This paper analyses how store lighting influences store atmosphere, price and quality perception, and the intention to shop in a retail store. A first experiment shows how the brightness and accentuation of lighting influence these dependent variables. The findings demonstrate that brightness especially results in higher pleasure and shopping intention, while for price and quality perception inferences via pleasure and direct categorisation effects cancel each other out. Accentuation has marginally significant positive effects on perceived pleasure and quality perception. A second experiment shows that warm orange light (compared to cool blueish light) results in greater quality perception and shopping intention via greater pleasure. However, this effect exists only when colours are saturated, but not for pastel colours. We recommend that retailers optimize their lighting concept based on our findings after filtering options, which fit with their positioning and store design concept.

1. Introduction

Store environmental factors influence customer behaviour in different ways. Studies anchored in environmental psychology have shown how the store environment influences approach/avoidance behaviour via affective dimensions, such as perceived pleasure, arousal and dominance (Chebat and Michon 2003; Donovan and Rossiter 1982; Donovan et al. 1994). Research on servicescapes has more specifically focused on the effects of specific design parameters as visual, auditory or olfactory cues (Bitner 1992; Lin 2004). More recently, the term sensory marketing has drawn our attention toward the question as to how marketing that engages the customers’ senses influences their perceptions, cognitions, emotions and behaviour (Krishna 2012). These research streams have not only shown positive effects of the store environment on customers’ emotional reactions, they also demonstrate that the store atmosphere or selected design parameters serve as cues for evaluating store image dimensions, such as price and quality perception (Baker et al. 2002; Gröppel-Klein 1998).

However, predicting the impact of design parameters on perceived pleasure, price and quality perception is sometimes difficult as they influence these variables via different effects, which can even cancel each other out. This especially holds for design parameters influencing perceived pleasure as a cue for higher prices and better quality (Baker et al. 2002), while they are simultaneously characteristics of retailers with a low price positioning.

Store lighting is one such design parameter. Predicting the impact of store lighting on customer perception and behaviour is a challenging task. Firstly, a number of different lighting parameters exist, such as brightness, accentuation or the colour and saturation of the light. Secondly, lighting influences a number of related variables, such as store atmosphere, price and quality perception, and the shopping intention. Predicting consequences of lighting parameters becomes even more challenging as, in some cases, conflicting theories suggest opposite effects that cancel each other out. Bright light, for example, might increase the perceived pleasure and thereby serve as a cue for higher prices. At the same time, bright light is also a characteristic of discount stores, while
darker light may indicate a more upmarket positioning (Briand and Pras 2010). Hence, retailers using bright light might be categorised as discount retailers. Contradicting effects also exist for colour. Previous colour research indicates that blue is preferred over orange, while research on colour appropriateness indicates that customers rate orange as more appropriate for social-sensory products, such as clothing (Bottomley and Doyle 2006). These appropriateness effects suggest a positive impact of orange light on the perceived pleasure and quality perception (Babin et al. 2004). However, warm colours such as orange might be also interpreted as characteristics of discount stores (Babin et al. 2003).

These examples illustrate that several research streams and theories contribute to our understanding of store illumination effects. Some of these research streams and theories suggest conflicting effects, such as inference theory and categorisation research or research on colour preferences and colour appropriateness. The examples also illustrate that it is not trivial to develop hypotheses about the effects of store lighting. This might be a reason why a comprehensive analysis of different lighting parameters and their interactions on a broader range of dependent variables is missing in the literature. Although store design and atmosphere are a popular research fields, only a few studies focus on store lighting in particular (e.g., Areni and Kim 1994; Babin et al. 2003; Briand and Pras 2010; Schielke 2010; Summers and Hebert 2001). This is also astonishing, as lighting is an important design parameter that retailers can change easily with subsequent consequences on energy costs and customer behaviour as well.

This paper addresses this research gap by (1) providing a comprehensive analysis of different lighting parameters on a broader range of dependent variables, (2) providing more insight into conflicting theories, suggesting opposite effects of lighting parameters on selected dependent variables and (3) providing more insight into the mediating role of perceived pleasure on the impact of lighting on price and quality perception, and the shopping intention. We present results from two experimental studies. The first experiment analyses the impact of overall brightness and accentuation on store atmosphere, price and quality perception, and the shopping intention. The second experiment investigates the impact of colour type and saturation on these variables. Lighting conditions are varied through digitally manipulated pictures of a fashion store. Interrelations between dependent variables and conflicting effects are considered via mediation analyses.

The results reveal interesting effects that have not been reported in prior research. The first experiment shows that overall brightness positively influences the shopping intention and that perceived pleasure fully mediates this effect. For price and quality perception, inferences via pleasure and direct categorisation effects cancel each other out. Accentuation has marginally significant positive effects on the perceived pleasure and quality perception. Results from the second experiment show that warm orange light results in greater quality perception and shopping intention compared to cool blue light and that pleasure fully mediates this effect. However, this positive effect occurs only when colours are saturated, but not for pastel colours, indicating a moderated mediation.

