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Abstract. This paper explores social interaction in local public squares under different lighting conditions. At its best public squares are social spaces that engender a sense of belonging, increase the quality of life and wellbeing of individuals. It is proposed that outdoor lighting would be essential to the use of the public realm after dark, but empirical results regarding lighting conditions and social aspects of life in public squares are limited. Based on a socio-physical conceptual model of the transactional relationship of the user, the lit environment and the behavioural outcome, this study investigated active social interaction in daylight compared to after dark. A field study was conducted in two local public squares in Malmö, Sweden. The occurrences of which visitors were being alone, in pairs, or in groups of three or more (N=2522), and verbal or non-verbal interaction amongst those in company of another person were recorded. The lit appearance of the two squares after dark, was assessed with HDR-photography and photometric measurements; portraying dissimilar spatial, spectral and intensity characteristics. The results of social interaction show dissimilar patterns of the two squares; an increase in social interaction in EL after dark was observed in one of the squares, while a decrease in the afternoon and no significant difference was displayed in the evening after dark in the other square. It is suggested that lighting may sustain patterns of social interaction after dark, however it might be, that the company of another is especially important after dark.

1. Introduction

UN Sustainable Development Goal (SDG) 11 targets the provision by 2030 of universal access to safe, inclusive and accessible public spaces in cities and human settlements.[1] Consequently, UN Habitat III policy paper *The Right to the City and Cities for All* promotes quality public spaces that are participatory, enhance social interaction, and engender sense of belonging.[2] The implementation of SDG 11 requires focus at a community level to make tangible differences to the everyday lives of people.[3] Urban theorists argue that the social and psychological health of modern communities requires quality public spaces, here defined as 'publicly accessible spaces' which generate public life, and support active and passive social interaction.[4-7] Social life in public spaces increase the quality of life and wellbeing of individuals.[4, 8] Measures of social interaction in public space may therefore be used to assess the level of health and vitality of communities.[9] Urban public spaces include a variety of urban settings such as streets, parks and squares. Outdoor lighting is essential to promote the use of public squares after dark because it supports movements and stationary activities.[10, 11] However, most research on the qualities of urban design and its role in facilitating social life in public space concern daylit conditions. Frequented public spaces are meaningful, protective of rights of different user groups, and responsive; that is, designed to serve the needs of users.[9, 12, 13] Users are here defined as those who frequent public spaces and rely on them for active and passive engagement.[13] Perceived environmental qualities such as accessibility, safety, comfort, pleasure and sociability encourage use of public spaces by day.[5, 14] While lighting research on pedestrians suggests that electric lighting may support these needs,[15] field-studies on the association between the lit environment and social life of public squares are still limited. Ethnographic approaches have revealed affective capacities of light and darkness by 'light walks', and thus accentuated the on-going flow of shifting impressions and feelings which are embodied in the experience of moving through an urban lightscape.[16] Lighting design research with a social oriented scope have stressed the need to study people's activities, pattern of use, and appraisals of lit environmental settings, to understand how lighting might encourage sociability and support users' daily life in public space.[9]

This paper reports on lighting conditions and social interaction in local public squares, which constitute 'everyday life spaces' set within the context of a neighbourhood.[17] While a local public square is a publicly accessible space, the sense of 'publicness' may vary along a continuum from 'public' to 'private', and so may the type of interactions vary from strangers to friends.[17] It is a space which offers an opportunity to be co-present with people, who might be either unknown (unacquainted), categorically known (the woman from the flower-shop), acquainted, or even a friend.[17, 18] Social interaction in a local public square might be expressed as a brief glance of recognition (face engagement), a greeting, a small chat or even spending time socializing with friends.[17, 18] Though merely observing others, to be co-present with strangers, to see and be seen, may induce a sense of belonging. A local public square may therefore serve as a social space *where interrelatedness with other human beings is affirmed*.[19] Public solitude (passive social interaction) may be a lone pleasure derived from people-watching. Public sociability though, by definition involves, spoken interaction between people in dyads, triads or larger groups.[17]

1.1. Aim
The intent of this study was to investigate active social interaction in daylight (DL) and in electric lighting (EL) after dark, in two local public squares in Malmö, Sweden. Three objectives were targeted. (1) To compare occurrences of people visiting the squares being alone, in pairs or in larger groups. (2) To assess the share of verbal and non-verbal interaction amongst those in company of others. (3) To investigate if there is any differences in visitors presence in the squares after dark between age groups.

