

REDESIGN ON SCENE CONTROL

A REDESIGN FOR MANAGING LUMINAIRES IN
LUXON DYNAMIC LIGHT CONTROL

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SUMMARY

If you own a large public or industrial building and want to save money, Luxon dynamic light control is a great product for you. It is a smart system that controls your luminaires and saves you energy. Money spend on lighting can be cut by 80%. The system eliminates the waste of energy in your building. It enables you to have the right amount of light in various areas at any time, no matter what the conditions are.

After it is installed you want to be able to use it without any trouble. However Luxon dynamic light control comes with a user interface which is hard to use. Especially a part called "Scene Control" causes much trouble. Scene Control is an essential part of managing the luminaire system. Here you can influence the luminaires in such a way, that you can save most money, while having the ideal lighting conditions for your building.

Customers are experiencing problems with the system and the user interface irritates them. This increases the workload on customer support, because they have to solve the customers' problem.

A redesign for the user interface is necessary. This project will guide you through the design process for the redesign of Scene Control. The current user interface and stakeholders are analysed to picture the situation. With the information from the analysis the requirements were setup. A short TRIZ analysis was used to gain rough ideas for a concept. After that, prototypes were made to test usability. A detailed concept was created, with the results from the user tests. This detailed concept is reflected on with the requirements.

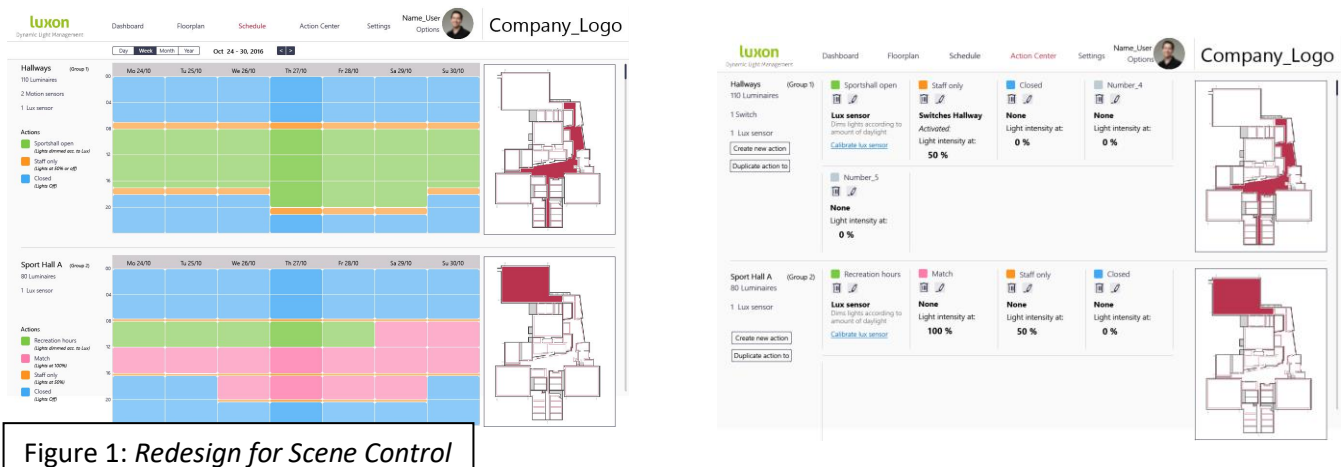


Figure 1: Redesign for Scene Control

In figure 1 the result of this project, a redesign for scene control, is presented. The redesign uses a calendar to plan the luminaires in the Schedule tab. The behaviour of these luminaires are determined in Action Center. Functionality is split up into these two tabs, to make Scene Control more predictable. Further details can be found in chapters 8 and 9.

At the end of this report recommendation for further improvements will be suggested. The people from customer support and a user interface developer were consulted for these recommendations. The concept was not tested with customers, but an example of a test format is provided in the recommendations.

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1 INTRODUCTION

1.1 Background about Luxon, dynamic light controls

Luxon is a Light Management System (LMS), developed at Nedap in Groenlo. This system allows their customers to manage clusters of lamps and save up to 80% on energy. This ultimately saves them money.

One Luxon Light Controller (LLC) can manage 200 luminaires. The LLC is a small device that sends signals to the luminaires and receives information from sensors and switches.

With the user interface the customers change the timing and intensity of the luminaires. This user interface is large and complicated. *Scene Control* is the part in the user interface that determines the behaviour of the luminaires. Scene Control has a large influence on the luminaires and therefore has a large influence on saving energy and money. The LMS cannot function to its' full potential if Scene Control is too hard to use.

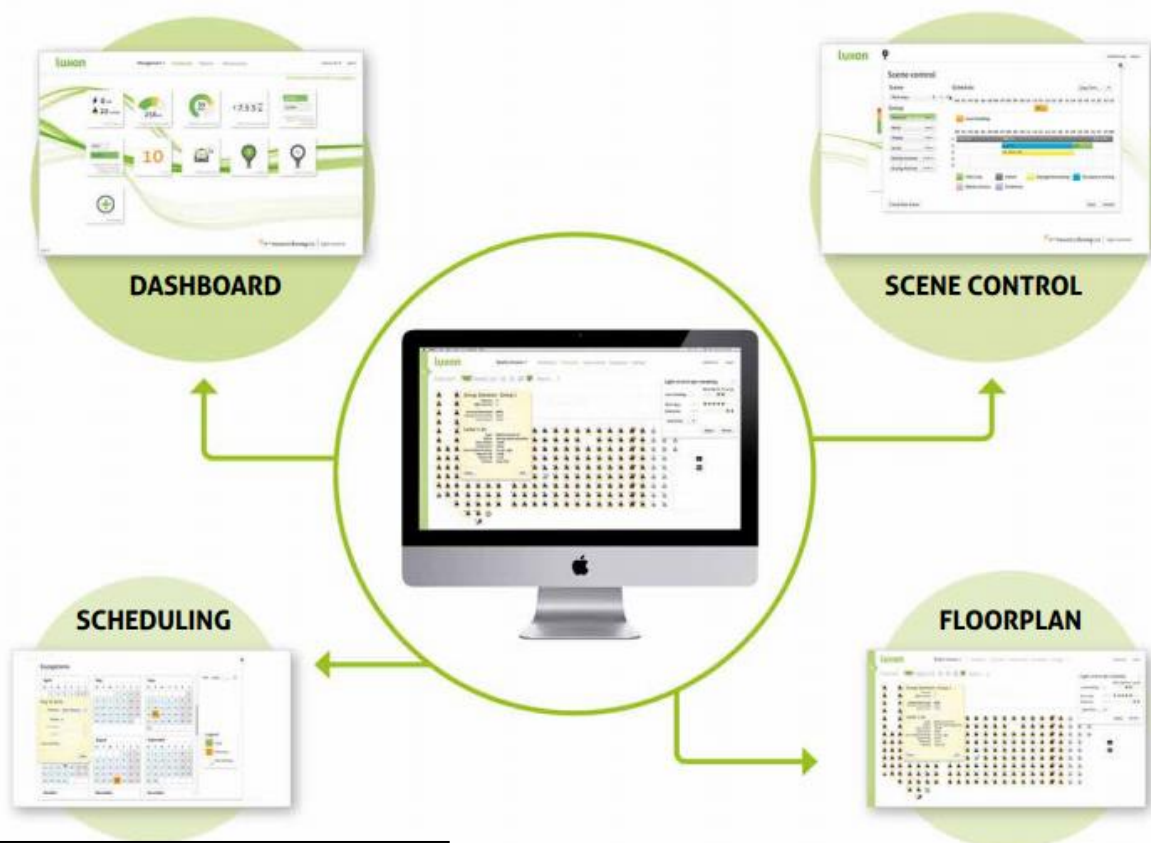


Figure 1.1
General view of the user interface

A demo the user interface can be found online.[1] This demo does not contain all features of the system.

1.2 Project goal

The LMS is used in a professional environment and has a functional purpose; saving money. It is not a consumer product and has not a high emotional value. That is why usability is more important than user experience. Also, in the future, Nedap only wants to deliver the software, while other aspects of the LMS will be handled by their business partners. In that case the quality of their product is determined by the usability of the user interface.

Since Scene Control has a large influence on energy and money savings, the main focus of the project lies there. Scene Control has many functionalities, which make it flexible. These functionalities must stay, but Scene Control must become more user friendly.

This project will contain new proposals for a redesign, a user test and a reflection on the redesign of Scene Control.

1.3 Approach

Chapter 2 analyses how the user interface and especially Scene Control is used. In chapter 3 the users and different profiles are analysed. With this information the requirements are made. These are found in chapter 4. Chapter 5 is the ideation phase. For the ideation a TRIZ analysis is used. The rapid prototypes of the redesign are found in chapter 6 and tested in chapter 7. In chapters 8 and 9 the detailed redesign is presented. It is evaluated in chapter 10 and the conclusion and recommendations are presented in chapter 11.

Chapters 2 and 3 are excluded from the paper due to confidentiality.



4 REQUIREMENTS

Requirements are not solutions nor functions or tools. They are measurable guidelines which help indicate the performance of a product. If a product performs according to the requirements, it can be considered as “performing well”.

4.1 Functionality of Scene Control

Scene Control has many functionalities. All the functionality of Scene Control must be implemented in the redesign. Only if a functionality in the system is unused it can be removed.

Table 4.1: *Functionality in Scene Control*

Functionality in Scene Control	Additional information
Controlling luminaires in groups	The groups are not made in Scene Control
Setting the timing of the luminaires	In a period of 24 hours
Setting the light intensity	In steps of 5%
Using sensors and switches	Switch, dim switch, motion sensor, ballast sensor, daylight sensor,
Influencing the luminaires with sensor or switch	Luminaires on or off
Influencing another sensor or switch with sensors or switches	Combined function or level to lower priority
Setting the switch speed	How fast the luminaires change between light intensities
Setting the minimum duration	The minimum time luminaires are on
Scheduling luminaire behaviour on weekdays	Is now done in a window called “Light control per weekday”

4.2 Understanding the functionalities of Scene Control

Currently the users seem to have trouble understanding Scene Control. Customers, Nedap and the business partners need to invest time in trainings, because it is hard to understand. The redesign must be so easy to understand that the users do not need training. The users must be able to use it after an explanation or with the use of a manual. They must be able to at least perform these tasks without help:

- Changing the timing of luminaires
- Changing light intensities
- Plan luminaire behaviour of the correct days
- Understand the legend
- Create a simple new scene.

An example of a simple scene is illustrated in Figure 4.1.

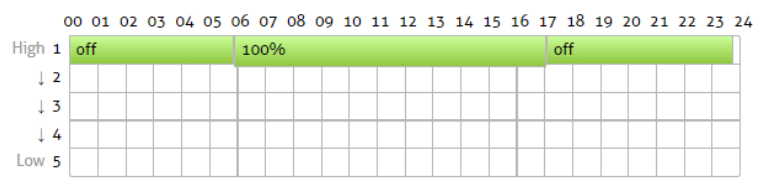


Figure 4.1: An example of a simple scene

4.3 Accessibility

Many functions are too difficult to access. It takes too many actions to make a small change. The following functionalities must become more accessible:

- Changing light intensities
- Changing the timetable for one day only
- Planning scenes on weekdays
- Overriding the scene temporarily

4.4 Prevent mistakes in Scene Control

Users make too many mistakes in the user interface. The following mistakes must not occur in the redesign:

- Wrong timing of luminaires
- Overlapping behaviour in a scene
- Empty spaces in the scene

4.5 Transparency in Scene Control

Preventing mistakes has its limits. Mistakes will be made, but it must become easier to solve for customer support. Scene Control must become more transparent. It should be clear which actions were taken and when changes were made.

The following must be visible for customer support:

- When a change was made
- What was changed
- Where in the interface it was changed
- By whom the change was made

4.6 Screen formats

People use technology everywhere. To offer the customers more freedom in when and where they influence the system, it must be made possible for the new interface to be used on desktop, but also on mobile devices. The functionalities from section 4.1 must be accessible on a 4 inch screen.

4.7 Profiles

As illustrated in chapter 3 users should have a profile that fits their needs. The users must influence the system as follows:

Profile 1: Owner

- He can see and change all features in the system, if he wants
- He has access to all locations
- He has easy access to the reports and savings of the buildings.

Profile 2: Technician

- He can see which hardware has an error
- He has the functionality to setup hardware

Profile 3: General manager

- He can see all groups
- He sees the details of all groups
- He cannot change the hardware of groups
- He has the full functionality of Scene Control
- He has personal and general settings
- He is notified about errors.
- He sees the status of the system and the savings of his building

Profile 4: Floor manager

- He is authorised to control a selection of groups
- He can adjust the light level of these groups
- He can only change scenes temporarily
- He can start the day earlier / later and end it earlier / later
- He cannot change the hardware of a group

Profile 5: Staff

- He is not allowed influence the LMS directly
- He can anonymously file a complaint about the working conditions (related to the luminaires)
- He can see the luminaires in the Floorplan
- He can notify the system if it is not working properly and describe the problem.

Profile 6: Customer support / Service

- He has all the functionality the current user interface has. (Service-profile)

5 IDEATION FOR THE REDESIGN OF SCENE CONTROL

In this chapter the first ideas are generated towards a redesign for Scene Control. Section 5.1 describes the TRIZ methods used and section 5.2 presents three concepts. In section 5.3 and 5.4 the concept choice is made and reflected with the requirements.

5.1 TRIZ

In the ideation phase a few TRIZ techniques are used TRIZ stands for “the theory of inventive problem solving”. [2] These techniques help to generate new innovations. In this case they help to generate ideas on improving the user interface. TRIZ contains tools for analysing problems and for ideating on solutions. TRIZ is ideal in this situation. The department does not have a design team to brainstorm with and this project has a time limit of three months. Doing a heuristics analysis is more useful when performed by three to five user interface developers. [3] So, using TRIZ can be more effective and faster than brainstorming or the heuristics analysis. In this chapter the root conflict analysis (RCA+) and 40 inventive principles are used.

5.1.1 RCA+ (Root Conflict Analysis)

RCA+ (Root conflict analysis) is an analysing tool that finds the root conflicts of the problem. These conflicts have a positive and negative effect and are also called “technical contradictions”. When the root conflict is known, it is easier to think of solutions that eliminate the negative effect, while maintaining the positive effect. [4]

The RCA+ for Scene Control is shown in figure 5.1.

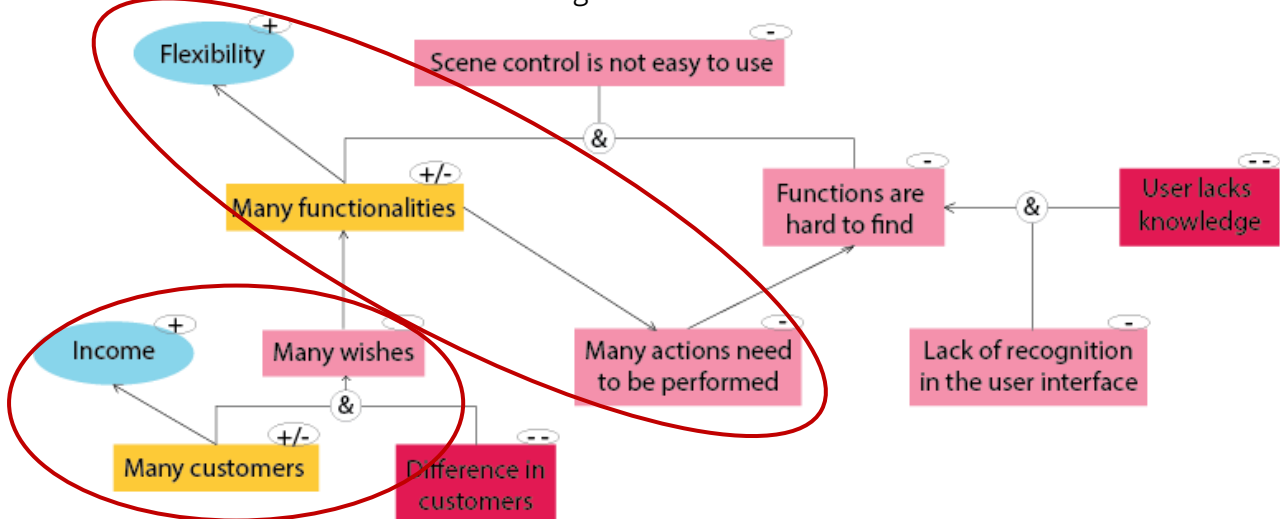


Figure 5.1: RCA+ diagram, containing two technical contradictions

The RCA+ is small. The right part of the diagram is not finished because customer information is missing.

The first technical contradiction is: “There are **many functionalities**, which causes the Scene Control to be **flexible**, but also causes **many actions to be performed**.”

The other technical contradiction is: “There are **many customers**, which causes the **many wishes and needs**, but also **provides income**.”

In this project Scene Control itself is changed. It is no option to make changes with customers or Nedaps' business plan. Therefore, an attempt will be made to solve the first technical contradiction. The right part of the RCA+ diagram, should be kept in mind for the redesign. It was not possible to analyse what the users' knowledge is on user interfaces. So, people in general must understand the features in the redesign.

5.1.2 Altshullers' matrix and the 40 Inventive Principles

To solve technical contradictions, a tool called "the Altshullers' matrix" is used. This is a matrix that plots the negative and positive effect of the contradiction and leads to design principles useful for solving the contradiction. [4]

In this case we want to keep the flexibility. So, the undesired result is "waste of information". On the other axis the necessary improvement is chosen, which is "the convenience of use".

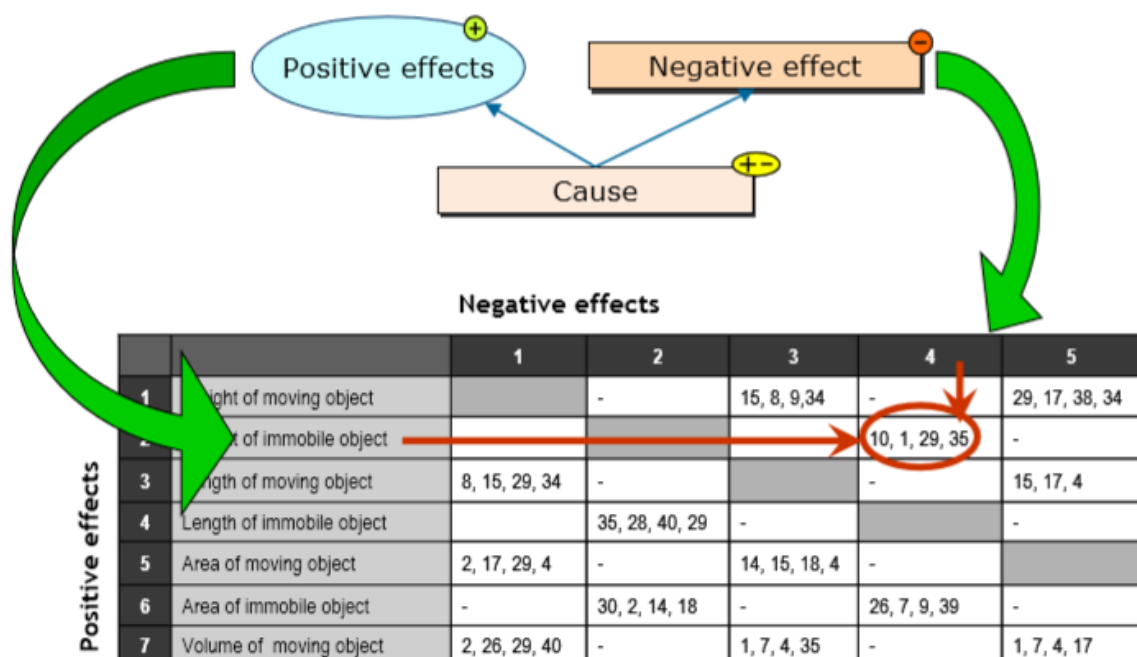


Figure 5.2: Diagram on the use of Altshullers' matrix

The matrix recommends the following of "the 40 inventive principles": [4]

Table 5.1: Principles for generating ideas to improve the ease of use, while maintaining functionality.

Number	Name	Principle explanation
1	Segmentation	Divide object into independent or linked parts.
3	Local quality	Redesign the object and environment such that each part of the object must be in conditions most relevant for each required operation.
5	Merging	Merge similar/identical functions of objects in space and time.
7	Nesting	Make specific process activities dynamically appear when needed only and disappear when not needed.
10	Prior action	If an object had to be changed. And that is hard to achieve, perform the required change of the object in advance.



5.1.3 Ideas on principle 1: Segmentation

#1 Divide Scene Control in two parts. One part where the planning is made and one part where the behaviour is decided.



5.1.4 Ideas on principle 3: Local quality

#2 Create profiles that differ per person. Users only has access to what they are authorised to see and control.

#3 Only present options in the legend that are installed in the installation. If there are no ballast sensors used in a group, it is also not visible for the users.



5.1.5 Ideas on principle 5: Merging

#4 A scene covers 24 hours and is assigned to weekdays in another window. These are both planning functionalities and can be merged. A calendar structure is the result. Some regularly used examples are; Google Calendar, Microsoft office Outlook and Apple Calendar.

#5 Scene Control uses five priorities. Merging these priorities to create one piece of behaviour, can create a better overview.

#6 Merge the advance options, *switch speed* and *minimum duration* in an interactive graph with on the x-axis time and on the y-axis light intensity.

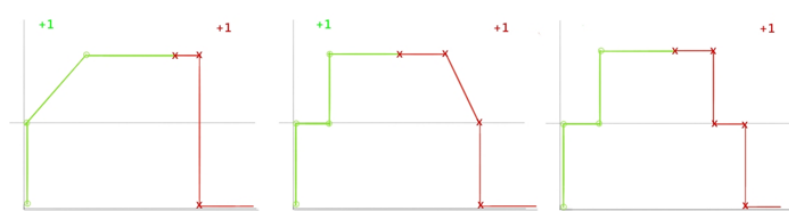
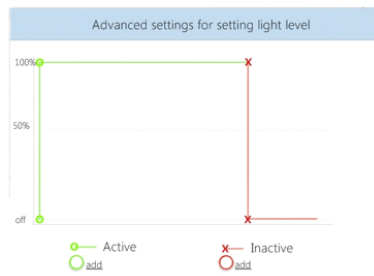
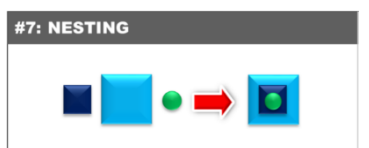


Figure 5.3: Advanced options for switch speed and duration



5.1.6 Ideas on principle 7: Nesting

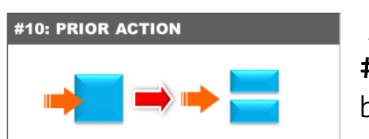
#7 Use information buttons in the legend of Scene Control to provide the user with more information.



