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Seeing and being seen inside a museum and a department store.

A comparison study in visibility and co-presence patterns

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Abstract

Regardless of their different purposes – one being educational and the other commercial, both museums and department stores show similarities in the structuring of spaces due to their nature of exhibiting material collections. Another overlap is found in their history of development, as they both had a purpose in reforming society. It is evident that inter-visibility among visitors inside these two buildings played a crucial role in this purpose. Therefore how inter-visibility is shaped by their spatial layouts is of interest. In this paper, co-presence, which is a fundamental element in creating interactions, is interpreted as a by-product of seeing and being seen among visitors in buildings.

This paper is designed to study the patterns of co-presence within these two building types and to make comparisons across them. The study employs a new methodology, combining Edward Hall's dimension of space and isovists, at room level to measure different degrees of co-presence. With this methodology, two sets of measures have been derived – boundaries and behaviours. Boundaries are based on visitors' personal, social and public dimensions defined by Hall. Measures of behaviours are derived from directed isovists and categorised into three types: spectating, acting and interacting. The paper demonstrates how this methodology can be applied to quantify degrees of co-presence inside a selection of rooms in a museum and a department store in London in relation to their spatial configurations.

Results indicate that the phenomenon of being seen is strongly associated with integration of spatial configurations. The relationship between these behaviours and spatial layout suggests that the patterns of co-presence seem to be generically formed by configurations. By introducing methodology to measure degrees of co-presence and comparing the different co-presence patterns generated by the two building types, the paper contributes to understanding of patterns of co-presence inside buildings at micro-scale.

Keywords

Co-presence, inter-visibility, isovist, museums, department stores.

1. Introduction

Public museums emerged from private collections in the late eighteenth and early nineteenth century and department stores developed as a new form of retail around the mid-nineteenth century. They clearly had different purposes, the former being educational and the latter commercial. However, despite being different building types, museums and department stores have social and cultural similarities.

It could be argued that there is an overlap in the two building types in terms of programme, functions and usage. Museums have been transformed into not only places for education and exhibitions but also recreational and social purposes. With the introduction of shops for raising money for conservation, museums have now become more commercial. Likewise, department stores are a popular public destination for shopping and other recreational purposes. To promote luxury items or to launch brands, department stores create events or exhibitions, such as "The Concept Store" in Selfridges, London as if they were museums. Hence, museums and department stores have created additional programmes and functions to accommodate the current needs of the public.

This phenomenon of changing typology of buildings has been an interest in the architectural field and it has been revisited recently by several authors (Koch, 2014; Sailer, 2014; Steadman, 2014). It is considered that changes in people's activities and developments in society and technology have been influential in changing the functions of buildings.

Despite their clearly defined main programmes of educating and selling goods, museums and department stores share similarities, for instance in showcasing artefacts, which raises the question whether visitors' behaviours inside these buildings are comparable.

This paper therefore compares co-presence patterns created by displays in a museum and a department store setting with a methodology combining Edward Hall's dimensions of personal, social and public distances (Hall, 1969) with isovists. The paper is structured as follows: the next section will briefly discuss the history of development of museums and department stores; then research on co-presence and visibility will be highlighted including the concept of Hall's distance measures; in a next step, the case studies and methodology will be introduced, followed by the presentation of co-presence patterns in both building types, a museum and a department store; finally a comparative discussion of results and a chapter with conclusions will reflect on the findings and suggest potential further research.

2. Historical development of museums and department stores

In order to discuss the similarities and differences of the two building types, understanding the historical development of museums and department stores and their similarities and differences is significant.

Museums existed in the form of collections until 'modern' or 'public' museums began to emerge in the late eighteenth century (Bennett, 1995). But the first 'public' museum in the UK is known to be the Ashmolean museum in Oxford, which was opened in 1677 by a private collector, Elias Ashmole.

Department stores were developed as a new type of retail business in the mid-19th century (Steadman, 2014). Department stores were the only place where women could enjoy themselves without being accompanied by men. They provided not only space for shopping but women could also "meet their friends… relax, eat, drink… and… feel at home" (ibid., p.155). This multi-functionality of the department store was evident from the late nineteenth century, as the department stores accommodated additional functions such as exhibitions, hairdressing salons and restaurants (ibid.).

Unlike department stores, which were regarded as public space, designed for women from the beginning, some museums still remained restricted for women until the late eighteenth century. However, by the early nineteenth century, women were permitted and even encouraged to visit museums, which provided them a public space along with department stores, unlike coffee-houses and academies, which were dominated by men (Bennett, 1995).

One of the similarities between the two types lies in the fact that both museums and department stores need to display objects and products to their visitors. It was regarded that department stores were 'major competitor[s] to museum[s]' for displaying objects (Harris, 1978, p.149). They "paralleled the display techniques of… museums" (ibid., p.154).