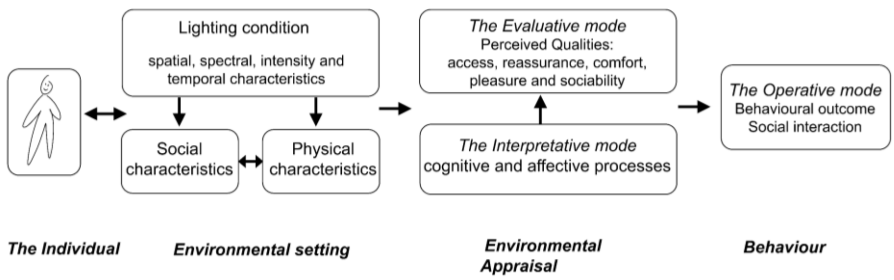

Figure 1. A socio-physical conceptual model of the transactional relationship between the Individual, the Environmental setting and the Behavioural outcome.

1.2. *A transactional-contextual framework*
To interpret the behavioural relationship between the individual (user), the lit environment of a public square and the behavioural outcome in terms of social interaction we employ a framework, that suggests a dynamic interplay between people and their every-day environmental settings.[20] With this perspective a behaviour is viewed in its socio-physical and temporal context. In any given setting physical aspects are closely linked to social ones, also giving spatiotemporal patterns to the occurrences of behaviours.[20] Furthermore physical aspects (limits, spatial arrangement and characteristics including lighting condition) may either facilitate or impede behaviours depending on the individual's appraisal of the setting.[20] We propose a socio-physical conceptual model (Figure 1) which shows the transactional relationship between the individual (with personal traits, abilities and needs), the environmental setting (with social and physical characteristics including lighting condition), the environmental appraisal

(including cognitive interpretative and evaluative processes), perceived qualities (access, reassurance, comfort, pleasure and sociability), and the behavioural outcome (social interaction). The configuration of the model departs from Stokols' modes of human environment transactions; the interpretive, the evaluative, the responsive and the operative mode.[21] It is stipulated that the individual's appraisal of a setting and therefore her behaviour, is conditioned by the lighting condition in terms of spatial, spectral, intensity and temporal characteristics.[22, 23]

2. Method

2.1. Direct observation of users' active social interaction

Direct structured observations of users' active social interaction was conducted at two local neighbourhood squares in Malmö, Sweden. In this method the observer adopts, as far as feasible, a non-participant pure observer role to avoid reactivity of those being observed.[24] Direct observation here involved watching, listening and recording types and frequencies of individuals' active social interaction, in DL and after dark in EL. A scheme for coding active social interaction was developed and tested in a pilot study. Amongst those involved in active social interaction, defined as being in the company of others, the occurrences of verbal or non-verbal interaction was recorded. A scan-sampling technique was employed for the recording of events of active social interaction in each setting.[25] Each event involving a social interaction was given an ID-number, used for field notes to provide qualitative information of social interaction and to discern any spatiotemporal pattern.

2.2. Settings

The two squares, Kirseberg square and Lindeborg square (Figure 2), were selected for having several features in common; function (as a local centre with services and amenities), size (in terms of surface area), physical setting and spatial arrangement (with design features such as benches, trees and planting). However, the lighting installations and lighting conditions were dissimilar in terms of spatial light distribution, intensity, uniformity, level of contrasts in the visual field, spectral power distribution (SPD), correlated colour temperature (CCT), CIE general colour rendering index (CRI) and differences in scotopic/photopic (S/P) luminance ratios. Therefore the after dark appearances and ambience of the squares are different, which enabled a comparison. Both neighbourhoods have equivalent number of inhabitants; approximately 5300 in Kirsebergsstaden in northern Malmö and approximately 5000 in Lindeborg in southern Malmö.

