Engaging citizens in co-creating smart lighting

Elke Den Ouden, TU/e LightHouse

Smart Lighting


Growth of Value of Light to Society

+ Light for Well-Being

+ Light for Sustainability

Energy Efficient Light

Quality of life

Human Centric Lighting

Intelligent Lighting Systems

Circular Economy

LEDification

2015　　　　2020　　　　2025

Source:
Strategic Roadmap 2025 of the European Lighting Industry - Lighting Europe[2]

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Smart public lighting

Smart urban lighting adds value to users of public spaces by:

- providing the right light at the right moment, in the right place and with the right atmosphere;

- enabling people to use and enjoy public space and realising a higher level of well-being;

- in an energy efficient way.

Smart public lighting
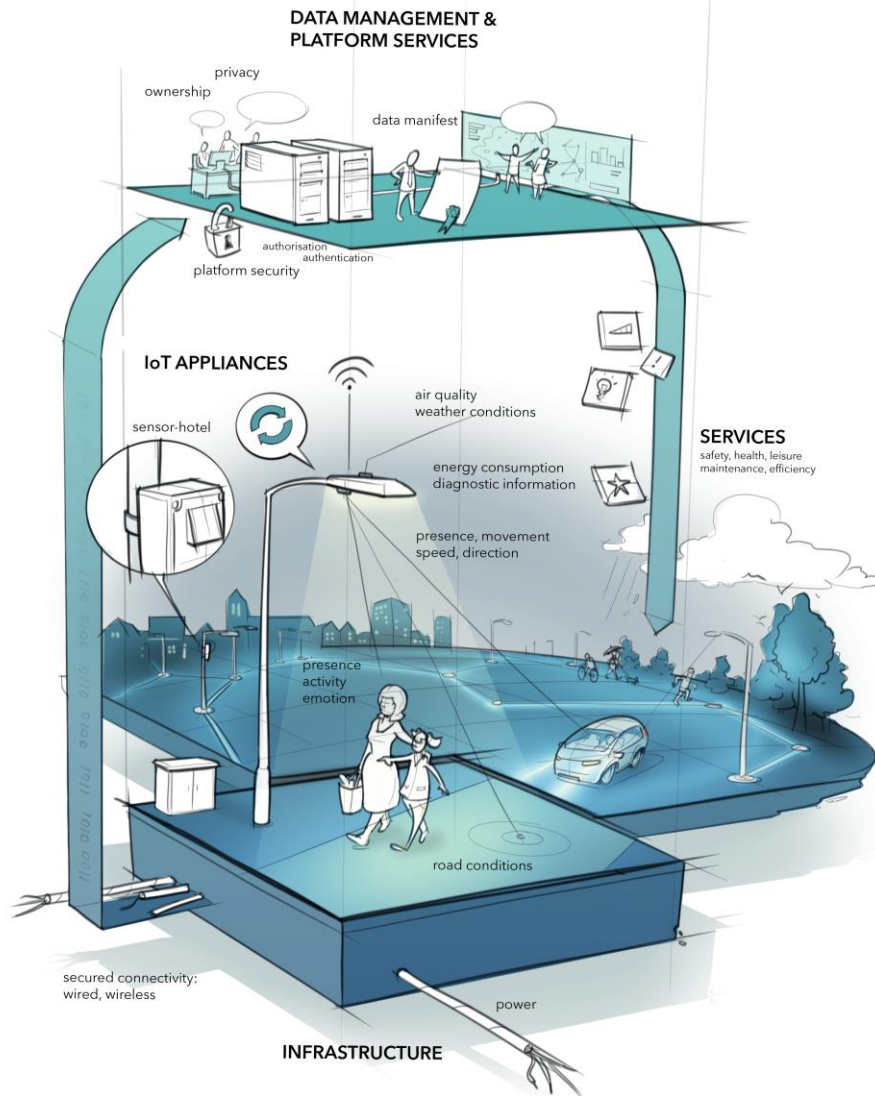
Data management

Controls
(sensors & software)

