Examining the Effect of Visitor Motivation on Observed Visit Strategies Using Mobile Computer Technologies

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Abstract

This paper examines the interaction between visitor motivation and in-museum visitor behavior. We postulate that, in order to understand this aspect of the dynamics of museum visiting, we need to view the motivations to visit the museum as both lists compiled by individual visitors but also as part of wider lists of reasons for visiting that exist in society—which we refer to as *cultural itineraries*. Self-report methods have been used to capture patterns of motivation that emerge across the data, which in this case were used to examine their relation to visit strategies as manifested by visitor pathways through the museum. Visitor pathways were captured through the novel use of mobile location-sensing technology which offers distinct opportunities in this context that have been unexplored by audience research. The combination of standard research methodology and automated location tracking employed by this study allowed us to indentify two distinct visit strategies that directly relate to social groupings with different motivations: (a) groups with an education/participation motivation, who visit exhibits only, and (b) groups with a social event motivation, who spend a considerable amount of time on non-exhibit related activities and socializing with other family members and friends.

Keywords: motivation, cultural itineraries, visit strategy, visitor in-museum behavior, automated visitor tracking, pervasive computing

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Visitor motivation has been linked with in-museum visitor behavior. In particular, research indicates that visitor motivation and visit strategy interact in complex ways and influence visitor behavior and learning (Falk, Moussouri, & Coulson, 1998; Moussouri, 1997, 2003). However, little concrete evidence exists to help us understand how these dimensions of visitor agenda, namely motivation and strategy, relate to each other. This is not surprising given how demanding is the collection of accurate tracking data in terms of time, resources, and effort and, thus, overall cost to the museum, especially when large numbers of visitors are involved or tracking must cover its entire public space over the full length of each visit (Falk et al., 2007; Yalowitz & Bronnenkant, 2009). An opportunity to remove this barrier is offered by recent advances in mobile computing technology, which have made practical the automatic or semi-automatic collection of accurate location data from a large number of visitors over extended periods of time and their efficient processing using software. In this paper we take advantage of this opportunity to investigate this until-recently intractable question about the relation between visitor motivation and strategy.

The main aim of this paper is to examine how visitor motivations, as expressed by visitors themselves, relate to observable aspects of visit strategies manifested by the paths they take through a museum. In this context we understand strategy as “a pattern in a stream of decisions” (Mintzberg, 1978) rather than an a priori constructed plan of action. Indeed, this work demonstrates that there is a direct link between motivation and the routes visitors follow: Family groups with an education/participation motivation visit exhibits only, whereas groups with a social event or entertainment motivation spend a considerable amount of time on non-exhibit related activities and socializing with other family members and friends.

Furthermore, with this paper we aim to contribute to the current discourse on the role of motivation in museum visiting in its sociologically-informed view of visitor motivation. In contrast to other visitor studies that approach visitors merely as individuals or small groups that go to a museum and engage with its content in their own particular ways, our study places museum visiting in a wider sociocultural context (Fyfe, 2011). Hence, we approach motivation as a culturally determined set of reasons—conceptualized as "cultural itineraries" (Macdonald, 1993)—that also appear on individual visitor lists and represent the perceived place and role museums play in people's social life. Finally, while our main focus remains firmly on our main research question, this paper also makes a strong statement in favor of the incorporation of mobile visitor tracking technology within standard visitor studies methods. Indeed, this work shows that this technology allows access to rich data sets affordably, thus opening up new opportunities for the exploration of the dynamics of museum visiting.

This paper begins with a brief overview of the existing literature on motivation and leisure choices. Within the context of our research, the concept of cultural itineraries is discussed in some detail, using findings from motivation studies we have conducted in a wide range of different museums and with different audiences. Previous work on visit strategies are also discussed which, together with cultural itineraries, provides the rationale for our methodological approach. Our method refers to automated visitor tracking technology that made feasible the study of how motivation and visitor pathways interact over the entire length of the visit, with a relatively large group of visitors, followed by a report of the results of a study conducted at the London Zoo. We conclude with a discussion of key points raised by the findings and their implications for future research and practice.