It was evident that department stores tried to mimic the displays of museums in the early days. For example, when Boucicaut commissioned a building for the Bon Marche, he wanted to recreate 'the experience of the exhibition' inside his department store (Lancaster, 1995, p.18). Shopping in department stores can be considered as similar to visiting museums since shopping involves not only buying but also 'seeing what is displayed seasonally' (Naaman, 1990, p.11). According to Harris (1978) customers of department stores respected products with the same dignity as museum curators appropriated objects in museums.

In addition to its similarity in displaying techniques, both museums and department stores had reformation of society as their purposes. While Bennett (1995) argued that modern museums had the primary purpose of reforming society by putting the working class under the surveillance of the middle class, Koch (2009) suggested that department stores are similar to open plan museums. It is argued that just like working class people did in the past at museums, people, who were not accustomed to the environment of department stores, may have felt left out and had to adjust as best as they can (Koch, 2009).

This notion of edification also affected architectural styles of museums and department stores. As there was a 'wish to make a society transparent' (Bennett, 1995, p. 48), transparency was the key to designing museum buildings at the time. In addition, inter-visibility among visitors or shoppers was promoted inside museums and stores for reforming society. Bennett argues that museums provided working-class people with spaces in which they could imitate civilised habits of upper-classes, as 'an exercise in civics' (ibid., p.102). Therefore, to allow clear visibility among the visitors themselves as well as in between objects and visitors, the relationship of space and vision was regarded as an important factor in the design of both museum and department store buildings (ibid.).

Even though the two building types differ, they do share similarities in displaying techniques as well as the fact that they were initially envisaged to reform society and offer a public space to women. It could also be argued that with recent changes to building typologies and usage processes (the commercialisation of museums and the increasing role of leisure in shopping), the boundaries between them become blurred and the types may converge.

3. Copresence and Inter-visibility

Buildings and movement of people inside buildings are closely related. Co-presence can be suggested as a by-product of movement created by visitors in museums and department stores. Hillier defines co-presence as the primary form of awareness of others (Hillier, 1996). Thus it is closely related to activities of seeing and being seen by other visitors in museums and department stores as discussed earlier.

Hillier further suggests that co-present people can be regarded as "the raw material for community" (1996, p.141). There are two forms of communities: spatial and transpatial (Hillier and Hanson, 1987). Transpatial groupings are formed by non-spatial relationship that 'overcome spatial separation', for example kinship, affiliation, profession or interests. Spatial communities in contrast are characterised by proximity. When visitors and customers go to museums and department stores,

they all have different purposes in mind. Someone may go to a museum for a special exhibition while another may visit just for a cup of tea. The same goes for department stores: someone may go to buy a pair of jeans when another customer may simply browse for cosmetics. However, once people are inside, it can be said that they are spatially brought together, as Hillier and Hanson (1987) suggest, space can bring people together. By being in the same space, transpatial communities transform into spatial communities, and what forms they take and how they are formed by syntactic patterns are of interest. In this paper, co-presence generated by this spatiality will be mainly explored.

In addition, co-presence can be defined in terms of proximity or density. An anthropologist, Edward Hall introduced Proxemics, the study of how humans unconsciously construct microspace, which is "the distance between men in the conduct of daily transactions, the organization of space in his houses and buildings, and ultimately the layout of his towns" (1963, p.1003). Followed by the study on territoriality of animals, Hall (1969) introduced human dimensions of territoriality. He defined each surrounding area enclosed by a radius of 0.45m, 1.2m, 3.6m, and 7.6m as intimate, personal, social and public spaces, respectively. Personal space can be regarded as "a small protective sphere or bubble that an organism maintains between itself and others" (ibid., p.112). Social distance is used for casual gatherings or impersonal business. Hall explains that social distance allows people "to continue to work in the presence of another person without appearing to be rude" (ibid., p.116), which means that people are not necessarily obliged to interact with someone else present within the social space. If these personal and social distances are associated with involvement with others, public distance requires no involvement but provides enough distance for observing the others.

Lopez de Vallejo (2010) used Hall's measure of personal space in order to examine encounters and interactions within workplaces. Doxa (2001) explored people's co-presence in the Royal Festival Hall and the Royal Theatre of London. She compared measures of co-awareness, co-presence and convexity in relation to these public buildings to discuss their similarities and differences.

People can become aware of others through all senses, like sight, sound or smell. However, awareness involved with vision is of importance in this study. Therefore the term co-presence can be defined as to have a close inter-visibility link between visitors. To what extent patterns of co-presence can be shaped by spatial layout will be discussed by examining occupancy patterns of visitors within the two settings.

4. Case studies and methodology

The Victoria and Albert Museum (V&A) in London and one of the major department stores in London were chosen as case studies. To compare visitors' behaviour inside the two buildings in detail, certain rooms were chosen for analysis. Rooms with the same or similar objects and products were selected: Jewellery (M1), Sculpture (M2) and Fashion (M3) rooms in the V&A, and Jewellery (D1), Casual Womenswear (D2) and International Womenswear (D3) rooms in the department store.