2. Theoretical background and hypotheses

Previous studies analyse the impact of several environmental factors on different dependent variables (Turley and Milliman 2000). Many studies build on Mehrabian and Russell’s framework (1974), assuming that environmental factors influence pleasure, arousal and dominance, which have an impact on shopping behaviour (e.g., Chebat and Michon 2003; Donovan and Rossiter 1982; Donovan et al. 1994; Eroglu et al. 2003; Ha and Lennon 2010). The framework also draws attention to the information rate of an environment (novelty, complexity, spaciousness) that influences the aforementioned emotional and behavioural responses (Donovan and Rossiter 1982; McGoldrick and Pieros 1998). However, environmental variables do not only influence the store atmosphere as the store design serves as a cue for price and quality perceptions (Hamilton and Chernev 2013). Baker et al. (2002), for example, show that design perceptions increase the perceived expensiveness and merchandise quality perception of a card-and-gift store. Gröppel-Klein (1998) has shown that the store environment positively influences the value perception of furniture stores through the perceived dominance (i.e. when customers feel free and strong while shopping in the store). Design factors like illumination also have an influence on brand images (Schielke 2010). Based on this prior research, it seems plausible that store lighting also influences the store atmosphere, price and quality perception and intention to shop in a retail store. The following section develops hypotheses about the impact of several lighting parameters on these dependent variables. Regarding store atmosphere, the hypotheses focus on the pleasure dimension as pleasure is especially assumed to be closely related to price and quality perception.

2.1. Brightness and accentuation

The brightness of the store is one of the most researched lighting parameters. Areni and Kim (1994) report that customers examine and handle more merchandise under bright versus soft lighting conditions. Similarly, Summers and Hebert (2001) observe that brightness increases the number of items touched in a store. Vision theory contributes to the explanation of these findings. Vision theory suggests that bright lighting influences behaviour through its impact on visual perception (Biner et al. 1989), resulting in a more pleasant store atmosphere. Furthermore, in clinical psychiatry brightness serves as an antidepressant. Light therapy, for example, is a com-

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mon treatment for seasonal affective disorders (Rosenthal et al. 1984; Golden et al. 2005). Hence, these theories provide strong support for a positive effect of brightness on the perceived pleasantness of the store atmosphere.

Inference theory and categorisation research explain the impact of brightness on price and quality perception. Inference theory assumes that individuals use information cues to make inferences in situations with incomplete information and which they cannot assess directly (Nisbett and Ross 1980). A pleasant store atmosphere can serve as a cue for higher prices and superior quality (e.g., Baker et al. 1994; Baker et al. 2002; Grewal and Baker 1994; Verhoeven et al. 2009). Hence, when brightness has a positive impact on the store atmosphere, it results indirectly in a more expensive price level and better quality perception.

However, categorisation research suggests the opposite. This research stream assumes that categories are internally structured into a prototype and several non-prototype members (Rosch 1975; Rosch and Mervis 1975). According to Keaveney and Hunt (1992), a new store is categorised based on the features, cues or stimuli it shares with the prototypes of different store categories. When customers associate bright light with a discount prototype, this results in a more favourable price and inferior quality perception. Briand and Pras (2010) support the latter argument by observing that “bright and cool light” results in greater stimulation (mixture of pleasure and arousal), while “soft and warm light” results in a stronger upmarket perception (measured with items, such as upmarket, modern, spacious and well-ordered). Hence, the arguments regarding effects on price and quality perception are mixed. Bright light influences price and quality perception directly through categorisation as a discount retailer and indirectly via perceived pleasantness as a cue for an upmarket positioning. Hence, we assume that brightness directly results in a less expensive price and inferior quality perception, while it indirectly (via pleasure) results in a more expensive price and better quality perception. Methodologically, this is a case of inconsistent mediation. Such mediation does not require a significant total effect of the independent on the dependent variable as direct and indirect effects can cancel each other out (Judd and Kenny 1981, p. 207; MacKinnon et al. 2000).

The impact of brightness on the shopping intention is indirect and depends on how customers value the importance of a pleasant store atmosphere, low prices and good quality. This importance may vary between retail sectors. Socially oriented products, for example, are evaluated better when they are presented in a prestigious atmosphere (Schlosser 1998). Therefore, in fashion retailing customers might especially value the store atmosphere, resulting in a stronger shopping intention for bright stores. Furthermore, several studies show a mediating role of pleasure in predicting shopping intention and approach behaviour, in particular in fashion retailing (e.g., Ha and Lennon 2010; Sherman et al. 1997). Hence, brightness should have a positive impact on the shopping intention mediated by perceived pleasure.

**H1:** A higher overall brightness level of store lighting

(a) results in greater pleasure; 
(b) directly signals a better (less expensive) price level perception and indirectly an inferior (more expensive) price level perception via pleasure; 
(c) directly signals an inferior product quality perception and indirectly a better quality perception via pleasure; 
(d) results in a stronger shopping intention, mediated by pleasure.

