

Space, Movement and Attention: Affordances of the Museum Environment

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Abstract

This article presents results from an in-depth visitor analysis conducted in the St. Gallen Museum of Fine Arts. Using the latest tracking technology, exact visitor positions and movement paths inside the exhibition were recorded. Based on the psychological concepts of “valence” (Lewin), “standing patterns of behavior” (Barker) and “affordance” (Gibson), the analysis of the movement data is an explorative and descriptive investigation of the “raw material”, investigating how architectural and curatorial settings influence visitor attention given to various artworks and how the visitors’ move within the facilities. The tracking technology revealed visitor streams alongside so-called “space-cells”, which were found to influence the rhythmicity of the museum visit. Space-cells can be firstly characterized by a reference point attracting visitor attention that produces a “stopping-moment”, followed by cell-specific movement patterns in relation to the composition of the cell. These results are important for curators, whose work in staging exhibitions can influence visitor attention, their itinerary and, generally, the aesthetic effects of artworks.

Keywords: visitor studies, spatial movement, affordance, exhibition planning/curating, exploration and encounter

Introduction

A museum can be understood as a place of interwoven spatial layers. When visiting a museum, one firstly experiences the urban environment. This may be a loud street, a silent park, or a representative area. In any case, the environment leaves an impression on us when moving through it and approaching the museum. Walking closer to the building, the architecture emits a certain aura; its style represents a certain time and perhaps some kind of grandness, projecting an atmospheric space. In her brief history of museum architecture, Giebelshausen (2006) states: “The architecture of the nineteenth-century museum embodied permanence. It was designed to make a symbolic statement” (ibid.: 231). Such an architectural-representational layer was evident at first glance for our study. Situated in the serenity of the city park of St. Gallen, our study was located within The Museum of Fine Art St. Gallen, one of Switzerland’s most outstanding classicist buildings built in 1877 (www.kunstmuseumsg.ch).

Pushing through the heavy wooden entrance doors and stepping into the entrance hall, another spatial layer opened up: the rather intangible space of the social. Recent museums studies and cultural sociology in particular (overview: Fyfe 2006; prominence: Bourdieu, Darbel 1991) have emphasized the role of the museum as a space of social distinction (cf. Tschacher, Bergomi, Tröndle, forthcoming). With less focus on concepts of social class and cultural capital, the individual and her/his museum experience have been coming back into the purview of visitor studies (Falk 2009). On an individual basis, the single visitor has been understood as pre-sorting and pre-structuring her visit, based on personal expectations (see also Kirchberg and Tröndle, forthcoming).

In the research project, *eMotion - mapping museum experience* (www.mapping-museum-experience.com) we found several other aspects influencing visitor behavior in the space. For example, we have demonstrated that the creation of a different milieu through speaking or

not-speaking during a visit significantly impacted the perception of artworks, how their aesthetic quality was rated and how they were physically experienced (Tröndle et al., 2012b).

When addressing the movement and space in a fine arts museum besides the monumental, architectural and manifold social dimensions, another important factor must of course be considered: the artworks. Artworks create their own space around them, the space in which they exert an effect on the beholder (in detail see Tröndle and Tschacher, 2012). The specific arrangement/hanging of the artworks are also implicitly perceived and physically influence the spatial behavior of museum visitors (Tröndle et al., 2014).

In this article we will empirically investigate how the architectural and curatorial settings impact visitor attention, and reflect on how these findings fit into, and contribute to the discourse of spatial behavior and museums studies.

Theories on Spatial Behavior

Initially, we will introduce three concepts of environmental psychology that underline our understanding of space. Nearly 80 years ago, psychologist Kurt Lewin (1936) argued that an object can attract people (positive valence), can push people away (negative valence), or do both and thusly exert an ambivalent effect. According to Lewin, an object has a positive valence if it personally fulfills a requirement of an individual in a specific situation. For someone lost in a city, street signs will become objects with positive valence; they will attract the person who will read them for orientation purposes. Whereas, if someone knows the way, they will not even look at the street signs, they will neither attract nor direct attention. The character of an object changes in relation to the situation of the observer. Lewin named this ‘driving force’ character of an object, as ‘Aufforderungscharakter’, in English: invitation or request (Lück, 2007: 255).

George Barker, a scholar of Lewin, defined a behavioral setting as inhabiting structural and dynamic attributes (1968). The structure might be physical (the architecture), but also

temporal (e.g. opening and closing hours) and milieu specific, i.e. in a museum you normally do not run, eat or shout. Barker found that behavioral settings evoke ‘behavior units’, a discrete “bounded pattern in the behavior of men, en masse.” (ibid.: 18) Behavior units are attached to a particular constellation of non-behavioral, environmental phenomena such as artworks, information texts or the architectural layout of the exhibition halls, but also to the milieu of the museum (ibid.).

In coining the term ‘affordance’, James Jerome Gibson developed a theory of how an object or an environment (implicitly) affects and structures spatial behavior. He described affordance as follows: “Perhaps the composition and layout of surfaces constitute what they afford. If so, to perceive them is to perceive what they afford. ...Moreover it would explain the sense in which values and meanings are external to the perceiver. The *affordances* of the environment are what it *offers*...” (1977: 127). The active exploration of the environment is central to his concept: People move through the space and perceive objects and actions in relation to their situational needs. Gibson’s theory of affordance also emphasizes the interaction between the environment and the person perceiving. In a museum context, a text will slow you down while reading it (if you are seeking information); a doorway will make you walk through it and perhaps speed up your pace upon entering the next exhibition hall.

It is of note that the concepts of Lewin, Barker and Gibson, with their central terms ‘valence’, ‘standing patterns of behavior’ and ‘affordance’ all point in the same direction. They offer a fruitful theoretical framework for the interpretation of our empirical data to get a better understanding of the spatial behavior in a fine arts museum. By following these concepts with the application of a new methodology to collect empirical data, we aim to more deeply understand how environmental affordances influence the attention of the museum visitors towards the exhibits.ⁱ

Goals

The aim of this article is to investigate the influence of the architectural and curatorial layouts on the attention of the museum visitors. Contrary to a concert hall or a theatre, museum visitors must move to encounter exhibits in order to have an aesthetic experience. Just as in a concert situation, where the fluency of music is structured in time, a museum is structured through its spatial organization. The exhibition itself is spread out across various rooms, connected via passages, making the visitor move from one room to the other. At first glance, it seems rather obvious to point out that visitors have to move through the exhibition halls to see the exhibition. Our hypothesis, however, is that this movement in space has a larger impact on perception than has been widely assumed in museum or visitor studies.

By analyzing the movement data of visitors, we found that the spatial layout and the way the artworks were positioned have a strong impact on the distribution of attention. There seems to be a ‘hidden’ spatial layer in the museum that we refer to as a ‘space-cell’, for which almost no research has been conducted to date. Our analysis, therefore, concerns how movement and space influence visitor attention in a fine arts museum.

