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Zumtobel Research

A study concerning the effectiveness of individual dynamic lighting parameters with respect to the perception and preference of customers in a shop

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A study concerning the effectiveness of individual dynamic lighting parameters with respect to the perception and preference of customers in a shop

Shop window design – is it worth taking a look inside?

This study was carried out within the scope of the bachelor thesis of Carolin Fröhlich in the interior design branch of Hochschule Coburg from September 2011 until March 2012.

Foreword

On the basis of a life-size video projection of two shop windows, various lighting parameters specifically made possible through LED-controlled lighting are meant to be examined.
Using eye tracking and an empirical survey based on questionnaires, the new possibilities of lighting control were examined, and accordingly some insights into dynamic lighting in the shop window have been obtained.
The interaction between shop window design and dynamic lighting requires a more detailed consideration of colour temperature, colour intensity and brightness contrasts varying over time in relation to the subjective buying behaviour of passers-by.

Abstract

Shop window design – is it worth taking a look inside?
Creating a scene is the magic word.

Today, light is considered an important element in the retail sphere to convey emotions and atmospheres, and especially to enhance the shop window by creating scenes, at the same time emphasising the image of the respective brand. Lighting that is harmoniously integrated into the overall design will entice people into the shop. Light has the power to arrange, to guide, to stimulate, to allure and to fascinate.

Particularly in shop window design, esthetics and attraction play a very important role. They reflect the image and the heart of a brand, creating the decisive emotional impulse to enter the shop. Frequently, nowadays, the furniture design is quite sober, in order to primarily present the goods to optimum effect and put them in an ideal light.

One big advantage is the possibility to flexibly and rapidly influence atmosphere, architecture and ambiance. In this way, by zoning and dividing the architecture through light, new spaces can be created.

In future, it will be possible to accommodate the needs of different target groups using intelligent lighting management systems, by implementing a balancing, orientation-based or contrasting, accentuating type of lighting depending on the time of day or day of the week and on the respective target group.

The study has mainly demonstrated how subjective the factors of brightness, light distribution and light colour influence the way customers are attracted to a shop as well as their purchasing behaviour. The subjectivity aspect is very important nowadays, since we increasingly tend to adopt a target group-specific and emotion-based purchasing behaviour.

For planning and design this means that we need to primarily pay attention to the target group we want to reach, in order to create any effect with dynamic lighting at all. Men and women respond to lighting in different ways. Shop window dynamics need to be overdone a little. The movement must be quick to be noticed immediately.

In this paper, the previous knowledge about design principles for shop windows and facades were defined and visualised. For this purpose, the time factor as well as lighting applications that are typical of shop windows (wide-area backlighting, focus on individual products etc.) need to be put in line with the subjective point of view of the customer.

To what extent will the buying behaviour of individuals impact the required lighting?

To answer this question, the lighting concepts are translated into, and presented in the form of, visualised storyboards for dynamic lighting solutions. Based on these animated scenes, the impact of different lighting effects in a shop window on passers-by can be determined by means of eye tracking and questionnaires.

For the study, a life-size visualisation of a shop window was shown on a rear projection screen in the premises of Hochschule Vorarlberg.

The visualisation is limited to two types of shop window. In the first concept, mainly wide-area lighting with wallwashing is used, while in the second concept the focus is on the pinpointed accent lighting of individual products exhibited in boxes.

By reducing the influencing factors, conclusions can be drawn as to certain principles and their effects. Within the scope of the study, 10 videos are shown, each of them 10 seconds long, during which the eyes of the test subjects are filmed by means of eye tracking. During the videos, individual lighting parameters are tested for their effect on the path the eye takes while the respective person is viewing the shop window.

In the subsequent survey, personal and target group-related data are collected. The questionnaire also serves to investigate which of the effects are actively perceived and consciously recognised by the test persons. For this purpose, the test subjects are required to assess for each video individually which lighting effects they have perceived and what kind of effect (positive or negative) these have on the presentation of the goods.

The design concepts may serve as a basis for practical implementation within a project and actual measurements in subsequent projects.

1 Problem definition

The factors and the effect of dynamic lighting

Due to the exhaustion of market potentials and an increasing number of virtual shops on the Internet, it is getting ever more important for retailers to sharpen their profile in the real world. It must be possible to experience the shop, the entire design needs to be inspiring and provide passers-by with an emotionally convincing argument to enter the shop.

The requirements with respect to change and flexibility are increasing. In combination with new technological possibilities, especially lighting control, they open up new ways in the field of lighting. It is precisely the trend towards an extremely sober interior design that increasingly brings the focus to the emotional effect of lighting and to the atmosphere in the shop.

In order to sell products to customers individually, therefore, the interactivity topic will become ever more important in the years to come.

Light in retail spaces is getting increasingly flexible – considering the rapid changes in fashion trends, customers' expectations are also constantly changing. The light cannot remain static in such a situation!

The new possibilities of lighting control to create different, dynamically active lighting scenes are associated with a big challenge.

