as a Loews Hotel.” *Architectural Record.* 189, 10 (October 2000): 137.
foot-high banking hall, elevator lobbies, and main entrance. However, architectural critics considered many of the stylistic differences stemming from reprogramming the bank into a hotel jarring and unauthentic to the architects' original elegant and streamlined design. The Loews' interior designer, Karen Daroff, made aesthetic decisions "to show respect for the original and soften it while creating a smooth transition from the original design to the present day." As a response, Suzanne Stephens of Architectural Record Magazine wrote in 2000, that the flamboyant approach to introducing an Art Deco motif complete with a bright, warm color palate, departed greatly from the aesthetic implications of the International Style, the style synonymous with the architecture of the PSFS building.78

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77 (Stephens, 137)
78 Ibid. Daroff said, "We wanted to show respect for the original and soften it while creating a smooth transition from the original design to the present day." In reality, anyone familiar with the 1920s International Style will still be able to tell where the old ends and the new begins. Strangely, that is the strength of Daroff's design. Her more flamboyant approach allows Howe & Lescaze's contribution to have its own identity, and Daroff to have hers."
Figure 13. Loews Hotel mezzanine with banquet hall to the left, 2013. Photo by author.
Renovated Illuminated Spaces

*Main Banking Floor to Ballroom*

The conversion of the original main banking room into a new ballroom called for changes in the room’s overall circulation, finish materials, furnishings and lighting components. Architects installed a frosted glass curtain wall with white roller shades to separate the ballroom space from the original mezzanine and now “pre-function” and lobby area. The curtain wall has two double door openings between each set of mezzanine columns. (Fig. 14) Donoff installed a brightly colored, hospitality-grade carpet over the original light-colored terrazzo flooring in the room. BTL Architects inserted an exit staircase in the southeastern corner of the room which is now screened by the bronze and stainless steel former vault door that was once situated in the center of the space. As I mentioned, the in-house architect oversaw the installation of curtains to the original PSFS banking room about 15 years after the building opened to mitigate the early morning sun. The new solid peach draperies and secondary sheer valance layer both hang from a movable track. Donoff placed six foot tall free-standing custom glass and aluminum electric torch luminaires at the base of each of the five columns on either side of the walls.
Figure 14. Loews Hotel banquet hall in former PSFS banking floor, c. 2009

Courtesy of Loews Hotel Philadelphia.
During the hotel conversion in 2000, BLT introduced a more efficient downlight system to the ballroom, replacing the Klemm Reflector Company's 1940s downlight intervention. A suspended red plastered element replaced the suspended black Belgian marble slabs. Atop this massive element sits a retrofit of the original incandescent strip system which houses a similar incandescent-spotted light application as the elevator lobbies. Renovation architects added an “extra stainless-steel rail” with opaque glass to the outermost edges of this drywall slab, perhaps to mimic the diffuse glow of the larger incandescent lamps. (Fig. 15)

Figure 15. Market Street view of Loews banquet hall showing suspended plaster ceiling element and downlights, 2013. Photo by author.
Figure 16. Lowes Hotel 12th Street elevator lobby renovation with downlights, 2013. Photo by author.

_Elevator Lobby_

The 12th Street elevator lobby, with its two unique diffuse light schemes and highly polished marble cladding, originally existed with a double-heighted, 27-foot high ceiling. This dramatically high ceiling from the ground floor created a difference in subsequent floor heights, and as so there was no second floor elevator lobby in the original PSFS building. To
accommodate for the building’s new hotel function, BLT Architects lowered the first floor ceiling to 17 feet to house a new elevator lobby with direct access to the second floor. (Fig. 16) In this renovation, the team lowered the ceiling, removed the suspended marble slabs, and replaced the slabs with a suspended dark blue plaster ceiling (Fig. 17). BLT additionally added a series of recessed down lights to this suspended plastered strip, creating direct glare from the lamps which is spotty and discordantly reflected in the white marble wall panels. Both of the white marble wall panels reflect the suspended plaster strip with glaring hotspot downlights, repetitively mirroring this image back and forth between them. They replaced the original recessed fluorescent fixtures above the elevator surrounds with a continuous strip of 2” incandescent bulbs which run the length of the lobby. Patrons now use this elevator lobby to access the hotel’s guest rooms and conference meeting spaces.79

Figure 17. Detail of Lowes Hotel 12th Street lobby renovation showing suspended plaster ceiling with the reflection of downlights, 2013. Photo by author.

79 (Stephens, 137)
Analysis of Lighting the Loews Hotel

Built: 1932  
Conversion to Loews Hotel: 2000

Converting the impressive main banking room space into a ballroom space required many interior changes, despite *Architectural Record*'s Suzanne Stephens or interior designer Karen Daroff having stated that it required minimal changes. Although the ballroom does evoke the spirit of the original banking hall, the finish materials, furniture, circulation, and of course the lighting have all been altered significantly. By installing 21st century interpretations of Art Deco furnishings and other materials in warm tones, the designer's modern take of the aesthetic displays a theatricized, almost theme park version of what were the streamlined elegant black and white International Modern interiors. Although the lighting renovation referenced the original effect planned by the architects, it was not true to it in several respects.

The skewed reinterpretation and repurposing of the building were the catalysts for several physical changes including the perpetuation of curtains and addition of intrusive lighting fixtures into the main banking space, a significant change in wall and ceiling materiality, and the lowered ceiling in the 12th Street elevator lobby. All of these physical changes altered the original lighting scheme in one way or another.

The 1940s drastic installation of floor to ceiling curtains around the northern and eastern window-walls to mitigate daylight from the heavily trafficked area significantly reduced the amount of daylight to illuminate the main banking space during the day. In 1949, downlights lights were added to the ceiling in a grid-arrayed arrangement, which extended beyond the ceiling and onto the underside of the suspended dark marble slabs.
that once sat clear of any electrical intervention (Fig. 9, 11)\(^8\). For the conversion to the Loews Hotel, the series of suspended black marble slabs were replaced with a suspended red plaster element mimicking the size and dimensions of the original marble slabs. The eggshell finish of the paint treatment on these dropped ceiling elements is subtle as to not interfere with the other reflections of the room, and the notion of 1949 intervention downlights were removed. Removing the downlights from the suspended ceiling element restored the original sense of depth that the plain, unlit dark element provided to the space, despite the stark change in color. The PSFS' most crucial original lighting expression, the daylight factor in the main banking area, was destroyed with the introduction of the fabric curtains in the 1940s. Daroff Design selected a pink curtain and white valance to perpetuate the 1949 non-original daylight-blocking intervention to the ballroom space (Fig. 14) This daylight mitigation strategy continues to severely divert from Howe and Lescaze's strong original daylighting scheme. From the exterior street view, the curtains do not allow direct views through the spanning glass windows and into the main ballroom space, a feature that originally rose the PSFS building to such architectural prominence.

During the renovation, Bower Lewis Thrower architects installed an “extra stainless steel rail,” with opaque glass to the top of the dropped brick-red-colored plaster element. The addition of the frosted glass was perhaps intended to hide and distort the glow of newer, larger incandescent bulbs, but the end result is spotty and shadowy in comparison to the original small incandescent strip. The diffuse light that originally emanated from the incandescent light strips atop the black Belgian marble slabs was dispersed uniformly through out the white ceiling. The glare and reflection from the “custom glass and

\(^8\) (Klemm Reflector Company)
aluminum torch luminaires,” unnecessarily installed at the base of the columns perpetuates seemingly into infinity through the 6-foot tall black marble slab that lines the northern wall of the ballroom (Fig. 14).\textsuperscript{81} Howe and Lescaze’s diffuse reflector lamps throughout the building were created to specifically to avoid the type of direct fixture glare that the new luminaires now produce.

Additionally, the hotel’s ballroom ceiling lights are left on throughout the day, even as the space is not used which raises concerns about energy efficiency and unnecessary costly maintenance of bulb replacements.

In a valiant effort to retain the original character of the main elevator, BLT was able to keep the elevator lobby and reprogram the elevator to serve the new hotel. When accommodating for a second floor elevator lobby, BLT removed the original centrally suspended black marble slab to lower the lobby ceiling, replacing it with a plaster element similar in size to the marble slab. The dark blue eggshell finish of the plaster element differs greatly from the once highly reflective surface of the black marble slab. (Fig. 17) The additional circular recessed lights are spaced approximately three feet apart from one another in the plaster element. These circular lights depart greatly from the horizontal geometries perpetuated by the original incandescent light strips atop the elevators and diffuse lights from above the suspended black marble slab. The change in reflectivity and direct glare make for a visually disorienting experience. Above the elevator surrounds, the spacing of the bulbs on the replacement incandescent lighting strip produces slivers of

\textsuperscript{81} (Stephens, 137)
vertical shadows and individual hotspots onto the surrounding marble slabs, an unappealing change from the original uniform diffuse light effect.

Bower Lewis Thrower Architects and Karan Donoff Designs’ restoration and conversion of the Philadelphia Savings Fund Society building captured the idea of the original lighting scheme, but not the exact original effects that the electric lights would have produced. As the project completely transformed the function of the building from a daytime bank and office space to a twenty-four hour hotel and event space, the renovation architects and interior designer managed to maintain the essence of the prominent character-defining features of Howe and Lescaze’s now historic interior. Given that the interior spaces were not designated on the National Register, those involved in the renovation had the opportunity to completely alter every aspect of the original bank, yet decided instead to introduce new materials and add electric light to suite the new programming needs.
Case Study 2: Lighting the Cranbrook Art Museum

Eliel Saarinen was an established architect in his homeland of Finland, when he made a big move to the United States in 1923 after winning second place for his noteworthy entry to an architecture contest for what is now the Chicago Tribune Tower. 1925 marked the beginning of a life-long relationship with Cranbrook Academy of Art President, George Booth. Driven by a vision to create an arts educational community in the Arts and Crafts tradition, Booth sought out Saarinen in 1932 as Cranbrook's architect-in-residence and tasked Saarinen with designing and implementing a master campus plan for the Cranbrook Art Academy in Bloomfield, Michigan. Saarinen eventually became the head of the Art Academy and a master teacher of architecture, designing and overseeing the construction of each of the buildings on the campus. Saarinen’s manuscript titled, the “Cranbrook Idea” illustrates his deep connection to, and admiration for, the Cranbrook campus was nearly complete at his death. The manuscript was divided into four sections, one of which described the background of Booth’s grand academy plans and its philosophical underpinnings. Subsequent chapters detail the “abstracted concept to build physical concept through architectural atmosphere and its educational programs,” and the process of determining an appropriate methodological approach to art education at Cranbrook. Saarinen’s philosophy that, “each generation must actively create its own forms for living, rather than borrow from the past,” is reflected Eliel Saarinen and architect son Eero Saarinen's design of the innovative lighting created for Cranbrook’s Kingswood School for Girls and for the campus’ “crowned jewel,” the Cranbrook Museum of Art.