‘Attention’ is a key term in understanding the development of display techniques and visitor behavior in the museum. Indeed, the historical development of the fine arts museum can be read as a way of directing the attention more and more towards the exhibited objects, in order for them to evoke a stronger aesthetic experience in the beholder. Not only the architecture (symbolic, representational, ornamental) and presentation modes (curatorial staging, creation of specific atmospheres), but also visitation rituals themselves (slow, contemplative walking; silent or discreet communication), shows this tendency towards an increased focus on directed attention (Schwarte, 2010; Tröndle et al. 2012b). The manner in which the environmental layout influences the generation of attention can be understood as a crucial aspect of exhibition planning and visitor research.

Methods

It goes without saying that visitor research in (fine arts) museums has a long history. Since the studies of Gilman, Robinson and Melton, executed in the early 20th century in the United States, various researchers have dealt with this topic. Important protagonists in the field of visitor studies were e.g. Chandler Screven and Harris Shettel in the 1960s and 1970s, but only since the foundational work of John H. Falk, Lynn D. Dierking, Zahava D. Doering, Hans-Joachim Klein and others, has visitor studies systematically established itself as a field, since the 1990s. Nonetheless, in 1933 Melton already stated: “The routes and frequencies of stops before objects located in the galleries indicate that certain habits of the museum visitor, as conditioned by the architecture of museum galleries, are more important in determining the objects which receive the attention of the visitor and the order in which he views them than the differential characteristics of the objects exhibited.” (1933: 720)

Asking relatively simple questions such as “How do visitors occupy different gallery spaces? What makes visitors stop in particular areas? How do visitors decide where to go?”, Klein (1993: 784) tackled one of the topics that has been driving visitor research in museums since the beginning. Klein’s investigations included unobtrusive observations of the visitors which he then mapped as a sketched, graphical grouping upon a floor plan (ibid.: 785). Nowadays, in the age of digital information cartography, these drawings of visitor routes look rather rudimentary (ibid.: 769).

Choi (1997) investigated the influence of the spatial structure of the museum layout on visitor exploration and encounter. In eight museums, Choi observed 20 visitors each and marked their position on a floor plan at regular intervals. One of the findings was that the configuration of museum layouts provides the visitors with a structure to explore the environment.

Reviewing the concept of space syntax, Hillier and Tzorzi (2006) asked how spatial design influences the museum visitors’ movement through the exhibition spaces. For Hillier and Tzorzi, the space is structured in fragments, which they call visual fields (isovists). A

visual field is a unit that can be overseen by the observer when moving through the space, which is why it can change depending on the observer's location (ibid.: 282).ⁱⁱ

Wineman and Peponis (2010) further developed the theoretical conception of space syntax and spatial meaning. They describe it as a “[...] spatial discourse based on patterns of access and visibility that flows in its own right, although not entirely separate from the curatorial message.” (ibid.: 89) According to the authors, through an understanding of the space syntax, spatially guided movements can be created so that experience unfolds along the content and sequencing of exhibited objects (ibid.). They conclude:

We come to see that exhibition layout and the organization of space have intrinsic cognitive functions and implications that can interact with curatorial intentions in alternative ways. Museum studies can only benefit from a better understanding of how space functions as a medium in its own right, one which can support curatorial intentions in rich and subtle ways. (ibid.: 107)

Set-up of our Study

The aforementioned studies (e.g. Klein, Choi, Wineman and Peponis), as well as most other studies analyzing visitor behavior, have used eye-observation, b/w sketches of visitor movements on floor plans, and stopwatches (overview in Hillier and Tzorzi, 2006; Yalowitz and Bronnenkant, 2009). Researchers had to observe and follow the visitors unobtrusively in the exhibition halls, while documenting their spatial behavior.ⁱⁱⁱ With regards to the development of visitor research, some these studies were milestones. Tiptoeing behind the visitors whilst drawing paths or measuring how long visitors remain in front of exhibits by stopwatch, however, are rather imprecise means for data collection.

In the Swiss National Research project *eMotion – mapping museum experience*, the understanding of the museum as a place of manifold, interwoven spatial layers could be unveiled using the latest technology. Only recently and technical advances in tracking

technologies, as well as high-speed computers, have made it possible to survey visitors with a much higher degree of accuracy. Tracking frequency (up to one second); the precision of location (up to 15 centimeters / 6 inches); the number of participants (several in one exhibition hall simultaneously); and tracking each of them for hours if necessary, raises the accuracy and validity of this study immensely. Furthermore, translating the data digitally into cartographies limits the possibility of human error in comparison with analogue methods and hand drawn graphs. The application of these technologies supports some of the former research results from the field, but it has also revealed several differences concerning the impact of spatial layouts and exhibited objects on museum visitors.

In our study, every visitor who was 18 years or older entering the Kunstmuseum St. Gallen between June and August 2009 was asked if she wanted to take part in our research project. Participants had to speak German or English and, because of technical reasons, only visitors in groups of up to three people were allowed to participate. Visitors could only participate in the project once. Visitors who had agreed to participate received an electronic glove at the exhibition entrance that included measurement sensors and a sender, which transmitted data to wireless receivers. From these positioning data, we could infer movement speed and time spent in front of a specific picture or object.^{iv} This data was subsequently transformed digitally into mappings of the museum visitors' movement. Out of the 576 participants we randomly chose the exhibition tours of 50 people for the cartographies presented below.^v Our analysis of movement was accomplished through an explorative investigation of the movement data. The results presented below are therefore not driven by a clear hypothesis, but in-depth, deductive analyses, in order to gain an understanding on how space and objects influence visitor attention.

The Exhibition

The exhibition (specially composed for our research project) consisted of around 70 artworks.

The selected artworks were created between 1890 and 2008, and were of various styles, techniques and materials, stemming from the collection of the fine arts museum. Artists included Claude Monet, Max Liebermann and Edvard Munch, Ferdinand Hodler, Max Ernst, Fernand Léger, Le Corbusier, Paul Klee, Max Ernst, Andy Warhol, Roy Lichtenstein and others, representing different styles, periods, and materials. The show raised the issue of donations to the museum, which explains the rather mysterious title “11:1(+3) = Eleven collections for one museum”. 14 detailed wall texts informed the visitors about the various donors. The artworks were loosely hung in chronological order, starting with impressionism (SPACE 2) and ending with contemporary art (SPACE 8). Figure 1 gives an impression of the exhibition setting:^{vi}



FIGURE 1 VIEW INTO THE EXHIBITION SHOWS A SELF-PORTRAIT BY HODLER IN THE FRONT AND AN ARTWORK BY MAX LIEBERMANN ON THE RIGHT HAND SIDE (SPACE 2), THE PASSAGE TO SPACE 3, AND GIVES A GLANCE THROUGH THE DOORWAY INTO SPACE 4.

The Exhibition Space

In the entrance hall (SPACE 1), the entrance survey was conducted and the electronic glove

was donned. The museum visitors could move uninhibited throughout the exhibition halls (SPACES 2-8). In Figure 2 the artworks are indicated by dark grey, slim rectangles. Three benches are indicated by light rectangles. Black lines and circles represent the floor plan and eight columns. Visitors left the exhibition in SPACE 9, where the exit survey was carried out (not shown). The figure depicts the exhibition layout as a combination of open-plan exhibition areas (3, 5, 8) as well as rather directed ones (2, 4, 7).

