Identifying spatial meanings of atria in built environment and how they work
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ABSTRACT
This paper focuses on atria in built environment in order to identify what kind of spatial meanings and values we can find in atria, how we perceive them, and to what degree the architectural properties of the atria are correlated to social meanings. For this, four shopping centres (malls) located in London, UK, were selected, and an online survey questionnaire in terms of the affordance theory was carried out to get substantial ideas of how they work. Throughout an in-depth analysis and evaluation of empirical data, it can be argued that atria help us to draw a spatial structure; they afford revealing oneself to or concealing from others due to the positional priority; lead us to resting, standing or waiting along the atria’s edge; provide a clue for descending or ascending to other floors; afford making aware of activities and facilitating social behaviours; and give us useful information with regard to wayfinding. It is clear, therefore, that atria should be understood as not a separate or independent space but rather an integrated, co-dependent, and comprehensive space from the aspect of the overall spatial configuration.

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1. Introduction
When we either walk along or go through an atrium in a building, we can recognize signs and displays; notice a number of architectural elements like walls, columns, doors, handrails, stairs, and even different spaces; and observe people’s movements and activities. The atrium is not only a space of providing splendid views or architectural aesthetics, but also a space of allowing us to identify the whole-part relation in the spatial layout. Even though it is not physically connected to the floors, it is linked visually and virtually. Atria encourage people social activities, and also they provide a visual clue (Saxon 1983). This is that atria, which are conceptually defined space in buildings, are strongly related to our cultural and social activities. However, it has been hardly studied how they work from the cultural and social aspects, how people perceive atria, and what meanings or values can be defined.

Certainly, atria work in different ways: for example, they bring light into buildings, and keep rain, solar gain and extreme temperatures away; they constitute main lobby and circulation space with access to all parts of the building; and they can be used for exhibition or performance space, or a market area. Apart from such those functions, it is not well known in what degree our social behaviours are influenced by atria yet. As a pilot study, therefore, it aims to explore what aspects might be appropriate and useful in order for us to understand the atria’s social meanings, and then find out social meanings and values by a newly designed research methodology.

1.1. Atria: archetypal approach
The concept of archetype is derived from the area of biological study in order to find out “structural similarities” between creatures. It means that archetype is a theoretical abstraction from the forms of all the actual species in question (Steadman 1998, 92). The main issue of archetypal study is not only to discover which parts of a body would be considered as having a similar structure even though the size or shape of the parts might be different among species, but also to understand which particular parts could be transformed by “continuous deformation.” Thus, the purpose of identifying the archetypal building is to explicitly draw “geometrical distinctions,” and to find out “invariant types of form” (Ibid, 94).

From the homologous viewpoint in relation to structural comparison between species, Steadman applies the conception of archetypes into architectural built forms in order to classify non-domestic buildings. It is because the spatial layouts of all nondomestic buildings can be drawn by a few patterns of composing spatial components, although buildings tend to have different spatial layouts in accordance with specific functions. Thus, he asserts that the forms of actual buildings may be related by continuous deformation of parts and by suppression of some parts altogether, so that the archetypal building serves to represent overall properties of the envelope, which are determined by the constraints of lighting and the close-packing of certain generic types of space, such as “cellular space,” “open-plan space,” and “halls” (Ibid, 92). In fact, the idea of both constraints is strongly correlated to the concept of adjacency complexes of spaces,
which could be defined as spatial “dissections” and “aggregations,” rather than that of permeability complexes. In other words, both the lighting and the generic way of packing spaces are concerned with dimensional limitations or the availability of actual depth on building forms in terms of building science, rather than functionality or intelligibility which is an essential idea of spatial configuration.

With the consideration of dimensional limitation, Steadman uses the idea of lighting as an essential criterion of classifying the archetypal building, and he divides the interior spaces into three types of “zones” distinguished by the nature of lighting: “side-lit” zone defined as space adjacent to the external facades, and around the courtyards which has the potential to be daylit via windows; “toplit” as space immediately below the bases of the courtyards, and on the topmost level of the courtyard floors which has the potential to be daylit by roof-lights; and “artificial-lit” as all other space in the interior of the archetypal building which must of necessity be lit by artificial light (Steadman 2001, 09.1). For instance, rooms like office spaces or shops could be classified as the zone of the sidelite spaces; corridors or common spaces like toilet or stairwell would be considered as the artificial-lit spaces; and halls and atria could be identified as the toplit space. From the archetypal viewpoint, he tries not to present “functional determinism” in building research but rather to define the extreme boundaries in which as much as accommodation as possible is fitted onto a given site area (Ibid, 09.2). From this aspect, atria could be understood as a spatial device for the purpose of maximising the plan depth, maximising the efficiency of circulation system in the deep plan, and allowing natural light into a deep inside of building. However, this approach is overly concerned with the relationship between maximising form and site condition, so it is hard to understand how atria work.

