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BEYOND VISION MOVING AND FEELING IN COLOUR ILLUMINATED SPACE

STINE LOURING NIELSEN, UTE CHRISTA BESENECKER, NANNA HASLE BAK AND ELLEN KATHRINE HANSEN

Abstract

This article presents the results of an experiment exploring how four chosen light spectra illuminating a space in different colours affect observed body movements and reported sensory experiences. In addition, the experiment explores if these effects are apparent only when the light is perceived by the eye. In our light lab, 26 participants were immersed in white, blue, amber and red illumination and asked to move around while blindfolded and non-blindfolded. The movements of the participants were observed and video-recorded, and information on sensory experiences and spatial perceptions were retrieved by interviews. Thematic analysis shows patterns of how participants experienced feeling: "sharp and clear" in a "dead" space while moving in a hard manner (white), "calm and introverted" in a "cold" space while moving in a coherent manner (blue), "happy and content" in a "supportive" space while moving in a soft manner (amber) and "grounded" in a "dense" space while moving in a downwards manner (red) – both while blindfolded and non-blindfolded. Statistical analyses show that the participants moved in significantly different manners and reported significantly different sensory experiences within the four lighting scenarios. Moreover, statistical analyses generally showed no significant differences between the two conditions of blindfolding and non-blindfolding.

Keywords:
Architecture, Light, Colour, Atmosphere, Perception, Sensory Experience, Body Movement

Introduction

Light, architecture and eye

Light is an integral element of architecture. It is defined as electromagnetic radiation and its visual spectrum (ranging from 380 to 780 nm) enables us to see our everyday spaces. As such, it shapes and gives spaces life, and ultimately puts us in touch with our environment (Lam, 1977, p. 10; Rasmussen, 1957, p. 188–216). Once dependent on the manipulation of daylight, today's lighting technologies open new ways for architects to integrate light as a multifunctional medium in our built environment. As a part of this, the spectral quality of electrical light can be adjusted like never before, now so-called "white" light is available in different compositions from a warm amber appearance (2200K) to a more neutral (3000–4000K) or a cool blue-white appearance (6500K) and beyond. In addition, new lighting and media technologies in both professional lighting design practice and smart-home lighting have enabled saturated colours to increasingly enter architecture and the built environment, from healthcare environments (Nielsen, Bille & Barfoed, 2020) to urban spaces (Ebbensgaard, 2015; Edensor, 2017) and private homes (Bille, 2019; Pink & Mackley, 2016).

With the development of new lighting technologies and their possibilities, research on their effects on human perception and well-being is expanding. In relation to this, we see a great body of Scandinavian research dedicated to study the psychophysiological effects of colour and light in indoor spaces. Back in 1981, Richard Küller published his annotated biography on research relating to physiological and psychological activation from light and colour (1981). Later, Küller and colleagues carried out several studies on the influence of colours on brain activity, mood and performance (Küller, Ballal, Laike & Mikellides, 2006; Küller, Mikellides & Janssens, 2009). For example, these studies found that the light level in work environments impacted workers' level of mood, that strong colours could cause increased arousal of the central nervous system and that especially red colours put the brain into a more excited state, sometimes to such an extent as to cause a paradoxical slowing of the heartrate (ibid.). In addition, the interdisciplinary Nordic research project "SYN-TES: Human colour and light synthesis; towards a coherent field of knowledge", has engaged in transforming the field of colour and light into a coherent field of research, driven by the general notion that "Light and colour together form our visual image of the surrounding world" (Anter & Klarén, 2017, p. 1).

More recently, research and discussions have emerged into the so-called "non-visual" effects of light entering the eye. This development was initiated by the discovery of a new photoreceptor in the retina, the ipRGCs, that signal not only to the visual cortex but also other areas of the brain, contributing to the regulation of mood, alertness, circadian clock entrainment and other functions (Berson, Dunn & Takao, 2002; Hattar et al., 2003). As such, the term "non-visual effect" is used, by some, to describe the impact of visible light on mechanisms other than vision and includes research into circadian entrainment assessed through markers such as melatonin suppression (Brown, 2020) and research into alertness and cognitive performance (Lockely et al., 2006).

Consulting this body of research, the current approach within lighting research to study "non-visual" effects of light predominantly seems to rely on light entering the eye. However, architects have long acknowledged that there is more to architecture than what meets the eye. As explicitly pointed out and stressed by architects such as Steen Eiler Rasmussen (1957), Peter Zumthor (2006) and Juhani Pallasmaa (2012), to name a few prominent voices – spaces are multisensory perceived and bodily felt.

Light, architecture and skin

In his essay *Eye and mind*, the French phenomenological philosopher Maurice Merleau-Ponty points out how "I do not see (space) according to its exterior envelope; I live it from the inside: I am immersed in it. After all, the world is all around me, not in front of me" (1964, p. 178). Following Merleau-Ponty and his phenomenology of perception, Pallasmaa takes on a multisensory approach to the human sensing body in architecture, when stating: "My perception is [therefore] not a sum of visual, tactile and audible givens: I perceive in a total way with my whole being: I grasp a unique structure of the thing, a unique way of being. Which speaks to all my senses at once" (2012, p. 23). From this multisensory approach, Pallasmaa argues against the Western tradition of favouring the visual sense in architectural design and argues for the significance of the tactile sense for our experience and understanding of the world. To support his inquiry, Pallasmaa draws on the medical arguments of anthropologist Ashley Montagu, who in his book on touching (1971) generally argues for the skin as the oldest and most sensitive of our organs. "Touch is the parent of our eyes, ears, nose and mouth", Montague writes, "even the transparent cornea of the eye is overlain by a layer of modified skin" (ibid., p. 3). And as such, he argues for touch as "the mother of our sense" (ibid.).

Today, the existential significance of the human skin is echoed in contemporary "skin studies" within social science and humanities, taking the body's surface as its key object of enquiry (Howes, 2005; Lafrance, 2018; Sheets-Johnstone, 2018). This field of research considers the skin as a paradoxical phenomenon by its inherent "in-betweenness" as both superficial and profound. Hence, on the one hand the skin is an absolute boundary, and on the other it is always already in flux, "full of folds, pores and orifices that push it into the world and the world into it" (Lafrance 2018, p. 6).

Following the lines of Pallasmaa, Montague and recent "skin studies", the human skin seems to position as the most fundamental sense organ in regard to our relation to the physical environment. However, what could this mean for the field of lighting? As in the matter of space, could light be telling the body more than what meets the eye?

Some recent studies within social science, neuroscience and biology point to that it might do so. For example, within social science, a preliminary explorative study preceding the experiment described in this article indicates that people experience different colour spectrums of light even when blindfolded (Nielsen, Friberg & Hansen, 2018). In this study, people described their sensory experiences and perceptions of space according to projections of blue, amber and red light, while lying blindfolded and non-blindfolded in a space. They for example described experiences of floating in an infinite space (blue), getting a soft hug (amber), and being pushed down to the floor (red) both when having covered, blindfolded eyes and when having the eyes uncovered and open (ibid.). As such, this study points to how light might be multisensory perceived and connected to the sense of touch. To expand on this preliminary explorative study and further investigate the possibility of sensing light while blindfolded, a neuroscientific EEG-study was conducted (Wulff-Abramsson et al., 2019). This study found that blindfolded subjects mainly processed their perception of three light spectra (red, green and blue) in the parietal lobe and the somatosensory cortex, both processing sensory information relating to touch, taste and temperature (ibid.). In addition, the study detected distinctly different neurological variations in the brain when blindfolded in response to the three studied spectra of light. As such, the EEG-study supports the possibility that different spectra of light might affect the human body beyond vision, as indicated by the preliminary exploratory study (Nielsen et al., 2018).

These findings might be further supported by biological discoveries of photosensitive opsin proteins in the cells in the outer layer of our skin (our epidermis) (Tsutsumi et al., 2009; Haltaufderhyde, Ozdeslik, Wicks, Najera & Oancea, 2015; Bennet, Viswanath, Kim & An, 2017; Olinski, Lin & Oancea, 2020). These discoveries indicate that the retina is not the only organ to detect visible radiation of light, but also the skin. Interestingly, results suggests that the active opsins in the skin appear to be of similar types as those in the retina, albeit less reactive (Bennet et al., 2017).

An interdisciplinary linking of research and perspectives across the philosophy of phenomenology, architecture, skin studies, social science, neuroscience and biology could thus serve to hypothetically expand the premise of traditional lighting research, that light is solely perceived by the human eye, to a hypothesis of light affecting the human body beyond vision.

Light, architecture and bodily affect

Placing the human perceiving body at the core of spatial experience is well-known within architecture by attendance to the concept of atmosphere. In operational terms, within architecture, atmospheres are considered an aesthetic quality, constituted by human perception of the dynamic force-field of multiple material surfaces, shapes, light absorptions and reflectance that constitutes architectural space (Zumthor, 2006). From this notion, designers and architects have long been developing multiple types of aesthetic work to give materials and spaces a certain presence, radiation or feel (Böhme, 2013; Edensor & Sumartojo, 2015).