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83 Ibid. 97
84 Ibid. 97
Saarinen and Lighting Cranbrook: Kingswood School for Girls

Eliel Saarinen served as the principal designer at the 1929 Metropolitan Museum of Art exhibition titled, “The Architect and the Industrial Arts – An Exhibition of Contemporary American Design.” Saarinen’s participation with the exhibition was an impressive honor and a sign of Saarinen’s recognition of leadership and involvement with international modern design.  

Saarinen’s involvement with this monumental exhibit promoted his own distinctive interpretation of the Arts and Crafts movement within an industrialized context. He exhibited restrained designs for furniture, cutlery, and stand-alone lighting fixtures with simple, repeated shapes and sumptuous materials. These translated into the rich Arts and

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Crafts interiors of the dining hall at Cranbrook’s Kingswood School for Girls, built in 1923. (Fig. 18) In the book Design in America: The Cranbrook Vision, scholar Craig R. Miller notes that the beauty of Cranbrook's richly detailed interiors was, "most especially employed in the natural and artificial lighting." \(^{86}\) Saarinen employed a "considerably complex," lighting system in the dining hall, which included general illumination from large north and south side rows of windows complemented by a row of clerestory windows in the upper walls. The upper walls contained niches, which concealed electric lights in a portion of the clerestory. This provided a diffused light, and since the lighting was wired as three independent circuits, the "most interesting angular pattern of light and shade on the ceiling arch" was formed. \(^{87}\) The lighting scheme Saarinen developed at the Kingswood School for Girls is an indication that he was particularly aware of controlling daylight and integrating electric light into his architectural works to devise entire lighting systems unique to the purpose and function of a space. Similarly innovative, at the Cranbrook Art Museum, Saarinen created a layered system of light to develop a new way to illuminate museum galleries by utilizing the most innovative lighting technology at the time.

On the Cranbrook Art Museum: Establishing Intent

Saarinen believed, especially with respect to CMA project, that "every part of the building should contribute to the complete realization of the overall idea." \(^{88}\) This philosophy is evident in even the smallest building details, spanning the entire 40-acre campus. The Cranbrook Art Museum and Library, completed in 1942 was Eliel Saarinen's last executed building for the Cranbrook campus. Revered as his most formal Cranbrook

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\(^{86}\) Ibid. 95


\(^{88}\) (Welsch, 97)
building, its classical balance and solid monumentality relied more heavily on material texture rather than ornate surface ornamentation,\textsuperscript{89} signaling a deliberate blend and adherence to both contemporary and historic architectural notions.

![Figure 19. Cranbrook Museum of Art, c. 1942. Courtesy of Yale University Library: Manuscripts and Archives.](image)

The Cranbrook Museum of Art required a building that embodied the institution’s architectural methodology to house and display modernist works in both two and three dimensions. The building is comprised of a long rectangular shape, with a central breezeway entry flanked by the museum archives on one end, and the museum’s exhibition spaces on the other. (Fig 19)

Daylighting exhibition spaces were common practice in the design of 19th century museums. Saarinen reconsidered this concept by developing a multi-layered electric lighting system throughout each of the three galleries of the museum’s exhibition space. Correspondence between Saarinen’s office, light fixture manufacturers, and contractors offer us insight into the planning considerations required to execute such an elaborate lighting system. A 1941 shop drawing from Benson Ornamental Bronze & Lighting Company depicts an adjustable spot light fixture, used to focus light directly onto art objects. Notes for changes on the shop drawing indicate that this version of the light fixture was not the final specification sent to the manufacturer. The spotlight bulb had not yet been selected, as the specification indicates a decision between a 100 Watt P-25 lamp and a 250 Watt G-30 lamp to be made. A now yellowed sketch of a coning diagram with a beam span of 40’ indicated the light range that the fixture would produce when directed onto artwork. Other marker sketches indicate a more streamlined “slip on friction cover,” in addition to suggesting reducing the dimension of the chrome reflector cap. A pencil-written note to alter the fixture’s ribbed yoke to “plain,” and to decrease the space between the fixture and its anchoring member show Saarinen’s immense concern with the minute details of his designs. However, Saarinen abandoned these designs for the adjustable spot light fixture in favor of a more streamlined eyeball fixture as a secondary method to spotlight the artwork. Change orders submitted to Standard Electric Company indicate that “fluorescent picture reflectors,” were utilized, “...in connection with the lighting in the special display,” within the museum, a technology that had been debuted just three years prior and was still only available in standard sizes.

Project engineers drafted a document outlining the installation for the electric features in which lighting manufactures advised contractors to furnish samples of each type of light fixture for approval by the engineers prior to manufacture and installation in the museum.\(^{91}\) The change order forms and lamp fixture specification documents range from as early as 1938 to the building’s completion in 1941, indicating that the lighting scheme’s electrical components were meticulously designed and revisited by Saarinen’s office for at least three years prior to the opening of the Cranbrook Museum of Art.

In Saarinen’s drawing, “Revised Profile of Fluorescent Light Through Housing,” a sectional cut through the length of one of the lighting units that made up a unique plaster-concrete curved coffer ceiling system reveals that the space between each coffer was lit by a single fluorescent tube bulb. (Fig. 20) The coffers lined the ceilings spanning the entire length of each of the galleries. The width of the one of the coffer systems, comprised of three coffer units in succession, was centrally aligned to the openings between gallery spaces in plan. The length of a standard fluorescent bulb determined the dimensions of the individual coffer units. The reflectors in the lighting unit and the light colored plaster treatment of the coffer above forced the light from the fluorescent bulb to reflect and bounce onto the recessed precast units above, offering an ambient, glare-free glow throughout the galleries. (Fig. 21, 22) The luminous field created formed no harsh shadows and appeared as translucent skylights, illuminated by daylight above. This coffer system was not only a lighting component, but also structure, architectural form, and electrical conduit all designed into one scheme.\(^{92}\) This high level of integration and detailing allowed for the


above channels that held the power cables and conduits to also serve as the structural support for the coffer system.⁹³ All of the system's mechanics and ballasts fit above the light system, conveniently arranged in the attic. Visually, the ceiling's coffers geometrically created an overhead pathway, guiding visitors from one gallery to the next by means of illumination.⁹⁴

Figure 20. Eliel Saarinen's "Profile of Fluorescent Light Through Housing" drawing, 1941. Drawing by Eliel Saarinen. Courtesy of Cranbrook Archives.

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⁹³ Jeff Gerwing. Telephone interview. 12 March 2013.
⁹⁴ (Dickinson)
The “Scale Details of Interiors Rooms # 209, 201, 211 & 213,” drawing dated November of 1940 show in detail the electrical outlets for “future spot lights,” which suggests that these spotlight fixtures were mobile when necessary based on the content of the exhibition (Fig. 23). The supplementary simple eyeball track lighting system was later implemented into the Cranbrook Art Museum after its opening. This section drawing shows an outlet box resting atop the plaster ceiling with a removable plug that would allow for the fixture to be somewhat recessed into the ceiling once installed. The plan suggests that the spotlights should be installed between the south exhibition wall and the coffer system at approximately 5’6” from the south wall and 2’ from the coffered system. The lamps were to
be spaced 10' apart from one another, allowing for multiple configurations for spot lighting a variety of 3 dimensional art works. This eyeball track lighting system, utilizing very common incandescent blubs with adjustable features similar to theatrical lighting instruments, is one of the first examples of early museum direct spot lighting systems.

Figure 22. Cranbrook Art Museum exhibition gallery, 1945. Courtesy of Yale University Library: Manuscripts and Archives. Photo by Harvey Croze. Courtesy of Cranbrook Archives.
Figure 23. Scale details of interiors rooms #209, 201, 211 & 213 at the Cranbrook Art Museum, 1940. Drawing by Eliel Saarinen. Courtesy of Cranbrook Archives.
The result of this meticulous planning included general ambient fluorescent illumination complemented by an early spot lighting system. In the case of the dining hall in the Kingswood School for Girls, and more so prevalent in the Cranbrook Art Museum, it is apparent that Saarinen understood the power that artificial light could have with interior space. Working with a limited range of fixtures for his era, Saarinen custom designed lighting systems utilizing the latest technology to create effects that mimicked daylight and offered directional accent light to isolate specific objects in the museum’s collection.

\[95 \text{(Gerwing)}\]
Relighting the Cranbrook Art Museum

By the 1980s, nearly 40 years after the Cranbrook Art Museum was built, the coffer’s original ballasts began smoking in the attic and the museum’s staff shut them off indefinitely. The fluorescent tube bulbs were now a fugitive technology. The museum’s staff installed additional makeshift track lighting to compensate for the loss of the overhead ambient lighting system. The coffers sat as a decorative, non-functioning element in the ceilings; static, outdated and inadequate for modern museum lighting. (Fig. 24)

Figure 24. “Form Givers at Mid-Century” exhibition in a Cranbrook Art Museum exhibition gallery with coffer light system off and retrofitted track lighting system turned on, 1961. Photo by Harvey Croze. Courtesy of Cranbrook Archives.