All six rooms were analysed with a Visibility Graph Analysis (VGA) at knee-level and eye-level using Depthmap (Turner, 2010). When creating eye-level visibility graphs, any furniture or display case smaller than 1.5m has been removed to represent visibility.

Snapshots were used for examining patterns of spatial usage and interaction between visitors. Two series of snapshots were taken for each room, one on a weekday and the other one on a weekend in June 2012, during afternoons avoiding immediate opening and closing hours. When observing people, directionality of their view was included in snapshots.

To analyse snapshots in detail, Hall's measures of personal (1.2m), social (3.6m) and public space (7.6m) were combined with the snapshots. People within the boundary of each area can be regarded as being within one's personal, social and public co-presence periphery. The area of personal, social and public distances will be called boundaries in the following.

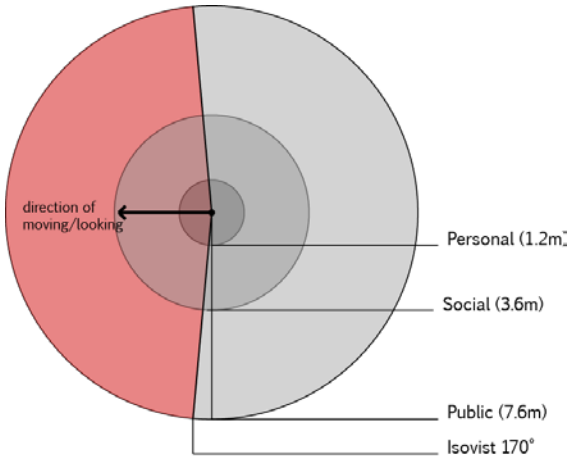


Figure 1: Dimensions used for snapshot analysis

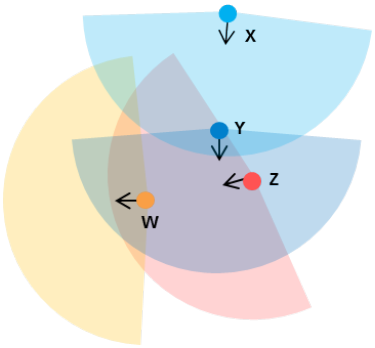
In addition to boundaries, isovists were created based on the snapshots (Figure 1). An isovist is the area covered by direct vision from a particular location. It is suggested that the way people experience and use space is associated with the interplay of isovists (Turner et al. 2001). A directed isovist was generated with a 170° viewshed for each person present on snapshots, and only up to a maximum distance of 7.6m, which is defined as public space by Hall, instead of covering up the whole area. It has been assumed that visitors can see across the room regardless of size of displays and in case of glass cases. For example, the tall displaying structure inside the Jewellery section at V&A, which allows visitors to see through, has not been included as an obstacle.

To analyse different modes of co-presence, visitors present within someone's personal, social and public isovist area were counted and classified in three different ways to distinguish different types of behaviours: spectating, acting and interacting.

The spectating value represents the number of people one can see within one's isovist area. Seeing a high value of other co-present people turns a visitor into a spectator. Since the value indicates the number of visible people, it can be considered as an indicator of controlling visibility. For this reason, it was expected to have a close relationship with the visual control measure of a VGA.

The acting value represents the phenomenon of 'being seen' and counts the numbers of people that one visitor is seen by. Being seen by a high number of other people turns a visitor into an actor. As Figure 2 shows, X can see Y but Y cannot see X, due to the direction of viewing. X gets assigned a value of 1 for spectating and Y scores a value of 1 for its acting behaviour. Actor values show how someone is located within a number of other people's viewfield. Therefore it can be referred as dependent degree of co-presence and it may be related to controllability of a VGA.

The interacting value in contrast describes mutual relationships of seeing and being seen at the same time. Combining spectating and acting values, the numbers of inter-visibility connections of each person (named as an interacting value) has been derived from a visibility matrix (Braaksma and Cook 1980: 191). As shown in Figure 2 and Table 1, the interacting values are given to Y and Z as they see each other.



	Spectating	Acting	Interacting
W	0	2	0
X	1	0	0
Y	2	1	1
Z	2	2	1

Figure 2 and Table 1: Example of calculating spectating, acting and interacting values.

All raw counts for spectating, acting and interacting were converted into percentages as a proportion of all observed people in each individual snapshot in a room, in order to account for densities and the overall number of people available at any one point in time.

In order to analyse the degrees of co-presence in relation to the spatial configurations, measures of integration, connectivity, clustering coefficient, control and controllability were collected from the locations of the observed people and correlations were obtained between configurational values from the VGA and the percentages of spectating, acting and interacting.

5. Co-presence inside the museum

The selected rooms in the museum all have different layouts. Due to their different spatial structures, different patterns of co-presence were observed.

The jewellery room (M1), which is split across two levels, is a linear space with display cases facing the wall and there are transparent display cases that allow visibility in between the two walls. The space in front of the lift is highlighted as a core space for both accessibility and visibility. The sculpture room (M2) is directly linked to the fashion room (M3). The visibility analysis highlights the area in front of the entrance to M3 as the most integrated. The fashion room (M3) has a paid exhibition in the central space. It also has displayed objects along the wall and there are benches located in between the display cases. Figure 3 shows the layout, configurational analysis and snapshot densities of the three museum rooms.