Furthermore, we are interested in the impact of accentuated lighting. Retailers can reduce the overall brightness level of a store by either dimming the existing beams (dimmed light) or by reducing the number of beams (bright accentuated light). We assume that accentuated light increases the information rate of the environment. Research from environmental psychology has shown that a higher information rate results in a more stimulating atmosphere (Donovan and Rossiter 1982; McGoldrick and Pieros 1998). Furthermore, accentuation might be more functional when it highlights shelves and merchandise. We therefore assume that accentuation increases the perceived pleasure. As outlined above, inferences drawn from pleasure result in an inferior (more expensive) price perception and better quality perception (e.g., Baker et al. 1994; Baker et al. 2002; Grewal and Baker 1994; Verhoeven et al. 2009) and pleasure also increases the shopping intention (e.g., Ha and Lennon 2010; Sherman et al. 1997). Furthermore, customers might characterise stores with accentuated lighting as more upscale, which directly signals an inferior (more expensive) price perception and better quality perception. Hence, the effects of accentuation on the price and quality perception are partially mediated by pleasure, while pleasure fully mediates the effects on shopping intention.

**H2:** More accentuated light (compared to less accentuated light) results in

(a) greater pleasure; 
(b) inferior (more expensive) price level perception, partially mediated by pleasure; 
(c) better product quality perception, partially mediated by pleasure; 
(d) stronger shopping intention, mediated by pleasure.

### 2.2. Colour temperature and saturation of light

Several studies analyse the impact of colour on evaluative and activation-related constructs, such as pleasure and arousal. Many of these studies find that cool colours with short wavelengths result in greater pleasure compared to warm colours with long wavelengths (e.g., Crowley 1993; Babin et al. 2003; Bellizzi et al. 1983; Bellizzi and Hite 1992; Yildirim et al. 2007; Valdez and Mehrabian 1994). However, other studies report no such
effects (e.g., Gorn et al. 1997) and it is questionable whether the supporting results on the positive effects of cool colours can be generalized. Bellizzi et al. (1983) observed that customers are physically attracted by warm colours, while they perceive cool colours as more pleasant. Bellizzi and Hite (1992) argue that warm colours can be unpleasant when they overstimulate customers and distract them from their shopping task. Hence, customers might particularly rate blue as more pleasant when they are task-oriented, while red or orange might be more pleasant when seeking stimulation. Furthermore, research on brand logos indicates that customers rate warm colours as more appropriate for social-sensory products, while they rate cool colours as more appropriate for functional products (Bottomley and Doyle 2004). Accordingly, red and orange are associated more with excitement, while blue is associated more with competence (Labrecque and Milne 2012). As the appropriateness of environmental stimuli is closely related to positive affect and hedonic shopping value (Babin et al. 2004), warm orange light may result in a more pleasant store environment for retailers predominantly selling sensory-social products (such as fashion boutiques).

Coloured light may also influence price and quality perception. Via a more pleasant store atmosphere, warm orange light can result in an inferior (more expensive) price perception and better quality perception. Accordingly, previous studies found that appropriateness also influences quality perception positively (Babin et al. 2004). However, similar to brightness, categorisation effects can cancel out these effects of orange light. Babin et al. (2003) argue that warm colours are more consistent with a discount concept, while cool colours are more consistent with a prestigious concept. Zaichkowsky (2010) also argues that orange is deemed inexpensive. Hence, categorisation research suggests that orange light should result in a more favourable price level and weaker quality perception. Reflecting these contrary direct and indirect effects via pleasure, it is not surprising that the prior empirical support for colour effects on price and quality perception is weak. Bellizzi et al. (1983), for example, find no such effects. Accordingly, we hypothesize inconsistent mediation effects and assume that direct and indirect effects of orange light might cancel each other out.

The impact of colour on shopping intention is indirect and depends on how customers value the importance of a pleasant store atmosphere, low prices and good quality. If customers especially value the store atmosphere, warm colours, such as orange, should result in a stronger shopping intention, mediated by pleasure.

**H3: Warm orange light (versus cool blue light)**

(a) results in greater pleasure;

(b) directly signals a better (less expensive) price level perception and indirectly an inferior (more expensive) price level perception via pleasure;

(c) directly signals inferior product quality perception and indirectly a better quality perception via pleasure;

(d) results in stronger shopping intention, mediated by pleasure.

The saturation of the light might also influence the dependent variables. Previous research observes positive effects of colour saturation on colour cards on pleasure (Valdez and Mehrabian 1994). Other studies find positive effects of colour saturation on feelings of excitement and liking for ads (Gorn et al. 1997) and positive effects on excitement as a dimension of brand personality for brand logos (Labrecque and Milne 2011). However, these effects might not necessarily exist for store lighting, where the light also has a functional purpose. Furthermore, Summers and Hebert (2001) argue that extreme stimuli may over-stimulate customers. Customers may also associate more intensive stimuli with a discount image and pastel colours with upscale store types. Hence, saturation can have direct effects on pleasure, price level and quality perception. The direct effects on price and quality perception are in line with the indirect effects via pleasure. The impact on shopping intention is fully mediated by pleasure.

**H4: Saturated light results in**

(a) less pleasure;

(b) better (less expensive) price level perception, partially mediated by pleasure;

(c) inferior quality perception, partially mediated by pleasure;

(d) weaker shopping intention, mediated by pleasure.

