The Networked Lighting Controls **User Experience**

A 2020 Project

lighting® design lab

Implemented in partnership with

INTEGRATED DESIGN LAB
UNIVERSITY of WASHINGTON // W

and

Integrated Design + Construction Laboratory
WASHINGTON STATE UNIVERSITY

Findings Webinar

December 12, 2020
10:00 – Noon

lighting® design lab

Powered by

Seattle City Light

Lighting Design Lab is supported in part by 2020 member utilities

BONNEVILLE POWER ADMINISTRATION

P.U.D. CHELAN COUNTY

SNOHOMISH COUNTY PUD PUBLIC UTILITY DISTRICT NO. 1

IDAHO POWER® An IDACORP Company

TACOMA POWER TACOMA PUBLIC UTILITIES

We'd like to thank today's event sponsor

Click the logo to check them out!

BETTERBRICKS

Powerful Energy Ideas. Delivered by NEEA.

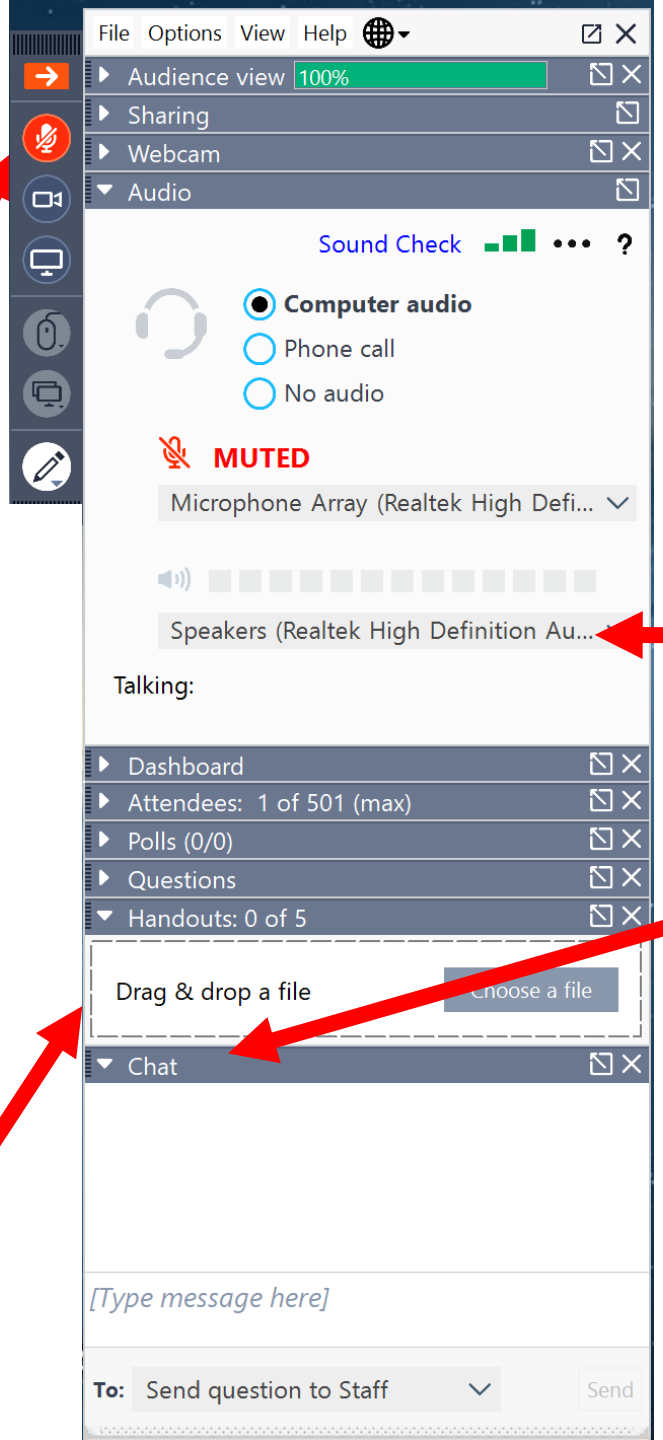
lighting design lab

GoToWebinar Platform:

Upon entry, your microphone will automatically be muted, To unmute click on the microphone icon in your toolbar

Please keep yourself on mute when you are not speaking, background noise will distract your fellow attendees as well as the instructor.

A PDF version of today's presentation is available for download here



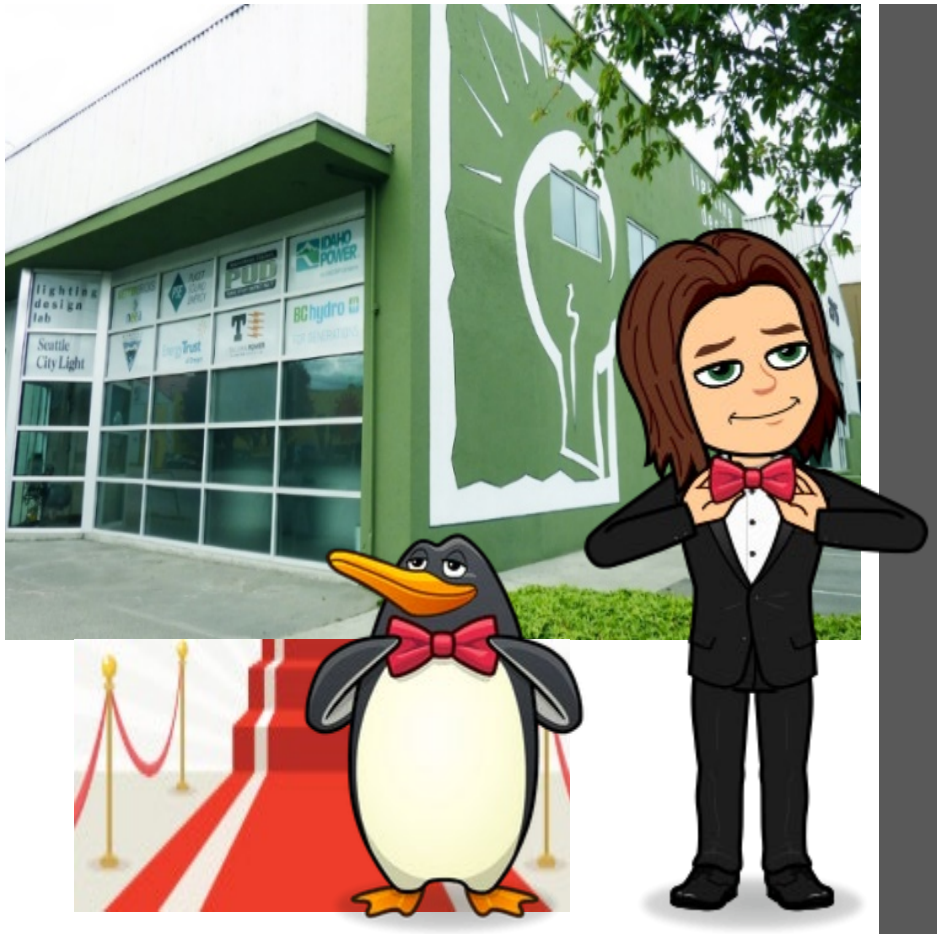
Spotty connection? Try closing other web browsing apps which may be running in the background.

Having audio issues? Make sure your speakers or headset are selected in the audio tab. If it persists, exit the platform and enter again.

Please use the chat feature to send your questions to LDL staff.

lighting design lab

Today's Speakers



Mr. Wilson, posing outside LDL on his way to the 2019 open house gala

-Puget Bugler

John Arthur Wilson

Tribune of the Stakeholders

Friend of Industry

Holiday Season Enthusiast

Today's Speakers

Shaun.Darragh@seattle.gov

- More than 30 years in the lighting industry as an architectural lighting designer, instructor, daylighting and sustainability specialist, lighting control system consultant, and theatrical designer.
- Has taught and consulted on sustainability issues, lighting, and daylighting for the Lighting Design Lab and University of Washington Architecture Department

Selected Projects

- King Abdullah University of Science and Technology
- Masdar Headquarters
- Pearl River Tower
- Canyon Ranch Spa Club
- Amgen Helix Campus
- Reebok World Headquarters
- Reno Sparks Convention Center
- Pacific Place Retail Center
- Ala Moana Retail Center
- REI Denver Flagship Store
- Boeing Commercial Airplanes Offices
- Real Networks Headquarters
- Tommy Bahama Headquarters
- Microsoft B16/17
- San Francisco PUC Headquarters

Selected Awards

- Amgen Helix Campus
- Amgen Helix Pedestrian Bridge
- Canyon Ranch Spa Club
- Harvard University 60 Oxford
- King Street Station
- Lighting Design Lab
- Methodist Hospital Research Institute
- Microsoft B16/17
- Pacific Place Retail Center
- Reebok World Headquarters
- Reno Sparks Convention Center
- Real Networks Headquarters
- SFPUC Headquarters
- Tommy Bahama Headquarters

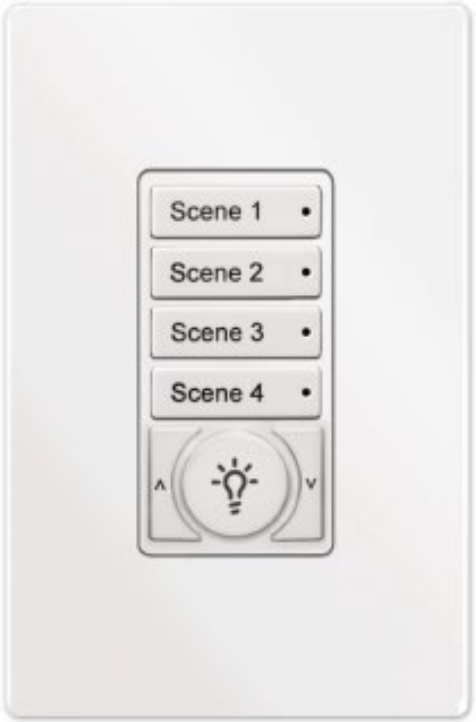
AIA COTE Top 10

- REI Flagship Store Denver
- King Abdullah University of Science and Technology
- San Francisco PUC Headquarters
- Manitoba Hydro Place

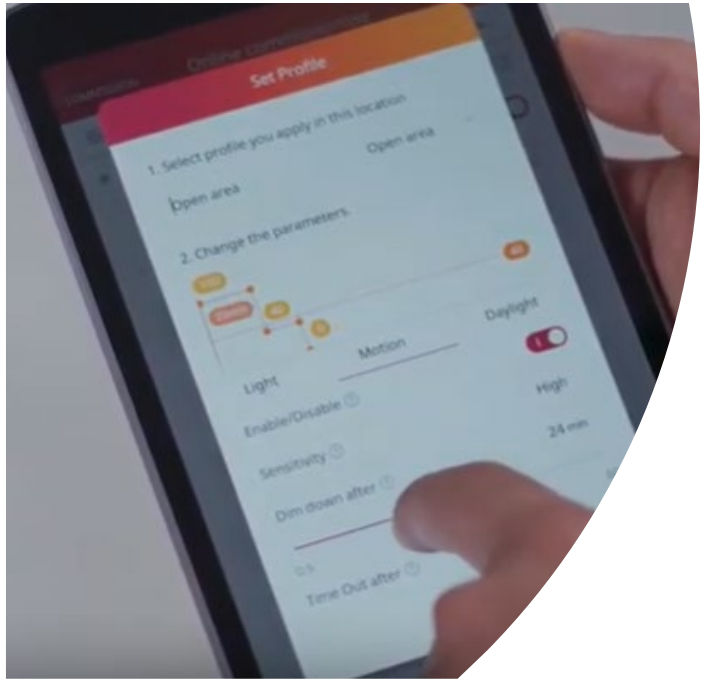
The NLC User Experience

refers to the way modern lighting systems are operated

Wall Stations



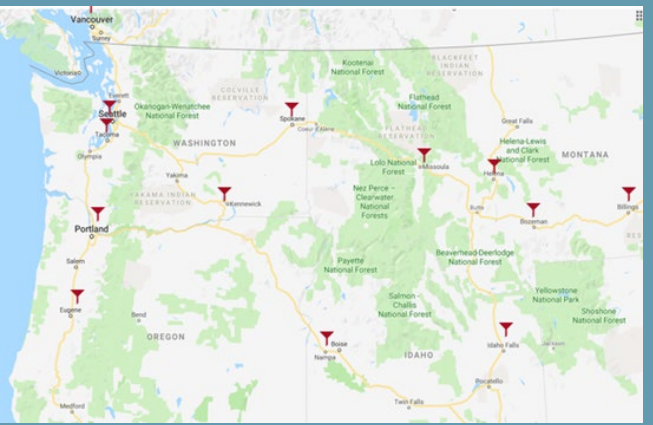
Configuration Apps



lighting design lab

The NLC UX… Why did we want to focus here?

The *AHA* moments!



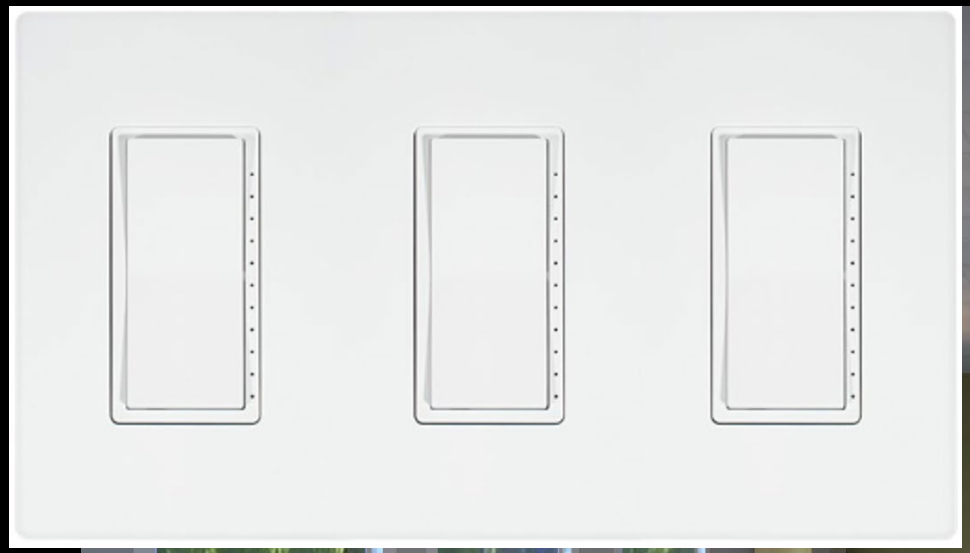
& the Industry Feedback

Two Minute Refresher

Lighting Scenes: Full Lights

Lighting Scenes: Test Time

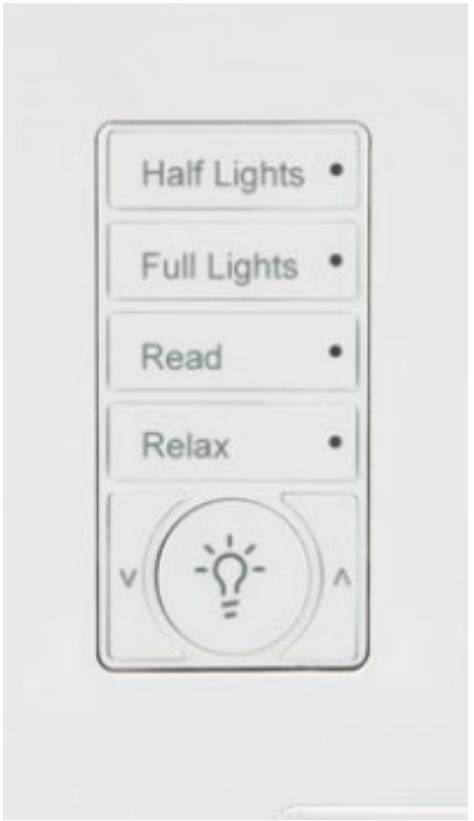
Lighting Scenes: Presentation



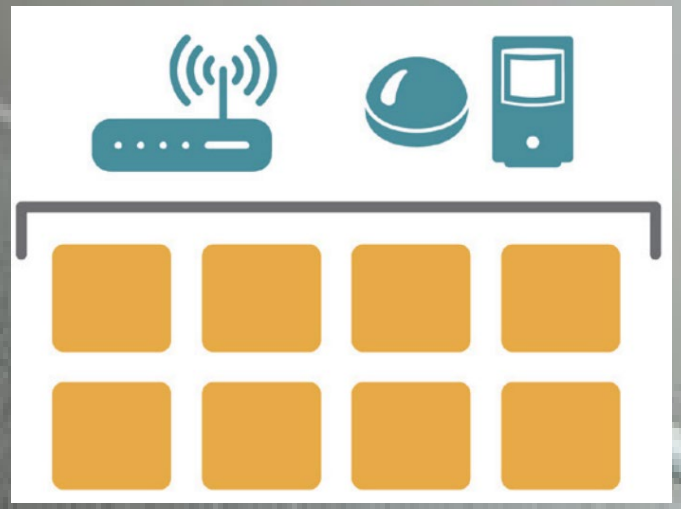
Introduction: Multi-Scene Wall Stations

Single touch scene control a big deal

Office Scenes:	Description
Half Lights	50%
Full Lights	100%
Read	30%
Relax	3%
Off / On	0% - 50%