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(Dickinson)
Investigations

By 2008, the outdated 1942 mechanical system in the art museum was unable to maintain humidity levels appropriate for the conservation of various artworks, posing an enormous problem. Because subpar interior conditions were threatening the museum's accreditation status and artwork, the museum contracted Detroit based architectural firm SmithGroupJJR for the renovation of the museum’s walls and to design a storage facility addition. SmithGroup charged with improving the hygrothermal performance of the building envelope for museum use. To accomplish this, the museum gallery’s exterior wall was stripped, rebuilt, and the ceilings were to be removed during the rebuilding.

The original neglected lighting scheme, however, was not initially a part of the museum's renovation scope, despite the fact that the ceiling had to be reworked as part of the envelope upgrade. While on a 2008 tour of the Cranbrook Art Museum, SmithGroup’s Detroit office head lighting designer, Jeff Gerwing looked up and noticed that coffer system’s lights were turned off and that the system had been compromised by inadequate secondary tracklighting, and headed to the nearby Cranbrook Archives to investigate the original system.

Research Considerations

The Cranbrook Archives, located within the museum, held correspondence documents regarding the original lighting prototypes between Saarinen, contractors, and

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lighting manufacturers. Jeff Gerwing was able to get into architect Eliel Saarinen’s mind and design process for the lighting system at the Cranbrook Art Museum through process drawings, light bulb specifications, and architectural plans. With these well-preserved documents, Gerwing was able to establish and determine the unique lighting expression that each illuminated coffer’s early adjustable eyeball fixture provided to the gallery space, even though it was no longer visible in the museum. SmithGroup was able to uncover the electrical system’s original lighting wiring and intended ballast placement, indicating that ballasts could be remote from the lighting fixtures. Saarinen’s original lighting documentation found at the archives by SmithGroup would prove to be invaluable in revamping the lighting scheme at the Cranbrook Art Museum.

Relighting Intent

Based on SmithGroup’s findings in the Cranbrook Archives, they determined that without Saarinen’s coffered lighting system functioning, the “Architectural character of the space was void of what the original design could be.”\(^9\) Beyond illuminating the works and the surrounding space, the lighting system contributed to Saarinen’s architectural vision for the space.\(^10\) SmithGroup wanted to make the renovation of the custom system dimmable, to allow for a variety of lighting effects to take place in the space based on the exhibition on display, unlike Saarinen’s original fixed lighting scheme. SmithGroup proposed new relighting ideas to the Cranbrook Art Museum’s director and board based on their archival research and convinced Cranbrook to allocate funding to renovate the 1942 lighting system, as much of the ceiling was to be replaced during the building envelope repair.

\(^9\) (Gerwing)
\(^10\) (Dickinson)
Execution

Utilizing the “revised profile of fluorescent light through housing,” SmithGroup Detroit’s in-house lighting group drew a “sweep of illumination,” or conical drawing, indicating how the light would emit from the fixture, over the old Saarinen plan utilizing new technologies that helped the designers determine how to proceed on the renovation of the nearly 70-year-old lighting system (Fig. 26). LEDs were selected by Color Kinetics and SmithGroup for their lumen output, efficacy, and sensitivity to artwork conservation standards. The light manufacturing company, Color Kinetics manufactured a new dimmable fixture utilizing LEDs to provide a diffuse light, similar to the effect that Saarinen’s fluorescent tubing and reflector system produced.101

101 (Donoff)
Figure 26. Eliel Saarinen’s fluorescent profile drawing overlaid with SmithGroup’s LED “sweep of illumination” intervention, c. 2011. Courtesy of Cranbrook Archives and SmithGroupJJR.
In addressing the early addition of the original spotlights, SmithGroup, "channeled the legendary architect [Saarinen]," and selected a cylindrical trackhead lamp with a simple yoke-free stem (Fig. 27). The custom streamlined tracklight utilized a PAR38 lamp, which could be snapped into place when exhibitions called for spotlight.102

Figure 27. Close up of modified coffer intersection with eyeball track accent lighting fixture, c. 2011. Photo by James Haefner. Courtesy of SmithGroupJJR.

102 Ibid.
With these two new lighting retrofits, museum curators and exhibit designers can now control and fine-tune the layers of light in each gallery for different exhibitions using a simple remote control system. SmithGroup and Color Kinetics created a series of preprogrammed scenes, which vary in light intensity, color and light direction offering lighting flexibility for a variety of exhibition types. 103
Analysis of Relighting the Cranbrook Art Museum

Built: 1942
Lighting system restoration: 2011

Showcased in the Cranbrook Art Museum, was architect Eliel Saarinen’s understanding of the power that electric light could have in an interior space. Saarinen was able to at once mimic traditional museum daylight illumination while utilizing the latest electric light technologies hidden in architectural elements to craft a new type of art museum on the Cranbrook campus. These once-novel technological advances found in the museum’s ceilings became underutilized by the museum in the 1980s, and it was by chance that investigating and revitalizing the original lighting scheme was added onto the building’s renovation scope of work. As the museum’s American Association of Museums accreditation was at risk, the scope of work included creating a new collections wing and updating the existing museum’s mechanical systems and structural components. In many instances of mid-century buildings like the Cranbrook Art Museum, the once innovative technology has fallen into disrepair despite it’s relatively young age in the scheme of architectural history. In the case of the Cranbrook Art Museum, the relighting of the original lighting system brought the interior precisely back to its former glory.

The 2011 lighting interventions installed in the galleries by architecture, lighting design and engineering firm, SmithGroupJJR, were approached with the utmost consideration for Saarinen’s original intent of creating an effect without an evident light source. To establish this, Jeff Gerwing of SmithGroup was able to seek out Saarinen’s original lamp, floor plan, and elevation drawings, early black and white photographs in

addition to contractors’ and light fixture manufacture correspondence. Through a thorough analysis of this original documentation, in which Gerwing utilized these original drawings as the base for his own interventions, SmithGroup’s in-house lighting team was able to determine the effects that the lighting system once produced, justifying their design interventions.

SmithGroup’s lighting team established lighting goals early on during the redesign phase of Saarinen’s coffered lighting system, goals which every practitioner working with a 20th century lighting system should consider. These included the preservation of the overall system, relighting to produce original diffuse glow, conservation considerations, flexibility and, of course, energy efficiency. In tracing over the, “revised profile of fluorescent light through housing,” drawing of one of the lighting units, Gerwing determined that dimmable LEDs would be the most appropriate retrofits for the system.105 LEDs were selected for their comparable color temperature, lumen output and efficiency, as a much better alternative for fluorescent lamps. Programming the light systems into different scenes allows the original lighting scheme to be flexible and accommodating to modern exhibition needs.

Those involved in the Cranbrook Art Museum’s renovation have since received lighting design, architectural and interior design accolades and praise for recognizing this time period and for sensitively approaching the relighting of the project while being informed with Saarinen’s bountiful original documentation. This project serves as an excellent example of how to go about the renovation process of a mid 20th century lighting scheme.

105 (Gerwing)
**Case Study 3: Lighting the Four Seasons Restaurant**

**The Seagram Collaboration**

The Seagram building at 375 Park Avenue in New York City was designed by architects Mies van der Rohe and Phillip Johnson and was completed in 1958. The building’s second floor features an intricately designed upscale restaurant created in a collaborative effort by notable architects, designers, and artists. Together, they conceived the entire Four Seasons Restaurant as a single, grand work of art. Architect Philip Johnson and Interior Designer, Richard Pahlmann, worked closely with lighting designer Richard Kelly to craft the Four Seasons as a world-class restaurant through which intentional lighting effects established a sense of elegance, atmosphere, and level of charm. 107

A prominent staircase in the restaurant’s own ground lobby floor entrance leads one up to the restaurant on the second floor of the Seagram building. The restaurant is comprised of a narrow central double-heighted hallway (Picasso Alley) with access to the Seagram building’s main second floor lobby, off of which flank the restaurant’s two dining rooms, the Grille Room and the Pool room, on either end. Two smaller hallways, with lowered ceilings lie symmetrically in between the main rooms and on either side of the central hallway, acting as transitional space. Kelly’s custom-designed luminaires penetrate into and project light from nearly every permanent surface of the restaurant’s walls, partitions, ceilings, artwork and bar.

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106 Belmont Freeman, Personal Interview. 24 March 2013.
107 (Neumann and Addington)
In 1958, Richard Kelly was at the prime of his career as an architectural lighting consultant when he designed the lighting for the Four Seasons Restaurant. Kelly’s later lighting design collaborations with many prominent architects allowed him to “realize his goal of fostering a true integration of light and architecture,” in utilizing light as an architectural material, embedded directly into the architecture itself, which was especially true in the Four Seasons Restaurant at the Seagram Building.108

Early Lighting Intent

The interiors at the Four Seasons Restaurant at the Seagram building served Kelly as an ideal opportunity for which to apply this integrated theory of light and architecture. By the mid-1950s Kelly had expressed disdain with the “contemporary lighting solutions,” of an overall unified luminance of a space.109 Kelly created a handwritten list titled, “Seagram Restaurant Lighting Schedule.” The list featured over 25 different light types organized by location, fixture quantity, lamp type, lamp quality, total wattage, whether or not it required a dimmer, and other additional remarks.110 This exhaustive list shows a high level of consideration for the lighting scheme in the abundant variety of controlled lighting effects that Kelly conceived solely for the Four Seasons Restaurant.

108 (Maile Petty, “Richard Kelly: Defining a Modern Architecture of Light,” 18)
Lighting Execution

*Ground Floor Lobby*

The first suite of Barcelona Chairs produced by Mies van der Rohe post-Barcelona Pavilion adorn the restaurant’s elegant ground floor lobby, which sits just below the Grill Room. The lobby has its own street access, separate from that of the rest of the Seagram Building and a centralized dog-leg staircase leads visitors directly up into the second floor Grill Room portion of the restaurant (Fig. 28).
Over a dozen custom designed circular black anodized metal reflectors, also known as "Seagram Type T-2 Darklites," are recessed into the lobby ceiling. Manufactured by Edison Price Inc., the housing for these lamps is approximately 12 inches deep, and 10 inches wide at the opening. The lamps’ reflectors and housings are flush with the ceiling plaster approximately seven inches from the opening. The entire darklite system is tucked high up into the housing to conceal glare in the relatively low ceiling while providing focused light beams throughout the white plastered ceiling and white travertine floored space.