1.2. Atria: functional approach

In contrast to the purpose of atria in terms of the dimensional limitation, Saxon presents a functional viewpoint of the atria. In (1983), he asserts there are four functions of atria in buildings: “cultural,” “economic,” “shelter,” and “accommodation” one. The cultural function is related to human activities, so not only do atria encourage people social activities, such as watching one another, promenading or moving about through space, and having social life, but also they provide a visual antidote to the oppressive interiors and the formless external spaces; from the viewpoint of economic function, atrium buildings are successful because of an extra attraction and earning power, and they also provide “shallow” spaces of a tower or low-rise, block-covering building; as the shelter one, the atrium can bring light into buildings but keep wind, rain, solar gain and extreme temperatures away, reducing costs, and increasing comfort; for the accommodation, apart from constituting a lobby and circulation space with access to all parts of the building, the atrium can provide useful space, for example, its floor can be a restaurant, lounge, exhibition or performance space, or a market area (Ibid). Of course, this functional viewpoint is not a fixed or single aspect of understanding properties of atria, but rather multilateral aspects of identifying spatial values or meanings among spaces. From the spatial or social viewpoints, the most essential function of the atrium is to facilitate social interaction through multi-levels in that the chances of natural co-presence could be increased.

In (1993), Saxon mentions specific functions of atria in accordance with different building types, such as hotel, shopping, office, government, and education. Table 1 explains the relation between the main purposes of atrium and the building types. Although each purpose seems to be different from one another, the primary aim of designing atrium in buildings is to provide a type of public space or square, which might be similar to open space in urban structure.

However, these two viewpoints cannot explain entirely the kinds of spatial meanings and values that we could find in atria, such as how we perceive them; to what degree the architectural properties of the atria are related to social meanings; and how atria affect the ways of our behaviours and social activities. In order to answer those questions, we need to look at a theory of “affordances.” According to Gibson, the theory of affordance begins with “a new definition of what value and meaning are,” so “the perceiving of an affordance is not a process of perceiving a value-free physical object to which meaning is somehow added in a way that no one has been able to agree upon”, but “a process of perceiving a value-rich ecological object” (Gibson 1986). Thus, this theory is not just the idea of the external meanings or values of the environment but the comprehensive aspects including the concept of the “visual perception” and the “movement.” Therefore, the aim of this paper is

| Building Type | Purposes of Atria                          |
|---------------|-------------------------------------------|
| Hotel         | Desire of creating memorable space & need for accommodating places of hospitality |
| Shopping      | Needs of multi-purpose space like community event or promotion, large floorplate buildings, attracting people and associating with leisure function |
| Office        | Desire for large floors with having daylight to all spaces due to the limitation of constructing high-rise buildings |
| Government    | Providing grand public interior spaces to allow easy approach |
| Education     | Need for assembly space & circulation between small spaces |
to investigate how the atria serve as one of the many visual clues that can allow us to derive spatial meanings and values from built environments.

2. Affordance theory

The central question for the theory of affordances is “not whether they exist and [they] are real but whether information is available in ambient light for perceiving them” (Ibid, p140). The affordances of the environment, furthermore, should be understood by the idea of locomotion, because observation implies movement so that the optical information will be changed by the movement (Ibid, p.72). However, the values or meanings of a thing in the environment cannot be measured like physical properties, because its affordance relatively depends on the posture, behaviour and experience of the observer. These cannot be evaluated as phenomenal properties either, because its affordance implies invariant information “relative” to the animals. For example, for human beings, the brink of a cliff can afford injury by collision with the ground; whereas, it cannot give the same affordance to birds. Therefore, the theory of affordance is the comprehensive and embodied aspects.

Gibson divides the environment into seven classes: medium, substances, objects, surface-layouts, surface and place, optical objects, and other persons and animals. All affordances are related to our optical perception as well as locomotion, and the meaning or value of our environment can consist of what it affords. However, the first three environments – medium, substances, and objects – are not irrelevant to the question of what atria afford or what people perceive through locomotion in atria (See Table 2).