To understand how a certain feel of a spatial environment might come about, one may turn to the philosophical fields of phenomenology and aesthetics. One of the most prominent contributors to the concept of atmosphere within this field is the German philosopher and phenomenologist, Gernot Böhme. Corresponding to Zumthor (2006) and other architects conceptualising on atmospheres (Pallasmaa, 2012; Rasmussen, 1957), Böhme categorizes atmospheres as a general theory of perception (1993, 1998). Within this framework of thought, he points to how our bodily sensations in space may always be attuned by the particular presence of aesthetic qualities of space, as they are sensed in bodily presence by us (1993, p. 122). As such, Böhme argues for a basic understanding of atmospheres as "manifestations of the co-presence of subject and object" (1998, p. 114). To operationalize this within the contexts of studying lit spaces, Böhme notes how light has an ability to tint space with a certain feel: "With the aid of illumination, entire scenes can be overlaid with a colour-modifying hue, lending a characteristic mood to the whole" (2017, p. 203). As such, he signifies how the chromatic tinting of a space becomes a crucial design element in architecture to attune the aesthetic quality of space and hence our bodily feel.

Unfolding how atmospheres may affect the human body in space, the works of another German philosopher and phenomenologist, Hermann Schmitz, are relevant. By means of his concept of "movement suggestions", Schmitz further argues for how atmospheric effects doesn't delimit to emotive states and bodily feelings (2017, p. 35–58; 2016, p. 4). For according to him, atmospheres too hold potential to affect the body's physical appearance in its expressive quality, such as posture, movement, gestures, gaze, voice, etc. (ibid.). To exemplify, an ethnographic field-study in a Danish maternity ward applying this conceptual framework of Schmitz, has pointed to how midwives experienced speaking louder and physically moving faster in delivery rooms illuminated by cool white light, as opposed to speaking in a lower, calm voice and moving slower in ones illuminated by warmer hues (Nielsen et al., 2020). As such, Schmitz' conceptualisation of body movements covers the expressive bodily dynamics of how aesthetic qualities in space may attune the body to move in certain directions and manners, by affecting bodily sensations and feelings. On this note, Schmitz ultimately argues for how the atmosphere of a space can be conceptualized as "bodily gripping powers" (Schmitz, 2017, p. 93–100).

In conjunction, Schmitz and Böhme may thus point to how aesthetic qualities in our surrounding physical environment – such as coloured illuminations – hold potential to atmospherically attune our bodily presence in space, as represented in sensory experiences and body movements.

Scope and aim

In the above sections, we have laid out the research background and framework for our study, pointing to particular aspects to consider when aiming at studying human perception and presence within a colour illuminated space. Based on prior studies, our objective is to further explore the possibility of different spectra of light within the visual range being perceived by the human body beyond the visual sense and triggering feels and movements of the human body. Within this framework, this study follows an overall phenomenological approach to human perception, where the human skin takes part in our perception and bodily presence within colour illuminated space. Informed by a theoretical concept of atmosphere, a geometrical space becomes a qualitative space of affect, where light colour may serve as a generator of atmosphere by the quality it instils upon the space. As such, different spectra of light may be understood as attuning aesthetic qualities in space, potentially affecting the human body in sensory experiences and bodily movements.

Correspondingly, the study described in this paper explores the following research questions:

1. How do four chosen light spectra illuminating a space affect observed body movements and reported sensory experiences?
2. Are these observed effects apparent only when the light is visible to the eye, or also when people are blindfolded?

In order to address these questions, this study combines qualitative and quantitative methodologies within lighting research, by combining ethnographic data collection and a controlled lab experiment. Data analyses include both a thematic and a statistical analysis.

The objective is to develop knowledge of how people move and feel in spaces of illumination with different spectral compositions and to introduce the opportunity to use such illumination as design element in architecture, as experienced, felt and lived space.

Experiment

Lab and Light Setting

The experiment took place in a light lab at Aalborg University in Copenhagen (*d* = 580 cm, *w* = 580 cm, *h* = 420 cm) – giving participants 5,8 x 4 meters of "movement territory", exclusive of space for lab equipment and two researchers – the first author and a technical assistant (cf. Figure 1). At the time of the experiment, the walls of the laboratory were painted matt white, with a black Molton curtain hanging in one corner, and the floor was covered with grey linoleum. The ceiling was white with a DALI Track for mounting fixtures. In each corner of the DALI Track, four iGuzzini Reflex Q263 Tuneable White + RGB LEDs with a 60° Wide Flood were mounted and tilt angled towards the centre of the lab space, to allow for an even lighting distribution (iGuzzini, 2021) (cf. the X in Figure 1).

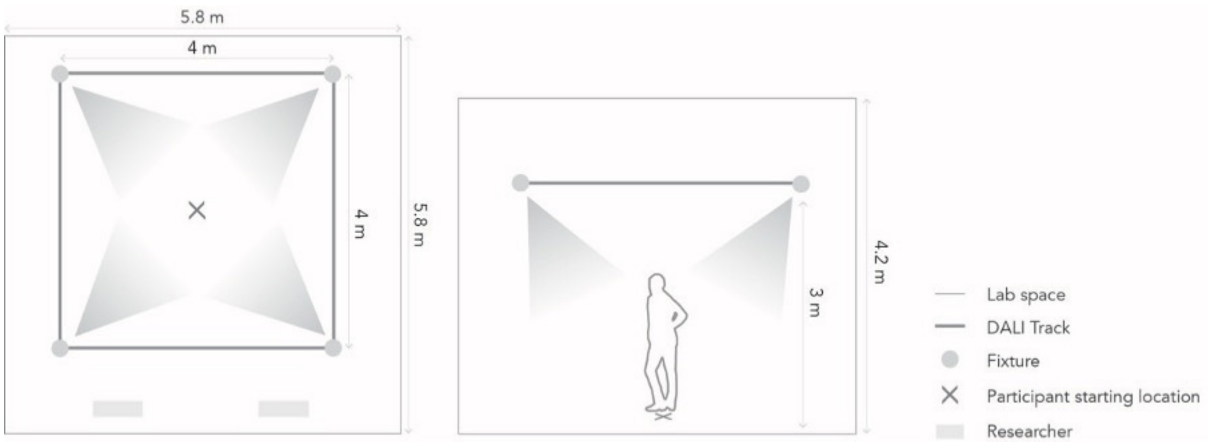


Figure 1
Lab setting and light distribution

The light setting of the experiment was programmed in Helvar Design software and consisted of four lighting scenarios of white, blue, amber and red illumination, chosen on the basis of the preliminary exploratory study (Nielsen et al., 2018) and their application as ambient interventions in northern architectural environments, such as homes and healthcare environments (Bille, 2019; Nielsen et al., 2020) (cf. Figure 2). Values are vertical illuminance at the height of 1,6 m centre of the space; based on simulation using manufacturer specifications, model of space including realistic reflectance values and DIALux lighting calculation software.

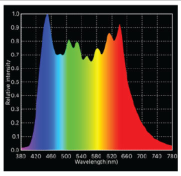
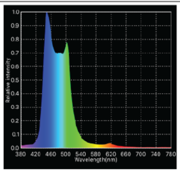
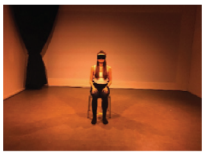
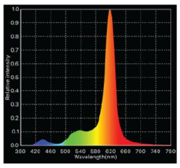
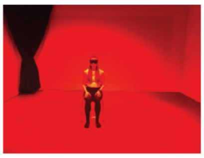
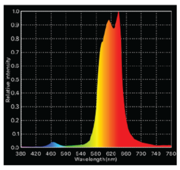
Scenario	Photo	Fixture	Illuminance	CIE1931	SPD
			DIALux Evo	Spectrometer – AsenseTek alp-01	
White		iGuzzini Reflex Q263 Round spot-light Tuneable White + RGB LEDs	460 lx	x 0.3338 y 0.3267	
Blue			50 lx	x 0.1450 y 0.1608	
Amber			290 lx	x 0.5720 y 0.3785	
Red			180 lx	x 0.6168 y 0.3565	

Figure 2
Lighting scenarios and values

Participants

To enable and support an access to detailed findings on participants' body movements and sensory experiences in lit space, the inclusion criteria of the experiment was to select people of a presumed bodily self-awareness, sensitivity to bodily sensations, skill in body movements and spatial awareness. In relation to this, social scientists have pointed to how "(dance) can lead to heightened awareness of body surface and sensory contiguity" (Reynolds, 2009, p. 30), and how dancers in general embody a particular body-sensuous awareness of self in relation to the surrounding physical and social context (Ravn, 2014). Inspired by this research, recruitment was done with the aid of several dancing institutions and Facebook groups concerning body movement (cf. acknowledgements). Participants included 26 people with different levels of professional and non-professional dancing experience ranging from 5 months to 20 years (mean 9 ½ years) – counting 20 Female, 4 Male and 2 with alternative gender orientation, all between 18–69 years old (mean 30 years).