Visitor Motivation

A number of researchers—such as Hood (1989), Csikszentmihalyi and Hermanson (1995), Doering and Pekarik (1996), Falk (2006), Falk, Moussouri, and Coulson (1998),

Rounds (2006), Macdonald (1992), Moussouri (1997, 2003, 2007), Packer and Ballantyne (2002), and Packer (2006)—have looked at motivation as a way of understanding why people engage in various cultural and other leisure activities, and the impact these activities have as a factor of motivation. Hood's (1989) groundbreaking research into what motivates families to visit museums has been very influential in the way we approach museum participation (and nonparticipation) by taking into account visitors' leisure criteria. Her study showed that families value leisure time experiences that involve social interaction, active participation, and entertainment. The importance of the social aspect of the visit also was highlighted by other studies carried out in museums (McManus, 1992), and has been associated with participation in and appreciation of the arts, heritage, broadcasting, and sport (Harland et al., 1996).

Csikszentmihalyi's pioneering research into intrinsic motivation is of particular relevance to museums, owing to the free-choice nature of the experience. Looking at what motivates people to pursue a wide range of activities even in the absence of any extrinsic rewards, Csikszentmihalyi and Hermanson (1995) used the term *flow* to describe "a state of mind that is spontaneous, almost automatic, like the flow of a strong current" (p. 70). This state is characterized by the ability of the individual involved in the activity to "fully express the self" (differentiation) and "to feel connected with other entities" (integration). When an individual is in flow he or she loses the sense of time and the sense of self. Csikszentmihalyi and Hermanson claim that the "dialectic between integration and differentiation is the process by which we learn" (p. 71). Thus "the key to 'flow' activities is the growth of the self" (p. 71). More recently, other approaches have focused on the role the self plays in shaping visitor motivation. Falk (2006) and Rounds (2006) have both used identity (seen as a psychological construct) as the prism to examine the meaning people make during and beyond their visit to a museum.

In contrast to the above, other studies have examined motivation in relation to the wider cultural context (not necessarily related to learning). More sociologically-informed studies, for example, have looked at visitor motivation as a factor of the ways visitors perceive the world around them. Looking at a decade's worth of visitor research conducted in Smithsonian museums, Doering and Pekarik (1996) used "entrance narratives" as a model to describe the type of roles museums play for their visitors. Entrance narratives compose the ways people perceive and interpret the world (basic framework), their knowledge of any given topic (that is shaped by the basic framework), and "personal experience, emotions and memories that verify and support this understanding" (p. 261). Hence, according to this approach, more often than not people visit exhibitions to confirm prior ideas about the world. Furthermore, Doering and Pekarik (1996) make an important point regarding the demographic characteristics of museum visitors: The level of formal education is a factor in predicting visitation patterns. Although there are variations across museums (Davis, 1994), this observation seems to be confirmed by studies conducted in museums of different types, sizes, and location (Hooper-Greenhill & Moussouri, 2001a, 2001b; Moussouri, 1997, 2003, 2007). Hence, although demographic characteristics alone may not be a good predictor of what visitors do during their visit and beyond, they define the people whose motivations we are examining and may play a role in determining which types of organizations (including museums) people have access to and use.

Similarly, Macdonald's research (1992, 1993, 1995; Macdonald & Silverstone, 1990, 1992) at the Science Museum, London, showed that visitors' motivation for visiting indicated the existence of "a more general set of cultural projects about museums—about museums' perceived place in social life according to their visitors" (Macdonald, 1993, p. 12). Using Lave's (1998) idea of *list*, Macdonald viewed visitor motivations as "cultural itineraries." According to Macdonald,

> the idea of itineraries...make[s] it possible to think about motivations to visit the museum as both somehow slotting into wider sociocultural patterns—the idea of lists being somehow "out there" being evident in visitors' own articulations—as well as giving ample space for considerations of visitors' own strategies for compiling their own individual lists or itineraries. (1995, p. 16)

In the case of the Science Museum, visitor itineraries included the follow "for a museum to attract visitors, the more cultural itineraries on which it features—and the higher up on each it is—the better." Hence, where the itineraries intersect, visitors' motivation for visiting is even stronger. Furthermore, she postulated that the dominant itinerary is likely to affect the frequency of visiting. The latter point is supported by Merriman's (1991) study and our own research (Moussouri, 1997), which also has highlighted a close link between motivation and frequency of visiting.