2.2.1. Kirseberg square has a surface area of approximately 3100 m^2. To the north there is an area (zone A) for stationary occupancy with design features including benches in each corner, a sculpture and a boule court. Cherry trees and rose bushes flank each side. To the east there is a one-way street mixed with vehicle, cyclists and pedestrians (zone B). To the south there is a pedestrian route with access to a frequented grocery store and to the west a pedestrian route along a residential building (zone C). The surrounding buildings are low rise (between one and four stories high) and were constructed in the 1960's. A technical description of the lighting installation is shown in Table 1 and Table 2. The square has 12 lampposts (3.7 m high) with two asymmetric reflector luminaires, each containing a 70W metal halide lamp (MH). The low height of the lamppost combined with a high luminous output of the lamp results in large contrasts between bright and dark areas (see the technical assessment of the luminous appearance, section 3.1).

2.2.2. Lindeborg square has a surface area of approximately 3100 m^2. The area for stationary occupancy (zone A) subjectively suits its purpose well; with a soft-scape of lime trees and cherry trees, cut hedges of beech and well composed flowerbeds with perennials, a water feature and a little sculpture. The surrounding buildings are low rise (between one and two stories high), constructed in the 1970s and host commercial services, gym, church and an elementary school. A pedestrian and cyclist's path (zone B) to the north gives access to the commercial service building and another path (zone C) along the western side provides a linkage to the surrounding neighbourhood. A technical description of the lighting installation is provided in Tables 1 and 2. There are 11 lamp posts (4.2 m high) placed at intervals of 20 m along paths and arranged to accompany flowerbeds and seating. The lanterns, with opal diffusers, have an omnidirectional distribution and 70 W high pressure sodium (HPS) lamps (see the technical assessment of the luminous appearance, section 3.1).

Table 1. Specification of Luminaire types

	Luminaire types						
Square	Type	Name	Light distribution	Optics	Shield	Height	Qty.
Kirseberg	road-luminaire	Philips, Copenhagen	asymmetric	reflector	upwards	3.7 m	2x12
	spotlight	SILL, Plane projector	rotational symmetric	reflector	lamels		
Lindeborg	park lantern	DEFA, Helena	omnidirectional	opal diffuser	glare rings	4.2 m	11

Table 2. Specification of Lamp types

	Lamp types						
Square	Type	Name	Luminous flux (lm)	CCT(K)	CRI (Ra)	S/P ratio	Qty.
Kirseberg	MH	CDO-ET 70W/828	7030	2800	84	1.3	2x12
	HPS2	HST-DE 150W	1500	2000	25	0.5	1
Lindeborg	HPS	SON Pia Plus 70W	6000	2000	25	0.5	9
	MH	CDO-ET 70W/828	7030	2800	84	1.3	2

2.3. Data collection

Observations were conducted for the same times of day in the two weeks before and two weeks after the autumn 2020 daylight savings clock change. This enables a comparison of users' active social interaction between the two lighting conditions and which offsets other confounding factors; i.e. the time of day factor is held constant and seasonal factors are sufficiently constant during the sampling periods. The spatiotemporal patterns of users' behaviour in a given time frame are supposedly similar, e.g. inhabitants of each neighbourhood would hypothetically perform the same activities and social interaction as part of their daily life rhythm.[20] Sampling in each square was performed on six days, two week-days and one weekend-day. Sampling sessions were scheduled in the afternoon at 16.15 to 17.00 and in the early evening at 17.30 to 18.15. In total, 18 hours of sampling was conducted and 2522 events were recorded. Prior to each sampling session, conditions such as precipitation and air-temperature, the present sky-condition (e.g. clear, semi-overcast, over-cast), the state of vegetation and the lighting condition (DL) or (EL) were recorded. Field notes regarding the ambient feeling, pace of movements and interactions were also taken prior to sampling sessions, in combination with notes on social interaction IDs these provided qualitative data used for a written narrative.

2.3.1. Sample. Individuals present at each of the square were classified visually by their apparent gender and by their apparent age into four age groups: children (0 - 12 years old approximately), teens (13 - 19 years old approximately), adults (20 - 64 years old approximately) and elderly (over 65 years old). Due to the observers non-participant role a visual classification of the individuals was employed. Table 3 shows the demographics of the visually classified sample.

Table 3. Demographics of sample based on a visual classification during observations.