Figure 5.4: Information button

#8 Use animations in Scene Control to show how to add an activity. Also dynamically show that blocks are clicked to open more options.

#9 Ask the user to assign it to a weekday, after he saved a scene. To prevent it is forgotten.



5.1.7 Ideas on principle 10: Prior Action

#10 Instead of asking afterwards on what day the scene should be applied, this is asked before someone edits or creates a new scene.

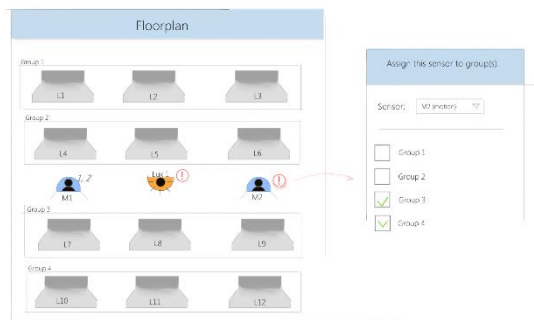


Figure 5.5: Assigning sensors to groups

#11 Luminaires are assigned to groups. Assign all hardware to groups, so not all sensors and switches can be selected in the options. This prevents the user from making mistakes.

#12 Use more copying functions. Often groups are similar. When a duplication is made in the behaviour of luminaires, the LMS remembers this. So, if it is edited, the duplications are automatically edited as well. This way the user performs less actions.

5.2 Combining the ideas to form concepts

The ideas generated with the principles only cover parts of Scene Control. To make a significant change in the usability, several of the ideas can be combined to generate proper concepts. Larger images of these concepts and iterations can be found on the flash drive, in the folder "Files>Sketches"

Table 5.2: Morphologic table combines ideas to create possible concepts

Number	Concept 1	Concept 2	Concept 3	Explanation
1				Segment in two tabs
2				Show less or more in different profiles
3				Show relevant sensors and switches
4				Calendar
5				Eliminate priorities
6				Interactive graph for advanced options
7				More information buttons
8				Use animations
9				Force apply to days after making the scene
10				Apply to days before making a scene
11				Assign sensors to groups beforehand
12				More copy from functionalities

5.2.1 Concept 1: Calendar and behaviour in two separate tabs

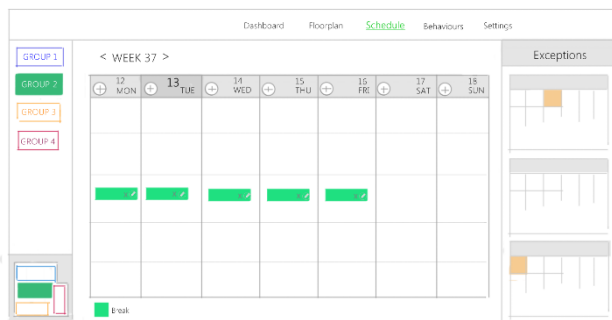


Figure 5.6: Schedule tab with a calendar

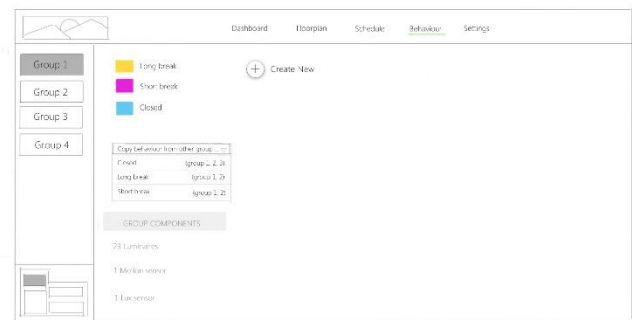


Figure 5.7: Behaviour tab with activities

With this concept Scene Control changes, in usage and appearance. The Scene Control tab is separated in two tabs: "schedule" and "behaviour". The schedule contains a calendar for each group. A calendar is recognisable for users. Like Nielsen says; "Use familiar concepts in an interface. This will make it easier to use." [5]

In the calendar there are actions with names like "store open" and "store closed". These names are chosen by the users themselves. It is important that they use logical words and not system-oriented terms. [5] This way all users can understand what is meant. The system knows how the luminaires behave during these actions. The user determines that in the behaviour tab.

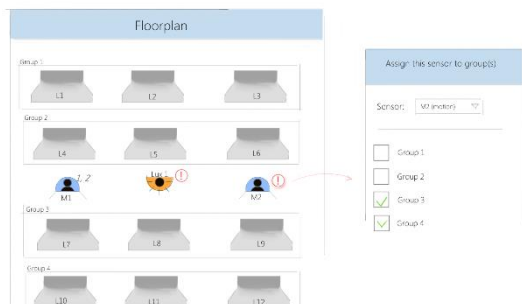


Figure 5.8: Assigning sensors and switches to groups

To reduce the amount of unnecessary information all hardware is linked to groups. This prevents mistakes and improves the usability. [5]

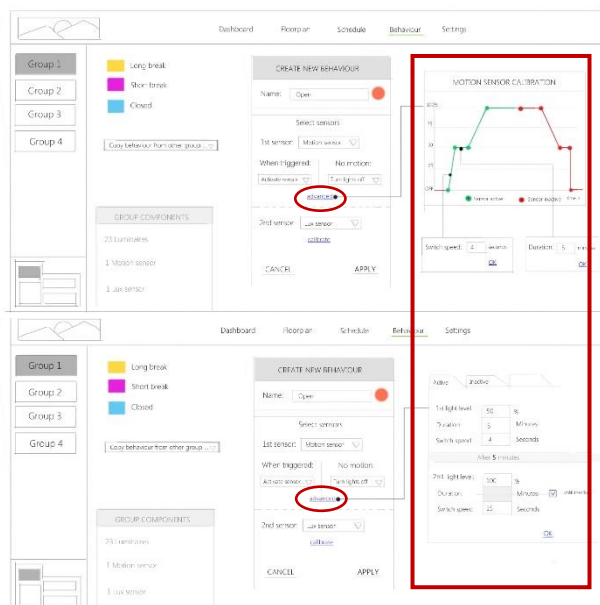


Figure 5.9: Advanced luminaire options

The table with priorities is eliminated. Instead behaviour is created in an options window. In this window hardware is selected. With a "Next button" hardware works parallel. With the function "turn on sensor or switch", hardware works in series.

More detailed luminaire properties are found in "advanced" options, which are also accessible via the options window.

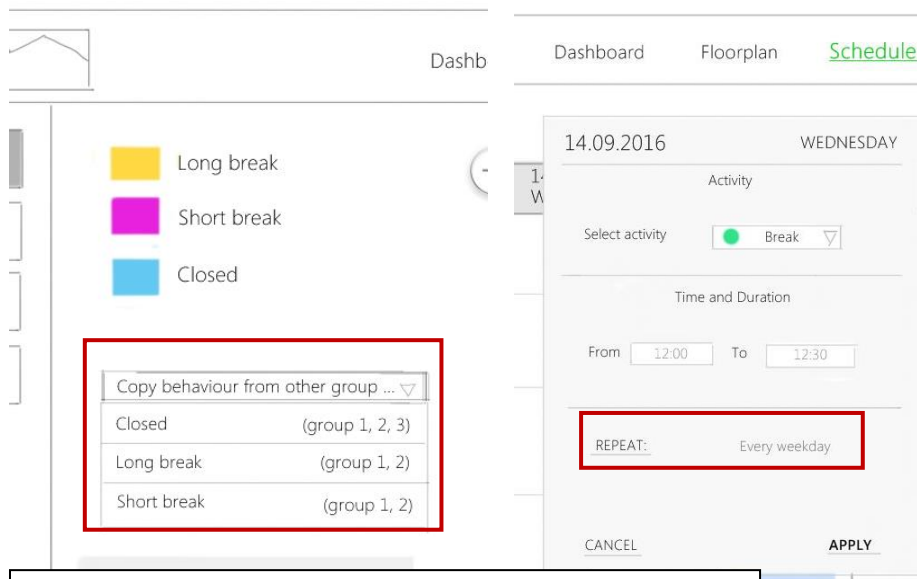


Figure 5.10: Copying options in behaviour and the calendar

In this design more copying functions are available. Actions can be repeated in the calendar and copied to other groups. In the behaviour tab, actions and their luminaire options can be copied from other groups as well. This gives the users the possibility to change light intensities and timing for several groups at a time. In other words they are shortcuts and allows to user to tailor frequent actions. For experienced users it can improve the usability of the interface a lot.[5]

5.2.2 Concept 2: Adjusted Scene Control

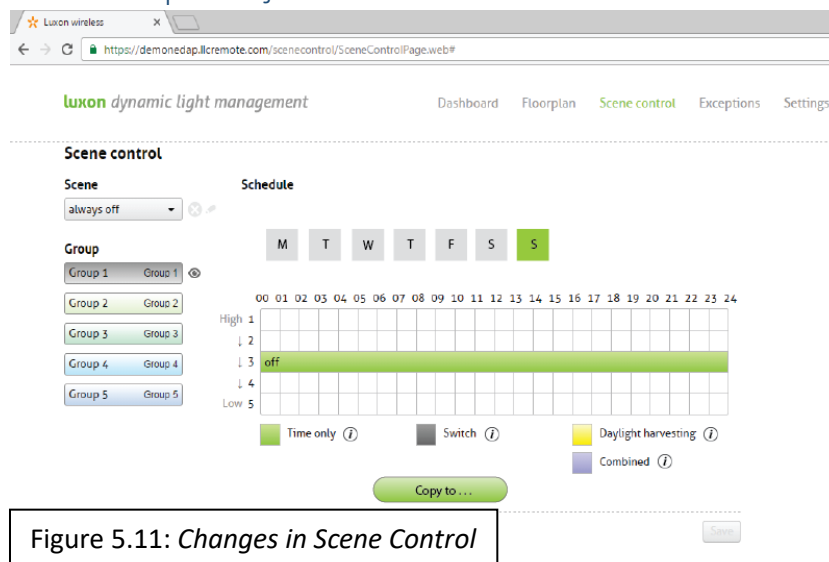


Figure 5.11: Changes in Scene Control

This concept does not change the appearance and usage of Scene Control. Again hardware is linked to groups, to reduce the amount of information in Scene Control. This also results in the legend presenting only relevant options for that group.

To prevent misinterpretation, extra information icons are placed in the legend. With short animations the usage of the legend is shown. It will illustrate that blocks need to be dragged and dropped in the table and that extra options will appear when the bar is pressed. If the user hovers over the legend the animation starts.

When a new scene is created, the user is asked on which days it needs to be active. This can later be changed in the scene as well. The copy from function will become more detailed

and the planning from one group can be duplicated as well. When changes are made, the system can apply it to the duplications as well.

5.2.3 Concept 3: Calendar and behaviour in one tab

This concept is a like the first one, but presents all functionality in one tab. The options window for luminaire settings will be more like the original one and does not hide the advanced options. A legend with activities will be presented next to the calendar. When pressed the luminaire behaviour appears and can be changed.

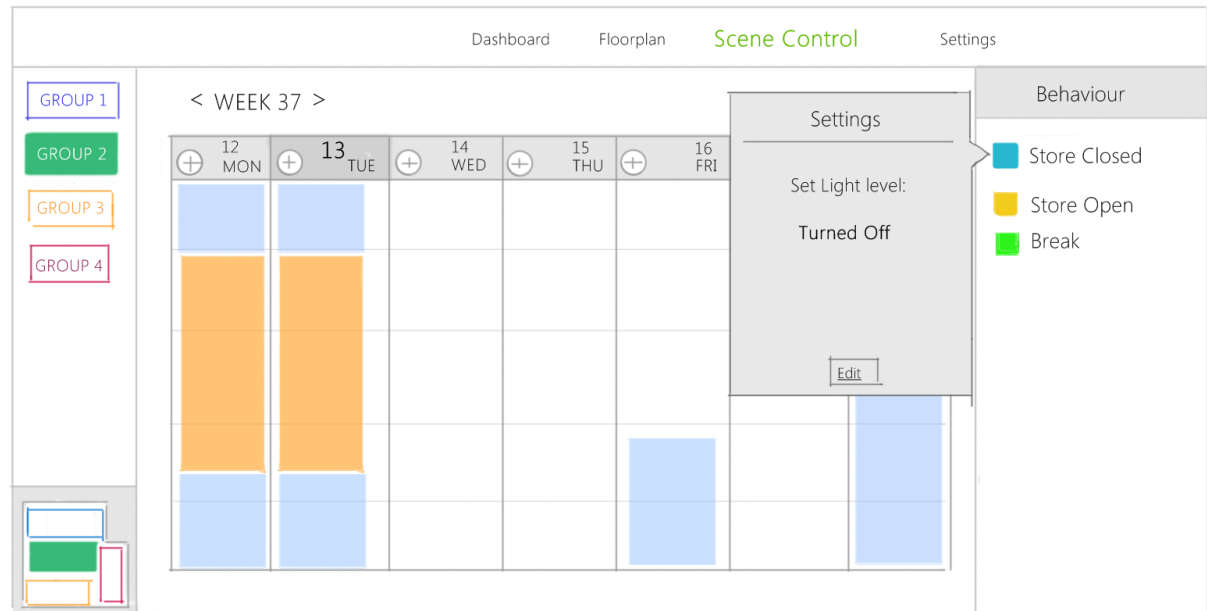


Figure 5.12: Redesign with all functionality in one tab

5.3 Concept evaluation with the requirements

The concepts are being evaluated with the requirements on functionality, understanding, accessibility and mistakes. Transparency and profiles are not considered in any of the concepts, because we need to focus on the existing functionality of Scene Control first.

Table 5.3: Concepts evaluated with the requirements

	Requirement 1: Functionality	Requirement 2: Understanding	Requirement 3: Accessibility	Requirement 4: Mistakes
Concept 1	++	+	+ -	+
Concept 2	++	-	-	-
Concept 3	++	+ -	+	+ -

5.3.1 Functionality

All concepts have the required amount of functionality. One functionality was lost. Load shedding is mentioned in the ideation. This function is not used and is therefore unnecessary. Removing it could lead to less confusion. In Concept 1 the functionality is

separated into two tabs. This makes the content of the tabs more predictable and less cluttered. It also makes the system more consistent. They do not have to wonder if functionalities mean the same. [5] In the schedule tab the user can only plan a calendar and in the behaviour tab the user only creates and changes actions.

5.3.2 Understanding

A calendar is frequently used by people. They will recognise this and users are able to predict how to use it. So, concepts 1 and 3 are easier to understand. However, the content of Concept 1 is separated and more predictable. Concept 3 is harder to predict due to the amount of functionality and it could become too cluttered. Concept 2 does not change much and therefore users will not understand it better either.

5.3.3 Accessibility

A calendar setup makes “planning behaviour to days” more accessible. Changing light intensities are still hidden behind an action and an override function is not yet implemented. These must become more accessible, but this should be in a logical place and that might not be Scene Control.

The accessibility of Concept 1 is lower, because it uses two tabs. The user needs to switch between tabs to reach all functionality. However, understanding the interface is more important.

5.3.4 Prevent mistakes

Mistakes can be prevented with a predictable interface. Since there is less functionality in the tabs of Concept 1, less mistakes can be made.

More developments can prevent mistakes. The user receives more notifications, or the system can automatically fix mistakes.

5.3.5 Concept choice

Concept 1 has much potential. This concept also has the many possibilities to grow with the future developments, because installations will become larger and more complex. Dividing the functionality in two tab, provides the possibility to add more functionality to the interface, without it becoming too cluttered. Therefore, it is decided to continue working on Concept 1.

5.4 Final remarks

In the ideation phase, customer information is missing. So, the chosen concept is missing this information as well. To effectively brainstorm or perform a heuristics analysis a group of user interface developers are required. The development does not have such a group, so TRIZ principles were used to generate ideas.

Concept 1 changes the user interface a lot, but is the best improvement according to the requirements. This concept is not finished. During further developments, consistency and usability principles need to be taken into consideration.

6 RAPID PROTOTYPING

Concept 1 is not finished. It is a rough idea, but a rapid prototype has already been made. By testing this idea with users, valuable feedback and information can be gathered. With that information new design choices and further improvements can be made.

In the first two sections the program in which the prototype is made and the first version of the prototype are described. Section 6.3 presents feedback on the first prototype. Finally sections 6.4 and 6.5 present the final prototype and the changes that were made according to the feedback.

6.1 Intuiface



Figure 6.1: *Intuiface logo*

The prototype is created in "Intuiface". This program allows the designer to create and test interactive user interfaces without coding. It has a wide range of possibilities and a prototype can be built relatively fast. Intuiface is made for touchscreen interfaces, but the touchscreen features will not be used in the rapid prototype. Furthermore, Intuiface only animates a user interface, it is not possible to control luminaires in the reality.

6.2 First prototype

The first prototype contains most of the functionalities Scene Control has. This made it too large, which caused the interface to crash. The interface must become smaller for testing. The first version of the redesign is presented in figures 6.2 to 6.19. This prototype can be

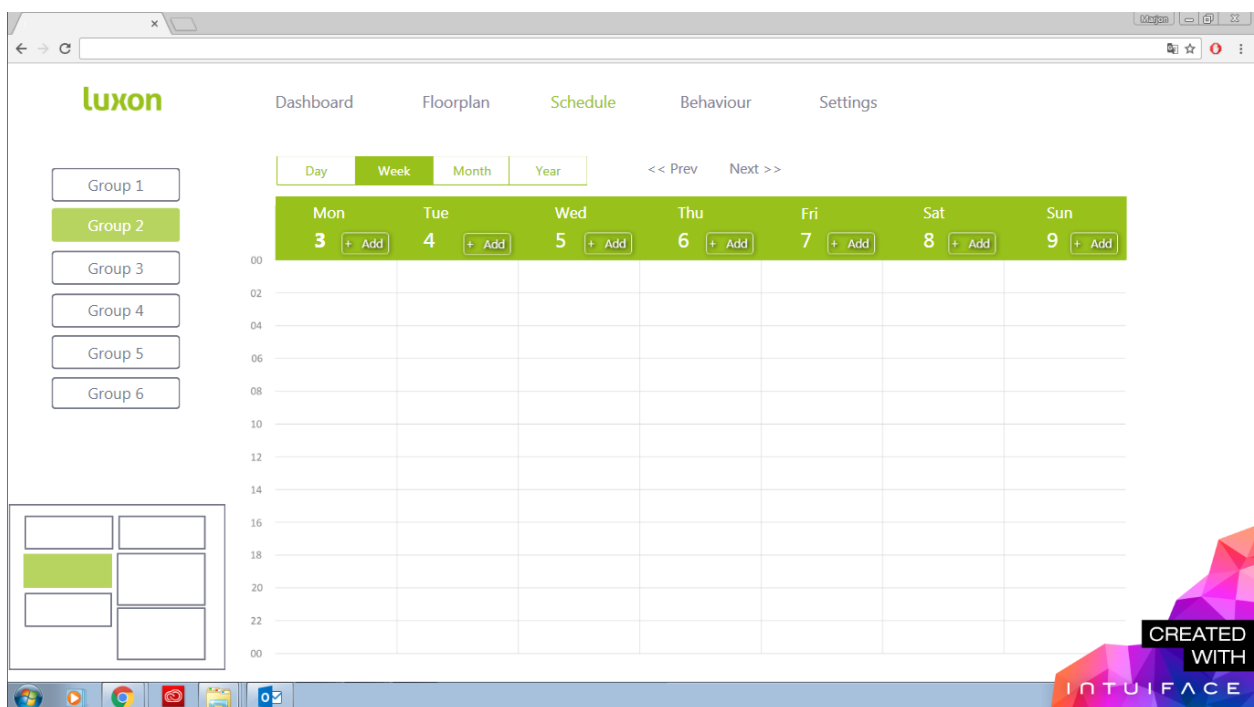


Figure 6.2: *Empty schedule tab*

found on the flash drive in the folder "Files > First rapid prototype". Open the "IFX"-file in Intuiface.

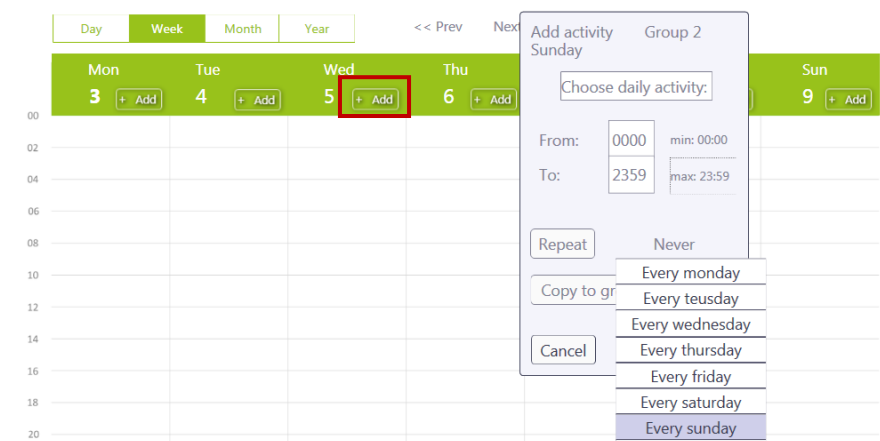
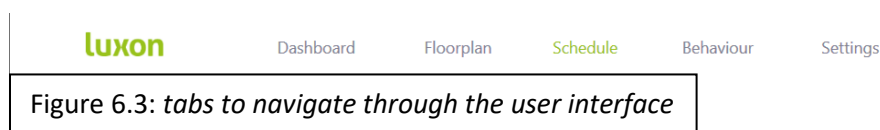
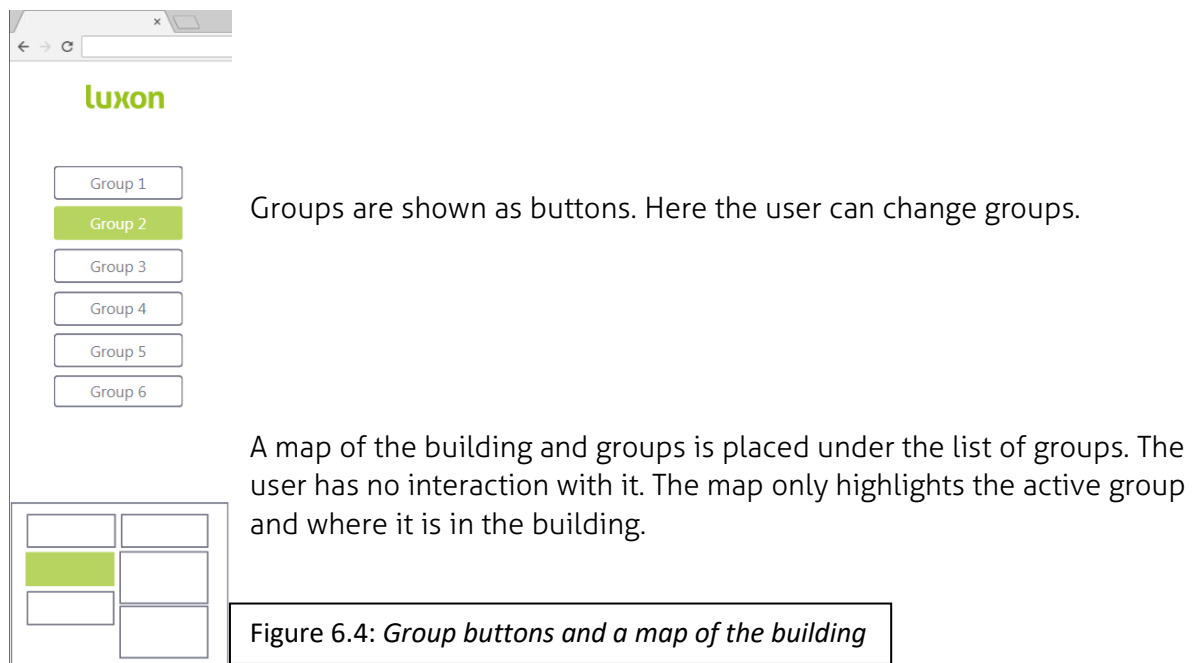


Figure 6.5: adding an activity to the calendar

A week calendar is presented for each group. With the add button a new activity can be added to that day.