Rationale for the Study

Using Macdonald's concept of cultural itineraries to conceptualize motivation, this study examined how motivation and visitor routes interact during a visit. It is based on previous research we have conducted—both independently and with other researchers—in a large number of museums and with different types of visitor groups (Falk et al., 1998; Hooper-Greenhill & Moussouri, 2001a, 2001b; Moussouri, 1997, 2003, 2004, 2007; Moussouri & Johnsson, 2006; Osborn, Deneroff, & Moussouri, 2005). To date we have identified 11 distinct categories[1] (Table 1). These are: education/participation, place, social event, life-cycle, entertainment, flow, biophilia,[2] introspection, political/participation, and therapeutic.

== Insert Table 1 about here ==

[1] In all but one (Falk et al., 1998) of the studies we have conducted, information on visitor motivation is collected as part of an open-ended interview in which visitors are encouraged to express their motivation in their own terms, and while they respond to a series of questions not necessarily related to the purpose of their visit.
[2] *Biophilia* is the term used by Edward O. Wilson (1984) to describe what he believes is our innate affinity for the natural world in his book, *Biophilia: The Human Bond with Other Species.*

Some of these itineraries can be found in almost all types of museums, ranging from science and children's museums to art, history, and archaeology. These are: education/participation, social event, life-cycle, place, entertainment, and practical issues. Others seem to be related to particular types of museums, depending on the subject matter, content of their collections, and, to some extent, their location (e.g., being able to enjoy nature in the middle of a big city when visiting London Zoo). There is also evidence that the image of the museum can influence the occurrence of certain related motivations. For example, biophilia is more common in zoos, aquaria, parks, and other nature centers. Introspection is more likely to come up in museums or exhibitions with a history or social history focus, while flow comes up in art museums and collections. Political/participation as a motivation for visiting has been associated with a social or political cause (raising environmental consciousness or fighting discrimination or exclusion) and reflects an expressed wish to take action with the aim to affect the well being of somebody's natural, social, and cultural environment or heritage. This has come up in a social history museum and a zoo. Visitors also refer to constraints or other practical issues—such as free entrance, accessible location, weather conditions, and distance to travel—that play a role in their decision to visit a museum on a particular day.

A common finding across all studies we have carried out is that people have multiple motivations for visiting. That is true for family groups (Moussouri, 1997, 2003, 2004, 2007), adult visitors (Falk et al., 1998; Hooper-Greenhill & Moussouri, 2001a, 2001b; Moussouri & Johnsson, 2006), and school children and their teachers (Osborn et al., 2005). Furthermore, our research (Falk et al., 1998) has shown that they do not perceive these reasons (i.e., wanting to learn and have fun) to be conflicting. This is supported by other studies (Packer 2006; Packer & Ballantyne 2002). Finally, there is an indication that the type of visitor group

we target may have a lot to do with how motivations are described and prioritized, or, indeed, how they might co-exist.

Earlier research (Moussouri, 1997) demonstrated that, together with motivation, visit strategy is a key aspect of the visitor agenda. It also indicated that visitor motivation may shape strategies for the visit, particularly in the case of frequent museum visitors. This relation between motivation and strategy was further explored and established for frequent visitors in a follow-up study (Falk et al., 1998). However, the latter study was based on self-reported visit plans rather than observation of visitor pathways. In the former study (Moussouri, 1997), *visit strategy* referred both to a specific plan of how to experience the museum articulated by visitors themselves and also to observable behavior manifested by visitors' movements through the exhibition space, recorded through tracking. Employing interview and observation data, the earlier research identified three types of strategies along a continuum from open to fixed. Visitors with an open strategy are generally unaware of museum/exhibition opportunities and are open to experiencing whatever the museum has to offer, at least in the early stages of their visit. Visitors with a flexible strategy are aware of museum/exhibition specifics—they may have even planned on seeing a particular exhibition during their visit—but a specific exhibition or aspect of the museum did not represent their sole, or even primary, purpose for the outing. No clear link has been established between these two strategies and motivation, although there is some indication (Moussouri, 1997) that in the case of visitors with a flexible strategy the social aspect of the visit could be a motivation for visiting. Finally, visitors with a fixed agenda plan their visit before they go to the museum. Typically, they have a visit routine which they follow and often this is to the exclusion of other things the museum might have to offer. Visitors who fall into this category tend to have an education/participation motivation.