Figure 29. Staircase leading from ground floor lobby to the Grill Room at the Four Seasons Restaurant, 1959. Photo by Ezra Stoller. Courtesy of ArtStor.
Figure 30. Grill Room at the Four Season Restaurant showing wall washers, and bi-level dining space, 1959. Photo by Ezra Stoller. Courtesy of ArtStor.

Grill Room and Bar

Traveling up the restaurant’s ground-level staircase, one arrives at the less formal Grill Room on the second floor, a bi-level dining space delineated by an enclosing wooden partition. (Fig. 29, 30) The lighting elements in this room can be found within nearly all surfaces of the space and the ambience produced upon arriving at the top of staircase landing is warm sense of spatial intimacy within the expansive room.\textsuperscript{111}

\textsuperscript{111} (Neumann and Addington, 165)
As one of the first example of a fully integrated ceiling system, Kelly designed a suspended ceiling grid that housed sprinklers, air conditioning returns, and rounded, “recessed regressed lens downlight” lamps that utilized 150 watt bulbs and included concentric glass lenses (Fig. 31). These “recessed regressed lens downlights,” were positioned into the ceiling at the intersecting corners of the suspended dark metal ceiling panels, which formed the grid and aligned with the exterior curtain wall supports.¹¹² The downlight lamps sent focused beams of light onto the dining tables twenty feet below.¹¹³

¹¹³ (Freeman)
Wall washer fixtures containing three to five incandescent bulbs each, lined the suspended ceiling perimeter of the Grill Room.\textsuperscript{114} Tucked into a reflective housing unit, these lamps were angled away from view and directed onto each of the room’s four walls. Rich walnut paneling lined two of the room’s walls. They were varnished minimally so as to not propagate glare from the wall washer fixtures. (Fig. 32) The room’s other two walls featured floor-to-ceiling windows dressed in a metallic chain “curtains” created by weaving artist Marie Nichols in collaboration with Richard Kelly. This fabric was made of three tones of gold-anodized aluminum to “diffuse, transmit and reflect light adequately,” throughout the space.\textsuperscript{115} Inspired by, “the Victorians,” who “used spotty pools of lighting breaking into the overall dark gloom of a room,” Nichols suggested that placing these curtains at a large window in combination with a concealed strip of light above would send an even glow of light into the room.\textsuperscript{116} The tinted glass of the windows reduced the incoming daylight while the thin metal chains still allowed for direct views outside.

\textsuperscript{114} Philip Johnson and Richard Kelly, \textit{Type VV}. 1959. Architectural Drawing. (Richard Kelly Collection. Yale Manuscripts and Archives. New Haven, CT)
\textsuperscript{115} (Neumann and Addington, 165)
Figure 32. The Grill Room’s Nichols metal curtain, wall washer fixture and ceiling grid, 2013. Photo by author.
Architect Philip Johnson’s drawings of the Grill Room’s bar featured a cold cathode lamp, “Fixture BB” on either side of the underside of the walnut counter, which lined the perimeter of the square-shaped bar.¹¹⁷ (Fig. 33) The lamp on the outer extremity of the bar was encased in satin aluminum reflector set at an angle, allowing light reflect onto the nude leather paneling below, giving the countertop a floating appearance.

Figure 33. Bar and with Richard Lippold sculpture suspended overhead in the Grill Room, 1959. Photo by Ezra Stoller. Courtesy of ArtStor.

A Richard Lippold sculpture comprised of hundreds of gold dipped brass rods of various lengths hangs delicately from the ceiling grid above the bar. Sixteen angled, recessed lamps divert from the regularity of the ceiling grid and focus on the focal point sculpture (Fig 34).118119

Figure 34. Richard Lippold sculpture suspended from ceiling grid showing focused recessed lamps, 2013. Photo by author.

119 (Neumann and Addington, 165)
The Pool Room featured a central marble-lined reflecting pool with a flowerpot located at each corner of the pool. "A Light Schedule for the Maintenance of Foliage in Four Seasons Restaurant," written by horticulturist, O. Wesley Davidson in 1959 detailed the lighting considerations for the trees which would fill these flower pots:

Relatively high light intensities would be required to maintain in flower for a three-month period some of the plants to be used in the restaurant. Such light intensities would be both impractical to maintain and inconsistent with the aesthetics of the restaurant. It is recommended therefore, that emphasis be placed on those factors that will extend the period during which the plants will remain attractive, and that a program of plant replacement be followed to maintain the plantings in desirable form.120

Davidson speculated that the light from the incandescent bulb specified for the lamp would offer properties of the sun to sustain the plant life. Davidson worked closely with Kelly to establish an “optimum micro-climate for plant survival,” which required the control of humidity, temperature, and light.121 Their system encouraged slower plant growth by keeping soil dry and room temperatures lower than when guests occupied the Pool Room. It would require staff to replace both flower and tree “displays” four times a year according to season. Maintenance crews spent three hours a day gardening to support the "continuously living and growing garden" only minimally supported the plants by the incandescent lamps.

120 O. Wesley Davidson, “Light Schedule for the Maintenance of Foliage in Four Seasons Restaurant.” (Richard Kelly Collection. Yale Manuscripts and Archives. Box 75. New Haven, CT)
The lamp for these pots was specially designed not only to illuminate the trees from below, but also to project the light between the plant’s branches and leaves, casting a leaf silhouette onto the ceiling (Fig. 35). 122 A 1959 Progressive Architecture article about the Four Seasons Restaurant mentions the complementary nature of the uplights for the benefit of the plantings’ survival, “Since the dim lighting of a muted restaurant atmospheres is insufficient for plant nourishment, all lighting is turned on at sunrise and left high until the restaurant opens.” 123 The light from the darklite in the ceiling grid complemented the illumination coming upward from the pots, providing a wash onto the upper position of the

122 (Linn, 142)
123 (Linn, 143)
trees, allowing for form molding through light contouring.

The Grill Room's metal curtain treatment for the floor-to-ceiling windows continued into the Pool Room, comprising the north and western walls. A highly finished walnut paneling lined the eastern wall, while a nude cowhide leather paneled the southern wall. A shallow, elevated square pool positioned in the center of the Pool Room serves as the room's focal point, seems to mysteriously glow from underwater lights (Fig. 36).\textsuperscript{124}

\textit{Hallways}

The lowered ceiling height of the circulation hallways between the Grill Room, Picasso Alley, and Pool Room feature a separate, uniformly illuminated ceiling scheme delineating the travel between the main rooms from a large-volume to compact-volume to

\textsuperscript{124} (Neumann and Addington, 165)
large-volume experience. (Fig. 37, 38) Kelly encapsulated six of his unique “Type R-2” fluorescent lamps with six-2’7 ½” by 6’9” gold anodized aluminum “egg-crate” ornamental grates over the entire hallway ceilings. The effect of the white fluorescent bulbs reflecting and refracting on the bronzed-crate’s intricately arranged louvers allowed for the narrow space to burst with a metallic diffuse yellow glow. (Fig. 37)

Figure 37. Gold anodized aluminum “egg-crate” fluorescent housing in ancillary hallway, 2013. Photo by author.

125 Philip Johnson and Richard Kelly, Type R-2. 1959. Architectural Drawing. (Richard Kelly Papers, Yale University Library: Manuscripts and Archives. New Haven, CT)
Figure 38. Picasso Alley, double heightened hallway between Grill and Pool Rooms, featuring ancillary hallway toward the left of the image, 1959. Photo by Ezra Stoller. Courtesy of ArtStor.
Mid-Century Praise

Lighting historian and scholar, Margaret Maile Petty, wrote that through his late 1950s lighting work, Richard Kelly “...replaced the question of lighting quantity with the question of individual qualities of light,” which can be found throughout the Four Seasons Restaurant. Numerous magazines including *Architectural Record, Progressive Architecture,* and *Interiors Magazine* interviewed Kelly when the Seagram building opened in 1959, and featured articles about the elegant mastery of mood and ambience of the restaurant’s interiors. A 1959 letter from *Interiors Magazine*’s editor, Olga Gueft to Kelly expresses the popular sentiment that “Like every other magazine under the sun, it seems, INTERIORS is doing the Four Seasons. It will be in our December issue.” Kelly’s groundbreaking lighting design made the Four Seasons restaurant one of the most sought after topics of discussion in the field of interior architecture.

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126 (Maile Petty, *Architectural Lighting*)
Relighting Plan for the Four Seasons Restaurant

In 1990, the City of New York prestigiously designated the Four Seasons Restaurant as the City’s second Interior Landmark. The most recent renovation of the restaurant was an overhaul upgrade of the kitchen and a restoration of the leaking pool in the Pool Room in 1990. Belmont Freeman, principal of Belmont Freeman Architects, was appointed by the Seagram owners to serve as the restaurant’s in-house architect to oversee and plan the maintenance of the interior.

Four Seasons Research

Recently, Richard Kelly has been the topic of a great deal of academic and professional research. His interior lighting work, not unlike his work with the Four Seasons Restaurant, makes him a wildly significant figure in the realm of lighting design. In fact, in the fall of 2010, “The Structure of Light: Richard Kelly” exhibition opened at the Yale School of Architecture. The exhibit celebrated the centenary of Richard Kelly’s birth. Curated by art historian and Richard Kelly scholar, Dietrich Neumann, the show presented Kelly’s drawings, “new luminous models of both contemporary and historic lighting designs,” and original interior photographs. Tracing his career, the show highlighted his seminal projects, particularly his work at the Four Seasons restaurant. Towards the beginning of the exhibit stood a mockup wall of the restaurant complete a single metal textile curtain, lent to the show by the restaurant, lit by a remade Four Seasons Edison Price wall washer fixture.

