VISUALIZING THE TORONTO ZOO VISITOR EXPERIENCE: INTERSECTING SPACE AND MEANING MAKING

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Abstract

This study explores how the educational intentions of a site of informal science education, the Toronto Zoo, as well as, its potential for meaning-making, are translated in the lived experience of its visitors. It explores these experiences geographically by tying the spatial and physical environment to the interpretations made by visitors. It cartographically juxtaposes "objective" investigations of space, namely space syntax and wayfinding analyses, with "subjective" measures of the visitor experience, obtained through an on-site Visitor Study, which revealed possible links between space and visitors' use of the site and meaning-making experiences. The value of geographically representing visitors' experiences to a cultural institution through the unique use of mobile digital technology is discussed. Conclusions are drawn about the connection between space and the visitors' meaning-making experiences, and about how an institution's educational intentions might be better realized or even re-defined with reference to the insights gained in this thesis.

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1. Introduction

1.1 Navigating this Thesis

This thesis is divided into six chapters, which support a collection of interactive visuals. It can be navigated in two ways:

1. Hard copy + disc: Viewing the thesis in its traditional hard copy format requires the reader to navigate to the disc in order to use the interactive visuals. If the reader prefers this option, they should open the "Interactive Visuals" file on the disc.

2. Disc only: The entire thesis, both written and visual components are saved on the disc as “Integrated Interactive Thesis”. This integrated version allows the reader to navigate to and from the written and interactive visuals with simple clicks of the mouse.

1.1.1 Summary of Contents

Chapter 1: Introduction describes an overview of the research undertaken and outlines its contributions to the fields of informal science education, visitor studies, and architecture.

Chapter 2: Context elaborates on the perspectives that the thesis uses as its framework. A meaning-making perspective and spatial point of view are taken as structures for understanding both the potential/intended curriculum and lived experiences of visitors to the Toronto Zoo. A review of the literature reveals a lack of consideration of the spatial dimension in typical investigations of meaning-making in sites of informal science learning and an absence of a concerted effort to measure the lived experience of visitors in visitor studies and space syntax investigations.

Chapter 3: Methods outlines the "objective" spatial analyses used in this study (i.e. wayfinding and space syntax) along with the "subjective" Visitor Study undertaken at the Toronto Zoo.

Chapter 4: *Findings* details the spatial organization of the Zoo site, as well as, both the Zoo's educational intentions ("intended curriculum) and the lived experiences of its visitors ("lived curriculum").

Chapter 5: Synthesis reveals the ways in which the layout of the Zoo might shape visitor movement and concentration points, affecting the meaning-making experiences actualized by visitors both familiar and unfamiliar with the site. Both distinct and overlapping, the spatial "hot spots" revealed by the movement of these groups is suggested as tying quite strongly to their meaning-making "hot spots". The educational intentions of the Zoo are revealed as being at least partially realized by Zoo visitors.

In the *Conclusion, Chapter 6,* the value of geographically representing visitors' experiences to the Toronto Zoo through the unique use of mobile digital technology is discussed. Conclusions are made about how the educational intentions of the Zoo might be better realized or even re- defined with reference to the insights gained in this thesis. The limitations of this project and suggestions for future work are also discussed.

1.2 Project Summary

This study explores how the educational intentions of a site of informal science education, the Toronto Zoo, as well as, its potential for meaning-making, are translated in the lived experience of its visitors. This experience and its potentials are considered by applying diverse perspectives from disciplines such as architecture, environmental design, visitor studies, and critical cartography to contemporary informal science

education theory and practice.

At its core the research is concerned with and explores the physical aspects of visitors' experiences at the Toronto Zoo ("the Zoo") and the meaning-making processes that occur as the visitors' bodies and minds interact with and interpret the designed space of the Zoo. It explores these experiences geographically by tying the spatial and physical environment to the interpretations made by visitors and comparing them to the Zoo's educational intentions. It cartographically juxtaposes "objective" investigations of space, namely space syntax and wayfinding analyses, with "subjective" measures of the visitor experience at the Toronto Zoo, obtained through an on-site Visitor Study. The resulting qualitative information is aggregated in a visual form with the goal of gaining a richer understanding of the meanings imbued in the landscape. This is undertaken with the aim of better understanding the spatial dimension of meaning-making in a site of informal science education with relation to how the site's potential and intended curriculum are actualized in the lived experiences of its visitors, represented by individuals both familiar and unfamiliar with the site.

1.3 Research Questions

In the context of the Toronto Zoo:

- How can visitors' experiences be mapped spatially using mobile technology? What is the value of this type of analysis?
- How do these lived experiences compare with the Zoo's intended curriculum?
- How might visual representations of the visitor experience move us toward a more holistic understanding of meaning-making on the Zoo site?

1.4 Summary of Approach

This research brings together theoretical and conceptual points of view from informal science education and museum studies, and from environmental design and architecture. Taken together, these perspectives are combined in the present research to form a framework that views visitors in sites of informal learning such as museums, science centers, zoos, and aquariums as constructing meaning via their interpretations of what they experience in these settings, and that these experiences are fundamentally defined by the form of the space and its environmental qualities. Layout influences movement, impacting choices visitors make in terms of the content they engage with, in what sequence, and in what particular social configuration. The qualitative aspects of the environment, including visual attributes and sensory qualities (e.g. sounds, smells), have the potential to support and enrich this meaning-making.

This framework acknowledges that the physical aspects of the site alone do not totally dictate movement, but rather that the individual's interpretation of the layout of the space, its visual attributes, and its sensory qualities (which may change based on the season, time of day, visitor goals) shape movement and thus the modes and outcomes of meaning-making.

With this framework then, we might now consider the Toronto Zoo as a whole as a site of meaning-making encompassing all aspects of the Zoo visitor experience, including but not limited to those elements that are explicitly intended to be educational. We might also consider the importance of physical space in interacting with the content of the site and the visitor to create an array of potential interpretations, as well as, enriching or detracting from the aesthetic experience of the visitor. Going forth, we might then explore the Zoo on a macro level, independent of its single exhibitions and

messages, as a seamless whole from which visitors actualize a number of potentials and create their own personalized meanings.

1.5 Significance and Rationale

1.5.1 Significance

In terms of its starting point in the field of informal science education, this thesis draws in various techniques and perspectives to suggest new ways of looking at and examining meaning- making in sites of informal science education, which can also be defined as free-choice settings.