	Age-group									Gender				
	0 – 12 yr.		13–19 yr.		20 – 64 yr.		> 65 years		Total	Female		Male		Unidentified
	N	%	N	%	N	%	N	%	N	N	%	N	%	%
Kirseberg	147	10.7	140	10.2	867	63.0	222	16.1	1376	743	54.0	627	45.6	0.4
Lindeborg	94	8.2	294	25.7	558	48.7	200	17.5	1146	606	52.9	538	46.9	0.2

2.3.2. Sampling units. To enable observations of individuals' social interaction from a visible and audible distance each square was divided into three sampling units (zones A, B and C), as shown in Figure 2. These zones were chosen due to their spatial arrangements and specific function; A is designed as a ‘social’ area with seating, B is a pedestrian and cyclist path with access to commercial shop(s) and other services(s) and C is a path linking the surrounding residential areas of the neighbourhood to its local square. A sampling session of 45 min enabled 3 rotations between the sampling units, with one rotation every 15 minutes always starting in sampling unit A, continuing to B and hereafter to C.

Figure 2. Plans of the two squares with sampling units (zone A, B, C) and after dark lighting layouts. From left Kirseberg Square. and to the right Lindeborg Square.

2.4. Technical environmental assessment

EL conditions were assessed in terms of spatial, spectral, intensity and temporal characteristics. The assessment was carried out as follows:

- HDR-images were captured for vital viewpoints in each sampling unit (zones A, B, C). These images were converted into luminance maps, calibrated against luminance spot measurements on a board placed in each image frame.
- HDR-images of spheres were taken in each sampling unit to convey facial recognition.
- Horizontal illuminance was measured at ground level across the whole square in a grid with a grid size of 3 m x 3 m.
- Horizontal illuminance was measured on paths (in zones B and C) in compliance with SS-EN 13201-3:2016.
- SPD, intensity and S/P-ratios of light sources were retrieved from the manufacturer.

2.5. Data analysis

Data analysis was carried out in IBM SPSS in two steps to establish the occurrences of active social behaviour in daylight compared to after dark in electric lighting in each of the squares:

Step 1: A frequency analysis for each of the selected behavioural categories:

- active social interaction operationalized as being alone, in pairs or in a group of three or larger,
- verbal versus non-verbal interaction amongst those individuals engaged in active social interaction.

Step 2: A Pearson’s Chi-square test to test for any differences of behaviour between:

- lighting condition in DL and after dark in EL,
- age groups in DL and after dark in EL.

The level of significance was set to $p \leq 0.05$ with Bonferroni correction for multiple comparisons.

3. Results

3.1. Technical environmental assessment

HDR-images with corresponding luminance maps are shown in Figures 3 and 4. An overview of the illuminance measurements is shown in Table 4. The illuminances in Kirseberg square have a high average and a low uniformity, resulting in large contrasts between bright and dark areas, especially in zone A, the stationary area for occupancy. Lit windows in the residential building (zone C) and the shop windows (zone B and C) contribute to a lit impression of the square. Lindeborg square on the other hand, has a low average illuminance but higher uniformity. The lit scene has a warm ambiance, diffuse and soft, with poor modelling characteristics of objects and spatial elements and poor colour rendering due to the low CRI of the HPS lamp. Along the commercial building linear fluorescent tubes cause a high contrast in the visual scene.

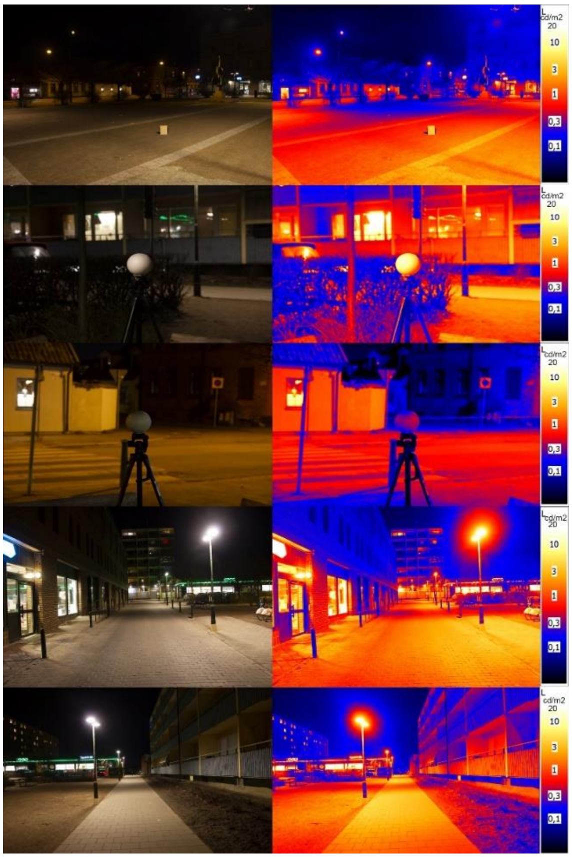

Figure 3. HDR-images with corresponding luminance measurements in Kirseberg square, from the top:

- Zone A - There are big contrasts between dark and bright areas on the horizontal level with luminance levels in the range of 0.1 – 15 cd/m^2.
- Zone A (bright corner) - The illuminated sphere with luminance levels in the range of 1 – 15 cd/m^2 depicts good facial recognition.
- Zone A (dark corner) - The dark sphere with low luminance levels in the range of 0.1 – 1 cd/m^2 depicts poor modelling and poor facial recognition.
- Zone B (path) - The façade is dark while the path is bright with luminance levels in the range of 1 – 15 cd/m^2.
- Zone C (path) - The path is bright with luminance levels in the range of 1 – 15 cd/m^2.

Table 4. Measurements of horizontal illuminances and uniformity of illuminance.

Square	Zone	Ē (lx)	E min (lx)	U_o
Kirseberg	All	23.4	0.6	0.03
	B (path)	35.9	8.9	0.25
	C (path)	25.5	6.5	0.26
Lindeborg	All	5.8	0.4	0.07
	B (path)	7.1	3.9	0.55
	C (path)	11.1	4.7	0.42

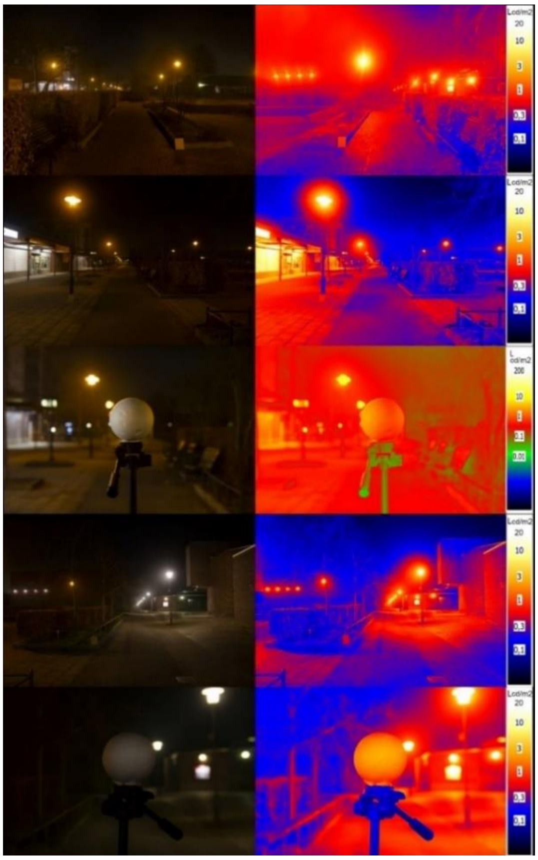

Figure 4. HDR-images with corresponding luminance measurements in Lindeborg square, from the top:

- Zone A - This area is characterized by a uniform and diffuse light distribution with low luminance levels in the range of 0.1 – 1 cd/m^2 and a poor colour rendering due to the low CRI of the HPS lamp. This also results in poor modelling of steps, benches and hedges.
- Zone B (path) - The luminance levels along the path are low in the range of 0.1 – 1 cd/m^2. There is a huge contrast to the light levels along the shops where luminance levels exceed 10 cd/m^2.
- Zone B (path) - The light distribution on the sphere depicts a fair modelling with luminance levels in the range of 1 – 10 cd/m^2 which give a fair facial recognition.
- Zone C (path) - The average illuminance levels are 11 lx with a uniformity of 0.42. Luminance levels are in the range of 1 - 10 cd/m^2.
- Zone C (path) - The light distribution on the sphere depicts poor modelling due to the diffuse distribution of light. Luminance levels are in the range of 1 – 3 cd/m^2.