Furthermore, interaction effects may exist. Pastel light has a lower percentage of hue pigment (Gorn et al. 1997) and is thus a less extreme stimulus. Therefore, it should reduce the hypothesized effects of colour type.

**H5: The effect of warm orange light on**

(a) pleasure, (b) price level perception, (c) quality perception and (d) shopping intention becomes weaker for pastel light.

### 3. Research design and sample

Two experimental studies test the hypothesized effects. Study 1 analyses the impact of brightness and accentuation on the perceived pleasure, price level perception, quality perception and shopping intention. Study 2 analyses the impact of variations in colour type and saturation on these dependent variables. Fig. 1 illustrates the design of both experiments.

Digitally manipulated pictures simulate the different lighting conditions. Several prior studies analysing the effects of architecture in general or lighting in particular simulate environments by using pictures (e.g., Briand and Pras 2010; van Oel and van den Berkhof 2013), vid-
The visualisations for the survey were based on the lighting simulation software DIALux 4, using digital luminaires with integrated geometry and an IES data format. The lighting concept used in the simulations is based on theories of visual perception (Lam 1977) and qualitative lighting design guidelines (Ganslandt and Hofmann 1992; Smith and Bertolone 1986; Lee and Rowlands 1996; Gordon 2003; Schielke and Leudesdorff 2014). In particular, the lighting scenes use a narrow lighting distribution to create a brightness contrast between objects and their environment. All luminaires were mounted on the ceiling. The recessed directional spotlights accentuated the objects in the shop window, the shelves on the walls and the furniture with the textiles in the centre. Due to the narrow light beams and precise aiming, we minimized the glare to enhance visual comfort. The interior design with the furniture and objects was constant for all scenes.

Photo editing software (Adobe Photoshop CS5) was used to create the manipulations of the basic scene. For the first experiment, we varied overall brightness and accentuation by manipulating the brightness and number of light beams in the store. The scenario with the highest overall brightness shows a store with a large number of bright beams (RGB mean = 170), while the scenario with the lowest overall brightness shows a store with a small number of dimmed beams (RGB mean = 55). Two further scenarios show stores with a medium brightness level (RGB mean = 110). RGB represents the average value for the three colour channels red, green and blue from the value 0 for black to 255 for white. The different colours were combined in a way that the light appears white and no colour dominates the scene. Furthermore, one of the stores with a medium brightness level uses strongly accentuated lighting (small number of bright beams), while the other store uses less accentuated lighting (large number of dimmed beams). In the accentuated lighting condition, shelves, aisles and display dummies were highlighted more strongly than in the other scenarios, i.e. selected objects were highlighted. For experiment 2, we created two scenarios with a warm white colour temperature in a saturated and a pastel orange version and two further scenarios with bluish daylight white colour temperature in a saturated and pastel version. The different colour conditions have the same overall brightness level (RGB mean = 125). The stimuli are included in the appendix.

Respondents were randomly assigned to one of the eight stimuli in an online survey. Firstly, we presented a picture of the stimulus scene and instructed respondents to look at the picture for one minute. After a minute, we asked them to answer a number of questions about the perception of the store. Then we presented a second store scene that was identical for all respondents. We also asked them to look at this picture for one minute. Afterwards, the respondents rated the pleasure, price level perception, quality perception and shopping intention for the first picture compared to the second picture (i.e. the ratings are relative compared to the second scene, which was used as comparison standard). Relative ratings were used to check for biases caused by individual differences in the general liking of the store presented in the scenes. All variables were measured with single items on seven-point scales (Instruction: Please compare store 1 (left) with store 2 (right). In which store is the atmosphere more pleasant? Which store presumably has lower prices? Which store presumably has better products? In which store would you rather shop?). Note that we operationalised the price perception as price level and not as value perception. This allows us to clearly separate the effects on price and quality perception. Single-item scales were used to shift more attention to the comparison of both stores in the relative rating. Preliminary analyses revealed that the relative single item-scales used in this study outperformed non-relative multi-item scales regarding their ability to indicate differences in customer perceptions and behaviour. Furthermore, recent research...
shows that single-item measures can also be sufficiently valid (e. g., Bergkvist and Rossiter 2007, 2009).

The questionnaire was also pre-tested with a small group of students (n = 14). The pre-test resulted in no major changes in the questionnaire. It also revealed that the digitally manipulated picture was perceived as realistic (M = 4.57, SD = 1.09; MIN = 3, MAX = 6, seven-point scale).

The sample sizes are 168 respondents for experiment 1 and 170 respondents for experiment 2. Hence, approximately 40 respondents rated each stimulus. To guarantee homogeneity between the groups, the majority of the respondents are students at a large European university. In experiment 1, the mean age of respondents is 26, 53 per cent are female and the median spending amount for fashion items is 500 Euros per year. In experiment 2, the mean age of respondents is also 26, 51 per cent are female and the median spending amount for fashion items is 600 Euros per year.