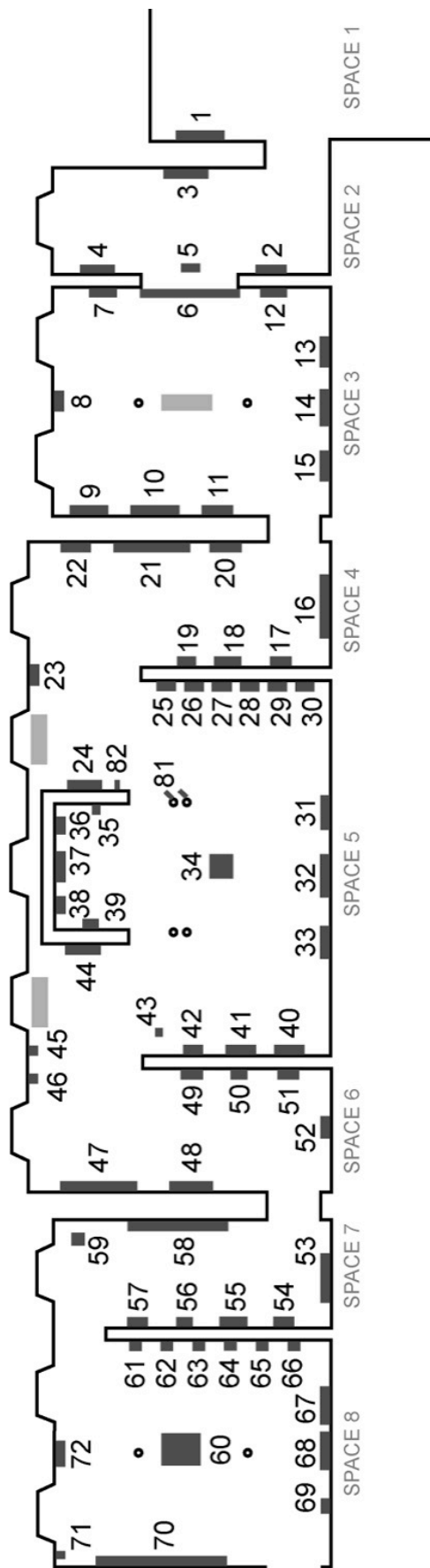


FIGURE 2 GROUND FLOOR, SPACES (1-8) AND ARTWORKS (1-72) OF THE ANALYZED EXHIBITION.

Results: Analyzing the Movement Data

In the following, we will investigate the spatial behavior of the museum visitors by analyzing their movement. As reported, every participant in our study wore an electronic glove on the right hand. Via an ultra wide band sender in the glove we could measure the exact position (up to 15 cm / 6 in) of each visitor once per second. These data points were then connected to visitor paths. The faster a visitor moved, the more faint and transparent the path appears in the mapping, the slower they moved, the denser and darker the path becomes (Figure 3a).



FIGURE 3A: MOVEMENT DATA ONLY OF 50 RANDOMLY CHOSEN VISITORS IN SPACES 1 AND 2. THE NUMBER OF 50 VISITOR PATHS WAS FOUND TO REPRESENT THE GENERAL MOVEMENT STREAM IN THE MOST ADEQUATE MANNER.

In the next figure (3b), we added the contextual information and randomly chose the data of another 50 visitors to raise the validity of our study and to show the similarities of the two

samples. The black lines represent the floor plan; the artworks are indicated by dark grey, numbered rectangles. The “T” indicates an informational text, which was given about the collectors. The movement stream is depicted as a black line:

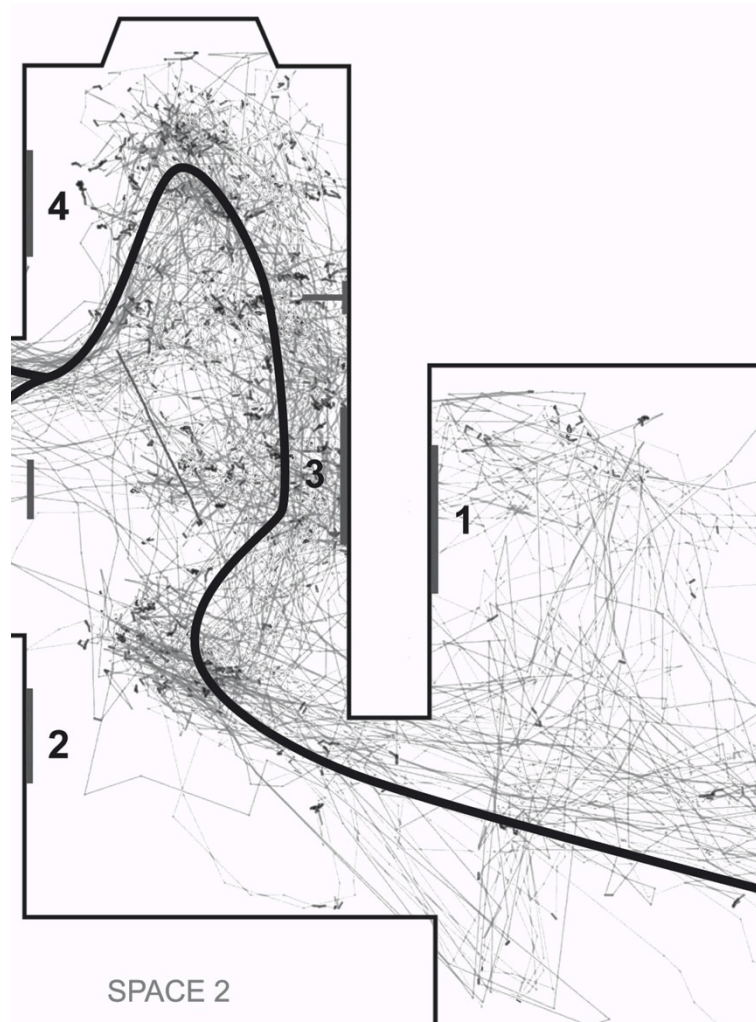


FIGURE 3B: CONTEXTUAL INFORMATION AND MOVEMENT DATA OF 50 RANDOMLY CHOSEN VISITORS ENTERING THE FIRST EXHIBITION HALL FROM THE ENTRANCE HALL.

Milieu

Taking a look at the visitor paths in Figure 3b, an obvious change is detectable: in the entrance hall (SPACE 1), the movement pattern seemed to be rather chaotic or diffuse, but upon entering the first exhibition hall (SPACE 2), it became more homogenous and showed some kind of rhythmicity. How can this abrupt change in the visitor behavior be explained?