Procedure

On arrival, participants read an information sheet on the experiment procedure and filled out an informed consent sheet plus a short background survey on gender orientation, age and dancing experience. To ensure skin surface exposure of light, participants were then handed a sleeveless white top to wear for the duration of the experiment. Next, participants were immersed in the four lighting scenarios and asked to move around in space. All lighting scenarios were experienced in two conditions – one without eye cover, non-blindfolded (NB) and one with eye cover, blindfolded (B). The order of representation of lighting scenarios was randomized, generated online (Random.org, 2019). Consequently, the number of cases allowed for a balanced representation, to account for the impact of the order of representation (cf. Table 1).

Table 1
Order of representation of lighting scenarios
* W = White, B = Blue, A = Amber, R = Red

Participant	Non-blindfolded	Blindfolded
P1	B – A – R – W	W – A – B – R
P2	B – A – W – R	W – A – R – B
P3	B – R – W – A	A – R – B – W
P4	B – A – W – R	R – A – B – W
P5	W – R – A – B	R – B – W – A
P6	W – R – B – A	A – W – B – R
P7	W – B – R – A	A – B – R – W
P8	W – A – R – B	W – B – A – R
P9	B – W – A – R	R – W – B – A
P10	W – B – R – A	A – B – W – R
P11	W – R – A – B	A – W – R – B
P12	A – R – B – W	W – A – B – R
P13	B – A – W – R	A – W – B – R
P14	W – R – B – A	A – B – W – R
P15	A – W – B – R	R – B – A – W
P16	B – A – W – R	B – R – A – W
P17	R – W – A – B	A – W – B – R
P18	A – R – B – W	B – A – R – W
P19	A – B – W – R	R – W – A – B
P20	R – A – W – B	B – R – A – W
P21	B – W – R – A	W – B – A – R
P22	R – B – W – A	W – R – B – A
P23	R – W – A – B	A – W – B – R
P24	W – A – B – R	B – R – A – W
P25	W – R – A – B	R – W – B – A
P26	B – R – W – A	B – A – R – W

The method for blocking light was a two-set blindfold. The first layer consisted of a 5 mm thick cotton sleep mask, with additional padding under the eye area (3 mm). The second layer of blindfold consisted of a 3 mm thick black velour fabric, which was placed on top of the sleep mask. As a pre-test, all fabrics had been controlled as light-blocking, by performing a test of shining light directly onto the fabric. In addition, participants were asked if they were able to visually perceive any light or not, before starting the experiment.

Each of the 4 lighting scenarios in each of the 2 blindfold conditions had a duration of 4 minutes – including 30 seconds for adaption, 3 minutes for free movement and 30 seconds for a task of a repeated body pose – plus 2 minutes for interview reflections. Hence, the entire experiment procedure for each of the participants would last 6 min x 4 scenarios x 2 conditions = 48 min. (cf. Figure 3).

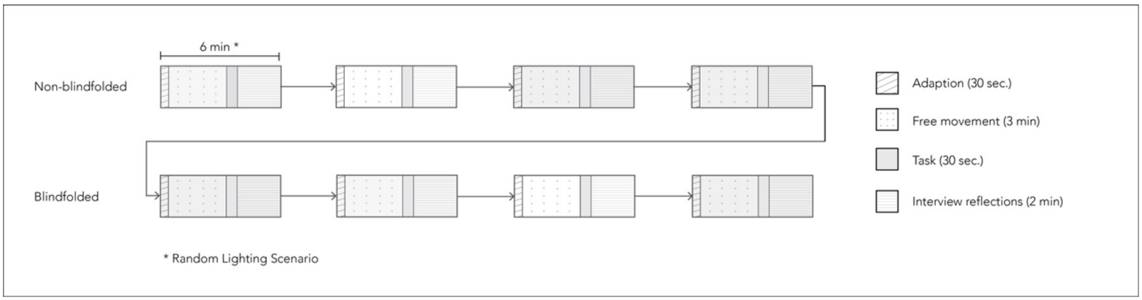


Figure 3
Procedure of experiment

Data was collected by two Canon EOS 7D video cameras, and body movements were examined in real-time by writing down descriptive observation notes (Spradley, 1980). The interviews on sensory experiences were carried out from a semi-structured approach (Spradley, 1979), all initialised by the same open-ended question of: "What did you experience?".

Analysis

Data consisted of ethnographic descriptive observation notes on body movements and transcribed interviews on reported sensory experiences. These were handled by an initial screening of the video data informing all descriptive observation notes of body movements in all four lighting scenarios and both conditions. These notes were then entered into Excel. Subsequently, all interviews on reported sensory experiences were transcribed from the video data and entered into a separate Excel sheet. All steps were performed by the first author of this article.

Thematic analysis

The coding of ethnographic data followed an inductive-deductive approach of thematic analysis (Clarke, Braun, & Hayfield, 2015). Hence, to enable the possibility of correlating data and to detect patterns across participants (26), scenarios (4) and conditions (2), data was coded following a general structure, deductively informed by the experiment's analytical framework of atmospheres, understood as the co-presence of *body* and *space*, in addition to an overall methodological framework to grasp body movement – that of Laban Movement Analysis (LMA) (Bartenieff, 2002). The LMA framework was originally a method developed for, and used by, choreographers to describe, visualize, interpret and document choreography. Nowadays, the method has been highly integrated in scientific studies of movement, as a means to break down and make sense of movement from categories of, for example, *pace, position* and *dynamics*, plus the body's location or *level* in space (ibid.). In the context of our study, the methodological framework of atmosphere and LMA thus served as a tool to enable detailed findings, by allowing for an in-depth coding of body movements and sensory experiences.

Accordingly, the thematic coding of the ethnographic data was structured within the general categories shown in Figure 4. All encodings were performed by the first author for all participants (26), in all four lighting scenarios (white, blue, amber, red) and both conditions (blindfolded and non-blindfolded).

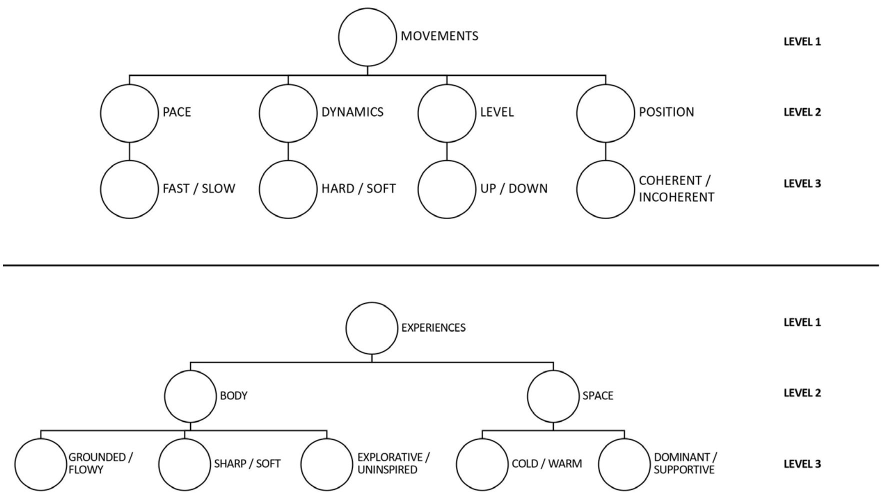


Figure 4
General categories of thematic coding

Qualifying the general deductive categories of level 1 and 2 in Figure 4 (informed by the analytical framework), an initial inductive thematic analysis of qualitative data on movements and experiences was carried out, represented by level 3 in Figure 4. In this regard, the third level represents binary categories, which were generated bottom-up by the screening and reading of the ethnographic data on observed movements and reported sensory experiences, and then later coded into the deductive categories of level 2 and 1 in Figure 4. In this regard, the *movement* category "coherent" was, for example, inductively generated from participants moving in a floating, waving, swaying or sliding manner, whereas the category "incoherent" was generated from participants moving quickly up and down, jumping, shaking, kicking or clapping. The following section on findings will further address the specific contents of the binary categories of level 3 in Figure 4.

Statistical analysis

Additionally, level 3 of the thematic coding was transferred into SPSS for statistical analysis, performed by the third author of this article, to assess whether the observed differences were likely to be meaningful and significant or by chance. To examine any differences in movements and experiences between the four lighting scenarios, a Friedman's Two-Way Analysis of Variance was conducted for each of the 8 movement and 10 experience categories in level 3 of Figure 4. In these analyses, the two conditions (blindfolded and non-blindfolded) were merged, so that a score 2 meant that the event in question took place in both the blindfolded and non-blindfolded condition of the particular lighting scenario, whereas a score of 1 indicated that the event had happened in one of the two conditions. A score of 0 meant that the participant did not express the event in question at all, when moving in that particular lighting scenario. Thus, the effects of the coloured lights were examined across both conditions to collect information on the first research question.