4. Manipulation checks

Manipulation checks reveal that brightness manipulation increases the brightness perception (F(2, 164) = 66.03, p = .000). The stimulus with many bright beams (RGB = 170) receives the highest overall brightness rating (M = 5.07, SD = 1.44), while the stimulus with a small number of dimmed beams (RGB = 55) receives the lowest rating (M = 1.94, SD = .84). Furthermore, respondents perceived the scenario with accentuated light more differentiated than the other scenarios (M = 3.11, SD = 1.76 vs. M = 2.76, SD = 1.42), but this difference is not significant (F(1, 166) = 1.59, p = .209). For the coloured scenarios, the respondents perceive those with orange light as significantly more orange than those with blue light (M = 4.26, SD = 1.76 vs. M = 1.72, SD = .88; F(1, 166) = 205.63, p = .000). Furthermore, they also perceive scenarios with saturated colours as more colour-saturated (M = 3.71, SD = 1.72 vs. M = 2.76, SD = 1.38; F(1, 166) = 15.56, p = .000). The manipulation checks support the appropriateness of using simulated lighting scenarios. Only the impact of accentuated light on the perceived differentiation of the store was not significant, but in the expected direction. Respondents also rate the scenarios as being realistic (M = 4.17, SD = 1.36).

5. Results

The hypotheses are tested using MANOVA, separate ANOVAs and the PROCESS Macro for testing mediation (Hayes 2013).

5.1. Results for brightness and accentuation (experiment 1)

The MANOVA results indicate an effect of the overall brightness (F(8, 322) = 7.11, p = .000), while the effect of accentuation is not significant (F(4, 161) = 1.61, p = .175). The significant effect of the overall brightness justifies conducting a series of separate ANOVAs for each dependent variable.

Fig. 2 reports the results regarding the impact of brightness and accentuation on the perceived pleasure, price level perception, quality perception and shopping intention. As the stimulus with many bright light beams (RGB = 170) serves as the comparison standard in the relative ratings, the dependent variables for this stimulus receive a fixed value of four in the results report.

For pleasure, the results show a significant main effect of brightness (F(2, 164) = 23.25, p = .000). Compared to the brightest scenario (RGB= 170; M = 4.00), a medium brightness level (M = 2.63, SD = 1.73) and a low brightness level (M = 2.04, SD = 1.59) resulted in less pleasure. Post hoc tests reveal that the difference between the low and medium brightness level is at least marginally significant (p = .083), while the differences of both with a high brightness level are highly significant (p = .000). Hence, these results support H1a. Furthermore, results show a marginally significant main effect of accentuation (F(1, 164) = 3.20, p = .075). Comparing both scenarios with a medium brightness level, the one with accentuated lighting results in higher pleasure (M = 2.94, SD = 1.97 vs. M = 2.35, M = 1.46). This result marginally supports H2a.

For the price level perception, brightness (F(2, 164) = 1.21, p = .300) and accentuation (F(1, 164) = .01, p = .984) have no effects. The non-significant effects indicate that direct and mediation effects may cancel each other out. Therefore, we also conducted mediation analyses using the PROCESS macro (model 4, bootstrap = 1000) to uncover possible inconsistent mediation effects (Fig. 3). The results show that brightness directly improves price level perception, i. e. customers perceive the store as less expensive (c' = -.42, p = .006), while the indirect effect mediated by pleasure reduces the price level perception (ab = -.26, LLCI = -.42, ULCI = .14; i. e. customers perceive the store as more expensive through pleasure). This result supports H1b. A mediation analysis for accentuation did not yield any significant effects. H2b finds no support.

For quality perception, brightness (F(2, 164) = .20, p = .819) has no effect, while the effect of accentuation is marginally significant (F(1, 164) = 3.03, p = .084). Comparing stores with a medium brightness level, the accentuated lighting results in a higher quality perception (M = 4.44, SD = 1.76 vs. M = 3.90, SD = 1.41). The non-significant effect of brightness indicates that direct and mediation effects cancel each other out. A mediation analysis indicates a marginally significant and negative direct effect of brightness (c' = -.27, p = .067) and a significant positive indirect effect of brightness on quality perception via pleasure (ab = .36, LLCI = .19, ULCI = .55). Hence, the mediation analysis supports H1c. The mediation analysis also supports a positive direct effect
of accentuation on quality perception ($c' = .49, p = .038$), but no indirect effect ($ab = .05, LLCI = -.21, ULCI = .34$). This result supports the direction of $H2c$, but not the hypothesized mediation effect.

For the shopping intention, the results show a significant main effect of brightness ($F(2, 164) = 10.20, p = .000$). Compared to the brightest scenario (RGB = 170; $M = 4.00$), a medium brightness level ($M = 2.99, SD = 1.63$) and a low brightness level ($M = 2.78, SD = 1.74$) resulted in lower shopping intentions. Post hoc tests reveal that the difference between the low and medium brightness level is not significant ($p = .736$), while differences of both with a high brightness level are highly significant ($p = .000$ and $p = .002$). Furthermore, the results show no effect of accentuation ($F(1, 164) = 1.81, p = .181$). Although the difference is not significant, the accentuated store shows stronger shopping intentions than the store with lower accentuation ($M = 3.22, SD = 1.88$ vs. $M = 2.78, M = 1.35$). A mediation analysis shows that brightness only indirectly influences the shopping intention ($ab = .66, LLCI = .49, ULCI = .90$), while the direct effect is not significant ($c' = .07, p = .599$). Furthermore, the results do not indicate any mediation effects of price or quality perception or any direct or indirect effects of accentuation. Hence, the results support $H1d$, but not $H2d$.