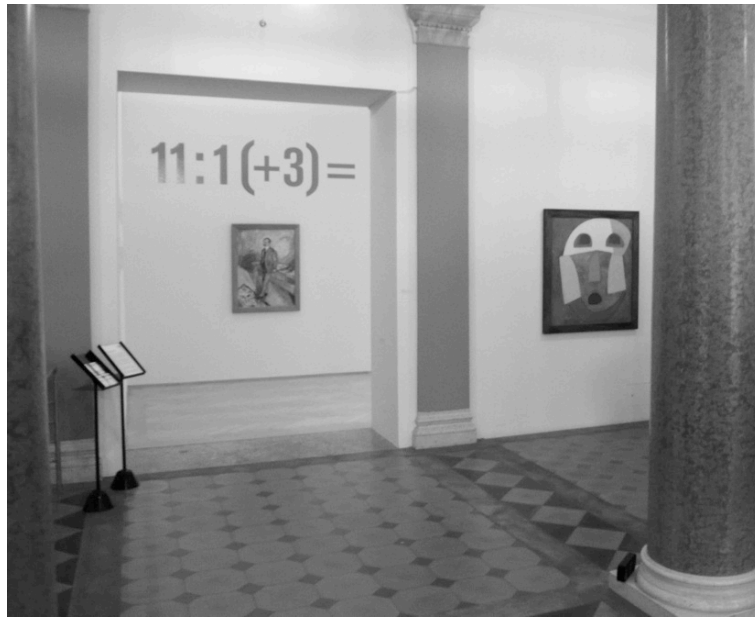


FIGURE 3C: THE ENTRANCE HALL AND THE DOORWAY TO THE FIRST EXHIBITION HALL. SELF PORTRAIT OF FERDINAND GEHR ON THE RIGHT HAND SIDE.

The large portrait by Ferdinand Gehr in the entrance hall (on place 1) hardly attracted any visitor attention. It seems that the entrance situation of the foyer did not generate a ‘milieu’ that made visitors stop to take a closer look at this painting. With regards to the rather diffuse behavioral pattern in the entrance hall, one can speak of a ‘behavior unit’ following Barker, which is characterized as chaotic and unfocused. This phenomenon is somehow understandable, given that the milieu of the foyer is influenced by the affordance of administrative acts (buying tickets, putting things into lockers/wardrobe, waiting for companions, etc.) in order to enter the exhibition.

The ‘positive valence’ of the passage was to urge visitors to enter the first exhibition hall (SPACE 2) and not view the painting beside the passage. All in all, the ‘milieu’ and the ‘affordance’ of the foyer did not create a contemplative viewing modality; as a result, the artworks in the foyer did not attract visitors’ attention. We considered the act of ‘paying attention’, when the visitors approached an artwork and stood still in front of it, in comparison

to other artworks, which did not produce this behavior, and they simply passed by.

The visitor behavior changes immediately upon entering SPACE 2 (Figure 3b). The visitors stopped, they turned to the right (an artwork by Monet was hanging in place 3), some took a look at the text (“T”), walked up to an artwork by Liebermann (place 4) and left SPACE 2 – nearly all in a single line on the right hand side of the passage. The walking paths towards the artworks as well as the stopping moments are clearly detectable. Here a dynamic and structured movement pattern evolved walking from artwork to artwork (place 2, 3, 4). Taken together, this produced a ‘rhythmicity’ in the walking behavior, demonstrating a stronger focus on the single artworks. Figure 3b displays two ‘behavior units’: firstly, the unfocused, rather diffuse entrance situation, and secondly, the rhythmical, more structured movement behavior in SPACE 2.

Text-Artwork Arrangement: Positive and Negative Valence

It is noteworthy, that after entering SPACE 2, all 50 visitors stopped at the same position, shown in the close-up below (Figure 3d):

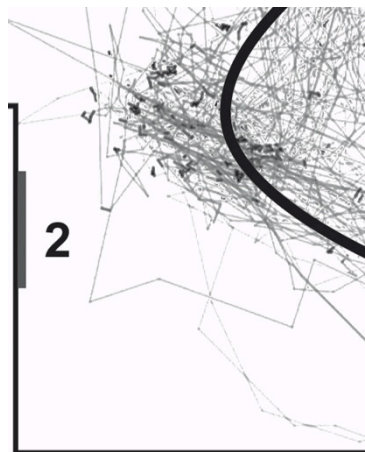


FIGURE 3D: CLOSE-UP, STOPPING MOMENT.

It is not only striking that the artworks produced a strong affordance, attracted the visitors and made them stay, creating such a rhythmicity, but also that only one visitor took a closer

look at the painting of Edvard Munch (place 2). Although Munch's paintings are some of the most expensive artworks on the market, visitors did not pay any attention to this first, prominently hung painting of the exhibition. The explanation for this phenomenon is that the visitors experienced the text-artwork-arrangement as a unity where the title typography dominated the space and was legible from a vast distance (Figure 3e). By contrast, the artwork itself, which one would have had to view up close, did not attract any visitors as a result of the text-artwork-arrangement. This is due to the fact that the exhibition title was written in large letters in the same corner where Munch's work was hung. The title worked as an orientation point and therefore caused a stopping moment (Figure 3c,d). Also the large graphic components created a 'spatial gap', pushing the visitors away, as such visitors did not get close to see the painting by Munch or reads its' label (Figure 3e). The 'negative valence' of the letters impact visitor behavior stronger than the 'positive valence' of Munch's painting.



FIGURE 3E: ARTWORK BY EDVARD MUNCH AND THE TITLE OF THE EXHIBITION IN BIG RED LETTERS ON A YELLOW PAINTED WALL AT THE ENTRANCE OF SPACE 2.

Orientation Point

Can this first finding on orientation points causing positive valence be supported in the following cartographies? Walking into the next exhibition hall SPACE 3, visitors saw works

from Ferdinand Hodler, Giovanni Giacometti, Cuno Amiet and Felix Vallotton (all 1899-1930). According to the curators, a ‘star’ was intended to catch the attention of the visitors, thus, the large and spatially dominating work “Linienherrlichkeit” (in place 10) showing a nude was hung in a sight line when stepping through the passage (see Figures 1 and 4a).



FIGURE 4A: “DER METTENBERG”; “LINIENHERRLICHKEIT” (PLACE 10); “DAS BREITHORN” (FROM LEFT TO RIGHT); ALL BY FERDINAND HODLER.