As Table 2 shows, M3 had the lowest rates of co-presence within all boundaries partly due to the large size of the room and its arrangement of objects, which were displayed along the wall making the visitors looking away from the circulation space. This is also evident in the visitors' behavioural patterns as the visitors in this room had only 15% of the people present at the time on average inside their public boundary, while other rooms had more than 25%.

	M1			M2			M3		
	WD	WE	Total	WD	WE	Total	WE	WE	Total
Density	0.20	0.37	0.29	0.11	0.16	0.14	0.12	0.14	0.13
Boundaries									
Personal space	2%	1%	2%	3%	2%	3%	1%	1%	1%
Social space	11%	12%	12%	10%	11%	11%	5%	3%	4%
Public space	26%	27%	27%	32%	41%	37%	14%	15%	15%
Behaviours									
Mean Spectating	8%	8%	8%	17%	23%	20%	5%	4%	5%
Mean Acting	8%	8%	8%	17%	23%	20%	5%	4%	5%
Mean Interacting	4%	4%	4%	7%	13%	10%	2%	2%	2%

Table 2: Boundaries – the percentage of everyone present in the room being in one's personal, social and public boundaries in the museum. Behaviours – the mean values of spectating, acting and interacting.

M2 had the highest mean values for all spectating, acting and interacting behaviours, as well as the highest ratio of people being in someone's public space. This did not seem to have a relationship with density of occupancy, as M1 has a higher density of 0.29 than M2, which had 0.14. This might be related to its high visual integration. When comparing mean values of visual integration within all three rooms, M2 had the highest mean (26.39 at eye-level, Figure 3) and this might have affected inter-visibility rates of the individuals.

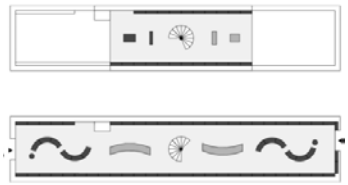
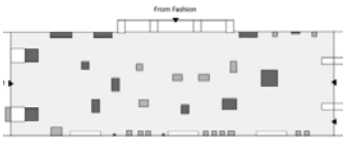
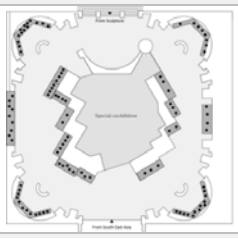
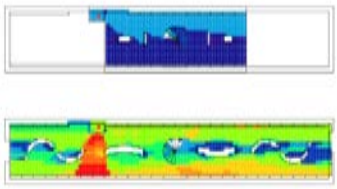
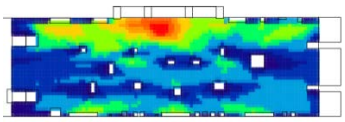
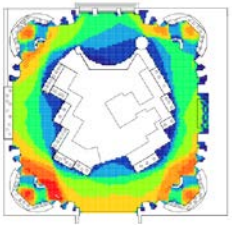
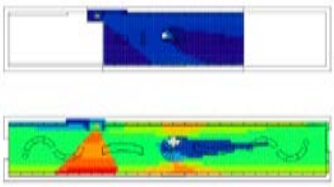
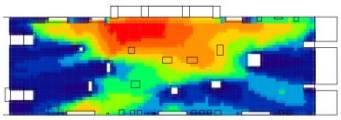
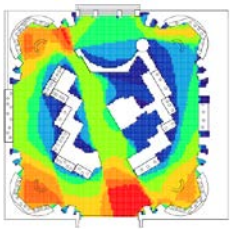
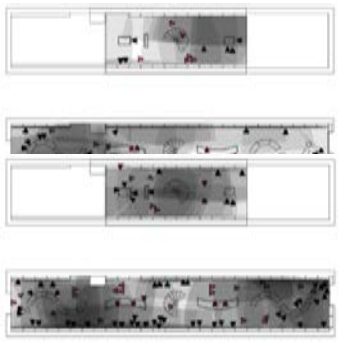
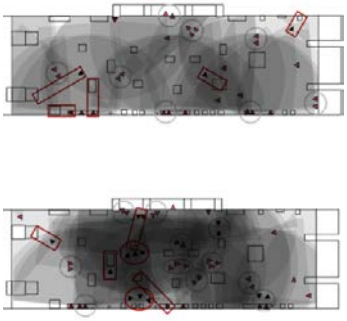
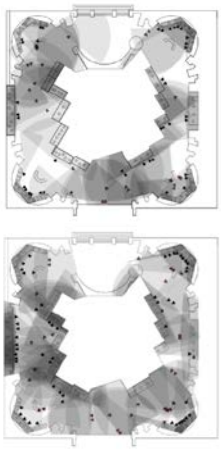
M1_ Jewellery	M2_ Sculpture	M3_ Fashion
Layout of the room		
		
Integration at knee-level		
mean: 5.93 	mean: 16.79 	mean: 11.24 
Integration at eye-level		
mean: 8.33 	mean: 26.39 	mean: 11.42 
Isovist based on snapshots – weekday (above) and weekend (below)		
		

Figure 3: Layout, of M1, M2 and M3, their integration at knee-level and eye-level and isovists based on snapshots taken on weekday and weekend.