While research within an informal science education framework shows that experiences at sites of informal learning do spur meaning-making, there has been little concentrated study on how this meaning-making might tie to the spatial dimensions of the site on a macro level. Furthermore, studies on or about meaning-making have often been undertaken, analyzed and reported on in mainly textual modes despite the fact that visits to cultural institutions are primarily visual in nature. Visitor studies research focuses primarily on physical space and features as it attempts to infer learning via quantitative measures based on unobtrusive observations. However, despite important contributions, its methods and approach tend to create barriers to understanding and describing the connections between physical features and meaning-making. Space syntax, geography, and neo-cartography add objective measures of space on a macro level, underscoring the importance of time and space in considering meaning-making, and opening up investigations to more qualitative, participatory, and visual approaches and methods. Space syntax, in particular, acknowledges that space is fundamental in supporting curatorial, scientific, and pedagogical purposes (Reynoso and Perez Reynoso

2012). It recognizes that space has as much a role to play as the individual content of exhibit elements, an aspect often lacking from studies of learning in free-choice settings. Precisely because there is a physicality to museum experiences, and because this physicality affects movement, viewing, and interacting, both with the collection and with other people, spatial configuration is key in determining the pedagogical potential of a visit (Zamani 2009). Space has the potential to reinterpret, rather than redefine, pedagogical messages (Psarra et. al. 2007).

Equally, this thesis contributes the subjective, perspective views of visitors' actual lived experience to these investigations of objective measures of space that tend to be isolated from the visitor perspective. In doing so, the thesis attempts to provide a more comprehensive picture of the visitor meaning-making experience than either provide individually. In this manner, it contributes to a growing body of work investigating experiences in sites of informal learning through a meaning-making lens. In particular, it contributes this perspective to the zoo context where more traditional views and measures of learning have predominated in the literature.

A core strength of this thesis is that it reveals value in qualitative data and subjective perspectives in providing a limited yet in-depth reading of the visitor experience to the Toronto Zoo. There is potential to provide insight to the Zoo's educators and other staff, as well as, guide future low-budget but high interest studies from similar institutions.

As revealed by a recent survey by the Association of Zoos and Aquariums (AZA) (Luebke and Grajal 2011), despite the educational goals of modern North American zoos and aquariums, these institutions have little capacity to evaluate their success. The present research proposes inexpensive and time-efficient methods for these institutions to better assess the achievement of their goals while suggesting perspectives from the

disciplines mentioned above that perhaps have not been traditionally tapped to assist zoos and aquariums in both measuring and conceivably re-defining their success.

Specifically, this thesis considers and applies new methods of data collection, analysis, and representation for examining the lived experience of visitors to sites of informal science education. In doing so, it addresses a gap in current methods used to track visitors and gain deeper insight into their experiences, from their own point of view, both in the fields of free- choice learning and wayfinding. It suggests how the use of mobile digital technology, specifically an application available on personal mobile devices, might assist these fields in updating their labour-intensive methods for tracking movement and behaviour while introducing a self-reporting method.

It also attends to the current lack of research techniques in the field of free-choice science learning for visualizing the visitor experience. Visually representing the spatial and meaning- making experiences of visitors in free-choice settings has the potential to provide valuable insight into the important link between the physical context of the institution and the types and qualities of experiences that take place there, on a holistic scale; insight that is lacking in traditional pre/post research and visitors satisfaction surveys. Visual representations, juxtaposing seemingly unrelated variables, have been viewed as a type of data in and of themselves, both portraying knowledge and producing "new understandings" (McKinnon 2011, 459).

Finally, the scope of this thesis, investigating the entire institution on a macro level, is a distinctive approach, not often seen in studies of meaning-making in free-choice settings. In these sites, meaning-making is often considered on the micro level of a single exhibition or even a single element.

1.5.2 Rationale

In order to tie the lived experiences of visitors to the spatial dimension of the Zoo site, it was vital to find an effective way to track them in situ. From a visitor studies lens, tracking visitors is an essential method for studying their behaviour (Yalowitz and Bronnenkant 2009). Traditional methods of unobtrusively following and tracking visitor routes with pencil and paper, an approach commonly used in visitor studies, results in high financial costs due to the staff time needed to obtain tracks from a representative sample. As such, much of the timing and tracking data is for single exhibitions, not the institution as a whole. Furthermore, timing and tracking studies often fail to consider or examine the experience from the visitor's point of view, restricting their investigations to the factors observable by researchers. While new methods have been developed for tracking visitors and recording their intellectual and/or emotional responses (e.g. Trondle, et al. 2012) the technological cost and expertise necessary make these cutting-edge methods prohibitive for most researchers, let alone practitioners in sites of informal learning.

The present research suggests a solution for these shortfalls by introducing the idea of real- time visitor-reported data via a smartphone application available free of charge on both Android™ and Apple® devices. This method is less time consuming and more cost efficient on behalf of the researchers as they only need to orient participants to the technology as opposed to unobtrusively observing visitors for a period of time. The method also opens up the potential for a wide-scale, visit-wide examination of the visitors' experiences while addressing calls for the importance of technology in visitor behaviour studies (Yalowitz and Bronnenkant 2009). On a broader, more theoretical level this method helps "bring the focus of the design debates to the real time visitor experience and out of the domain of theory, rhetoric or even simple observation…

[challenging] the assumptions about what visitors will find meaningful" (Allen 2002, 54).

In the Visitor Study portion of this research, visitors' self-recorded comments and photographs were used to gain information about their experiences. Similar to conversations, these comments were seen to provide insight into visitors' thoughts and feelings. Visitor conversations have been commonly accepted in the field of learning in informal settings as both measures of learning and methods by which visitors learn (e.g. Leinhardt, Crowley, and Knutson 2002). Conversations allow one to examine the "subtle moment by moment learning that characterizes learning in museums" (Allen 2002, 3). Traditional methods for recording and analyzing visitor conversations however, are time-consuming and expensive. The simple experimental design used in this thesis, use of free technology, and heavier reliance on the visitor in collecting their own information are potential ways to reduce these barriers. While not undertaken in this thesis, using more traditional, in-person observation methods along with real-time visitor self-reports is a possibility for future research. Combining these methods has the potential to provide a richer and more holistic analysis of the visitor experience.

2. Context

2.1 Theoretical and Conceptual Framework

2.1.1 Meaning-Making in Sites of Free-Choice Learning

Making meaning, interpreting what one does, sees, and otherwise experiences, and the associated thoughts and feelings, and negotiating a place for these interpretations into what one already understands about the world, is a basic human process, something "we all do" [sic] (Silverman 2013). When we encounter information, we seek to make sense of it. In contrast with more traditional views of communication where it is assumed that the message transmitted is received exactly as it was sent, the meaning-making perspective frequently espoused in the field of museum studies equalizes the process by acknowledging that, whether intended or not, individuals make what they will of the information given to them (Silverman 1999).