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129 (Freeman)
Six-months after the exhibit opened, Freeman and his firm’s lighting designer traveled to Cambridge to scour Yale University’s Manuscripts & Archives for the Seagram files inside the Richard Kelly Collection. They sought to learn more about the original fixtures for the relighting process. They were able to pore over drawings, early blueprints, magazine articles, and lighting-related newspaper clippings with Kelly’s handwritten notes.

Goals for Approaching the Renovation

To determine goals to approach the renovation, Freeman conducted a thorough study of the condition of the restaurant’s lighting fixtures and the state of the furniture and material finishes. The study ranked different parts of the restaurant by “priority of importance,” for replacement. The ancillary spaces like the carpet on the landing off the staircases, or the interstitial hallways seem to take the most wear and tear. Freeman’s basic evaluation method deemed the lighting scheme as a “critically important” element in the design and ambience of the Landmarked interior. With that in mind, the overall lighting goal was to preserve the physical lighting fixtures and replace the insides with modern energy efficient technology. As they came to understand it, the goal in recreating the restaurant’s authentic mood and ambience would involve achieving a perfectly even, low glow and restoring the lighting’s original clarity and crispness.131 Today, The William Armstrong Lighting Design Studio, or WALD, continues to serve as the Four Seasons lighting design consultants and have collaborated with Freeman and with the original lighting manufacturer Edison Price, to establish a timetable for when the retrofitting of Kelly’s lighting fixtures can be renovated, once funding becomes available.

131 (Freeman)
Deterioration of Original Technology
*Ground Floor Lobby*

As with any building material, factors like time, foot traffic, and fluctuations in temperatures and humidity have caused the anodized metal that surrounds the darklites that protrude from the ceiling to corrode. The corrosion appears on these black anodized metal reflectors as a textured reddish film. A variety of building professionals have installed repair and replacement campaigns for these darklites over the years, causing variations in the thickness of the lights’ metal surround rings and an uneven ceiling profile (Fig. 39).

Figure 39. Four Seasons Restaurant ground floor lobby with darklites of uneven profiles, 2013. Photo by author.
Grill Room & Bar

The fluorescent lamps under the Grill Room's bar no longer function due to fugitive technology, and as such the bar has not glimmered as originally intended for years. Freeman and WALD have planned for LED strips to replace the more recent incandescent retrofitted strip.132

Figure 40. Grill Room at the Four Seasons Restaurant with glare from wall washer fixtures on walnut panels, 2013. Photo by author.

Many of the bulbs in the wall washers are burned out, or exhibit different color temperatures, producing a disparate reflected effect on the exotic walnut paneling (Fig. 40). A building professional applied a new finish to the panels, a finish that was much higher the original, causing the wall washer light fixtures to produce mirroring glare at the top of all of the walnut walls throughout the restaurant.

132 (Freeman)
Pool Room

The guidelines that horticulturist O. Wesley Davidson established in his lighting schedule that electric light would be able to provide the Pool Room's plants with the nutrients produced by the sun proved to be inaccurate.\textsuperscript{133} Today, there are four sets of artificial trees to be installed into the lamped flower pots at the onset of each changing season.\textsuperscript{134}

Figure 41. Pool Room with fiber optic lights in pool, c. 2005. Courtesy of the Four Seasons Restaurant.

White fiber optic lights were installed into the pool in 1996 when the marble-clad water feature was repaired for its leaks (Fig. 41). At the time, fiber-optics was the latest

\textsuperscript{133} (Davidson)
\textsuperscript{134} (Freeman)
technology to be introduced to such a feature. Future pool illumination renovations will most likely include LED lamps.\(^{135}\)

**Hallways**

The gold anodized aluminum egg crate ceiling grate, suspended in the ancillary hallways, has discolored severely over time. For many years after the restaurant opened, cigarette smoking was allowed indoors, which severely discolored the ornamental grates. (Fig. 37) They exist today as a patchwork of various hues of gold, with several of the louvers dinged and warped. These trajectories, although small, create additional surfaces for the fluorescent bulbs to reflect off of and result in small speckles of glare, which distract the eye from the original intended glow.

\(^{135}\) (Freeman)
Preservation Theory

“Its an interesting philosophical dilemma,” said Freeman, when expressing the conflict between either conserving or reproducing the warped metal egg grates in the ancillary hallways. Because of this dilemma, Freeman’s team will have the option to either accurately Because the original metal manufacturer, Milgo Buñkin, is still in business and Kelly’s original plans for the crates exist, the Four Seasons restaurant stakeholders will have the option to accurately recreate them. Similarly, the ground floor lobby’s bronzed anodized darklites are facing conservation treatment or being “re-spun” by the original jig that produced them.\textsuperscript{136} These dilemmas between recreating the light fixture’s components with the aid of the original plans, original factory mechanisms, and production by the same company still in operation, weigh heavily against having a professional metal conservator clean, treat and repair the original, physical lighting fixtures components. This dilemma between \emph{new-old} and \emph{old-new} is a concept that is at the core of modern day preservation theory.

\textsuperscript{136} (Freeman)
Analysis of the Relighting Plan for the Four Seasons Restaurant

Built: 1959
Lighting system restoration: 1996 - ongoing

Architects and preservationists have approached all upgrades to the Four Seasons Restaurant with scrupulous preservation considerations, as the restaurant is one of the few National Historic Landmarked interiors in the nation. This designation status has allowed for the original finish materials, furnishings, decorative elements and the lighting, to be protected from significant alterations that would effect the overall character of the space.

The Landmarked status paired with the availability of architect Phillip Johnson and lighting designer Richard Kelly's original lighting drawings has allowed for periodic maintenance of the lighting systems through out recent years. Periodic maintenance of a mid-century lighting system, however, has proven to be a difficult endeavor as lamps and fixtures are either no longer produced, or expensive to reproduce. Additionally, these outdated bulbs and housing fixtures are not energy efficient according to modern accepted standards, which becoming an ever-present concern to building stewards, owners and preservationists alike.

In a unique circumstance, Kelly's lighting approach and original lighting drawings have been researched and studied by Brown University History of Art and Architecture Professor and Richard Kelly scholar, Dietrich Neumann and Four Seasons in-house architect, Belmont Freeman. The collaboration between Freeman and historic preservation researcher Liz McEnaney allowed Freeman and lighting design firm, WALD Studio to establish goals for approaching the lighting renovation.
Together with the original documentation and in referencing Kelly’s other seminal works, they have been able to determine the significance of the lighting designer’s deliberate ambient and moody lighting moments through out the restaurant. Freeman established a “schedule of priority” for the completion each individual lighting retrofit, which will be put into action once project funding becomes available.

A theoretical preservation dilemma has arisen due to the fact that the restaurant is still used for its original purpose, the original documents have been uncovered and many of the original manufactures are still in business. The dilemma revolves around the notion of authenticity and whether to remake or restore original building fabric. In this, the preservation architect will have to decide whether to re-cast the original elements of the lamps and create new ones or to hire a conservator to clean and repair the original lamp elements.

In addition to the lighting fixtures themselves, the renovation and conservation of the original or installation of new finish materials must be meticulously selected and tested as to complement the properties of the lamps themselves. The Grill and Pool Room’s walnut paneled walls have been restored with a finish that is much higher than the original finish, which causes the bulbs of the wall washer fixtures to produce mirroring glare through out the spaces. Similarly, the original pale saddle colored leather panels present both below the bar and in the Pool Room have been replaced with black leather panels, a color which has completely different light reflecting properties, and absorbs the light rather than reflects it.

The case study of Four Seasons Restaurant’s lighting design can serve preservationists, architects, lighting designers and other building professionals as an
example of how to approach the research of a historic lighting scheme, and of how to establish both the intent of the lighting designer and subsequent relighting goals.
Chapter 4: Evaluating Existing Guidelines and Criteria for Consideration

The foregoing case studies reveal a range of successes and lost opportunities in preserving and restoring the original architectural intent and effect of artificial light in mid 20th century buildings. This chapter analyzes these relative successes and missed opportunities and will summarize existing guidelines and consider whether they are sufficient given details of our case studies.

Today, the original lamps from these buildings are largely considered by practicing architects to be fugitive technology. Their electrical components are outdated, their replaceable parts are no longer manufactured, and their inner wirings are so obsolete that they are no longer compatible with simple retrofits. At a certain point during the lifespan of each case study project, the building stewards were forced to discontinue an original lighting scheme because it was outdated. In the case of the Cranbrook Art Museum, they actually replaced the original lighting scheme with a newer system to serve the need of illuminating the galleries. On the other hand, the stewards at the PSFS Building altered the original lighting scheme to illuminate a new hotel function, in transforming a bank into a ballroom. If building professionals do not carefully select the renovation technology for lighting interventions to produce the same effect as the original lighting scheme, even well executed interior renovations will fall vastly short of a space's original intended glory. If even one lamp is left installed with a burnt fuse, or relit in a manner that fails to replicate the initial lighting design, the interior would lack the ambience necessary to create the experience intended for the public by the architects and lighting designers.
The final outcomes of the case study lighting renovations provide us with an array of successful planning and intervention strategies, as well as a range of neglected or not thoroughly considered alterations in respects to the original, architect designed lighting schemes. In evaluating what worked and what didn’t with these examples, one can note the types of issues practitioners faced perhaps due to a lack of appropriate, inclusive guidance in this specific field.