As having looked into affordances in accordance with environments, atria are understood as the environment of surface-layouts drawn by surrounding edge of floor. It is because atria are surely composed of stand-on-able and walk-on-able ground floor and falling-off places around the atria from the upper floor, and they are stepping-down or stepping-up place. Thus, atria afford resting and footing on the ground, injury by collision with the ground, and descending or ascending movement. As surface and place, atria afford revealing of oneself standing on the ground floor to others on upper floors. As displays, they are used to offer information regarding to wayfinding by means of signage. The most important affordance of atria can be defined as behaviour. Like the affordance of revealing oneself to the others, atria can afford social behaviour. For example, when an atrium in a shopping centre is used for promotions, it can afford gathering people; or when it is used for exhibition place, it can afford slow walking and looking at the exhibition. Thus, behaviours of other people in atria can afford perceiving the behaviours.

3. Cases and research methodology

In order to identify spatial meanings or values of atria, shopping centres were selected. As mentioned before, the atria of shopping centre are different from those of other building types such as hotel or office, because they can be thought not only of creating social interactions and co-presence but also of using it as a spatial device to lead shoppers from the ground level to the top (Saxon 1993). Besides, shopping centre does not require any specified users. This means that anyone can visit, shop and have a fun with their companions. Thus, it is expected that these facts can help us to find out more substantial and ecological meanings from a sociological perspective. Considering those characteristics, four shopping centres located in and the outskirts of London, were chosen; Bluewater (BW), Brent Cross (BX), Westfield (WF), and Whiteleys Shopping Centre (WL) (Figure 1).

| Table 2. Affordance of Environment (Gibson, 1986; 1971a; 1971b) |
|---------------------------------|----------------------|------------------|
| Environments                     | Examples & Affordances | Relevant to Atria |
| Surface & Surface-layouts       | - Stand-on-able surface | : Resting          |
|                                 | - Walk-on-able surface  | : Footing          |
|                                 | - Vertical rigid surface or obstacle | : Collision & barring locomotion |
|                                 | - Interspaces or opening between obstacles | : Locomotion |
|                                 | - Falling-off place or brink of cliff | : Injury by collision with the ground |
|                                 | - Gap between the cliff and edges | : (May be) Jumping |
|                                 | - Stepping-down or stepping-up place | : Descent or ascent |
|                                 | - Sit-on-able surface | : Sitting          |
|                                 | - Stand-on-object or stool | : High reach |
|                                 | - Climbable layout (eg tree, ladder, stairway) | : Climbing & locomotion |
|                                 | - Get-underneath-able surface | : Shelter (roof) |
| Surfaces & places that Reveal or Conceal | - Occluding surface, opaque surface | : Concealing |
|                                 | - Transparent surface (eg glass) | : Revealing |
|                                 | - Place (eg hiding or private place) | : Concealment of oneself from others |
|                                 | - Place or layout (eg peek-a-boo, hide-and-seek) | : Concealment of an object from others |
| Displays (Optical Devices)      | - Images, pictures, written-on surface | : Offering mediated/indirect Knowledge & permitting the storage of information |
| Other Persons & Animals         | - Behaviour (eg sexual, nurturing, fighting, cooperative, economic, political behaviors) | : Behaviour |


It should be mentioned about the configurational features of the cases, because they do not have the same spatial structure. In BW, for instance, the internal spatial layout is characterized by three malls, and three atria are located at the junctions of malls; BX is perpendicular and linear, and especially the spatial structure is flipped on both levels; in WF, there are two ringy structures linked at an atrium, so that it can be said that this atrium creates a short cut; and in WL, lastly, it shows a linear spatial structure and an atrium is placed in the middle of the path. Additionally, when we look at them with metric ideas such as length, width or height, they are all different from one another. Regarding to these distinctive characteristics, it is hard to say that the cases might not be appropriate. However, when we look at them in a topological sense, they can be understood as
an important node in a given spatial layout. They play an active role in providing spatial information, generating an effective movement, encouraging social encounters, and fostering cultural activities. Instead of considering configurational or metric sense, we focus on looking into the atria at the topological level.

To begin to investigate how people understand atria with regard to the visual perception and movement, an online survey was conducted. The online survey is consisted of 10 questions concerning with the environmental affordances, such as “resting/footing/collision/descent/ascent/sitting” from “surface & surface-layouts”, “revealing” from “surfaces & places”, and so on. Each question is made up of a scenario which happens frequently in a shopping centre, for example, bumping into one of friends, a need for quick chat, or waiting for a family member in or around an atrium. With a series of scenarios, the online survey was carried out in the following process:

- Online survey was consisted of four sets according to shopping centres, and two of them were randomly given to a participant.
- Each set provided two photos taken at different levels of an atrium in a shopping centre; each photograph was divided into squares, and each square was uniquely identified and referred to by a letter (horizontal) and number (vertical) code.
- Participants were asked to imagine that a scenario takes place in the shopping centre, and told to answer which location (i.e., “A1,” “D4,” etc.) you might choose in order to act in that given situation and to describe briefly the reason of why you chose this place.
  * Example question: You have arranged to meet a friend in this atrium. Where would you stand to wait for him/her?
    
