Galleries with Windows:
Strategies for Collecting and Processing Light Data

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Introduction

Light monitoring projects in galleries with windows can be made more challenging by a gallery's architecture or limited monitoring time. In the two lighting surveys presented here, we implemented additional resources for approximating light exposure and developed methods for revisualizing data into more comprehensible formats. Both surveys primarily used commonly available Onset HOBO monitoring tools, Microsoft Office Excel templates, and inexpensive mobile applications.

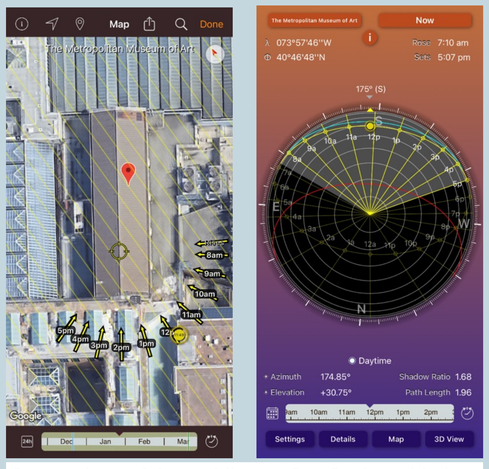
To understand the contribution of sunlight to light levels in a large gallery, light measurements were combined with national weather data (historical cloud cover) and sun positioning data. Incorporation of cloud and solar data enabled us to extrapolate a few months of light level measurements to estimations of light levels throughout the year.

In a separate large gallery with a glass ceiling and multiple sunlight abatement systems, 12 months of light level data were collected with the addition of intermittent automated photography of the space. The addition of cameras greatly improved our understanding of the light levels along each display wall. Due to the large quantity of monitors and resulting data, we also developed semi-automated methods for simplifying and revisualizing the data in Microsoft Excel. The development of an Excel template allowed the data to be expressed in monthly and seasonal patterns.

Accounting for variables in shortened monitoring timelines

Solar elevation:
- Windows along the top third of two walls
- Direct sunlight causes brief, intense light levels
- Trigonometry determined that the casework is in direct light when solar elevation is 36 to 62 degrees
- Using a solar tracking app, we calculated how long the cases would be in direct light during months that were otherwise unmonitored

Daylight shining directly on Arms and Armor casework through upper windows



Screenshots of the mobile app Sun Seeker with the Arms and Armor gallery pinpointed (left) and solar elevation data displayed (right)

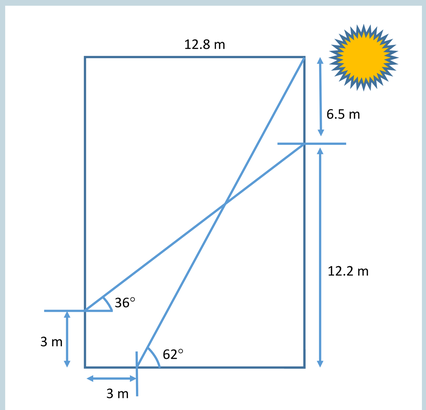
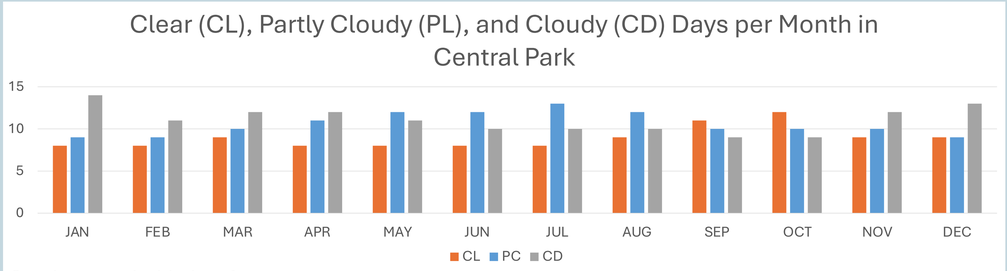


Diagram of a cross-section of the gallery with measurements used to determine the angles that the sun must be within to shine directly on the casework along the walls.