Lighting
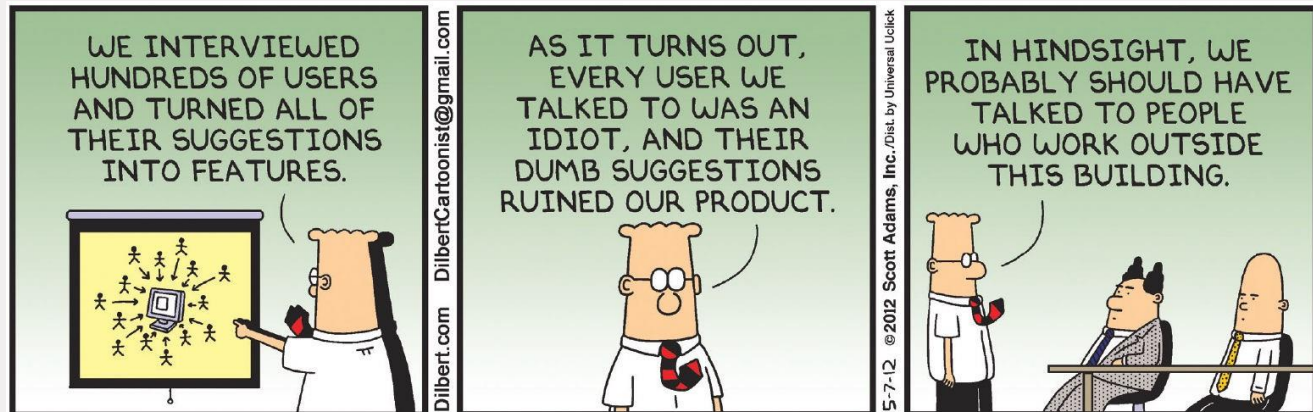(public lighting including special elements)

Infrastructure
(energy & connectivity)

So, do we only talk about users, or do we engage them?

Human centric lighting requires _real_ user involvement!

Citizen engagement:

- identifying citizen needs

- co-creating use cases

- user experience research

Investigating citizens needs

Cool wall session

- Playful way to collect insights from citizens and other stakeholders

- Citizens as experts of their living environments

- Start a dialogue through a simple question:

"What are pleasant or unpleasant places in the area?"

Why are they (un)pleasant? (needs)

What is there to improve? (opportunities)
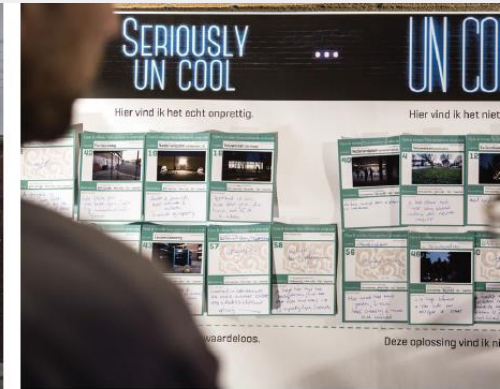
Examples of Cool Wall sessions with residents

Light Sketching for Placemaking

Using 5 lamp posts in a temporary setting, each with 38 bulbs:

- **RGB**
- **Warm White**
- **Cool White**

Design:
Studio Philip Ross

Pictures:
Bart van Overbeeke

[5] https://www.studiophilipross.nl

Investigating citizens needs

Needs of citizens are quite generic

But linked to specific locations and situations

And contain rich stories

Need MR 1. Safe bicycle crossings

What do people want?

People indicate that many cyclists (school children) use the different crossings on the Rooseveltlaan. Although measures are taken to slow down the traffic at the Noordweg-crossing, they are perceived as dangerous, both by the cyclists as well as by car drivers. They express the need to safely cross the (mainly car) road by bike.

Who experiences this?

Residents, both cyclists and car drivers

Where does this occur?

Crossings with the Nieuwenhovenseweg, the Brigdamsepad, and the Noordweg.

What opportunities do people see?

Enough light at the crossings, and sensors to detect bikes as well as cars and warn drivers when there is someone coming.

> "Fietsers hebben voorrang, maar zijn hun leven niet zeker." – resident

> "Het is heel onoverzichtelijk: je ziet fietsers pas heel laat als je van de rotonde komt." - resident

> "Sensoren die auto's detecteren en fietsers waarschuwen dat er iets aankomt." - visitor

Need MR 2. Comfort in adjacent houses

What do people want?

