Transforming Healthcare and Well-Being through Lighting Workshop

October 22-23, 2016

Discussion by:
Jason Schroer, AIA, ACHA, LEED AP
Director HKS Houston

jschroer@hksinc.com
@jasonschroer
PROJECT APPROACH

- Project Based/Client Focused Research
- Rapidly Deployable Tools; Point of Use Resources
- Informed design outcomes and process
- Cutting-Edge Foundational Research

Steps:
1. Information Gathering
2. Simulation
3. Field Research
4. Evaluation

Informed design outcomes and process.
**TARGET**
Create design aims based on performance goals of the organization

**EXPLORE**
- Gather Knowledge; Understand Users; Simulate Scenarios; Test Prototypes. Use Tools That Balance Technology With Empathy

**DEFINE**
Link Design Solution to Performance Hypothesis

**MEASURE**
- Identify key metrics in design and performance and collect baseline data

**MONITOR**
- Confirm design is implemented as planned; towards targeted performance goals

**TEST**
- Test the success of the design post-occupancy; evaluate if target was achieved
HUMAN EXPERIENCE LAB

Think Space  Maker Space  Test Space
ENVIROMENTAL VARIABLES
BIOMETRIC VARIABLES

Lighting plays a role

movement  mood  performance  Stress/ anxiety
Goal: Meaningful collaborations academic + industry to advance the field

1. Sample: 500 architects
2. 800 projects going on at a time (real life test)
3. A testing/ lab space
4. Research+ Design Expertise
DESIGN DIAGNOSTIC

2.5 Days on Site

Day 0
- Online Survey
- Photo-Essay

Day 0.5
- Site Tour
- Intro
- Pilot Shadow
- Interviews
- Sound readings

Day 1
- 17-Hour Shadow (3+2+12) 2 RNs
- 8 Staff Interviews
- 12 Behavior Maps
- 52 Sound Readings

Day 2
- Interviews
- Debrief
- Behavior Maps

[Protocol Development]
Interviews
Observation Guide

[Analysis + Report]
On-Site Data
Online Survey

Kick Off Call

705 DOCUMENTED MINUTES

Note: Time spent transitioning from one room to the next are accounted for within the activity. Of the 705 minutes total, 10 minutes were considered wait time. Breaks are excluded.
**DESIGN DIAGNOSTIC**

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**705 DOCUMENTED MINUTES**

- Patient Care I, 110 minutes (30 instances)
- Patient Care II, 184 minutes (42 instances)
- Med Admin, 26 minutes (11 instances)
- Med Prep, 32 minutes (10 instances)
- Documentation, 124 minutes (33 instances)
- Care Coordination, 162 minutes (54 instances)
- Socialization, 9 minutes (4 instances)
- Lab, 18 minutes (8 instances)
- Miscellaneous, 20 minutes (15 instances)
- Supply, 20 minutes (9 instances)
- Wait/Waste, 15 minutes

**Note:** Time spent transitioning from one room to the next are accounted for within the activity. Of the 705 minutes shift, 15 minutes were considered wait time (break) or waste.
DESIGN DIAGNOSTIC

South facing, Oct 16th @10.35
Sunny day, semi-closed shutters

North facing, Oct 16th @14.25
Sunny day, wide on shutters
Facility-wide assessment which can be customized in specific modules and can be benchmarked against our previous facilities.

Appropriate time: In pre-design and post-occupancy for a facility wide snap shot. The survey component is what sets it aside from a simple expert walk through.
## WHY LIGHTING IS IMPORTANT IN HEALTHCARE