    Location code (eg, “A1”) and/or description: 
    Reason for choice:

The answers collected from the surveys were explored in the following ways: as a quantitative analysis, the frequency of locations were investigated at first; and then, as a qualitative one, the brief descriptions were closely looked into how often what kinds of words might be used, and what words would seem to be deterministic on choosing locations. Once data have been cleaned, important spatial meanings were derived from the locations and descriptions.

A total of 37 respondents, all graduate students in 20s–30s, participated in this survey. In total, 61 sets were gathered, and 53 of them were used for data evaluations.

After having completed the online survey questionnaire, an observation was carried out for the purpose of discovering stationary activities in and around the atria by using static snapshots. Every activity was recorded on a sheet of paper with the idea of four basic activities: standing, talking, sitting and walking (Figure 6). Note that this method, the field observation, was intentionally used to make sure that the findings derived from the online survey would be in effect.

4. Evaluations & findings

4.1. Affordance regarding surfaces & places

To explore first affordance, five scenarios with regard to revealing, resting, standing, sitting, and locomotion were asked to subjects (Table 3).

4.1.1. Question 1. Revealing (or meeting)

With regard to the affordance of revealing (Figure 2), we need to look at the frequency of which floor would be selected as a waiting place. Table 4 is the result of selected level for each case. Overall, majority of the respondents (72%) preferred the lower level for waiting a person rather than the upper level, because they thought that the places on the ground floor would be directly connected to the main entrance (a "free comment" box was included after each question, permitting the subject to justify or explain their selection). Hence, they could easily see and approach friends without long journey from the upper to the lower level. However, in BX, it was hard to distinguish the proportion of choosing the lower level from that of choosing the upper level, because the views on the ground floor were restricted by the vertical circulation elements, the escalators and lifts, in contrast to the other cases. In detail, the most frequently selected spot on the ground floor was the place of being most easily noticed or identified by another, such as the location in front of the blank wall in BX, beside a red-colour chair in WF, and in front of spiral stair and colourful fruits in WL. It was because these spots were so remarkable or identifiable that it was easy to describe the waiting place to others. Other subjects selected places

| Table 3. Questions Regarding Surfaces & Places. |
|------------------------------------------------|
| Categories*                                 |
| Scenarios (Contents of Questions) | Revealing (or Meeting) |
| Q1. You have arranged to meet a friend in this atrium. Where would you stand to wait for him/her? | Standing (including chatting) |
| Q2. You unexpectedly bump into a friend in this atrium, where would you go to talk to her? | Resting |
| Q3. Having finished shopping, you are waiting for a family member. You are holding many shopping bags. Where would you stop with your bags? | Sitting (including resting) |
| Q4. You suddenly feel faint and need to sit down. Where would you sit? | Locomotion (descent/ascent) |
| Q5. You are shopping with a baby in a pushchair. How do you think you could reach the upper level if you are currently on the lower level? |

*Categories are derived from Gibson’s Affordance (See Table 1).
near the atrium’s entry point or beside an escalator, or at the centre of the atrium because these places would attract people’s attention. On the other hand, the rest of the respondents (28%) preferred the upper level because

Table 4. Results of Selected Levels for Revealing (or Meeting).

| Levels (%) | Total | BW | BX | WF | WL |
|------------|-------|----|----|----|----|
| Lower Level | 72    | 62 | 58 | 88 | 77 |
| Upper Level | 28    | 38 | 42 | 12 | 23 |

Figure 2. Revealing (top), Standing (middle) & Resting (bottom).
of the vantage point of a high position and the relative security of a wide field of view gained (or presumed to be gained) from the upper level, so that most respondents selected one of a sequence of places situated along the handrail of the upper level. Thus, these results tell us that the atrium in buildings afford not only revealing oneself but also revealing others. The shape of atria can be considered as an enclosure or a convex space even though they are vertically exposed, and this combination of bounded convexity and visual openness may promote social co-presence and interaction.

4.1.2. Question 2. Standing (& chatting)
The second question explored where people would stand and have a chat when they bumped into friends. The results of the responses were somewhat varied, but they can be sorted into three groups. The first group chose seating areas, restaurants, and cafés to have a chat, because these places could provide good views, natural light, and also seating areas so that people could sit comfortably on chairs during a chat. The next preferred place was the area near the handrail along the atrium at the upper level, because this place was considered to have nice view (prospect), and it was comfortable for a quick chat and perceived to be less noisy than the lower level. However, the subjects who stated that they preferred this place also stated that they would try to stand near the handrail to avoid blocking another people’s movement. Last, the place selected by subjects for a quick chat, was somewhere less busy, yet within the atrium itself. These other places, such as the place beside column or the staircase on the ground floor, or the area behind or beside handrail, were selected for having a brief chat. These results can tell us that people would be willing to avoid blocking the other people’s movement by standing back from the main stream of pedestrian movement.