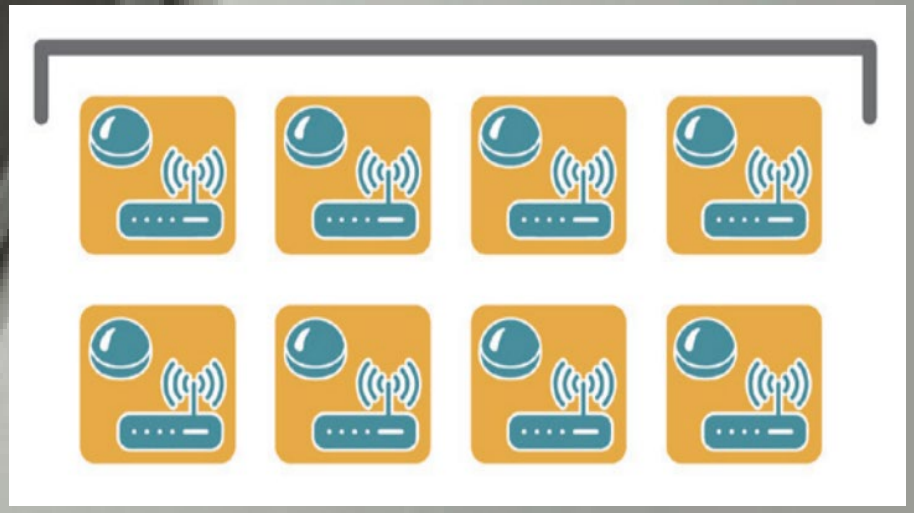


Basic NLC Configuration



1 : Many

LLLC Configuration



1 : 1

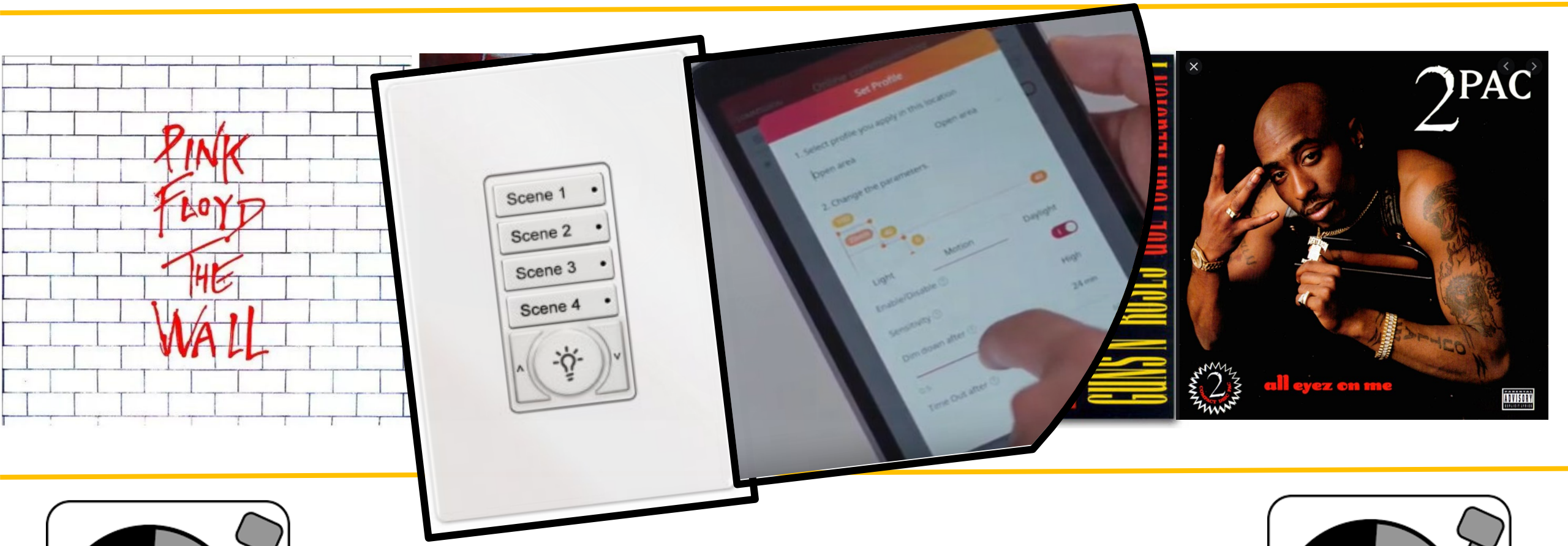
Luminaire Level Lighting Controls
are **Networked Lighting Controls**

The Super User,
Tunnel Vision Paradox

Don’t focus on the brands

Focus on the features & design approaches

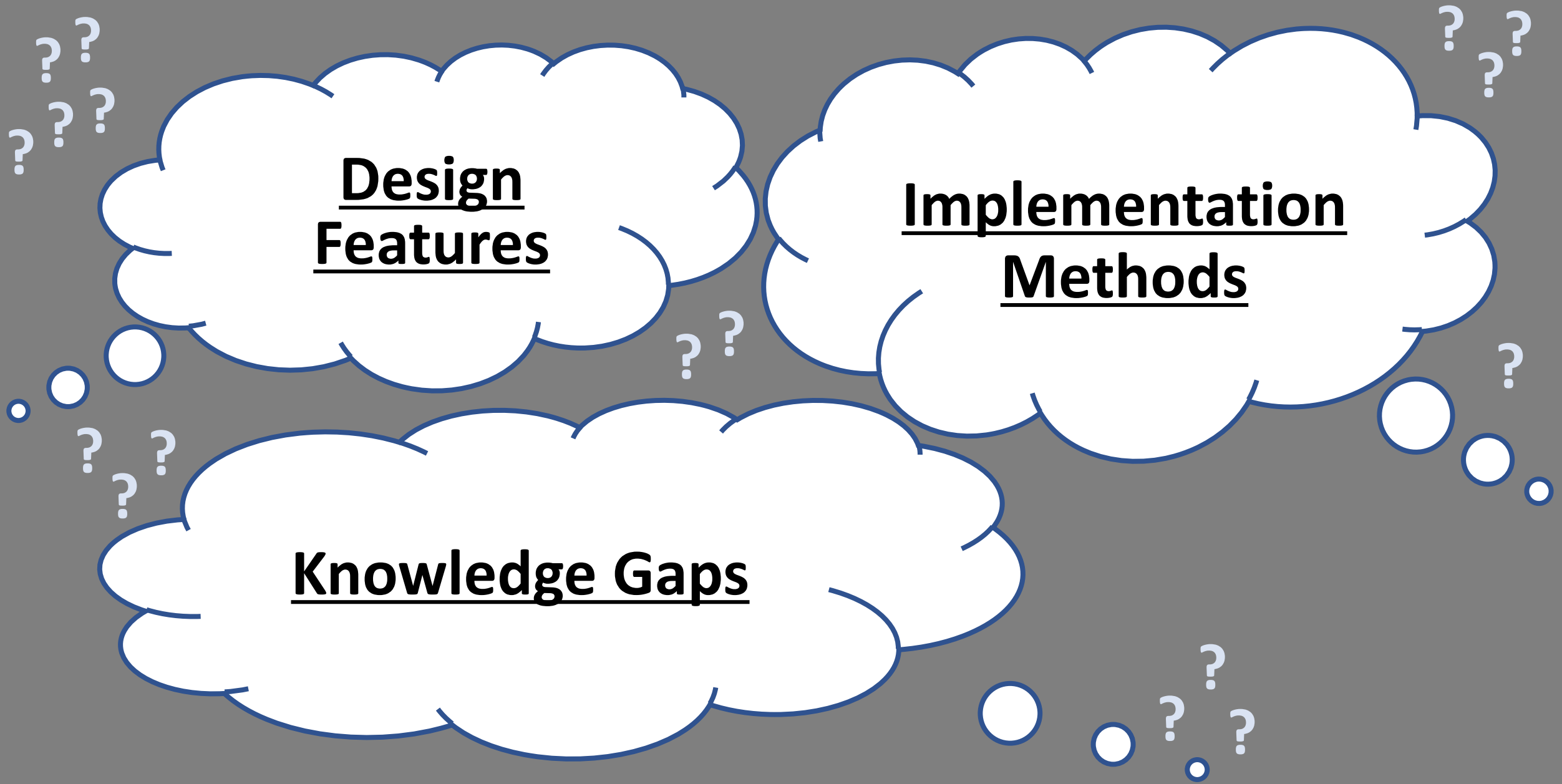
THE NLC USER EXPERIENCE



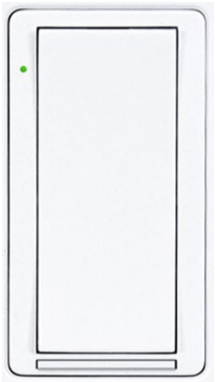
DOUBLE ALBUM

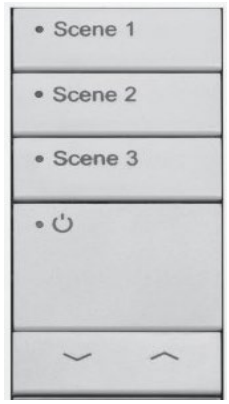
Wall Station Survey

Inquiring Minds Wanted to Know…



Observing the Market



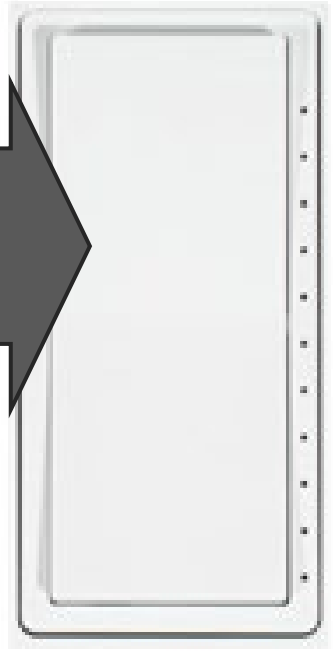


Summary of What We Observed: Old Meets New

Single-Scene

Multi Scene

≤ 2 buttons



4 buttons

≥ 4 buttons

Very Simple Design	Simple Design	Simple Design	Advanced Design

Summary of What We Observed: Manual ↑ / ↓ dim (and how)

Integrated / press n’ hold

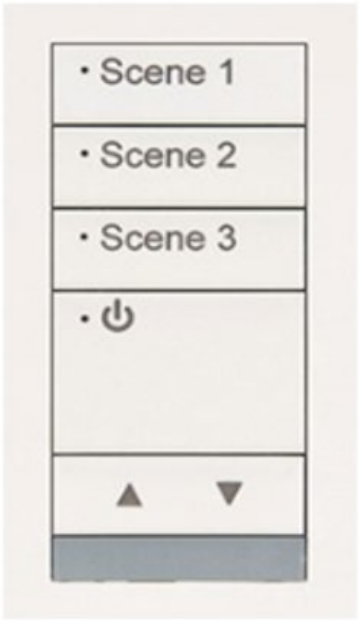
Dedicated buttons

Nada

Dedicated buttons

Summary of What We Observed: Approaches to Labeling

six approaches to labeling



No labeling

Indicator lights

Icons

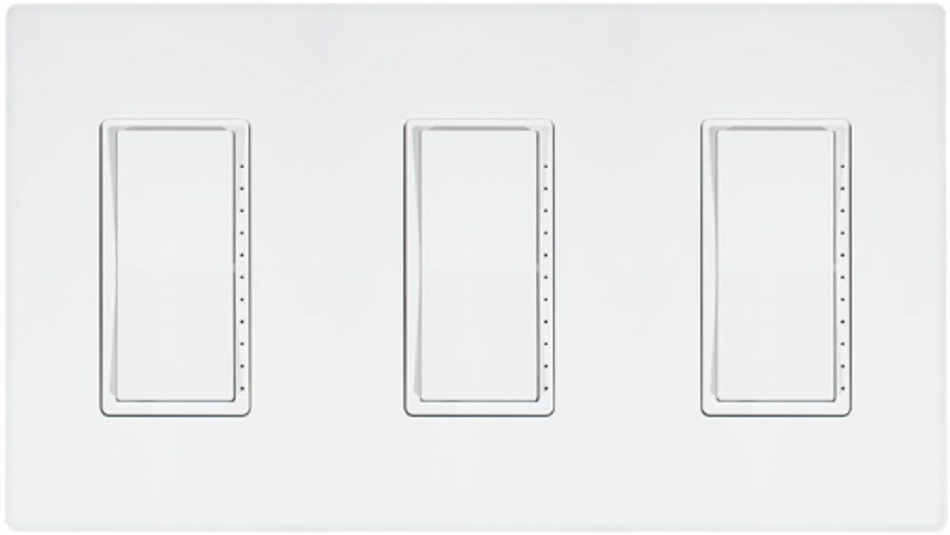
Generic text

Specific text

Hybrid

Summary of What We Observed: Space type matters

What We Observed in Practice



General disconnect between

Modern system capabilities

Approaches to multi-scene space design

The right wall station for the space

Developing a Hypothesis

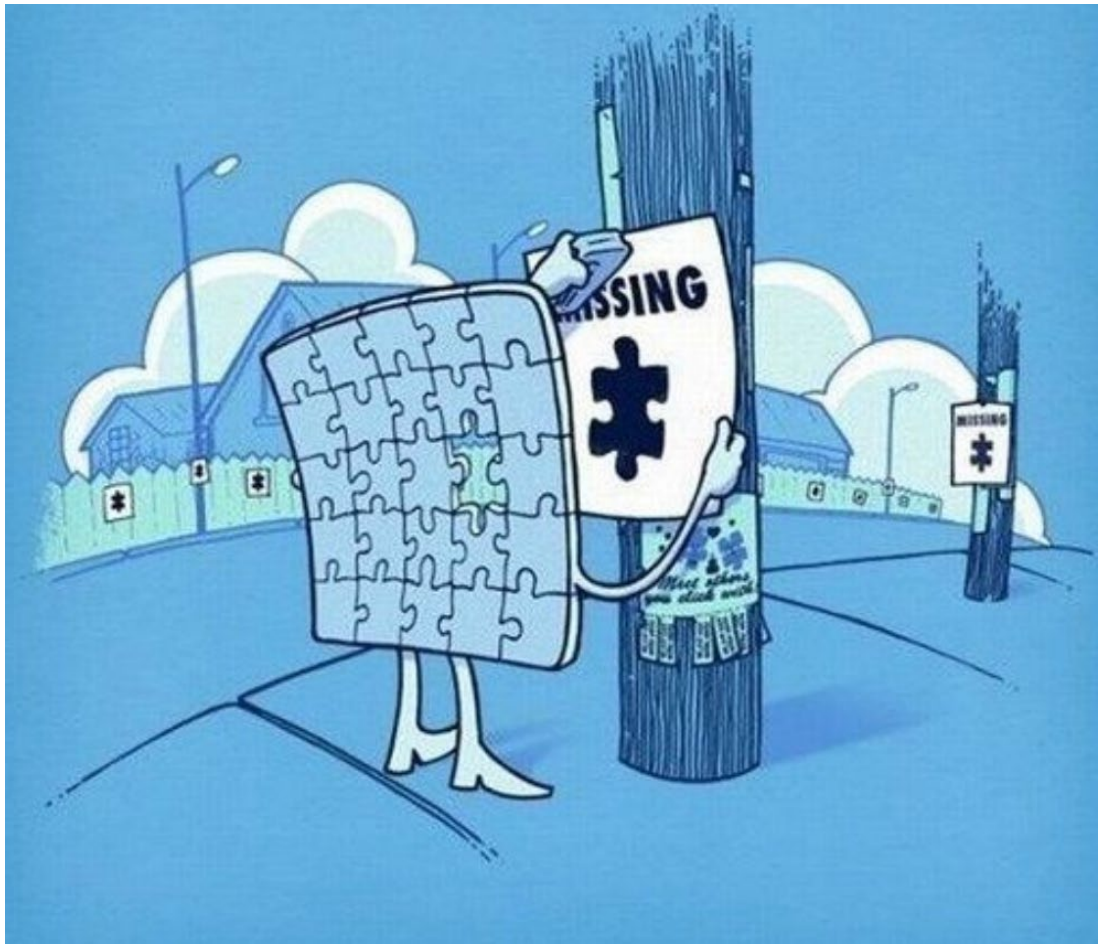
In **multi-scene** spaces, NLC systems manifest best for **tenants and facility operators** when they are