<table>
<thead>
<tr>
<th>Building type</th>
<th>Potential economic benefits of natural light</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OFFICES</strong></td>
<td>20 - 32% lighting energy savings (3.3 – 6.5 kWh/m² per year)</td>
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<tr>
<td></td>
<td>2.8% - 15% increase in productivity</td>
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<td>15% - 25% decrease in absenteeism</td>
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<td></td>
<td>20% decrease in staff turnover</td>
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<td><strong>SCHOOLS</strong></td>
<td>0 – 30% lighting energy savings (about 10% total energy savings)</td>
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<td>Attendance increase of 3.2 - 3.8 days per year (an increase of about 2%)</td>
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<td></td>
<td>2 - 21% increase in test scores</td>
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<tr>
<td><strong>HEALTHCARE</strong></td>
<td>0 – 30% lighting energy savings (about 12% total energy savings)</td>
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<tr>
<td></td>
<td>Reduce energy costs by about $30 per bed per year</td>
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<tr>
<td></td>
<td>Reduced patient stay</td>
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<td></td>
<td>Average 3.67-day shorter hospital stay for patients with depression</td>
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<tr>
<td></td>
<td>30% shorter stay for female heart attack patients</td>
</tr>
</tbody>
</table>

**Energy efficiency**

**Human efficiency**

HOW DOE WE DESIGN FOR (DAY)LIGHT WITH SO MANY VARIABLES?
THE LIGHT ITSELF...
THE LIGHT ITSELF...
THE ORIENTATION OF THE BUILDING...

<table>
<thead>
<tr>
<th>Baseline inputs</th>
<th>Reflectances: Internal walls</th>
<th>Ceiling</th>
<th>Floor</th>
<th>External walls</th>
<th>Ext Window properties: SHGC</th>
<th>VLT</th>
<th>Reflectance inside: ( \mu_e ) is set to 0.29</th>
<th>( \mu_e ) is set to 0.06</th>
<th>( \mu_e ) is set to 0.25</th>
<th>( \mu_e ) is set to 0.5</th>
<th>( \mu_e ) is set to 0.5</th>
<th>( \mu_e ) is set to 0.5</th>
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<tbody>
<tr>
<td>Analysis surface at: Hi: 2.5' from floor level</td>
<td>Occupancy: 8am - 6pm</td>
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<tr>
<td>Model Outboard</td>
<td>avrg UDI (%)</td>
<td>60.92</td>
<td>65.1</td>
<td>60.52</td>
<td>70.06</td>
<td>71.14</td>
<td>62.90</td>
<td>60.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>avrg % + 1000lux</td>
<td>23.04</td>
<td>16.06</td>
<td>22.26</td>
<td>8.38</td>
<td>735</td>
<td>21.25</td>
<td>22.07</td>
<td></td>
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<tr>
<td>sDA</td>
<td>49.72</td>
<td>4.95</td>
<td>51.21</td>
<td>44.64</td>
<td>68.72</td>
<td>53.26</td>
<td></td>
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* UDI Useful Daylight Illuminance: Percentage of time during the active occupancy hour that the vast majority receive Illuminance between 500 and 2000 lux.

*DA spatial Daylight Autonomy: is the percent of analysis points across the analyzed area that meet or exceed 300lux for at least 50% of the analysis period.
Design A: The Outboard Bathroom

Design B: The Nested Bathroom

Design C: The Inboard Bathroom

Figure 1: The three designs of patient room (WWR= 35%)

Hospital Patient Room Design for Desert Climates: Effect of Room Shape on Window Design for Daylighting, Sherif, A. 1, H. Sabry2 and A. Wagdy1, 1The American University in Cairo 2 Ain-Shams U.
STABLE VS. VARIABLE...THE CHALLENGE

Ocular light

Visual
Non-Visual/Circadian/Perception

Requirement for different Tasks Abilities (visual impairment)
Reduce Errors, Falls

Performance/Safety/Energy
Health/Perception

Physiological
Psychological
Invisible benefits (e.g. vitamin D, mood fluctuations, perception of pain, agitation)

Stable light source
Variation is desired

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STABLE VS. VARIABLE...

Is daylight enough?

Can artificial light compensate for the shortcomings of variables of daylight?

How can we, as an architecture firm, leverage our applied research lab, to support and further the agenda of basic research in academia?

How important is a “view” of nature?

Where do architecture and lighting design meet? How can we experiment with different lighting conditions in our simulations/mockups to design an optimum sensory experience?

Can artificial light replace daylight? If so, is it the right thing to do?

Can artificial light enhance the experience of space that may be deficient of daylight?
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