Having observed these phenomena, it is of interest to see whether spatial structures drive visitors' behaviours on a more systematic level by correlating the spectator, actor and interactor measures with the VGA properties.

Table 3 summarises the results for all three museum rooms aggregated. Although the R2 values are relatively low (between 0.02 and 0.40), the correlations illustrate that the majority of correlations between the visitors' behaviours and spatial values at knee-level show high levels of significance. It

can be suggested that accessibility plays a significant role in creating visitors' co-presence patterns. The interacting values have relatively high correlations with integration at both knee- and eye-levels. This suggests that both accessibility and visibility influence the possibility of encounters among visitors.

		Boundaries			Behaviours		
		Personal %	**Social %**	**Public %**	**Spectating %**	**Acting %**	**Interacting %**
Knee-level	Connectivity				-	-	0.08**
	Clustering Coefficient				-0.06**	-0.11**	-0.05**
	Control				-	0.02*	-
	Controllability				0.10**	0.17**	0.03**
	Integration				0.20**	0.22**	0.24**
Eye-level	Connectivity				-	-	0.08**
	Clustering Coefficient				0.01*	-	-
	Control				-	-	-
	Controllability	0.10**	0.38**	0.40**	0.13**	0.17**	-
	Integration	0.11**	0.02**	0.24**	0.31**	0.36**	0.25**

Table 3: Correlation between boundaries and behaviours values of everyone observed in the museum and visual properties at knee-level and eye-level in the museum. Only significant correlations are shown. (N=362, * $p < 0.05$, ** $p < 0.01$).

The best correlations for both spectating and acting values are with eye-level integration. This suggests that both behaviours tend to correlate with visually more integrated space. Interestingly, both measures have shown relations with controllability, which indicates the level of visual dominance. The visually dominant space may result in creating higher rates of seeing others as well as being exposed to others.

The significance of controllability can also be seen in relation to the visitors' social (R2=0.38) and public (R2=0.40) dimensions. This suggests that more visually dominant spaces affect the ratio of people present within one's social and public boundaries.

6. Co-presence inside the department store

All rooms at the department store have the same open plan layout, as they are located on top of each other, although D3 has a large void in the centre (Figure 5). Different types of furniture used in displaying products and their arrangements make the spatial configuration of each room distinct. The jewellery room (D1) has its display cases in the centre of the room and taller furniture is located along the wall. Casual womenswear (D2) has its hangers in the middle of the room as well. International womenswear (D3) has its hangers and mannequins around the void but it allows visibility across the void. All these rooms are designed not to block any visibility inside the room.