> *Visitors create the meanings they need, and we, as producers, cannot impose meanings upon them. This is partially because the individual visitor's mind is not a blank sheet… …they bring their autobiography, their lived experience…"*
> *(Boon 2011: 421)*

In the context of the museum field, this process is seen as involving an interaction between the institution and its message, the inherent meaning in the media, text, or object on display, and the visitor, all situated within a culture that delimits the range of meanings that may be derived (Silverman 1999). Visitors select what content and experiences to engage with, in what sequence, and to what depth based on a variety of interrelated personal and sociocultural factors, such as personal interests and visit goals, level of experience in museums in general, and the composition of the group with

whom they visit. Meanings are not fixed and everlasting but instead are influenced by past and present experiences and change over time in a constantly shifting understanding of the world and the individual's place within it (Falk and Dierking 2013).

The meaning-making paradigm reflects a shift in the field from seeing visitors as passive consumers of curated truths to an understanding of visitors as active participants in constructing dynamic and personally relevant interpretations of their experiences (Silverman 1999). It reflects a more balanced view of the museum experience and acknowledges a more realistic, yet more limited, scope to the influence of the institution on the visiting public.

In cultural institutions, this paradigm encompasses a broader definition of learning than simply acquiring content knowledge, recognizing the multi-dimensional nature of the experiences that take place in cultural institutions and their unique differences from formal schooling. Experiences in these settings are more "fluid and sporadic" (National Research Council 2009, 127) and usually occur episodically, as opposed to the seemingly continuous routine of school-based settings or formal educational programs. With this understanding comes the acknowledgement that sites of informal learning provide a large variety of potential experiences and outcomes, sequences and messages, and ultimately meanings (Hein 1999). These potentials are actualized differently for different visitors as they view the content that is of interest to them, in the sequence they choose. What is understood or remembered about these experiences is also highly individual and interpretational.

If we bring space to the forefront, both the institution and the visitor can be thought of as interacting in "three-dimensional space" to "construct narratives" (Boon 2011, 423). Within this physical space there are an unlimited number of unanticipated relations and

meanings, a “potential” curriculum that interacts with designers’ and educators’ intentions and is realized by visitors in different ways, that cannot possibly be designed for. Boon (2011) conceptualizes this point of view by quoting from Michel de Certau’s The Practice of Everyday Life:

> *If it is true that a spatial order organizes an ensemble of possibilities (e.g., by a place in which one can move) and interdictions (e.g., by a wall that prevents one from going further), then the walker actualizes some of these possibilities. In that way, he makes them exist as well as emerge. But he also moves them about and invents others, since the crossing, drifting away, or improvisation of walking privilege, transform or abandon spatial elements (1984, 98).*

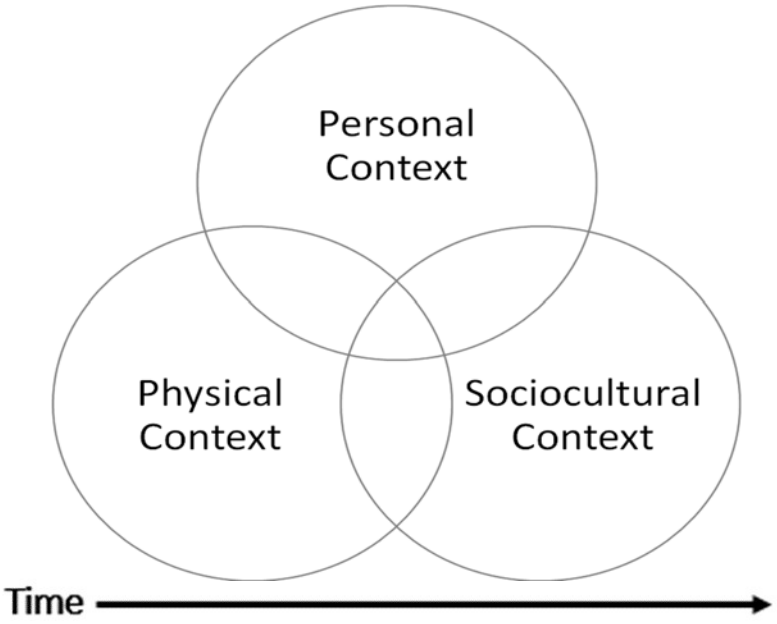
This framework broadly reflects a constructivist perspective in which individuals actively construct, rather than acquire, knowledge based on their interactions with and experiences in their environment. Learners continuously test their understandings of the world via social negotiation and bring their past experiences and cultural context with them to each learning situation. In contrast with other educational theories, constructivism sees meaning-making as the inevitable result of human’s interaction with the environment, as “not only necessary but also as desirable… ….a human attribute that can be exploited to enhance learning” (Hein 1999, 17).

2.1.2 Contextual Model of Learning

The Contextual Model of Learning (Falk and Dierking 2000) is a conceptual framework that has grown out of research in the field of learning in informal settings and reflects the thoughts and trends of many of its academics and practitioners. The Model incorporates the meaning-making perspective in an effort to better understand and frame the varied factors that comprise the visitor experience and making of meaning in sites of free-choice learning. It situates meaning-making within three interacting and integrated contexts: the personal, the sociocultural, and the physical (Figure 1),

emphasizing the on-going, continuous, and dynamic nature of learning as an individual constantly interacts in a discourse with the physical and sociocultural environments. A discourse in which any one context may take precedence over the others at a given point of time and, which, over time and through the integration of other life experiences, becomes that visitor's experience.

Figure 1 – Contextual Model of Learning (Falk and Dierking 2000)



The *personal* context incorporates the individual's interests, values, and beliefs, her preferred learning styles, knowledge of the content on display, and motivations for visiting. These factors influence the types of experiences that particular individual might be attracted to, enjoy, and engage with.

The *sociocultural* context is comprised of both the social aspects of the visit, as well as, the wider cultural context of both the visitor and the institution. Visitors, both within

and outside of an individual's group, influence the type and depth of attention and interaction that visitor has, both with other people and with the content of the institution. The cultural aspects of the visit includes the culture the visitor has been born into and that of the institution itself in terms of how the cultural values of the institution's staff have influenced what is on display and the communication methods used.

The *physical* context strongly influences how visitors move and what they observe and remember. This includes the architecture and feel of the building and objects within, as well as, the objects and events visitors experience prior and subsequent to their visit. Emphasized in this context are both the location of exhibits in institutions and locations of elements within exhibits. "Using the raw material of the museum itself, museum visitors actively create their own physical contexts" (Falk and Dierking 2013, 107); they choose where to go and in what order based on the visual characteristics of the setting and its displays, in addition to the personal and social contexts of their visit.