Just how much change will attract attention, and what kind of effects will rather irritate the viewer? Is the eye attracted to the goods or is the viewer's attention being diverted?

Accordingly, in the study various dynamic lighting scenes were tested using separate videos in order to find out which factors have an impact on the amount of time potential customers spend in front of the shop window.

2 Scientific state of the art

Starting point of the study:
The results of the previous Zumtobel Research study on shop lighting have shown (by way of summary) that the attractiveness of shop window lighting is decisively influenced by horizontal and vertical brightness. In this context, it is not decisive to have maximum brightness but that the contrast between foreground and background is as high as possible. While during the day, through daylight, a large amount of directed light hits the shop window, low ambient brightness prevails at night. For shop window lighting this means that during the day high-contrast lighting through focussed accent lighting on the goods and only little lighting of vertical surfaces is required.

In situations with low ambient brightness, even small differences in luminance will be perceived as a contrast. For lighting at night this means wide-area background illumination at lower illumination levels

– vertical surfaces will be visible even from a distance and attract pedestrians. In order to avoid the silhouette effect of objects, a slight amount of accent lighting is necessary.

Adequate lighting and presentation of goods and brands through shop windows and facades demonstrably decides on whether a shop will be remembered or entered by the passer-by or not.

3 Research hypotheses

Apart from the study of criteria related to the psychology of perception, the influencing factors relevant in persuading a customer to enter a shop were investigated more thoroughly.

Just how much change will attract the customer's interest, and what kind of effects will rather irritate them?
How do you attract people's attention to a product in a targeted manner, and what will rather divert their attention?

What will have a more favourable effect in combination with dynamic change:
A balanced lighting and design or rather one that is rich in contrast?
Attractions and quick changes or recognition?
The speed of the change in lighting?

In this context, the impact of the lighting parameters change of brightness, change of colour and colour temperature, and the direction of the light were tested on different groups of buyers, to

– attract the attention of the passers-by
– to increase the time that people will spend in front of the shop window

Visual mechanisms to be examined:
– pulsating coloured light (pulsating = quick change)
– pulsating light in delimited area
– dynamic colour change (dynamic = changing slowly over time)
– dynamic increase of colour intensity
– dynamic increase of brightness versus reduction of brightness
– dynamic change of brightness versus static accent lighting
– accent on delimited area
– accent on indefinite area
– dynamic change of brightness in delimited area
– dynamically changing accent to guide the path of the eye

4 Theoretical background

Perception

In this chapter a few basic models of the psychology of perception are going to be presented in a first step; the lighting scenes were developed on the basis of these models.

In the age of overstimulation, it is essential for products and services to be perceived by consumers at all. Such perception takes place through interactions among our senses. Our perception works in a multisensory way, our senses accordingly cooperate with each other. Nevertheless, visual perception alone, with the eye as the sensory organ, takes up 80 percent of our attention and is therefore our most important organ of perception.

4.1 Seeing – the fovea

First of all, one needs to know that visual acuity is highest in the area of the fovea. This is a point on the retina of our eye where only cone receptors (colour vision) occur. As, moreover, in this spot the density of adjacent cones is highest in percentage terms, this is the place of maximum visual acuity. The fovea is located exactly in the visual axis of the sighted object – so, whenever we look at an object, its image will directly fall onto the fovea. This is why the object sighted at the respective moment is always the clearest.

Our eye is permanently moving to obtain new information and to guide us to various parts of a scene. These movements, also called saccades, can be recorded and analysed by means of camera-based eye tracking. Saccades are themselves interrupted by breaks, the so-called fixations. During the fixations, the eye briefly stops to obtain information on any part of a scene.

These fixations indicate the spots that we are paying attention to. When we watch a scene, there are 3 fixations per second. Since many factors co-determine what we are looking at, it is no surprise that a large amount of variations of the fixations is possible while a person is scanning a certain scene. This is due above all to the mental aspect of attention that occurs in addition to the eye movements. Based on experience and subjective remembrances, different objects are of greater or lesser importance for each of us individually.

While it is frequently possible to tell in advance what part of an image a person is going to look at, it is much more difficult to tell in what order a certain person is going to fixate the various objects.

4.2 Selective attention

Human perception is selective, we actively see only what is most important. We filter our perceptions based on our value system and frame of reference. In doing so, we summarise objects into shapes as simple as possible. We perceive primarily what we are interested in, what is important to us. Selective perception also impacts our consumer behaviour.

In the process of perception, the shop window has the important task of attracting pedestrians' attention.

To attract people's interest, the retailer has usually only got 2.5 to 3 seconds. Visual impressions, for instance a cleverly structured shop window decoration, facilitate perception and influence our selective sensation. In this context, interest needs to be stimulated through emotions upon the first glance at the shop window. What counts is the first impression, it is this first impression that must provide information on the service offered.

Selective perception works through our eye movements. We scan a scene by focussing the fovea of the eye on the objects we are interested in.