The work by Moussouri (1997) provides a strong indication that certain types of motivation may be associated with particular museum visiting strategies. To further investigate this link, we set out to examine the relation between visitor motivation and observable strategies in more detail, using the London Zoo as the setting. In this case, we only consider the observable aspects of visitor strategies, as revealed by their detailed visit routes recorded using location-sensing technology on mobile phones. A significant methodological question in this context has been how to extract a description of the strategies observed from the recorded data, which we discuss in detail in the following section.

Method

We combined concepts developed in our previous work on visitor motivation (Moussouri, 1997, 2003, 2004, 2007) with data about visitors' usage patterns collected at the London Zoo, as manifested through their pathways, with the aim to identify different cultural groupings. From a methodological point of view, we combined a naturalistic approach to explore visitor motivations with a quantitative approach to record visitor routes and characterize the respective observed visitor strategies. Self-reporting, specifically Personal Meaning Mapping (PMM) and informal interviews, were used to elicit motivations, and GPS tracking and timing was employed to capture location trails, which were subsequently processed using the techniques provided by an analytics platform developed by Audience Focus to characterize visitor strategies (Kostakos et al., 2011; Papadogkonas et al., 2008).

Visitor Motivations

We approached family groups as they were entering the Zoo and explained the purpose of the study and what their participation in it would involve. Forty-six family members were approached as they were queuing to enter the Zoo. All adult members of the groups approached gave their consent to take part in the study; there were no refusals. Parents or other guardians gave consent for babies or very small children in their group. However,

children also gave verbal consent. Upon giving their consent, families were offered free entrance to the Zoo and were escorted to a sitting area near the main entrance. Participating families were asked to complete a PMM, using *London Zoo* as a key word. Each family member was asked to write down any ideas, thoughts, feelings, and images that came to mind in relation to the key word on his or her own Personal Meaning Map (see Appendix A). On the PMM sheet there is also a list of prompts with terms selected to encourage visitors to record their understanding of London Zoo. The words, ideas, images, phrases, or thoughts used by the visitor then formed the basis for an open-ended interview (see Appendix B) that focused on motivation and expectations from the visit. In particular, visitors were encouraged to explain why they wrote down what they did and to expand on their thoughts or ideas relative to what they expected to do or see in relation to each word or phrase, as appropriate. Their responses were recorded on the same piece of paper using their own words and their own conceptualization. The same process was followed after the visit. Participants were asked to review their previsit map and add any further words, ideas, images, phrases, or thoughts they might have.

PMM has mainly been used to measure learning by assessing levels of understanding across four semi-independent dimensions: (a) the extent of someone's knowledge and feelings, the use of appropriate vocabulary; (b) the breadth of one's understanding, the range of someone's conceptual understanding, (c) the depth of one's understanding, how deeply and richly someone understands the concepts they use; and (d) mastery, the overall facility with which someone uses their understanding (including the emotional intensity associated with someone's understanding). The last is a holistic judgment that qualitatively takes into account the extent, breadth and depth of someone's knowledge. Moreover, PMM data have typically been analyzed in a quantitative way (e.g., Adelman, Falk, & James, 2000; Falk et al., 1998). In this study it has been adapted and used as the basis for a semi-structured

interview aiming to reveal participants' prior knowledge, interests, imagined visit routes, and expectations of the visit. Finally, the PMM data have been analyzed in a qualitative way, looking for patterns and themes. Interview data also were analyzed qualitatively and, although the motivation categories that were identified by our previous research were used to code relevant data, we also allowed for new categories of motivation to emerge from the data itself. The predetermined categories were neither presented to visitors nor were visitors asked to make a choice from them in their response. Furthermore, we queried each family member with a view to capture all the reasons why families visit the Zoo both individually and as a group. Our previous research has shown that key aspects of the family agenda are constructed, negotiated, and refined not only during the visit but also before and after each visit. It is a dynamic process that is repeated every time families visit museums. The postvisit PMM and interview captured information related to changes in knowledge and interests, reconstructed visit routes, and the extent to which expectations were met. Three of the 46 participating families were not able to complete the postvisit interview, due to time constraints, and were excluded from the study.