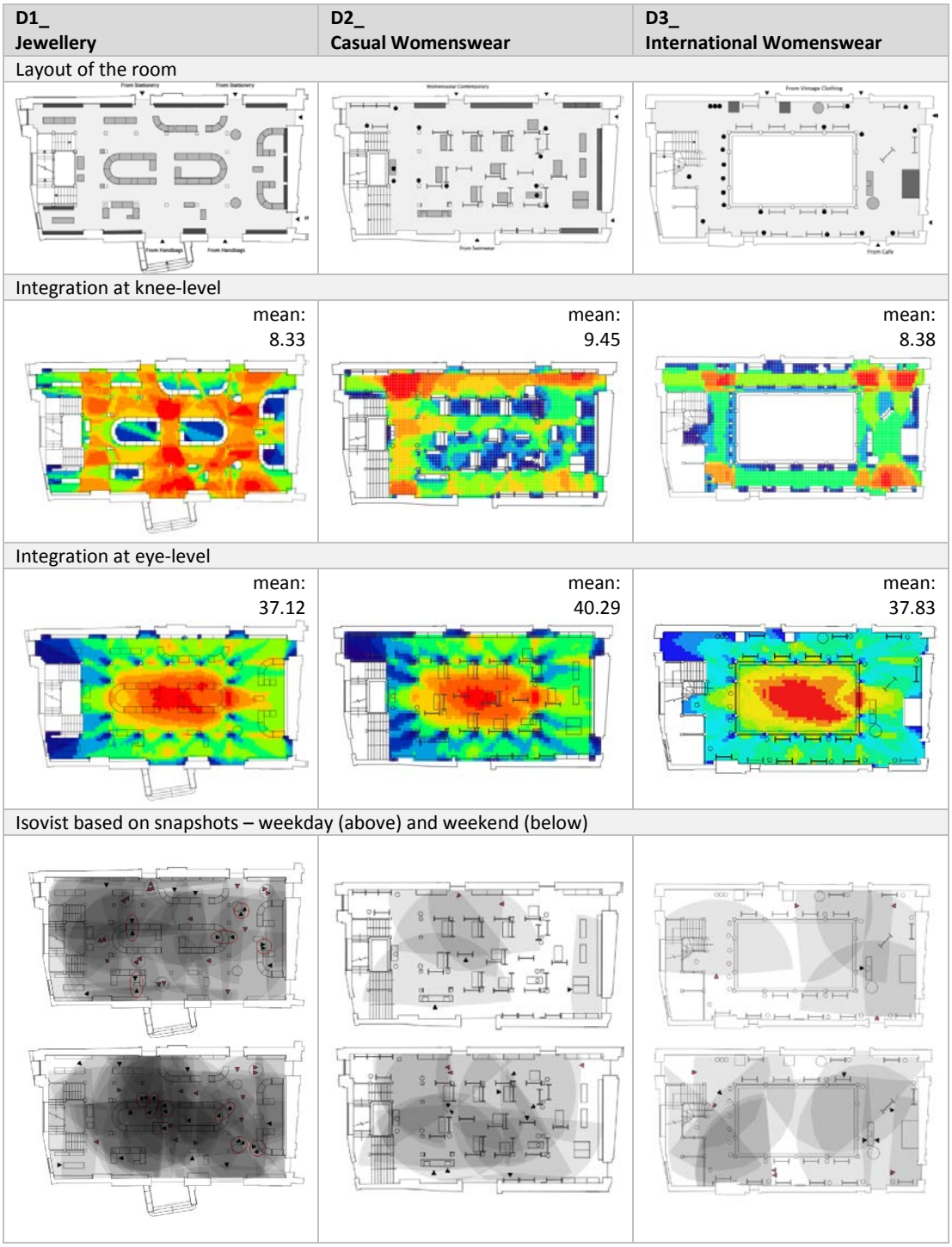


Figure 5: Layout of D1, D2 and D3 and their integration at knee-level and eye-level and isovists based on snapshots taken on weekday and weekend.

Table 4 summarises the results from snapshots and isovists (Figure 5). As an effect of the spatial layout, allowing visibility across the rooms, almost half of the people on average in D1 and D2 were inside someone's public space. D2 and D3 have relatively low rates of people in personal and social spaces. This indicates that people try not to get too close to each other, unlike the visitors observed in the museum, where the visitors were brought closer to each other by looking at the same object.

However, in D1, higher proportions of people inside one's personal space (3%) were observed. This is partly due to the relationship between the customers and the products (jewellery). In order to take a closer look at a product in D1, the customers have to look into the glass displays, which might result in bringing them closer if they are interested in the same product, just like in the museum.

	D1			D2			D3		
	WD	WE	Total	WD	WE	Total	WE	WE	Total
Density	0.12	0.12	0.12	0.02	0.04	0.03	0.03	0.05	0.04
Boundaries									
Personal space	3%	3%	3%	0%	1%	1%	0%	1%	1%
Social space	12%	14%	13%	0%	1%	1%	4%	8%	6%
Public space	38%	49%	44%	40%	50%	45%	20%	30%	25%
Behaviours									
Mean Spectating	17%	24%	21%	24%	19%	22%	16%	14%	15%
Mean Acting	17%	24%	21%	24%	19%	22%	16%	14%	15%
Mean Interacting	8%	13%	11%	16%	8%	12%	16%	8%	12%

Table 4: Average percentage of everyone present in the room being in one's personal, social and public boundary in the department store.

The higher rate of people within the social boundary in D1 can be explained by the higher occupancy density (0.12) than the other rooms (0.03 in D2 and 0.04 in D3), as well as the relationship between customers and staff. In D1, if customers want to take a closer look at products, they have to ask one of the staff to take them out of the display case, whereas in D2 and D3, people can just browse as they wish, without any necessary interactions with staff.

		Boundaries			Behaviours		
		Personal %	**Social %**	**Public %**	**Spectating %**	**Acting %**	**Interacting %**
Knee-level	Connectivity	-	-	-	-	-	0.05*
	Clustering Coefficient	-	-	-	-	-	-
	Control	-	-	-	-	-	0.04*
	Controllability	-	-	-	-	0.06*	-
	Integration	-	-	-	-	-	-
Eye-level	Connectivity	-	0.16**	0.34**	0.15**	0.25**	0.11**
	Clustering Coefficient	-	-	-	-	0.07**	-
	Control	-	0.11**	0.26**	0.12**	0.19**	0.10**
	Controllability	-	0.13**	0.32**	0.15**	0.25**	0.11**
	Integration	-	0.17**	0.39**	0.18**	0.37**	0.15**

Table 5: Correlation between spectating, acting and interacting values of everyone observed in the department store and visual properties at knee-level and eye-level in the department store. Only significant correlations are shown. (N=101, * $p < 0.05$, ** $p < 0.01$).