**Overview of Successes and Missed Opportunities**

Relative Successes

- Ambient glow (Cranbrook Art Museum, Four Seasons Restaurant)
- Diffusion (Cranbrook Art Museum, Four Seasons Restaurant)
- Introduction of dimmers (PSFS/Loews, Cranbrook, Four Seasons Restaurant [existing])
- Redesigning fixtures to house LEDs (Cranbrook Art Museum)
- Research process to determine intent (Cranbrook Art Museum, Four Seasons Restaurant)
- Source location (Cranbrook Art Museum, Four Seasons Restaurant)

Missed Opportunities

- Addition of decorative luminaires (PSFS/Loews Hotel)
- Addition of extraneous lamps (PSFS/Loews Hotel)
- Allowing technology to deteriorate while building interior is in use (Four Seasons Restaurant)
- Diffusion (PSFS/Loews Hotel)
• Renovating of surface material with materials of incompatible reflectance
  (PSFS/Loews, Four Seasons Restaurant)

• Renovating systems with sources that produce incompatible effects (PSFS/Loews Hotel)
Analysis of Existing Lighting Guidelines and/or Criteria

The following sources are each institutions and organizations central to conceptualizing and creating best practices in the field of lighting design preservation. Together, their work summarizes the current state of mid-century historic lighting guidelines (or lack thereof) in the fields of building preservation and materials conservation. These organizations—whether public or private—have done everything from forming lighting standards to issuing research-based symposia. They are American government offices and leading associations specializing in preservation, conservation, and electrical illumination. The aim of this Chapter is to explore the lengths these organizations have gone to protect the lighting design that has truly impacted the field as we understand it today, and whether the work they have done indicating standards and best practices is truly enough. We will explore whether our field needs a more supportive set of guidelines to usher preservationists through our most historically significant lighting retrofits. It seems that almost by trial and error, these organizations have made tremendous strides in issuing best practices that others readily adopt, but in a moment when our most important lighting retrofits are without question in the future, could preservationists benefit from more structured guidelines?

Professional Association Administered Guidelines

*American Institute for Conservation, AIC*

One such organization, the American Institute for Conservation, has an online resource center, including a segment called, “Caring for Your Treasures,” dedicated to presenting a range of objects that the AIC values as significant for the preservation of cultural heritage. Although the list ranges categorically from architecture to books, metal
objects, furniture, photographs, and textiles. The “architecture” segment in particular includes considerations of environment, inspection and maintenance, housekeeping, recordkeeping, alterations and general improvements when selecting an appropriate conservation treatment.\(^{137}\) However, the notion of “lighting” in any capacity (especially from the “inspection and maintenance” segment) is void from these guidelines. In this document, the AIC suggests that traditional building materials found on a building’s interior including brick, stone, wood, plumbing, heating, and cooling systems each be inspected specifically by an engineer. If the AIC were to identify these systems as “mechanical systems,” then lighting systems would fall into this category and be considered and inspected according to AIC guidelines.

The AIC has another segment dedicated to “Sustainability Resources,” which provides the user with several, “Suggested Resources” and links to a list of additional LED-related links. The majority of the available LED downloads focus on color rendering index, color quality, life span and reliability of lamps, Energy Star Criteria and conservation suggestions for collections.\(^{138}\) These guidelines do not address retrofitting lamps for a specific effect produced by older lighting schemes, but instead address the retrofit of antiquated lighting devices with new LED technology.

The National Association of Electrical Equipment and Medical Imaging Manufactures (NEMA) works closely with the AIC and created minimum performance requirements for the retrofit of solid state lighting lamps. The criteria in this document


specifically apply to LED lamps intended to replace standard incandescent lamps, decorative lamps ("candelabra style"), and reflector lamps. Subsequently, a significant group of these organizations, including American National Standard, International Electrotechnical Commission, Institute of Electrical and Electronics Engineers and International Commission on Illumination Standards published a long list of specific lighting standards to exist in cooperation with the replacement standards referenced above. The majority of the references listed address technical aspects of lighting including photometry and colorimetry.

Association for Preservation Technology, APT

In 1998, the AIC and the Association for Preservation Technology hosted their third joint symposium on museums in historic buildings, with “light and lighting in historic buildings that house collections” as the symposium theme. The lighting guidelines that follow were a direct result of this symposium and address the notion that, “problems of light and lighting in historic structures that house collections have often been seen as someone else’s concern.” At this point, preservationist were just beginning to address lighting concerns collaboratively with various historic professionals and practitioners. Although the needs of a historic building that houses a collection differ greatly from, say, a mid-century historic interior that the public still frequents (like our case studies), the practitioners involved in the preservation, restoration and maintenance of these public mid-century buildings should work together as a cohesive team for the relighting to be a success.

This would include the renovation architects, engineers, fixture manufactures, electricians, interior designers, lighting designers and building stewards.

In 2011, architect, lecturer and preservationist, Vanessa Fernandez wrote an article titled, “Preservation of Modern-Era Office Buildings and Their Environmental Controls,” for an APT special issue on "Modern Heritage." In it, Fernandez explores the history of the glass façade, and focuses on several of Le Corbusier’s buildings and the UNESCO Secretariat building as case studies supporting retrofitting modern glass curtain wall façades. Fernandez summarizes her article, writing that “preservation projects should take into account historic environmental control systems,” citing Modern precedents ranging from the 1930s to the 1960s. As extensive condition assessments of mid-century buildings become more prevalent with time, building preservationists like Fernandez recognize the original character that earlier technological advances contributed to these early modern buildings. As they do, they innovate not to create new systems as in our case studies, but instead innovate unique lighting interventions and retrofit methods to bring fugitive technology back to life.

The Northeast Chapter of the Association for Preservation Technology’s 2012 annual meeting and symposium was dedicated to, “Historic Lighting.” Keynote speaker, Domingo Gonzalez, of Domingo Gonzalez Associates Architectural (DGA) Lighting Design, addressed the symposium with an “evolutionary discussion on historic lighting.” Gonzalez has been practicing lighting design in New York City for over 35 years, and has served as the

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142 Association for Preservation Technology North East Chapter. *ATPNE Annual Meeting & Symposium: Historic Lighting.* (Hartford: 2012)
lead lighting designer on over 1,500 new construction and historic preservation projects. These projects include the lighting of civic, corporate, educational, healthcare, hospitality, retail and transportation facilities. DGA’s mission statement combines the idea of bringing, “a dynamic creative vision to the enhancement of architecture through illumination,” with, “a philosophy that allows its clients a clear window into the design process,” a confluence of ideas undoubtedly influenced by the writings, teachings and methodology of turn of the 20th century light scientist, Joachim Teichmuller, early 20th century theatrical lighting designer, Stanley McCandless and mid-century lighting designer, Richard Kelly. His presence at the APT annual symposium speaking as the keynote, signaled that APT acknowledged bridging the connection between contemporary methods of electric lighting (in which include utilizing light as an architectural material to create mood), and between early, rudimentary methods of lighting (in which the light fixture itself was treated as a stand-alone decorative element). The speakers that followed Gonzalez focused on the restoration of traditional luminaire fixtures and light renovations in pre-mid century interiors. These presentations included discussions about the relighting, restoration and replication of the Belasco historic theatre, efficient relighting of the Isabella Stewart Gardner Museum, an assessment of the energy costs related to historic lighting, streetscape lighting and the preservation of neon electric displays. As the Association for Preservation Technology, they are responsible for including mid 20th century lighting systems in their preservation considerations and guidelines, and not simply addressing the relighting of historic lighting fixtures. In selecting Gonzalez as the keynote speaker for the APT’s symposium on historic lighting, it seems as though the APT is edging closer to recognizing mid 20th century lighting systems for their contributions to the development of modern lighting design.
The Illuminating Society of Engineering is the oldest continuously active illuminating society of its kind in America. The IES’s 2012 Publications Catalogue enumerates and summarizes each of the available technical courses and technical publications available for purchase by members or student members. The breadth of publications includes lighting ordinances, handbooks, standards and fundamentals for lighting reference and for application into a wide range of projects.  

In, “A History of Light and Lighting in Celebration for the Centenary of the Illuminating Engineering Society of North America,” lighting designer David L. DiLaura gives a “progressive history of the technical art of lighting,” which leads up through the turn of the 21st century, focusing primarily on early the development of electricity and the development of early, pre-WWI, luminaire light sources.  

Published in 2007, “IESNA Guidelines for Upgrading Lighting Systems in Commercial and Institutional Spaces,” serves to inform “designers and specifiers as well as commercial and institutional building owners, managers, facility engineers, energy service companies, retrofitters, and utility representatives,” of generic lighting upgrade issues, typical equipment used in lighting upgrades and application situations typical of lighting upgrades. This document is organized into three distinctive sections, and progresses in specificity and level of technicality. The language in a document of this type could easily

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144 (DiLaura)
145 (Illuminating Engineering Society, 14)
be tailored to suit the upgrading needs of mid 20th century lighting fixtures, to make them more energy efficient and functional for modern needs.

"Energy Efficiency Guides for Existing Commercial Buildings: The Business Case for Building Owners and Managers," written in 2009, is a guide developed under the supervision of energy professionals from including ASHRAE, IES and the U.S. Building Council, which aims to "enable building owners to evaluate current operations and conduct the economic analysis necessary to make wise decisions regarding improvements." This provides the reader with the knowledge to make effective energy efficient cost decisions during a renovation, which in turn, will increase the (monetary) value of the existing commercial building. In historic buildings deemed worthy of preservation, the value of a building is a confluence of several factors, including social, aesthetic and cultural values. While the existing commercial buildings that these Energy Efficiency Guides address may or may not be historic, the overarching idea of efficiency in a retrofit should always be considered as lighting technology continues to improve.

In IES’s December 2012 LD+A magazine article, Kurt Vogel, director of product development for Lithuania Lighting, wrote, "Strategies for Lighting Retrofits," an article which offers an overview of traditional and newer solutions to lighting retrofits. Vogel enumerates the benefits of replacing antiquated lighting systems with more modern lighting solutions, including "enhanced light quality, reduced energy use, lowered maintenance costs and the ability to achieve sustainability goals." The author also discusses the economic viability of retrofits and lists the pros and cons of traditional retrofit solutions, and those of a newer, all inclusive “kit” solution. The kit solution can be available in

\[146\] (Illuminating Engineering Society, 12)
fluorescent or LED options and has the components to be installed directly into the housing of old fixtures “while maintaining their integrity and delivering the appearance and efficiency of a modern fixture.” Amid the technical language, Vogel does mention maintaining the light quality or enhancing the original effect. He also goes onto mention that the new lighting should “enhance the look and feel of the space,” in a tone reminiscent Stanley McCandless or Richard Kelly. In this article, the IES seems to be bridging the gap between a concern for energy efficient retrofitting of mid-century buildings, and of restoring the planned effects that the original lighting once had. To make this connection, the highly influential IES should consider approaching relighting older buildings with a more introspective look at the artistic and ambient qualities produced by the light itself, so that the concept of light being preserved as a building material can begin to enter the public mindset.