Observed Visiting Strategy

Having completed the previsit PMM, families were then issued a smart phone that was used to record their location as they moved through the Zoo for the duration of their visit. Visitors' location, represented as latitude-longitude pairs, was time-stamped and logged every second using the Global Positioning System (GPS) unit integrated in the smart phone. This high-frequency recording rate was selected to achieve as detailed and accurate a record as possible. The specific smart phone model[3] employed features a precise Assisted-GPS unit

[3] Although it is possible to use many different consumer devices currently widely available, in this study we opted to provide the same smart-phone model to all participants. In this way, we were able to eliminate any possible variations in the recorded data resulting form the different capabilities of different models. The specific model employed was the Openmoko Neo (www.openmoko.org), which at the time provided superior programmability and extensibility, which greatly facilitated the study. We expect that in the future similar studies will be carried out using a variety of smart phones carried by the visitors themselves.

complemented with EGNOS functionality and Kalman filtering (Welch & Bishop 2001), which smooth data and provide location estimates with an accuracy of approximately one meter. We were thus able to obtain detailed sequences of the locations visited by the families, automatically incorporating accurate timings for each recorded observation. This was assisted by the fact that in most cases we were able to track families indoors since the GPS signal was rarely lost. At the end of each day, the captured data traces were extracted from the devices and processed in a form suitable for further analysis and investigation (Papadogkonas et al., 2008). During the postprocessing we removed samples for which the confidence of the GPS estimates was below a certain threshold. (It is relatively straightforward to identify erroneous measurements, which are often caused by poor reception of the GPS signal.)

To extract observable strategies from the raw data traces, we adopted the so-called Data Analytics approach. Data Analytics is a data-driven methodology used for decision-making and characterizing performance in information systems, and aims to identify and extract patterns using computable functions. Following this approach, we investigated three alternative ways to characterize the observed strategies, each of which could be derived algorithmically from the traces. This is a critical feature of any method that can be used with location data captured in this way, since their volume and detail make manual processing too cumbersome to carry out.

Specifically, we considered three alternative ways to represent observable strategies:

- Statistical distribution of displacements: Observed strategies are associated with the statistical distribution representing the variation in visitor displacement[4] magnitudes or the relative frequency of the distances traveled by the visitor per unit of time. For a particular visit a distribution is fitted using the recorded location traces so that we obtain a mathematical equation that represents the

[4] The term displacement is used here in its mathematical sense referring to the shortest distance between two consecutive location measurements.

pattern of displacements. The observed strategy overall is thus represented by the derived statistical model and the values of the associated parameters estimated by the data. (The rationale behind this approach is further discussed below.)

- Trails: Observed strategies are described as ordered sequences of places where the visitor has been observed to be present. Each item in this sequence is associated with several descriptive statistics, such as dwell time at the specific location, actual time, and speed during this segment of the visit, which can also be used to derive navigation decisions at nodal points, the order of exhibit visitation, and so forth. The places employed as items in this sequence can be either defined a priori, for example by annotating the site map by demarcating the boundaries of specific landmarks, or derived by the data through the application of a so-called Point-of-Interest algorithm.
- Functional: Observed strategies are represented as lists of the functions associated with places visited, for example, whether it is an exhibit (in which case we also associate the specific exhibit theme), a rest area, a shop, and so forth. Contrary to the previous two representations, the functional approach provides a qualitative description of the strategy that is related to the semantics of space rather than to the quantitative characteristics of spatial behavior. This representation also can be constructed automatically from the visitor location traces by using an annotated digital map of the site.