The add button will open the window for planning an activity. Here the user can choose an activity. He decides the start and

end. He selects the days to repeat it on and can copy the activity to other groups.

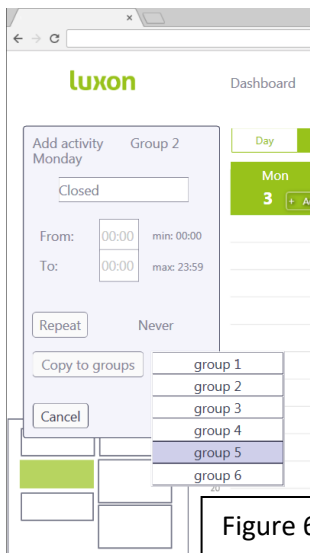


Figure 6.6: copying an activity to other groups

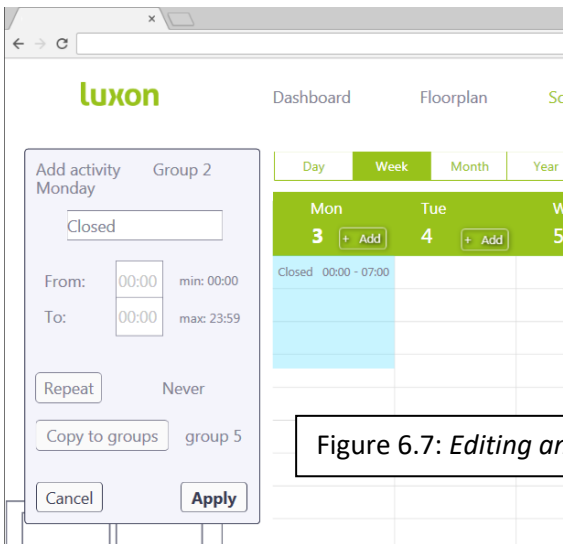


Figure 6.7: Editing an activity

The blue block in the calendar is an activity. When it is pressed, the users opens the options window. Here can edit the activity.



<< Prev Next >>

Figure 6.8: Navigating through the calendar

This part allows the user to switch between day-, week-, month- or yearmode. With the "Prev" and "Next" buttons the user can skip through weeks, in this case.

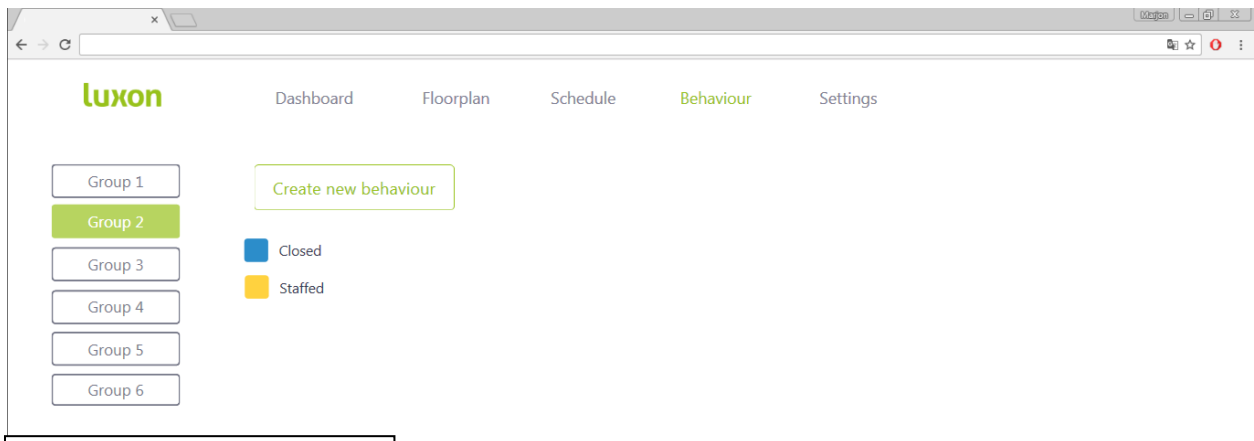
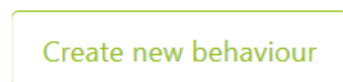


Figure 6.9: The behaviour tab

In the behaviour tab new behaviours can be added and edited for each group.



This is the button that opens an empty window for a new behaviour.

Figure 6.10: Creates a new activity



These are existing behaviours. The behaviours appears in the schedule tab as an activity. In behaviour they can be edited. When the user presses a behaviour a window opens. There the user can see what the luminaires will do and change that.

Figure 6.11: Activities containing luminaire behaviour

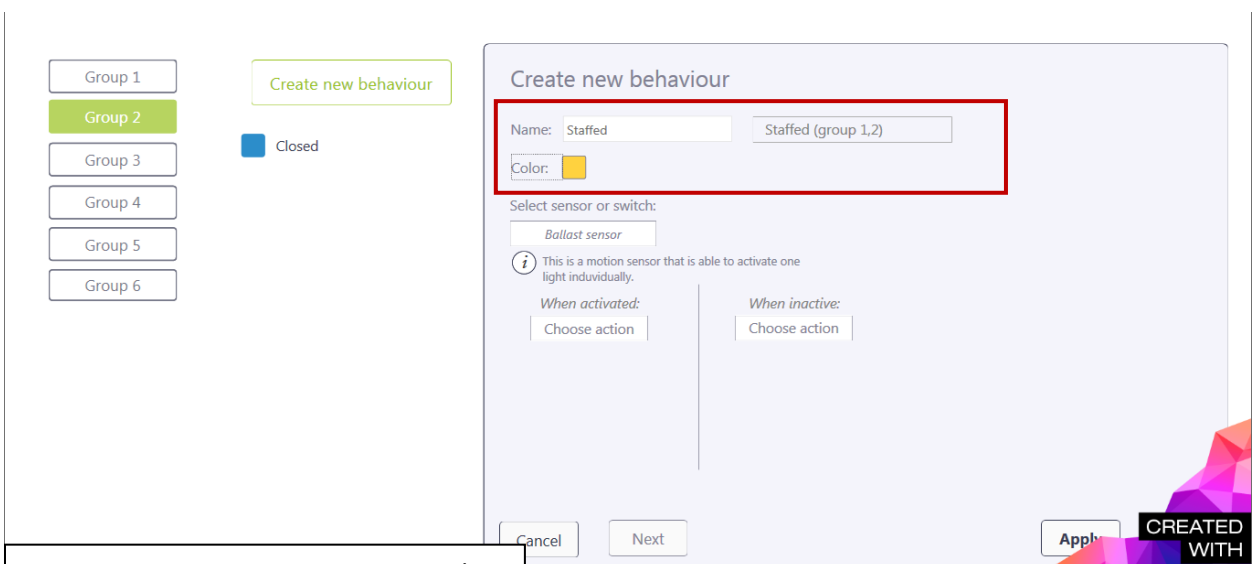


Figure 6.12: Create new activity window

In the upper part of the window a name and colour is chosen for the new activity. The "copy from group" button allows the user to copy the settings of an existing activity to this new one. In select sensor or switch the user can select a sensor or switch that is linked to the group, but he can also choose to use none.

Different options for creating behaviours are found in figures 6.13 to 6.20: They can differ from simple to complex, depending on the needs of the user.

Create new behaviour

Name:

Color:

Select sensor or switch:

☐ None

i No sensors or switches are used now. The lights will be set as you decide.

Set light level:

off % 100%

[Advanced](#)

Figure 6.13: No sensor or switch is used. The light intensity is set.

Create new behaviour

Name:

Color:

Select sensor or switch:

☐ Dimmer

i A dimmer will dim the light according to the input it gets.

[Calibrate dimmer](#)

Figure 6.14: A dimmer is chosen. It can only be calibrated.

Create new behaviour

Name:

Color:

Select sensor or switch:

☐ MotionA (motion)

i With a switch the user can trigger actions on location.

When activated:	When inactive:
<input type="button" value="Choose action"/>	<input type="button" value="Choose action"/>
<input type="button" value="Turn off lights"/>	
<input type="button" value="Turn on lights"/>	
<input type="button" value="Turn on light with sensor or switch"/>	

Figure 6.15: A motion sensor is chosen. The user can choose two actions.

Create new behaviour

Name:

Color:

Select sensor or switch:

☐ MotionA (motion)

i With a switch the user can trigger actions on location.

When activated:	When inactive:
<input type="button" value="Turn on lights"/>	<input type="button" value="Choose action"/>

Set light level:

off % 100%

[Advanced](#)

Figure 6.16: When motion is detected the luminaires turn on.

Create new behaviour

Name:

Color: ☐

Select sensor or switch:

i With a switch the user can trigger actions on location.

When activated:

Select sensor or switch:

When inactive:

MotionB (motion)

i With a switch the user can trigger actions on location.

When activated:

When inactive:

Set light level:

off 100%

[Advanced](#)

Figure 6.17: When motion is detected another motions sensor turns on.

Select sensor or switch:

i With a switch the user can trigger actions on location.

When activated:

Select sensor or switch:

i This sensor is a light sensor. When there is a lot of daylight, the lights will dim.

[Calibrate Lux](#)

Figure 6.18: When motion is detected a lux sensor turns on.

Create new behaviour

Name: copy group group:

Color: ☐

Select sensor or switch:

MotionA (motion)

i With a switch the user can trigger actions on location.

When activated:

Sensor or switch

Select sensor or switch:

Lux sensor

i This sensor is a light sensor. When there is a lot of daylight, the lights will dim.

[Calibrate Lux](#)

When inactive:

Turn off lights

Next

Apply

CREATED WITH

Figure 6.19: "Next" lets sensors work parallel. Two motion sensors influence the lux sensor.

The "Next" button, makes it possible to let two sensors work independently from each other, while influencing the same group at the same time. This is needed a group covers a large area and more motion sensors are needed.

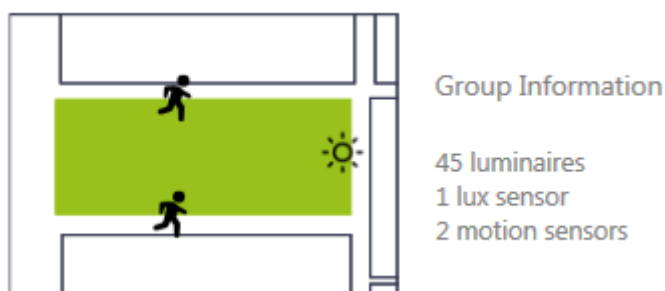


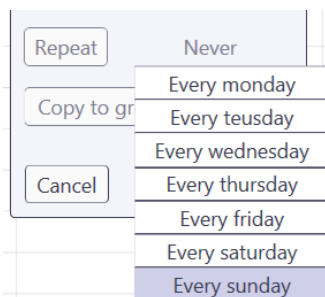
Figure 6.20: Map with close up of a group and group information

At the left bottom of the screen a close up of the map is presented. This presents the group the user works in. It also reveals where sensors and switches, linked to that group are located. Next to the map a short description of the groups is given. This close up map and information appears when a new activity is created or edited.

6.3 Feedback

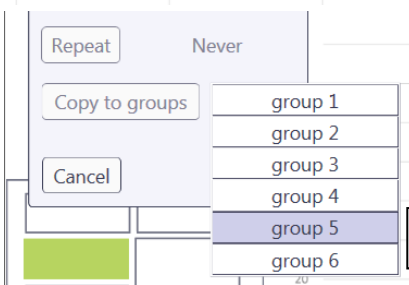
Before starting any tests, a feedback session was arranged with another developer from Nedap. He made clear that users need a better overview of the groups. The map must be more recognisable. Further, he emphasised that many customers use 20 groups or more. He questions if this concept is handy enough for large installations.

With handy he meant: "Do people need to repeat many steps?" This is the case in Scene Control. Large installations often have many groups that are similar. The redesign makes smart use of the similarities of these groups, by using more copying options. So, user does not have to repeat as many steps.



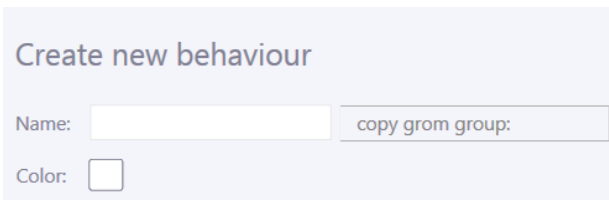
1. Repeat is an option found in the calendar, under the settings of an activity. With this option that activity can be repeated on weekdays. So for example when the user selects Monday, the activity will be repeated on every Monday of the year.

Figure 6.21: Repeat an activity on every Sunday



2. Copy to groups ... is also found in the calendar under the settings of an activity. With this functionality that activity can be copied to other groups that contain the same activity. This way the users do not have to plan an activity for every group separately.

Figure 6.22: Copy the activity to the calendar of group 5



3. Copy from group ... is found in the behaviour tab, when creating a new activity. This duplicates an activity from a group. It prevents the users from having to create the same activities every time.

Figure 6.23: Duplicate an activity from another group

All copied items can still be changed separately. The user must have the option to apply the change to all copies or to only one activity.

Presets were mentioned in the feedback session as well. These could be used for holidays and other exceptions. The current user interface has a tab "exceptions". Without scenes this tab would disappear. Presets would replace this functionality. However, with the use of a calendar "exceptions", "scenes" or "presets" are not necessary anymore, because users can plan every day separately, so an exception as well. It is interesting to have a look at a presets option. This will be discussed later in this chapter.

6.4 Final prototype

According to the feedback a final prototype was made. In this prototype not every aspect is working. Only functionalities that perform a task in the user test are working. So, several buttons do not react and changes only happen when the right conditions are met. This way the program runs at a proper speed. A prototype with a proper reaction speed is more useful than one that runs slow and freezes.

This final prototype can be found on the flash drive in the folders "File > Final rapid prototype > NEW SCHEDULE ONLY" and "File > Final rapid prototype > NEW BEHAVIOUR ONLY". Open the "IFX"-files in Intuiface.

The changes in the prototype are described below.

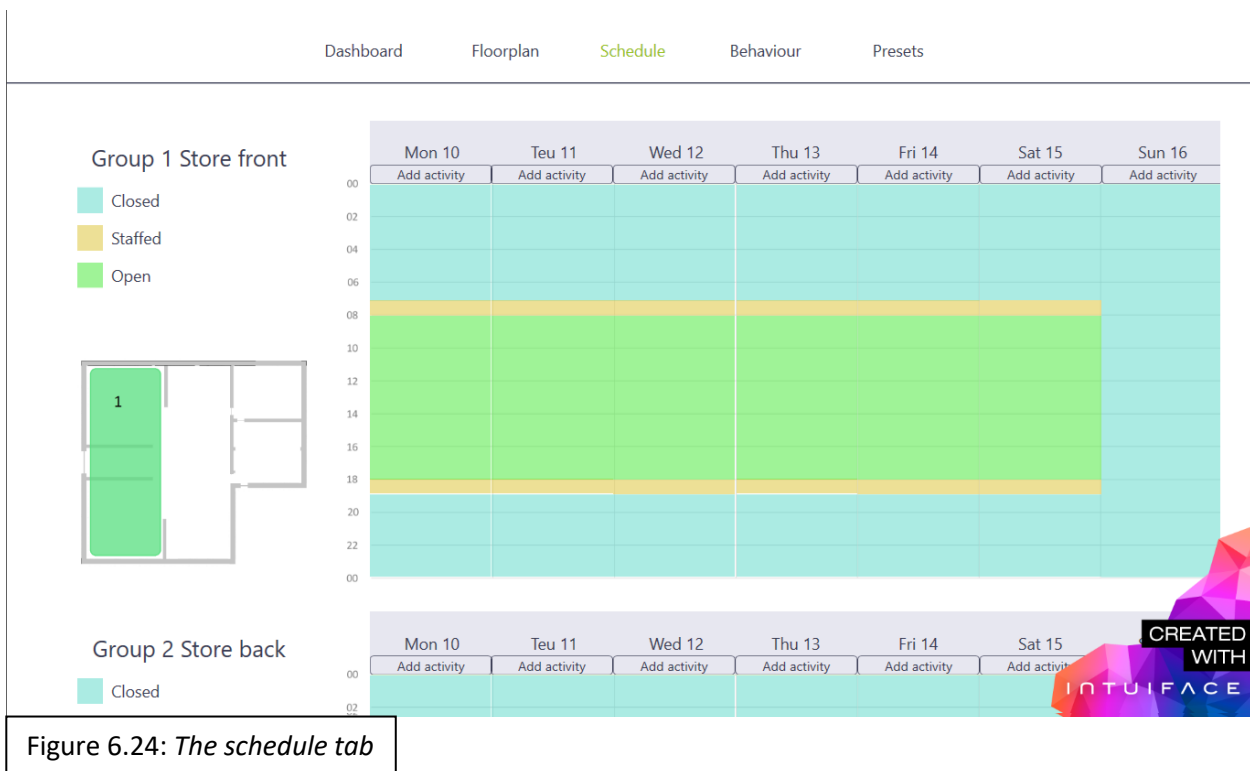


Figure 6.24: The schedule tab

All groups are now found on the same page. Users navigate to groups, by scrolling. The map has become less abstract and represents an actual building.

The screenshot shows a settings window titled 'Monday 10'. It has a dropdown menu set to 'Closed'. Below the dropdown is a checkbox labeled 'All day'. Underneath the checkbox are two time input fields: 'From: 00 : 00' and 'To: 7 : 00'. Below the time fields is a 'Repeat' button. To the right of the 'Repeat' button is the text 'Every Mo, Tu, We, Th, Fr, Sa'. Below the 'Repeat' button is a button labeled 'Apply to other groups'. To the right of this button is the text 'Groups 1, 2, 3'. At the bottom left of the window is a 'Cancel' button, and at the bottom right is an 'Apply' button.

The settings window for adding or changing an activity in the calendar stayed the same.

Figure 6.25: Add or edit window in schedule

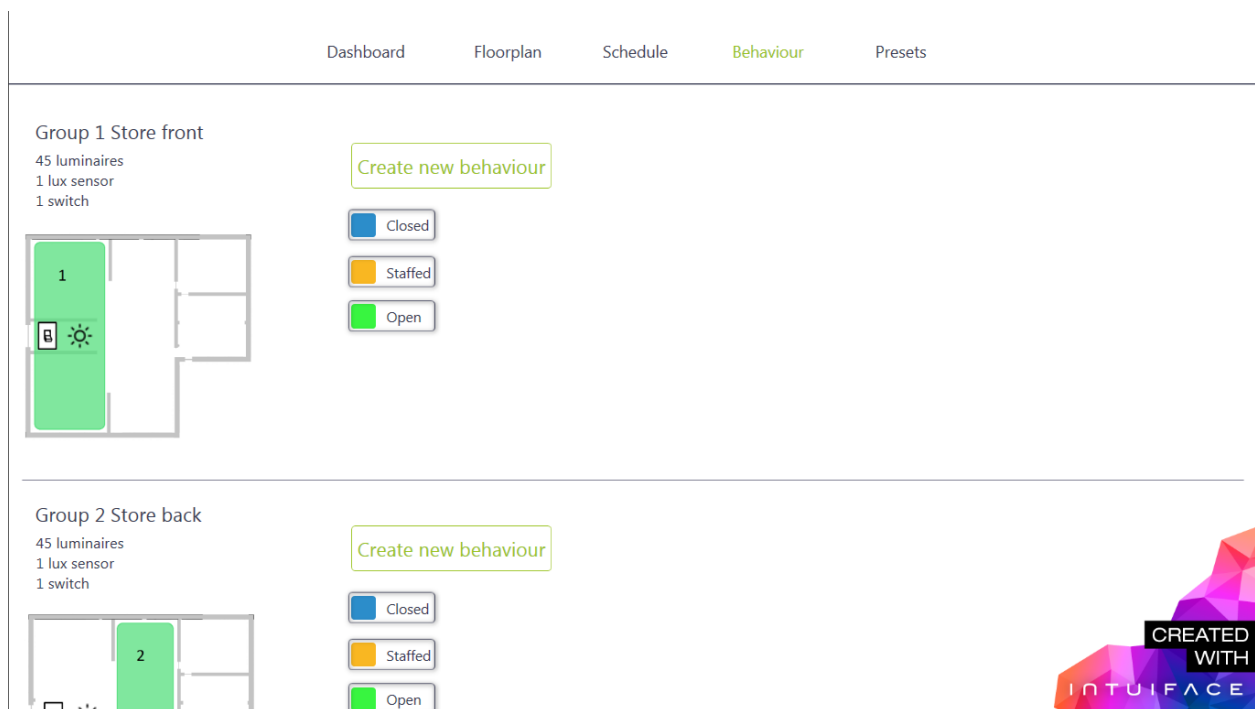


Figure 6.26: The behaviour tab

In behaviour the same changes were made regarding the navigating to groups and the map.