3.2. Social interaction in Daylight and in Electric lighting after dark

3.2.1. Alone or accompanied? Results of the Chi-Square test, shown in Table 5, for Kirseberg square. in the afternoon session display a significant difference between the level of social interaction in DL compared to after dark in EL (χ^2 (2, N=603) = 6.58, p=0.038). Social interaction of people being in pairs or in group of three or larger decreases after dark. Results for the early evening session display no significant difference between the level of social interaction in DL and after dark in EL (χ^2(2, N=772) = 2.74, *n.s.*). The results of Chi-Square test, shown in Table 5, for Lindeborg square display a significant difference between the level of social interaction in DL and after dark in EL for both the afternoon session (χ^2(2, N=540) = 11.64, p=0.003) and for the evening session (χ^2(2, N=605) = 12.45, p=0.002). After dark in EL less people are present alone, more people instead are present in pairs both in the afternoon and in the early evening session. The presence of people in groups of three or larger also increases in EL.

3.2.2. Narrative of the spatiotemporal patterns and social interaction
Narrative 1 – Kirseberg square, Afternoon in DL on the 7th of October. The sky is clear. Long afternoon shadows stretch across zone A. A pair, a girl and a woman, is sitting on a bench enjoying the late afternoon sun, which still lingers in the north eastern corner of zone A. An elderly woman rests on her walker, she is smoking. As the bus stops a few people get off, they head in different directions, some of them cross zone A and head for the grocery store. A man and two boys halt at the sculpture and the boys start climbing. Later a man on his bike rush towards the children's day-care centre in zone B. He picks up his son and chats to the lady at the centre, while the little boy patiently waits on his side on the curb-stone. Two chatting teenage girls walk by, heading for the grocery store. An elderly woman, a beggar, sits on the pavement outside the store. There is a gentle flow of people entering and exiting the grocery

store. Occasionally people stop and exchange a few words with the begging woman. In zone C an elderly man walks his dog in a slow pace. A man in his fifties walks along the path, he stops to chat with a woman on her balcony. Kirseberg square, Early evening in EL on the 13th of October. There is an evening chill. Four men in zone A are playing boule, the game is not intense though. They are chatting and drinking rather than playing, it seems. The pace of people walking to and from the grocery store is intensified.

Narrative 2 – Lindeborg square, Afternoon in DL on the 2nd of November. The sky is partly overcast with clouds passing quickly, autumn leaves whirl in the wind. Four boys in their teens are hanging out by the benches in the north east yet sunny corner of zone A. A boy on scooter roams around. Every now and then someone enters and exits the grocery store. Two teen girls walk by, they receive attention and comments from the boys. Lindeborg square, Early evening in EL on the 2nd of November. The sky is dark, it is still warm for the season, 16 degree Celsius. A teen boy is sitting on a bench texting on his mobile. He is anxiously looking out for his friends. He makes a call. A few minutes later another boy arrives and soon they are an enclave of six. A man walks by he is heading towards the fitness centre. The flow of people to and from the grocery store is steady at this hour.

Table 5. Frequencies for visitors being alone, in pairs or in groups of three or larger in DL and in after dark in EL conditions, measured in the afternoon and in early evening in the period with (DST) and in the period after daylight savings clock change.

Square	Social interaction	DL		EL		Total	Pearson's Chi-Square Tests		
		N	exp.	N	exp.	N	χ^2	*p*	df
Afternoon at 16.15-17.00									
Kirseberg	Alone	211	226	151	136	362			
	Pairs	122	110	54	66	176			
	Group ≥3	43	40	22	25	65			
	Total	376		227		603	6.58	0.038	2
Lindeborg	Alone	188	173	120	135	308			
	Pairs	86	88	70	68	156			
	Group ≥3	30	43	46	33	76			
	Total	304		236		540	11.64	0.003	2
Early evening at 17.30-18.15									
Kirseberg	Alone	212	203	229	238	441			
	Pairs	94	105	134	123	228			
	Group ≥3	49	47	54	56	103			
	Total	355		417		772	2.74	0.255	2
Lindeborg	Alone	168	146	124	146	292			
	Pairs	88	100	112	100	200			
	Group ≥3	47	57	66	56	113			
	Total	303		302		605	12.45	0.002	2

3.2.3. Verbal or non-verbal after dark? The results of Chi-Square test, Table 6, suggests a significant difference between the level of active social interaction in terms of non-verbal or verbal amongst those people being present in pairs or in groups of three or larger, in DL compared to after dark in EL for both squares. In Kirseberg square results suggest that people being present in pairs or groups of three or larger are engaged in verbal interaction in EL (χ^2(1, N=573) = 6.010, p=0.016), while in Lindeborg square people are less verbal after dark with (χ^2(1, N=546) = 23.221, p<0.001).