4.1.3. Question 3. Resting
With regard to resting, the responses could be divided into two groups. The first group was strongly related to salient objects which could be described clearly to the family member without confusion or misunderstanding. Thus, the majority of respondents of the first group chose places on the ground floor, and they were focusing on reference-points such as the big letters on the side of escalator or red-colour chair in WF, the white wall in BX, the spiral-shape staircase in WL, or the chairs beside the column in BW. The other preferred places were related to the act of revealing oneself to others or maximizing self-visibility rather than external, identifiable references, so subjects selected places on the ground floor, such as the centre of the atrium on the ground floor in BX and WF, or the spot beside the stair in WL, because these places could be easily observed from the upper level or revealed to others. The other group selected areas along the handrail on the upper level because these places could provide a high position and good sightlines to the lower level. However, the most interesting aspect of the responses is that almost all subjects appeared to prefer locations adjacent to fixed or rigid vertical surfaces in order to define their “own space” and to put down bags. This was frequently coupled to the desire to invoke salient objects as points of reference to describe their waiting locations.

4.1.4. Question 4. Sitting (& resting)
This question explored where people would go if they felt faint or needed to sit down (Figure 3). Almost all subjects responded that they would go to wherever seating was provided and quickly accessible: in BW, subjects chose the chairs beside the columns around the atrium on both floors; in BX, the place next to the lift was primarily considered as a seating spot; in WF, the chairs on the ground floor and the seating areas belonged to restaurants or cafés on the upper were selected for this purpose. However, in the case of WL, which had no seating place in the atrium, some of the respondents chose the steps of the main stair to sit down, and others selected the areas next to the handrails or columns on the upper level in order to lean against or sit down; whereas, in the case of BX, which did not have sufficient seating spots in the atrium, some of them responded that they would like to go to the areas beside the handrails on the upper level or the frontage of the white wall on the ground floor to lean or sit against. Overall, like the previous results, the main finding is that people appear to favourite places which have at least one vertical, rigid surface or similar “obstacle” to avoid other people’s movement trajectories but could also be directly accessible, thus the atrium help provide such appropriate locations.

4.1.5. Question 5. Locomotion (descending/ascending)
Concerned with locomotion, responses were divided into two groups according to the presence of escalators or lifts in the atrium-photograph. In cases of BX and WF, in which the escalator or lift were clearly visible, most of the subjects responded that they would use them in order to get to the upper level with a baby in buggy or pushchair. On the other hand, in the cases of BW and WL, in which there was not a visible escalator or lift but rather a stair in the atrium in each case, all respondents answered that they would walk around the atria or walk along routes leading off the atrium to find the lifts and hence reach the upper level. These results suggest that locomotion is, not surprisingly, strongly related
to the visibility of lifts or escalators but also that people expect them to be co-located with the atrium, leading to identifying candidate-spaces behind columns or staircases, or down corridors as potential lift-locations if otherwise not visible. Of course, this is, in part, due to prior experience of other shopping centres, but it is also possible that the atrium creates an expectation that there should be a lift or escalator...
present, since the atrium spatially and visually links the different levels (and therefore why not physically linking too?).

4.2. Affordance regarding behaviour

The second affordance is related to behaviour. According to Gibson, behaviours produced by other animals and other people can provide the richest and most elaborate affordances of an environment (Gibson 1986). To investigate what kinds of affordances could be perceived through other people’s behaviours and how the atra might play a role in such affordances, four questions were asked (See Table 5).

4.2.1. Question 6 & 7. Non-following movement behaviour

Two questions (Q6 & Q7) are very similar and related to the affordance of non-following movement behaviour. However, the questions differ in that one ostensibly considers the pattern of behaviour for a long time, while the other one examines a brief “snap shot” of time. Firstly, with regard to the behaviour of feeding a baby for a while, most of respondents chose places where they would be able to sit down, such as the restaurants or café in WF and WL, or chairs in the atrium in BW and BX (Figure 3). The next preferred place was near the handrail on the upper level in BW and WL, next to the columns in WF and WL, or behind the elevator in WF, because these places were comparatively less visible from others and not crowded. Other subjects described quieter and less bright places with chairs as places for feeding their baby, although not directly in the atrium; the atrium was not judged the best place for feeding a baby. The question of tying shoelaces, most respondents selected a wide variety of locations which were near to columns or walls, beside or behind escalators, next to handrails, chairs, or on the steps of stairs or escalators (Figure 4). The most important unifying feature was that all of the places were less crowded and not in the main thoroughfares. Thus, these results suggest that there are two kinds of characteristics in relation to non-following movement behaviour. The first one is that enduring behaviours tend to occur in comparatively different places to more fleeting ones. The second is that the former avoids movement flows in the atrium whereas the latter are strongly attracted to the already-occurring behaviours or movement flows in and through the atrium. Since most people wish to avoid interrupting or obstructing others, the places which incorporate at least one fixed, rigid surface are frequently selected in order to create a personal space in which to perform a specific activity.