Note that the insight behind the adoption of the statistical representation of observable strategies comes from related literature, which observes that human mobility is inherently bursty in that it is characterized by long periods of moderate or low activity intermixed with highly active periods that last a short time. Such behaviors typically correspond to a distribution of displacement magnitudes that follow a power law, an observation that has

been confirmed in several different settings (Barabasi, 2005). In this case, we relate the degree of burstiness observed to the specific value of the power law coefficient for the estimated fit, which is known to cause qualitatively distinct mobility strategies.

As regards the functional representation described above, we have identified and employed the following categories to classify the use of space: exhibit, retail, recreation, food, rest, program, and circulation. These categories capture the diversity of space use in the Zoo. In addition to its exhibits, restaurants and shops, the Zoo incorporates several recreational areas, such as a playground and carousel, and dedicated areas for programs, notably the theater. Finally, the site naturally provides walkways required to allow the circulation of visitors from one area to the other, which we also identify separately.

Study Participants

Families were approached as they were entering the London Zoo. Every third group was chosen in an effort to randomize the sample. All groups were approached by the research assistant (EN) and asked if they would mind discussing their ideas and expectations of the visit before they entered the Zoo. Out of the total of forty-six participating families, forty-three groups (130 individuals) completed all elements of the study. Of those, we have complete data sets (i.e., paired PMM and complete GPS traces) for twenty eight families (90 individuals). All age groups were represented in the group of participants (see Table 2).

== Insert Table 2 about here ==

There were more women than men and slightly more boys than girls (see Table 3). Time spent in the exhibition ranged from 1 hr 47 min to 4 hr 57 min with mean time 3 hr and 5 min. Distance covered ranged from 1.4 km to 5.2 km. Twenty one participants (in 11 family groups) had visited the London Zoo or other zoos before.

== Insert Table 3 about here ==

Results

One of the consequences of collecting data automatically, rather than by employing a researcher to track the families, is that this process puts some distance between the researcher and the data in the sense that she no longer has first-hand experience of the routes followed or the opportunity to develop a subjective impression of the family profile. Nevertheless, it is still possible to gain such understanding by displaying the recorded traces on the map or satellite imagery and replaying the visits. Indeed, using common web mapping tools it is fairly straightforward to produce animations of the visit trails so as to allow the visual inspection of visitor trails and visitor observation after the event (Figure 1). Furthermore, it is possible to develop simple visualizations of the data that reveal some simple insights about the structure of the visit strategies, notably the so-called heatmap visualization which immediately indicates the areas where families spent most their time (Figure 2).

== Insert Figures 1 and 2 about here ==

Using the previsit interviews we identified the motivations reported by the visitors. Specifically, nine categories of motivation were mentioned in this study: education/participation (9 mentions),[5] social event (33), entertainment (21), place (15), biophilia (15), life-cycle (5), therapeutic (2), political/participation (12), and practical issues/constraints (14). Motivations for visiting the Zoo were not exclusive and, in the vast majority of cases, there were more than one reason in operation at the same time. We explored whether it is possible to associate specific motivations with observed strategies and examined the three alternative representation for the observable strategies presented in the previous section. We found that it is possible to do so by employing the functional representation of the previous section and by conducting an association rule learning study, a standard data analytics technique used to discover relations between variables. Specifically, we employed the a priori algorithm as implemented by the Weka data mining system (Witten

[5] The numbers in the parenthesis refer to the number of times each motivation was mentioned.

et al., 2011) to carry out this calculation. We preprocessed the data so that for each family we provided a list of attributes representing whether its members reported a specific motivation and if a place with particular function (i.e., the functional use categories in the previous section) was present in its observed strategy.

The outcome of this processing was to classify families in two completely distinct groups, thus revealing a direct link between motivation and observed visit strategy. Indeed the two family groupings were clearly distinguished, namely:

- Families with social event or entertainment motivation always visited at least one place of the non-exhibit function, spending an average of one fourth to one third of the total visit in places such as the café, shop, and playgrounds (see Figure 2);
- Families with education/participation motivation visited only places with exhibit functions.

We did not find any links between other motivation types and visit strategies.