If Friedman's test was significant, all pairwise comparisons were calculated with Dunn's post-hoc test, applying the Bonferroni correction for multiple testing, in order to examine which colours differed from each other.

Additionally, Wilcoxon Signed Rank Test was conducted for each movement and experience categories, in order to compare the potential differences between the two conditions: non-blindfolded and blindfolded (18 in total). The codings from the four lighting scenarios were added up to two 0-4 scales – one for each condition. Thus, a score of 4 indicated that the event did take place in all four lighting scenarios, whereas 3 meant that the event had happened in three of them, etc. In this way, Wilcoxon's test aimed at examining the second research question on the effect of being blindfolded compared to being non-blindfolded on the participants' movements and experiences.

Findings

In this section we lay out the findings of our thematic and statistical analyses. In order to address the study's first research question: "How do four chosen light spectra illuminating a space affect observed body movements and reported sensory experiences", the following presentation of findings will be focussed on describing the general patterns, detected in sensory experiences and body movements of participants in each lighting scenario across visual conditions. The patterns will mostly be exemplified by similar experiences of different participants in blindfolded and non-blindfolded conditions and to a lesser extent by corresponding experiences of the same participant in both conditions. To support transparency and validity (Seale & Silverman, 1997), non-blindfolded/blindfolded condition, lighting scenario and participant number is noted when presenting interview quotes and descriptive observation notes – for example: (NB-W, P2) (cf. Table 2).

Table 2
Explanation of abbreviations

Abbreviation	NB	B	W	B	A	R	P1, P2, P3...
Explanation	Non-blindfolded condition	Blindfolded condition	White Lighting Scenario	Blue Lighting Scenario	Amber Lighting Scenario	Red Lighting Scenario	Participant Number

To address the study's second research question, that is to what extent the effects of light spectra on observed body movements and reported sensory experiences are "apparent only when the light is visible to the eye, or also when people are blindfolded", the overlaps in participants' sensory experiences and body movements between conditions are furthermore represented by a grey column in each presented graph material.

To further inform the strengths of the effects observed, the results of Wilcoxon's test (T and z values) are added below each graph material, in order to provide information on whether the participants moved significantly differently or had significantly different experiences depending on whether they were blindfolded or not. Likewise, the results of Friedman's test (χ^2_F values) are provided in the same location, where a p-value of < .05 indicates that at least one of the lighting scenarios differed significantly from one or more of the other colours of light. Finally, selected pairwise comparisons with the Bonferroni correction are reported in the text to highlight which colours differed significantly from each other.

White scenario

Across the non-blindfolded and blindfolded condition, participants in their own words experienced being "fast", "clear", "sharp" and/or "geometric" in the white spectrum (W) of illumination. They described how they felt more "in my mind and not my body", like they "could cut through things", had "a reaction of hurry", felt "like being overtired" or "impatient", sensed "a higher tone in my body" or were "searching for things but couldn't find them". Additionally, sensory experiences of clearness, sharpness and hurry were expressed in the following reflections:

> *I was driven more by a clear sensation. I felt a need of clarity and sharpness in my movements plus speeding up the tempo. I felt like my movements should be more defined and almost geometrical. I had a clear vision of purpose of where I wanted to go.* (NB-W, P19)

> *I felt the sense of clarity and sharp and clear movements and position. Also, I felt like the air was a bit more fresh and sharp and that my exercise was precise again. It was more about doing the right moves rather than being in touch with myself.* (B-W, P19)

> *I wanted to keep my eyes closed, and I found it hard to keep aware of my breathing. I didn't feel like dancing … I felt like walking. Quite busy.* (NB-W, P20)

> *I felt busy so it was difficult to breathe down into my stomach … It was in my chest. I felt like a busy bee … in a hurry … I wanted to do the movements fast. The space felt bigger, so I was surprised to be close to the wall when I felt it.* (B-W, P20)

> *My movements were quite squared and aligned, and at some point, I felt like not moving, like very neutral. I felt very bored … and a sense of daily life, like a body without impulses. I was tired, lazy and a little bit annoyed.* (NB-W, P3)

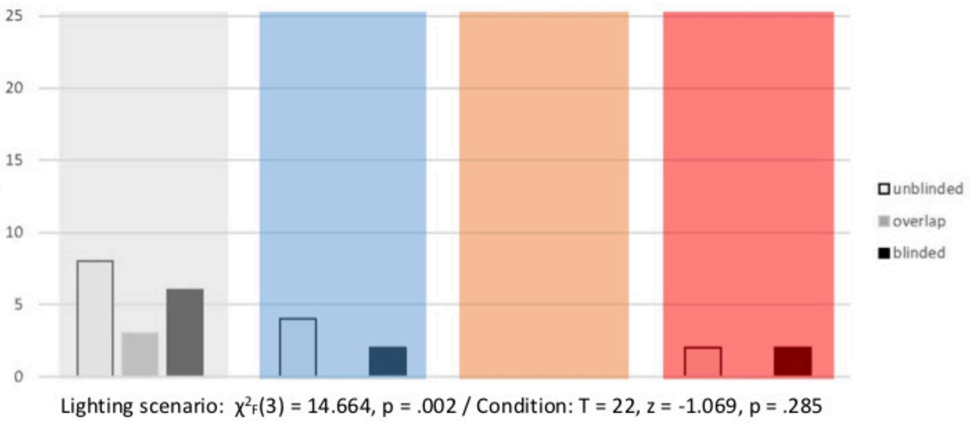


Figure 5
Experienced sharpness in each lighting scenario and condition

As shown in Figure 5, the white spectrum of light generated the most sensory experiences of sharpness and/or focus compared to the other three spectra. Friedman's test confirms that there are significant differences between the lighting scenarios (p = .002), while Wilcoxon's test shows no significant difference between the two conditions (p = .285). Statistically, the pairwise correlation between white and amber showed the only significant difference; however, not when applying the Bonferroni correction that adjusted for multiple comparisons (p = .094).

On another account, participants also experienced being "bored", "uninspired", in "no specific mood" or "floating in a non-space". Others felt like being watched or exposed, with "too much spotlight" or "too much attention to me". In relation to these experiences, the space was described as "big", "natural", "dead" and "cold", as "a light or bright non-space" with "no limit up". Moreover, some participants mentioned how "the textures seemed more present" and "visible" and referred to the space as being "rough", "squared" or "hard". Also, they compared the space to a "classroom", a "class scenario" or a "lab", plus mentioned how they wanted to explore the space for inspiration in lack thereof:

> *It just became colder... and more visible. So I needed to touch and check out the walls. I just wanted to move a bit more. The light is not as soothing as the other one (NB-R). This gave like another kind of energy ... like "pfff!"... more energetic. Also, the space is more visible, before I couldn't decide on the shape of the room. Here there is not so much to play with. I felt a higher tone in my body. The light is rough and makes me wanna respond to it ... it sets a certain pace in the body.* (NB-W, P23)

> *I felt detached of my inner private mood and like very rational. My movements were more shape-defined and geometrical. Also, I wanted to move. It was like the space allowed me to be physical without being in a certain mood.* (NB-W, P1)

> *I felt very clear and just wanted to move. It felt very neutral to be here. Like being in no specific mood.* (B-W, P1)

These sensory experiences also translated into the body movements of the participants, who predominantly were observed to move in an upward position and up-stretching manner, by hard dynamics of, for example, straight lines, staccato movements and/or tension, as exemplified in Figure 6 and the following descriptive observations:

Figure 6
Participant moving non-blindfolded in the white lighting scenario

> *floating + sliding + backwards up with legs + wave + straight angles + diagonals + flipping around + up and down + faster + flow + quickly around + squatting + stretching + circle around + quickly up and down + straight angles + quick kick + following movements with eyes + staccato.* (NB-W, P5)