4.3 Blindness through lack of attention

If we look at the decoration in a shop window, we do not perceive the reflexions in the shop window. If you change focus, fixating on the reflexions in the window, you will no longer perceive the objects exhibited, you will not be aware of them any longer. This effect is also called blindness through lack of attention.

4.4 Change blindness

Change blindness refers to the trouble we have discovering changes in scenes. Test subjects who are subsequently shown two pictures with minor or even quite obvious changes will often find it difficult to discover the differences.

4.5 Difference threshold

Nowadays, retailers try to attract people's attention through changes in the shop window. How marked this change needs to be to be noticed at all, can be described with the Weber fraction. According to Mr. Weber, a scientist, this so-called difference threshold is the smallest difference between two stimuli that a human test subject is able to perceive. Weber discovered that we are not very able to perceive small differences. The difference threshold in the meaning of the difference, which you just can not perceive, increases with the intensity of lighting.

In the case of light, the Weber fraction is around 8 percent. Accordingly, the intensity must be increased by 8 percent for any change to be perceived at all!

4.6 Estimate of degree of stimulus increase (Stevens' power law)

Mr. Stevens, another scientist, found out that the increase of the magnitude of a physical stimulus causes a logarithmic increase of its perceived intensity, following the power function.

To double the perceived brightness, a nine-fold increase in intensity is required. If we are in a room looking out of the window, the intensity of the light inside the room is much lower than that outside. Nevertheless we will hardly perceive any dazzle. This is due to said downward curve causing a low increase of perceived brightness.

5 Research methods

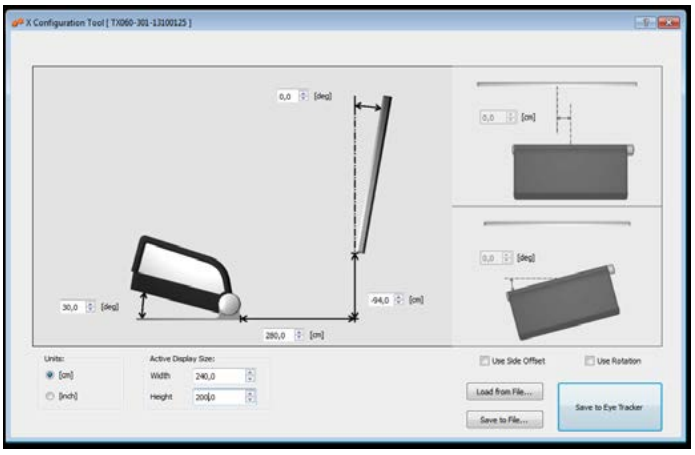
5.1 Selection of methods

Eye tracking
Within the scope of the study, 10 videos are shown, each of them 10 seconds long, during which the eyes of the test subjects are filmed by means of eye tracking. During the videos, individual lighting parameters are tested for their effect on the path the eye takes when viewing the shop window. By reducing the influencing factors, conclusions can be drawn as to certain principles and their effects.

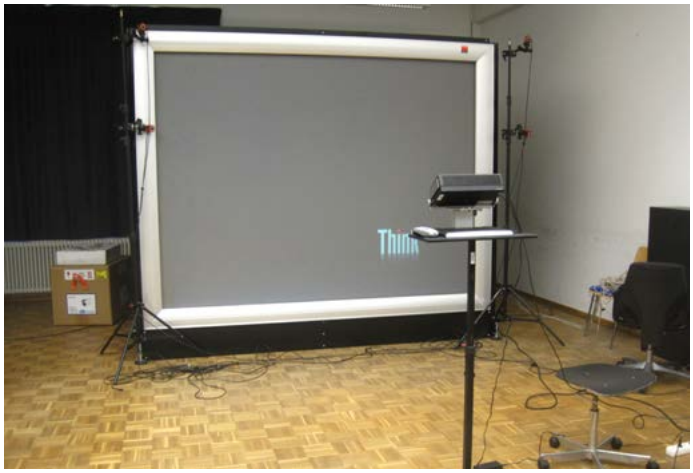
Questionnaire
Inquiry of personal and target group-related information. The questionnaire also serves to investigate which of the effects are actively perceived and consciously recognised by the test subjects. For this purpose, the test subjects are required to assess for each video individually which lighting effects they have perceived and what kind of effect (positive or negative) these have on the presentation of the goods.

5.2 Test setup

Basics – test setup
Projector with rear projection
Distance between projector and screen: 2.20 m
Projection surface: 2.65 m x 2.00 m
Distance of eye tracker from screen: 2.80 m
Distance of test subject from screen: approx. 3.20 m
Angle of eye tracker: 30 degrees
Bottom edge screen to bottom edge eye tracker: –94 cm



FH Vorarlberg
Research centre for user-oriented technologies
Projector and test person are always positioned centrally in front of the projection surface.