3.2.4. Home turf of the teens? Which age groups visit the squares after dark? The frequencies for visiting people per age-group in DL and EL after dark are shown in Table 7. In both squares children and elderly are more likely present in DL than after dark in EL. In Lindeborg square, teens have a significantly higher presence in the square after dark, which suggests a spatiotemporal pattern of the teens in this neighbourhood.

Table 6. Frequencies for verbal and non-verbal interaction amongst those involved in social interaction in DL and after dark in EL, measured in both timeslots in the period with (DST) and in the period after daylight savings clock change.

		DL		EL		Total	Pearson's Chi-Square Tests		
Square	Active social interaction	N	exp.	N	exp.	N	χ^2	*p*	df
Kirseberg	Non-verbal	114	100	72	86	186			
	Verbal	195	209	192	178	387			
	Total	309		264		573	6.010	0.016	1
Lindeborg	Non-verbal	45	70	107	82	152			
	Verbal	207	182	187	212	394			
	Total	252		294		546	23.211	<0.001	1

Table 7. Frequencies for visiting people per age group in DL and after dark in EL, measured in both timeslots in the period with (DST) and in the period after daylight savings clock change.

		DL		EL		Total	Pearson's Chi-Square Tests		
Square	Age group	N	exp.	N	exp.	N	χ^2	*p*	df
Kirseberg	Child	95	78	52	69	147			
	Teen	87	74	53	66	140			
	Adult	417	461	450	406	867			
	Elderly	133	118	89	104	222			
	Total	732		644		1376	25.28	<0.001	3
Lindeborg	Child	58	50	35	44	94			
	Teen	132	156	162	138	294			
	Adult	295	296	263	262	558			
	Elderly	122	106	78	94	200			
	Total	608		538		1146	16.49	<0.001	3

4. Discussion

This study investigates active social interaction in DL compared to EL after dark in two local public squares in Malmö, Sweden. To interpret the relationship of the individual (user), the lit environment of a public square and the behavioural outcome in terms of social interaction, we proposed a socio-physical model, Figure 1, stipulating that the individual's appraisal after dark and therefore her behaviour is conditioned by the characteristics of lighting. A technical environmental assessment of the two squares, section 3.1, depicted two dissimilar visual scenes after dark; Kirseberg square has a high average illuminance level but very low uniformity resulting in large contrasts between dark and bright areas and particularly so in the social area (zone A). Lindeborg square has a low average illuminance but a higher level of uniformity across the whole square. Observations of social interaction at both squares also reveal different patterns; In Kirseberg square the rate of social interaction decreases in EL in the afternoon, but there are no significant differences in the evening. Lindeborg square displays the same pattern in both timeslots, with less people being alone and more people being in pairs and in groups of three or more in EL. This suggests that being in company of another person is important during darkness. However the pattern of active social interaction in groups of three or more is increased in the evening only in Lindeborg square. It implies that spatial light distribution is important to sustain patterns of social interaction.

Results suggests that teens have a higher presence in EL than in DL in Lindeborg square, while this pattern is not evident in Kirseberg square. Although this study is limited to two squares, it suggests that lighting may sustain social interaction and spatiotemporal pattern after dark, as was displayed for teens in Lindeborg square. However, the results also indicate that for small children and elderly the after dark conditions do not sustain their presence at any of the squares. Results for verbal and non-verbal interaction are contradictive. Research on pedestrians indicate that lighting may impede or facilitate walking through the support of accessibility, reassurance, comfort and pleasure.[15] Investigations on movements and stationary activities in local public squares also imply that lighting may sustain use of public squares.[11] However further attention and focus on how lighting may support social life in public space is needed, as the provision of inclusive and participatory public spaces are considered a universal right. Future research should strive to investigate user's appraisal in relation to the spatial, spectral, intensity and temporal characteristics of lit environments in relation to the afforded social and physical qualities of the settings.

5. Conclusion

This investigation indicates that EL may sustain spatiotemporal patterns of social interaction in local public squares after dark. Spatial distribution might be an important lighting characteristic for social interaction. However further research is required to confirm how different lighting characteristics might impede, facilitate or vitalize social interaction in public spaces.

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