A. multi-scene based, with scene specific labeling, and

B. provide manual raise / dim as a dedicated feature.

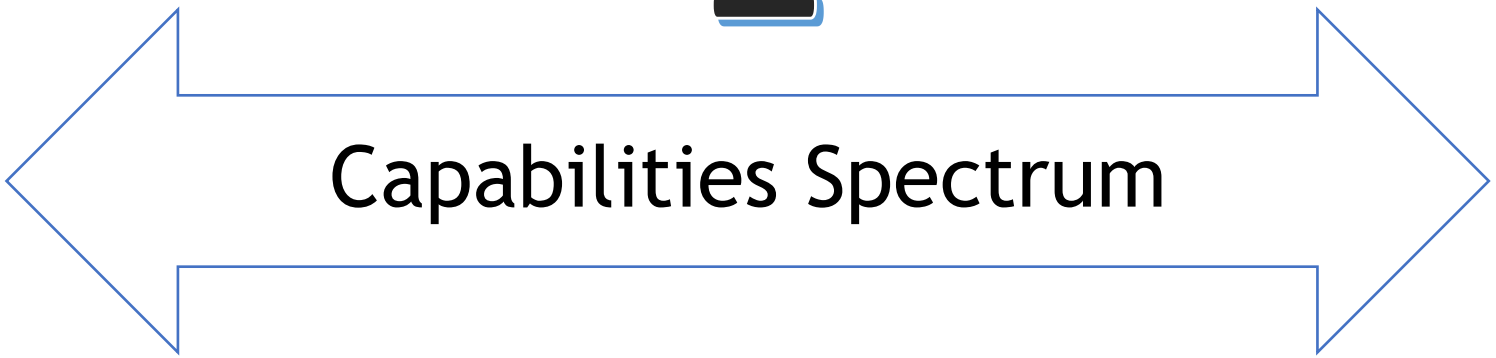
The Extra Hypothesis

User experience is <u>worse</u> for people who aren't familiar with networked lighting technology and key concepts.



Organizing the Market: Two Spectrums

1



EXAMPLES	*Objective*	EXAMPLES
Single-scene		Multi-Scene
Limited Programing		Advanced Programing
No manual raise / lower		*Includes* manual raise / lower

Organizing the Market: Two

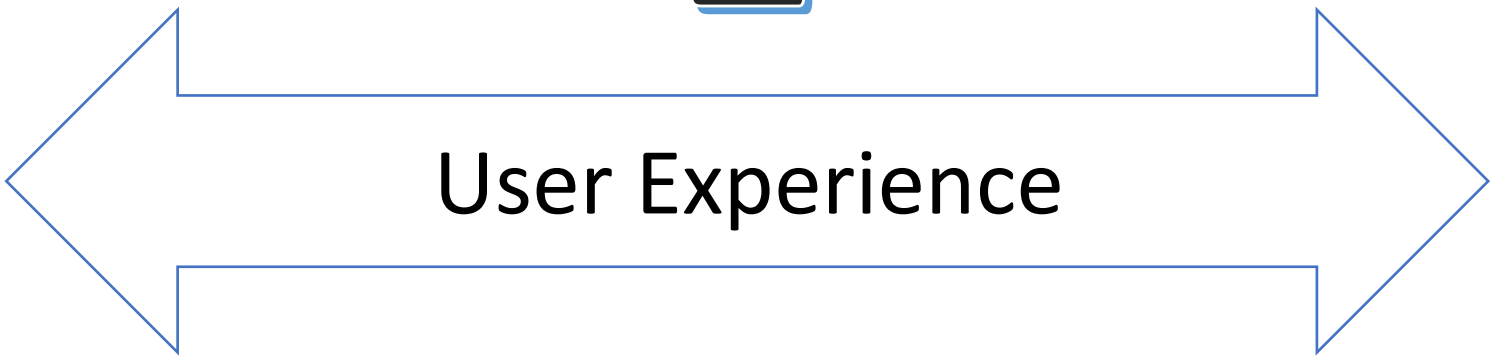
Fe re

Feat res?

The Interface Distraction

Organizing the Market: Two Spectrums

2



Which design approaches result in the best user experience?

How to Test?

Official Survey Dates
Oct. 5 to Oct. 16

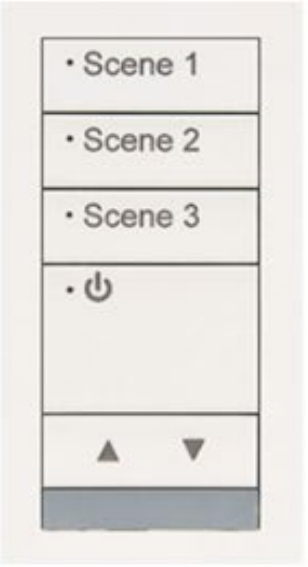
53 Questions

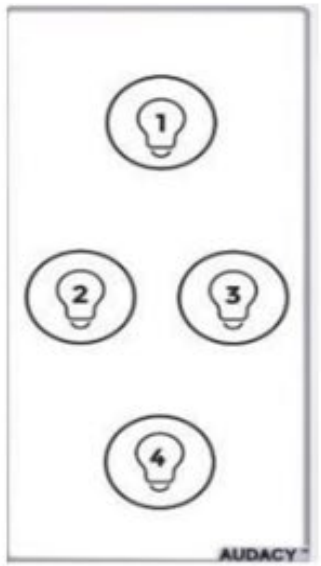
82 Complete Responses

Average Interview Time
~30 Minutes

The Wall Station Survey

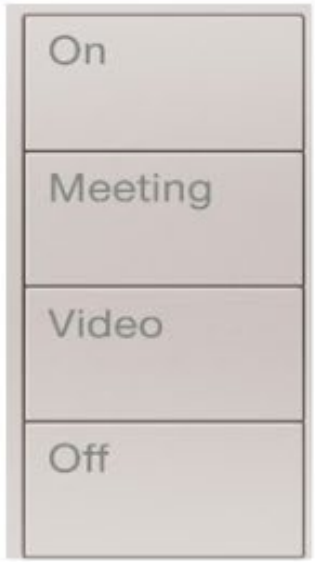
Category A





Category B

For Testing Purposes



Category C

Nine Wall Stations

Three Categories

Quick Reminder of the Main Hypotheses

In **multi-scene** spaces, NLC systems manifest best for **tenants and facility operators** when they are

A. multi-scene based with scene specific labeling, and

B. provide manual raise / dim as a dedicated feature.

YES, with lots of fun highlights!

Get to the Findings already!

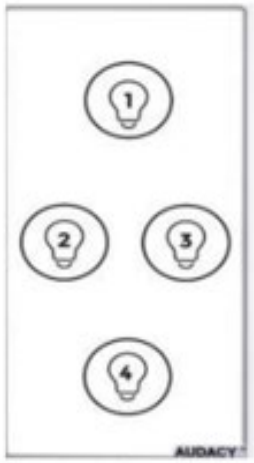
DRUM ROLL SOUND

Results: Preferred

All Wall Stations

Least preferred

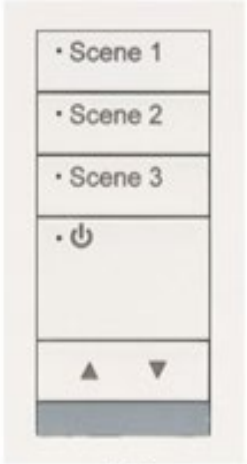
Most preferred



(6)

(4)

(1)



(5)

(3)

(7)

(2)

(8)

(9)

Top two answers

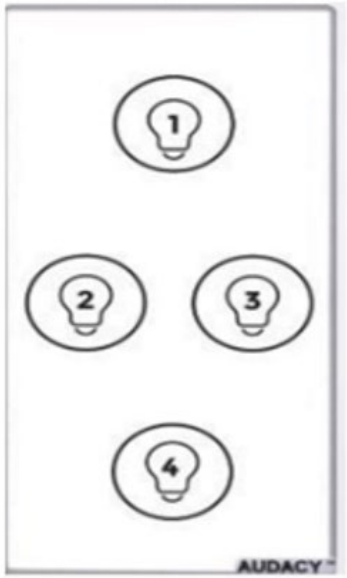
Most Intuitive

(2)

(9)

Least Intuitive

(1)



(6)

Results: Category Favorites

Category A

Favorite

(2)

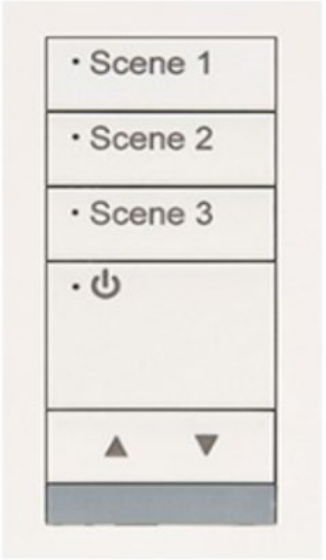
Least Favorite

(1)

Single-scene

Category B

Favorite



(5)

Least Favorite

(4)

Multi-scene, generic labeling

Category C

Favorite

(9)

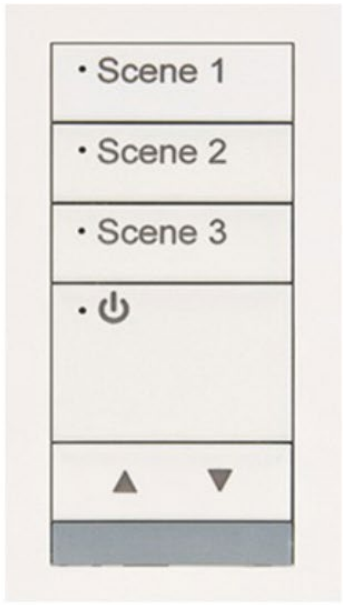
Least Favorite

(8)

Multi-scene, specific labeling

Results:

Do users prefer multi-scene wall stations *with* scene-specific labeling?



Example of **generic** scene labeling

Example of **specific** scene labeling

80% Prefer

84% Prefer

74% Prefer

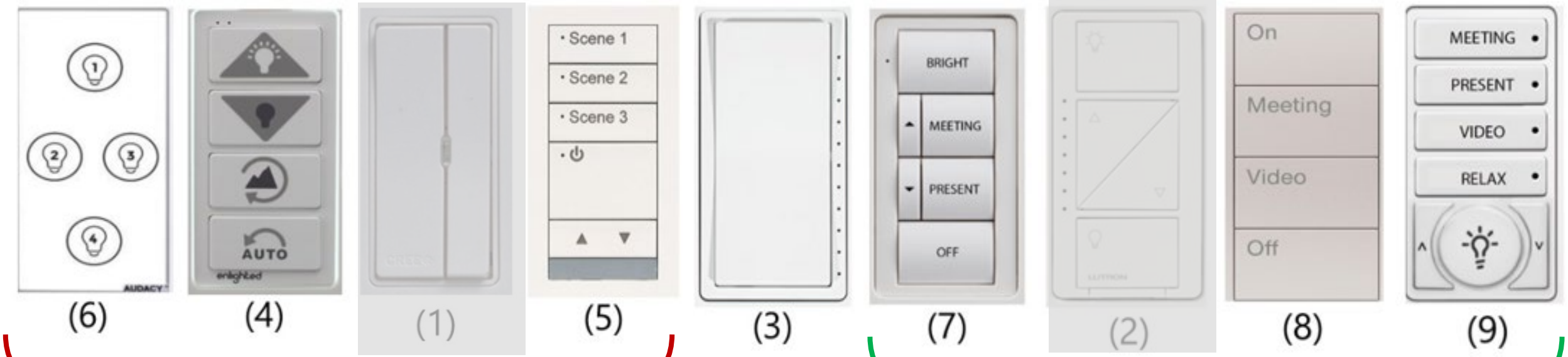
87% Prefer

Results:

Do users prefer multi-scene wall stations *with* scene-specific labeling?

Least preferred

Most preferred



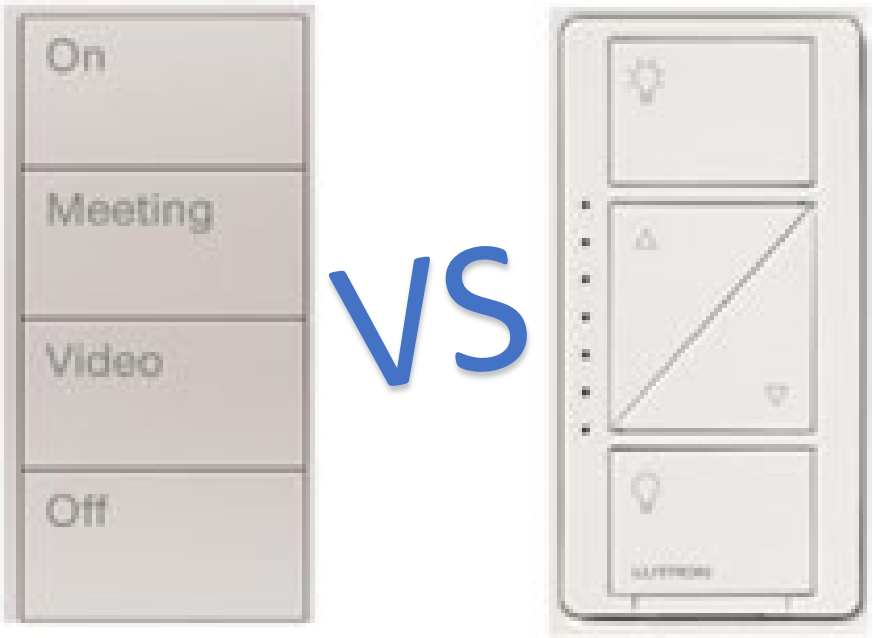
Generic text scene labeling is least preferred

Multi-Scene with scene specific text labeling is most preferred

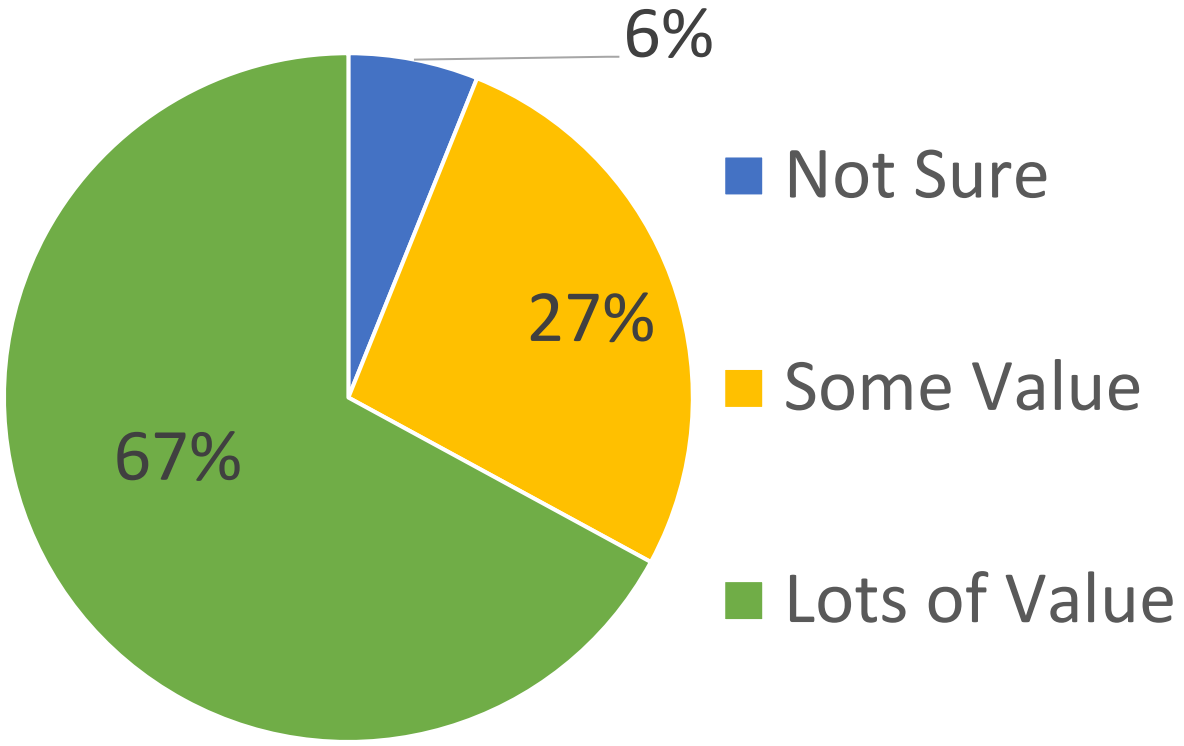
Results:

Do users prefer wall stations with manual ↑ / ↓ *as a dedicated feature*

How much do you value manual raise / dim?