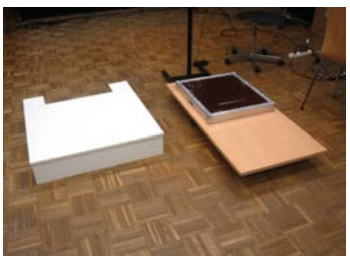


Equipment
Eye tracking
Tobii X60 Eye Tracker
Accuracy: 0.5 degrees
Variation: < 0.3 degrees
Data processing rate/speed: 60 Hz
Range for head movements: 44 x 22 x 30 cm
17 x 9 x 12
Binocular (two eyes)
Weight: 3 kg

Software
Eye-Tracking software – Tobii Studio™

– Computer for presentation of the videos
– Pedestals of various heights

Test subjects stand in front of the eye tracker. To maintain measuring accuracy, the eye tracker/screen geometry must not be altered during the test. For this reason, the test subjects must stand on pedestals of different height, according to their respectice height, so that they are always in the same position and their heads are always at the same height as with the other test subjects.



Presentation
For the test, 10 videos of two shop windows were developed, recording the test subjects' responses to various lighting parameters. The videos are 10 seconds each and separated from each other through 2 seconds of black foil.

The order of the videos is completely random; 4 different sequences were allocated to 4 groups in order to exclude any habituation effect when viewing the shop windows.

Shop window visualisation
The videos used for the test were prepared by means of the VIVALDI software by Zumtobel. To do so, individual images of each luminaire were first visualised using the 3ds Max software from Autodesk as HDR. Accordingly, they had realistic brightness indications, as they had also been designed with real luminaires and their light distribution curves. The images of each individual luminaire were then entered in the VIVALDI software, resulting in the overall picture of the completed dynamic sequence of shop window lighting. Since all luminaires were inserted as individual images, all luminaires can now be addressed in the VIVALDI software individually. Thus various lighting effects and ambiances may be tested.

Test lighting
The luminaires used were meant to cover all conceivable areas: direct lighting of mannequins through spotlights on the ceiling and walls. These are mounted on invisible tracks to ensure flexibility. Indirect lighting through wallwashers of the right-hand exterior wall by means of three spots to create some accents. Moreover, by wallwashing the left-hand rear wall through wide-area luminaires recessed into the floor and ceiling.

Unusual contrasts can be created by uplights recessed into the floor. On the bottom of the right-hand shelf, there is a small spotlight for targeted, pinpointed shelf lighting.

Shop windows
For the shop windows themselves, rear walls as high as the room were chosen to be able to selectively test the lighting in the foreground.

Visualisation with VIVALDI
In previous surveys and studies, it was only possible to examine static lighting scenes. But the new technological developments of the luminaires, especially in the LED sphere, and the new options of lighting control require the inclusion of a new dimension into the evaluation: time.

In order to be able to take account of the time factor, visualisations in the form of videos are required. This is where the VIVALDI software comes in. It was quite simple to create various lighting scenes and to test new lighting solutions such as dynamic dimming.

So far, it has only been possible to test high or low contrasts. But we did not know how attractive or even irritating – for instance – a pulsating type of lighting would be. What if the light is flickering all the time? Would we look in the respective direction because it attracts our attention, or would we rather look away because we find it irritating?

These scenarios, in particular, can be tested under realistic conditions with VIVALDI. Accordingly, it was possible to examine the individual parameters separately from each other. One effect could be tested per video. The spots where people looked first during a video – and for how long – were recorded on film by means of eye tracking. In this way it is now possible to determine the percentages to show whether any lighting effect is actually effective.

In addition, in the questionnaires candidates were asked to assess the situation with respect to the presentation of the goods. The test subjects had to indicate whether the lighting factors have an influence on the presentation and whether they consider said influence positive or negative.

5.3 Test procedure

Carrying out the test – duration
Total duration per test subject: 30 min
Explanation: 5 min

Part 1
Eye tracking 2.5 min
System set-up: 5 min

Part 2
Watching the videos individually + questionnaire: 15 min
Saying good-bye: 2.5 min

The procedure
Target group classification according to a questionnaire

Part 1
Within the scope of the study, 10 videos are shown at first, each of them 10 seconds long, during which the eyes of the test subjects are filmed by means of eye tracking. Subsequently, the participants fill in a questionnaire that is meant to document (for subsequent enquiries) how the test subjects had felt about the videos.

Part 2
Each shop window video is then shown again individually. Immediately following each video, a separate questionnaire is provided. The questions contained therein are meant to be answered spontaneously and quickly. The test subject is now asked whether he/she has actively perceived the changes, and how he/she had liked the shop window at the respective time.