2.1.3 Space Syntax

From an architectural point of view, space can be understood as "a structure of visual fields that are seen gradually through movement" (Psarra 2003) and as "what we use in buildings" (Hillier 1996, 19). Architectural theories of space syntax (Hillier and Hanson 1984; Hillier 1996) help to frame an understanding of the importance of the configuration of space, the way in which the discrete spatial units in a particular layout are organized into a patterned whole, in shaping the movement of people through that layout, including the likelihoods that certain spaces will be more or less used or traversed and the patterns of co-presence and encounter between and among people that is created. This whole is seen as more important than any one individual space in

isolation and the key link in understanding spatial use, how space functions socially, and its wider cultural meaning (Hillier & Tzortzi 2011). Spatial configuration is seen as affecting movement as it offers certain sequences and choices of movement to the individuals who perceive and explore its more or less intelligible structure. From a social perspective the configuration of a given space integrates certain activities and segregates others by controlling access to parts of the layout to varying degrees.

Central to space syntax is an understanding of space as an intrinsic part of the human experience, with behaviour exhibiting its own geometry or spatial forms and the built environment thus embodying certain social and cultural systems through its physical qualities and configuration, as well as, creating these experiences by shaping patterns of use and encounter with others (Hiller and Tzortzi 2011). Space syntax techniques can then be used to explore the ways in which culture is physically manifested in the layout of the space.

As Hillier and Tzortzi (2011) explain, space syntax examines configuration based on the assumption that layouts can be perceived of differently from different points within them. It describes layouts using the global measure of integration, the relationship of each space to all others in the layout, and the local measure of connectivity, the connection between each space and those immediately adjacent to it. Integration is measured based on the number of spaces that must be traversed from a given space to all other spaces in the system. The less depth from the system as a whole, the more integrating the space, and vice versa. Connectivity is measured by counting the number of immediately adjacent spaces that are directly accessible from a given space. The relationship between integration and connectivity is described as intelligibility, defined as what can be understood of the global relation of a space from what can be observed

within an individual space in that layout. Highly intelligible spaces offer more opportunities of encountering others and a greater chance that all parts of the system will be evenly used or traversed.

One of the major contributions that space syntax can lend to this study is how it relates architecture, as a system of spatial relations, as a key element in both the way cultural institutions convey and embody their curatorial and pedagogical goals and in the lived experience of the visitors who occupy these spaces. Movement through spaces that cannot be seen all at once, and encounter where "reciprocal visibility gives rise to a sense of spatial culture" (Choi 1999, 249) are intrinsic aspects of the experience of architecture, including in museums settings. In fact, movement and encounter are the aspects that make the structuring of narratives in museums unique as spatial accessibility and the configuration of individual elements affect what is perceived and understood (Wineman and Peponis 2010).

2.1.4 Environmental Design

Urban planner Kevin Lynch's book, "The Image of the City" (1960), points to the potential and importance of environmental design in enabling humans to develop strong, meaningful connections with their world that support finding one's way and, perhaps more powerfully, provide a sense of aesthetic connection and purpose to our daily lives. Lynch's ideas about navigating urban environments are quite complementary to the meaning-making paradigm gaining strength in the museum sector today.

Lynch feels that, in a given environment, an individual's movement choices, or wayfinding, result from "the consistent use and organization of definite sensory cues from the external environment" (Lynch 1960, 3). The key factor in this process is the

"environmental image", or cognitive map, a mental representation of a given place, which is used to take in and process physical information from the environment with the aim of making movement-related decisions. The image is not simply a map in the cartographic sense, but rather a simplified and modified representation of reality in which some elements are emphasized, others are omitted, and layouts and distances are distorted in such a way as to make the image more useful for its purposes.

According to Lynch, well-formed environmental images are important for moving through complex landscapes, as these environments cannot be taken in with a single view in a single moment. The organization of the external environment, along with its sensory attributes (visual, tactile, olfactory) may help or hinder the ability of the individual to form an image that is both practical for navigation purposes and allows that person the opportunity to develop a depth and breadth of experience that enriches everyday life.

He classified environmental images based on the cognitive distinctions made by participants in his study into five interrelated categories[1]: paths, edges, districts, nodes, and landmarks (1960). The organization of these five types into a whole, along with their perceptual qualities, affect the image that is created, the resulting ease and

[1]Paths, such as sidewalks, roads, and railways, are the principal feature in the image of many individuals. Since people experience the landscape while moving along these thoroughfares, other environmental elements are cognitively arranged and related along paths. Edges are barriers to movement or linear breaks in continuity such as shorelines, railway tracks, or fences. They restrict movement and may force it in certain directions. Districts are medium to large sections that are conceived of as having a two dimensional quality inside of which the individual enters. Nodes are points at which paths intersect or they may be concentrations of use, such as a city square. As points at which decisions are made, nodes cause individuals to heighten their attention, thus perceiving nearby elements with higher clarity. Landmarks are reference points that individuals cannot move through or enter into. Depending on the image, landmarks may be distinct, striking objects, or may only subtly emerge from the rest of the landscape due to spatial or visual qualities that are unique or memorable in the context. Landmarks may or may not be visible from a distance.

patterns of movement, and also promote meaning-making, exploration, and enrich everyday life.

Similar to museum visits, images are interpretive in the sense that they are formed through an active, continuous, reciprocal process between the individual and the landscape, in which the visual qualities and features of the landscape emphasize certain elements and relationships to the individual who, using perception and memory, and for her own purposes, "selects, organizes, and endows with meaning" what is seen (Lynch 1960, 6). Lynch argued that "nothing is experienced by itself but always in relation to its surroundings, the sequences of events leading up to it, the memory of past experiences (Lynch 1960, 1).

Wayfinding can also be seen as an active and continuous process of spatial problem solving that involves mental representations of the environment and processing environmental cues to make decisions that guide movements (Passini 1981). Immediate perception and cognition, as well as, the cognitive map/environmental image guide the selection and planning of a route from origin to destination and the execution of that plan by making appropriate decisions at the right time and place along the route. The latter variable can be seen as being strongly affected by the available environmental information. While "research on cognitive maps and imagery emphasizes a static phenomenon, i.e., to have a cognitive map or image, to be oriented…. …wayfinding, quite on the contrary, is a dynamic affair; it points to behavior and to the cognitive processes involved in reaching a destination" (Passini 1981, 18).

In urban environments, navigation is guided by the individual's familiarity with the route, as well as, personality, spatial ability (sense of direction), and speed at which decisions can be made. The mode of travel (e.g. on foot, by car, by bus), availability of

choices, and location in time and space are other important influences (Stern and Portugali 1999).

During wayfinding people will select and focus awareness on that information that is relevant to their task, based on the route they have planned, while ignoring or failing to perceive other information. Rather than spending time analyzing the optimal solution to their wayfinding challenge, people will "satisfice", that is, find a good enough solution that can be made quickly and weighs both costs and benefits. The concept of "satisficing" (Simon 1956) applies to wayfinding design in that often "spatial representations that can provide on demand sufficient [sic] information to allow a problem to be solved or a spatial task to be completed are all that are required for most human wayfinding purposes" (Golledge 1999, 44).