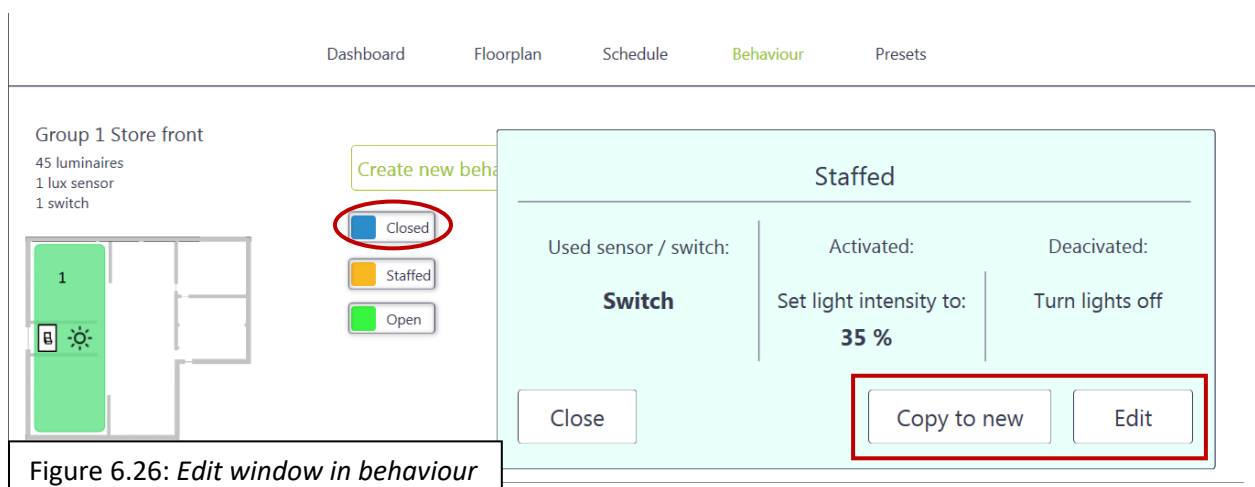


Figure 6.26: Edit window in behaviour

First, when an activity is selected, more information about the luminaire behaviour appears. The user can edit the activity and duplicate it to other groups, as well.

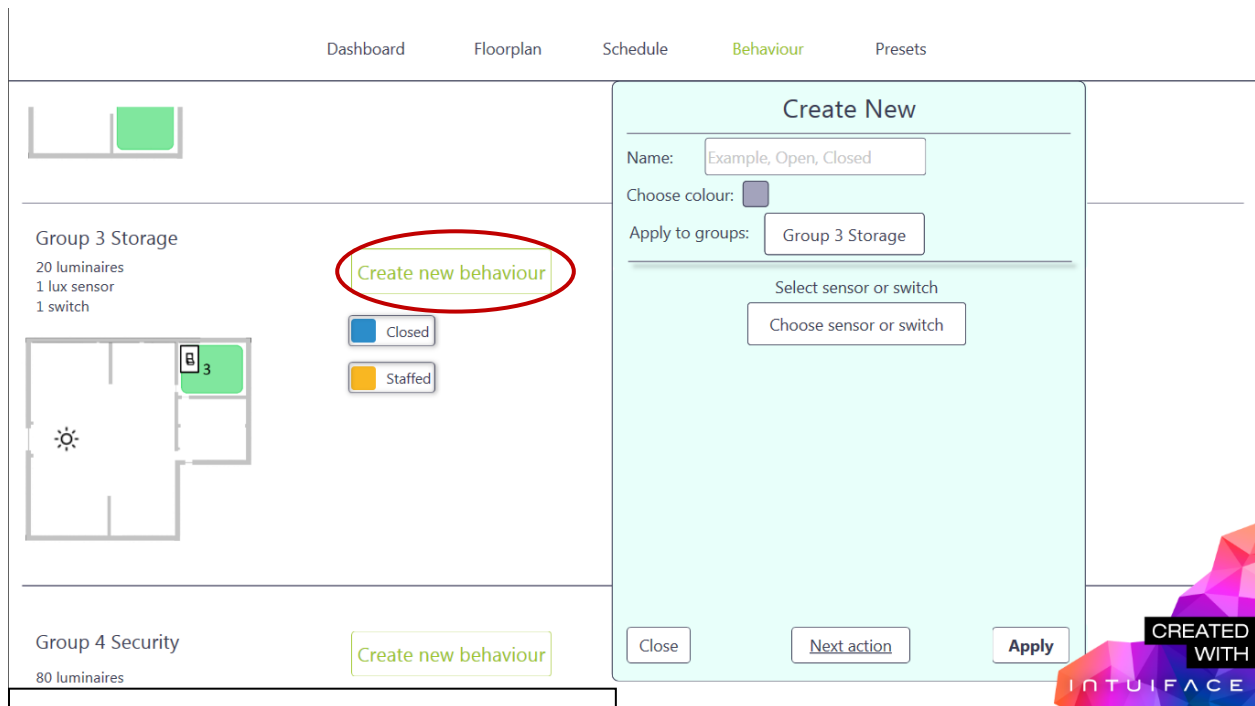
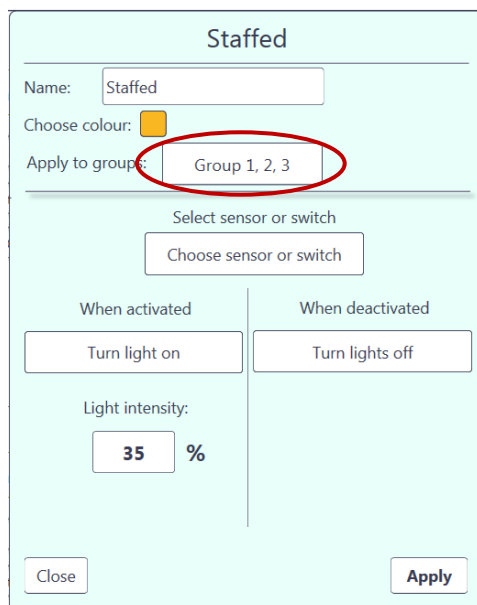


Figure 6.27: Window for creating a new activity



Editing and creating an activity stayed mostly the same. The window became slimmer and the user can immediately choose to duplicate it to other groups.

Figure 6.28: Editing an activity in behaviour

6.5 Presets

After the feedback session presets were taken into consideration. An idea formed and a prototype was developed. The presets prototype can be found on the flash drive in the folder "File > Final rapid prototype > Preset ONLY". Open the "IFX"-files in Intuiface.

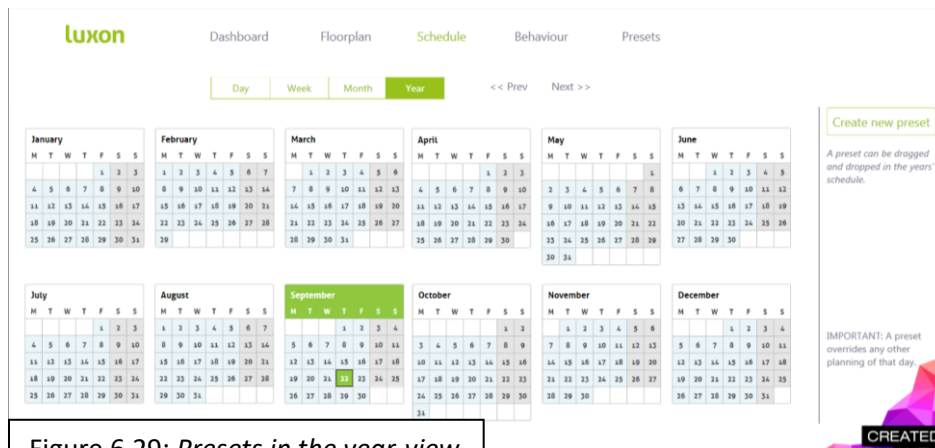
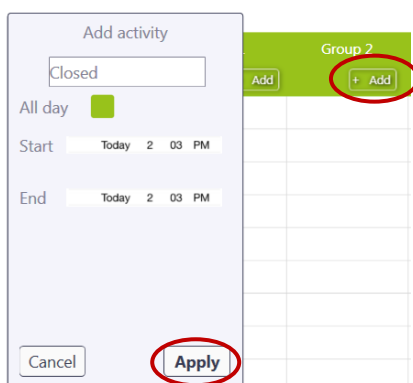


Figure 6.29: Presets in the year-view



Figure 6.30: The presets tab



When the add button is pressed a window opens in which an activity is chosen for that group.

"Apply" adds the activity to the table.

Figure 6.31: Adding an activity to presets

Presets are used in the years view. The presets appear on the right and can be dragged and dropped in the calendar.

Here presets are made. It looks like the calendar, but places the groups at the top of the table instead of days.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
	+ Add	+ Add	+ Add	+ Add	+ Add	+ Add
00	Closed 00:00 - 23:59					
02						
04						
06						
08						
10						
12						
14						
16						
18						
20						
22						

Create new preset

In a preset you can determine the planning for one day for all groups. You can use this for example for planning holidays.

The saved presets are shown in the year calendar. There you can place the preset on the desired dates.

Save preset as...

Go to year
schedule

Figure 6.32: An activity is added to presets

The screenshot shows the 'Presets' tab in the Luxon interface. It displays a table with 6 groups and 24 time slots. The first group is 'Closed 00:00 - 23:59'. The 'Save preset as...' button is circled in red. Below the table, there is a 'Go to year schedule' button.

When the table is fully filled, it can be saved.

Save preset as...

Choose name: Holiday

Example: Holiday,
Summer break

Choose preset color: HOLIDAY

This color is shown
in the year schedule

Cancel

Save

Figure 6.33: A full preset

Figure 6.34: Save preset window

After it is saved it will appear in the year schedule.

The screenshot shows the 'Schedule' tab in the Luxon interface, displaying a year view calendar. The 'Year' tab is selected. The calendar shows months from January to December. A 'Holiday' preset is highlighted in red in the calendar view. On the right, there is a 'Create new preset' button and a note: 'A preset can be dragged and dropped in the years' schedule.' Below that, the 'Holiday' preset is listed with a red circle around it. At the bottom right, there is an important note: 'IMPORTANT: A preset overrides any other planning of that day.'

Figure 6.35: Preset shown in the year view

Presets do not add a new functionality to the user interface. This is already possible in the calendar itself. Presets only allow the user to make exceptions with less actions.

This approach for presets is different from the calendar and makes the user interface less consistent. For now it is more important that Scene Control becomes easy to use. That is why presets it not tested in this project.

Later in the detailing phase another approach for presets is presented.

7 TESTING THE FINAL PROTOTYPE AND SCENE CONTROL

In this chapter the test setup is described for the user test. The test compares Scene Control and the final prototype. Scene Control is described in chapter 2 and the redesign is found in chapter 6. Section 7.1 describes the questions that need to be answered by the test. In section 7.2 the method is described. My expectations are described in section 7.3. In section 7.4 the results are presented and discussed.

7.1 Goals of the user tests

To make sure the redesign is an improvement, the following questions need to be answered.

1. *Can users perform tasks more easily in the redesign than in Scene Control?*

Momentarily users seem to have trouble performing tasks in Scene Control. It is important to know how large that problem exactly is and if the new interface improves the usability of the system.

Task success is a usability metric that can be tested. The results of task success are binary. The user is either able to perform a task or not. If users cannot complete a task that means it needs to be changed. [6] The participant can score 0% or 100% in assignments that test task success.

2. *Is the redesign more efficient than Scene Control?*

Efficiency is also a usability metric. It measures the amount of effort needed to complete a task. Effort is the amount of time it takes or the physical and mental effort a user puts in the task. [6] When participants perform the same tasks, the duration can be measured and compared.

In case there is no large difference in task success, the duration can also say if there is a change in usability of the interfaces.

3. *Do users understand the functions in the user interface?*

If people can finish a task, that does not necessarily mean they understand the interface. When the interface is predictable, the interface is easier to learn, easier to use and mistakes are prevented. [7]

The options presented in the legend of Scene Control contain the main functionality. If users can predict what these options do, that interface is understandable. Else, the user needs to be educated and the interface is not understandable enough.

4. *Is there a difference in user satisfaction between the redesign and Scene Control?*

Satisfaction measures how happy a user was during an experience. If a user likes to use the product, he is more likely to use it again or recommend it to others. The ease of use contributes to the user satisfaction, but how people feel about it is subjective. It depends per individual, on their mood and on other external factors. So the results are harder to analyse. [6]

7.2 Method

To answer the questions from section 7.1, two tests are made. One test examines Scene Control. The other investigates the redesign. Sixteen participants will take part. These participants are aged between twenty and thirty and have a technical background. Scene Control will be tested with eight people and the redesign as well. The participants are allowed to see one interface. This way they cannot compare them or learn from them. This amount of participants does not provide a statistical representation. It can however offer a useful impression on what to improve in the design.

The two user tests contain the same assignments. With these assignments task success and duration is measured. The two user interfaces are different from each other, but the assignments will be as similar as possible, so results can be compared.

Users are asked questions to determine if they understand the user interface and how they experienced it. The evaluator communicates all the assignments and questions to the participants orally, to make sure the duration of assignments are not influenced by differing reading speeds.

7.2.1 General test setup

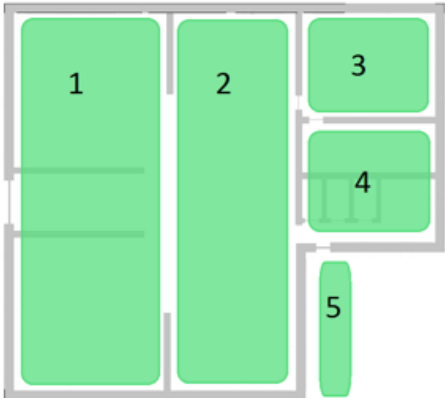
Every participant will receive the same introduction text, which they read themselves.

Scene control

In dit onderzoek krijgt u een aantal opdrachten die u gaat uitvoeren in een computerprogramma. U wordt aangemoedigd om de dingen die u denkt hardop te zeggen. Dit kan namelijk helpen bij het verbeteren van de interface.

U bent de eigenaar van een groot winkelwarenhuis, vergelijkbaar met de Makro. Om energie en geld te besparen heeft u geïnvesteerd in een slim licht systeem waarmee u de verlichting in het pand kan regelen. In uw pand wordt gebruikgemaakt van een daglichtsensor en schakelaars.

Dit systeem komt met een computerprogramma waarin u de sensoren en lichtintensiteit kunt aansturen. In de afbeelding is een kaart te zien van uw locatie. De groepen die u ziet in de locatie zijn in de realiteit groepen lampen. Deze lampen worden ook als groep aangestuurd in de web applicatie.



#	Groep naam	Omschrijving
1	Group 1	Voorkant van de winkel
2	Group 2	Achterkant van de winkel
3	Group 3	opslagruimte
4	Group 4	Beveiligingsverlichting
5	Group 5	Reclame verlichting

Als er iets nog niet helder is kunt u dit vragen aan de persoon die met u de test afneemt.

Wanneer u niet meer verder wilt gaan met het onderzoek, mag u er altijd voor kiezen om te stoppen. |

Figure 7.1: Introduction of the user tests

The introduction text pictures a scenario in which the participant is the owner of a member warehouse. They receive a map of their building and an explanation on what Luxon dynamic light control is. The text says that they are going to test a user interface in which they can manage the luminaires.

If they have any questions, they can ask the evaluator. If there are no more questions and the participant wants to continue, the user test starts. All participants are encouraged to speak their thoughts out loud, while doing the test.

Detailed versions of the user tests are found on the flash drive, in the folder "File > User test questions". These files are written in Dutch, since the test was performed with Dutch people.

7.2.2 Scene Control test

The Scene Control test starts with a few assignments. Later the participants receive a question on the legend on how satisfied they were. The test finishes with question on the legend.

The test goes as follows:

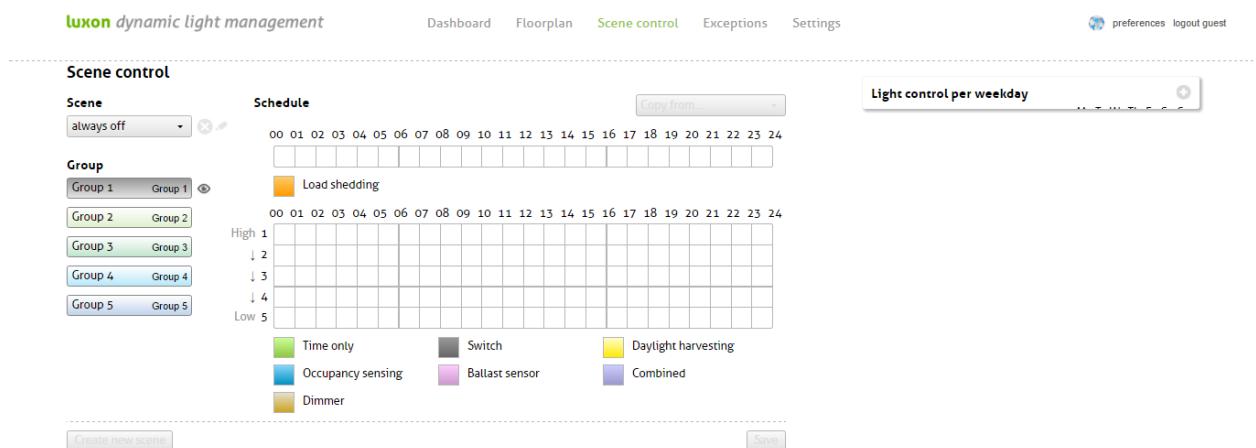


Figure 7.2: New scene in Scene Control

1. Make sure the store is closed and groups 1, 2 and 3 have the lights off for the whole day. When users fail to perform the first assignment, they will receive a hint. If they after the hint still fail to do it, the evaluator will explain it.
2. Make sure the safety lights are on during the security round.
3. Make sure the billboards are on the whole day.
4. Apply the scene to Sunday.

Assignments one to four challenge the participants immediately. This confirms how easy Scene Control is for new users. The duration of the assignments is also be documented.

5. The planning has changed and the store opens an hour earlier. Make sure the light can turn on an hour earlier for group 1.

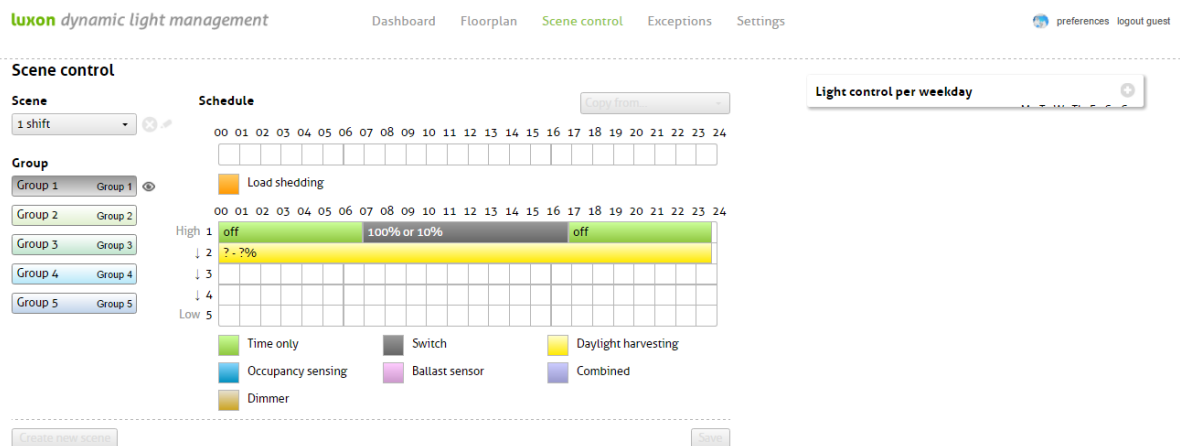


Figure 7.3: A filled table in Scene Control

This assignment tests how easy it is for users to change an existing scene.

6. How satisfied are you about this user interface. Give a mark between 0 (very unsatisfied) to 10 (very satisfied). Explain why you give this mark.

Here the user satisfaction is measured. Since they cannot compare the two interfaces, it is important to know why he chooses a certain mark.

7. Explain what you think the blocks mean in the legend.

Assignment seven provides insight on how well people understand what their possibilities are in the interface. Scene Control has seven items for which they can score a point.