5.2. Results for colour and saturation (experiment 2)

The MANOVA results indicate an effect of colour type ($F(4, 163) = 3.34, p = .012$), a marginally significant effect of saturation ($F(4, 163) = 2.42, p = .050$) and a significant interaction between both ($F(4, 163) = 2.49, p = .046$) for the dependent variables. A series of separate
ANOVAs provides more insight into the specific effects on the dependent variables.

Fig. 4 illustrates the results on the impact of the colour type and saturation. For pleasure, the colour type has a significant main effect (F(1, 166) = 12.27, p = .001) as orange light results in greater pleasure (M = 5.18, SD = 2.01 vs. M = 4.13, SD = 2.18). Colour saturation has no significant main effect (F(1, 166) = 1.78, p = .184), but the interaction effect with colour type is significant (F(1, 166) = 9.78, p = .002). For saturated light, orange has a positive effect on pleasure (M = 5.93, SD = 1.49 vs. M = 3.85, SD = 2.20; p = .000), while this effect disappears for pastel light (M = 4.53, SD = 2.19 vs. M = 4.41, SD = 2.16; p = .788). This result supports H3a and H5a, but not H4a.

The effects on price perception are not significant. This holds for the main effect of colour type (F(1, 166) = .23, p = .633), saturation (F(1, 166) = 13, p = .716) and the interaction between both (F(1, 166) = .30, p = .585). Nor do the mediation analyses using the PROCESS macro (model 8, bootstrap = 1000) yield any significant effects (Fig. 5). Accordingly, H3b, H4b and H5b are not supported. However, the results show some effects for quality perception. Colour type has a marginally significant main effect (F(1, 166) = 3.72, p = .055), while the main effect of saturation and the interaction effect are not significant. Orange light results in a better quality perception compared to blue light (M = 4.90, SD = 1.44 vs. M = 4.45, SD = 1.55). However, a moderated mediation analysis finds a positive indirect effect of orange via pleasure on quality perception only when saturated light is used.
(ab = .61, LLCI = .32, ULCI = .99). The direct effect and effects for pastel light are not significant. This moderated mediation effect partly supports H3c (indirect effect via pleasure) and the moderation effect suggested in H5c. However, H4c is not supported.

The results for the shopping intention are quite similar to those reported for pleasure. Colour type has a significant main effect (F(1, 166) = 10.04, p = .002) as orange light results in a stronger shopping intention (M = 4.73, SD = 1.87 vs. M = 3.88, SD = 1.73). The main effect of colour saturation is not significant (F(1, 166) = .115, p = .735), but the interaction has a significant effect (F(1, 164) = 6.45, p = .012). For saturated light, orange has a positive effect on the shopping intention (M = 5.05, SD = 1.72 vs. M = 3.49, SD = 1.75; p = .000), while this effect disappears for pastel light (M = 4.45, SD = 1.97 vs. 4.28, SD = 1.64; p = .652). A moderated mediation analysis found a significant indirect effect of orange via pleasure on shopping intention for saturated light (ab = 1.38, LLCI = 0.85, ULCI = 1.97), but not for pastel light (ab = .08, LLCI = -.54, ULCI = .74). The direct effect was not significant for saturated and pastel light, either (sat: c' = .18, p = .51; pastel: c' = .09, p = .705). This indicates a full moderated mediation and supports H3d and H5d, but not H4d.

6. General discussion and implications

The results support many of the hypothesized effects. The results of experiment 1 in particular underline the positive effects of brightness. Accordingly, the stimulus with the highest overall brightness yields the highest pleasure and shopping intention. Pleasure fully mediates this positive effect on the shopping intention. This supports the positive effect of bright light suggested based on vision theory and antidepressant effects of light. However, the results also indicate that the relationship between overall brightness and pleasure is non-linear as customers especially prefer high brightness levels over medium or low ones. Regarding price and quality perception, the mediation analyses show that inference effects through pleasure and direct categorisation effects cancel each other out. Therefore, the overall effects on price and quality perception are not significant.

In addition, results for accentuation are interesting. For accentuation, only marginally significant effects on pleasure and quality perception exist. The effect on the shopping intention is not significant, but at least points in the right direction. A closer look at means for quality perception even reveals the highest quality perception for the scenario with accentuated light (RGB = 110). Furthermore, accentuated light can improve the quality perception without signalling higher prices.

Regarding effects of colour type and saturation, the results mostly support hypotheses for colour type and interactions. The results show that saturated orange light yields higher pleasure and a stronger shopping intention compared to saturated blue light, while this effect does not exist for pastel-coloured light. This result supports the positive effects of colour appropriateness. However, the respondents do not generally perceive pastel light as more pleasant compared to saturated light. According to the hypothesis, saturation should have a negative effect on pleasure as saturated coloured light might over-stimulate customers, but customers may also perceive saturated stimuli as more exciting. These effects might cancel each other out. The significant interaction effects between colour type and saturation also show that the impact of saturation strongly depends on the colour of the light.