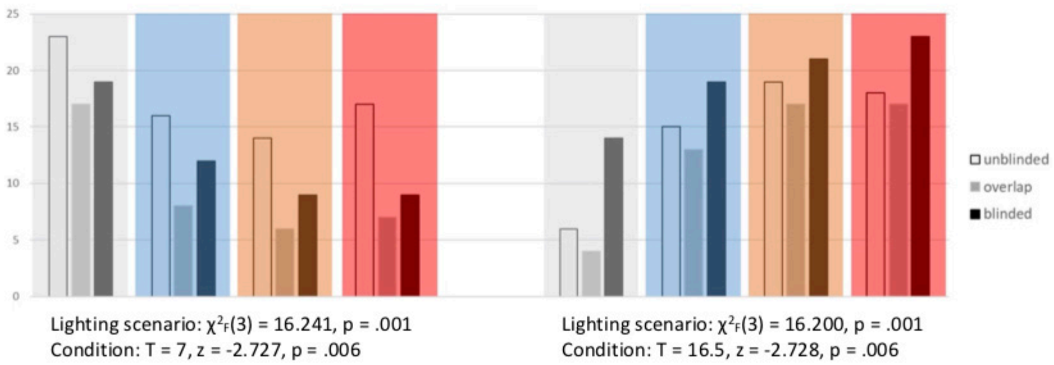
> *stretching out and up + quick swirls + quick movements + swirling around + shaking body + staying in the centre + quick steps + turning around with torso + moving all limbs + quick, messy, fast, loose flow + swirling around + breathing from exhaustion + hanging down + hands on the floor + stretching forward + stretching up + stretching.* (NB-W, P9)

> *("I feel the light… like I can see it") + stretching out arms + faster movements than before + open arms + straight lines with body + cutting through the air + (close to table) + hand straight up + wavy arms swirling + swirling torso + upwards movements + straight feet + open straight arms + swirling around.* (B-W, P25)

The statistical analyses support that more participants had hard movements in the white lighting scenario compared to the three other lighting scenarios (p_{blue} = .011, p_{amber} = .001, p_{red} = .037). Moreover, a general and significant tendency was for the participants to move faster (p = .001) and less slow (p = .001) in the white spectrum of light, compared to the three other spectra (cf. Figure 7). When looking at the pairwise comparisons, there are significant differences between the white and amber lighting scenarios, as regards being both fast (p = .027) and less slow (p = .022). The same trends apply to the comparison with the red lighting scenario (p_{fast} = .051, p_{slow} = .022). These statistical findings suggest that when exposed to the white lighting scenario, more participants moved faster and less slow than when exposed to the red and amber scenario.

Moreover, participants moved most incoherently in the white spectrum of light, compared to the three other spectra by, for example, jumping, bouncing, kicking or going up and down (cf. Figure 11); however, these differences were not found to be significant (p = .432). One participant (P13) expressed her reason for jumping in the blindfolded condition like this: "I was doing jumps because I had a focus on the vibration … I followed it … it was more in the shape jumping, like something inside going in an up and down direction".

Figure 7
Observed fast pace (left) and slow pace (right) in each lighting scenario and condition



The speed of movement was one of the two categories where the difference between the two conditions was significant, suggesting that blindfolded participants moved slower (p = .006) and less fast (p = .006) than when non-blindfolded (cf. Figure 7), which makes sense given that one is more careful moving when not being able to see one's surroundings.

Blue scenario

Across the non-blindfolded and blindfolded condition, participants expressed feeling calm and introspective in the blue spectrum (B) of illumination. Participants described how they sensed a "silence", "more space inside", feeling "chilled out", "dreamy", "inwards", "intuitive" or experienced "mind pictures". On the same note, they expressed feeling "more tactile", "emotional", "fragile" or "separated from the space". Sensory experiences of calm and emotional states of being were additionally expressed in the following reflections:

> *It was sort of a chilly calm ... it is like at ease but icy. It has a sort of sharpness to it. I felt dizzy and found it hard to find my balance. I didn't want to move a lot ... I wanted to stay calm and still and wait. I felt smaller than normal in this space.* (NB-B, P12)

> *I went into a flow where I stopped thinking. I lost sense of the room but was quite calm about it. I felt big but not as much as before (B-R). Also, I have this feeling of temperature ... I can turn my arms and feel a different temperature. The space is almost empty, and I start noticing mind pictures.* (B-B, P15)

> *The room becomes very big ... I wanted to find my own square. I can really feel that I get much more emotional. I become smaller and the room bigger. I feel more fragile ... I can even hear it in my own voice. I felt more lost and not knowing where I was.* (B-B, P5)

In relation to feeling emotional and fragile, a common sensory experience of the space was as a "big", "infinite", "fresh" and "cold" space. According to the coding represented in Figure 8, the blue scenario induced the most expressions of cold sensations of all four scenarios. Again, these differences between lighting scenarios were significant ($p_{cold} < .001$, $p_{warm} = .003$), while this was not the case for the two conditions ($p_{cold} = .786$, $p_{warm} = .106$). Moreover, participants experienced how the air felt "more fresh", "easier" or "better to breathe", or how they "were freezing", while also expressing connotations of "winter", "snow", "wind" and "moon light" in the blue lighting scenario.

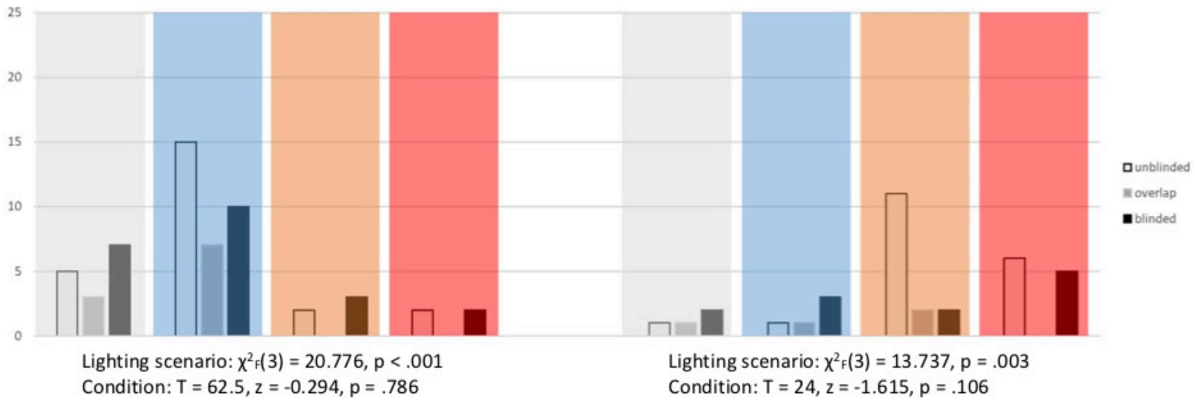


Figure 8
Experiences of cold (left) and warm (right) sensations in each lighting scenario and condition

Additionally, the spacious feel was expressed by articulations like "it feels more like a broader space", "I have a more spacious feeling" or by stated sensory experiences of being in a more "open" or "deep" space "feeling lost". Furthermore, participants experienced fluid sensations and body movements in the blue illumination:

I have a more spacious feeling. It is like the blue light is penetrating or dissolving the space, where the red is closing it a bit more. I moved lighter and a little more inspired. (NB-B, P8)

In the beginning I was trying to let my mind go a bit away. The first thing I felt was the temperature ... connected to the energy it created ... and the contact of my skin. I let go and felt calm ... and cold ... and a bit tension. It was the first time I felt a bit fresh. I became aware of the different textures of my skin. The space felt cold and very big and wide ... not comfortable. (B-B, P13)

It was kind of more blurry in this deep blue. It invited me to more fluidity. I didn't experience a warm sensation, but it was more like going into an aquarium. I sensed the fluidity in the body ... more undulation in my spine ... like a fish-body. I am enjoying the space a bit more. The light makes the space a little more dense and infinite. (NB-B, P23)

Figure 9
Participant moving blindfolded in the blue lighting scenario

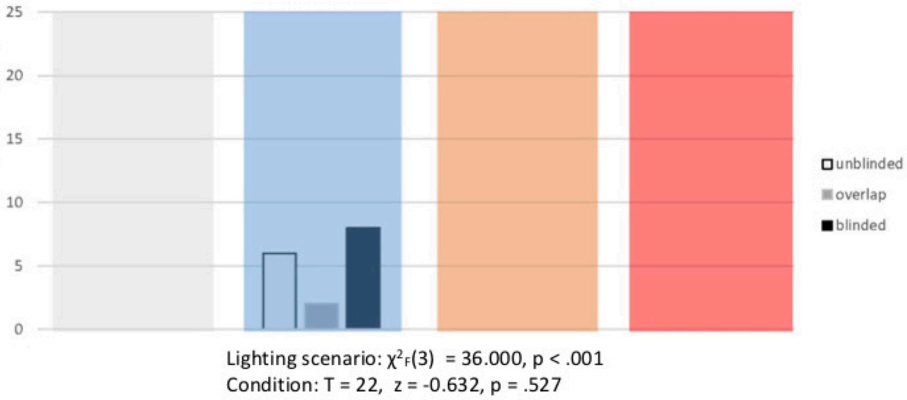


Figure 10
Experiences of a flowy sensation in each lighting scenario and condition

As shown in Figure 9 and 10 and the selected quotes above, several participants expressed feeling flowy in the blue scenario, compared to none in any of the other three scenarios (cf. Figure 10). Here Friedman's test showed overall significant differences between the lighting scenarios ($p < .001$), but these differences were not significant after controlling for multiple comparisons in the pairwise comparisons ($p_{blue\text{-}white} = .060$, $p_{blue\text{-}amber} = .060$, $p_{blue\text{-}red} = .060$).