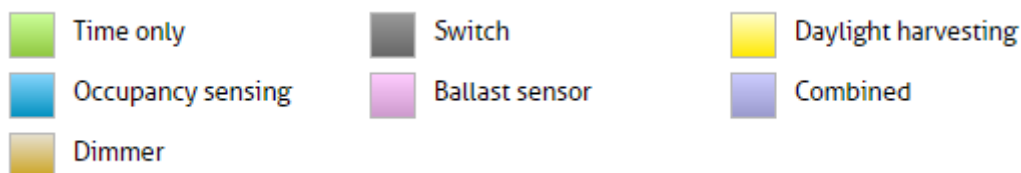


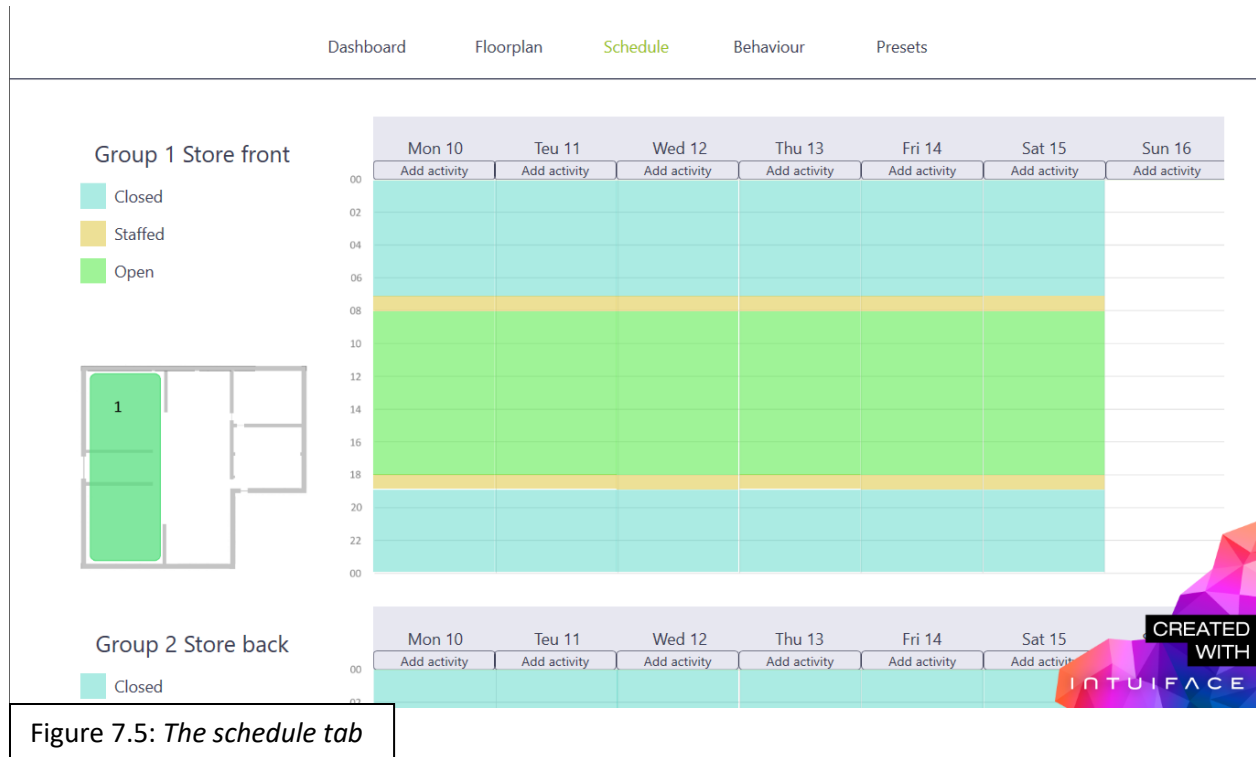
Figure 7.4: The legend of Scene Control

Table 7.1: Questions and assignments in the Scene Control test

Question	Assignment to answer the question	Score
1. Task success	1, 2, 3, 4, 5	0 or 100%
2. Efficiency	1, 2, 3, 4, 5	Duration in minutes
3. Understanding	7	Between 0/7 and 7/7
4. User satisfaction	6	Between 1 and 10

7.2.3 Schedule test (redesign test part 1)

Eight participants will take part in the user test for the redesign. The test is divided in two parts: "schedule" and "behaviour". The assignments, questions and scores of the schedule test are the same as those in Scene Control.



1. Make sure the store is closed and groups 1, 2 and 3 have the lights off for the whole day.
2. Make sure the safety lights are on during the security round.
3. Make sure the billboards are on the whole day.
4. Apply the scene to Sunday.

Here the user will see a filled calendar, because in reality a user receives a fully prepared system. The gap on Sunday is only possible when the user already removed other activities. Scene Control starts in a new scene, so the redesign starts with an empty Sunday. That situation is closest to reality.

Assignment four, planning on Sunday, is in schedule a function merged with the calendar. In both tests the participant receives a score for this assignment.

5. The planning has changed and the store opens an hour earlier on every day the store is open. Make sure the light can turn on an hour earlier for group 1.

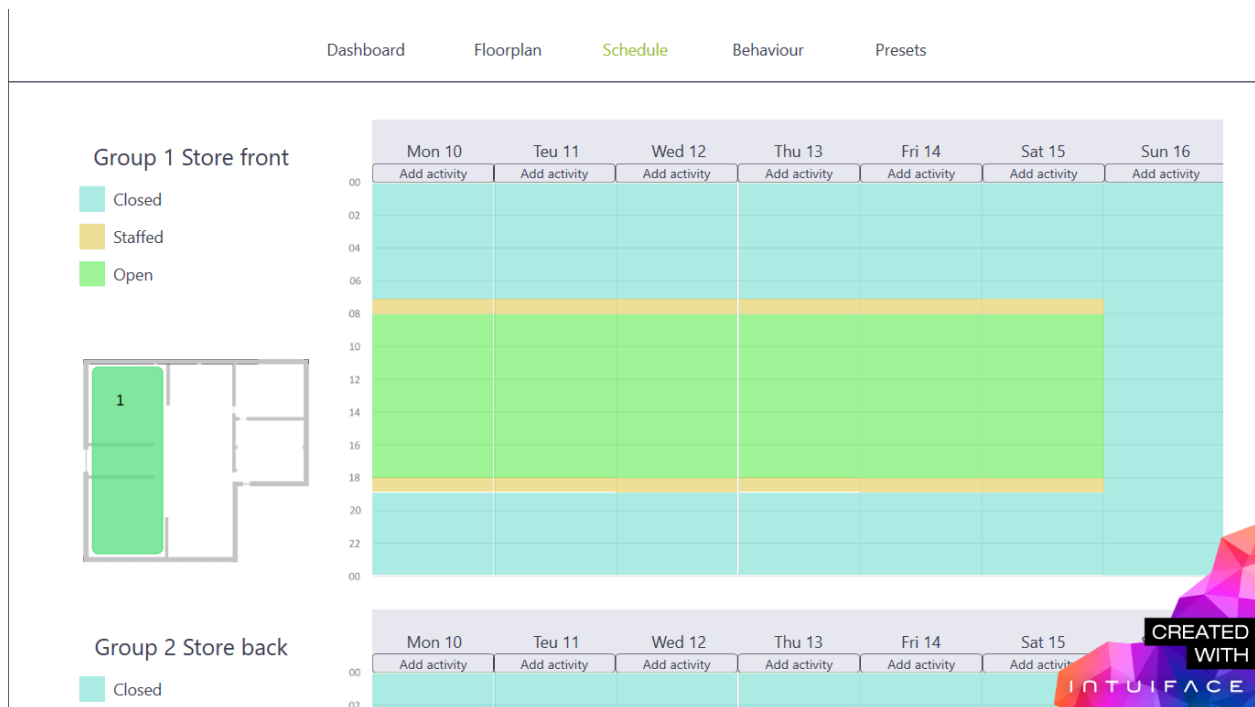
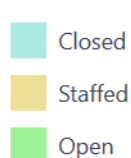


Figure 7.6: The schedule tab

This assignment test how easy it is for users to change existing activities in the calendar.

6. How satisfied are you about this user interface. Give a mark between 0 (very unsatisfied) to 10 (very satisfied). Explain why you give this mark.

At this point the user has not yet seen the full user interface. However, it is already asked to keep the test consistent. The evaluator asks why the participant chooses a certain mark.



7. Explain what you think the blocks mean in the legend.

The schedule tab only has three items for which they receive a score.

Figure 7.7: The legend of schedule

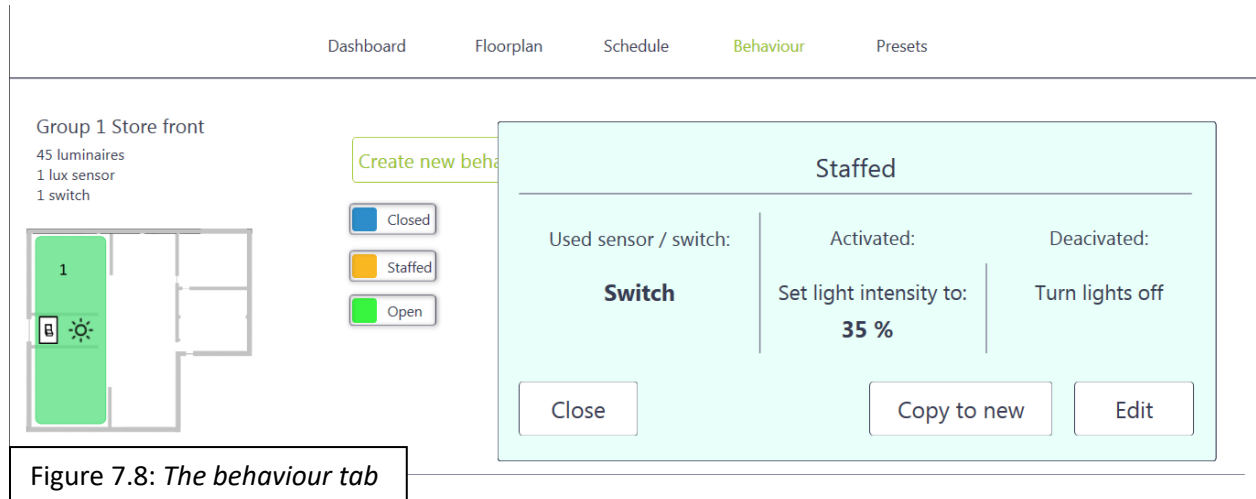
Table 7.2: Questions and assignments in the Schedule test

Question	Assignment to answer the question	Score
1. Task success	1, 2, 3, 4, 5	0% or 100%
2. Efficiency	1, 2, 3, 4, 5	Duration in minutes
3. Understanding	7	Between 0/3 and 3/3
4. User satisfaction	6	Between 1 and 10

7.2.4 Behaviour test (part 2)

This test starts, still in the schedule tab. The duration of the assignments are also measured, to see how much time it will take to use the full functionality of the interface. Which is also tested in Scene Control.

The participant is asked the following:



1. Where would you go if you want to change light intensity?

This assignment confirms if the redesign is predictable. It determines if it is logical to go to "Behaviour" to find what the luminaires do. It also reveals if participants learned that activities contain the luminaire behaviour.

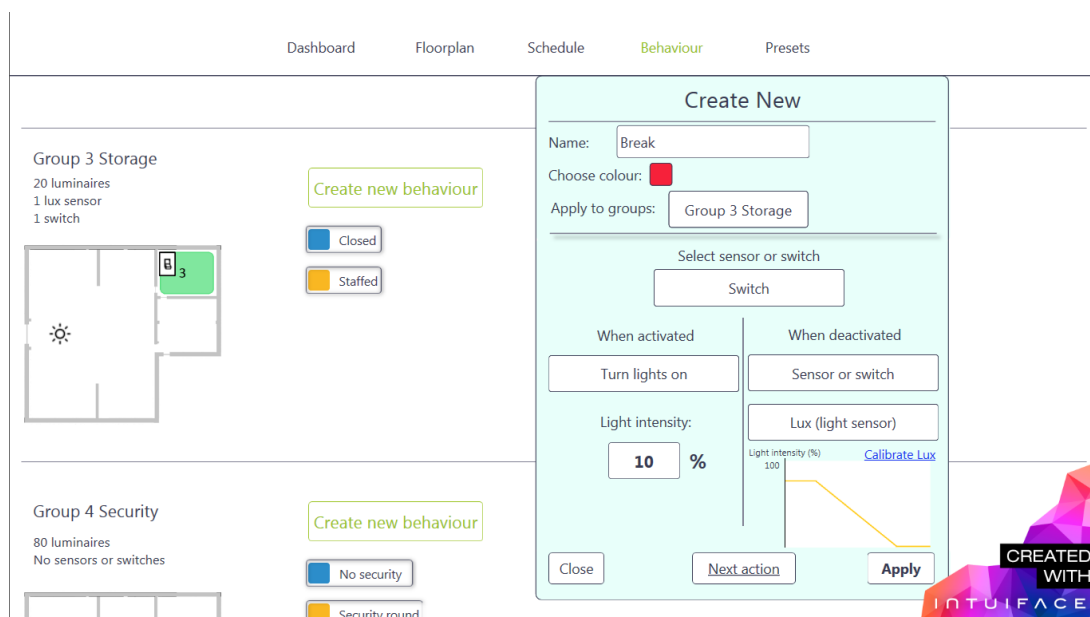
2. Staff complained that the light are not bright enough when they start working. Increase the light intensity for staffed hours with 10%.

This assignment illustrates how easy it is to adjust the light intensity.

3. Make a new behaviour for the storage group.

4. Make sure that, when a switch is flipped, the light must lit up with 10% of their power.

5. Also, when a switch is not flipped, the lights must dim according to the amount of daylight available.



Assignment three to five test how easy it is to create a new activity. In Scene Control it is possible to create a behaviour like this one, but is not tested in detail.

6. Considering the schedule and behaviour tabs both. How satisfied are you about this user interface. Give a mark between 0 (very unsatisfied) to 10 (very satisfied). Explain why you give this mark.

This question confirms if there is a change in satisfaction. They know now all the possibilities with the luminaires. It will be clear whether the behaviour tab is a positive extension or not and why.

Even though this mark is given for the full functionality of the redesign, this is not comparable with the mark obtained in the Scene Control test. In Scene Control they are only asked to change light intensities, while in the behaviour tab they are asked try more complicated functionalities. This affects the mark.

Table 7.3: Questions and assignments in the Behaviour test

Question	Assignment to answer the question	Score
1. Task success	2, 3, 4, 5	0% or 100%
2. Efficiency	2, 3, 4, 5	Duration in minutes
3. Understanding	1	0% or 100%
4. User satisfaction	6	Between 1 and 10

7.3 Expectations

For every question stated in section 7.1 the expected outcome is discussed.

7.3.1 Task success and duration

I expect that the results for task success in Schedule are better than Scene Control. In Scene Control the users perform more actions to complete a task. I also think that the participants will have difficulties interpreting the table of Scene Control correctly. The redesign on the other hand is divided in two parts. So, schedule has less functionality and less possibilities to misinterpret it.

I also think the results will differ because of assignment four. In Scene Control this is a separate task. In the redesign, when the participant completes the first assignment, he automatically scores 100% in assignment four.

A learning effect might occur in both tests. The first assignment will probably cost more time or might even fail, but the following assignments should be easier for the participants.

In behaviour I predict that the majority of the participants perform all assignments without trouble. They are familiar with activities, all buttons contain text for more clarity and again there is less functionality present to misinterpret.

I do not think that the duration of the performed assignments will differ much. The interface is new for all participants. However, since I predict that the tasks success of the schedule test is better, I also think the duration is shorter.

7.3.2 Understanding

Regarding question seven, I expect that the legend from schedule scores better. In Scene Control only three out of seven functions are used, so they cannot learn the others. I predict that participant will not understand names like "ballast" or "combined".

In schedule all three activities appear in the calendar, so a learning effect can occur. I think that participants will not know what the lights will do exactly, but they will understand in what situations they are used. That knowledge is enough for planning.

7.3.3 User satisfaction

User satisfaction is hard to predict. I think that the users will be more satisfied with the redesign, but they cannot compare it with each other. Marks are abstract and subjective measures. Also the prototypes have some malfunctions. For example scrolling in the redesign does not work smoothly, so the user must sometimes drag the page down. Many buttons perform no task, because the system would not run if it were possible.

In Scene Control the save options do not work and the participant will constantly receive saving warnings. It is necessary for the participants to take into consideration that these are demos and that these errors are present in real interfaces. Due to all these factors it is uncertain what the marks could be.

If I need to guess, Scene Control might score a 6.0, because it is difficult to use, but the interface is sufficient to perform the tasks. The redesign could receive a 7.5, because it is easier to understand and easier to use.

7.4 Results of the user tests

In this section the results of the user test are presented. The results are sectioned per question. The questions are found in section 7.1

The user tests went as planned. Eight people participated in the test for Scene Control and eight in the redesign test. Everyone got the same treatment and all results were recorded in the same manner. The total averages were taken from the scores of all participants. These make up the following results:

Table 7.4: Overall results of the user tests

TEST	AVERAGE TASK SUCCESS	AVERAGE UNDERSTANDING	SATISFACTION	SUM OF AVERAGE DURATION
SCENE CONTROL	60%	57%	7,0	8,93 minute
SCHEDULE	98%	100%	7,7	4,63 minute
BEHAVIOUR	97%	75%	7,9	1,77 minute

The results can be found in the excel sheet "Results user test", found on the flash drive in the folder "Files".

7.4.1 Task success and duration

As expected the schedule test scored better on task success compared to Scene Control. A few outcomes are notable. For example the first assignment of the Scene Control test was successfully performed by 25% of the participants. The rest needed a full explanation. Other similar tasks were performed more easily. So, Scene Control has a strong learning effect.

The fourth assignment was difficult for participants of Scene Control as well. They did not see where to assign scenes to days. When they found the window, they often clicked the wrong options. Here also 25% performed it successfully. Only assignment three, planning the billboards, scored 100% in Scene Control.

The participants who took the redesign test had double the assignments and it took them 28% less time to complete in comparison with Scene Control. Since the tests were performed with 16 participants, it cannot be said with confidence that the redesign is more efficient. This amount of participants do not provide statistical support.

7.4.2 Understanding

There is a large difference in understanding between the user interfaces. The outcome was as expected. Participants understood what the activities were and how to use them in the redesign, but did not know exactly what the luminaires would do.

Some items in the Scene Control legend were frequently misinterpreted. For example the block "Dimmer" was interpreted as a function to dim the lights, no one thought of a physical dimmer. "Ballast" was not answered correctly, because they did not know what a ballast sensor did and the "Combined" function was not understood either.

Navigating to behaviour was for many participants not a problem. The people who got it wrong, thought they had to navigate to "Presets" or the "Floorplan".

7.4.3 User satisfaction

The mark for user satisfaction is almost a full point more for the redesign in comparison with Scene Control. Participants considered that the prototypes had limitations. Marks like this were not expected.

Scene Control was estimated to score lower, because it is hard to use. However, participant said that after an explanation, they felt that they understood it and found it easy to use. They also stated that they got the feeling a lot was possible with the system. They said: "I think it has a lot of potential". This feeling played a large role in the user satisfaction. Some participants did not feel unsatisfied, because they considered themselves as beginners. They were convinced that a next time it would be easier. They said: "There is just too little information for a beginner". So, participants had trouble using it for various reasons, but tended to blame it on themselves.

Schedule scored 0.7 higher than Scene Control. People thought it was clear and it worked. The majority of them said that they wanted more information on what the luminaires exactly do, even though they did not need it to perform the tasks. Their curiosity was not satisfied with only the necessary information. They also wanted a better indication that they could click the blocks in the calendar. They said: "The calendar is not intuitive enough".

After the participants had finished the second part of the redesign, the behaviour test, the average score increased. Participants were positive about the extra functionality and

therefore gave it a higher mark. 38% of the participants did not increase the mark. Some did not understand the possibilities. For others the interactions were not clear in the behaviour tab. So, these participants did not change or gave a lower mark.

In section 7.3.3 was stated that a mark is abstract and subjective. User satisfaction can also be evaluated by the phrases people use when explaining why they choose a certain mark. [6] In these tests clear statements were made. These appear in table 7.5.

Table 7.5: Count of positive and negative reactions

Scene Control		Schedule		Full redesign	
Difficult	x4	Clear	x4	Great	x1
Too little information	x3	It just works	x1	More possible	x2
I am irritated	x1	Very satisfied	x1	I want more icons	x1
Complete / much functionality	x2	It's visual	x1	Works well together	x1
Unclear	x5	Nice	x1	It's handy	x2
I would use it	x1	Not intuitive enough	x1	Not intuitive enough	x1
It works but, ...	x1	I miss some information	x1	Not clear enough	x1
Too much functionality	x1	Unexpected actions	x1		
Not very intuitive	x4	Not clear enough	x1		
Quite clear	x1				
It's handy	x1				
Total Positive reactions	5		8		6
Total Negative reactions	19		4		3

Negative comments like "difficult", "unclear" and "not very intuitive", are said by half of the participants that used Scene Control. Only 21% of the comments about Scene Control are positive. In schedule, 67% of the comments are positive and negative statements are tuned down. Participants used words like "some" or "not enough". A statement that says: "It is not clear enough", is not as strongly negative as, "it is unclear". Comments in behaviour are similar. Again 67% of the comments are positive and some positive statements became stronger. For example in schedule "nice" is said, while in behaviour "great" is mentioned.

The comments in Scene Control confirms that the user interface is not user friendly, which probably lowered the user satisfaction. The marks, but especially the comments make clear that the redesign satisfies the users more.

7.5 Conclusion

The results from this test cannot be used as a statistic representation. In the test the participants performed relatively simple tasks. The results confirm however that the redesign improves the usability. The test gives an impression on how the interface is used. With the result and the participants' comments, the redesign can be further developed. It has to become clearer and more intuitive. To satisfy the users' curiosity, the interface needs to provide more information.

Some functionalities still need to be worked out in the detailing phase. These have to be consistent and recognisable. This way, the interface stays easy to use and understand.

8 DETAILED REDESIGN

In this chapter every part of the detailed redesign is explained. For images, go to the folders: "Images Paper > Action Center", "Images Paper > Schedule", "Images Paper > Mobile format", found on the flash drive. This chapter starts with the Schedule tab, continues on the Action Center tab and ends with the mobile format.

8.1 Banner



Figure 8.1: *Banner*

8.1.1 Logo's

The logo of "LUXON dynamic light controls" is shown so customers and all users can see who developed the software.

On the right side of the banner the logo of the company appears. This makes clear to customer support, which company they are helping and gives the user the feeling they are part of the company, when working in this user interface.

8.1.2 Tabs

The tabs have not changed much. Current users will recognise this. I predict that new users will not have trouble with using the tabs either, since it is common in many programs.

8.1.3 Profile

On the right of the tabs the user sees his picture, name and "options". This gives the user a feeling of individuality and the ability to personalise his profile. When he clicks "options" a window should open where he can change his personal settings, like a password. He should also be able to see what parts of the user interface he is authorised to use.