2.1.5 Environmental Design versus Space Syntax

Environmental Design and space syntax seem to offer two distinct ways of thinking about and examining space. To Lynch's qualitative visual categorization of environmental elements, space syntax offers an objective, abstract, and mathematical way of describing and measuring the same. While Lynch indicates the importance of how each of his five elements fit together, he does not theorize on how. Space syntax theory is based primarily on configuration, underscoring movement through the layout as systematic, not accounting for the visual. However, both perspectives have similar aims (to describe and predict the navigability of an environment on a macro scale), and both underscore the importance of the cognitive processes involved in the practice of navigation.

It has been argued that the visual elements and configurational structures of an

environment are inter-dependent in that the visual elements are distinguished "by the fact of their relationship with each other and to their context (i.e. the structure permits the recognition of elements)" (Dalton and Bafna 2003, 59.21), and that sets of elements exist in hierarchical relationships. Dalton and Bafna (ibid) found corollaries between some of Lynch's elements (i.e. paths, nodes, and districts – "spatial descriptors") and space syntax properties (i.e. axial lines, convex spaces, and isovists) but not for Lynch's "edges" or "landmarks" ("visual descriptors"). They posited that factors over and above syntax (i.e. visual qualities) can affect the significance of paths in the cognitive map and also that visual qualities can be overridden by syntax.

In addition, Long and Baran (2012) showed that space syntax's intelligibility is correlated with Lynch's legibility in that individuals had higher recognition of and confidence in navigating within more intelligible landscapes. So, it would seem that perhaps both structural and visual properties do affect movement choice. As will be discussed below, results from the present research hint that perhaps the relative importance of each depends on the familiarity of an individual with the landscape.

2.2 Literature Review

2.2.1 Learning/Meaning-Making in Informal Settings

This research takes the field of informal science education as both a starting and a jumping off point. In attempting to pinpoint the sense visitors make of their experiences, Bloom's (1956) taxonomy of educational objectives (cognitive, affective, psychomotor) is often used for broadly categorizing the types of experiences visitors have as it seems to relate well to how people experience museums (e.g. Allen 2002). Emotional responses in particular have been seen as important in the museum field

"since the nature of [the] medium is profoundly affective. By their nature – multisensory, three-dimensional, interactive- [cultural] institutions appeal strongly to that part of the brain concerned with space, image, affect" (Roberts, 1991, 17). For example, exhibits that elicit high levels of excitement have been shown to result in more post-visit reflection and learning (Falk and Gillespie 2009).

Analysis of conversations is a common method for both investigating and signifying learning in these settings. Research has found that visitor conversations include cognitive, affective, and psychomotor elements and has emphasized the importance of the latter two categories as they reflect what has "generally been regarded as fundamental areas of strength in informal learning environments, and which extend the assessment of learning beyond the strictly cognitive realm." (Allen 2002, 20).

Other studies that have used visitor conversations to investigate and signify meaning-making have found that certain visitor behaviours (i.e. asking or answering a question, commenting/explaining, reading aloud or silently) were correlated with learning (Borun, Chambers and Cleghorn 1996). The statistically significant behaviours that indicated learning in the above study seem to be mainly cognitive in nature. It is unclear as to whether this is an indication of learning in informal settings being primarily cognitive or whether it is based on the initial classification of learning levels by the researchers, which are all decidedly cognitive as well.

Silverman (1990) found that visitor conversations fall into five basic categories[2], all

[2]The five categories of conversation that Silverman (1990) found were: 1. Establishment (determining what something is). 2. Evaluation (expressing opinion or judgment). 3. Absolute object description (i.e. describing what is before you). 4. Relating special knowledge (about what is before you). 5. Relating personal experience (connected to what is before you).

which are strongly linked to the concrete visual characteristics of the items on display. She further classified meanings-made into three categories: Objective (message intended by institution or exhibitor); Subjective (that in the realm of the personal, subjective, or associational) or Combination (concern for both). She found that visitors who were less well-educated were more likely to have subjective meaning while those with higher educational levels were equally likely to emerge with either objective or combination meanings.

In the context of zoos and aquariums, both cognitive and affective learning has been shown to occur more frequently at live exhibits than hands-on elements (Allen 2002). The content of conversations in these settings has been shown to be commonly made up of descriptive comments (e.g. location, behaviour, appearance) and inferential statements (e.g. inferring animal's state of mind) (Clayton, Fraser and Saunders 2009), however conversations also reveal that the attainment of complex concepts can be achieved (Ash 2003). Live exhibits have also been found to result in longer viewing times than traditional museum exhibits (Clayton, Fraser and Saunders 2009) and have been tied to specific learning behaviours such as making and testing claims about the animals (Kisiel et. al. 2012).

Studying conversations however, is complex (Allen 2002) and has relatively high costs in terms of time and finances. Due to these limitations most studies, including those mentioned above, are only able to study conversations for a short period of time or discrete area, potentially limiting the insight that might be gained from studying discourse throughout the visit.

2.2.2 The Physical Context and Learning

The Physical Context in Research on Informal Science Learning

The literature on learning science in informal settings agrees on the importance of the physical context in meaning-making at both the macro (e.g. layout, architecture) and micro (e.g. configuration of individual elements, lighting, sound) levels (e.g. Falk and Dierking 2013, Maxwell and Evans 2002). This designed space "helps to guide or mediate the visitors' attitudes or perspectives, their relationship with the content and the institution, the meaning of their activity there, and how the institution views them" (National Research Council 2009, 128). The physical characteristics of the displays and architectural features also influence movement and affect which exhibits visitors are likely to encounter and their interest in the displays (Bourdeau and Chebat 2001).

Maxwell and Evans (2002) theorized that orientation and wayfinding are important in the way that an easily navigable environment frees the visitor's mind to focus on the purpose of the visit. Visual exposure via the design of the space might be seen as offering greater chance of distraction, as can a space that is busy with many other moving visitor. These elements shift visitor's focus about instead of concentrating it.

Despite the various publications that focus on the design of exhibit elements to support learning (e.g. Bitgood 2000, Sanford 2010) , and still others, to be discussed below, that examine physical characteristics alone, studies linking spatial characteristics and thorough investigations of meaning-making are less common.

Furthermore, often studies that attempt to include the physical context only obliquely examine the contribution of space, architecture, and crowding on the overall learning of visitors (e.g. Falk and Storksdieck 2005), instead focusing on deeper investigations of

personal and social factors at the expense of physical context. In many cases, Falk, pioneer of the Contextual Model of Learning, which gives equal importance to the physical, has focused more deeply on personal or sociocultural factors in meaning-making (e.g. personal meaning making, Falk 2003; identity- related motivations, Falk 2009).