94% see value



Results:

Do users prefer wall stations with manual ↑ / ↓ *as a dedicated feature*

Top two most intuitive out of all 9 wall stations

Multi-Scene

(9)

Single-Scene

(2)

What do they have in common?

Hybrid labeling

Dedicated
Raise / dim

Results:

Do users prefer wall stations with manual ↑ / ↓ *as a dedicated feature*

Least preferred

Most preferred

(6) (4) (1) (5) (3) (7) (2) (8) (9)

No ↑ / ↓

Press & hold ↑ / ↓

Includes dedicated ↑ / ↓

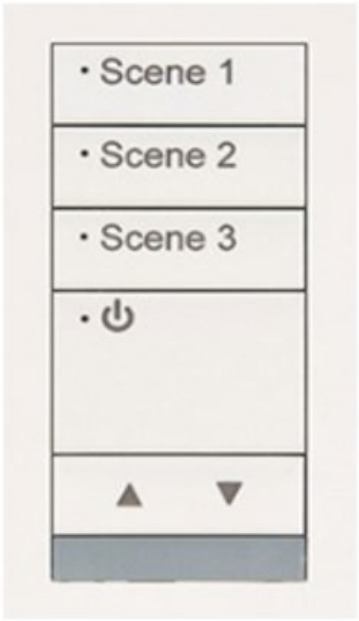
Additional Findings:

The following findings are supported by the survey results…

But further study is recommended.

Additional Findings: Approaches to Labeling

six approaches to labeling



No labeling

Indicator lights

Icons

Generic text

Specific text

Hybrid

Additional Findings: Overall Labeling Preferences

Hybrid Labeling

A closer look at single-scene

Multi-Scene

Scene Specific Text	Icons	Indicator Lights
Bright *Relax* *Read* *Off*		

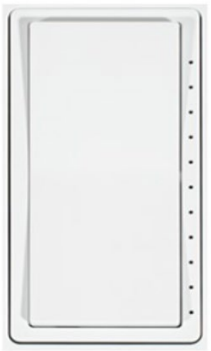
Additional Findings: Overall Labeling Preferences

Single-Scene Wall Station

(1)

Very Simple Design

1 – 2 buttons



Labeling Approach

No Labeling

OR

Indicator Lights *Only*

Simple Design

2 – 4 buttons

(2)

Hybrid Labeling

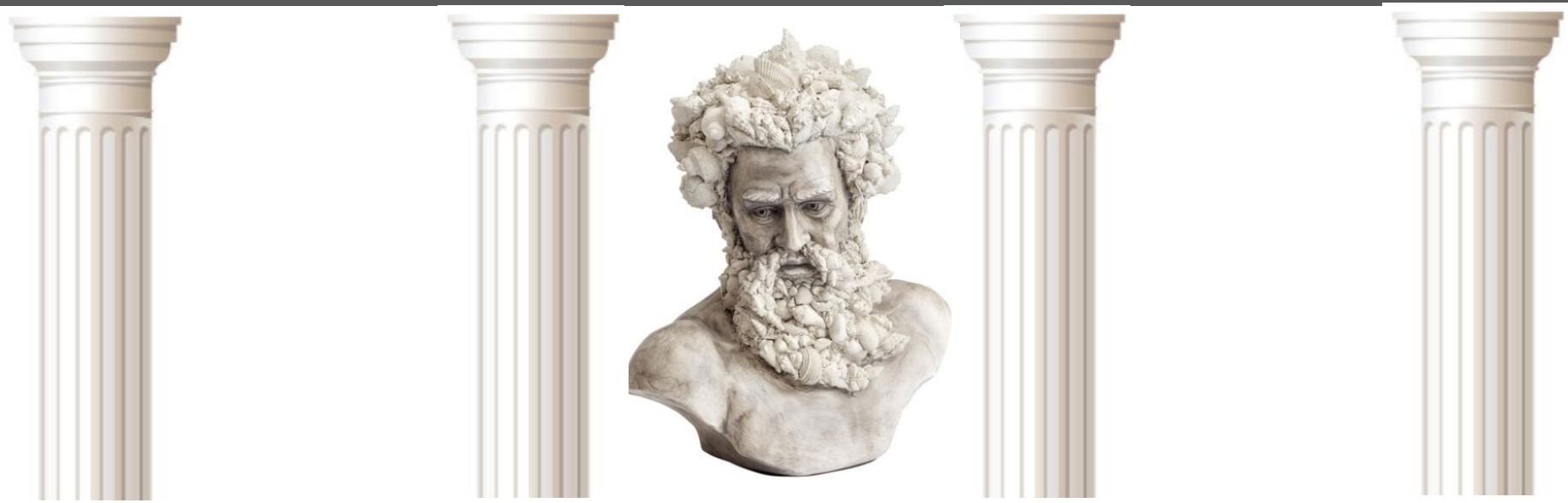
Icons

AND

Indicator Lights

Additional Findings: Approach to Design Type

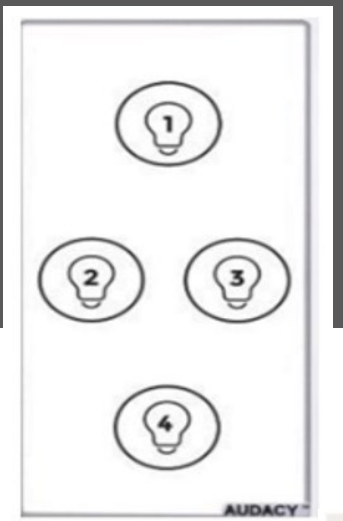
Fewer buttons does not equal simpler



Wall station #6
Least Intuitive

Additional Findings: Overall Labeling Preferences

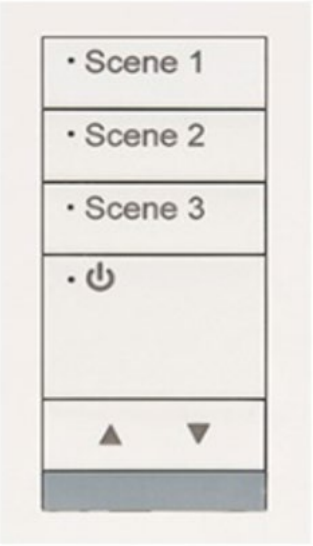
Multi-Scene with generic labeling is likely the *most* confusing



(6)

Despite leveraging multi-scene capabilities!

(4)



(5)

Summarizing Findings With Pictures

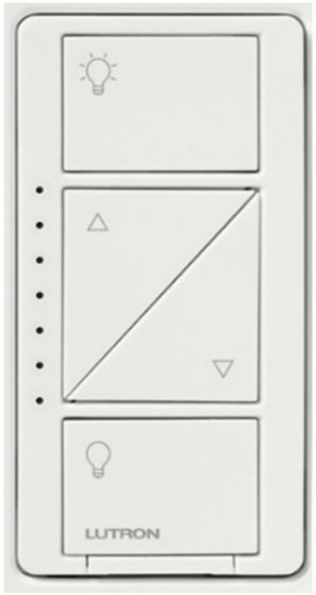
Single-scene space

Limited

Capabilities

Advanced

meets space needs



Simple Design

Hybrid Text

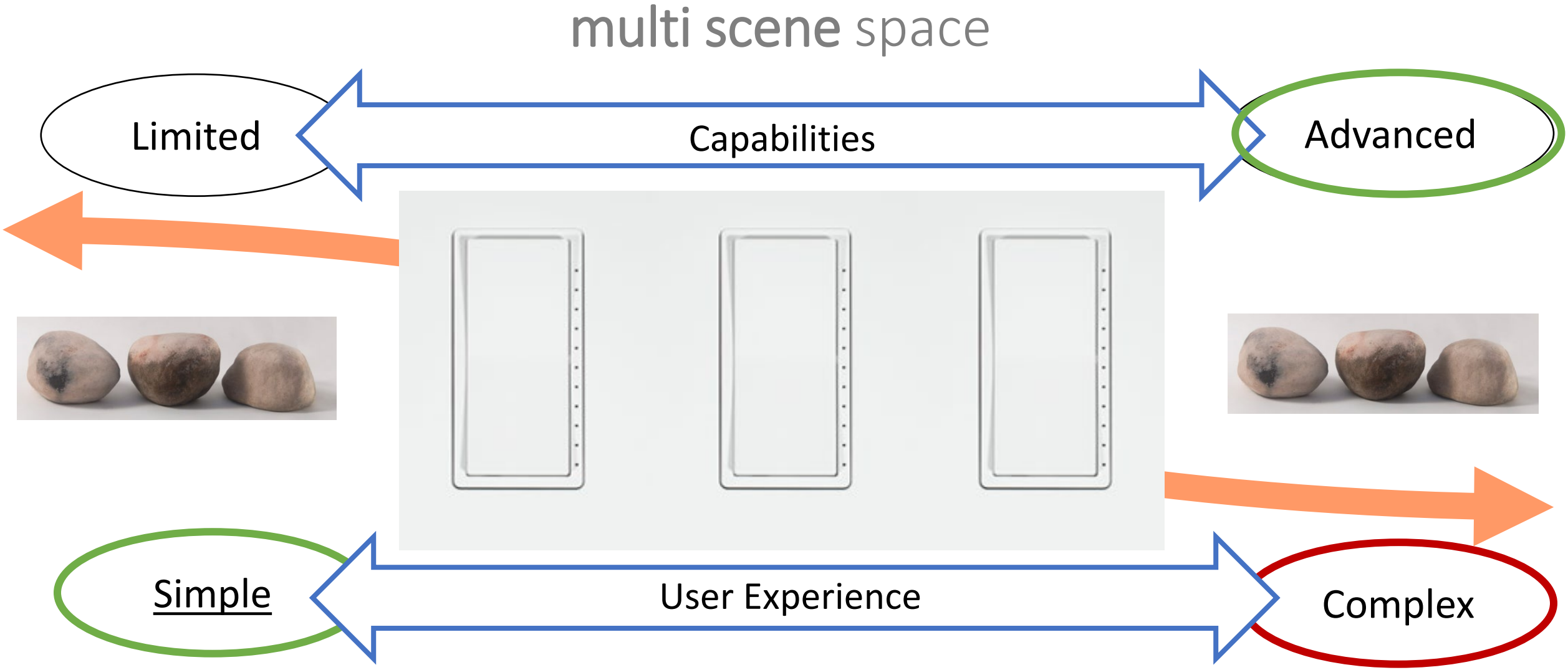
Dedicated ↑ / ↓

Simple

User Experience

Complex

Summarizing Findings With Pictures



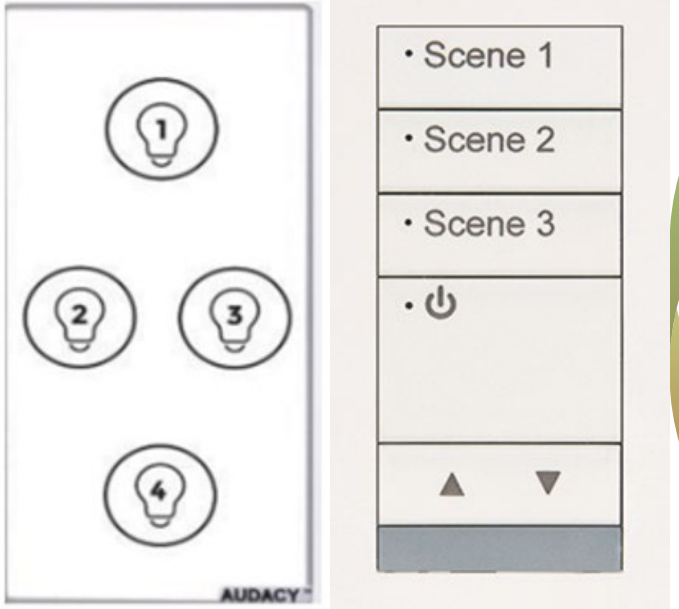
Summarizing Findings With Pictures

multi scene space

Limited

Capabilities

Advanced



Multi-Scene control meets space needs

Generic scene labeling is confusing

Simple

User Experience

Complex

Summarizing Findings With Pictures

multi scene space

Limited

Capabilities

Advanced

Scene
Hybri

Multi-Scene control meets space needs

Simple

User Experience

Complex

The Bonus Hypothesis

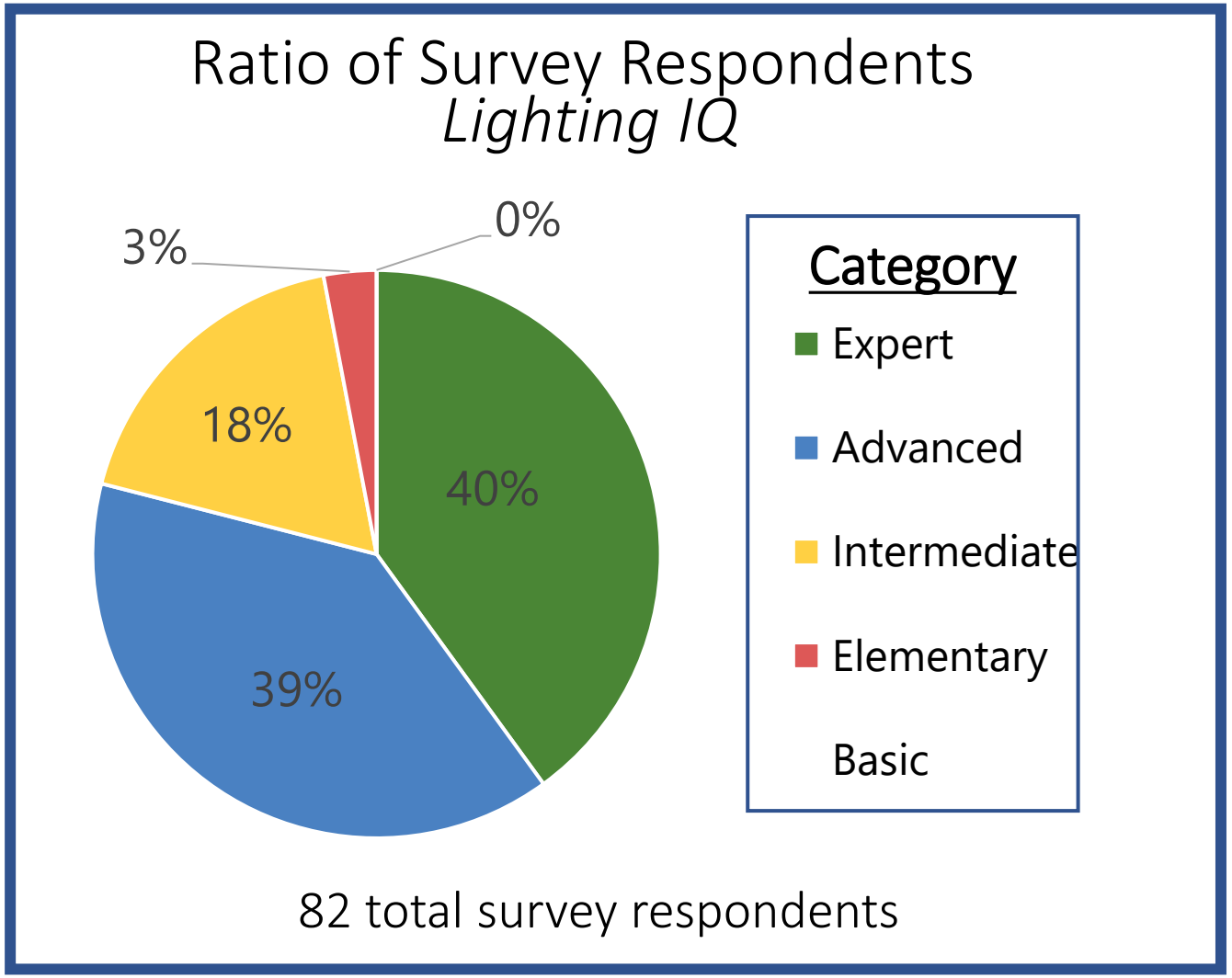
User experience is worse for people who aren't familiar with networked lighting technology and key concepts.