People indicate that the current lighting is very bright and the lampposts are taller than the noise barrier. This causes that the light shines into the houses of people living next to the road. They express the need to live comfortable in their houses, to be able to sleep well and have darkness in their homes and gardens.

Who experiences this?

Residents, adjacent to the road.

Where does this occur?

Rooseveltlaan, nearby the Brigdamseweg and the Arondensstraat. Generaal Hakewell Smitlaan.

What opportunities do people see?

Decreasing the light pollution by dimming the lights, shape the light beam and/or lower lightpoles.

Adjust the lighting with the private lights (Jumbo and VMBO).

> "Wij wonen daar, er staat enorm hoge en felle straatverlichting op de kruising - de hele nacht." – resident

> "Veel licht in onze slaapkamer. De lantaarnpaal staat heel hoog t.o.v. de woningen. Het geeft (te) veel licht." - resident

> "Verlichting lager en meer op de weg gericht. Verlichting zo richten dat de woningen, slaapkamers en tuinen niet aangelicht worden. Verlichting kan mogelijk een deel van de nacht uit." - resident

A light on the future
Opportunities for improving public space with smart lighting

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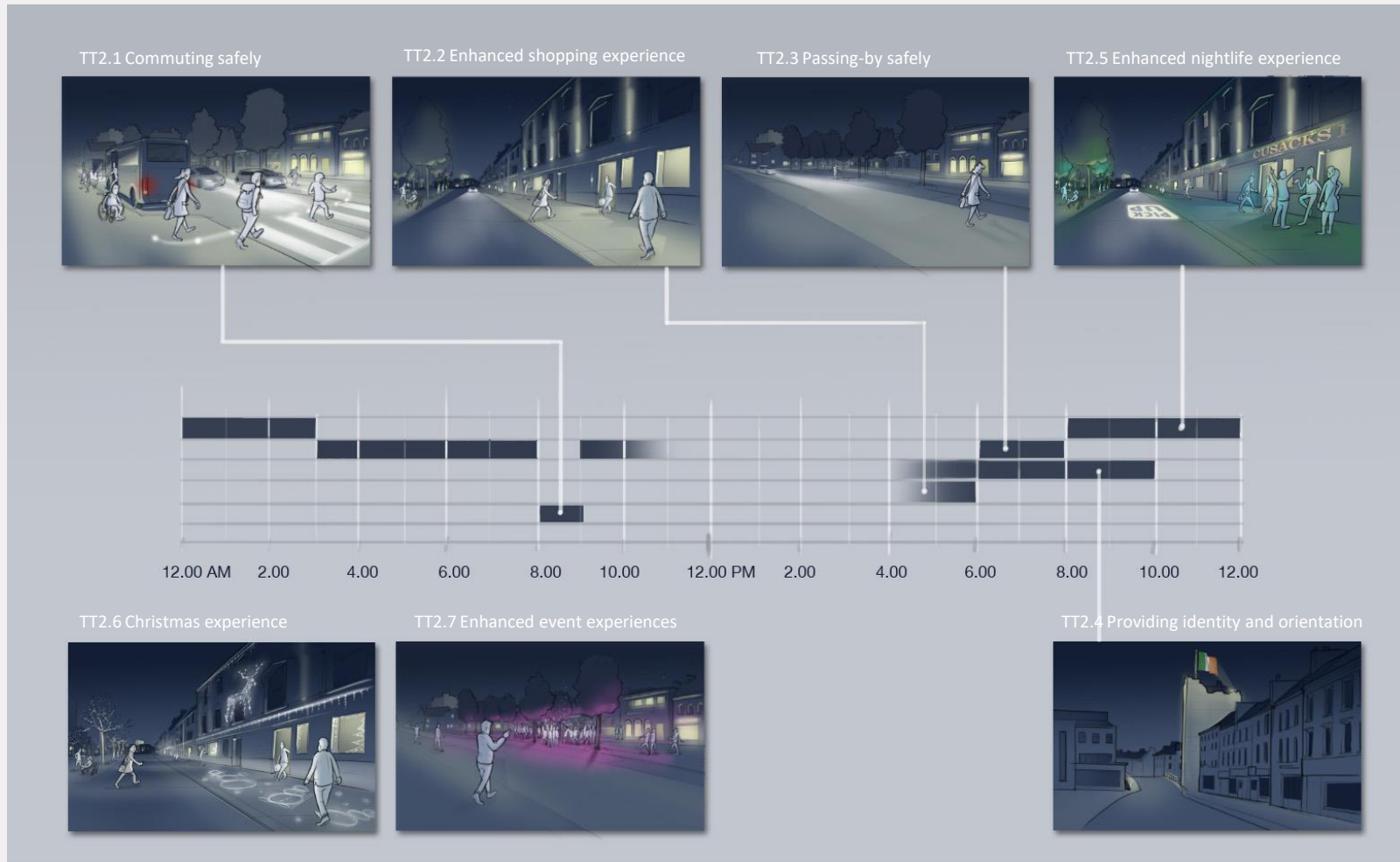TU/e
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Co-creating use cases

