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Attention guidance, perceived brightness and energy demand in retail lighting

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Abstract

The presentation of merchandise often happens undifferentiated with a high level of brightness causing high energy demand. For human perception this results in intense light pressure and risk of increased glare. We developed and investigated lighting concepts with various lighting distributions and colour contrasts which were investigated in a perception study. 30 participants rated homogeneous, zonal single-coloured and zonal colour-contrasted lighting scenes regarding their brightness impression at two 1:10 scale shop models. Compared to homogeneous reference lighting scenarios, the zonal lighting scenarios can be operated with about 30% reduced overall room illuminance values while being perceived as similar bright.

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1. Introduction

Very high illuminance levels can be found in many retail stores. Shop operator seem to assume that this leads to increased attention and greater stimulation of customers [1]. We confirmed this aspect by measurements in a local shopping center in Innsbruck, Austria [2]. Unfortunately, this design approach – high illuminance values uniformly all over the shop - obviously has serious disadvantages. Energy demand and risk of unpleasant light pressure as well as glare increases considerably. Rethinking this phenomena from our experience in lighting design we know that perception of rooms and objects of course not solely depends on the illuminance and luminance level, but among

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many other also on light direction, shadiness, contrast, thus a spatial light distribution. Some normative rules or advanced planning guides do name these important parameters [3,4], but they do not provide reliable models for design purpose.

Our idea was to examine the influence of a zonal layout with higher local intensities and a reduced ambient illumination on the perception of a sale room. Reduction of ambient illuminance makes highlighted zones more evident and in total can cause a reduced needed luminous flux and in a row savings in energy demand. Hereby we aimed to maintain the existing perceived brightness in order not to decrease the impression of this essential parameter and worsen the performance of the sale environment.

The zonal concept seems to be very natural for shops as it is able to guide attention to special products and areas or dissolves consciously distraction sources like a diffuse offer of too much visual information. In this way it improves the effectiveness of visual components through a transition from undirected to direct attention [5].

2. Thesis, methods and model

2.1. Thesis and methods

As the thesis of our experiment we expected to find retail store lighting solutions that creates the same perceived brightness while less energy is being consumed using a spatial zonal light distribution. Zonal differentiation was achieved by intensity and colour temperature contrast. The resulting brand image of a store illumination was evaluated and should not be effected negatively.

For economical and cost reasons we decided to build two 1:10 scale models. Scene illumination integrally was quantified photometrically by the vertical illuminance Ev (eye level)) at the model opening by a sensor orientated towards the halfspace of the shop space. Perceived spatial brightness was evaluated at the same viewpoint rated by test persons looking towards the space (see Fig. 1).

Fig. 1. Participant looking into the shop model.

In the first part of our experiment lighting scenes were presented successively. Lighting scenes were rated one by one only in the left model. So we got successive ratings due to perceived brightness. In this part of our experiment a magnitude estimation of perceived brightness was evaluated, the participants were asked to assign numbers in proportion to the magnitude of the stimulus directly.