8.2 Schedule

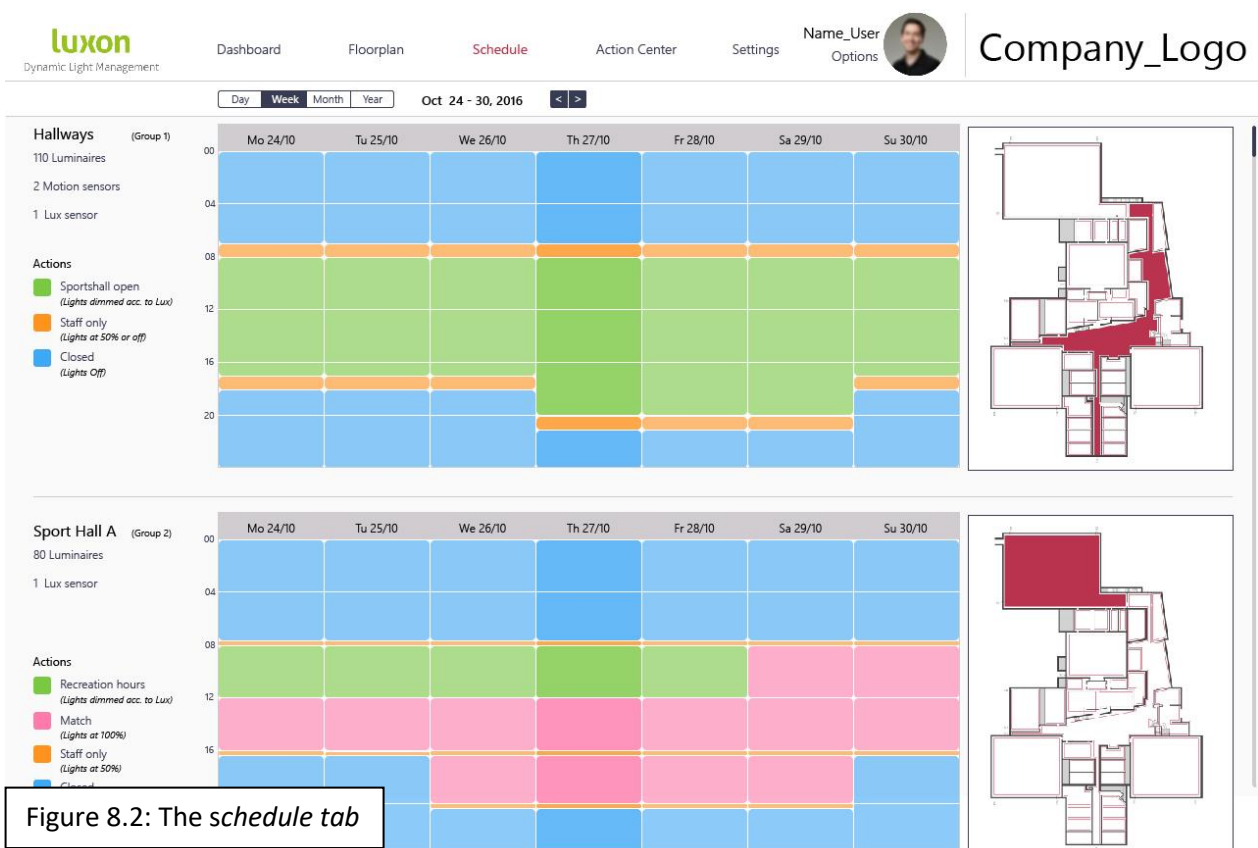


Figure 8.2: The *schedule tab*



Figure 8.3: Group information

8.2.1 Information

To create a better understanding on the groups users need some information. On the left of the calendar information is present about each group. It tells the name, number, size of the group and the hardware it contains. This way the user knows in which group he is working and what hardware could be used in the actions.

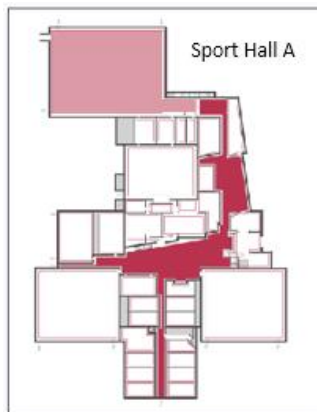


Figure 8.4: group navigation with the map

8.2.2 Navigating to other groups

The user can navigate to other groups by scrolling. It is common that a building contains many groups. This makes the page long and results in a lot of scrolling. Scrolling is considered a hindrance. It takes time and effort. [4] Therefore, the user can use the map to navigate to other groups. When the user clicks a group in the map, he is directed to that group.

The map reveals the layout of the real location. The red blocks are groups. In Scene Control it was not possible to see in which area of the building the group was. The user had to switch to the Floorplan.

8.2.3 Actions in the schedule tab

Activities are now called actions, because it was considered it more logical in a calendar structure. It was clearly not the same as an "event" used in an actual calendar.

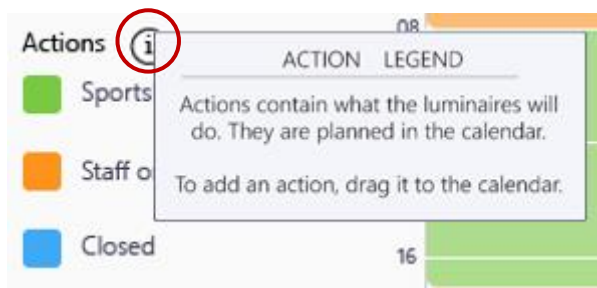
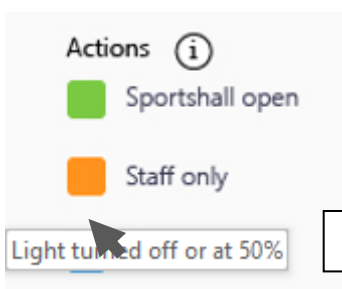


Figure 8.5: Information about actions

Actions have a name and a colour. The colour is displayed in the calendar for recognition. The name can be seen in the calendar when the user hovers over it. This keeps the interface simplistic and serene, without lacking information. Mouse over functions also have a prime effect on the usability as long as it does not become too cluttered. [2]

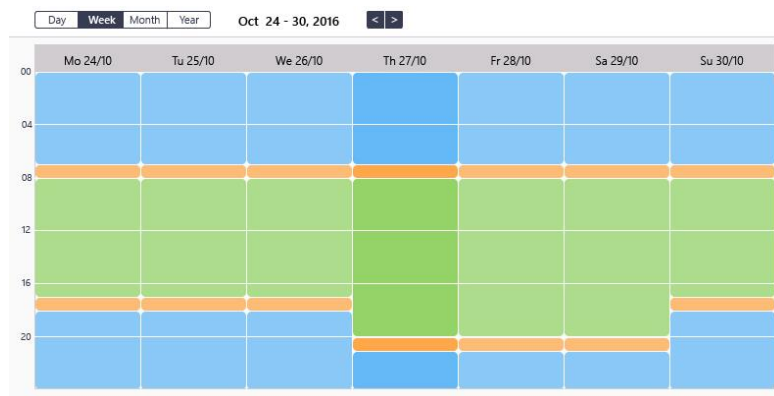
To provide beginning user with more information, the "i" button can be pressed. It tells the user what an action is and how to add it; by dragging and dropping.



To satisfy the users' curiosity more information is provided. If he hovers over an action in the legend, the user sees how the luminaires behave, during that action.

Figure 8.6: Luminaire behaviour of an action

8.2.4 Calendar



A calendar is a structure that is recognised by new users. Current users have to become used to the new interface, but since using a calendar is common it will not take long for them to learn it.

Figure 8.7: A filled calendar

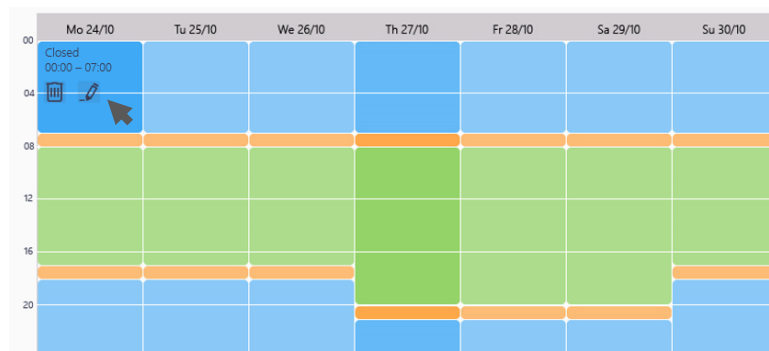
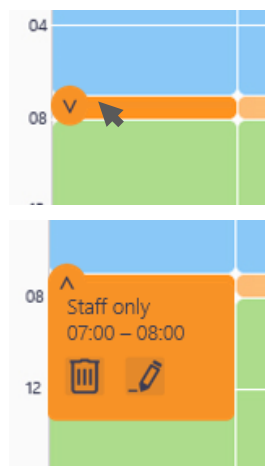


Figure 8.8: User hovers over an action

removing and editing are present. This way the user will know he can interact with it.



The size of the blocks represent the duration of an action. That also means that short durations will become small blocks. This was also the case in Scene Control and resulted in blocks that could hardly be pressed and edited. To solve this a round button appears when the user hovers over it. When the round button is pressed, the action “unfolds”. Now the action reveals information and interactions.

Figure 8.9: Small block change shape when the user hovers over and unfolds when it is clicked



Figure 8.10: Navigation buttons of the calendar

Calendars have a navigation function. With this function the user can easily find a date. When the user goes to the day view, he sees a large

view of the day planning. Blocks in the calendar are larger, so more information can be displayed.

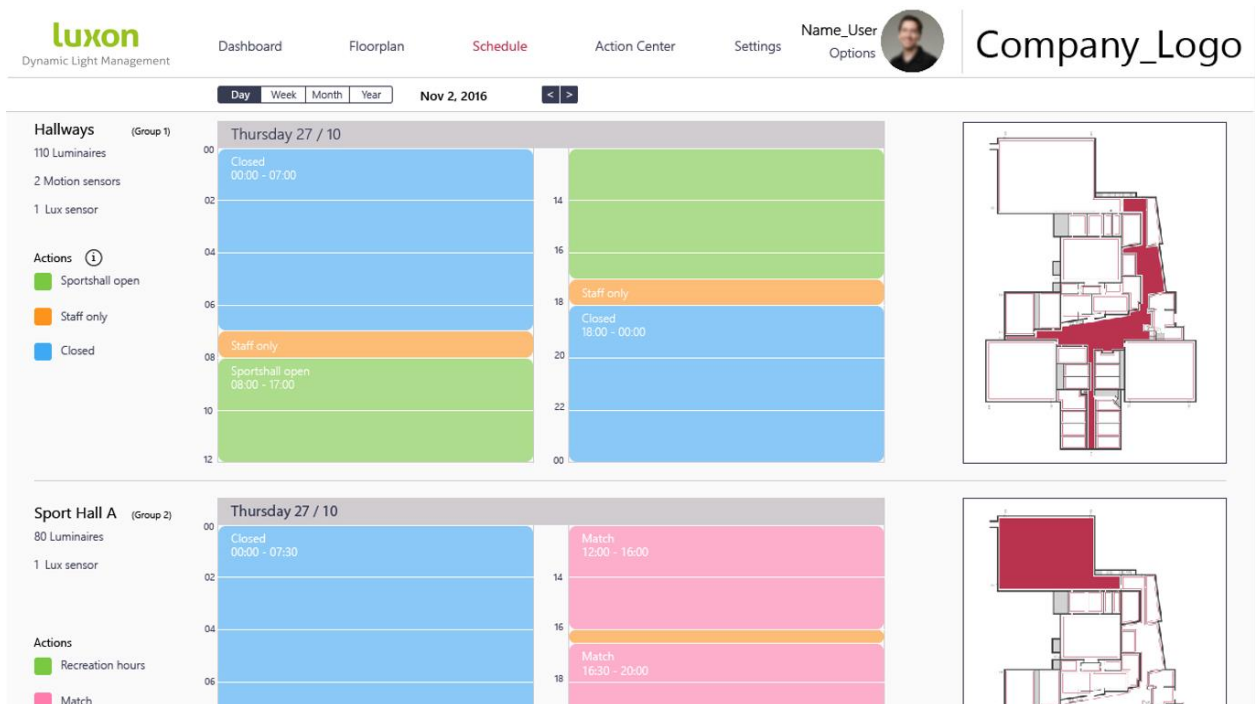
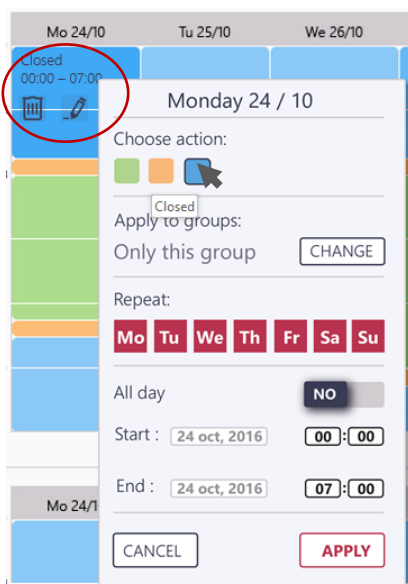


Figure 8.11: Day view of the schedule tab



8.2.5 Edit an action in the calendar

When the user clicks on an action in the calendar or clicks the edit button, the edit window opens.

In the upper part, only the coloured blocks are presented. When the user hovers over a block the name of that action appears. The name is not displayed, because they can become long. More room would be needed and it could become too cluttered. It is preferred to look simple and minimalistic.

Figure 8.12: Edit window of an action in the calendar

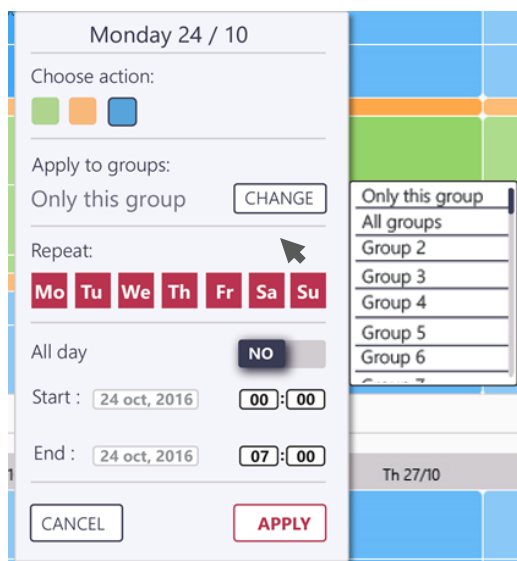


Figure 8.13: Copy to groups function

In the second part the user chooses to which groups the action applies. The list only contains groups that share that same action. Actions can be duplicated in the Action center, see section 8.3.1. The groups are listed with only their number, because their name often is too large. When the user hovers over a group in the list, the name of that group will appear. Earlier was said that scrolling is a hindrance to users. However, in this case scrolling was chosen instead of using the map, because a map takes too much space.

To make sure the user receives enough information on groups, the map next to the calendar must be visible. The mouse over function must also work.

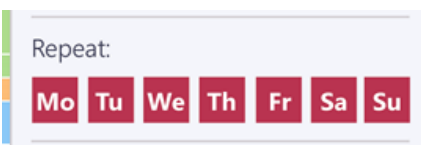


Figure 8.15: Repeat on weekdays function

In the third part, the user chooses on which days the action repeats. The red colour means that the action will be repeated on that day, every week of the year. This also applies all groups, it is copied to.

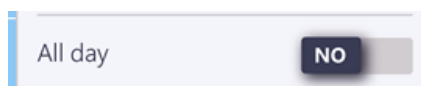


Figure 8.16: Apply an action all day long

The last part of the editing window contains calendar options. Here the user can choose to apply it for 24 hour.

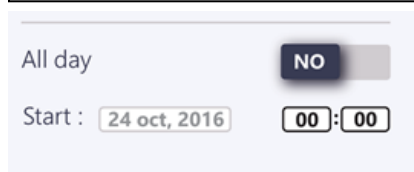


Figure 8.17: Time and date options

The user can also choose a specific duration. Here he changes the date, hours and minutes.

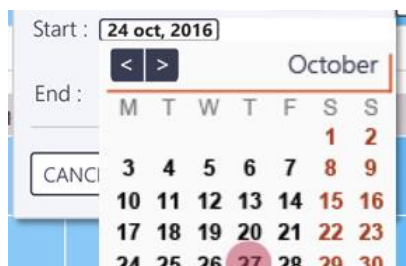


Figure 8.18: Changing the date

For choosing a date, only clicking actions are used. Clicking is less of a hindrance than scrolling and mistakes are made less easily, compared to typing the date.

The hours and minutes are typed however, but mistakes are prevented. The hour input boxes only accept digits between 00 and 24, while the minute input boxes only accept digits between 00 and 59.



Figure 8.19: *Cancel and Apply buttons*

Lastly the user applies his action to the calendar. The font of the apply button is red and bold, while cancel is dark coloured and regular. This way the emphasis lies on apply, because the user must not forget to apply his changes. [5]



When the user applies changes he can see several warnings:

Figure 8.20: *Warning about a conflict with other actions*



Figure 8.21: *warning about empty space in the calendar*

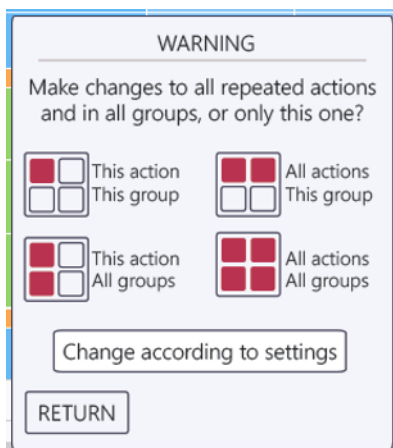


Figure 8.22: *warning about changes made to copies*

The user always has the choice to go back. The information must prevent mistakes, if the user reads well.

8.2.6 Adding an action to the calendar

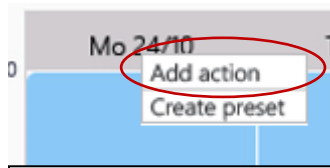


Figure 8.23: Add action dropdown

The user adds an action by right clicking a day or dragging it from the legend and dropping it in the calendar. Current users will recognise the drag option, because Scene Control uses that too. New users will probably not know this. So, when they press the

information icon, they get an explanation on how they add actions to the calendar. For Nedap it is beneficial to right-click instead of drag. They have to fill an empty calendar and clicking decreases the amount of effort in comparison with dragging. [2]

Adding an action to the calendar uses the same window and warnings as changing an action.

A screenshot of the 'Add Action' dialog box. It includes a 'Choose action' section with three colored squares (green, orange, blue). Below is 'Apply to groups' with 'Only this group' selected and a 'CHANGE' button. The 'Repeat' section shows a row of day buttons (Mo, Tu, We, Th, Fr, Sa, Su) with 'Mo' selected. There is an 'All day' toggle set to 'NO'. The 'Start' and 'End' fields both show '24 oct, 2016' with time selectors set to '00:00'. At the bottom are 'CANCEL' and 'APPLY' buttons.

Figure 8.24: Add action window

A screenshot of a 'WARNING' dialog box. The text inside reads: 'Other actions are already active during this new one. Continuing will shorten, extend or remove current actions. Do you want to continue?'. At the bottom are 'CANCEL' and 'YES' buttons.A screenshot of a 'WARNING' dialog box. The text inside reads: 'This day is already full. Continuing will shorten, extend or remove current actions. Do you want to continue?'. At the bottom are 'CANCEL' and 'YES' buttons.

8.2.7 Removing an action in the calendar

Removing actions from the calendar is possible. It is not possible to leave it empty. The user will have to fill it up again. If not, the luminaires have no behaviour assigned and it is unknown how they will behave. This affects working conditions and energy savings. Therefore, the user is asked to add another action in its place, or to move existing actions to fill the gap.

Figure 8.25: Warnings for removing an action

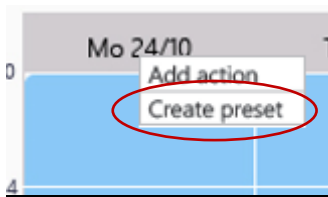


Figure 8.26: Create preset dropdown

8.2.8 Presets

Presets is an option to replace the “exceptions” tab. This option was discussed in section 6.5, but not further tested. Later it was analysed again and an idea formed in which presets could be made using the calendar. This way the interface stays more consistent. When the user right clicks a day he can create a preset.

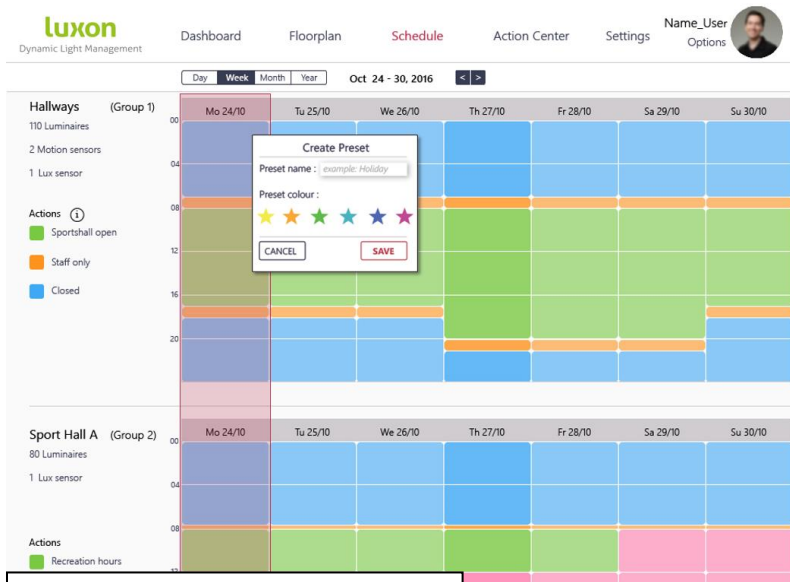


Figure 8.27: Create preset window

When creating a preset all actions of all groups are selected. All these actions, make up the preset. The user chooses a name and colour and saves.