4.2.2. Question 8. Navigating behaviour

The next question considers navigating behaviour. This question is important to understand where people would initially go to gain knowledge of the spatial layout of the building: linked to the idea of how to construct mental models of environments. More than half of the subjects (a total 58%) considered the upper level as a starting point for looking around or exploring the building, because they thought that the upper level would allow us enhanced visibility through the atrium and also to see lots of shop signs in comparison to the lower level (Table 6). Whereas, the rest of them (a total of 42%) preferred to go to the lower level at first in order to look for an information desk or to otherwise obtain some information, or they simply started “exploring” from the nearest entry point or the centre of the atrium. Therefore, it can be said that the space of the atrium is not just a place for providing vertical openness or excellent views, but rather it can afford us rich spatial references by permitting a comprehension of the whole spatial structure (survey knowledge). Moreover, it can help us to get information about how to move about in and experience the building.

4.2.3. Question 9. Wayfinding behaviour

The last affordance concerns the act of wayfinding in a situation of becoming lost or needing a map. The essential purpose of this question was to look into how people understand a wide variety of objects and human behaviours. Only two respondents in BX and WF knew the exact location of the information desk, but the others

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**Table 5.** Questions regarding behaviours.

| Scenarios (Contents of Questions) | Categories* |
|----------------------------------|-------------|
| Q6. You are shopping with a baby who starts crying because he/she is hungry. Where might you go to feed him/her? | Non-following movement behaviour |
| Q7. You suddenly need to tie your shoelaces. The shopping centre is extremely busy and crowded. Where would you do this? | Non-following movement behaviour |
| Q8. You have never been to this shopping centre before and you have no specific agenda other than to wander around and explore. Where would you go first? | Navigating behaviour |
| Q9. You have become quite lost and need a map. Where would you expect to find a floor-plan map or other signage? | Wayfinding behaviour |

*Categories are derived from Gibson’s Affordance (See Table 1)

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**Table 6.** Results of Selected Level at each case.

| Levels (%) | Total | BW | BX | WF | WL |
|-----------|-------|----|----|----|----|
| Lower Level | Specific Location | 29 | 28 | 24 | 47 | 17 |
|             | Anywhere | 13 | 14 | 5 | 20 | 17 |
| Upper Level | Specific Location | 42 | 14 | 52 | 33 | 49 |
|             | Anywhere | 16 | 44 | 20 | 0 | 17 |
just guessed the most probable locations of maps or info-desks through their prior experiences of other shopping centres. In detail, the most frequently answered site for gathering information was immediately surrounding the escalators or staircases (for floor-plans or You-Are-Here Maps), the next place was the centre of the atrium on the ground floor, and finally another group of subjects chose places where people were gathering. From these results, we can think of that wayfinding behaviour is related to the presence of other people in a building.

Figure 4. Tying Shoelaces (top), Navigating (middle) & Wayfinding (bottom).
4.3. Affordance regarding displays

The last affordance is about displays which can offer us meanings or information, thus images, pictures, or written-on surfaces are belonged to the types of displays. Actually, this affordance is not exactly related to the space of the atrium, but its architectural property, which is the vertical openness from the ground floor to the top, can allow us to see and catch the meanings or information through lots of signs and images on frontages at different floors. Thus, it is necessary not only to look into how many signs or shops we can identify at different levels, but also to analyse which signs catch our attention.

4.3.1. Signs capable of being caught through the atria

Table 7 is about the mean number of identified shops at both levels. On the whole, in the cases of BW and BX, we can see that the mean number of shops which we can identify on the upper level is higher than that on the lower level. As the primary reason, we can think of the differences of architectural attributes; that is to say, the range of visibility on the lower level as we see is relatively restricted by massive size of columns, low ceiling height of the first floor, and the main stair located at the centre of the atrium in BW, or by escalator and lifts in BX. It is clear that the visibility on the upper level is much better than on the lower level. Thus, subjects could see and identify shops and signs on the upper level. On the other hand, in the cases of WF and WL, the results are totally different from the former cases. The mean number on the lower level is almost two times higher than that on the upper level. In WF, we can see there are not too many shops on the upper level in comparison with the number of shops on the lower level, because the left front-shop along the atrium is used as catering areas like restaurant or café facilities. In WL, it is hard to look down on the upper level through the notable handrails, which are made of black-colour steel, while we can look up various signs of shops on the ground floor. However, the atria can afford to catch a variety of meanings and information at each level because of their openness from the ground to the roof, although the amount of capable information would be different according to the architectural properties. In addition, they can help us to understand how the spatial layouts would be organized through the vertical visibility.