For purposes of simplifying & compari

(Q39) Rate your knowledge of lighting controls + (Q40) Rate your comfort with lighting controls = Self
Particip Q

You can do that!
Study wall stations in peace…

Lighting IQ



Lighting IQ was the <u>ONLY</u> significant predictor!

Not age, background, professional role, gender…

Lighting IQ Predicts A lot!

As *lighting IQ* increases… …liably shift.

Predictor	Q.	Q. #33	Q. #34
Lighting IQ	1.848*	224* ↓	-.341 ↓

Hip to scenes?

T… lig…

…ned …ning…

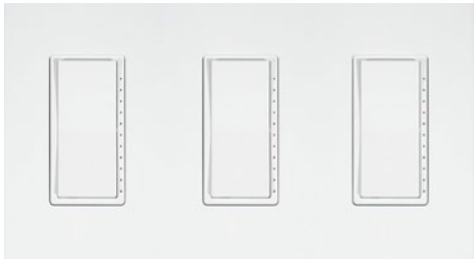
My views shifted…

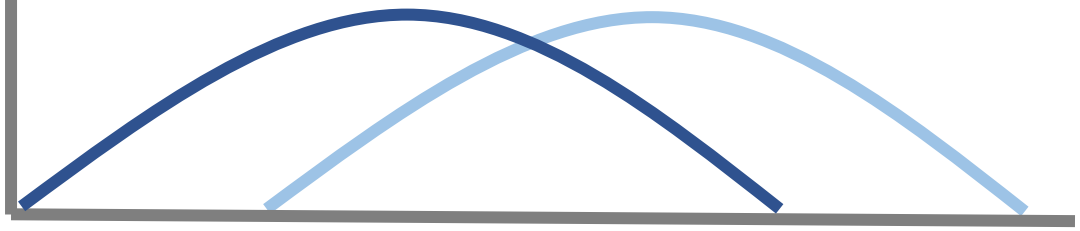
*p<.05; **p<.01; ***p<.001; standard error…

Note: prediction results for Q3 are logistic… …whereas Q28, Q31, Q33, and Q34 are OLS regression.

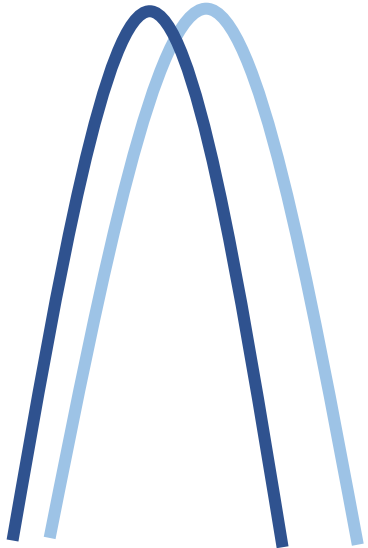
Lighting IQ Predicts Preferences

Population group with minimal lighting chops have a wide range of preferences





Population group with basic to advanced lighting chops tend to agree on design & approach



Design preference

Multi-scene approach


Look harder

Recommendation to Industry

1

Download the report & check it out!

2

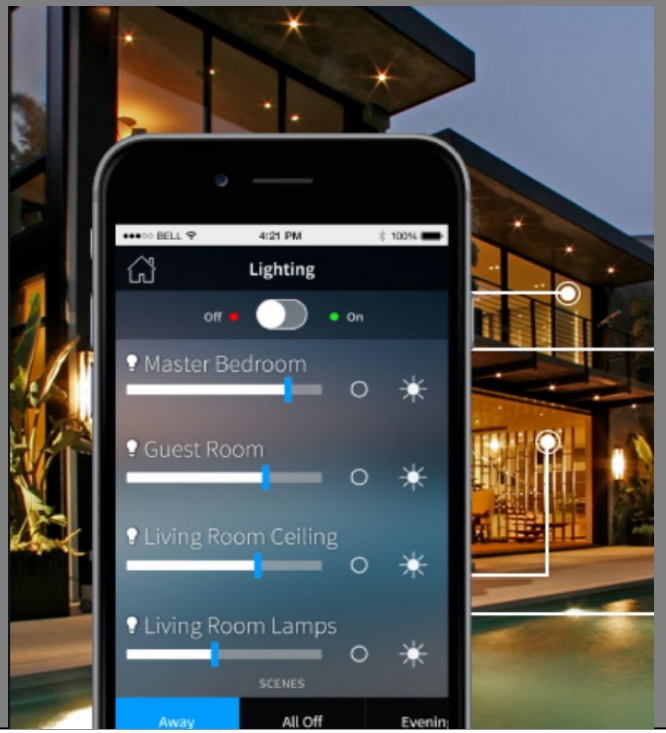
Make this part of your value-add!

Include customers earlier

Make the process easier

3

Track residential lighting app trends for digital interface insights



QUESTIONS?

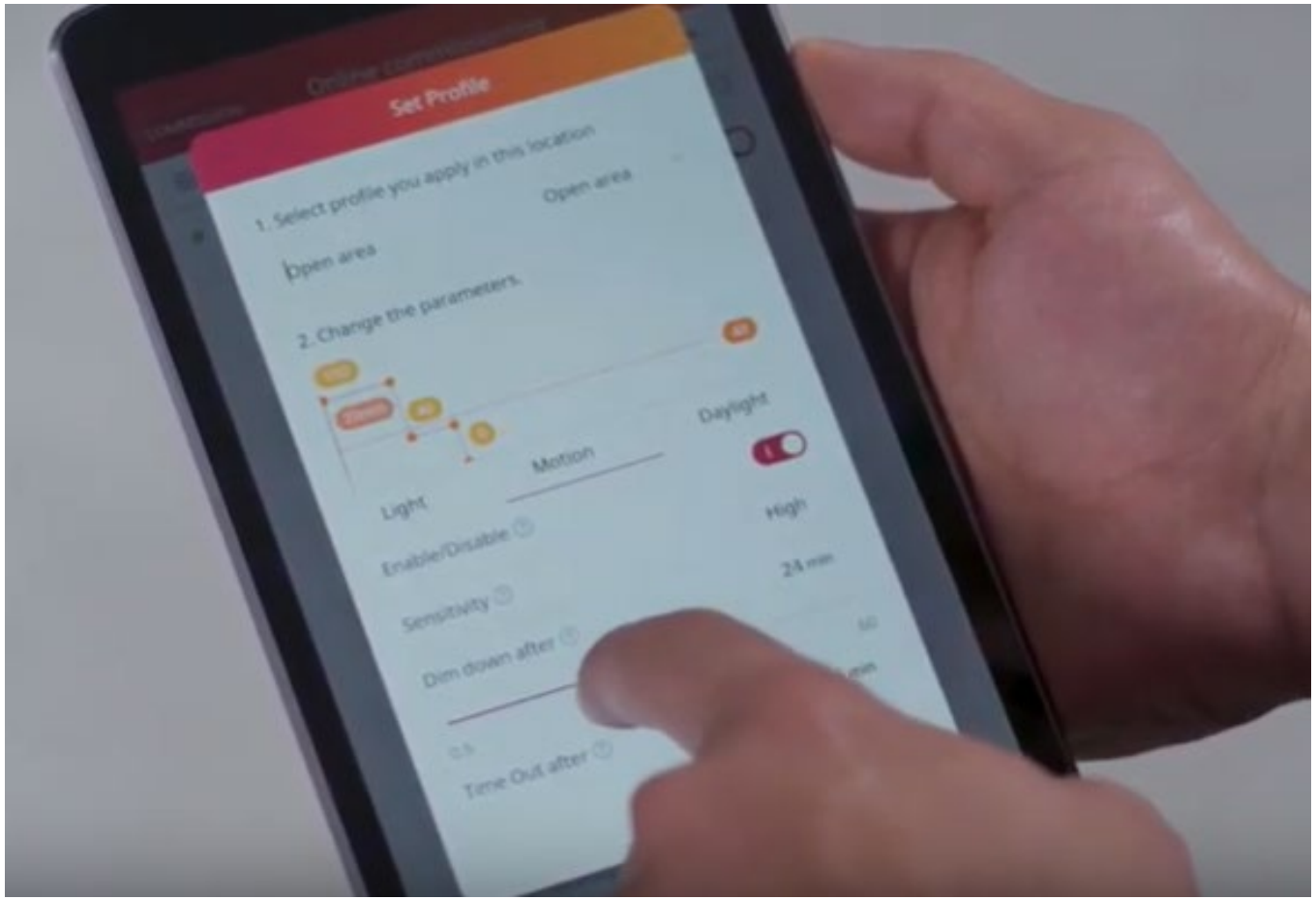
lighting design lab

App-Based Configuration Tools

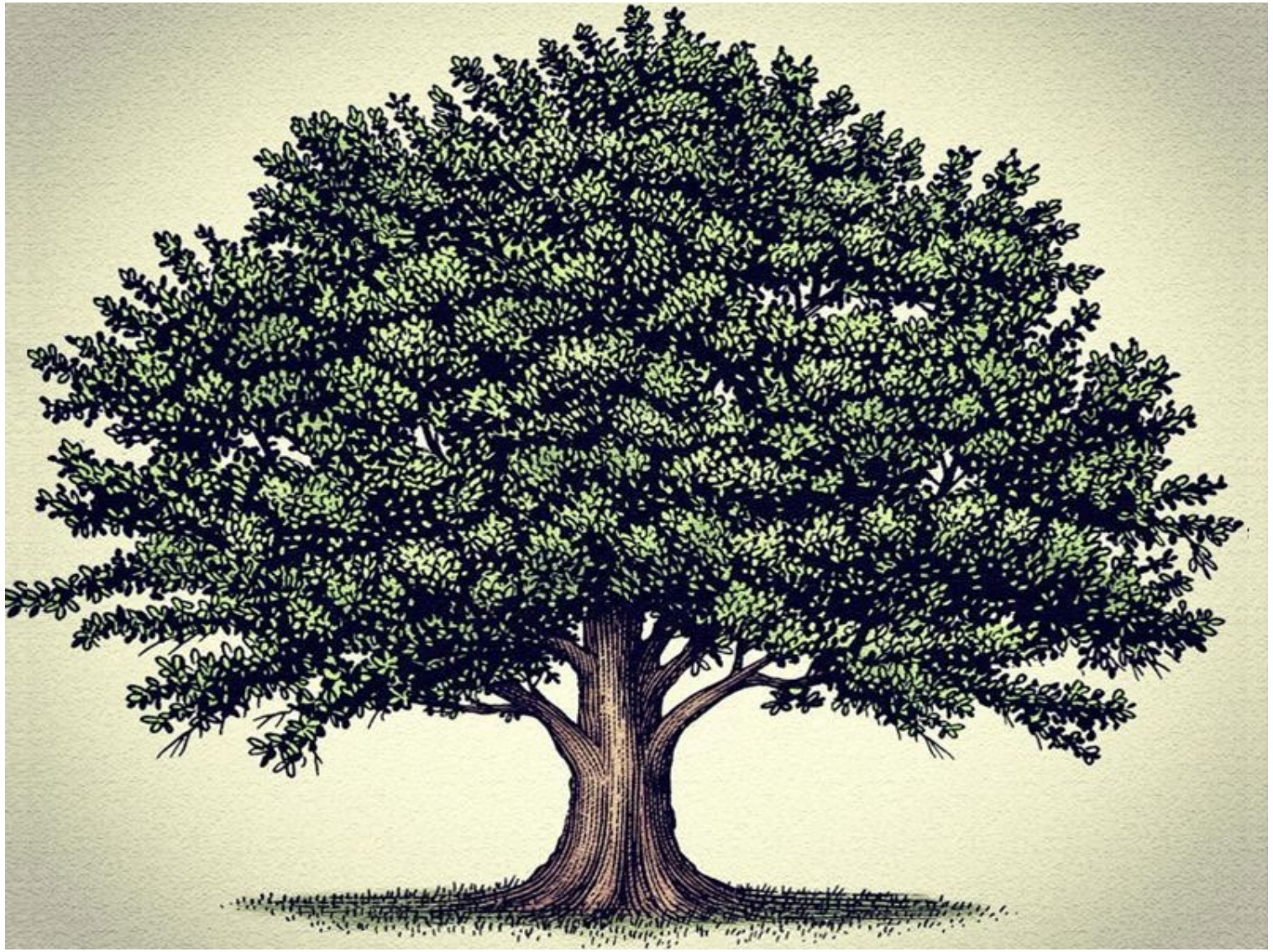
Why Configuration Tools?