5.4 Test subjects

Number

Test candidates: 54 (100 %)

Sex

Men:	41	(75.93 %)
Women:	13	(24.07 %)

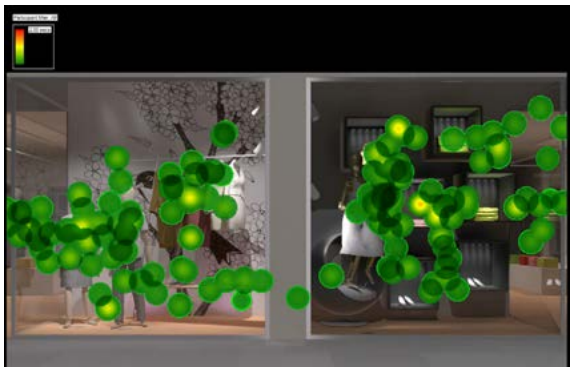
Age

0–25 years:	19	(35.19 %)
26–35 years:	15	(27.78 %)
36–45 years:	13	(24.07 %)
45–55 years:	5	(9.26 %)
56–66 years:	2	(3.70 %)

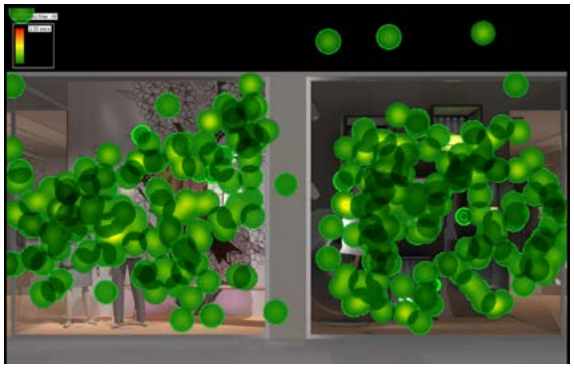
Occupation

Business:	17	(31.48 %)
Design:	23	(42.59 %)
Technology:	6	(11.11 %)
Other:	8	(14.81 %)

6 Results



Women



Men

6.1 Results, statistics and interpretation

Scenes for statistical comparisons

Video 1
No change of the lighting – static

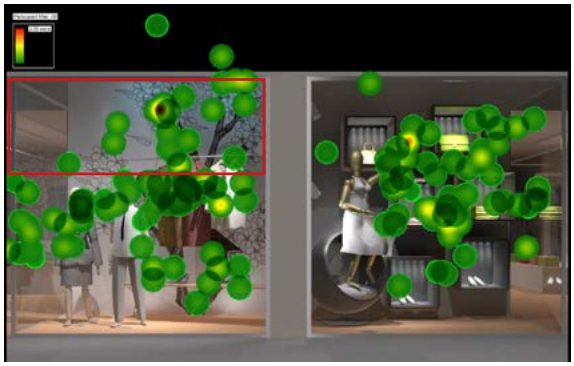
Hypothesis
In this situation, only the shop window design is effective.

(Comparative video)

In this video nothing is happening in order to obtain a comparison as to what test subjects will look at if no dynamic stimuli are offered. What is remarkable here is that women will look at the goods in a much more targeted manner, while men will rather scan the entire room first.

The heat maps indicate the points where brief fixations by the test subjects took place. The more fixations accumulate in a certain spot, the darker the spot will be due to overlapping of the heat maps. A longer duration of fixations is signalised by the colours yellow to red.

Accordingly, spots that are markedly yellow, red or dark green are perceived as attractive by the test subjects.



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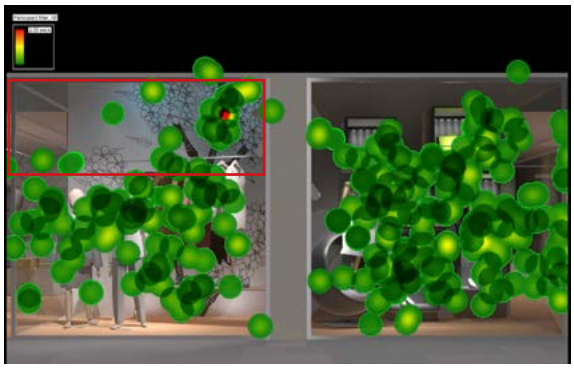


Men

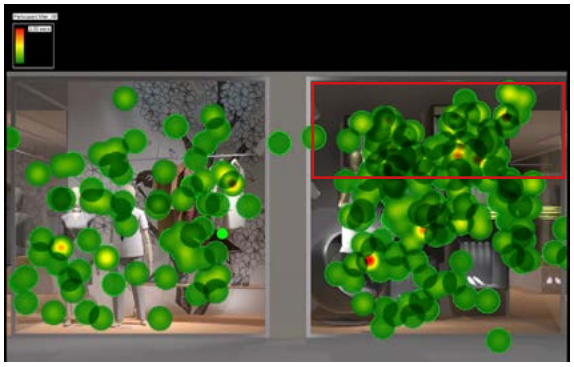
Video 2
Pulsating changes of intensity of coloured rear lighting on indefinite surface

Hypothesis
Lighting an indefinite surface in a pulsating, rhythmic way will attract glances.

Evaluation
Pulsating light was hardly noticed at all. Half of the test subjects recognised the change in colour and colour intensity.

Pulsating light on indefinite surfaces is not to be recommended. Colour changes have an impact that might be utilised.

Women



Men

Video 3
Pulsating changes of the intensity of coloured rear lighting on a delimited surface

Hypothesis
Attention is best attracted through an eye-catching event.
A pulsating, rhythmic type of lighting on a delimited surface will attract glances even more than on an indefinite surface.