The observed, non-significant trend towards a sensory experience of fluidity was also represented in the body movements of the participants, which were predominantly observed as big, soft and coherent (cf. Figure 9). In this regard, coherent movements of floating, waving, swaying or sliding showed significant differences, depending on the colour of light ($p = .001$), occurring the most in the blue scenario; however these effects were only significant when comparing the blue and white lighting scenarios ($p = .013$). On that note, one participant (P14) mentioned how she "got dizzy, and I never get dizzy (haha)" while non-blindfolded in the blue lighting. Descriptive observations further indicate the tendency to coherent movements:

Floating movement + light twirling around + liquid, light inner wave + turn around own axis + hands in the air + soft body roll movements + leaning backwards + swirling arms around + sensing spaciousness + arms up + twisting joints + reaching out in space + big turning movements + liquid. (NB-B, P3)

Instantly starts floating + stretching out arms, long and slowly + up on toes and down + floating + organic + inner wave movement + open body language + slowly down on floor + sliding around + leaning back... sliding around + in a floating and interlinked manner + slow and calm + sliding up. (B-B, P3)

Swaying arms + swaying from side to side + touching stomach + swaying from side to side + small circle + bigger sway in torso + breathing + a bit more flow + faster movements of swaying + floating arms + breathing in deep + open swaying arms + bigger body language + caressing arms (cold?). (B-B, P7)

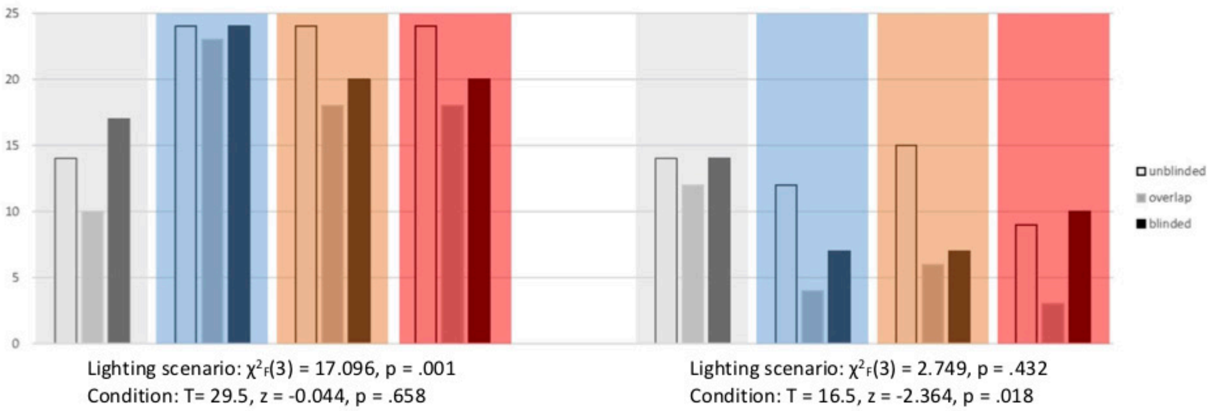


Figure 11
Coherent (left) and incoherent (right) movements observed in each lighting scenario and condition

As shown in Figure 11, as the second only movement category besides *pace* (cf. Figure 7), there was a significant difference in terms of conditions as regards incoherent movements (p = .018), while this was not the case for coherent movements (p = .658). Moreover, in the blue lighting scenario, participants were primarily moving upwards in an upright manner but also downwards, for example, represented by participants sitting, crawling, lying or rolling down on the floor (cf. Figure 18), in addition to moving a bit more slow than fast in the blue scenario (cf. Figure 7). However, these effects were not significantly different from the other lighting scenarios.

Amber scenario

Across the non-blindfolded and blindfolded condition, participants expressed feeling “comfortable”, “energized”, “natural” or “neutral” in the amber spectrum (A) of illumination. Essentially, out of the four lighting scenarios, the amber scenario was where participants reported feeling the most comfortable, for example, by expressing feeling “happy”, “careless”, “content”, “strength” and “safe”. One participant furthermore experienced “this proud sensation, like ‘look at me, I am beautiful’!”. Additionally, the amber scenario was where sensory experiences of being free, playful and/or creative ranked the highest amongst the four lighting scenarios, for example, as articulated by reported feelings of a “childish energy”, “playfulness”, “like dancing with the air”, like “I could just move” and more:

> *I experienced being supported, a supportive atmosphere I think … and welcoming … it felt good. The place that the movements came from was not that serious and I could just move.* (NB-A, P6)

> *I experienced more liberty in the dancing. I was moving more naturally and not that thought through. It was very pleasant and felt OK to slow down. Like nothing was forced.* (NB-A, P11)

> *I felt like moving and listening to my body. I felt very content and like I wanted to expand and be free.* (B-A, P16)

Linked to the sensory experiences of feeling “good”, “free” and “content”, the amber lighting scenario was also the one where participants were observed to smile the most. As one participant even stated, “everything was perfect” (B-A, P16). In relation, participants experienced the space as supportive, elaborated by articulations of the space being “like hugging me”, “like a good friend”, “like being under a duvet”, or as “something circular or round” and/or “like wool or furry”. Thus, the amber scenario was where participants mostly noted sensory experiences of the space as friendly and supportive (cf. Figure 13). Similar trends were seen in the statistical analyses, however, none of the pairwise comparisons remained significant after the Bonferroni correction, although overall differences between colours were seen in Friedman’s test ($p < .001$). The difference between the blindfolded and non-blindfolded condition as regards the participants’ experience of a supportive space did not show significance ($p = .058$).

Figure 12
Participant moving blindfolded in the amber lighting scenario

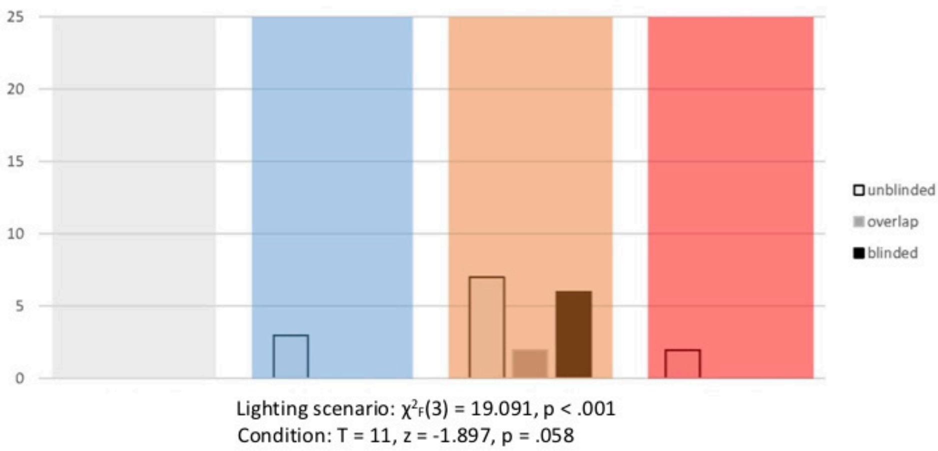


Figure 13
Experience of a supportive space in each lighting scenario and condition

Additionally, participants described how they experienced feeling "soft" and "organic" (primarily when not blindfolded) and aware of their body and skin. Possibly in relation, participants were observed to mostly caress their bodies in the amber (and red) scenario, for example by sliding their fingers softly over their face and/or body and by hugging themselves. In addition, participants were observed to move more softly than hard and more slowly than fast across conditions in the amber scenario, as shown by Figure 12 and Figure 14 and the descriptive observation notes below (cf. also Figure 7). The statistical analyses confirmed these trends suggesting differences between the four lighting scenarios as regards both hard ($p < 0.001$) and soft ($p < .001$) movements and with no significant differences between the two conditions ($p_{hard} = .871$, $p_{soft} = .560$). When exposed to the amber light, the participants moved significantly slower ($p = .022$), softer ($p = .003$), and correspondingly less fast ($p = .027$) and less hard ($p = .001$) compared to when they were exposed to the white light. Also, the participants did interact significantly more with the space in the amber lighting scenario, compared to the white one ($p = .019$).