If this assumption is true, we should have been able to clearly detect an effect in the movement pattern of the visitors. However, when looking at Figure 4b, a different behavior became obvious:

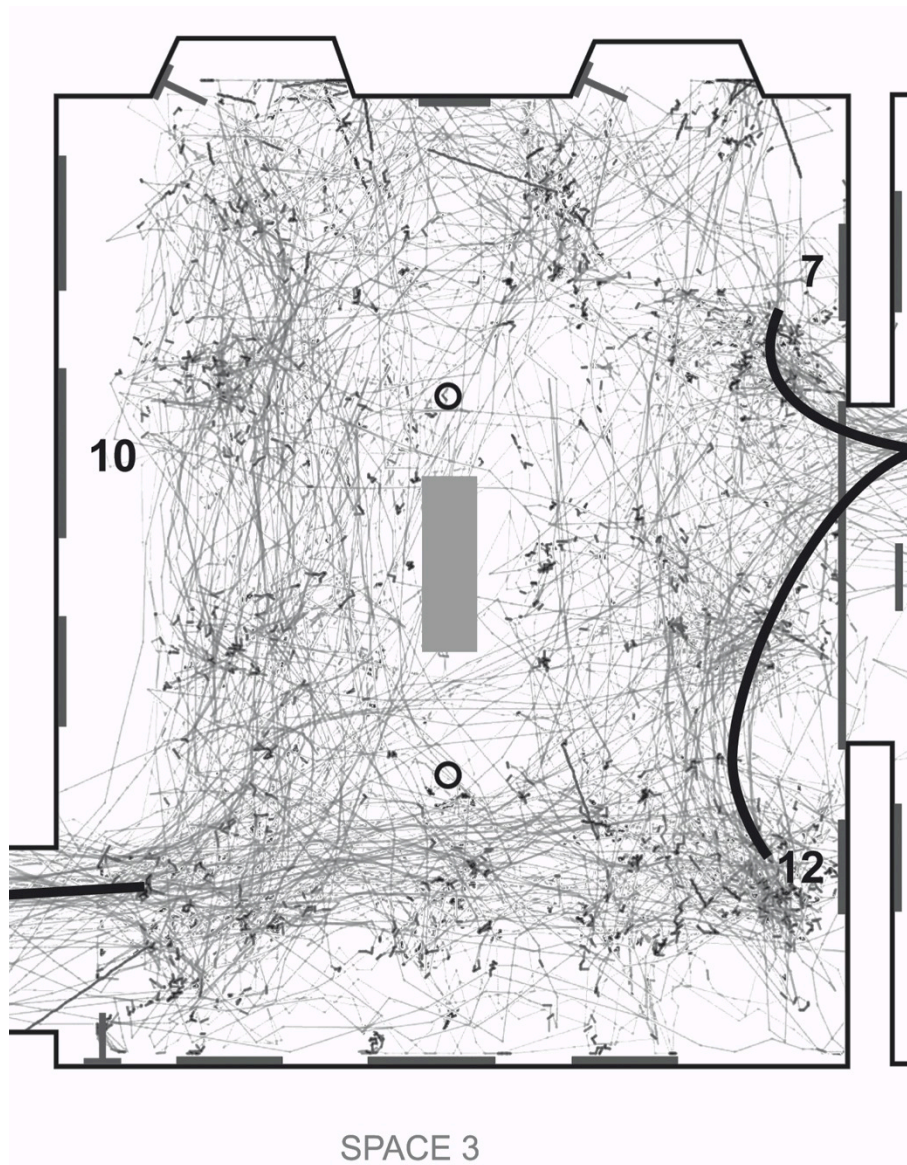


FIGURE 4B: MOVEMENT DATA OF 50 VISITORS IN SPACE 3.

Visitors entered the exhibition hall from the right hand side, coming from SPACE 2, but instead of being attracted by the dominant painting on the opposite wall, they either turned to the right (7) or the left (12) (nearly 50%) and stopped directly after traversing the passage (Figure 4b).

One could argue that this behavior was caused by the two artworks (one by Felix Vallotton in place 7, and the other by Giovanni Giacometti in place 12). As we can show, however, in the previous example and in forthcoming ones, the visitors seem to be attracted to the first possible stopping point upon entering a new exhibition space, irrespective of what is

actually there. In SPACE 2, this function of a reference or orientation point was the exhibition title; in SPACE 3 it was the two artworks on either side of the doorway. The orientation point seems to have a high positive valence (Lewin), attracting visitors and calling them take a closer look.

Orientation Point and the Organization of Movement

This orientation point also seems to be of high importance for the organizing of further movement. If an orientation point is not reachable at a short distance or if there are several, a chaotic behavior ensues. In SPACE 3, a mild diffusion is already visible: the visitors split into two groups and a few were undecided of where to move. This disorientation effect is even more visible in the next exhibition room, SPACE 4. Contrary to the former exhibition hall, SPACE 4 is not square-shaped but a rectangular room through which the visitors had to pass.

After passing through the door, the visitors had to decide whether to turn right to see the Le Corbusier (20); left for the Giacometti (16); or to go straight for the Léger (17). Figure 5a shows the effect the hanging had on the visitors' movement.

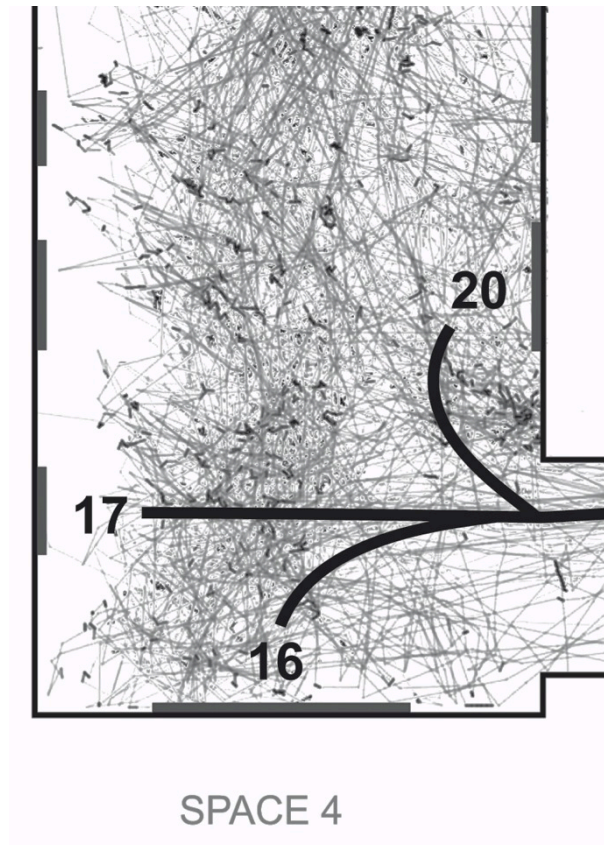


FIGURE 5A: MOVEMENT DATA OF 50 VISITORS IN SPACE 4.

The movement in SPACE 4 can be described as highly chaotic. Compared to the movement in front of the other artworks in SPACES 4 and 5, the visitors were neither attracted by the artworks, nor did they focus on them, their paths were rather dispersed. Only after leaving this spatial situation did the visitors' behavior become more directed and rhythmic once again (see 22, 23, 24, 25), focusing more intensely on the single artworks and texts (Figure 5b).