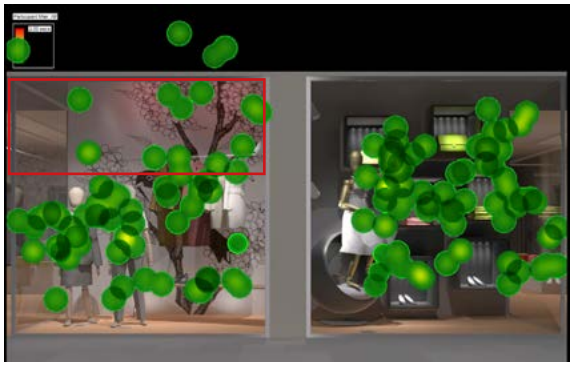
Conspicuous changes will have an unpleasant effect.

Quick changes will have an unpleasant effect.

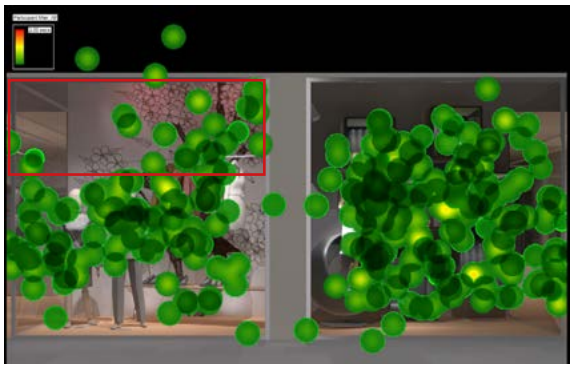
Evaluation
The effect was well recognised.

Women perceive the pulsating movement even more strongly, all of them noticed the pulsating light.

Men are looking for flickering light on the entire right-hand side, while women quickly focus on that top right-hand spot, which they also fixate (indicated by the yellow-red colouring of the heat maps).



Women



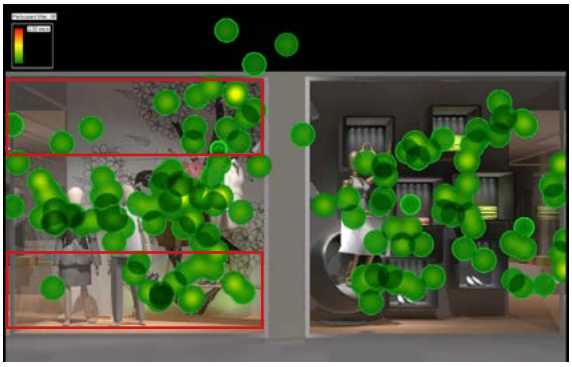
Men

Video 4
Change of colour of rear lighting on indefinite surface

Hypothesis
A slow colour change will arouse interest and increase the length of time people stay in front of the shop window.

The colour change is conspicuous and should be used discreetly, otherwise it will have an unpleasant effect.

Evaluation
Is perceived well on average. Almost half of the test subjects have noticed the colour change. Men tend to notice this test even more than women.



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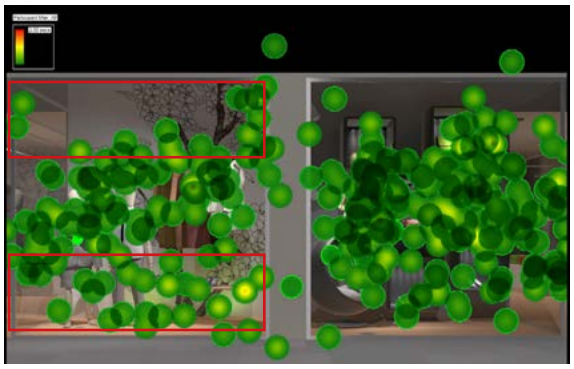


Men

Video 5
Change of intensity and colour of rear lighting on indefinite surface

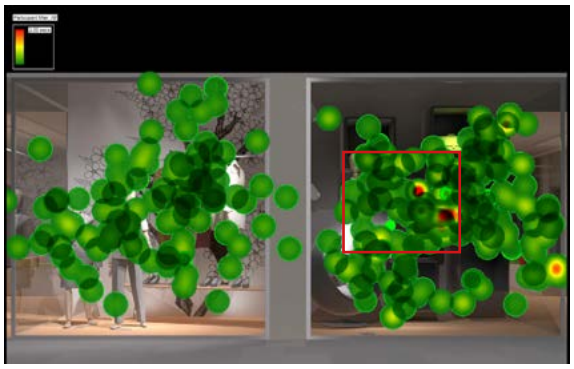
Hypothesis
A slow change of colour attracts more attention than the parallel reduction of brightness.

Evaluation
A little under half of the test subjects perceive the colour change.

The change of brightness is only perceived by 25 % of the test subjects and is accordingly less effective than the change in colour.