### Table 7. Mean Number of Identified Shops at Each Level.

| Shopping Centre | BW  | BX  | WF  | WL  |
|-----------------|-----|-----|-----|-----|
| Mean Number of Identified Shops (When standing on the Lower Level) | 3.13 | 2.75 | 6.36 | 4.18 |
| Mean Number of Identified Shops (When standing on the Upper Level) | 4.29 | 3.06 | 3.00 | 2.20 |

4.3.2. The most recognized signs

The next question is about which signs would catch our attention in the atria. The purpose of this question is to look into not only the vertical relation between the position of signs and our standing points, but also the horizontal correlation between the position of signs and the range of our vision. Let us look at the most identified signs in each case (Figure 5). In BW, “Currys” on the lower level and “Lacoste” on the upper were frequently chosen as the most identifiable signs; in BX, “Summer Surprises” rather than brand or store names on both levels were picked out; in WF, “Vue Cinema Opening Soon” and “2 Hour Free Parking” were chosen rather than the signs related to commodities or store; in the last case, WL, “Books” and “HMV” were selected on both levels. From the result of the most frequently selected signs, the signs would be related to our standing level like the lower or the upper level, but this relation is not always present, for example, the sign of “2 Hour Free Parking” in WF are selected on both levels. However, the vertical position of signs is generally related to our eye level, so that when we are standing on the ground floor, the signs on the same floor could be easily identified and catch our attention rather than those on other floors. On the other hand, the horizontal relation between the position of signs and the range of vision is not much correlated, but rather the signs are strongly related to the font size of signs; that is to say, the bigger the font of letter, the more it can be readable or identifiable. The other interesting things are that some respondents chose people’s behaviour, interior features with regard to aesthetics, or event of exhibition rather than signs or written-on surfaces. For example, in the case of BX, two of subjects chose the queue in the centre of the atrium; in WF, two respondents selected the wooden finished interior walls on the upper levels, and four out of them considered the event of exhibition as the most interesting sign. It means a particular behaviour or event would be more identifiable and sometimes it can effectively or strongly catch our attention rather than signs which should be read in order to get meanings. Therefore, the atria can provide us social meanings through people’s behaviours as well as signs so that they can foster social interaction.

5. Discussions

5.1. Findings from the online survey

One of significant findings is that the atria can be considered as a place of revealing oneself to others from the “ecological aspect”. From the results of the online survey with regard to the choice of meeting a friend, a third of subjects preferred to move to the upper level to wait their friends; whereas, the others (two thirds of respondents) selected the middle area of the atrium or spots on the lower level with regard to identifiable referential objects such as escalator,
staircase, or colourful chairs. This result can tell us that the atria have different positional meanings in accordance with the levels; the lower level serves to be used as a place of being revealed oneself to others, whereas the upper level concerns with a place of revealing people due to the positional priority although our visibility on the lower level would be decreased by the atria themselves (as if we were standing in a place surrounded by trees).

The second finding is that the atria can instantly provide us a personal space. In contrast to the corridor or mall which comprised more or less simple and linear convex spaces, they are composed of small convex spaces in that it is architecturally defined by columns, handrails, walls, or sometimes vertical circulations like escalator, stair, or lifts. These architectural elements are considered as extra vertical, rigid surfaces or layouts from, and they can allow us to get personal spaces for a while because these are perceived as barriers or obstacles for the progress of locomotion. The next one is that the atria can help us to perceive a variety of meanings through not only the displays around the atria but also human activities performed. This finding is strongly related to the architectural properties of the atria. The primary feature of the atria is the vertical openness from the ground floor to the top, and our visual range at a standing point in the atria is higher than the other spaces. This spatial property of the atria makes us capable of catching displays on different levels through the section, and it can help us to understand the spatial relationality through the vertically extended visibility. Besides, the vertical openness can make us to catch our attention through people’s behaviours, as the different standing positions as well as the vertically extended visibility surely increase the chances of looking at the other people’s behaviours. Therefore, the atria can afford us not only to get information through the displays but also to be aware of co-presence through people’s behaviours by the vertical

Figure 5. Displays.
openness, the vertically extended visibility, and different standing points.