- The pilot sites are analysed and 8 use cases are developed with local stakeholders, the municipality and experts

- Creating story boards of interactive use of smart lighting

A light on the future
Opportunities for improving public space with smart lighting

Use case example: Supporting event experiences on Liberty Square in Tipperary

TT2.1 Commuting safely

TT2.2 Enhanced shopping experience

TT2.3 Passing-by safely

TT2.5 Enhanced nightlife experience

12.00 AM   2.00   4.00   6.00   8.00   10.00   12.00 PM   2.00   4.00   6.00   8.00   10.00   12.00

TT2.6 Christmas experience

TT2.7 Enhanced event experiences

TT2.4 Providing identity and orientation

MC1.1 Passing-by safely and efficiently

MC1.2 Providing identity and orientation
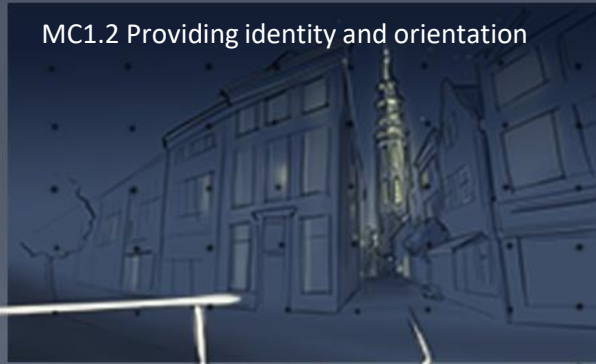
MC1.3 Enhancing wandering around

MC1.4 Prolonging the stay

Scenario MC1.1 Passing-by safely and efficiently

Use case		Description	Providing good visibility and a pleasant atmosphere for people to pass-by safely and efficiently. With well-designed lighting scenes at low light levels and different scenes that dim further over the course of the evening and night.
		Timing	Always on
		People	All people
		Activity	Passing-by
		Desired state of users	Safe and efficient
		Goal of the solution	Good functional lighting
		Function of lighting	Functional lighting level - light level as low as possible with sufficient homogeneity - adapted to seasons (flexibility)
		Function of 'smart'	n.a.
Requirements system	**Lighting**	Type of lights	General / public lighting (the basic lighting grid)
		Scenes	Active: multiple dim scenarios with timer control
		Light level	tbd
		Colour	(Tunable) white
		Adjacent streets/areas	Similar light levels
	Smart	Activation of the scene	Timer control
		Deactivation of the scene	Timer control
		Dynamics within the scene	Dim scenarios over the evening and night - adjusted to other scenarios when needed
		Activation of the dynamics	Timer control
		Deactivation of dynamics	Timer control
		Data collection for system	n.a.
		Data collection for learning	n.a.