We also investigated the effectiveness of the statistical and trail-based representations of observable strategies discussed in the previous section. In particular, we found the distribution of displacements to follow a power law in all recorded visits so that the reconstructed pathways are consistent with a Levy flight pattern of movement, which is characteristic of information-seeking behavior (see Clauset et al., 2009). We explored the relation between reported motivations and plans for the visit to the calculated power law exponent through clustering algorithms with Weka, but no direct links were discovered. Using the trail representation of the observable strategy,[6] we investigated the relation between motivation and the trail representation of the visit, also considering specific attributes incorporated in this form, such as the number of exhibits viewed, time spent for the

[6] Trail representations were calculated using the custom software described in Papadogkonas et al. (2006) and maps of the London Zoo annotated by hand to demarcate the boundaries of specific areas and exhibits using the open-source QGIS system (Sherman & Mitchell, 2012).

visit, and area of the Zoo covered (see Figure 3), again finding no direct relation between the former and the latter.

== Insert Figure 3 about here ==

Discussion

The study presented in this article set out to examine how the motivations of family groups relate to observable aspects of their visit strategies as they were manifested through their pathways during their visit to the London Zoo. The findings show that particular types of motivation determine the type of places and activities families choose to engage with, and this choice is based on the function those places or activities play, namely, whether the place visited performs an exhibit or non-exhibit function. Two visit strategies were indentified that directly relate to social groupings with distinct motivations. Specifically, families with education/participation motivation actively seek to engage in exhibit-related activities, and families with a social event or entertainment motivation are likely to engage in at least one activity with a non-exhibit function during their visit. This finding strengthens previous evidence obtained through self-reporting techniques on the relation of motivation and visit strategy (Falk et al., 1998; Moussouri, 1997).

This study establishes that there is a link between how specific categories of motivations are framed and types of in-museum engagement. This finding has wider implications that go beyond the specific context of this study as it can substantially extend current understanding of the dynamics of museum visiting. Education, social event, and entertainment appear to be wider cultural itineraries on which museum visits feature, as documented by empirical studies conducted in a wide range of museums in the UK, North America, and Australia (Doering & Pekarik, 1996; Falk et al., 1998; Hood 1989; Macdonald 1992; McManus, 1992; Moussouri, 2003, 2007; Packer, 2006; Packer & Ballantyne, 2002). If those cultural itineraries are widely shared by visitors across cultures it may also be possible

to establish similar links between particular cultural itineraries and shared ways of in-museum engagement within specific museum types or even across museums (and other cultural organizations). Another strand of research could look at similar patterns in relation to participation in programs or other type of public events offered by museums. Do people who choose to participate in programs have particular types of motivations, and does that lead them to seek out particular types of engagement that programs offer? For example, one of the families with a political/participation motivation with conservation high on its agenda was in London for a multiple day visit to the Zoo, a key element of which was participating at a special event the following day.

Future research should also include other factors that the study presented here did not examine. More specifically, it would be interesting to examine the role played by a number of factors that have been identified as contributing to the development of an agenda for the visit (with motivation being one element) and affecting the visit experience. For example, research should investigate the role that socioeconomic background, education, prior knowledge and interest (Doering & Pekarik, 1996), frequency of museum visiting (Merriman, 1991; Moussouri, 1997), or access to different resources and membership to different communities (Hooper-Greenhill & Moussouri 2001a, 2001b) may play in shaping motivation. It is also interesting to consider how particular framings of motivations and ways of engagement may shape the ways exhibitions are understood by visitors. Prior research has shown that visitors' readings of an exhibition are shaped by culturally dominant narratives about particular types of exhibitions (Macdonald, 1992; Moussouri, 1997, 2007). However, the question still remains about the relation between motivation and the narratives people employ or draw on for particular exhibitions. For example, in the case of the family with political/participation motivation mentioned above, it would be of great interest to zoos and aquaria to know what

narratives this type of visitor might construct and how they could develop interpretation that can support or challenge existing narratives and encourage further reflection.