- How *MOST* modern NLC lighting systems are
  - Setup
  - Programming
  - Commissioning

- Increasingly App based



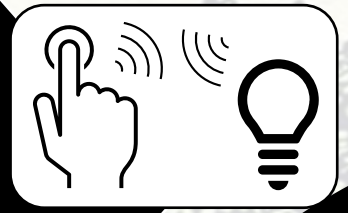
NLC CONFIGURATION TOOL UX



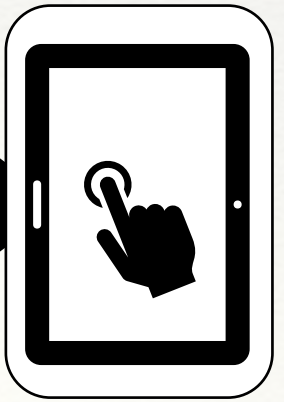
Lots of different approaches

NLC CONFIG. TOOL UX EVOLUTIONARY TREE

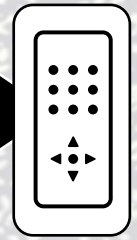
Click & Pair



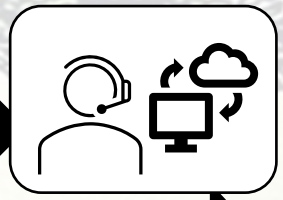
App Based



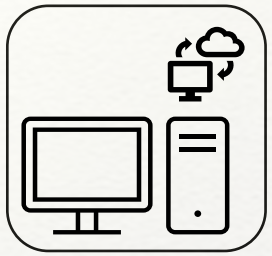
Remote Control



Cloud Based Service *Only*



Desktop Applications - *enterprise systems*



Original Project Approach

In-person guided interviews

Participants guided through a randomized selection of 2 of 6 available systems

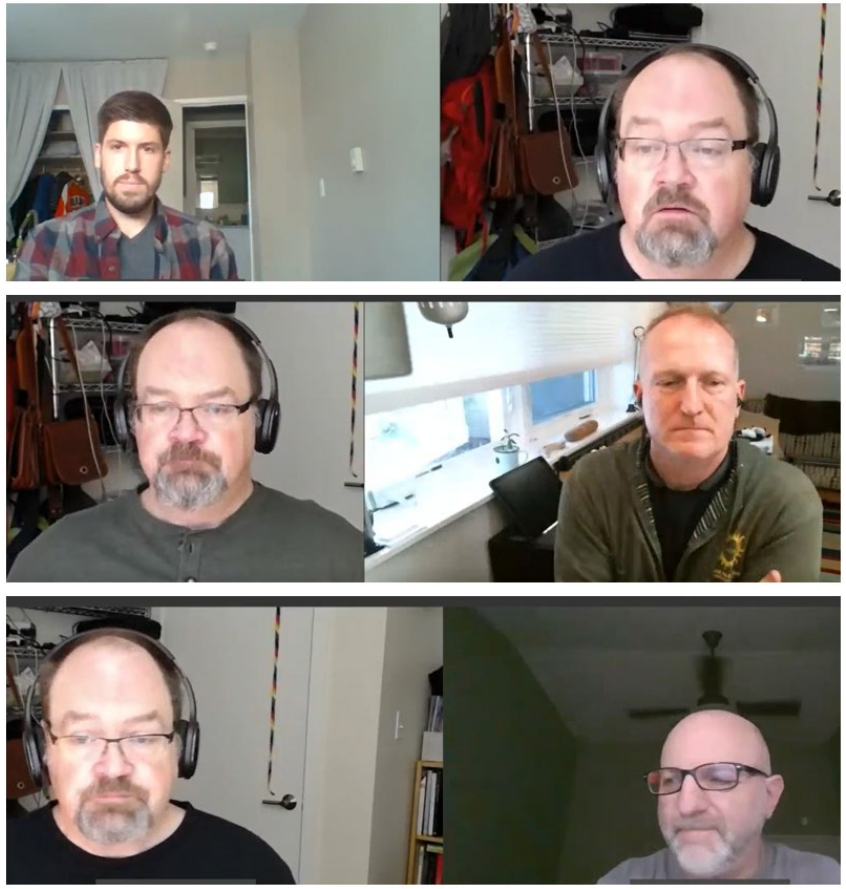
1. Basic setup
2. Adding & pairing devices
3. Creating scenes
4. Configuring primary control Strategies

Better 1? *Better 2?*

The best laid schemes of mice and men…

New Project Goals for Configuration Tools

- Leverage the Configuration Tool Matrix we developed to understand and catalogue system approaches
- Conduct interviews with NLC manufactures to document a spectrum of system approaches
- Identify market trends that are facilitating market adoption
- Incorporate into LDL Tools & Resources – and share the good word with industry partners



What's Past is prologue

NLC Hands-On

Workshops

2-4 Systems

Per Class

Delivered

Regionally

With 8 rotating

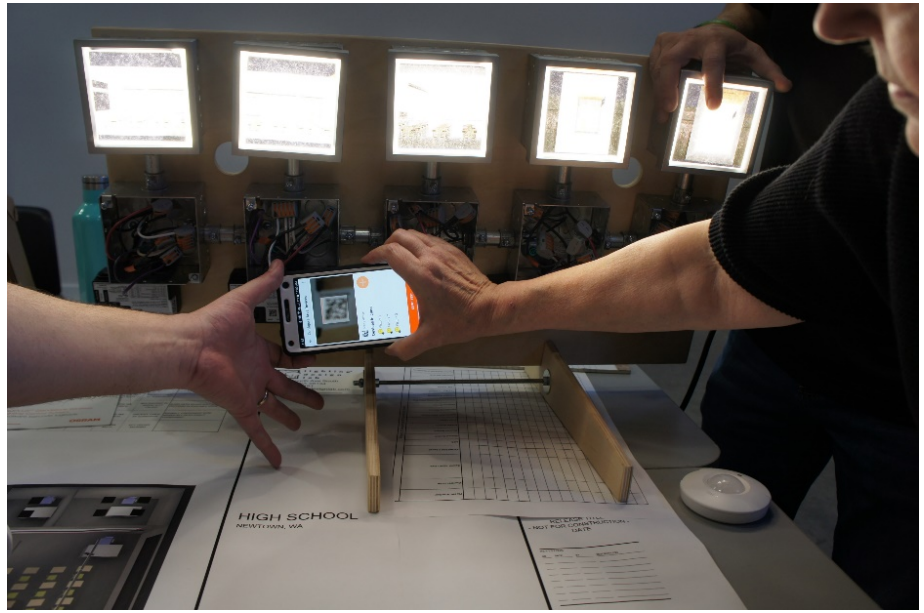
Manufacturers

Talk back with

Manufacturers & Reps

Participant Feedback

NLC Systems	LLLC Systems
Crestron – Zum	Lutron – Vive
ETC - Echoflex	Cooper - Wavelinx
Ideal - Audacy	Acuity – nLight Air
Osram – Encellium Edge	Cree – Smart Cast

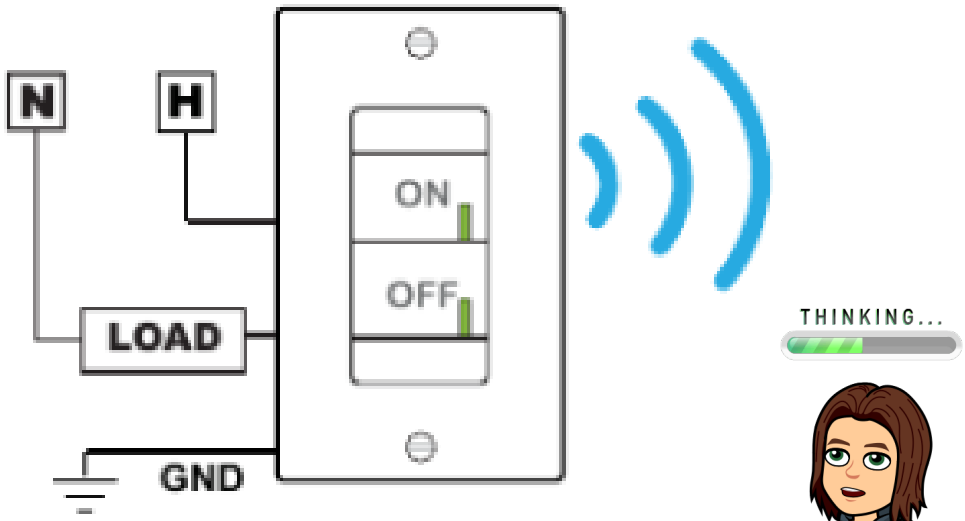


Where We've Been

The Click & Pair Paradigm

Simple on one level…

But confusing on other levels



Limited capability

Desired Timeout (Minutes)	Number of Flashes from Light/Motion Sensor
1 Minute	2 Flashes
5 Minutes	3 Flashes
15 Minutes	4 Flashes
30 Minutes	5 Flashes

lighting design lab

Typical Control Strategies

- Manual Switching
- Manual Dimming
- Scene / Preset Control
- Occupancy / Vacancy Sensing
- Daylight Harvesting
- Task Tuning
- Time Scheduling
- Astronomic Scheduling

- Color selection
- Tunable White
- Circadian Lighting

Sequence of Operations - Setup

- What are the time and astronomic schedules
- Which sensors are vacancy and which are occupancy?
- What is the vacancy timeout?
- What are the target light levels for task tuning?
- What switches or dimmers are tied to which zones?
- What zones are included in each preset and at what levels?
- What are the daylight zone dimming thresholds?
- Are there any specialty programming tasks like partition controls?

lighting design lab

App Based Programming Tools

Potential Benefits of the App Based Approach

- Open / easy access
- Extended programming capabilities
- Time saving opportunity
- May guide the user through the process
- May provides visual confirmation
- May have integral help features

Some can still be confusing!

lighting design lab

Configuration Tool Hypothesis: Apps work best for users when…

Multiple devices can be discovered (and paired) in a single process

Repetitive actions have streamlining shortcuts

Primary control methods are easy and obvious to access and modify

Integral Help Features

Stepping Back to Observe the Market

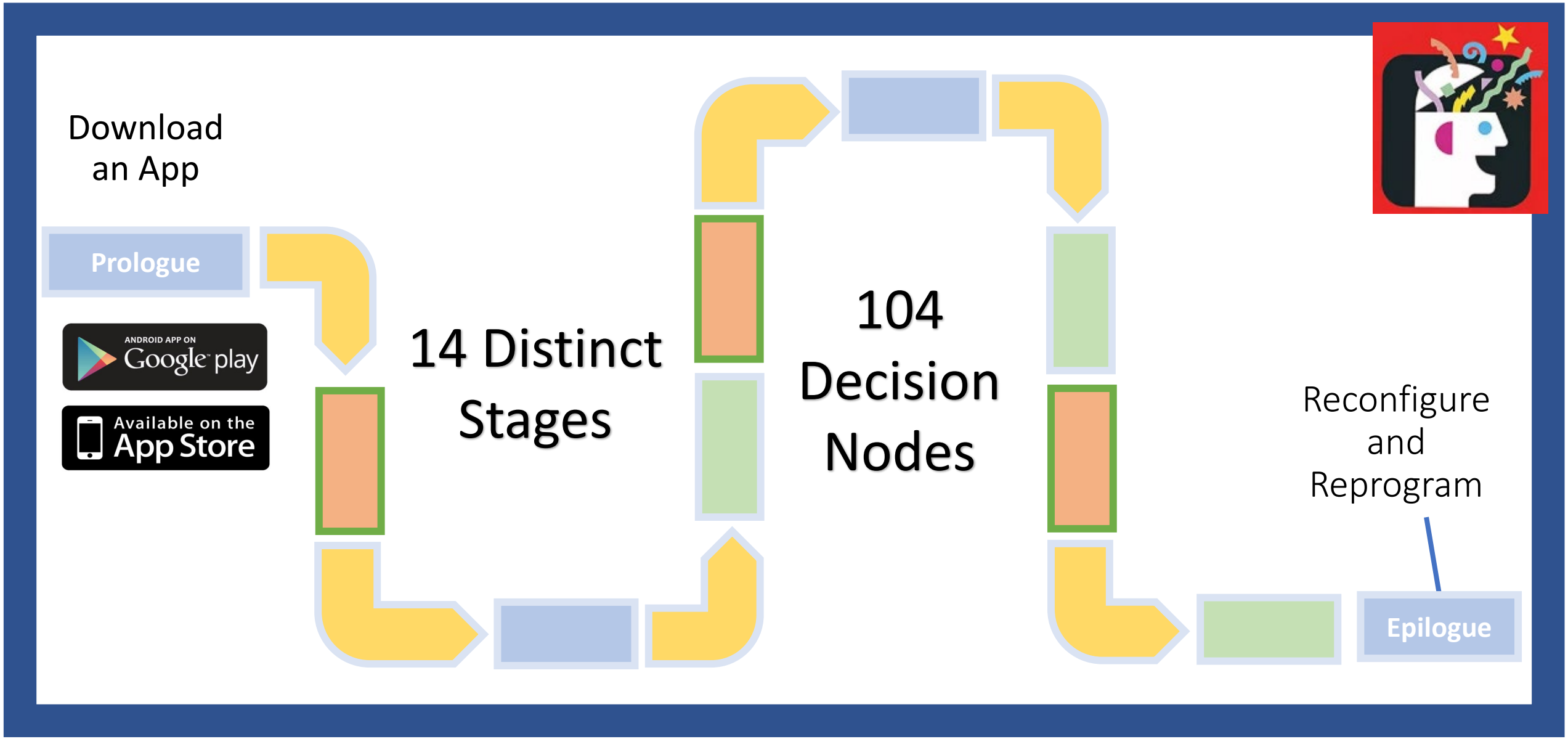
How do these apps really work from the end user perspective?

Where are the commonalities?

Where are the points of divergence?

What can we learn from both?

Where to begin? What are the common system setup steps?



14 Key stages for most system setup

Programming Apps

Networking

Device Discovery

Area / Room Setup

Loads and Zones

Sensor Hardware

OS / VS Configuration

Daylight Configuration

Task Tuning / High End Trim

Scene Programming

Wall Station Hardware

Wall Station Configuration

Demand Response

Streamlining

Help / Documentation

Reporting / Dashboarding

Offline Functionality

Full Reprograming

How LDL Prioritized

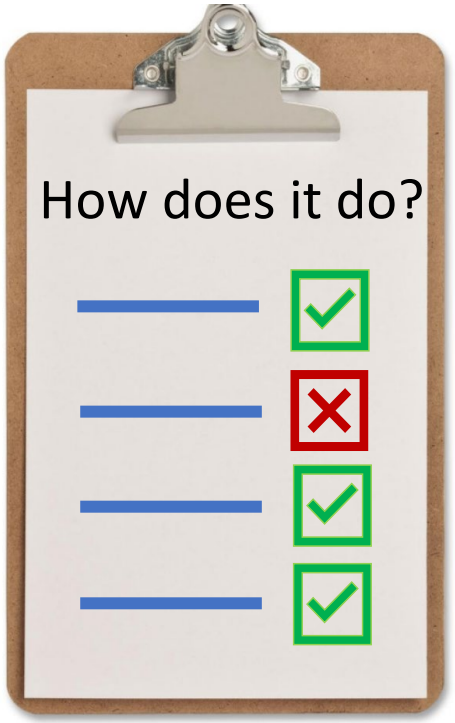
The key concepts and focus areas that were prioritized for the Interview Process

- Programming commonalities
- Programming divergences
- Can save time
- Cause most confusion
- Adds barriers
- Removes barriers

Simplify, Simplify, Simplify…..

Completed Interviews or Discussions

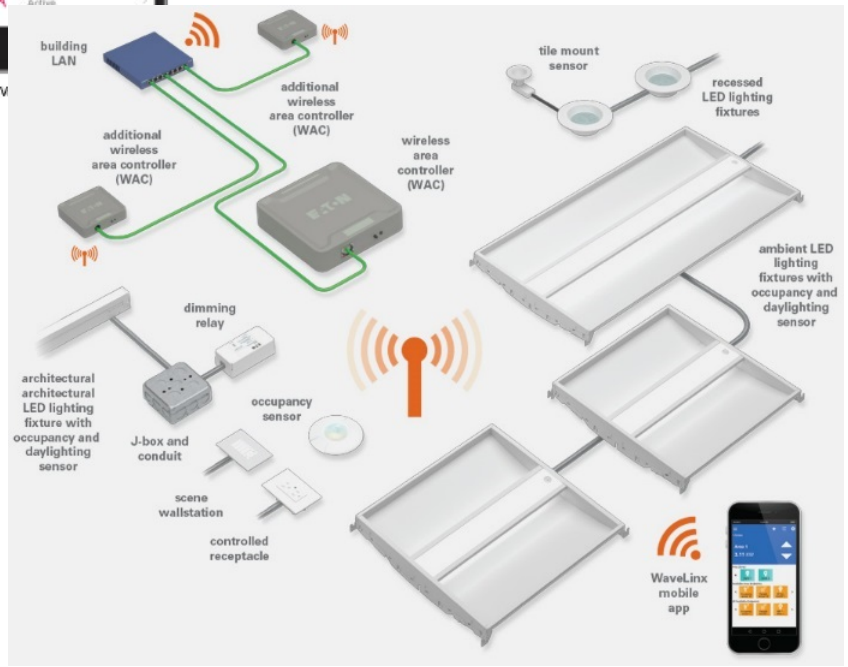
LLLC Systems	NLC Systems
Acuity nLight Air	OSRAM Encellium Edge
Cooper Wavelinx	Crestron - Zum
Hubbel NX	Ideal - Audacy
Lutron Vive	RAB – Light Cloud*
	ETC – Echoflex*



Let’s walk through your configuration tool…

Networked Lighting Controls Today

- Distributed
- Wireless
- More Capable
- More Complex
- Less Complicated
- Less Costly
- Easier to Install / Setup
- Compatible
- Integrated
- Better!



Courtesy: Lutron, Cooper

Most systems share some common features:

Hardware:

- Similar kit of parts
- Wired and wireless devices
- Wide range of wall stations
- Labelling Options
- Easy to specify
- Easy retrofit opportunities
- LLLC?

Setup and Programming:

- Occupancy/Vacancy Configuration
- Advanced sensor options
- Simple High End Trim
- Simple Demand Response
- Scene based
- Wall Stations Preconfigured

First, a note about vocabulary….

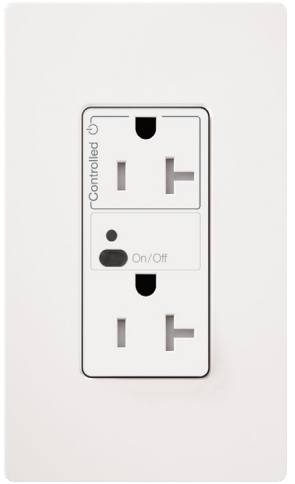
“England and America are two countries separated by the same language!”