Find out more…

All reports are available for download on:

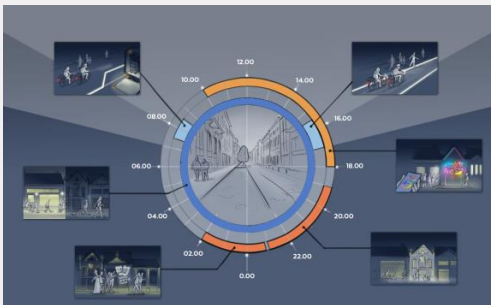https://www.tue-lighthouse.nl/SmartSpace.html
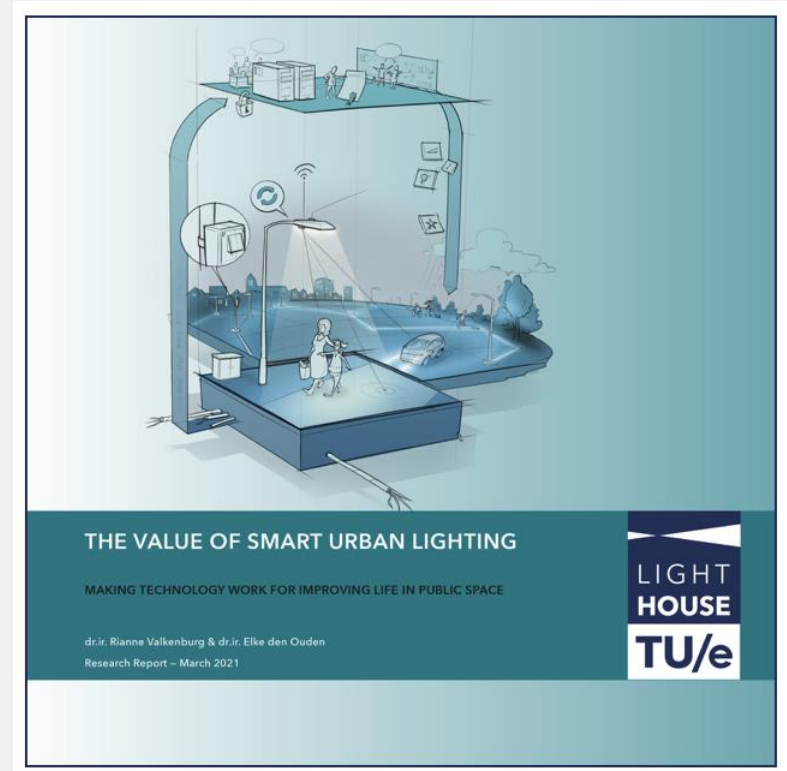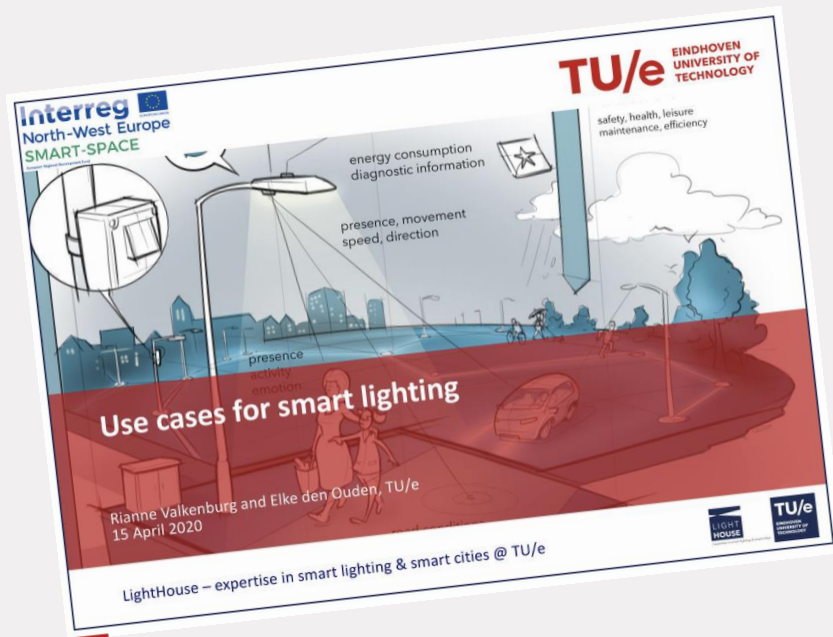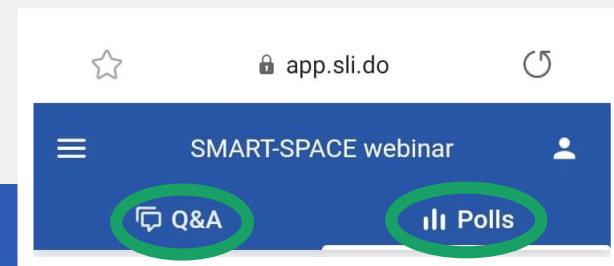
The value of smart lighting