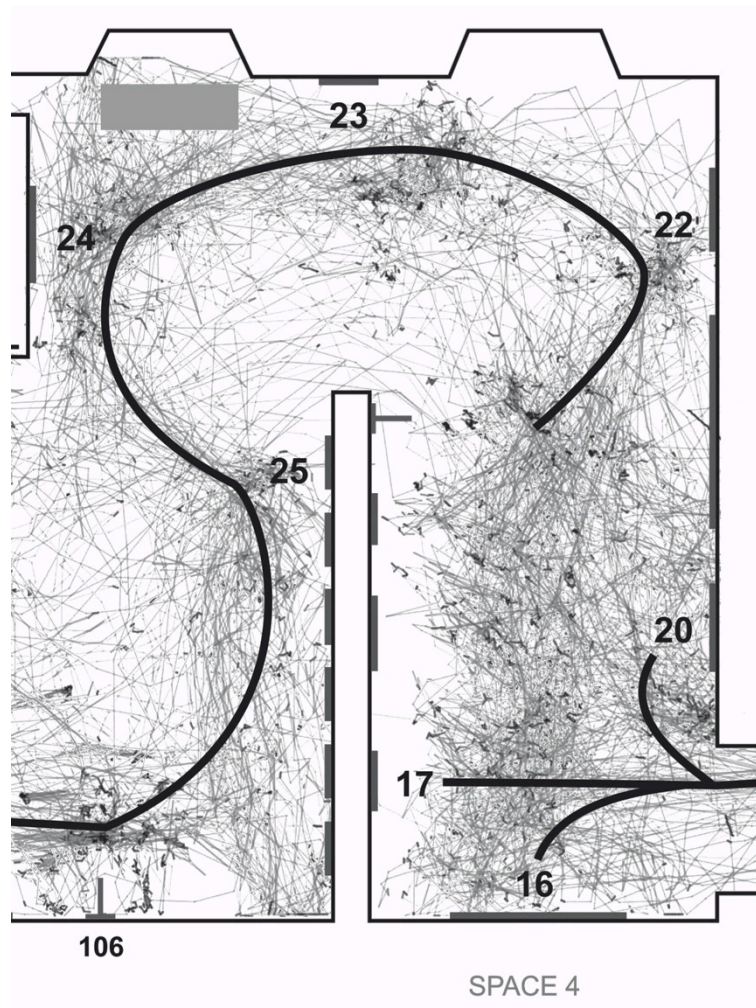


FIGURE 5B: MOVEMENT DATA OF 50 VISITORS IN SPACES 4 AND 5.

Space-Cells

Furthermore, we observed that visitors charted their way through the museum by orienting themselves to what they could oversee in their immediate surrounding, what we will call a ‘space-cell’. The architectural space (which we referred to as exhibition space, e.g. SPACE 2) may be, but is not necessarily equal to this space-cell. A space-cell is not identical with space segments, or rooms on a floor plan, it is rather, a ‘syntactic’ space by moving through the exhibition halls. As noted above, Barker (1968) had named this a ‘behavior unit’, namely, settings evoking a standing pattern of behavior. Wineman and Peponis (2010) spoke of a specific space syntax, comprised of overseeable units that create spatially guided movement. Hillier and Tzorzki (2006), defined it as a unit that can be overseen by the observer when

moving through the space. Here, we have been able to make these space cells visually observable, and for the first time show how they effect the locomotion, the direction of attention, as well the rhythmicity of the museum experience.

An exhibition hall may house one or several space-cells. In Figure 5b, it is the area around the works 16-20 – a space-cell characterized by a chaotic visitor movement. The next space-cell surrounds the works 22-24, showing a highly rhythmical movement and high attentiveness towards the exhibited artworks. Another space-cell is noticeable in front of a series of works (25 on-going) with the first artwork acting as the attraction point. The visitor movement then continues in a semicircle evoked by the artwork series and comes to an end with the text panel (T 106) belonging to the five works. Figure 5b shows that a space-cell can overlap or be part of two exhibition halls (places 22-24).

In SPACE 2 the exhibition space is identical with the space-cell, clearly marked by the stopping moment, followed by a dynamic and rhythmical movement pattern. In SPACE 3 space-cells are more difficult to uncover: after the two stopping moments behind the passage, the movement is slightly diffuse, probably due to the two reference points and to the fact that a walking direction was neither implicitly nor explicitly indicated.

Position or Reputation?

It seems to be clearly mirrored in the data how the exhibition architecture influences movement and ordering of attention. However, one could still ask if it is not the ‘quality’ or the reputation of the artist or artwork that is more influential, than its’ hanging and positioning in the architectural space. This can be answered then looking once more at the figures 4b. In SPACE 3 the artwork nude “Linienherrlichkeit” (place 10), was created by a far more renowned artist (Ferdinand Hodler) compared to the reputation of Felix Vallotton or Giovanni Giacometti, who made the two paintings which clearly attracted more people than Hodler’s work (place 7, place 12). According to art-historians, Hodler is also more highly appraised

than Vallotton or Giacometti. The positioning seems to have more impact than the artist's reputation or the actual image, even in the case where one artwork shows a large nude, and the other two smaller sized artworks 'only' display portraits of (unknown) persons.

The result above is replicated in figure 5b. Here, Augusto Giacometti, Fernand Léger and Le Corbusier (place 16, 17, 20) did not attract the attention of the museum visitors. Whereas the artworks of less renowned Swiss artists Walter Kurt Wiemken and Otto Tschumi (place 21, 22) are able attract and hold visitors attention.

SPACES 6, 7 and 8

Figure 6 further supports these findings as to the existence and the structuring power of space-cells, displaying such spatial behavior in SPACES 6, 7 and 8. Nearly identical spatial behaviors can be seen in SPACE 4 and SPACE 7, both of which had the same spatial layout and similar hanging order (Figure 8a). Visitors entered from SPACE 6 (see Figure 6), where in the beginning, the spatial behavior was focused on the artworks (47, 48, 49). Subsequently, the walking paths lose their rhythmicity due to the information text (T 110), which distracted attention from the artworks on the other side (49 and following). Walking through the doorway into SPACE 7, the dominant behavior was omnidirectional (as in SPACE 4, visitors were seeking an orientation point). Some turned to the right (53, artwork by Peter Phillips), some went straight (54, artwork by James Rosenquist) and some turned left (information text T 111). In the beginning of SPACE 7, visitors displayed diffuse and unfocused walking behavior (Figure 6):