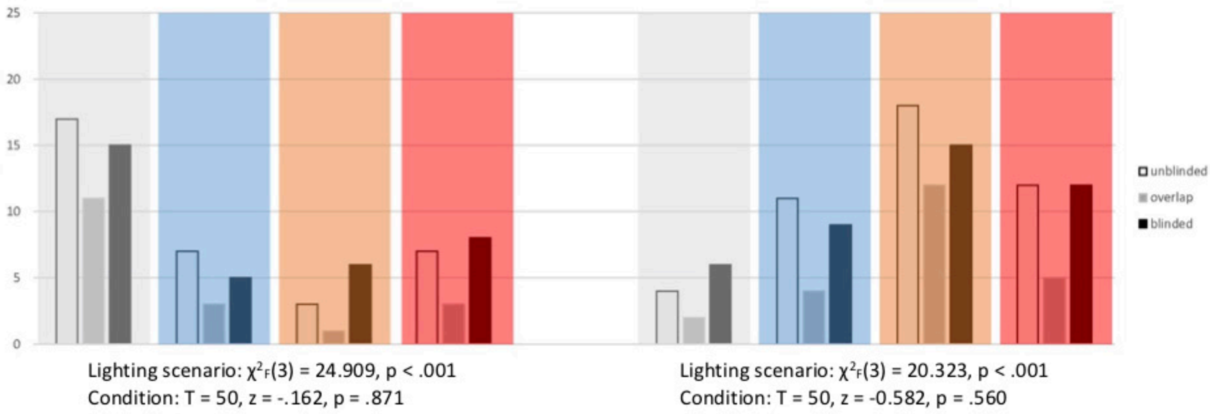


Figure 14
Hard (left) and soft (right) movements observed in each lighting scenario and condition

> *Slow and organic movements upright + floating movements + down on floor, crawling back + wavy movements + down towards floor + stretching one arm + floating hands + organic movements + open arms + floating flow movements + stretching one arm out + open, inviting arms touching one wall.* (B-A, P6)

> *Sitting down + touching floor + moving back on all four + lying on back + sliding to the middle + curling round on all four down + slow movements + swaying softly + swirling softly around + turning in circles in the middle + little skip + standing looking up + mainly in centre + carrying the air + making a bowl + open arms + turning around + twirling.* (NB-A, P12)

> *Centred + waving + sliding softly from side to side + standing still + closed eyes + smiling + swirling a little around with open arms + waving arms from side to side + softly and slowly moving + smiling + putting hands on upper chest + softly from side to side + waving arms softly from side to side + stops (like before in NB-W).* (NB-A, P26)

Finally, the amber scenario was that of the four scenarios where most participants reported feeling warm, nearly equalled by the red scenario (cf. Figure 8), but none of the pairwise comparisons showed to be significant. In relation, participants expressed how "it is like being in a desert", "I felt more warmth on my arms" and "like the sun was shining on me".

Red scenario

Across the non-blindfolded and blindfolded conditions, participants reported feeling comfortable, strong and grounded in the red spectrum (R) of illumination. In relation, participants expressed feeling "curious" and how they wanted to "colour the room" or "touch the room with my body". In relation, out of all four lighting scenarios participants most frequently interacted with the space while being in the red spectrum of illumination, for example by touching or seeking surfaces and borders of space.

In relation, the interactions in the red lighting scenario differed significantly from those seen in the white one (p = .002). Participant's sensation of strength was for example expressed by experiences of "power", "being in charge" and/or "more confidence and direction". Moreover, the sensation of grounding, for example, manifested in "an urge to sit down" or participants feeling "curious of the floor", "heavy" or "pushed down". Out of all the four lighting scenarios, the red scenario was where participants most frequently expressed feeling grounded, as shown in Figure 15 and 16 and the interview quotes below:

> *I felt my muscles more and a more juicy, like an elastic sense of movement. Like more earthy and down to the ground. (...) I felt more down ... grounded. (*NB-R, P3)

> *I experienced a lower level and flat horizontal movements. A bit more animalistic, like an insect. (...) it was easy to explore in movement, in shapes and tempo.* (B-R, P3)

> *I definitely felt the space pushing down ... not in a bad way but I was grounded. It felt like the instinct of human, more organic and animal ... I was more comfortable being in myself.* (NB-R, P13)

Figure 15
Participant lying blindfolded in the red lighting scenario

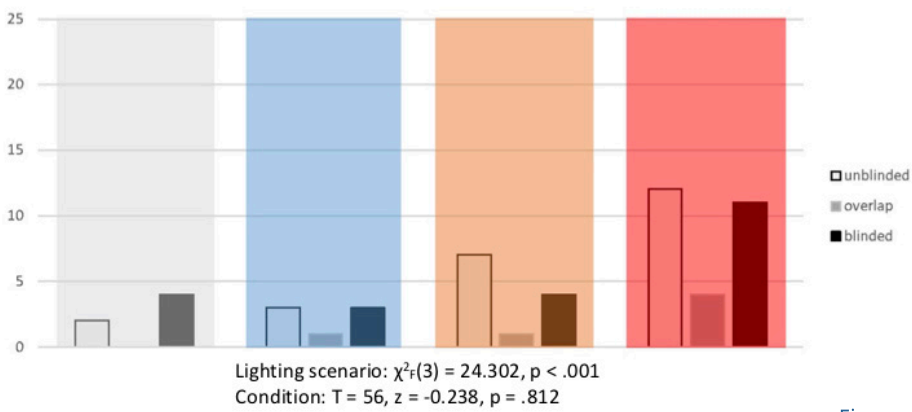


Figure 16
Experience of feeling grounded in each lighting scenario and condition

The predominant sensory experience of feeling grounded in the red lighting scenario remained significant even after applying the Bonferroni correction in the pairwise comparisons with the blue (p = .006) and white lighting scenarios (p = .009) (cf. Figure 16). This feeling was also reflected in how participants experienced the red illuminated space. Generally, they sensed the space as a "warm", "small", "intense", "dominant" or "dense" space with "thick air", where some felt it was "hard to breathe" and others felt "out of breath" or "like being cooked in an oven". To some, this resulted in sensory experiences of feeling "condensed", "small" or "pressured from the space", which could be accompanied by feeling "threatened" or "wanting to get out". To others, the dominant or dense notion of space generated a sensory experience of "intimacy", " relaxation" and "calm" joined by "an urge to be still inside", as exemplified in Figure 17 and the following quotes:

> *It was harder to breathe, and I had to swallow a lot of spit and catch my breath. I was moving like I wanted to get out of here. Walking around to find a way out... wanting to protect myself ... wanting to move slowly. I felt unsafe, like walking through a dark forest, knowing that something is there. It feels like there is a lot of darkness all over not stopping. (B-R, P7)*

> *I felt like I had to be more slow and felt like the space helped me to slow down the movements. I felt a little safe and I became more grounded like also relaxed. I found that there was flow and that I felt good the way I was. (B-R, P10)*

> *I felt like being in a smaller room, in a hole or a cave. Like the room was closer to me. I felt safe and relaxed, and it was just comfy, like it was a nice place to sleep and not move so much. I was like a bear crawling into a cave in the bottom of the forest. The air felt soft and warm and nice on the skin. (NB-R, P21)*

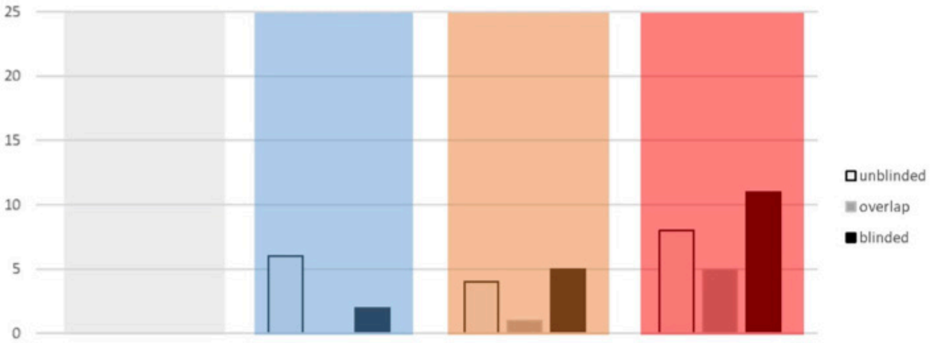


Figure 17
Experience of a dominant space in each lighting scenario and condition

Significant differences were found between the colours of light as regards the participants' experience of feeling grounded ($p < .001$) as well as experiencing the space as dominant ($p < .001$), but not between the two conditions ($p_{grounded} = .812$, $p_{dominant} = 1.000$) (cf. Figure 16 and Figure 17). Here, the difference between experiences of space as dominant in the white and red lighting scenarios was significant ($p = .011$). In potential relation to this, participants in the red illuminated space were carrying out downward movements, by crawling, rolling, crouching, sitting and lying down. Similarly, they were observed to position themselves stilly in the same positions and slide their feet across the floor. These downward, grounded movements were mostly observed and experienced by participants during the red scenario. This should also be seen in relation to the upward movements of the participants, which occurred the least in the red scenario, as shown in Figure 18. Here, the red light differed significantly when compared to the white light, as regards moving downwards ($p = .006$). Overall differences between lighting scenarios were significant both when participants were moving downwards ($p < .001$) and upwards ($p < .024$), but not across conditions ($p_{downwards} = .907$, $p_{upwards} = .070$).