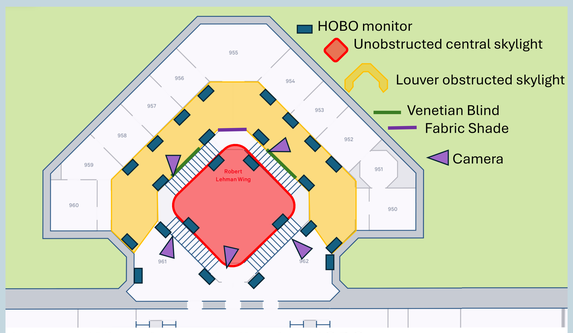
Cloud coverage:
- Weather patterns impact sunlight intensity and can vary throughout the year
- National historic records confirm that cloud coverage in NYC is relatively consistent and unlikely to cause significant seasonal differences in light levels



Graph created with data from:
National Oceanic and Atmospheric Administration (NOAA). Comparative Climatic Data. 2018. "Cloudiness – Mean Number of Days (Clear, Partly Cloudy, Cloudy).

Determining monitor placement in an irregular space and useful data organization

Monitor placement:
- Onset HOBO light monitors ■ and AtliEon time-lapse cameras ◀ installed
- Data collected every 10 minutes for 12 months.



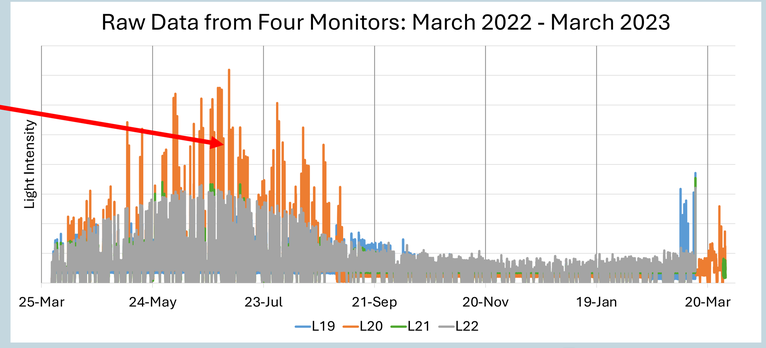
Lehman Wing diagram indicating HOBO sensor and camera locations, skylights, and shade systems.

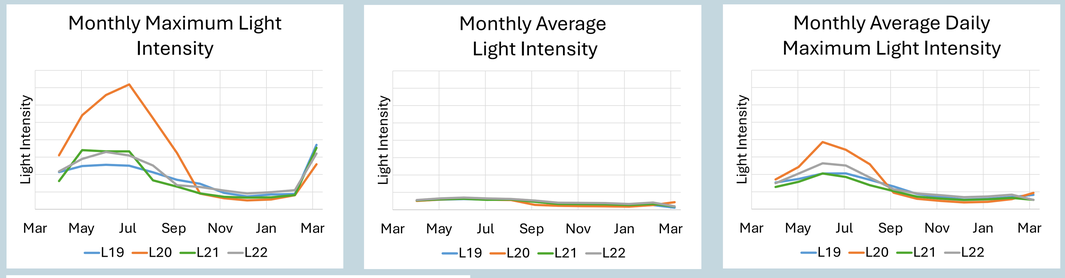
Lehman Wing central courtyard and skylight (left) and the internal immobile louvers (right)

Timestamped camera footage

Data Organization and Visualization:
- Microsoft Excel template designed to calculate monthly averages, monthly and daily maximums, and total lux hours
- Trends are less obvious in the raw data compared to monthly calculations

Google Sheets version of the template





All four graphs are the same scale along the y-axis

Conclusion

When light monitoring projects are time restricted or include architecturally complex spaces, additional resources and data visualization techniques can be helpful for gaining a better understanding of environmental conditions. In the two light level surveys outlined here, we made use of a low-cost mobile application, publicly available weather data, and basic spreadsheet programming to effectively evaluate lighting conditions in the galleries. These present a few highly accessible methods for reviewing light levels in spaces where the presence of a window and infiltrating sunlight create uncertain and dynamic conditions.