The last finding is concerned with the navigation and wayfinding within the spatial layouts. Regarding to navigation, the upper level of the atria rather than the lower level is very important to be constructing the cognitive map or mental model. This result shows that the atria are considered as an essential referential space in the complex spatial system, so that they are clearly defined as a starting point to explore or move about the buildings. On the other hand, the atria are clearly considered as the place capable of getting some information related to the wayfinding. It can be thus suggested that they are a landmark node within the spatial layouts, which is similar to open space or square in urban structure. As an internal landmark in buildings, the atria are identifiable and legible within the spatial system, even though they are hardly defined in a physical way.

5.2. Comparing the findings with the snapshots

Figure 6 is the results of the snapshots with four categories (eg, standing, talking, sitting and walking). From the recording of the use pattern of atria, it can be argued that most areas of the atrium on the ground level, with the exception of WL, are used for moving activity, and more interestingly some static activities like standing and interacting each other are discovered around escalators and columns. This use pattern implies that the lower level seems to be considered as a kind of passageway to get to the opposite side of the building. When some of shoppers make an activity of standing or talking to each other, they do not try to disturb the main stream.

Figure 6. Static Snapshots of Cases*.
of movement. On the other hand, the pattern on the upper level is distinct in that static activities are performed along the edge of the atrium.

These distinctive use patterns are valid in the online survey questionnaire as well. In particularly the question of resting, standing, chatting, waiting with bags, feeding a baby and tying a shoelace, the preferred locations are either along the handrails on the upper level or beside columns, escalators or staircases on the lower level. Thus, it can be said that although the online survey is based on the assumption starting from the ecological perception, its result is in somewhat corresponded to the actual use pattern of the atria.

6. Conclusion & limitations

Without question, we can see these four main findings are strongly related to the affordance. The atrium can afford revealing oneself to others or concealing oneself from others by means of the positional priority. It affords resting, standing or waiting, descending, or ascending with regard to the property of surface-layouts. Also, it affords making aware of people’s activities and facilitating social behaviours. Last, the atrium can afford not only getting directions easily but also constructing mental model. From these findings and spatial meanings in terms of the affordance theory, it is clear that the atrium should be understood as not a separated or independent space but rather an integrated, co-dependent, and comprehensive space. In addition, the atrium can be thought of as an enclosure or a convex space. Thus, this combination of bounded convexity and visual openness can promote social interaction.

These results have in somewhat substantial implications for applying to the practical fields such as architectural design and facility management. For example, atria should be considered as a space of generating personal activities as well as social community events in buildings. This means both the stationary and dynamic activities co-arise in the atria, so that architects use them as a buffering zone in order to minimize the conflict between those opposite activities. From the managing viewpoint, on the other hand, atria could be understood as a type of public space in that they serve to facilitate social interactions and increase the chances of social co-presences through spatial properties.

This paper tried to answer how we perceive atria in the built environment, and how strongly they affect our social behaviours in an ecological perspective. However, this study has a number of limitations. First, this paper focused on only one building type, so that it is hard to say that the findings are effective on all building types, such as offices or hotels. It needs a follow-up study on the purpose of investigating whether the spatial meanings found in the shopping centre are still valid in other building types, or they should be rectified in accordance with the different architectural and social functions.

Second, this study does not explore how the physical properties of atria might be correlated with the meanings. For example, each atrium has a unique size and three-dimensional volume, so that it can be expected that these characteristics lead us to perceive and understand the space in different ways. In the case of WL, the atrium is comparatively small and circle shape. Besides, its ground floor is used for a daily market place selling fresh food like meat and fruit. These features seem to be different from the WF’s atrium which is relatively rectangular, has a lengthy side, and used for an exhibition. These characteristics might make us to perceive and understand the atrium in substantially different ways.

This study, as a pilot study, aimed to open a door in that how the conceptually defined space (ie, atria) works, and what meanings the naïve (ie, non-professional people in architecture) can build through their perception. The research findings, therefore, can be used as a cornerstone for understanding an architectural space from an ecological perspective, and this frame is of value in developing further the relationship between architecture and our perception.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Jae Hong Lee obtained his doctoral degree from the Bartlett School of Graduate Studies, University College London, UK. His research focuses on understanding the process of that intrinsic spatial culture or social knowledge determines form-function relations, and the way of that spatial design affects social behaviours from a syntactical perspective. In particular, he is interested in measuring effects of specific components such as atria, graphic designs, floor-plan maps, in complex built environment, and developing the discourse on spatial design throughout the relation of architectural design, map making, and spatial cognition.

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