Contributions from the Field of Visitor Studies

Research in the visitor studies and architecture fields elevate the importance of the physicality of the museum experience. They do so however, at the expense of a deeper investigation of the meaning- making process or meanings made. Stephen Bitgood, a leader in the visitor studies field has critiqued John Falk for an excessive interest in the personal, claiming that the visitor studies viewpoint gives equal balance to the role of the institution and the visitor in the learning experience (Bitgood 2013). However, much of the work in the field of visitor studies fails to consider the personal context, instead assessing how successful the institution has been at guiding movement and/or relaying information as <u>they</u> intended. "Timing and tracking has become one of the most consistently used methods in exhibition evaluations, because it is able to indicate the extent to which visitors are behaving <u>in the expected and intended manner</u>" (Yalowitz and Bronnenkant 2009, 62) (underline is this author's emphasis).

The majority of recent work in the field related to exhibit design and development focuses on how the design of individual exhibit elements engages visitors' attention. The better an exhibition or element attracts and holds visitor attention, usually measured by the amount of time a visitor spends, the more successful visitor studies researchers deem it to be.

Some research has acknowledged that quantitative "objective" measures such as the above do not necessarily provide an improved understanding of the visitor learning experience (Shettel 1997). Today timing and tracking studies are usually paired with other investigation techniques (e.g. interviews) to gain information about why people have behaved in the manner that they have. Through these combined methods, some research has acknowledged the importance of the visitor's interpretation of their experience, arguing that visitors' selectivity in viewing and using exhibit elements, allows them to achieve their personal visit goals (Rounds 2004).

As tracking studies are often completed from a design perspective and used to inform layout and to control crowding, flow, and stop times, it probably should not be surprising that they have only begun to consider the meanings visitors are making and the effects of layout and placement beyond the physical.

2.2.3 Space Syntax: The Role of Space in the Visitor Experience

One potentially useful method for gaining a new perspective on the physicality of the visitor experience to informal settings comes from the architectural technique of space syntax, where much emphasis has been placed on the role of space in the visitor experience in cultural institutions. Space syntax theory and the toolkit have been applied relatively extensively in the museum and gallery context, with a strong focus on art museums, although at least one relevant study does exist in a zoo context.

The organization of space can be seen to create relationships between spaces, objects, and visitors in museums spaces (Tzortzi 2011). Syntactical properties of layouts have been shown to influence movement patterns, privilege contact with certain exhibit elements and works of art over others, as well as, influence opportunities for co-

presence and encounter with other visitors.

The “combination of the spatial design of a museum building and the conceptual and spatial organization of its displays create different kinds of visitor experience and give a museum its distinctive spatial, social, and intellectual character” (Tzortzi 2011, 26). While spatial characteristics alone may not explain all of the reasons for the ways in which the layout is used (for example, the attraction of feature exhibits may override certain configurational properties), they do exert a very strong influence that guides movement (Psarra 2005).

Individual spaces with high integration values see more dense patterns of visitation than others and greater co-presence among visitors (e.g. Wineman and Choi 1990; Choi 1999; Psarra 2005). More integrated spaces have been shown to create more explorative, dynamic, and social experiences while less integrated spaces result in more “private and idiosyncratic” (Psarra et. al. 2007, 070-14) visits (e.g. Psarra et. al. 2007; Tzortzi 2011 and 2005). Integrated spaces seem to add more relations among objects and embody a sense of letting visitors create their own interpretations.

Conversely, more segregated layouts result in more selective visiting and less evenly distributed routes, as the layout forces movement in certain directions to the exclusion of others and a visitor’s initial route choice may limit movement choices later in the visit (Choi 1999). Physically and/or visually segregated layouts present ideas in a more constrained, preconceived, and sometimes more didactic manner, while also allowing for more concentrated focus on the displays (e.g.Tzortzi 2011; Rohloff et. al. 2009).

Visual accessibility, regardless of direct physical accessibility, also structures and controls movement patterns (e.g. Kaynar 2005; Wineman and Peponis 2010; Choi 1999;

Peponis et. al. 2003). Highly visually accessible objects or elements are more likely to be contacted, regardless of their physical accessibility (e.g. Kaynar 2005; Peponis et. al. 2003; Wineman and Peponis 2010). Visitors tend to stop more often in spaces from which more people are visible and those spaces which have greater visual connections with other spaces (Choi 1999), especially the integration core. Where visual information is limited, stop times at individual elements is longer and variability in movement paths is low (Kaynar 2005). This is interesting in how it might relate to findings mentioned above regarding the higher rates of visitor distraction in crowded spaces and its detrimental effect on learning (Maxwell and Evans 2002). While the space might be forcing movement in certain ways, this movement might detract from the learning potential of the space.

From a navigation perspective, people tend to return most often to the routes and nodes with the highest integration values, especially when they feel disoriented (Peponis 1990). Peponis' (1990) other findings demonstrate that people develop an understanding of the syntax of the space beyond the use of local visual cues and use this to structure their movement, bringing with them prior knowledge, whether it be about how buildings are organized or about how to behave to find one's way.

Syntactical properties of space have also been linked to the explicit and implicit expression of certain curatorial and pedagogical philosophies both with regards to design and to the realization of these forces in the lived experiences of visitors, as observed in visitor behaviour. In many cases, designers and curators consciously manipulate space to support and/or further certain points of view, often reflective of a small set of dominant ideologies about ways of presenting objects and knowledge (e.g. Psarra et. al. 2007; Tzortzi 2011; Zamani 2009; Zamani and Peponis 2007; Tzortzi 2005).

In others, the layout of the space implicitly embeds certain philosophical and societal ideals in a more or less unintentional manner (e.g. Wineman and Choi 1990).

Specific to a zoo context, Wineman and Choi (1990) showed that ways of viewing and changing philosophies on the transmission of knowledge can be tacitly embedded in a layout. In the original Zoo Atlanta site plan, the most integrated spaces were located along the central spine, which functioned as a central point to access circular routes of animal exhibitry. With no direct visual access to the animals, this central spine was primarily a people space, representing the main purpose of the zoo as a social gathering place.

The spatial layout of the new plan conversely, through its more complex layout, seems to represent a change to a more introspective and individual experience between people and animals. In the new plan, high integration values are found both in the central spine and also along exhibit routes where the "animal-people interface" occurs. It seems to emphasize a more focused sense of viewing while also providing a more interpretive viewing sequence. Visitors can choose from a variety of paths and the short visual fields seem to create a more individual experience where the interaction between people and animals is privileged over that between people and other people (Wineman and Choi 1990).