The results do not reveal any effects of colour type and saturation on price perception. One explanation might be that coloured light generally results in a weaker price perception (i.e. higher prices), so variations of colour type and saturation do not make any difference. However, some effects exist for quality perception. Orange light (compared to blue light) increases the quality perception via pleasure when saturated. However, an inspection of the means reveals that this effect mostly results from a low quality perception of blue light, which was also perceived as the least pleasant. Furthermore, the non-significant direct effect in the mediation model indicates that only inference but no categorisation effects work. Hence, it seems that categorisation effects (orange light as a characteristic of discount stores) do not exist for price and quality perception.

Although, this study does not analyse interactions between colour and brightness, the results provide at least some insight into the general effect of coloured compared to white light. The respondents evaluated the coloured scenarios in relation to the basic scenario with many bright white light beams. Hence, price perception levels below four (in the study between 3.20 and 3.41) indicate that coloured light is perceived as more expensive compared to the basic scenario, while quality perception levels above four (between 4.20 and 4.94) indicate positive effects on quality perception.

6.1. Theoretical contribution

The results contribute to the literature by revealing several interesting insights. Firstly, the results show that lighting influences several dependent variables beyond store atmosphere, such as price perception, quality perception and the shopping intention. Hence, lighting parameters can be interpreted as nonverbal in-store means of communication.

Secondly, the results also show that lighting parameters can send out contradictory messages about the price and quality perception of a store, which rule each other out. In particular, bright light positively influences the perceived pleasantness of the store atmosphere, which has a negative impact on the perceived price level (i.e. the store is perceived as more expensive), but a positive impact on quality perception (indirect effect). At the
same time, a bright store is obviously characterised as cheaper and offering lower quality products (direct effect). Similar to brightness, we assumed that colour influences price and quality perception through effects that rule each other out. However, we only observed an indirect effect of colour type on quality perception via pleasure. Appropriateness effects cause higher perceived pleasure, which serves as a cue for better quality perception. As the mediation analysis indicated a full mediation (the direct effect was not significant), it seems that inference effects outperform categorisation effects. This questions results from previous studies which found that orange characterises discount stores. These results draw attention to stimuli which are perceived as pleasant, while they are simultaneously typical characteristics of low-priced stores. For these types of stimuli, it is important to analyse indirect inference and direct categorisation effects simultaneously to understand how they really influence customer perception. Here, it is important to consider that the total effects can be different, depending on the strength of the specific single effects.

Thirdly, the study reveals further effects that were not reported in the prior literature. The results show, for example, that high brightness results in higher pleasure and shopping intention, while differences between scenarios with low and medium brightness levels are smaller, indicating a non-linear effect. The results also show effects of accentuation. In particular, the accentuated scenario with a small number of bright beams is characterised as more upscale compared to a less accentuated scenario with many dimmed beams (both having identical overall brightness levels). The effects of colour on pleasure and the shopping intention are especially interesting as prior research suggests that blue is usually preferred over orange, while the present study reveals higher pleasure and a stronger shopping intention for orange light. Furthermore, orange light also results in a better quality perception for orange light. Appropriateness effects mediated by pleasure explain this result. Hence, this study underlines that appropriateness plays a major role in understanding colour preferences.

Fourthly, the results also shed light on the relevance of different theories explaining the observed effects. The impact of brightness on pleasure is explained by vision theory and the antidepressant effects of light. For the impact of brightness on price and quality perception, inferences from pleasure and categorisation effects rule each other out. The effects of coloured light can be interpreted by referring to appropriateness and categorisation effects, as mentioned above. Hence, several theories and research directions, such as vision theory, light therapy, inference theory, categorisation research and appropriateness research contribute to the understanding of lighting effects.

Finally, the results underline the central role of the store atmosphere, not only as a relevant store image attribute and influencing factor of shopping intention, but also as a cue influencing price and quality perception. Hence, this paper also contributes to price image research (e.g., Zielke 2010).

6.2. Practical contribution

Regarding brightness, the results suggest that retailers should use bright lighting concepts. In particular, very bright stores with a large number of bright beams result in a more pleasant store atmosphere and stronger shopping intention compared to stores with lower brightness levels. Furthermore, retailers should not fear any negative effects on quality perception, as positive inferences from higher brightness cancel out negative categorisation effects resulting from a possible discount image of brighter stores. However, retailers may also want to dim the light for some reason (e.g., energy costs, differentiation from competitors, fit with brand positioning and overall store design concept). These retailers should not generally prefer a medium over a low brightness solution. Results have shown that medium and low brightness levels yield marginally different levels of pleasure and no significant differences in shopping intentions. Retailers may also prefer light with low compared to medium brightness levels as these result only in small differences in pleasure and shopping intention, but may have major effects on energy costs. A darker lighting concept might be also advantageous to stand out from competitors and create a unique atmosphere. Furthermore, accentuated lighting may pay off and at least increase the perceived pleasure and quality perception.