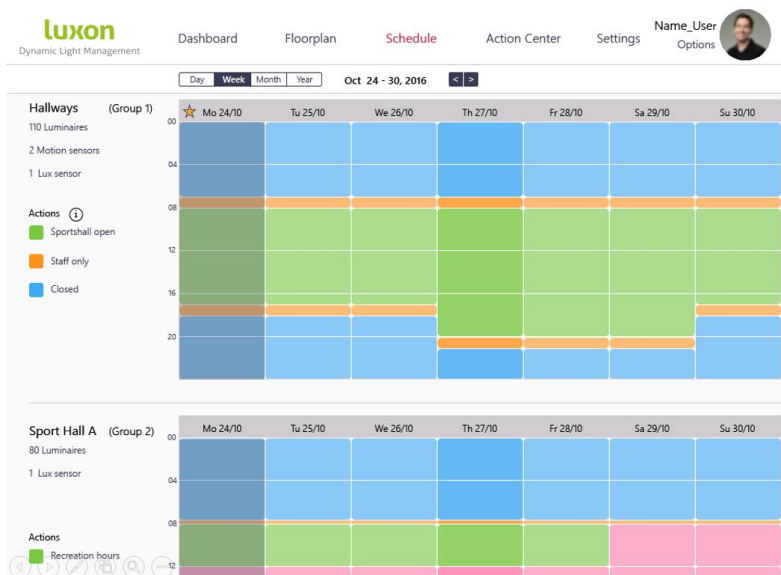
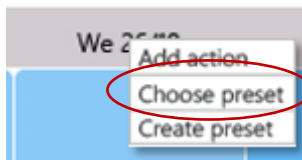


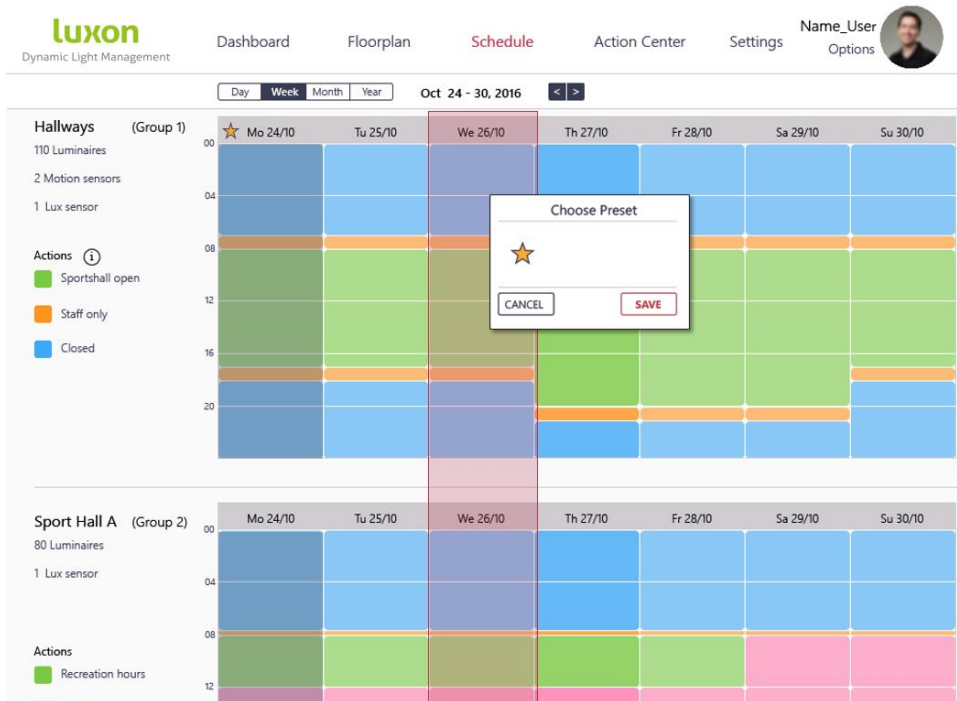
Figure 8.28: Preset coloured dark in the calendar

In figure 8.28 the preset is added. Days which have a preset are coloured darker and have a symbol at the top. So it is clear that this day is different from other days.



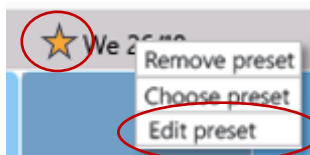
In case there are already presets present in the system. The user can also choose an existing preset.

Figure 8.29: Choose preset



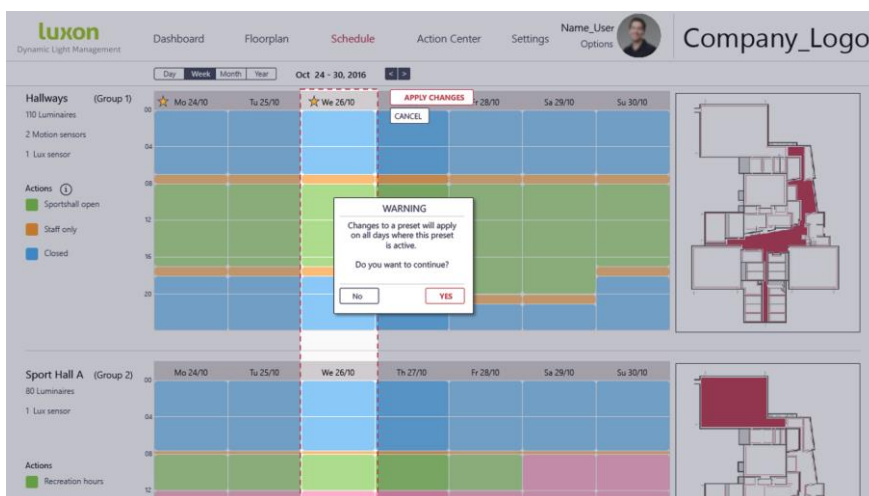
That day is now overwritten with the preset.

Figure 8.30: Choose preset



Right clicking on a day with a preset, shows the options to edit remove or choose a preset.

Figure 8.31: Edit preset dropdown



Editing allows the user to change the actions in that day. Changes are applied to all days that use that preset.

Removing the preset will that day with repeated actions or a default action.

Figure 8.32: Darkened interface and warning while editing a preset

8.3 Action Center

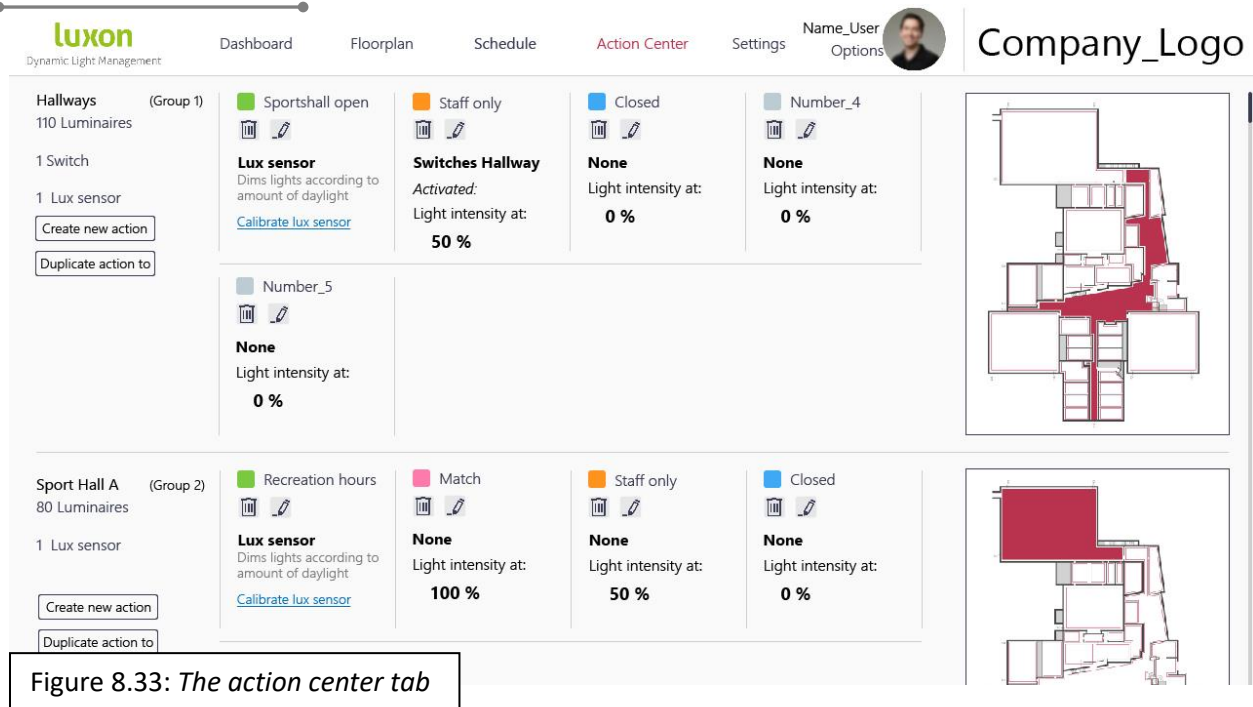


Figure 8.33: The action center tab

Behaviour is now called “Action Center”. It is clearer that this tab is related to the actions in the schedule.

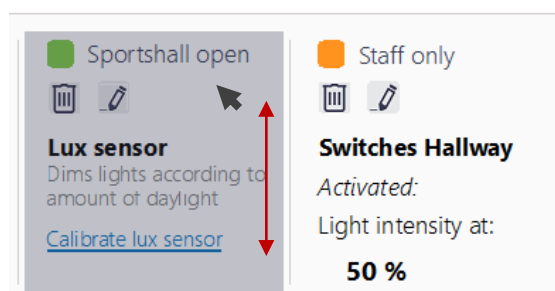
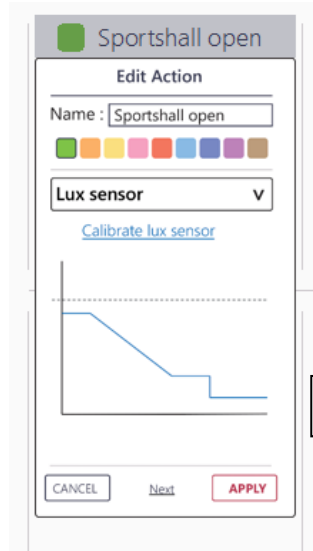


Figure 8.34: user hovers over an action in action center

When the user hovers over an action, the colour changes and buttons appear for deleting and editing the action. This is an indication for the user that there is an interaction possible.

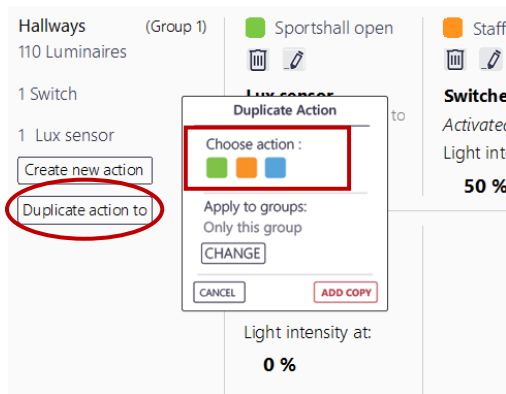
Under the action is also information displayed on how the luminaires will behave and which sensors and switches influence them. When this is too much to display in the box, the user scrolls in that box for all the information. So, when the user

stands on it with the mouse, he can scroll down.



When pressing the action or edit button the editing window opens. Here the user can also see and change how the luminaires behave.

Figure 8.35: Edit window of an action in action center

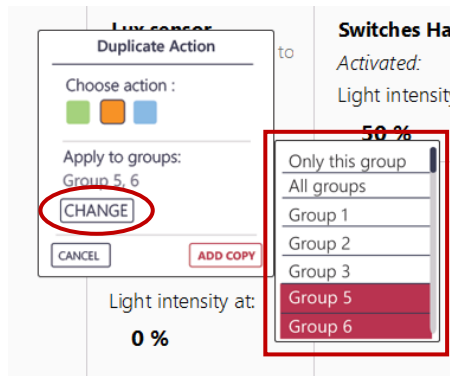


8.3.1 Duplicate an action in Action Center

Often groups are similar and use the same behaviours. So, actions from one group can be duplicated to other groups, with the "duplicate action to"-button.

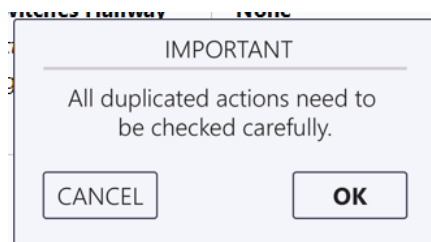
This opens the duplication window. Here the user chooses an action to duplicate.

Figure 8.36: *Duplicate action window*



He selects the groups to duplicate it to and applies.

Figure 8.37: *Duplicate to group 5 & 6*



Even though groups are similar, they often use different sensors and switches. So, the user must carefully check the duplications.

Figure 8.38: *Notification to check duplications*

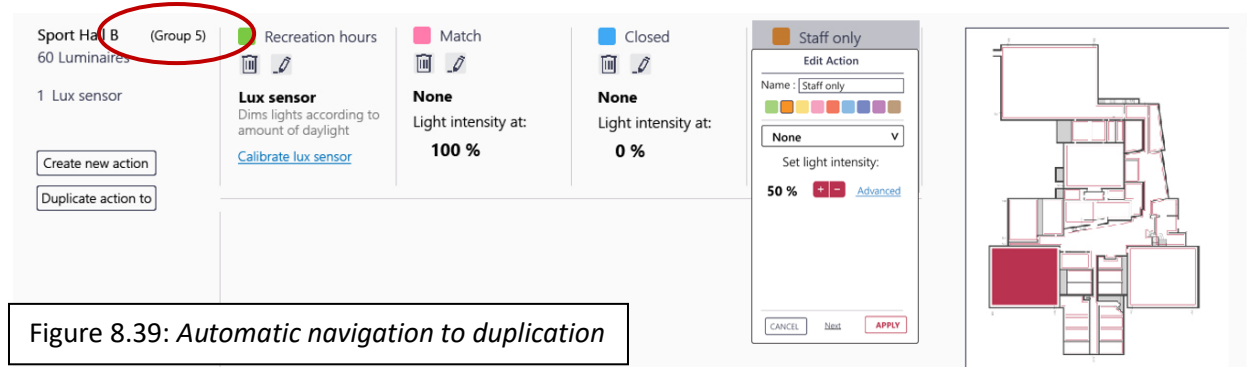


Figure 8.39: *Automatic navigation to duplication*

After adding the duplicated actions, the user is automatically directed to those actions. In the groups the edit window automatically opens and the user is forced to apply first. He has to do this for all the duplications before continuing. This prevents mistakes.



Figure 8.40: Advanced button

8.3.2 Advanced luminaire options

In Scene Control the user can add a duration and switch speed, when he sets the light intensity. In the redesign this is found under advanced.

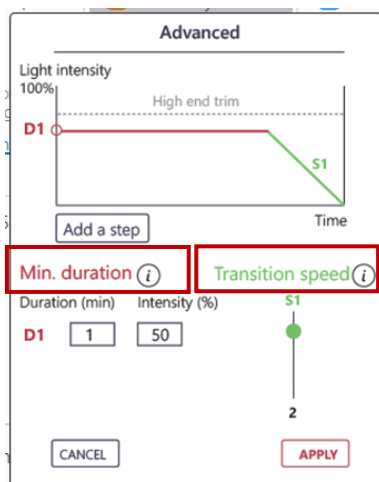


Figure 8.41: Advanced window

The advanced link opens a window. A graph illustrates on the x-axis the time and on the y-axis the light intensity. The red coloured, horizontal line represents duration and the sloping, green line is transition speed. Duration determines how long a behaviour is at least active.

For example; the luminaires are turned on by a switch. In the duration it says that they are on for at least 20 minutes. That means the user cannot turn the luminaires off with the switch, before those 20 minutes. It is also not possible to start another action before those 20 minutes. So, duration can have an influence in the calendar.

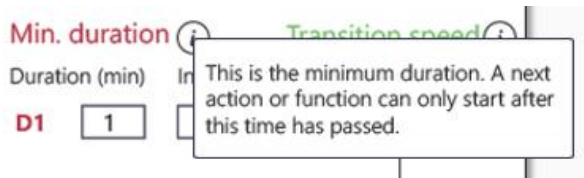
Transition speed determines how fast the luminaires change to another light intensity. For example; a new action starts and the luminaires dim automatically from 90% to 60%. The transition speed of the ending action says, that the light intensity must change over a period of 5 seconds. So, the light intensity changes, in 5 seconds, from 90% to 60%. Using a transition speed is beneficial for the working conditions. Staff cannot be distracted from their work, because of flashing luminaires.

There are two cases where the transition speed is ignored: when the light intensity increases, due to an activated switch or motion. In these cases users enter an area and the luminaires must immediately respond. A slow response could result in the staff being slowed down. In these cases the transitions speed is one second.

Table 8.1: Transition speeds in different situations

Transition by	Transition speed with Decrease in light intensity	Transition speed with Increase in light intensity
A flipped switch	As set by user	1 second
Motion detected	As set by user	1 second
A lux sensor detects other daylight intensity	As set by user	As set by user
Next action starts with other intensity	As set by user	As set by user

The name changed from switch speed to transition speed, so it cannot be associated with a physical switch.



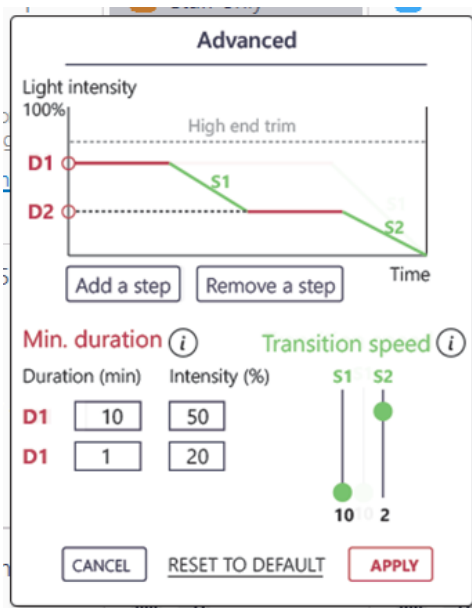
The user can see more information on durations and transition speeds, by clicking the "i" buttons.

Figure 8.42: Information on the minimum duration



The user adds another step in the graph with the button in figure 8.43. There are a few customers who wish to have this possibility. By adding steps the user can gradually increase or decrease the light intensity for better working conditions.

Figure 8.43: Add step button in advanced



For example, the luminaires dim from 80% to 50% (step 1). The light intensity stays on 50% for 20 minutes and then gradually turn off (step 2). This could be used to notify the end of a shift. The luminaires dim and the staff has 20 minutes to finish what they are doing.

Figure 8.44: Advanced window with two steps



Figure 8.45: Star added to the light intensity

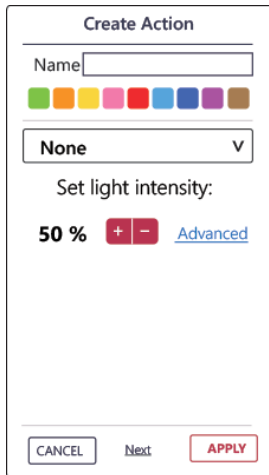
To indicate a light intensity has custom advanced settings, a star is displayed in front of the intensity. The percentage displayed here, is the intensity used during the first duration.

Create new action

8.3.3 Create a new action in Action Center

Figure 8.46: Create new action button in action center

With the button from figure 8.46, the user can create a new action.

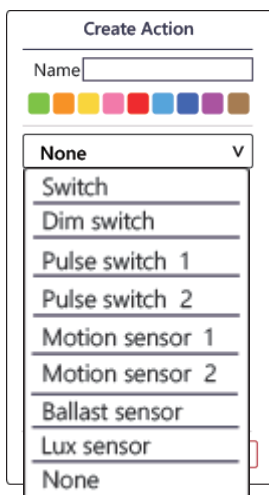


Many different actions can be created. This is the window the user will see first, after pressing "create new action". No sensors or switches are used and the user can immediately choose a light intensity. The plus and minus buttons increase or decrease the intensity by 5%. A change of less than 5% is not noticed in reality.

To create an action the user types the name of the new action. For determining the behaviour the user only clicks buttons and chooses from drop down menus. This is to prevent mistakes. Dropdown menus are made as short as possible, to prevent scrolling.

Figure 8.47: Standard window for creating a new action

Also specific text for sensors and switches is used, because "when on" and "when off", which is used in Scene Control, is not clear enough for users.



The user can choose to use the sensors or switches shown in figure 8.48. The list only contains the sensors and switches linked to the group. In this example this groups contains all possible hardware.

Figure 8.48: Dropdown containing the hardware of the group

Figures 8.49 and 8.50 describe the options for a switch. A switch can have two states: activated and inactive. For both states the user chooses a function. When choosing a function the user has three choices: "Set light intensity", "Turn lights off" and "Turn sensor or switch on".

Figure 8.49: Create action window with a switch

Figure 8.50: Options for creating an action with a switch

A dim switch has no states and uses a graph to illustrate its' behaviour. The x-axis is the voltage and the y-axis is the light intensity. The user can change the calibration of a dim switch. When he presses "calibrate dim switch" he is redirected to the place where calibration takes place.

Figure 8.51: Create action window with a dim switch

Figure 8.52: Create action with a pulse switch

A pulse switch is added to the possibilities. Pulse switches are commonly used in the industry. They are used to create multi-way switches. A multi-way switch is currently made in setting and saved as a normal switch. In Scene Control it is also presented as a normal switch. It is however more convenient to have all sensor and switch options, in one location.

A pulse switch also does not use states, but uses of state of the luminaires.

For example, the luminaires are off. The pulse switch is pressed and they will turn on. Now another pulse switch is pressed and the luminaires will turn off again.

Figure 8.53: Create action with a motion sensor

Setting up a motion sensor works the same as a switch, but the states are called differently. Here it says "motion detected" and "No motion".

Figure 8.54: Create action with a ballast sensor

A ballast sensor is also a kind of motion sensor.

Like the dim switch, a lux sensor also has no states and its' behaviour is illustrated in a graph. It can be calibrated when the user presses "calibrate lux sensor".

Figure 8.55: Create action with a lux sensor

Figure 8.56: Dropdown with functions

With the function "turn on with other sensor or switch" the user can program sensors and switches in series. For example, when a switch is activated, two motion sensors must turn on. The user can scroll down to see the options for the motion sensors. He assigns behaviour and saves. Now this action uses two sensors and a switch in series.

Figure 8.57: Using hardware in series

The function "Turn sensor or switch on" replaces priorities. Customers are not limited by five priorities anymore. This way they can use more sensors and switches per group of luminaires.

Create Action

Name :

Pulse switch 1 v

Pulse given:

v

50 % + - [Advanced](#)

OR

v

[Advanced](#)

Sensors and switches can also work parallel from each other. For example we want to create a two-way switch.

One pulse switch is given a behaviour. Then the user chooses "Next" to add a new section. Here he chooses the second pulse switch and assigns the same behaviour.

Figure 8.58: Create action with a motion sensor

Create Action

Name :

Pulse switch 1 v

Pulse given:

v

50 % + - [Advanced](#)

OR

v

[Advanced](#)

Next sensor or switch v

Create Action

Name :

Pulse switch 1 v

Pulse given:

v

50 % + - [Advanced](#)

OR

v

[Advanced](#)

Pulse switch 2 v

Pulse given:

v

OR

v

Create Action

Name :

Pulse switch 1 v

Pulse given:

v

50 % + - [Advanced](#)

OR

v

[Advanced](#)

Pulse switch 2 v

Pulse given:

v

50 % + - [Advanced](#)

OR

v

[Advanced](#)

The user created a two-way switch. It is not necessary anymore to create these multi-way switches separately in the settings tab.

Figure 8.59: Using hardware parallel

8.4 Mobile format

People have technology everywhere and want to be able to adjust their luminaires from their mobile devices as well. So, the redesign must be scalable for different screen sizes. To illustrate a possibility for smaller screens, a 4 inch example is made.



In figure 8.60 the schedule is presented. The user is in the day view of the current date. To see the full day he has to scroll up and down. Mobile devices are used with fingers. This makes it easier to scroll. Using fingers also make pressing small buttons harder. The average size of an index finger is 57 pixels and the average thumb is 72 pixels. [8] So, the buttons will be at least 57 pixels.