The behaviours observed inside the department store seem to be not related to accessibility but more associated with visibility as shown in Table 5. The strongest correlation is found between acting value and spatial integration at eye-level (R2= 0.37). This indicates that visitors in the most integrated space are more likely to be seen by other customers in the same space.

Interestingly, measure of control is picked up as highly significant in relation to the number of people present within public space. This means that in spaces with more visual control, more people will be co-present within one's public boundary.

As the observations in the museum and the department store have shown some interesting differences, it is of an interest to see if spatial configurations have relations to the patterns of co-presence created in the two buildings.

7. Comparative results – Towards exploring generic patterns

In general, the department store seems to have higher potential in creating interactions. Visitors in the museum could only see 9% of the people present in the room on average, while customers in the department store could see 20% of all present people (Table 6).
Visitors inside the museum had a higher proportion of people within their personal and social boundaries than those in the department store. However, customers in the department store had higher number of others being inside their public space (38%).

	Boundaries (%)			**Behaviours (%)**		
	Personal	Social	Public	Spectating	Acting	Interacting
Museum	2	9	26	9	9	6
Department Store	1	6	38	20	20	10

Table 6: Summary of boundaries and behaviours measures in the two buildings.

In order to see if it is indeed the building type or a particular layout or display of each room that affects people's behaviour patterns, the relationship between the observation data and morphological characters have been investigated by grouping the data into different sets. Table 7 summarises all correlations between behaviour values of all observed people across the different datasets.

As the table illustrates, aggregating all data seems to improve significance levels. Behaviours captured on weekday and weekend, are not comparable as one snapshot only represents a single point in time. When the data from both days of observation were aggregated for each room, degrees of significance seem to fluctuate within all six rooms.

On the other hand, when data was aggregated within a building type, it began to show some trends, even though the correlation coefficients were relatively low. In the department store, only a few spatial properties are highlighted as significant relationships with behaviours at knee-level, whereas the museum seems to have more spatial relationships across both knee-level and eye-level. This might be related to the fact that in the museum, visitors are more programmed to move in certain ways, either due to its curatorial purpose or display settings, than the customers in the department store. Therefore the visitors inside the museum result in having higher correlations with spatial accessibility such as controllability and integration at knee-level.

		Weekday and Weekend separately												Each room						Building type		
		D1 WD	D1 WE	D2 WD	D2 WE	D3 WD	D3 WE	M1 WD	M1 WE	M2 WD	M2 WE	M3 WD	M3 WE	D1	D2	D3	M1	M2	M3	D	M	ALL
	Sample size	34	35	5	12	5	10	47	86	31	44	66	88	39	17	15	133	75	154	101	362	463
Spectating																						
Knee-level	Connectivity							0.08*	0.10**	0.13*							0.09**					0.04**
	Clustering Coefficient								0.10**		0.18**						0.05*	0.08*			0.06**	0.04**
	Control								0.19**		0.09*						0.14**					-
	Controllability								0.18**	0.13*							0.12**				0.10**	-
	Integration									0.19*	0.11*										0.20**	0.06**
Eye-level	Connectivity		0.25**								0.10*			0.16**						0.16**		0.01*
	Clustering Coefficient								0.19**								0.13**				0.01*	0.03**
	Control		0.23**						0.20**					0.12**			0.12**			0.13**		
	Controllability		0.25**						0.18**		0.10*	0.06*		0.16**			0.08**		0.05**	0.16**	0.13**	0.22**
	Integration		0.26**								0.09*			0.21**						0.19**	0.31**	0.38**
Acting																						
Knee-level	Connectivity						0.61**		0.15**													0.05**
	Clustering Coefficient								0.07*								0.03*				0.11**	0.09**
	Control						0.72**		0.12**							0.42**					0.02*	
	Controllability						0.58*		0.05*							0.34*				0.06*	0.17**	
	Integration						0.50*		0.15**								0.06**				0.22**	0.06**
Eye-level	Connectivity								0.05*			0.07*		0.27**	0.38**					0.25**		0.01*
	Clustering Coefficient	0.15*									0.23**			0.11**				0.20**		0.07**		0.03**
	Control		0.35**	0.82*										0.17**	0.38**					0.19**		
	Controllability		0.45**											0.27**	0.38**					0.25**	0.17**	0.28**
	Integration		0.61**		0.33*				0.20**			0.11**		0.39**	0.42**		0.12**			0.37**	0.36**	0.47**
Interacting																						
Knee-level	Connectivity								0.05*				0.14**				0.06**		0.04*	0.05*		0.03**
	Clustering Coefficient									0.13*		0.12**	0.15**	0.06*							0.09**	0.04**
	Control							0.14*	0.07*				0.15**				0.09**			0.04*		
	Controllability							0.12*	0.06*				0.10**				0.08**		0.05**		0.11**	
	Integration									0.14*			0.15**								0.22**	0.05**
Eye-level	Connectivity										0.12*	0.09*		0.11**		0.29*			0.06**	0.11**		0.02**
	Clustering Coefficient								0.06*				0.05*				0.05**					0.02**
	Control		0.21**	0.84*					0.09**					0.08*		0.30*	0.06**		0.04*	0.10**		
	Controllability		0.24**						0.06*		0.12*	0.12**		0.11**		0.29*	0.05*		0.06**	0.11**	0.11**	0.18**
	Integration		0.31**						-		0.10*	0.07*		0.17**		0.37*			0.05**	0.15**	0.32**	0.36**

Table 7: Correlation table with coefficients for spectating, acting and interacting analysis of all datasets. Only significant correlations are shown regardless of their R2 values. Positive correlations are in pink and negative correlations in blue. (* $p < 0.05$, ** $p < 0.01$).