interaction levels for smart lighting to improve the use of public space

Rianne Valkenburg, TU/e LightHouse

8 use cases in the cites of the Smart Space project

Atmosphere and light experience in shopping street the Stationsstraat in Sint-Niklaas
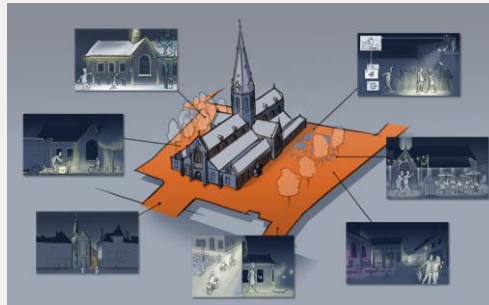
Perceived safety at the night life area Sint-Nicolaasplein in Sint-Niklaas
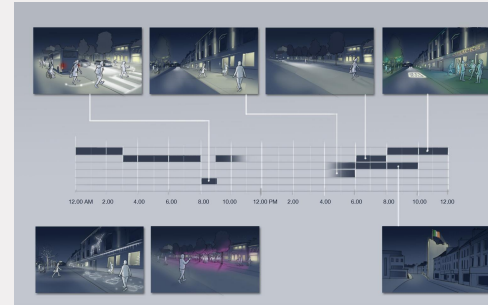
Supporting event experiences on Liberty Square in Tipperary
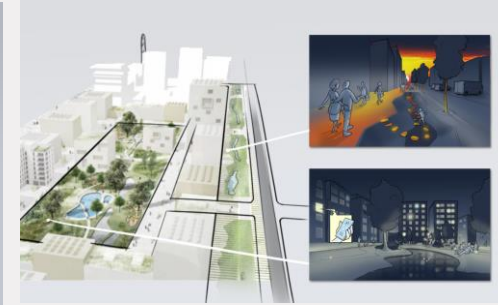
Lively urban space evoking (social) activities at Victorialaan and the connection with Central park at Sea in Oostend
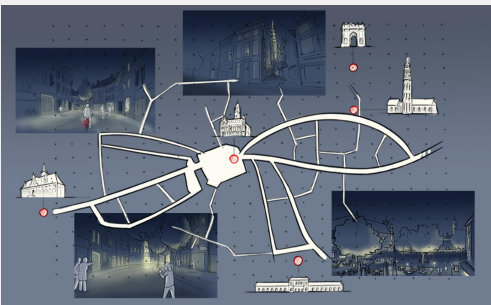
Atmosphere and light experience in shopping street Lange Delft in Middelburg
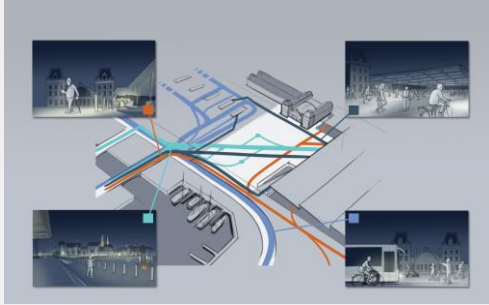
Atmosphere and light experience in the station square Oostende
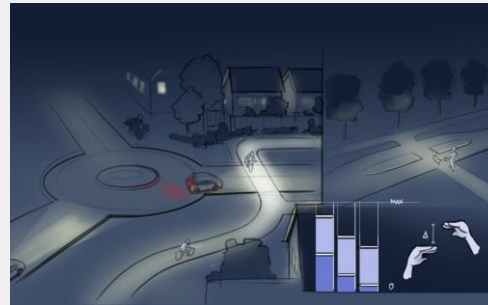
Safe cycling and walking crossings on through roads at the Rooseveltlaan Middelburg

Safe cycling and walking along mixed trafic roads in Thurles

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33 desired scenarios are designed as a basis for the smart lighting system in these places

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33 desired scenarios are designed as a basis for the smart lighting system in these places

- 3 clusters of anticipated use
- Different levels of interactive use

A: Improving safety for all road users

B: Enhancing leisure experiences

C: Increasing security for nightlife

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Static Lighting

Commuting safely: Providing a good overview of the area to support the flows of commuters (pedestrians, cyclists, bus and tram-passengers) to/from the train station and avoid collision.