Space syntax offers a way to systematically examine the physical element of the museum experience, a focus that is lacking in the museological literature on visitor behaviour (Wineman and Choi 1990). Its methods have been seen as being advantageous in their potential to introduce some level of objectivity into mapping and visual representations. As justified graphs, axial and convex maps all look at a system externally, they equalize the various roles, relationships, and representations of space,

in certain cases showing the effects of space on non-dominant groups (Davis n.d.)

Perhaps because of this external viewpoint, they also tend to distance researcher from subjects, rather than bring them together. Quantifying space and observing visitor movement from afar are top down approaches to understanding the function of spaces and the experiences they support. While visitors may move in certain ways and have contact with elements that seem coincident with the curatorial intentions of the space, without bridging that distance, space syntax has only part of the picture. Understanding at a greater depth the meanings that visitors bring and take away from their experiences and the methods for sense-making these visitors employ might perhaps further enhance studies of space.

2.2.4 Visualizing Learning

As this thesis is dually concerned with the visitor experience and with how to visually represent it, contributions from the field of geography and from arts-based neocartography[3] and counter- mapping[4] projects are a useful guide in that they conceptualize fresh perspectives on space and its importance, as well as, underline the potential benefits of visual information in data analysis and representation.

Geographers understand that human behaviour is affected by the knowledge they construct out of the mass of information available to them, which is delimited by personal, physical, and social/cultural contexts (Golledge and Stimson 1997). Geography is fundamentally concerned with the relationships between space, time, and variables

[3] The term neocartography refers to emerging map forms, mainly those that are technology-based.
[4] Counter-mapping refers to efforts and projects to discard or remix the dominant view portrayed and relayed by traditional maps and regain and reclaim dominance over the landscape.

and emphasizes the importance of “where things happen as critical to knowing how and why they happen” (McKinnon 2011, 456). Maps and other visual representations can be viewed as a type of data in and of themselves, both portraying knowledge and allowing for new insights as they reflect the dynamic nature of their subjects and reveal links, connections, and insights that might “produce new understandings” (McKinnon 2011, 459). It has been argued that mapping, as a process rather than a product, is the “contextual glue linking the tangible world… …with the intangible world” (Abrams and Hall 2006, 12).

The use of maps to represent data has been seen as more effective than more textual or numerical forms of reporting (Yalowitz and Bronnenkant 2009). The map as a bird’s eye view lends a coherent picture of community or space (Cosgrove 2006) however, one must be cautious in analyzing maps to ensure attention is paid as much to what is shown on the map as to what is hidden or not represented (Abrams and Hall 2006).

Participatory Geographic Information Systems have been lauded for their ability to accurately describe the physical landscape while simultaneously providing a “richer portrait of place” (Collins 2011, 474) by offering evidence of the lived experience of those who inhabit, interact with, and use that landscape. It has been argued that a myriad of visual techniques, for example narrative and photo documentation might augment the use of PGIS in decision-making as they “would anchor the map representation within the lived experience of place” (2011, 490).

Maps and mapping embody a dual subjective/objective nature. While maps are often viewed as objective and true representations of reality, they are, in fact, subjective artifacts of their makers. The inability of the map maker to separate herself from the world and the limitations of the medium itself make it impossible to create “maps or

any other images which are exact equivalents of what they represent" (Davis n.d., 41).

With new GPS technology, it has been argued that the objective and subjective are put in close relation. "While the technology itself is highly objective, applying the same rules to every GPS client, it is also intensely personal. This is my position, mapped for me on my device... … at this moment" (Davis n.d., 47). While traditional maps equalize attention on an entire area, giving the impression of objectivity, perspective views are more open about their subjectivity by showing a clear focus (Davis, n.d., 47).

Projects that attempt to embody these ideas include "Amsterdam RealTime" where participants wore GPS devices to track their daily movements in a project that attempted to "reclaim spatial meaning" over the city as each individual's non-dominant perspective was incorporated into a collective map of the area (Deitz 2006). The project was a commentary on the potential of maps to be infused with both geographic information and the dynamic, subjective qualities that give a city its character (Ross 2006). Christian Nold's Biomapping project (Nold n.d.) involved participants being tracked, both physically via GPS and emotionally, via state of arousal as measured by a portable skin conductance device, as they walked about their neighbourhoods, making comments at points that were of interest to them. The resulting "biomaps" collectively describe the physiological experiences and opinions of the community.

The eMotion project explored the aesthetic experience in an art gallery setting by tracking visitors' routes and physiological reactions to the displays and augmenting this data with interview material (Trondle, et al. 2012). The resulting series of maps showed routes of movement with physiological responses overlaid, simultaneously revealing the objective and subjective, in relation.

The types of projects described above ignite a spark in this researcher in the way that they link the subjective and objective, the internal and external, the personal and communal, the intimate and anonymous. They simultaneously give a broad overview of a space and the responses it evokes and pinpoint intensely distinctive insights into a discrete location within that space and the person who experienced something there. Both academic and practical research often seem to give greater respect to the objective, however, through this thesis, the present research has come to the understanding that the subjective has an equally valuable contribution to make, especially in the life it brings to more objective information.

3. Methods

3.1 Overview

With its holistic attention on both the physical and intellectual/emotional experiences of visitors to the Toronto Zoo, this research used existing technology and established techniques in novel ways to allow for a targeted investigation of the research questions. It adapted the techniques of space syntax to measure the integration and connectivity of this large-scale, outdoor setting and used a wayfinding analysis to further categorize the site physically in order to explore how this physicality might pattern visitor movement and experience. It also took advantage of a commercially available mobile phone application in order to conduct a participatory, visitor-led study of the public's experiences on the Zoo site and to collect information on the educational intentions of Zoo staff. Digital techniques were used to visually represent, cross-reference, and juxtapose the results both for analysis and presentation, allowing for a holistic yet multi-layered overview of the Zoo visitor experience.

3.2 Visitor Study

3.2.1 Setting

Toronto Zoo is a 710 acre not-for-profit zoological park boasting an average attendance of 1.3 million visitors per year. Located in the east end of the City of Toronto, Ontario, it is the largest zoo in Canada, both in physical size and collection, displaying over 5000 specimens from over 500 species in naturalistic exhibits. The Zoo's main goals are conservation, education, research, and recreation, as they fulfill their Vision to "be a

dynamic and exciting action centre that inspires people to love, respect, and protect wildlife and wild spaces" (Toronto Zoo 2009). Committed to its educational goals, Toronto Zoo's Conservation Education mission is to "engage communities by providing the tools and knowledge to connect to nature and protect our natural world" (Toronto Zoo 2013).