Figure 8.60: *Mobile format of the calendar*



Figure 8.61: *Add button*

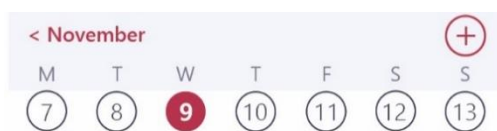


Figure 8.62: *Edit and remove buttons*



Figure 8.63: *change group and menu buttons*

All buttons are also placed on the right side of the screen. When handling a phone, often one hand is used. Users then only have their thumb to control their phone. In case the user is right-handed, it is easier for him to reach the right side of the screen.



The user can easily navigate to other days by using the calendar setup.

Figure 8.64: *Mobile calendar navigation*

In the mobile format the user can also edit and add actions in the calendar.

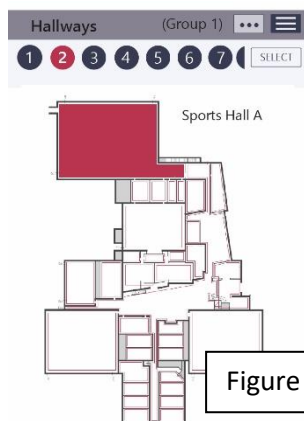


Figure 8.65: *Select group window*

To make changes in another the group the user switches between groups. To do this he presses the group at the top, which opens the window in figure 8.65. The group mentioned at the top is the group that is currently selected. The red number is the group the user wants to use.

In the larger format for computer screens, the user has a better overview of actions and the building, because the map is visible. In the mobile format the user would have to change to the Floorplan.

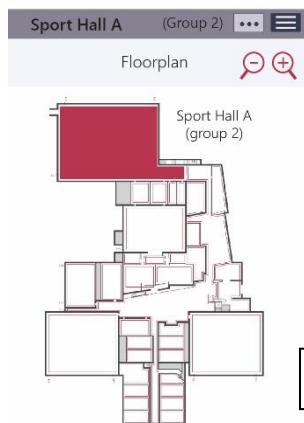
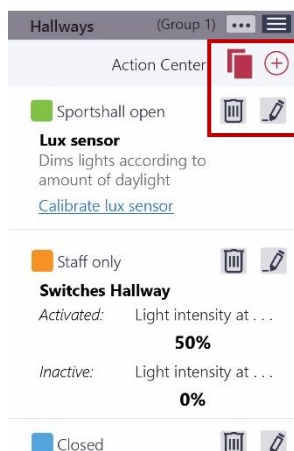


Figure 8.66: *Floorplan window*

The Floorplan contains the map of the building and the different groups. The group that the user is working in is coloured red. The user cannot change groups, using the map, like in the larger formats, because the size of a group can become smaller than the 57 pixels, making it too hard to select.



In Action Center all items are placed underneath each other. The user can still add, duplicate, edit and remove actions. The user can change groups at the top of the screen.

Figure 8.67: *Action center window*

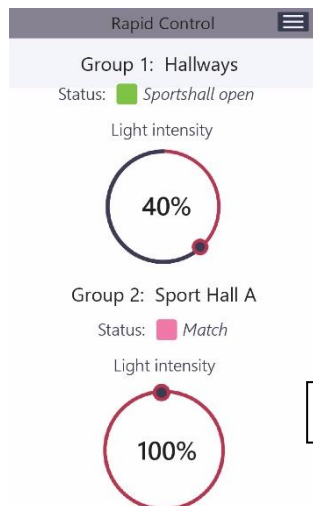
The options for editing and adding an action in the calendar and in Action Center is similar to the desktop format. Options are found in the same places, keeping the interface recognisable.

Figure 8.68: *changing an action in the calendar*

When someone is present in the building and wants to change the light intensity, it is more likely that he does this on his mobile device. These changes need to apply immediately.

For example; the chef is early and the luminaires are still off. These need to turn on, so he can start working.

Another scenario; wintertime started and the lux sensor is somehow not working properly. The luminaires are not bright enough and working conditions are suffering under it. The light intensity needs to be adjusted.



For these situations Rapid Control is made. Here the user sees, per group, which action is active and the light intensity of the luminaires. The light intensity can be adjusted. This will overwrite the group immediately. It stops again when a new action starts or when an adjustment is made in Rapid Control.

Figure 8.69: *Rapid control window*

9 Interactive PowerPoints and videos of the redesign

For presentation and instruction purposes interactive PowerPoints and videos were made. This chapter briefly elaborates on them.

9.1 Interactive PowerPoints

With the visuals from chapter 8 interactive presentations are made in PowerPoint. In PowerPoint you can add buttons and animations that will navigate you to other slides. This makes it seem like you are interacting with an interface. The interactive PowerPoints are found on the flash drive in the folder "Files > PowerPoints"

These PowerPoints are made to help me explain to people from Nedap, what the redesign contains, how it works and where they can find the functionalities. This helped much during meetings. It became more "alive" and therefore it was clearer how it worked. When people had a question, I could simply show it.

Nedap can do the same with the presentations I did. They can explain to their business partners and their customers what they are working on. They can explain how it works. They can answer their questions with the presentations and eventually ask their opinion on it.

Knowing the opinion of business partners and customers is important. To continue developing the redesign you need to know if the customers would like to use it over Scene Control.

9.2 Videos

The videos indicate exactly what is possible in the PowerPoints. These videos describe where to click. Not all items in the PowerPoints work, because it would make the file too large and the response of the presentation slow. In the videos an English spoken voice also explains what happens in the interface. The videos are found on the flash drive in the folder "Files > Videos"

Nedap can use these videos to see which aspects of the interface are working in the PowerPoints. So, they can prepare what they want to present the customer. If a customer cannot be visited, the videos can also be send to the customer. Together with a questionnaire, Nedap can gather information. The total duration of the videos is about fifteen minutes.

10 Evaluating the redesign and the full user interface

The redesign, described in chapter 8, is reflected on in this chapter. In section 10.1 it is analysed according to the requirements. Section 10.2 analyses the amount of actions necessary, in the same scenarios used in section 2.2.

10.1 Requirements and the redesign

Here the redesign is evaluated according to the requirement from chapter 4. At the end of this section an overview is given in a table.

10.1.1 Functionality

All functionality of Scene Control except from load shedding is present in the redesign. The redesign even has more functionality. The advanced settings for light intensity have more options. It is now possible to not only turn luminaires on with the ballast sensor, but also other hardware, with the “turn sensor or switch on” function. In the redesign it is also possible to create multi-way switches, which was not possible in Scene Control.

10.1.2 Understanding

The results of the user test in chapter 7 prove that the redesign is better understood than Scene Control. Not all functionalities were tested and the scenarios were relatively simple. So, for complicated scenarios it is not proven that the redesign is easy to understand. However, with simple tasks less mistakes were made in the redesign compared to Scene Control. So, it is the redesign is an improvement.

10.1.3 Accessibility

Changing the light intensities for a group, is more accessible in the mobile app. With the use of Rapid Control, the user can immediately change the intensity of the luminaires.

Changing the timetable for a day (overworking, starting early) became more accessible with the calendar. If only one day needs to change, for example a Saturday. The user can go to that day in the calendar and adjust it. In Scene Control the user must create a new scene and place it as an exception. Or he must change a scene, which will automatically repeat on every Saturday. The timetable can also be changed with Rapid Control, since that overwrites the system.

Planning scenes on weekdays, is also more accessible with the use of a calendar. When actions are added they are automatically active on the correct days.

Overriding the scene temporarily is possible with Rapid Control.

Rapid Control can be used in many scenarios. It might be handy to also provide that functionality in the desktop format.

10.1.4 Prevent mistakes

To prevent mistakes several design choices were made. Users receive warnings when there is a conflict with other actions and will be forced to correct it. The warnings state clearly, what will change and where. The interface also automatically makes changes to prevent mistakes. For example, the interface fills the calendar when empty spaces occur. Again the interface will notify the user of this change.

The system tells the user what is going to happen and provides choices. This way the user interface is more forgiving and the user does not have to focus as much on what he is doing. Less mental effort leads to a decrease in mistakes made. [6]

10.1.5 Transparency

The redesign does not have a place yet where changes are visible. Transparency was mainly a functionality for customer support, which could also benefit the customer. In this project to focus lied on the usability of the interface. That is why it was not addressed. It is recommend to create a change log, so the job for customer support becomes easier.

10.1.6 Screen formats

A redesign was made for a 15.5 inch screen and for a 4 inch touchscreen. It is possible to put all functionality in the mobile format, but the interface is less clear. So, for more complicated tasks, it is recommended to perform those on a larger screen.

Table 10.1: *Evaluation of the redesign with the requirements*

Functionality	Is it available in the redesign?
Controlling luminaires in groups	YES
Setting the timing of the luminaires	YES
Setting the light intensity	YES
Using sensors an switches	YES
Influencing the luminaires with sensor or switch	YES
Influencing another sensor or switch with sensors or switches	YES, even more possibilities available in the redesign.
Setting the switch speed	YES, transition speed
Setting the minimum duration	YES
Scheduling luminaire behaviour on weekdays	YES, with the use of the calendar
Understanding	Did participants know what to do?
Change the timing	YES, the majority of the participants
Change the light intensity	YES, all participants
Plan luminaire behaviour	YES, the majority of the participants
Create a simple scene	YES, all of the participants, but scenes no longer exist
Understand the legend	YES, All of the participants. Users decide the names in the legend
Accessibility	Is it more accessible in the redesign?
Change light intensity	YES, in Rapid Control
Change the timetable for one day	YES, with the calendar
Plan scenes on weekdays	YES, with the calendar
Overriding the scene temporarily	YES, in Rapid Control
Preventing mistakes	Is the mistake prevented?
Wrong timing of luminaires	YES, no more dragging. The user sees precisely what he changes.
Overlapping behaviour	YES, the system automatically corrects this mistake.
Empty spaces in a scene	YES, the system automatically fills empty spaces in the calendar
Transparency	NO
Screen formats	YES, 15.5 inch and 4 inch is possible

10.2 Action count of the redesign compared to Scene Control

The amount of actions needed in Scene Control to complete simple tasks were counted in chapter 2. These same scenarios were analysed with the redesign and the actions were counted as well.

The results were as follows:

Table 10.2: Action count of Scene Control and the redesign

	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4
SCENE CONTROL	81	141	121	301
REDESIGN	13	6	63	90

For the redesign less actions are needed. This is because of the copying, repeating and duplication functions. Also there are warnings in the redesign that provides options on which copies exactly must change. In this scenario there is a strong repetition in groups, but in reality installations are not that ideal. It proves however that smart use of copying functions can decrease the amount of actions taken.

The full actions count is presented in the excel sheet "Action count", found on the flash drive in the folder "Files".

10.3 Evaluation of the redesign with customer support

People from customer support have contact with the customer. They are also experts in using Scene Control and are able to see what it might be missing. They had several suggestions that could improve the redesign.

10.3.1 Use of the term "lumen" in the redensing

When selling, installing and communicating the system to the new customers, customer support and the customer speak in terms of lumen. When the new customer start using the system however, the interface only speaks of light intensities. Customer support believes it can be beneficial to change those terms to lumen.

Lumen is not the same as light intensity or power level. Lumen is the unit for of luminous flux. Luminous flux is the amount of visible light. Light intensity relates to the radiant flux, which is the amount of light emitted by the light source. [9] So, lumen is more useful, since it represents the amount of light you actually see. Radiant flux partially is lost in the environment or can be invisible for the human eye.

It is not possible to exactly calculate how much the luminous flux will increase when radiant flux increases. This is only possible when the luminous efficacy of the area is known. As shown in formula 1.

"The power P in watts (W) is equal to the luminous flux φ_v in lumens (lm), divided by the luminous efficacy η in lumens per watt (lm/W): "

$$P_{(W)} = \varphi_{v(lm)} / \eta_{(lm/W)} \quad (1)$$

Correct values for luminous efficacy cannot be derived by measurements. A measured value would only apply to the condition it was measured in. The efficacy changes with the amount of daylight available and changes when the floor is repainted for example. [10]

So, the user can only receive a rough estimate on the amount of lumen in his building. Using the light intensity might be less practical, but it is more accurate.

I am not sure if using lumen instead of light intensity will improve usability or increases user satisfaction. If confirmed that it is beneficial, an estimation must be made if changing to lumen is cost efficient.

10.3.2 Customer supports' opinion

When asked: "Do you want to use this? ", the people from customer support immediately answered: "No". They do not want to use it. Simply because they need to learn a new user interface, while they know how to use Scene Control.

If customers have less trouble with the new user interface, resulting in a lower workload for customer support, they said to be willing to learn the new user interface. Since they are power users, they predict that it will not take much time to learn.

Their final problem with the redesign is that they think that the current customers will reject the redesign. The customers are familiar with Scene Control and might not want to spend time in learning a new interface. They already invested a lot of time in understanding Scene Control.

New customers on the other hand, don't know Scene Control and have not invested time in it. So, they might be more satisfied and react more positively to the change.

I think it is necessary to go to customers with the redesign. Explain to them that the department is improving Scene Control, for the sake of the customer. It is necessary to listen to their opinion and use that to improve the redesign.

A redesign for a user interface like this cannot be finished in three months, so further improvements must be made.

10.4 Evaluation with UI expert

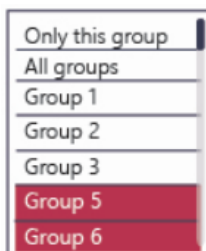
For more feedback on the redesign a meeting was planned with a user interface developer from another department within Nedap. He had more suggestions for changing several details, visualisations and terms used. He also strongly suggested to meet with customers, before taking any further steps in the redesign.

10.4.1 Improvements on the redesign

Intuitiveness

In several places the intuitiveness can improve.

Many calendars have the option to select a period in the calendar. For that period the user can add an event. Therefore he thinks that users would probably try to click in the calendar to add an action. Making this functionality or placing a clear add button next to the calendar, improves this.



The list of groups, does not use the group names. This is because those names can become too long. However, to make clear which group they are, the names must be displayed. It would be possible to do that by using a mouse over function. When the user hovers over a group, the name will automatically appear.

Figure 10.1: Group selection list

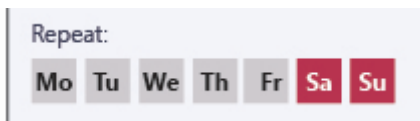


Figure 10.2: Repeat on weekdays

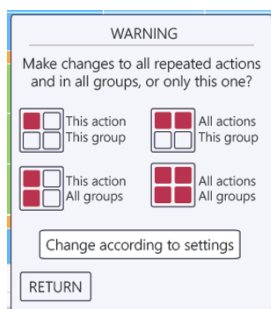
At repeat on weekdays, it is not directly clear which days are repeated. The change in colour is not clear enough.

More feedback can be provided in text. So, if no days are selected, it will say "Never".

It would be useful to have a separate option for "Never".

For example a toggle button. When a user wants to make

a change to only that day, he does not have to disable all active days, but just presses "Never".



To improve the predictability of schedule, the user should see what is going to change. For example when an action is edited, copies of that action can be highlighted as well. So, it is visible these change too.

During the warning in figure 10.3, the calendar animates the change, so it is clearer for the user what exactly happens.

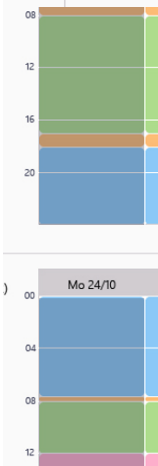
Figure 10.3: Copying warning



In the duplicate window in Action Center, it must confirm from which group the action is duplicated, to offer more feedback.

Figure 10.4: Duplicate window

It is not clear enough that a preset is connected to the dark colour in the schedule. To improve that, the dark colour must be one continuous bar, covering all the groups.



Terminology

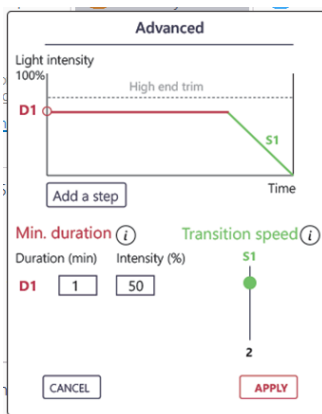
The developer was positive about the use of presets, but he thinks the word "preset" is too vague. It could have many definitions. To choose a better name it is necessary to ask users what they would call it. A word like "exception" or "automatic fill" might be more logical for them.

Figure 10.5: Presets dark coloured in the calendar



Figure 10.6: Next button

The word "next" in the window for creating an action is not clear. It lets the user use sensors and switches parallel from each other. A name as "add", "add actuators" or "more actuators", would be more suitable for that button.



In advanced it must say that transition speed is in seconds. This is not made clear yet. The scale is also not clear. It should say it is from 1 – 10 seconds.

Figure 10.7: Advanced window

The text in buttons of warnings and notifications need to be revised as well. It must be discussed when Cancel/Apply, No/Yes, Back/OK or Return/Continue are used.

Other user interface developers must look at the redesign as well for further improvements. When about 5 people perform a heuristic evaluation, a high percentage of usability problems can be found. [3]

10.4.2 Gather customer information

The developer emphasised that the light controls department must gather more information from the current and future customers, before developing this redesign further. For this

project it was not possible for to speak with customers directly, so that information is missing in the redesign.

It is useful to test the duplication and other copying functions in different scenarios. This could prove that they are handy. It could also reveal the occurrence of harmful side effects.

I would recommend to first make a revision with the improvements from 10.4.1. Test that design with current customers and customers that do not use Scene Control yet. Ask what they think about it. Listen to their opinion. When a customer wants an aspect to change, ask why, because there are more solutions possible that the customer can think of. An interface designer, can invent a solution that benefits most users, while keeping the interface consistent.

The user interface developer confirmed that there will be customers that do not want change, but there will probably be enough that want to cooperate in testing the new design and would like to see change.

It is useful for customers talk to designers. In contrast to people from sales or customers support, designers do not go to the customer to sell the product or bring a solution. The designer can just be there for information. The designer is there to listen and learn from the customer. The information gathered is not guaranteed to be used for the redesign, but it can give the customer a feeling of importance. This can create a better bond. On the other hand, when the opinion of the customer is used in the redesign, it can give him the feeling that he contributed in the development, making the interface more fun to use.

When changes are made, I think it must be tested and evaluated again. Do not be afraid to say: "This part of the redesign is wrong". Do not be afraid to take it away or change it completely.

To measure the perceived ease of use, customers can be asked to participate in a test. In the test they perform a task. They can use the video on how to do that. Lastly they receive a set of questions regarding their opinion. An example of a question is like this: [6]

Change the "staffed" action on Monday the 10th from **07:00 – 08:00** to **06:00 – 07:00**. The "sportshall open" action should also start on **07:00**.

If necessary watch video "02 change schedule".

After you completed this task answer the following statements:

1. "I am satisfied with the ease of completing the tasks in this scenario."

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

2. "I am satisfied with the amount of time it took to complete the tasks in this scenario."

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

3. "I am satisfied with the support information (video and messages) when completing the tasks."

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

All three questions measure the user satisfaction. Question one says evaluates the effectiveness and question two the perceived efficiency. These are also the fundamental areas of usability. [6]

10.5 Reflection on the full user interface

With the redesign, only a part of the user interface is improved. The rest of the interface can still use improvements as well. Recommendations on these improvements are presented in this section.

10.5.1 Transparency

Not only Scene Control could use transparency. In other parts of the user interface, changes are made as well. Those influence the installation. When all changes in the user interface are monitored in a change log, it is easier for customer support to find problems.

10.5.2 Floorplan

Currently the Floorplan has many details. These details are not useful for every type of user. Many users will only influence the luminaires as groups, so it would be more convenient to display them as groups as well.



Figure 10.7: Floorplan illustrating groups and status

The figure illustrates an idea on a redesign of the Floorplan. The blocks are groups of hardware (luminaires, sensors and switches). The green blocks are the groups, which this user is authorised to change. In the blocks the current light intensity is visible and which sensors are active. When he selects a group, he receives basic information. When he clicks on the light intensity, he can change the intensity. That overwrites the active action.

This idea implements Rapid Control (discussed in section 8.4) in the desktop format.

10.5.3 More copying options

Lux sensors are calibrated per group. Copying this calibration to other groups should be possible. More similarities between groups should be identified to create copying functions. This will decrease set-up and installation time and benefits the user.

10.5.4 Profiles

Create different profiles. Let customers answer the following questions for their users. The answer to these questions make up the profile for that user. He receives the proper authorisation to parts of the interface. The user will also see less unnecessary, difficult and technical information.

Table 10.3: Questions, answers and profile content

Question	Possible answer	Consequence
Which groups can he control?	Groups 1, 2, 3 or all	User can see all groups, but his are highlighted
Can he change the light intensity of the groups (override)	Yes / no	Rapid control, general Floorplan.
Can he change the schedule of these groups?	Yes / no	Schedule
Can he change the behaviour of these groups?	Yes / no	Action Center
Can they change the item is a group? (Floorplan)	Yes / no	Floorplan
Can they change the item is a group? (installation)	Yes / no	Floorplan
Is an overview of energy and money savings useful for this user?	Yes / no	Dashboard tiles. Rapports of savings.
Is an overview of all the items in a Floorplan useful for this user?	Yes / no	Floorplan (view mode)
Does he need to be notified about errors? Can he change the LMS when an error occurs?	Yes / no	Message centre, Floorplan
Is it useful for this person to know that changes have been made in the system?	Yes / no	Transparency: Change log on the full user interface
Is it useful for this person to know that changes have been made in one of his groups?	Yes / no	Transparency: Change log on his groups.

11 Conclusion and recommendations

The redesign meets many requirements. Only the transparency requirement was not met. It is recommended that the user interface becomes more transparent, as this decreases the workload on customer support.

The user performs less actions for simple tasks in the redesign. This means the user puts less effort in. It increases the usability and is positive for the user experience as well. The redesign is tested in relatively simple scenarios. It is proven to be easier to use and understand in these scenarios. The redesign must be tested in more complex scenarios as well, to make sure everything is easy to use.

The redesign is evaluated with people who work at customer support and by talking to another user interface developer. This indicated that the redesign needs more improvements. Developers who will continue on the redesign of Scene Control, must test more scenarios, to find flaws and harmful side effects. They also need to go to the customers before further developing the redesign. Their information is still missing.

For the full interface to improve, not only Scene Control must change. Other parts of the interface must become more recognisable and usable as well. When these changes are made, the developers need to look at the total interface and make sure it is consistent.

The redesign has the potential to become a success, but is not finished.

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