Enhanced shopping experience: Creating a warm atmosphere to attract more people in the afternoon and to emphasise the lighting of the shops and facades.

1	Static	• one lighting scene • activated on/off via a clock timer in the control software • no data is integrated in the system • no communication (local switching)

Active Lighting
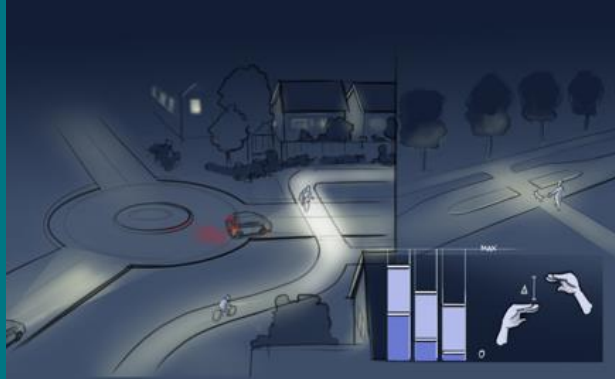
Crossing safely: Providing good visibility of cyclists and pedestrians crossing the road with multiple lighting scenes that dim further over the course of the evening and night, with constant contrast for a crossing, a bicycle/footpath and the main road.

Enhanced night life experience: Creating a surprising experience to make going out a memorable event, and tempt visitors to return. With a well-timed scene that lights-up objects in the street and creates a 'drawn-in/waving goodbye' experience for people going out.

2	Active	• multiple static lighting scenes • activated on/off via a clock timer in the control software • no data is integrated in the system • no communication or one-way communication to light sources (individual or in groups)

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Reactive Lighting

(Un)Loading and commuting safely: Creating good visibility to avoid accidents between loading and unloading delivery vans and commuting cyclists and pedestrians, with a brighter area around parked vans.

Enhanced nightlife experience: Creating a pleasant atmosphere during pub hours to make the area lively and enhance the safety of pedestrians, e.g. while being picked up or grabbing a cab.

3	Reactive	• multiple static lighting scenes • scene selection is activated by a single trigger or sensor (real-time – 'slow') • monitoring data from the single sensor and the active scene • bi-directional communication within a (local) system

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Interactive Lighting

Providing good visibility of cyclists and pedestrians alongside mixed traffic road with local adaption of the lighting to create brighter areas around pedestrians and cyclists

Creating a fun and lively area that evokes people to be active to walk and play together with specially-designed playful elements that interact with people, their movements and the environment.

Supporting guards in their jobs with technology to detect and locate incidents and de-escalate aggressive behaviour.

4	Interactive	• dynamic scenes with localised effect • scene selection is activated by multiple triggers or use actions • monitoring data from the sensors and the active scene • bi-directional communication within a (local) system

Intelligent Lighting

Learning system to maximise activities outdoor and *increase safety and comfort of road users*, learning from historical data (e.g. use patterns and -near- accidents) to adapt settings and anticipating on real time input.

Enhance leisure experiences with personalised shopping routes or training (e.g. interval training and high score 'show') by connecting online user profiles and personal data to select scenes and learning from results.