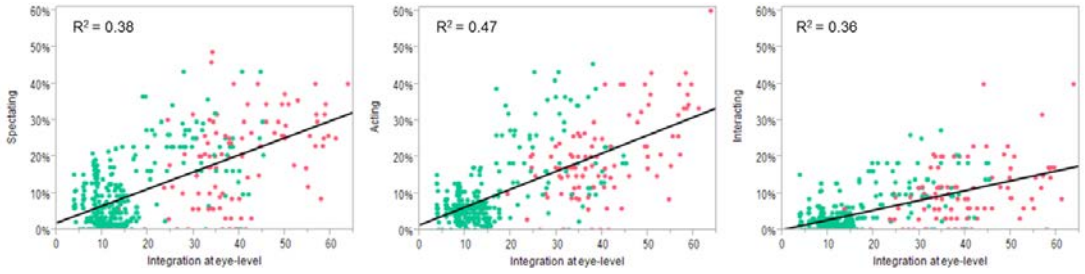


Figure 6: Scatterplots of all data aggregated showing relationship between behaviours - spectating, acting and interacting - and integration at eye-level (green: museum, red: department store).

Aggregation of all data in both building types had the strongest correlations for all behaviours. Visual integration at eye-level seems to be a representation of the most significant relationship for the observed behaviours (Figure 6). Coefficients for the visual integration have increased for spectating (from R2 values of 0.19 within the department store (D) and 0.31 within the museum (M), to 0.38), acting (from 0.37 in D, and 0.36 in M to 0.47) and interacting (from 0.15 in D and 0.32 in M to 0.36). The second significant variable is controllability. It has the highest correlation with acting behaviour. As controllability picks up the locations that can be easily dominated, it can be argued that visitors present in a space with higher controllability are likely to be seen by more people.

In summary, the analysis has shown that the overall configuration of rooms in museums and department stores has an impact on patterns of co-presence. Particularly spatial integration at eye-

level shapes the numbers of people that one is seen by (acting), but also the numbers of people one can see (spectating) and the numbers of people that can see each other (interacting).

The fact that aggregating data across building types improves the correlations and shows clearer results highlights an interesting aspect. It could be argued that the relationship between spatial integration and co-presence patterns is indeed generic and independent of the specific layout of a room, the function of a room, the types of display furniture and the type of building.

8. Conclusion

This paper has examined the role of spatial layouts in the creation of co-presence patterns in two building types, a museum and a department store. It was expected that the two buildings would generate similar patterns of co-presence as they share similarities in the function of displaying goods. However, the study has highlighted that they shape visitors' behaviours slightly differently.

The co-presence patterns observed in the museum seem to have stronger association with accessibility. Due to the layout of displays focused on certain narratives or classifications, inter-visibility rates among the visitors are relatively low. This creates another form of co-presence between the visitors, who look at the same objects, as they are brought closer to each other in order to look closer to the objects.

In the department store, the spatial layout enhances visitors' inter-visibility rates. It can be suggested that accessibility does not seem to be an important factor in creating the visitors' patterns of movement. This may be related to the nature of the department store, where the displays are arranged to maximise visibility for higher purchase rates.

The paper has some obvious limitations. First of all, the limited number of snapshots could have distorted results. Each snapshot shows a unique moment in time and the same room would show quite different patterns of behaviour at a different moment in time. Hence with more distinct snapshots, more reliability of the analysis would be achieved. In addition, only three rooms in each building were analysed. Again, a higher number of different rooms might show different results.

Therefore, further study would be required to investigate and test the methodology introduced in this paper, which quantified degrees of co-presence with isovists and Hall's dimensions. It would be worthwhile to apply this methodology to different settings, possibly across different building types and design a study with larger sample sizes.

Nevertheless, this paper has made an important contribution to the understanding of patterns of co-presence and how they seem to be generically shaped by spatial configuration at the room level, independent of furniture layout, built form types and activity types. It was shown that being seen is shaped most strongly by spatial integration with the phenomenon of seeing and interacting following the logic of space in a considerable way as well.

Another contribution is made to the state of the art in syntactical research. Often contributions in space syntax focus on the whole building level with a lack of studies considering the micro level of more simple and contained settings, such as a single room. Hence the paper addressed this gap in our understanding by highlighting interesting ways in which configuration at the micro-level plays a role for the immediate sociality among people being co-present.

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