State and National Government Administered Guidelines

*Design Guidelines for Landmark Lighting created by the Denver Landmark Preservation Commission & Planning and Development Office* 147

In 1997, the Denver Landmark Preservation Commission & Planning and Development office of the City and County of Denver established a series of design guidelines for exterior night landmark lighting as supplement to the city's 1995, “Design Guidelines for Landmark Structures and Districts.” These guidelines were written to aid the Commission “in conducting its review and in granting its approval of landmark alterations and additions having to do with exterior night lighting.” This was executed with a brief history of electric street lighting in the city of Denver, beginning in 1880 and extending to current day, with mention of the city's larger and prominent street lighting installations

which illuminate significant civic buildings, parkways, parks. Historic photographs and municipal annual review documents serve as visual examples of the text throughout the body of the guidelines. A review of Denver's “public building lighting” is also discussed in the guidelines, suggesting that the presence of “decorative lighting as major design elements,” in some of these public buildings contributed to their importance. Historic commercial building lighting was deemed significant for its ability to properly showcase and entice customers to purchase goods. “Residential lighting” is similarly profiled, followed by a thorough analysis of the development and application of various lamps for exterior lighting. In summary, the primary concerns for adequate exterior night lighting for historic structures are safety, visibility and preservation of the building’s historical character and physical integrity. Appropriateness of floodlights, glare mitigation, lamp positioning and color rendering index specifications are also addressed in Denver’s design guidelines for landmark lighting. Overall, the suggestions are referring to additive light systems, and not ones which are integrated into the building as part of the architecture itself. In the case studies, an effect was created while the light source itself wasn’t evident, leaving room for the creation of protection guidelines for alterations of these 20th century interior lighting schemes, which would similarly outline their history and significance for a larger commission to consider.

*Secretary of Interior Standards for Preservation, Rehabilitation and Restoration of Historic Buildings*

The National Park Service glosses over basic and minimal protocols in regards to the preservation, rehabilitation or restoration of electrical systems found in historic buildings. "Identifying, retaining, and preserving visible features of early mechanical systems that are important in defining the overall historic character of the building, such as radiators, vents,
fans, grilles, plumbing fixtures, switchplates, and lights," is listed as a recommendation in the interior mechanical systems portion of the standards for rehabilitation and guidelines for rehabilitating historic buildings. It is important to note that "lights," the standalone term, not encompassing the light’s effects, or particular components of the fixture’s composition, comes after radiators, vents, fans, grilles, plumbing fixtures and switchplates. Stated as such, the light fixtures themselves contribute to the "overall historic character," however, the ambience and mood produced by the fixtures- undoubtedly integral to the historic character mid-century interiors- is not addressed. It is not recommended that the important historical character defining features of the mechanical systems be removed or radically changed. In the case of the PSFS/Loews Hotel, the original housing of the recessed strips was maintained, however, they were retrofitted with bulbs that were inconsistent with the light quality of the original fixtures, hence causing the light produced to have a very different, ununiformed and spotty-look.

Other Interior Mechanical Systems-related recommendations include repairing mechanical systems by augmenting or upgrading parts, but not replacing these systems or their functional parts when retrofitting and retention are possible. Also recommended is, "replacing in kind—or with compatible substitute material—those visible features of mechanical systems that are either extensively deteriorated or are prototypes...” To that, it is not recommended to install a visible replacement that does not convey the same visual appearance. It is unclear if the NPS specifically means the light fixtures should convey the same visual appearance as the original fixture, or if the lighting effects should convey the same visual appearance as the original scheme.148 It is most likely that like in the

recommendation of "Identifying, retaining, and preserving visible features of early mechanical systems," that this recommendation only holds up for the light fixtures themselves, and does not consider the ambience or mood produced by said fixture.

Guidelines for the Preservation of Early Electrical Systems

In 1984, Maximilian L. Ferro, founder of The Preservation Partnership architectural firm, wrote Electric Wiring and Lighting in Historic American Buildings: Guidelines for Restoration and Rehabilitation Projects. The book addresses the issues in rewiring early electrical systems and early electrical systems that were inserted into historic buildings historically lit by gas. Ferro establishes guidelines for the electric wiring and lighting of historic American buildings, addressing systems and fixtures just prior to the time period that this thesis focuses on.149 The publication highlights the importance of depicting the original aesthetic quality of the lit interior, and presents the succession of luminaire styles that ultimately created a “right form for the function,” of the space. This writing is significant in its organization of the luminaires chronologically, which expresses the changes in technological developments.

Later in 1992, lighting advocate and designer, Gersil Kay, wrote Mechanical & Electrical Systems for Historic Buildings: Profitable Tips for Professionals, Practical Information for Preservationists, to address relamping lighting fixtures from 1889 to 1905.

149 (Ferro)
The text focuses on the concern for wiring outmoded systems with electricity, while still emulating their original light source, such as gas, oil or candle flame.\textsuperscript{150}

While both of these sources deal explicitly with historic interior lighting, they do not address mid-century lighting aesthetics and are too outdated to serve modern practitioners, as the texts do not address the technological lighting advances made by scientists, architects or engineers over the past 20 to 30 years.

Conclusion of Existing Lighting Guidelines and/or Criteria

The sources enumerated show that conservation and preservation associations and societies currently recognize early mid 20th century technologies as contributing character defining features of historic buildings, and promote their general maintenance and restoration but do not specifically address the effect that the light that these technologies emitted. Similarly, existing lighting guidelines specific to historic buildings either address electrically illuminating historic buildings that did not originally have electricity or address bringing their historic decorative luminaires up to modern standards. The Illuminating Engineering Society continues to publish energy efficient standards and strategies for easy retrofit installations, but does not address the reproduction of the specific light qualities that the original mid century lamps produced. In this, preservation professionals, architects, designers and conservators seem to be at the verge of recognizing the cultural and aesthetic value in reevaluating and retrofitting mid-century technologies to their intended glory. Specifically, the literature suggests a disconnect between the utilization of light as a building material by architects, and between the preservation of light as a building material by preservationists. A critical evaluation of the three case studies shows that there were relative relighting successes and failures, which would have been addressed, had proper guidelines been established. After an evaluation of the relevant preservation guidance, it is apparent that relighting mid 20th century lighting schemes has not yet been specifically considered, and as such the need for guides to address their renovation is crucial and necessary for the continued preservation of these spaces.
Chapter 5: Criteria for Guidance for the Restoration of Mid-Century Lighting Systems

In deeming electric light as an architectural material and major component of these mid-century technologies, it requires its own set of preservation guidelines and considerations for the preservation of the interiors they illuminate. From the mid-20th century to today, utilizing electric light in this way has become as integral to architectural expression as space, circulation and materiality are. In the examples of the PSFS/Loews Hotel, Cranbrook Art Museum and Four Seasons Restaurant, the lighting fixtures were hidden behind architectural elements, integrated within the actual fabric of the interior just so, that the effect produced seemed to glow from thin air. Not serving the space as merely an additive decorative element, these recessed fixtures or luminaires were secondary to the effect that emanated from them.

These suggestions are intended to be undertaken by an architect or historic preservation professional with knowledge of architectural plan reading, archival research techniques, lighting terminology and mid-century technology. The research and results produced from these suggestions can then be directly relayed to the project architect, interior designer or contractor in order to implement and oversee that the relighting of the lighting scheme is being addressed correctly. The foregoing guidelines are a first attempt at addressing an appropriate preservation retrofit of these now historic mid-century lighting schemes, and will address the following seven considerations.
1. Benchmarks for acceptability

The building preservation factors that must be addressed prior to a retrofit lighting intervention include: structural stability, safety, Register listing, and the current use of the space. The following two lists are characteristics of what should be done and what should be avoided during a renovation of a historic lighting scheme.

For a successful renovation, the following must be addressed:

- Ambient glow
- Adequate research undertaking
- Conservation of original housing
- Diffusion
- Introduction of dimmers
- Redesigning fixtures to house energy efficient technologies
- Reproduction of original fixtures and interior elements with compatible materials
- Source location within housing

For a successful renovation, the following must be avoided:

- Addition of decorative luminaires
- Addition of extraneous lamps
- Allowance of technology to deteriorate while building interior is in use
- Renovation or replacement of surface material with materials of incompatible reflectance
- Renovation of systems with light sources that produce detrimental, incompatible or inconsistent effects
2. Research Considerations

Due to the fact that the buildings we are focusing on were built approximately 50 to 80 years ago, it is most likely that many of the architect’s, engineer’s or lighting designer’s original light schedules, plans and manufacture correspondences are still in existence. It is also possible that these documents are in archival collections and/or have been digitally scanned and exist in an accessible online database.

Pre-Research

Prior to beginning the research process, it is important to take into consideration the current state of the project’s interior, taking photographs, field notes, sketches and measurements to prepare oneself to begin searching for the project’s original documentation. Being acquainted with the project in person will save research time and avoid confusion when scouring hundreds of fragile documents in the on-site research process.