- Among the most frequent discussion points at NLC Classes
- Is it a Zone? Group? Channel? Room? Area?
- Wait – I thought a group was a collection of zones
- Is it High End Trim or Task Tuning?
- Do I pair sensors to zones or devices to rooms….or areas…or…..zones…..or….
- Why can’t we all just get along?

Device Discovery

Kit of Parts Approach

- Load Controllers
- Digital Driver Controllers
- Sensors
- Wall Stations
- Receptacles
- Ancillary Devices



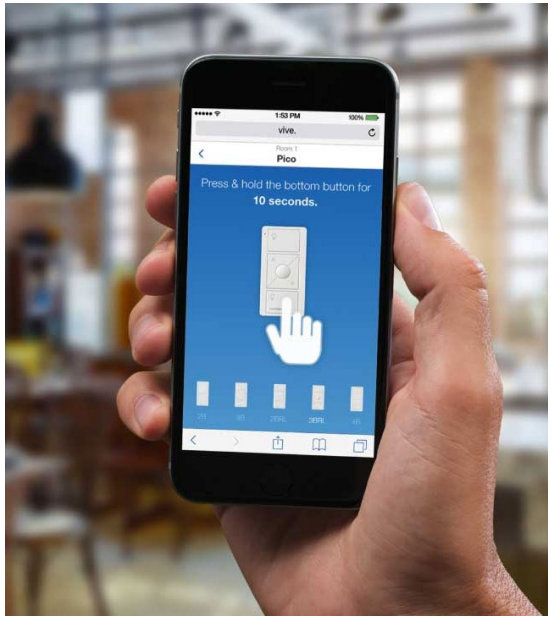
lighting design lab

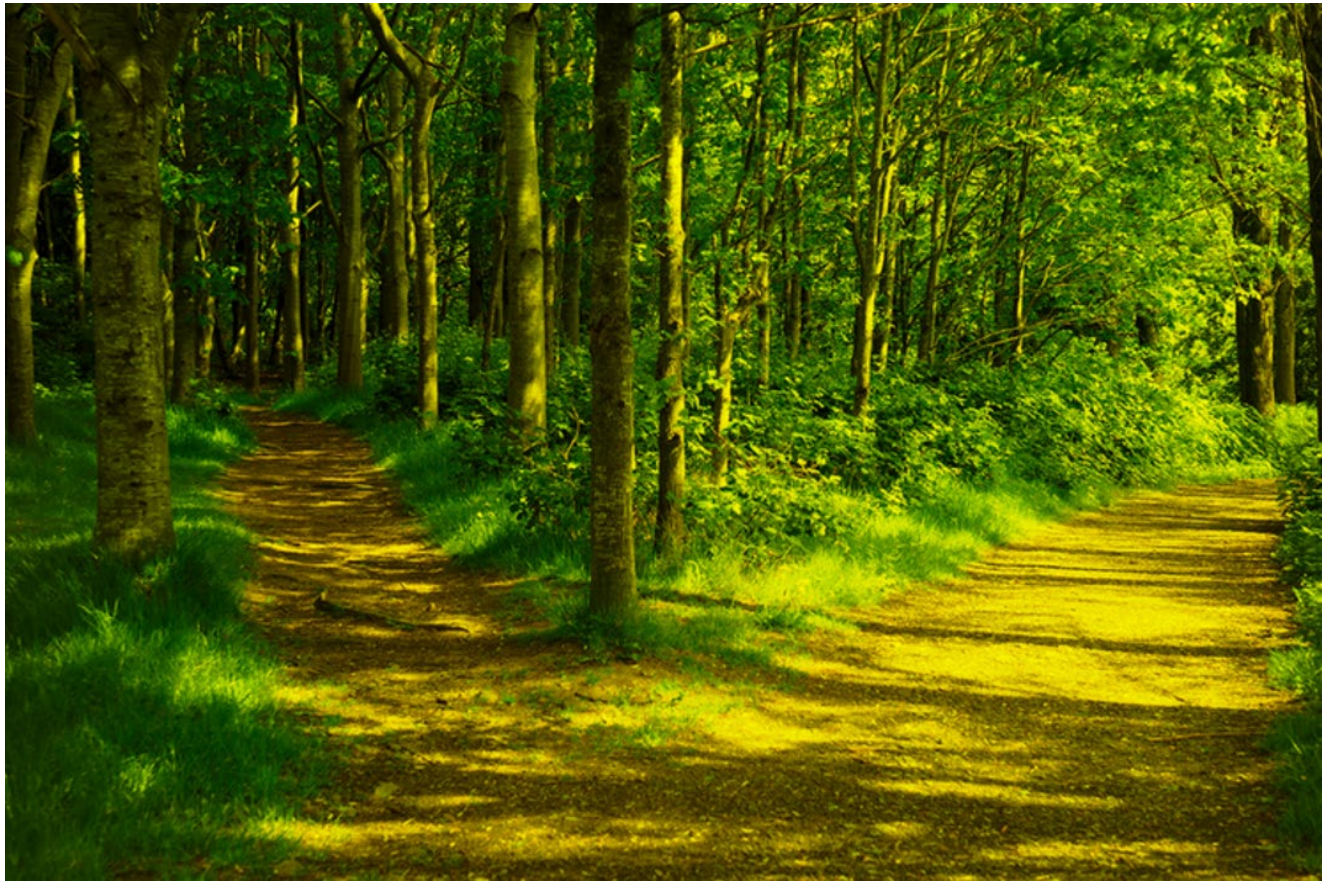
Guided Setup

Diverging Approaches

- Intuitively Guided App
- Power User App

- Images
- Icons





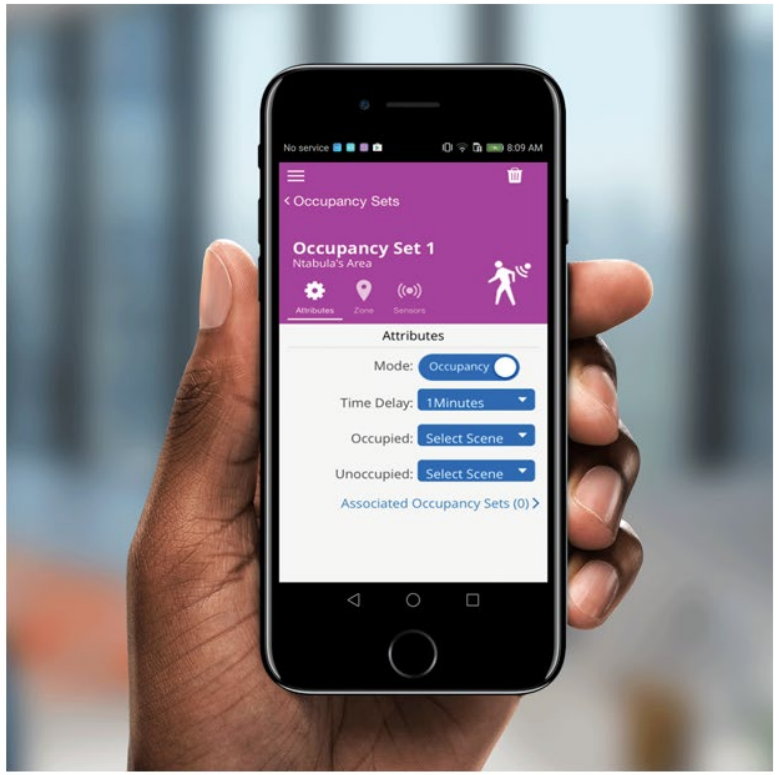
lighting design lab

Sensor Configuration

- Touchless through the app
- Touch the device

- Occupancy/Vacancy
- Daylight
- Others?

- Get on a ladder?



lighting design lab

Setup Streamlining

Minimizing repetitive steps

- Copy Paste?
- Archetypes or templates

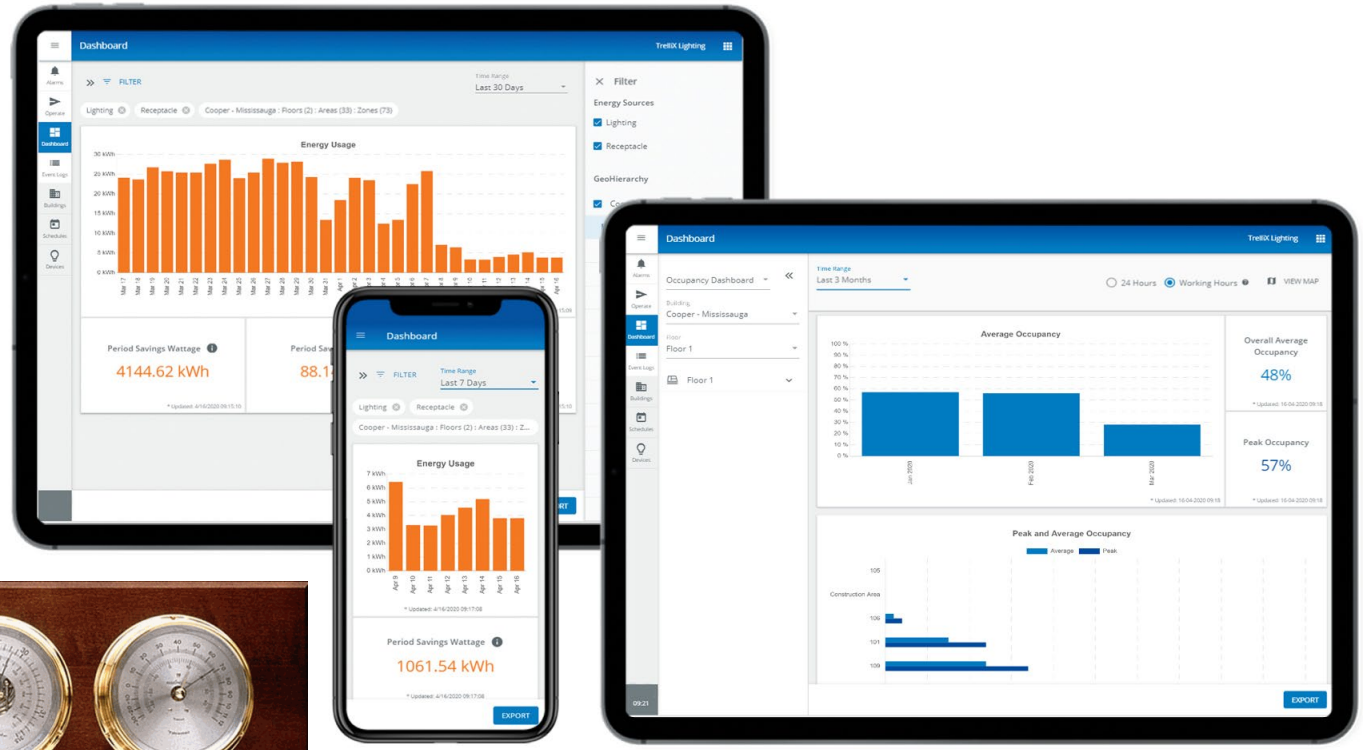
- Keyword sets
  - Office
  - Conference
  - Corridor
  - AV
  - Reading

lighting design lab

Data Logging / Energy Use / Dashboarding

Simple reporting functions

- Initial configuration
  - Sensor Timeout
  - Target Light Level
  - Device Pairing
- Energy monitoring
- Energy trending
- Battery life
- System status



lighting design lab

In App Help / Documentation

Questions inevitably arise

- Context driven help options
- Help Menu
- System Documentation
- External Media / Videos

- Help line or Chat

- Remote system access options?

lighting design lab

Reprogramming

Reconfiguration simplicity is a big selling point

- Factory Reset
- Reconfigure
- Reprogram
- Offline reprogramming?

- How much is a ladder needed?

Luminaire Level Lighting Controls

- Wrap all of the sensors and most of the logic into the luminaire itself
- Individually Addressable
- Has some level of functionality our of the box
- May be capable of all control strategies
- Fully Programmable in most cases
- Integral part of a NLC

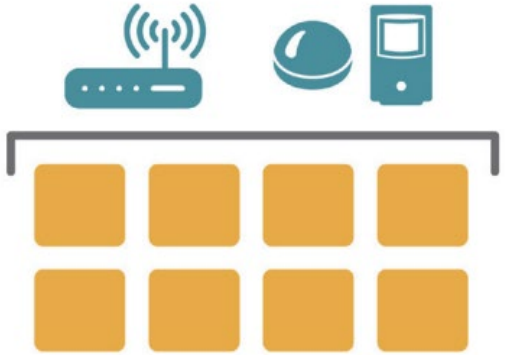
Courtesy: Cree

LLLC Availability and Configuration

Half of manufacturers queried had LLLC systems available now.

Two more noted that the ability was in the process.

Typical NLC Configuration



LLLC Configuration

Does LLLC Take more time to Setup?

LLLC Luminaire has integral:

- Load Controller or Digital Driver Controller
- OS/VS Sensor
- Daylight Sensor

- 1 Device to discover instead of 3
- 1 Device to add to a room instead of 3
- Luminaires may be added into groups if preferred in some cases
- Sensor programming is similar
- Scene programming is similar

lighting design lab

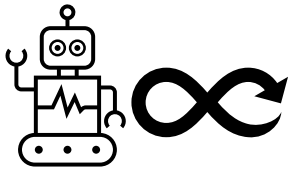
Key Goals for Everyone…

- Manufactures
- Sales Reps
- Distributors
- Contractors
- Designers
- Engineers
- Architects
- Owners
- Users

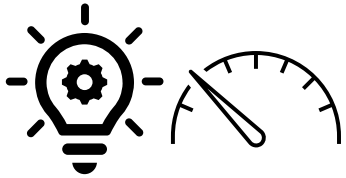
- Saving time
- Increasing uptake / sales
- Reducing call backs
- Reducing frustration
- Increasing user acceptance
- Increasing user satisfaction