Learning and adapt the scenes to atmosphere and emotion to avoid incidents for *increased security for nightlife.*

5	Intelligent	• self-creating lighting scenes with personalised effect • decisions based on learning • historical data for improvement system • bi-directional high-speed communication

Interaction levels in Smart Lighting

5 Intelligent
- Personalised effect
- Decisions based on learning
- Historical data for improvement system

4 Interactive
- Dynamic scenes with localised effect
- Multiple triggers or use actions
- Monitoring data

3 Reactive
- Multiple static scenes
- Single trigger or sensing
- Logging data

2 Active
- Multiple static scenes
- Switch by calendar
- No data

1 Static
- One scene
- On/off by clock
- No data

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Smart public lighting

Data management

Controls
(sensors & software)

Lighting
(public lighting including special elements)

Infrastructure
(energy & connectivity)

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Smart Lighting System components

Lighting	Controls	Data management	Infrastructure
• Public lighting • Special elements • Lighting scenes	• Sensors • Software • Scene selection	• Management • Ownership • Accessibility • Privacy • Analysis	• Connectivity • Energy

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Interaction levels and requirements for Smart Lighting System

Note: higher levels also need the functionality of the lower levels

Interaction level

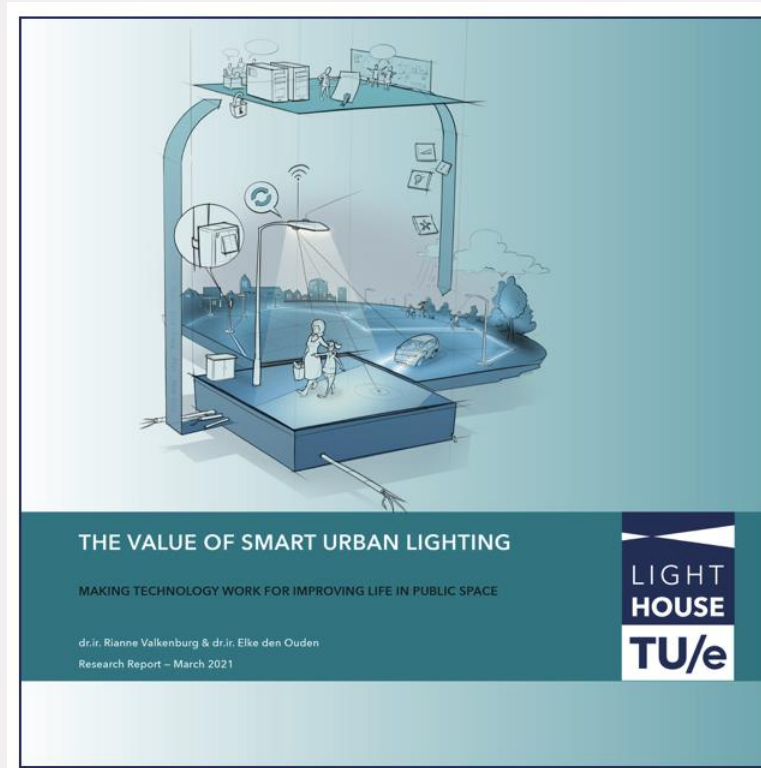|		Lighting	Controls	Data management	Infrastructure
5	**Intelligent**	Dynamic scenes with localised effects	Scene selection and local dynamics by multiple triggers or user actions and personal profiles, adapting settings based on learning	Continuous data collection for learning and improvement of system performance and increasing impact	Bi-directional high speed communication within system and to the cloud
4	**Interactive**		Scene selection and local dynamics within scene activated by multiple triggers or user actions (real-time – 'fast')	Monitoring data from multiple sensors to create the right interaction (dynamics within the scene) and scene selection	Bi-directional high speed communication within (local) system
3	**Reactive**	Multiple static scenes	Scene selection activated by single trigger or sensor (real-time – 'slow')	Monitoring data from single sensor and active scene	Bi-directional communication within (local) system
2	**Active**		Switching of scenes based on schedule (time and/or calendar) in control software	Regular data collection (not integrated in the system) on patterns of use and emitted light by other sources as input for the design of the lighting scene	No communication (local switching) or
1	**Static**	One static scene	On/off via clock-timer in control software		one-way communication to light sources (individual or in groups) for switching

Opportunities for improving public space with smart lighting

- Lighting systems will become smarter in the (near) future

- Understand what this will mean for (your) public spaces

- 5 levels of interactive use with smart lighting define different lighting solutions

- Make future-proof decisions for investments in (smart) lighting systems

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The value of smart urban lighting
Making technology work for improving life in public space

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