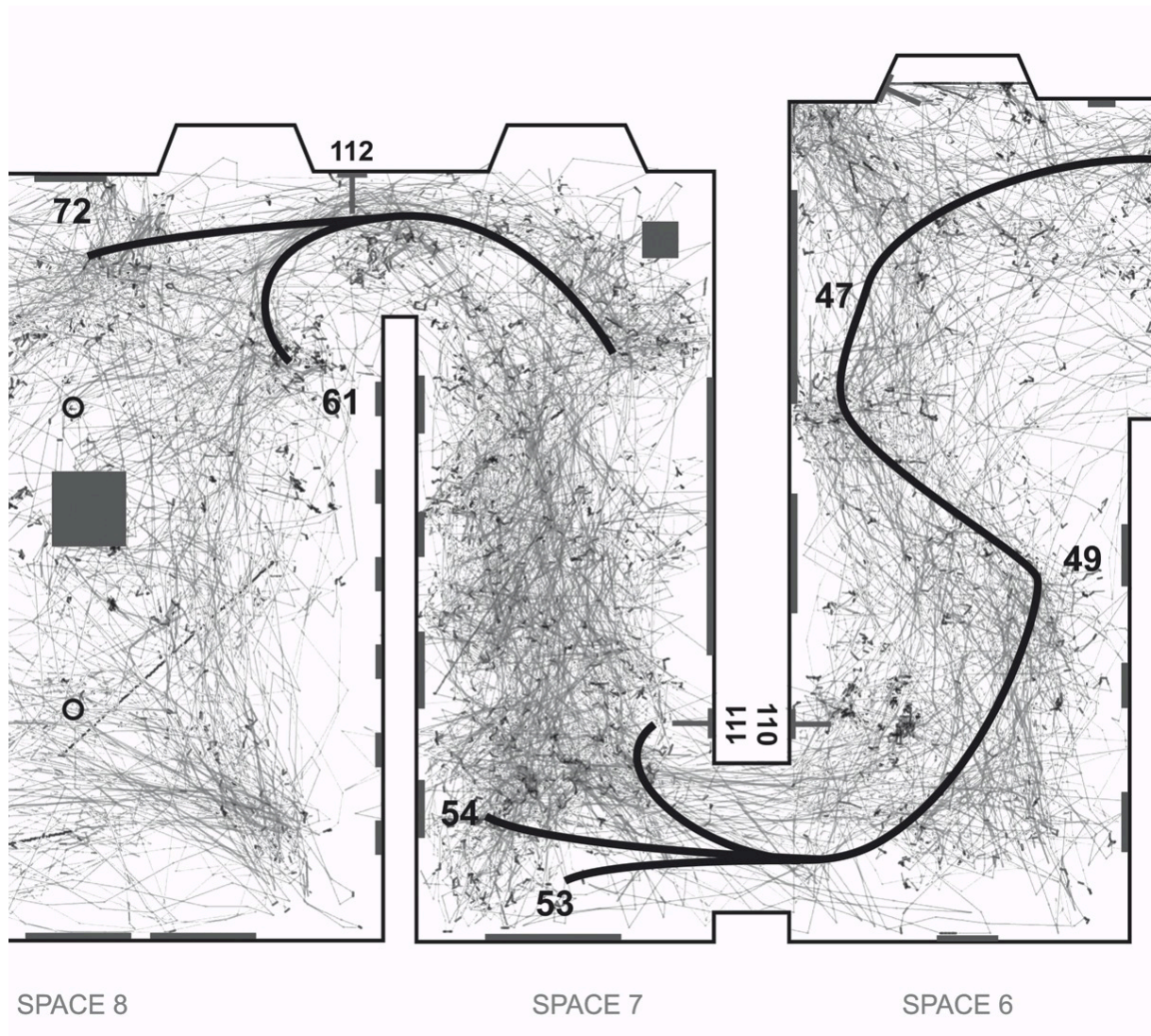


FIGURE 6: MOVEMENT DATA OF 50 VISITORS IN SPACES 6, 7 AND 8.

The paths once again became more rhythmical upon leaving SPACE 7, visible in front of the information text (T 112). When looking at SPACE 8, one can detect similarities to the movement behavior uncovered in SPACE 3. In SPACE 8, the audience also splits into two groups of nearly the same number. One group turned to the right (artwork by Ingrid Calame, 72), the other to the left (artwork by On Kawara, 61), subsequently, the visitors in both groups stopped. Like the series of artworks in SPACE 5 (25 on-going), the first artwork of the series of six by On Kawara (61 on-going) in SPACE 8 attracts most of the visitors and produces a stopping moment. Afterwards, they walk in a semicircle to see the other artworks from that

series.

Proximity: Closeness – Distance

Analyzing the visitors' paths, we found another peculiarity: Different artworks required different distances from which they should be observed (cf. O'Neil 2012, Schittich 2009). A painting might be very detailed and the observer would have to stand close to the artwork to see the imagery. Max Liebermann's painting "Atelier des Malers am Brandenburger Tor in Berlin", 1902 (Figure 1) is exemplary in this regard; Figure 7a shows a close up of that painting.



FIGURE 7A: MAX LIEBERMANN, "ATELIER DES MALERS AM BRANDENBURGER TOR IN BERLIN", 1902.

The artist can be seen in the painting as a reflection in the mirror, his wife and his daughter are sitting on the sofa and his dog sleeps on the chair; as a result, the visitor can only read/comprehend this artwork in close proximity. Within the global context of the exhibition (the interplay of collector/donators, the artists, and the museum), the painting was part of a thematic prelude in the first exhibition hall, portraying the scenery of an artist's studio.

Another artwork shown in Figure 1 represents the opposite requirement, the female nude “Linienherrlichkeit” (Beauty of lines) by Ferdinand Hodler (see also Figure 4a), where it best takes effect when observed from a distance. To implicitly influence the visitors’ behavior, the curators positioned a bench in front of the work that should stop the visitors and put them into a position to observe the painting from a distance (Figure 7b):



FIGURE 7B: “DER METTENBERG”; “LINIENHERRLICHKEIT” (PLACE 10); (FROM LEFT TO RIGHT); BOTH BY FERDINAND HODLER AND A BENCH.

Were the museums visitors aware of the necessity of varying ‘optimal’ distances for artworks to best take effect? Analyzing the close-up (Figure 7c) of Figure 4b reveals that the curators’ aim was not attained. Nearly no visitors took a seat on the bench (light grey rectangle), nor did they observe the painting from the necessary distance for maximal effect. Instead, they stood rather close to the artwork and read the label on the right hand side of the painting, indicated by the clustered paths (Figure 7c):

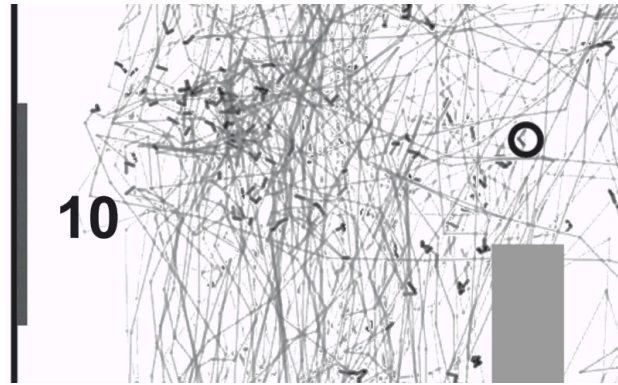


FIGURE 7C: MOVEMENT DATA OF 50 VISITORS IN FRONT OF “LINIENHERRLICHKEIT” BY FERDINAND HODLER. THE GREY RECTANGLE INDICATES A SITTING BENCH.