The colour intensity is still recognised by almost 40 % of the test subjects, who also accord a higher evaluation to the shop window.

Women



Men

Video 6
Random appearance of accent lighting on a box

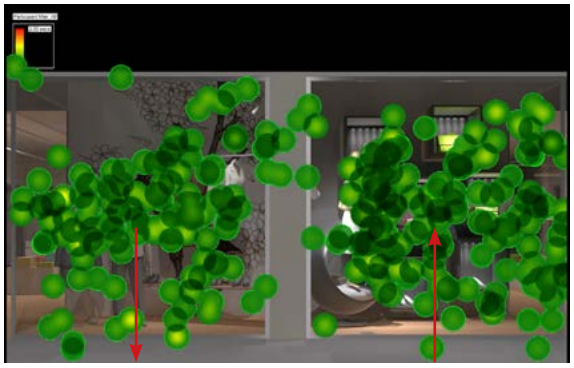
Hypothesis
Obvious accents attract attention and create a dramaturgy.

The length of time that people fixate the accentuated products will increase.

Evaluation
Women tend to perceive the strong accent lighting better than men.

This was already demonstrated in the first study. Women will rather focus on smaller parts and limited surfaces, while men tend to first scan the entire room.

Women



Men

Video 7
In a shop window the intensity of general lighting is increased, while it is reduced in the other shop window.

Hypothesis
In case of simultaneous up-/down-dimming of both sides, the reduction will be noticed more quickly due to Stevens' power law. The bright side will be perceived as more attractive.

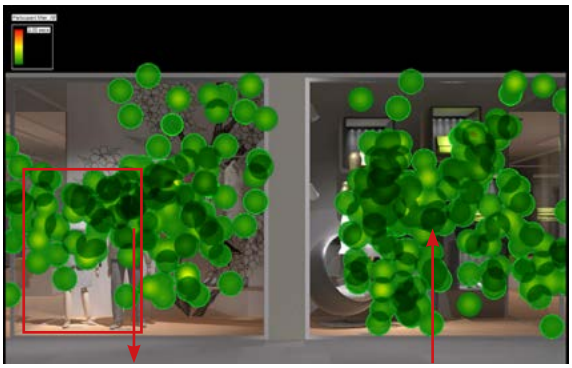
Wide-area changes of total luminosity are perceived better than on a separate surface.

Evaluation
The change of brightness "getting brighter" was recognised by half of the test subjects.

The change of brightness "getting darker" was only recognised by every sixth test person. However, the scenes were assessed very positively.

In spite of Stevens' power law, we will perceive increasing brightness more easily if both changes take place simultaneously!

Women



Men

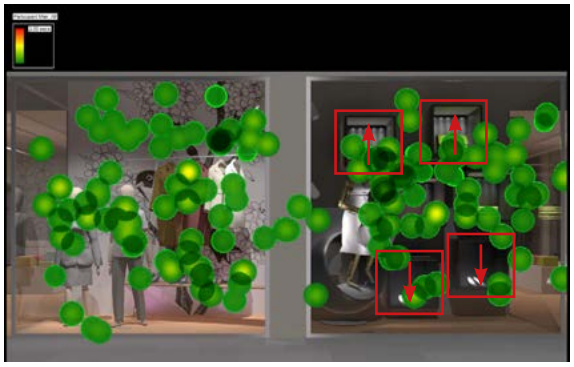
Video 8
In a shop window the intensity of accent lighting is increased, while it is reduced in the other shop window.

Hypothesis
In case of simultaneous up-/down-dimming of both sides, people will look at the constantly bright accent on the side that is getting darker.

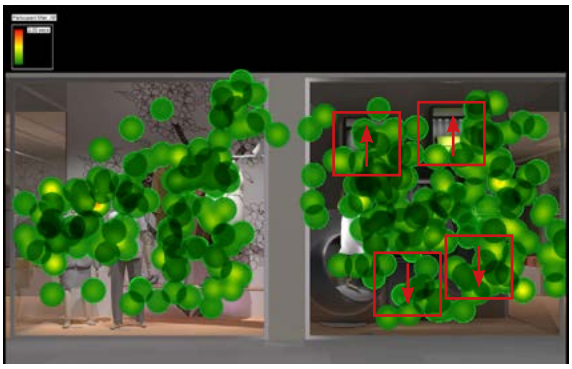
Evaluation
The brightness change was noticed by less than half of the test subjects.

The accent was not noticed particulary well as compared to the change in general lighting.

The change of brightness “getting darker” was again only recognised by every sixth test person. However, here too, the scenes were assessed very positively.



Women



Men

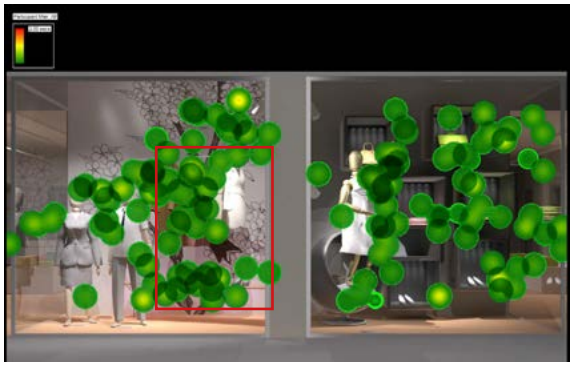
Video 9
In the boxes in the right-hand shop window, the intensity of the light was changed.