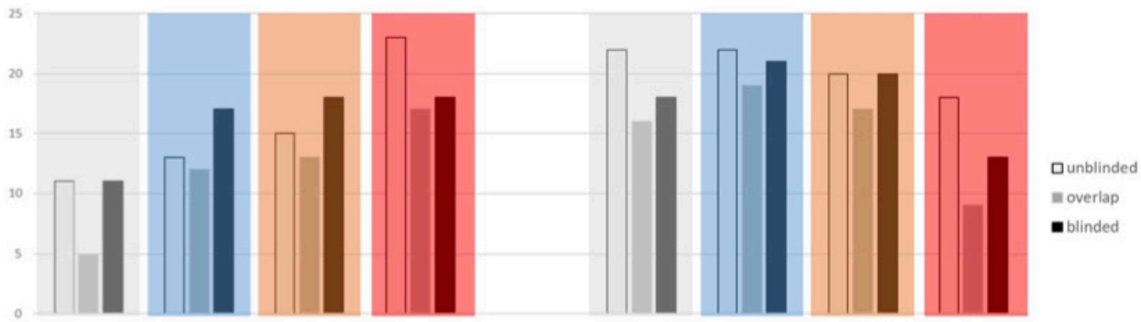


Figure 18
Observed downward (left) and upward (right) movements in each lighting scenario and condition

Besides feeling and moving the most grounded, participants were observed to move more slowly than fast (Figure 7) and more softly than hard (Figure 14) in the red lighting scenario. These differences in hard movements were significant only when comparing the red lighting scenario with the white lighting scenario (p_{hard} = .037).

Discussion

Generally, our thematic and statistical analysis of ethnographic data indicated some differences and some general patterns in participants' sensory experiences and body movements in the four different lighting scenarios and two blindfold conditions.

In regard to the detected differences, some participants' movements and experiences in the different lighting scenarios did not correspond across the non-blindfolded (NB) and blindfolded (B) conditions. For example, one participant felt "calm" and "careless" in the amber scenario while non-blindfolded but "activated" and "explorative" while blindfolded (P7). Another (P23) felt "soft" and "introverted" vs. "strong" and "energized" in the red scenario. Also, some participants felt unsafe in the red scenario when blindfolded (P7) while others felt relaxed (P10) and some participants experienced a warm sensation in the white scenario when blindfolded (P21, P15) and non-blindfolded (P21), as well as in the blue scenario when blindfolded (P10, P22, P25) and non-blindfolded (P25). Moreover, some participants did not share the general pattern of movements, of, for example, moving downwards in the red scenario (23/26 non-blindfolded, 14/26 blindfolded) or moving fast in the white scenario (23/26 non-blindfolded, 19/26 blindfolded).

However, in regard to detected patterns, when comparing the four lighting scenarios statistically, overall significant differences were found in all movement categories (except for the incoherence category) as well as in all experience categories. This means that the participants generally moved differently and had diverse experiences depending on the colour of the light. Particularly, the participants' movements in the white light differed from the three coloured lights, especially when compared to the amber light. When it comes to the participants' experiences, the red lighting scenario differed the most from the white and blue lighting scenarios. Unlike the movement categories, the amber light did not stand out in terms of experiences. Thus, the statistical results of the present study seem to support the hypothesis that disparate coloured illuminations affect movements and experiences in various manners, as the participants felt and acted differently when exposed to the different colours of light (cf. research question 1).

No significant differences between the non-blindfolded and blindfolded conditions were found in any of the statistical analyses of the movement or experience categories, except for the pace and incoherence of movements. When the light was visible to the participants, they moved faster, in a less incoherent manner. Conversely, participants also moved slower and more incoherently when blindfolded. As regards all other movement categories, the participants moved in a similar manner whether they could see or not – and the same was the case for the experience categories. Overall, this is a strong indication that participants had similar experiences and movements whether they could see the coloured light or not. Therefore, the statistical results of the present study appear to support the hypothesis of a multisensory perception of visual spectra of light, as the participants seem to be able to sense the differences of the light, and react to it, without perceiving it with their eyes (cf. research question 2).

Limitations and future work

The experimental set-up of this study in terms of inclusion criteria and lighting scenarios derives some limitations. For example, on one account, while our selection of dancers as participants served to enable and support an access to detailed findings on body movements and sensory experiences in lit space (Ravn, 2014; cf. Reynolds, 2009), in accordance with our scope of study, this inclusion criteria raises questions about the applicability of our findings beyond dancers and gender, as women tend to dominate dancing communities (Bassetti, 2020). As such, it might be that the effects of coloured illuminations detected in our study do not apply in the same extent to people of a lesser bodily awareness and sensitivity, or other genders. Moreover, in regard to the lighting scenarios, a major limitation of this study is that only the colour, and not the light levels, were planned and controlled for (cf. Figure 2). Consequently, the effects on movements and sensory experiences detected in this study could be because of colour, but also because of the amount of light the participants were exposed to. Consequently, further studies are needed in order to control this variable, for example by studying different (or matched) amounts of light, in addition to addressing the applicability of the study's findings by studying effects beyond female dancers.

Moreover, to increase validity of the analyses and eliminate potential for bias, all the video footage could have been desaturated before the coding or/and analysed by somebody unfamiliar with prior studies of the impact of colour. This is advised for a future follow-up. Addressing this matter, an additional coding has however subsequently been carried out, by two independent research assistants without any pre-notion of the study and its hypothesis. The results of these codings appear to be in line with the results of this article and are planned to be presented in more detail in a forthcoming publication.

On a final note, while this study shows advantages of collecting descriptive ethnographic data, in terms of exploring complexities and individual differences of human sensory experiences and movements in a lab environment, it could be interesting to study the socio-cultural and situational implications of the increasing application of new chromatic lighting technologies in real-life built environments. This has been partly attempted by an ethnographic field-study of a delivery room applying chromatic lighting during childbirths (Nielsen et al., 2020), without however addressing the possibility of light being perceived by the skin. Here, transdisciplinary collaborations with researchers from the medical field would be very welcome, for example in exploring the gap between research from social science and the recent biological discoveries of photosensitive opsin proteins in the cells in our epidermis (cf. Tsutsumi et al., 2009; Haltaufderhyde et al., 2015; Bennet et al., 2017; Olinski et al., 2020).

Essentially, developing targeted hypotheses based on the trends from this exploratory study, directed follow-up investigations could test the impact of chromatic lighting on sensory experiences and body movement – by and beyond visual perception – to work towards developing evidence and possible guidance for design.

Conclusion

The objective of this study has been to develop knowledge of how people move and feel in spaces of illumination with different spectral compositions and to introduce the opportunity to use such illumination as design element in architecture, as experienced, felt and lived space. In addition, following a body-sensory approach and studies concerning the human skin, we have pointed to possibilities of how light might affect the human body beyond visual perception. By this, we have tapped into the architectural notion of space as multisensory perceived, sensory experienced and bodily felt, while exploring the hypothesis of whether there is more to lit space than what "meets the eye".

The article has described an experiment to collect ethnographic data on sensory experiences and body movements in four different spectra of light within the visual range with four different distinct colour appearances. Despite variations, findings from our thematic analysis of data show some general patterns in how people experience and move in different spectra of light across a blindfolded and non-blindfolded condition. For instance, in the white lighting scenario, participants experienced feeling "sharp" and "clear" in a "dead" space while moving in a hard manner. In the blue scenario, participants described feeling "calm" and "introverted" in a "cold" space while moving in a coherent manner. In the amber scenario, participants described feeling "happy" and "content" in a "supportive" space while moving in a soft manner. And in the red lighting scenario, participants described feeling "grounded" in a “dense” space while moving in a downwards manner. Generally, these findings were supported by statistical analyses, which showed overall significant differences in the participants’ movements and experiences depending on the colour of the light. Consistently, the statistical analyses also showed that the participants’ movements and experiences, in general, were not affected by being blindfolded, thereby supporting the hypothesis of a possible multisensory perception of coloured illuminations.

By addressing the architectural element of lighting as a generator of atmosphere, potentially attuning sensory experiences and body movements in space, our study opens up a way for architects to consider light as a design element, supporting architecture as experienced, felt and lived space. As such, our study and its body-sensory approach emphasizes the article’s initial statement of light as a fundamental element in architecture and a principal medium, which puts people in touch with their environment. Additionally, pointing to how light affects the human body beyond visual perception, our research suggests further exploring the need to designing for and applying illumination in architectural spaces to support the body beyond the needs of visual perception. Hence, ultimately, our study points to new opportunities, necessities and interests in further exploring the significance and meaning of atmospheric effects of chromatic lighting and their significance in human sensory architectural experience, awareness and application … beyond vision.

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