Looking at another close-up (Figure 7d), it becomes evident that the visitors showed a similar behavior in front of Max Liebermann’s painting. They observed this artwork at more or less from the same distance, which was too far to discern the studio scene. Only three visitors of our sample of 50 approached the work closely (Figure 7d):

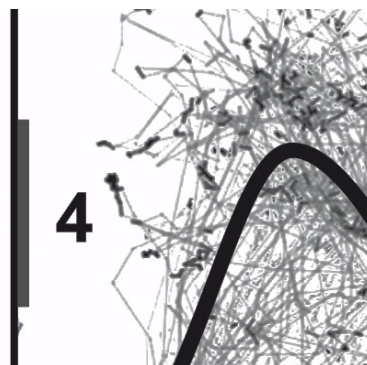


FIGURE 7D: MOVEMENT DATA OF 50 VISITORS IN FRONT OF MAX LIEBERMANN “ATELIER DES MALERS AM BRANDENBURGER TOR IN BERLIN”.

These two examples show that most of the visitors did not observe the artworks from an appropriate distance. Several other examples for such behavior can be found in our data. What these two paintings exemplify, is the necessity for arranging the observation distance in a fine arts museum more carefully. With regards to Barker, it should be asked how the ‘standing patterns of behavior’ could be organized discretely, so that artworks could be observed from

an adequate distance to take maximal aesthetic effect.

Discussion

By using latest tracking technology and digital mapping tools, we have shown in a detailed manner, that the affordance of the museum environment strongly effects visitor movement, whereby the attention towards objects, the itinerary, and the intelligibility of the exhibition are influenced. This is in accordance with Wineman and Peponis (and others) who found that “the unfolding paths of visitors offer spatial affordances that in turn begin to inform their subsequent choices.” (2010: 104). Our results, however enlarge the already existing theories and findings, in the following manner: A museum might be conceived as a space of interwoven layers, including the force fields of single artworks, groupings of artworks (such as series, or compositional hangings), the social and the individual space, etc. – all of these elements impact the museum visit. In addition, we discovered a new, and only rarely discussed space layer, namely the space-cell. Space-cells are not necessarily identical with the architectural space, for as we have seen in the cartographies, a space-cell is a particular territory that can easily be overseen and has specific characteristics. It can be created, for example, by a series or an ensemble of artworks evoking the visitors’ (unconscious) process of orientation in the exhibition halls, forming part of how they experience the space via their movement. A space-cell is marked by an orientation point at its beginning, subsequently the visitors’ movement shows a cell-specific pattern. This finding relates to earlier concepts of behavioral units (Barker) or space syntax (Wineman and Peponis).

The advantage of the methodology we used in this study, was that it allowed us to empirically detect ‘standing patterns of behavior’ (Barker, 1968), which are evoked by each space-cell: As soon as visitors entered a space-cell, they stopped at the first reference point to orient themselves. It did not matter if this was a text or an artwork. Every artwork or object that was positioned there, would gain attention, irrespective of its quality, size or other

attributes.

After looking at this object, visitor movement through the museum space became highly rhythmical and focused on the exhibits if the space-cell was well organized. This pattern, as well as the focus towards the artworks was maintained throughout the whole cell. On the other hand, when there was no clear landmark or sequential arrangement, behavior was diffuse or even chaotic; the attention did not seem to be focused on the artworks either.

By building space-cells, one develops the *rhythmicity and dramaturgy of the museum visit*, but also directs the attention to specific exhibits and includes several exhibits into one unit. In particular, if the exhibition has a narrative or thematic thread (where perhaps visitors should even observe the artworks in a specific sequence), our findings on space, movement and attention are of high relevance in exhibition planning and curatorial studies.

We also found that when planning an exhibition, curators should focus more on the organization of the visitors' spatial behavior with respect to the artworks' individual necessity of *proximity and distance*. Most of the visitors did not respond to this essential position of aesthetic viewing and therefore the exhibited artworks did not attain as much 'force' as they could have. Lastly we have shown that the aesthetic viewing mode requires a *milieu* through which a specific visitor behavior may evolve, for example, the foyer that is still part of the museum, did not work as such.

Acknowledging the great work of scholars in the field of visitor research up to now, we might state, that the findings presented here on 'Milieu', 'Text-Artwork-Arrangements', 'Reference / Orientation Point', 'Space-Cells', 'Proximity: Closeness – Distance' have been empirically demonstrated for the first time. The research not only provides a strong foundation for the theories of Lewin, Barker and Gibson, but also leads to a manifold of practical implications for exhibition planning. On the other hand, arguments that have been cited for many years, such as, that museum visitors would always turn to the right-hand side after entering a space could not be verified. Visitor behavior is more complex. Overall,

Melton was already correct when he stated in 1933, that the architectural layout might be more important on directing visitors' attention than the characteristics of the objects exhibited, but Melton and his followers did not have the methodological tools available to them for empirical validation. Therefore, we believe this article to be an important contribution to the field; firstly to empirically ground some of the aforementioned theories, but also to refine and enlarge them by developing a more nuanced understanding of spatial behavior in museums. Going beyond pure eye-observations, and pencil sketches, the technology deployed allowed our study to generate new insight and formulate new theories on visitor behavior.

The 'take home message' for curators and exhibition planners can be summarized as follows: The attention economy in the milieu of a fine arts museum is highly driven by walking patterns. Walking patterns are evoked via space-cells. Ideally, each space-cell starts with one reference point. The reference point is the one object catching attention that is the closest to observe when a visitor enters a new space-cell. Whatever object is put on display at this location will be noticed. Reference points inhabit a stronger positive valence than sight lines or curatorial groupings. If an exhibition narrative (thematic, timely, aesthetical etc.) is planned, visitors should be guided implicitly from cell to cell via a dynamic and structured rhythmicity of the hangings and placements. Typography, groupings/ensembles and series evoke strong standing patterns and may produce negative valences. Diffusion and un-attentiveness should only be created intentionally.

Limitations and Outlook

It must be stated, that these findings arose from a pilot study in a fine arts museum in Switzerland, in one particular exhibition, and one specific spatial situation; any generalizations can only be made carefully. On the other hand, we assume that this spatial behavior may also be observable in other museums and in other countries. The behavior we

found here is not bound to art objects per se, but can be classified, rather, as anthropological. It seems evident to first stop and orient oneself in an unknown territory and to experience it from the point of where you stand, the reference point; the evolving pattern of movement will be determined to a large degree by the presentation of the exhibits.

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Endnotes

ⁱ Very few studies also empirically analysed visitor movement through exhibition halls and tried to identify factors such as exhibits, socio-demographics, or personality traits influencing the spatial behaviour (Imamoğlu and Yilmazsoy, 2009; Umiker-Sebeok, 1994).

ⁱⁱ For further Information on space syntax and current research see www.spacesyntax.net

ⁱⁱⁱ An exception is the study from Lehn (2006), who conducted an experimental video-based study to analyse how museum visitors interact with the artworks as well as with their companions and other visitors. Also handheld computers are used to record visitor behaviour, but there is still someone walking behind the participant, trying to stay out of her line of sight (Arnsdorf 2010).

^{iv} In this article, we will only analyse the movement data; not the data obtained by the physiological measurements or the questionnaires. Tröndle et al. (2012a) present the technical development and set-up in detail and discuss its scientific reliability.

^v For a description of the development of the cartographies see Tröndle et al. (2011).

^{vi} For further images on the exhibition see www.mapping-museum-experience.com/presse