Why App Based Configuration Tools are so Important

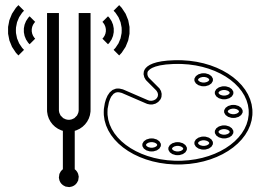
The Proliferation of *FEATURES…*



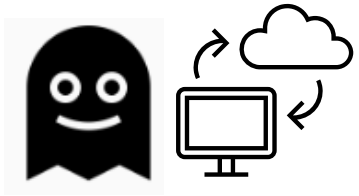
Controls Persistence



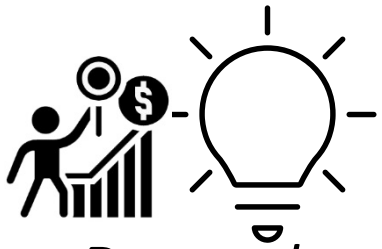
Energy monitoring



Color tuning



Cyber security



Demand Response

… and so many more

lighting design lab

Ten Key Recommendations to Industry

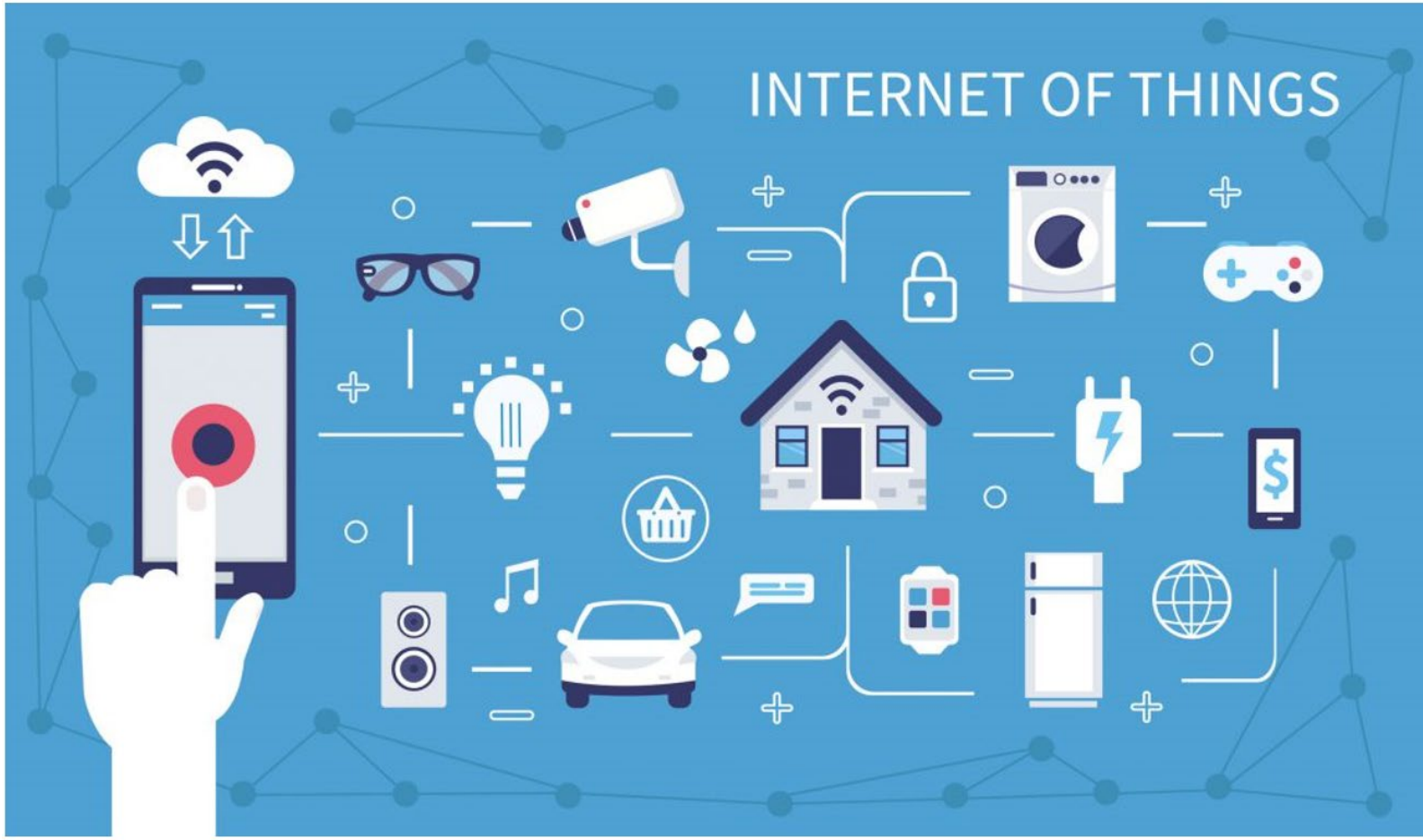
1. Adopt a common vocabulary
2. Adopt more common standards.
3. Simplify app acquisition use
4. Adopt a guided user-experience progression
5. Provide In-App help and links to setup videos

Ten Key Recommendations to Industry

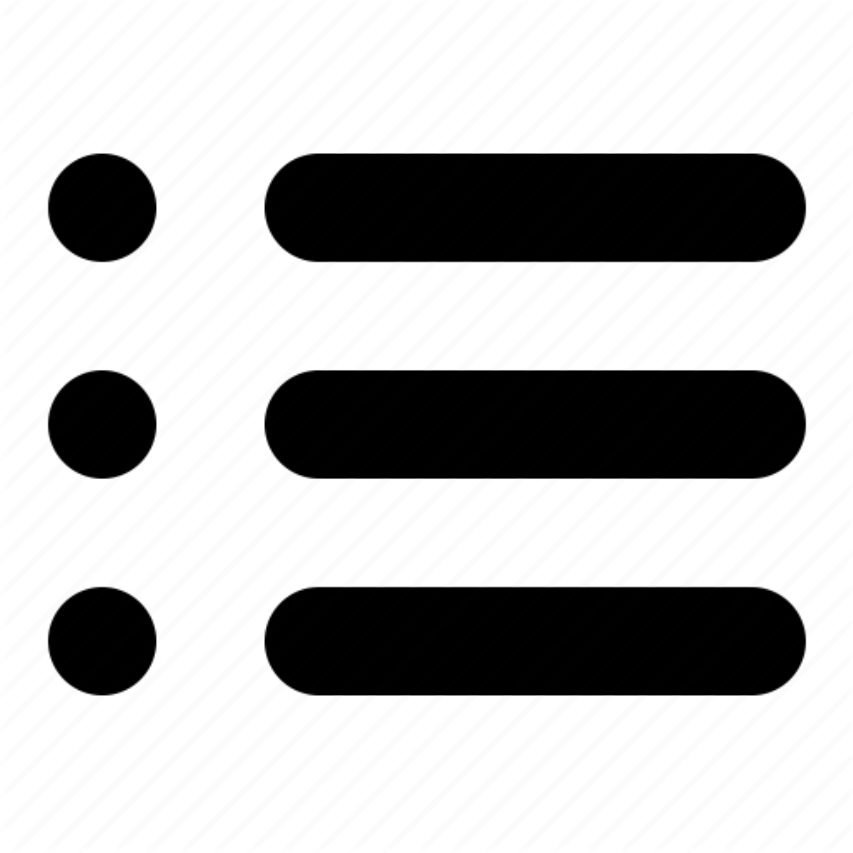
6. Remove ladders from most setup requirements.
7. Provide functionality like energy monitoring dashboards and standardized setup reports at this product level.
8. Make a point to experience each other’s apps.
9. Open API
10. Simplify Simplify Simplify

Lighting Controls Aren’t Just for Lighting Anymore…

The only standard in the industry is that there are no standards…..no standard…



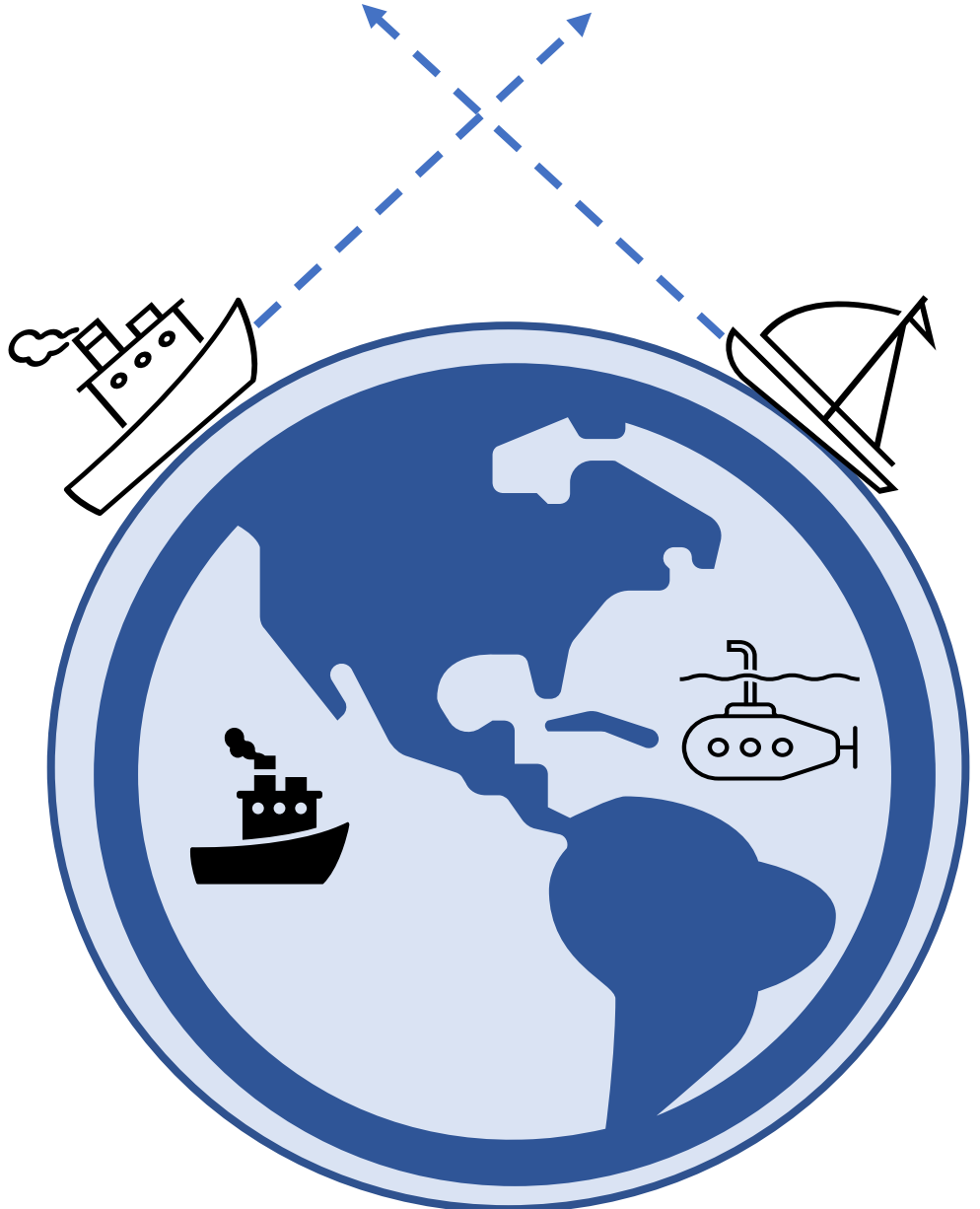
Interconnectivity between systems?



What's Over the Horizon?

Hopefully, Connecting!

1. Share findings with manufacturer and industry partners
2. Sharing findings with design and implementation communities
3. Incorporate findings into LDL's suite of NLC curriculum
4. Potentially extending research
5. Periodic review of the state of the industry



Updating Existing Educational Content

The NLC Education Carrier Group

Tunable Light

NLC For School Districts

NLC For Warehouses

Light & Health

Power Over Ethernet

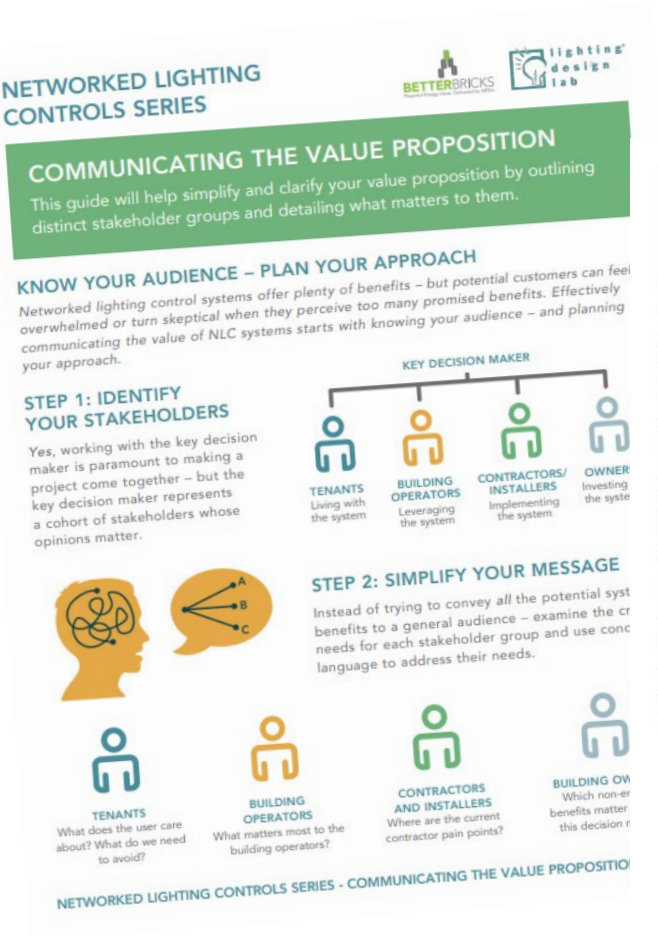
Exterior Lighting

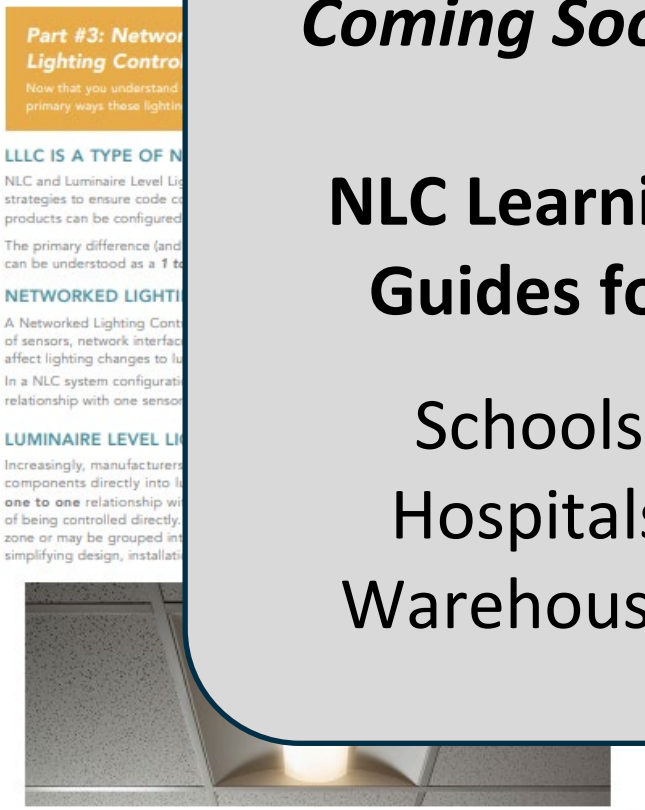
Communicating the Value of NLC

NLC For Healthcare

lighting design lab

Tools & Resources





Coming Soon…

NLC Learning Guides for

Schools
Hospitals
Warehouses

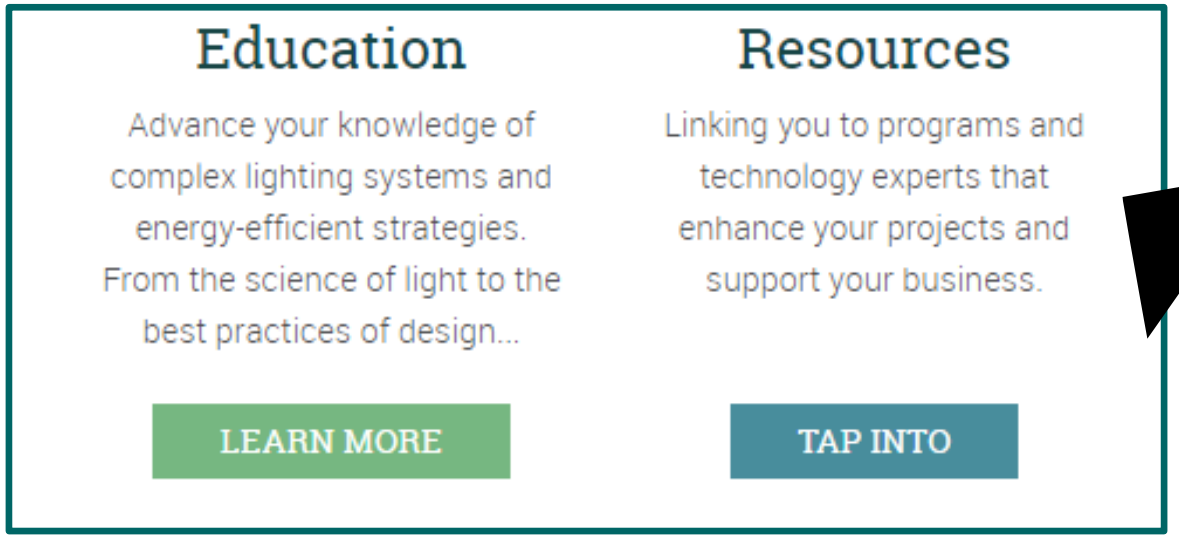
[Click to access the LDL networked lighting control learning guides]

lighting design lab

Click – Call – Connect

- John Arthur Wilson – Stakeholder Solutions Manager
  - 206.418.9195
  - John.Wilson@Seattle.gov

Visit us online



OR

Email Us

lightingdesignlab@seattle.gov

Todays slide deck will be posted here!

lighting design lab

To Everyone Who Made Today's Webinar Possible

UW IDL Team
WSU ID+CL Team
LDL Staff
NEEA Peeps

Industry Partners

& Most of all
YOU!

Please take the online survey once you exit the webinar

We'll *SEE* you NEXT YEAR... ☺

lighting design lab