Hypothesis
In case of simultaneous up-dimming of the top boxes and down-dimming of the bottom boxes, people will again look first at the boxes that are getting darker.

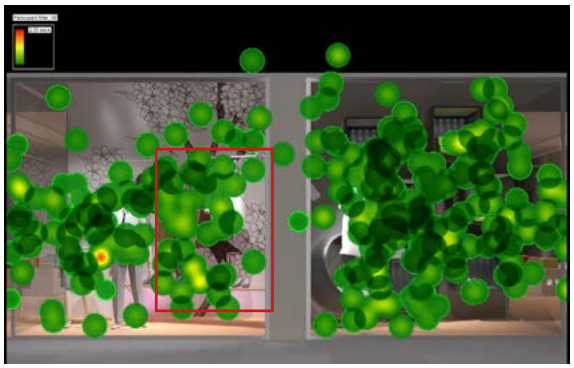
The effect in video 9 is delimited to a small space and is therefore less noticeable than the effect applied in the entire shop window half in videos 7 and 8.

Evaluation
This time, men perceived the effect better.

Women find it difficult to recognise the dimming effect. Women found it easier to recognise the focussed accent lighting from experiment 6 (“one box on”).



Women



Men

Video 10
The accent lighting shifts from right to left

Hypothesis
The eye can be guided from right to left through discreet brightness accents – waymarking.

Time-delayed accent lighting of different objects from left to right will guide the customer's eye.

Evaluation
The accent is too weak.

The increasingly bright accent was hardly noticed.

Minor brightness increases to make an accent visible will not increase attention.

Effects may well be more marked, since on account of change blindness they are not perceived as clearly as one might expect.

6.2 Summary

The study has demonstrated how subjective dynamic changes of the factors brightness, light distribution and light colour influence the way people are attracted to a shop as well as their purchasing behaviour. The subjectivity aspect is very important nowadays, since we increasingly tend to adopt a target group-specific and emotion-based purchasing behaviour.

For planning this means that we must pay attention above all to the target group we want to reach, in order to achieve any effect with dynamic lighting at all. In this context, the movement must be quick in order to be noticed immediately.

With a view to our target groups, we may conclude as follows: Quick movements should preferably be applied to the lower price segment. They have a definite, immediate effect and allure passers-by, while reducing the perceived “value” of the shop window. For instance, contrary to expectations, pulsating light has an attractive effect at first and is even associated with a high score for recognition. Only when dealing with the question more thoroughly during a personal interview, the effect is compared to a faulty luminaire and rated negatively.

So, for the medium to premium price segments, quick changes are not recommended, since they may be interpreted as cheap, trashy or associated with faulty lighting.

Slow movements over the course of the day, on the other hand, offer variety to people who pass a shop repeatedly. In this way, attention will focus on the accentuated product in case of high-contrast lighting. Over the course of the day, it is possible to emphasise different products through varying contrasts, permanently offering something new to passers-by in the shop window. Even effects related to the psychology of perception play a more important role than was initially expected. Change blindness contributes to the differences in individual dynamic effects often being hardly perceived. A person passing by a shop window and not specifically paying attention to the lighting may easily miss the dynamic effect if it is too faint; and accordingly said person will not notice any change at all.

For any follow-up study this means: How marked such a change can be in order to be noticed without irritating should only be tested under real-life conditions.

One thing is certain: The change must be much more pronounced than on the computer, since we have to compete with a much more diverting environment, with selective perception and with a reflective window pane in order to gain people’s attention.

The effect of an accent shifting from left to right, with one product on the left, then one in the middle and then one on the right being gradually illuminated, was rated positively in personal interviews, but unfortunately was presented too discreetly in the test. The change in brightness was not perceived adequately. This is the result of the change blindness described above, which prevails whenever any changes are too small or too slow.

Dimming in itself is usually noticed by few people only. In the darker segment – in case of down-dimming – it is always rated positively. This means that we should only use this effect in a targeted manner, but will always be able to reach a few customers by using it. Persons who notice the effect evaluate it positively, since it offers something new and unexpected.

A change in colour and generally changes on indefinite surfaces were perceived better in the test by men than by women. Overall, brightness changes on a limited surface were more easily recognised, with the women finding it even easier to recognise such changes.

In a next step, the principles defined must be examined under real-life conditions in a trial shop window with more test subjects and in a controlled or comparable lighting situation. Also, the combinations or correlations from the individual parameters so far examined should be analysed. Especially the aspect of intensity should now be clarified, i.e. how strongly a certain effect impacts passers-by with a view to alluring them – instead of making them run away.

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Brief portrait of the partners

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