Regarding colour temperature, retailers selling sensory-social products, such as fashion, should prefer warm versus cool light and not hesitate to use saturated light. However, as appropriateness mostly explains the positive effects, the preference for warm orange light should not necessarily hold for less hedonic and more utilitarian product categories. Retailers should also consider that all types of coloured light may result in more favourable quality, but less favourable price perceptions compared to white neutral light. Hence, especially retailers with a low price image should not use any coloured light. Furthermore, when using coloured light, a good colour rendition of the merchandise should be considered for customers evaluating the colour of fashion items.

As most total effects on price and quality perception are not significant, retailers should not hesitate to create a more upscale store atmosphere via their lighting concept. However, when two effects rule each other out, retailers can try to strengthen or weaken one of these effects, for example by means of marketing communication and other store design concepts. Retailers using bright light may benefit from higher pleasure and resulting positive quality inferences. At the same time, they can weaken negative categorisation effects on quality per-
ception by using additional cues to be characterised as an upscale store (appropriate background music, high-quality furniture, etc.). Furthermore, they can also weaken negative inferences from higher pleasure on the price level perception by strengthening the categorisation effect (e.g. by presenting additional cues that are interpreted as characteristics of discount stores, such as large price tags, etc.).

Finally, we want to point out that retailers should apply these implications sensibly and align them with the store type, general positioning and image, and design concept of the store. Hollister or Abercrombie & Fitch, for example, use dark accentuated lighting concepts, which are core parts of their image and identity. Other retailers, such as Tommy Hilfiger or Guess use bright design concepts, which also fit well with their image and identity. Furthermore, the lighting must fit with the general design concept of the store. Bright light might be appropriate for stores with a modern design concept, while darker light might fit with a vintage look. Hence, we recommend that retailers firstly filter lighting options, which fit with their positioning and general design concept and then optimize their lighting concept based on our findings. This might be particularly important for single-brand flagship stores.

6.3. Limitations and future research

Finally, some limitations and directions for future research should be mentioned. The present paper focuses on four dependent variables, which are perceived pleasure, price level perception, quality perception and the shopping intention. Future studies may extend this approach by adding further dependent variables, such as perceived arousal, but also the perception of value for money or discrete emotions induced by store lighting. The perceived dominance might also be an interesting dependent and mediating variable as prior research has shown a positive effect of dominance on value perception and other positive reactions at the point of sale (Gröppel-Klein 1998).

Furthermore, we analysed three brightness levels and one type of accentuation. Future studies might analyse more brightness levels to uncover more nonlinearities in the effect of brightness. In our study, the brightest scenario resulted in the strongest pleasure and shopping intention. However, even higher levels of brightness may overstimulate customers at some point. The Yerkes-Dodson Law, for example, suggests that the relationship between arousal and performance follows an inverted U-function. Furthermore, customers have individual optimum stimulation levels (Raju 1980; Wang et al. 2012), so that overstimulation through extreme brightness or extremely saturated colours might be possible. Future research may also analyse more forms of accentuation. While our accentuated scenario highlights shelves, aisles and display dummies, alternative forms of accentuation might highlight different store zones (e.g., cashier zones or floors).

Furthermore, future studies might analyse interactions between colour and brightness more systematically. The present study indicates that price level perception is relatively unfavourable for all colour treatments, while the quality perception is generally higher. However, this effect may interact with different brightness levels of coloured light.

Another avenue for future research is analysing the congruency effects of lighting parameters. The present study focusses on the effects of vision only, while sensory marketing would call for a more holistic approach, considering multiple modalities (Krishna 2012). Research on processing fluency also shows that the “gestalt” of a stimulus set influences its processing. Stimuli sets that are easily processed are in turn perceived as more aesthetically pleasing and credible (Reber et al. 2004). Furthermore, previous research has shown positive congruency effects of package design features (van Rompay and Pruyne 2011) and arousal qualities of scent and music (Mattila and Wirtz 2001). Hence, the effects of lighting might depend on the congruence with other design parameters, such as music or the general store design concept.

Future studies might also analyse the impact of lighting in different retail sectors and situational contexts, such as browsing versus purchasing conditions (Ha and Lennon 2010). Furthermore, effects of lighting may depend on the availability of competing cues, such as store architecture, interior design and retail brand strength. Previous research, for example, has shown that the effects of store architecture on price perception are weak for strong retail brands, while they exist for less known retail brands with a blurrier price image, such as fashion boutiques (Zielke and Toporowski 2009, 2012). The impact of store lighting might also differ between individual customers. The consumers’ need for cognition and tolerance for information ambiguity can, for example, influence congruence and appropriateness effects (van Rompay et al. 2009). Shopping motivation can have an impact on the preference for arousing versus relaxing colours (van Rompay et al. 2012). Furthermore, this study does not check for the effects of individual colour preferences, although previous research finds no indication that colour preferences influence the impact of colour in retail settings (Bellizzi et al. 1983).
Appendix

Many bright light beams

Many dimmed light beams

Few bright light beams

Few dimmed light beams

Blue saturated light

Blue pastel light

Orange saturated light

Orange pastel light

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