To the Archives

Extensive archival research to find these documents may begin at local historical societies, architectural archives and city hall records departments. Many American universities have special archival collections that may be specific to a particular architect or period of architecture. If the architecture or lighting design firm is still in practice, it may be beneficial to contact the firm, as they may house original process drawings, handwritten notes and early change orders. This research may also extend to similar projects that the lighting designer or architect worked on during the same time period.
From personal narratives, such as published biographies and interviews about the architect or lighting designer, one can learn of their design process when approaching a new project. Newspaper articles published around the time of the building’s opening, or in celebration of a milestone may reflect the public’s perception of the new lighting systems. From professional trade or technical publications, such as the Illuminating Engineering Society’s Transactions and LD+A magazine, one can compare the project’s mechanical prowess with current trends of the time. The language and imagery depicted in manufacture advertisements found in these professional trade and technical publications will also reveal a mainstream acceptance of lighting methods and fixtures. In many instances today, these publications can be found online through an archival search on the publisher’s website. For others, single archived paper copies may be available only in the publisher's headquarters or in library collections.

Professional interior photographs of the building may have been taken upon its opening, and will most likely show the electric lights on in reverence for the new technology. Photographs or illustrations used in promotional material or, in the case of an art museum, photographs of exhibitions or in the case of a restaurant, photographs of events will depict how people interacted and appeared with the original lighting scheme turned on.

3. Establishing Intent

Organizing the all of the research material chronologically or into some other logical construct suitable to the breadth of found information is the first step to analyzing the research. Through a thorough analysis of these research materials, one can come to
determine the intent of the lighting designer or architect in order to inform the replication of its lighting effect during a renovation/ lighting retrofit.

What to draw from each source

Black and white interior photographs can be most helpful in determining light source, direction, and even intensity. Intricacies in the photographs, such as a system being turned off, or secondary additions to the system can be traced when chronologically comparing all found images.

Personal narratives such as bibliographies or interviews can trace the architect or lighting designer's introduction to and involvement with lighting design in addition to his or her professional theoretical approach to designing electric lighting schemes. This can be further discovered through similar works from the same time period during the architect or lighting designer's career, which can suggest experimentation or development of a particular method.

Newspaper articles can express the public's perception for the acceptance of, or excitement for technological developments in new buildings.

Publications of the era can show seminal technological developments and theories, which can be historically compared or contextualized with the project in question.

Analysis of correspondence between the light fixture manufacture, building stakeholder, and designer can offer a glimpse into the business transaction aspects of the
project in addition to construction or design concerns and an overall view of how the project developed.

4. Considering Previous Alterations and Improvements

In conducting extensive research, one may come to realize that the original lighting scheme and/or other contributing interior elements may have been altered. Changes could include the addition or removal of lighting fixtures, change in the space's use, alterations of room configuration, or substitutions of incompatible finishing materials, such as flooring or paint finish type. These alterations may have improved the original scheme in ways that may have made the changes more favorable for the overall space. However it is likely that the alterations may have hindered, hidden or not fully utilized the original scheme. It would be a collective decision on behalf of the involved stakeholders, building owner, renovation architect, preservationist and interior designer to determine which period of the building's history to represent in the final renovation.

Comparing black-and-white images to one another is the best way to determine how an interior's lighting scheme has changed over time. Although one cannot compare the coloring rendering index produced by the light source in black-and-white photographs, the luminance levels, beam spread and direction of light can be determined to a greater extent without the presence of color. Scrutinizing for differences in the reflectance of building materials, changes in glare, or for the addition of supplementary lamps allows one to determine when alterations were made or when systems failed, if not documented elsewhere. Similarly, chronologically organizing the correspondence and change orders between architects, contractors and fixture manufactures would allow one to string
together the reasoning behind the alterations to gain an understanding for how the building has arrived at its current state.

5. Collaborative Efforts

For the restoration of a historic lighting scheme, insight and professional guidance from a variety of building professionals is warranted, and collaboration between them is necessary. Establishing open communication between those involved is crucial from the early planning stages of a renovation of this type. Stakeholders, owners, building stewards, preservationists, architects, interior designers, building contractors and workers must be willing to collaborate with one another at various levels to ensure that the relighting of a space is approached sensitively and constructively. For example, it will be at the discretion of this group of invested professionals to determine whether it is appropriate to consult a conservator to restore original elements of the building’s light fixtures or to have these parts remade with the appropriate manufacturing processes and original documentation. All involved should have a shared goal of utilizing energy efficient strategies and technologies through out the redesign process through to the system’s final implementation.

6. Importance of Creating Mockups

"Mockups," or sample stand-alone models of electric lighting fixtures are an extremely helpful tool when redesigning an original lighting fixture to house newer, energy efficient technology. Mockups must be compatible with the existing housing and overall dimensions of the existing unit. The more recent implementation of energy efficient standards and regulations for lighting systems by the government will add another layer of
complexity when creating mockups, as this factor was most likely absent in the design of the original technologies. These mockups should be tested to match the original effect determined by the research process, and also be created with dimmers so that the light can be adjusted to suit.

7. System Maintenance and Housekeeping

Unlike maintaining superficial interior materials such as wall paper, tile or wooden floors, the maintenance of entire lighting systems will require periodic re-lamping and testing to ensure the quality and brightness levels of the emitted light and to ensure the condition of the ballasts. The approach for this must be at once sensitive as to not interfere with the function of the interior space, and timely scheduled as to avoid systems from operating with burnt fuses.
The influences of architectural design, engineering and the theatre and the performing arts advanced the development of electric light in the early 20th century and perpetuated the establishment of lighting design as a distinguishable profession in America by mid century. The ambiguous nature of early electrical lighting technologies, its effects and the overall intentions of new applications of electrical light were traced from their inception in the 1880s up through the lull of modernism in the 1950s. Overviewing the expansion of the electric lighting field over this period of 70 years has allowed us to appreciate the experimental strides that early lighting designers were able to achieve with a limited palate of lighting sources.

In recognizing the emergence, progress, and execution of custom-designed mid century architectural lighting schemes, we can appreciate the uniqueness of our systems are today. As buildings from this era begin warranting conservation treatments, strategic maintenance plans, and restoration, it is crucial that practitioners working on buildings that feature these architecturally integrated lighting schemes take into careful consideration the revival of the lighting effects as well as the physical building materials. In these technologies, the effect that the concealed lighting devices produced was crucial to the reception of the modern interiors that housed them. Particularly through the case studies, the author evaluated the relative successes and missed opportunities of recent relighting renovations to develop a protocol appropriate to both the historical character and current use of the space.
Existing governmental, conservation and retrofit guidelines do not specifically address lighting of this mid century period, its intended effects nor light as a conceptual building material. As these systems are being neglected by building stewards or are being replaced by less complementary systems, the need for guidelines to address their renovation is ever-present and necessary. These guidelines will serve address the research process to determine the architect or lighting designer’s original intended effect, the importance of considering previous alterations, creating fixture mockups and periodic system maintenance. To best achieve an accurate and successful restoration of these unique lighting schemes, the proposed series of guidelines should be collaboratively adopted and further developed by architects, preservationists, lighting designers, interior designers, conservators and building stewards, alike.

The innovations mid 20th century lighting designers achieved in their time working on these buildings was unprecedented, and as such the retrofitting plans we install today must be equally inventive, focusing as intently on preserving the original aesthetic as the lighting designers and architects did envisioning them. The collaborative adherence to a cohesive series of lighting preservation guidelines will bridge the disconnect between the light being viewed as a building material by architects and between light being considered as a building material by preservation professionals, and will allow for the inclusive preservation of these technologically innovative mid 20th century interiors.
Bibliography


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**Accent Light:** A specific source used in addition to more basic light to draw attention to a particular object or area.

**Angle of Light:** The angle formed between the light and an object, an essential aspect in creating mood and form modeling.

**Ballast:** A device required to start and operate a fluorescent lamp.

**Beam:** A cone of light emitted by a luminaire.

**Bulb:** Common term for an incandescent lamp. Also refers to the outer class envelope of the lamp.

**Color rendering index:** (CRI) The ability of a light source to accurately render an object’s color in comparison with a natural light source. Measured on a scale of 1-100 with 100 being the ideal.

**Daylight:** Encompasses all natural light that is available during the day and originates from the radiation of the sun in the visible spectrum.

**Diffusion:** The scattering of light.

**Dimmer:** An electric or electronic device that regulates a fixture’s brightness.

**Downlight:** A lamp that emits its light directly downward with a round or square reflector shape.

**Effect:** Production of a specific impression or support of a general design or intention.

**Egg Crate:** A square or rectangular grid that, when installed on large open face light sources, alters the shape and intensity of the light and reduces glare.

**Filament:** The tightly coiled tungsten wire of an incandescent lamp, which glows to produce light when electricity is applied.

**Fixture:** A term that is often used interchangeably with luminaire.

**Floodlight:** A wide, semi-soft source often used to direct a large amount of light to a relatively large area.

**Fluorescent lamp:** Operates by creating an electric arc inside a gas-filled tube.

**Footcandle:** (fc) A non-metric unit of measurement for illumination, measured as 1 lumen per square foot.
Glare: An interference with visual perception caused by an uncomfortably bright light source or reflection

Illuminance: Light arriving at a surface, expressed in lumens per unit area; 1 lumen per square foot equals 1 footcandle, while 1 lumen per square meter equals 1 lux

Incandescent lamp: Produces light with a wire filament, created when heated by an electric current

Intensity: The “strength” of the light independent of subject reflectivity, measured in footcandles or lux

Lamp: see bulb, luminaire

LED: Light emitting diode

Lens: A glass or plastic element used in luminaries to seal a fixture or control the exiting light

Light source: A device serving as the source of illumination

Lumen: (lm) the unit of light power

Luminaire: A complete lighting unit, which contains a lamp, housing, ballast, sockets and any other necessary components

Luminance: (unit: cd/m²) a measure for the apparent brightness of a light source or illuminated surface

Lux: (lx) the unit of illuminance, equal to 1 lumen per square meter

Reflectance: Light that falls upon a surface and is reradiated in the visual spectrum

Reflector: A metal or glass component of a luminaire, usually curved in some manner and used in most light sources for the purpose of directing light rays from a light source

Scheme: A series of planned lighting effects

Wash: An even, overall illumination over a large area

Watt: A measurement of power or the rate at which electrons move along a wire

Note: The general definitions listed here have been compiled and streamlined from sources referenced in the bibliography of this thesis.
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