One area of museum practice that the research presented here can impact is interpretation. Specifically, access to and analysis of this type of automated tracking data in conjunction with other visitor data could lead to developing more customized interpretation to fit different motivations and pathways. Analysis and interpretation of heat map visualizations, like the one presented in Figure 2, could identify areas within the exhibition space that are either heavily used or not used at all, and be used to develop targeted interpretation for different types of motivation groupings that is more evenly spread throughout the museum and to market those areas accordingly. In fact, research on motivation groupings will probably affect how the museum is marketed quite drastically as well. The fact that we were not able to establish any clear links between the other seven categories of motivation identified in this study may be related to how families were recruited or the way family members prioritized their motivations for this particular visit. More research is needed to examine this issue.

A distinct contribution of this study is its method. By combining qualitative and quantitative approaches, we were able to place the visitor pathway data in context and to interpret their meaning. Qualitative data elucidate subtle variations in meaning related to motivations. This element of our method was combined with the use of mobile visitor tracking and analytics technology that made possible the collection of detailed pathway data and allowed us to establish the relation between visitors' observed strategies for the visit and their motivations. We have specifically considered issues related to conducting audience research using GPS, including possible limitations and ethical issues, in a paper to appear soon (Moussouri & Roussos, in press). Our plans for the near future include combining automated tracking data with visitor in-museum conversations, and collecting data about

other aspects of the visit strategy. Moreover, in view of the limited success with two of the alternative representations of observable strategies, statistical and trail-based, we intend to revisit these techniques to investigate how to best capitalize on their features. The pattern emerging from the statistical description of the recorded pathways suggests a broad underlying generative mechanism which is likely influenced by several independent factors that may include social interactions, cognitive processes, and the constraints of physical space. The trail-based approach has significant potential, as it is a generalization of typical descriptive statistics employed in timing and tracking studies, which have been used to reveal the important aspects of museum visiting in the past.

The proliferation of alternatives, such as ecology and ethnic museums, and the adoption of progressively participatory exhibition approaches, have produced museums that perform a greater variety of functions and attract a greater variety of audiences, or audiences that have distinct motivations for visiting (Loukaitou-Sideris & Grodach, 2004). User communities also are more mobile, connected, and heterogeneous, and their members belong to increasingly diverse cultural and social groups. These changes call for a comprehensive analysis of the characteristics of visitor groups that use museums and their services and resources. It also calls for a better understanding of museum visiting within a wider sociocultural and possibly global context. We anticipate the investigation of visitor motivations, and their relation with the dynamics of the visiting experience, to provide significant insights towards achieving this goal.

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Appendix A

Sample Personal Meaning Map

== Insert Figure A1 about here ==

Appendix B

Visitor Interview

Previsit Personal Meaning Map

Interviewer: On this sheet of paper, I'd like you to write down as many words, ideas, images, phrases or thoughts that come to mind related to the phrase *London Zoo*.

Prompt 1: Can you explain why you wrote down this word? (point at specific word)

Prompt 2: Do you want to expand on what you've written? (general)

Prompt 3: What does this word mean? or Just to confirm, this word is … (if unclear)

Previsit semistructured questionnaire

1. What do you expect to be able to do or see in relation to this (point at visitor's word)?

{Interviewer: repeat for up to 3-4 words}

2. Why do you expect to do or see that?

Postvisit Personal Meaning Map

Interviewer: Is there anything about the *London Zoo* you would like to add, remove, rearrange or change here?

Prompt 1: Can you explain why you wrote down this word? (point at specific word)

Prompt 2: Do you want to expand on what you've written? (general)

Prompt 3: What does this word mean? or Just to confirm, this word is … (if unclear)

Previsit semistructured questionnaire (based on visitor's map & pre-visit questionnaire)

1. Before your visit you said that you expected to do/see … Did you manage to do/see that?

2. Did you do/see anything you didn't expect to be able to do/see?

3a. Have you been to the London Zoo before?

If yes

3b. How many times have you been in the last year?

Figure Captions

Figure 1. Animation of family tracks on satellite imagery of the Zoo using Google Earth.

Figure 2. Heat map visualization for one family visit.

Figure 3. Statistical information for one family visit.

Figure A1. Sample Personal Meaning Map.