Data from the Zoo's 2012 Visitor Survey reveal that attendance is highly local, with over half of all visitors coming from the Greater Toronto Area. The bulk of Zoo visitors are families with young children.

Toronto Zoo sees a high degree of repeat visitation with over three-quarters of visitors having visited the Zoo in the past and almost 50% of visitors having attended in the previous twelve months. The Zoo sells yearly Zoo Membership packages that allow unlimited admission during the period of membership. Membership visitation represents roughly 300 000 visitors per year.

A Zoo visit is usually a day-long event with an average length of stay of 4.17 hours. The majority of visitors attend for a family outing (Figure 2 a). Others are attracted by a special event/exhibit or favourite animal. In 2012 the main draws were the white lions, polar bear cub, and Splash Island, the Toronto Zoo's water play area.

When asked to provide their most memorable experience of their visit (Figure 2 b), close to three-quarters identified an animal. Other various reasons highlighted interactive Zoo features, as well as, enjoyment of spending time with others in their group. Zoo visitors highly rated the signage, wayfinding, and learning value of the Zoo.

Figure 2a – Toronto Zoo Visitors Reasons for Attending

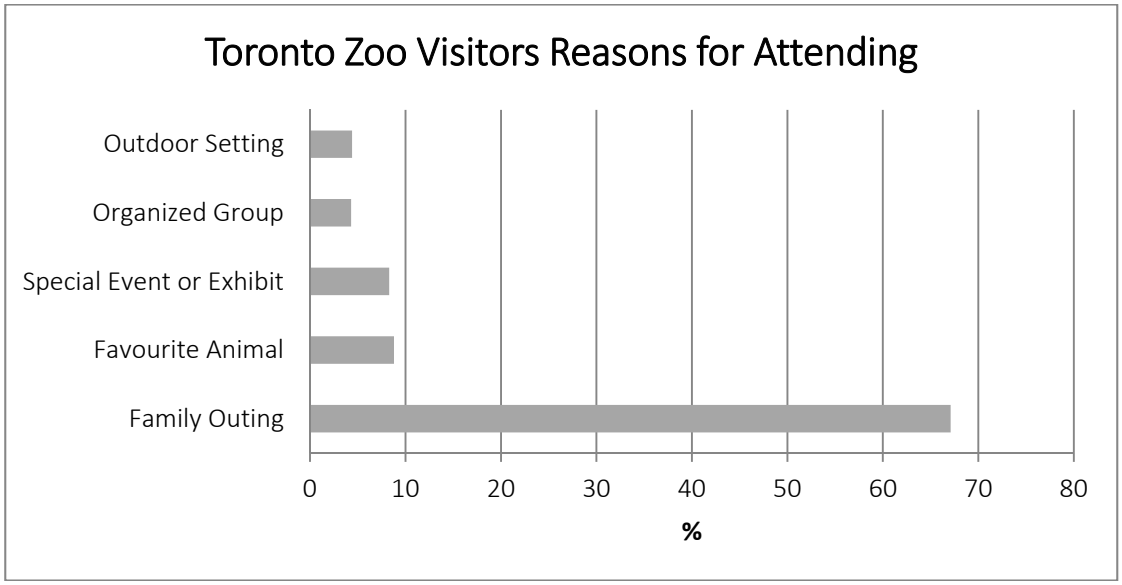
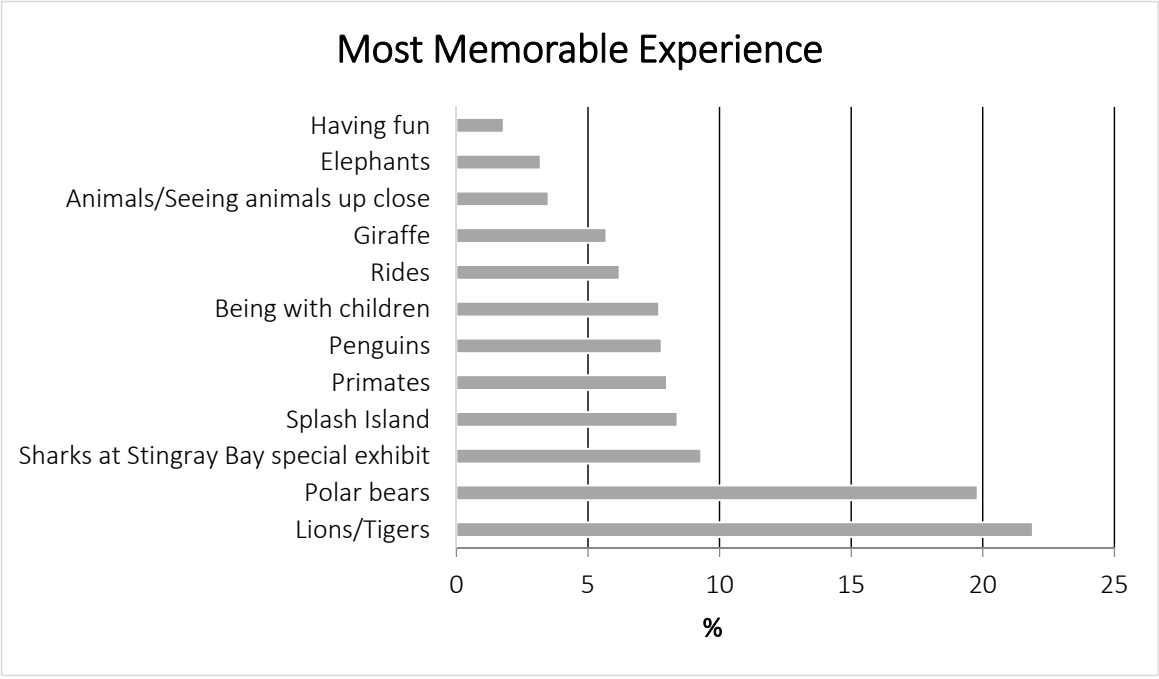


Figure 2b – Toronto Zoo Visitors Most Memorable Experience



3.2.2 Subjects

Overall 49 groups including a total of 184 people participated in the study. As it has been noted (Falk and Dierking 2013) that studies of experienced visitors are lacking in the field of free- choice learning, it was decided that one of the sub-groups would contain groups who had a high frequency of experience on the site (i.e. had visited four or more times in the year leading up to their participation in the study). The 12 groups in this category were then contrasted by also analyzing the results of 15 groups who had no recent experience at the Toronto Zoo (i.e. had not visited in over one year, if ever). It should be noted here that these are "samples" in only the most general of ways as the primarily qualitative nature of this research precludes a true statistical representation, but rather generalizes to a broader theory about meaning-making for these two types of audiences (Golledge and Stimson 1997).

Characteristics of the Entire Sample

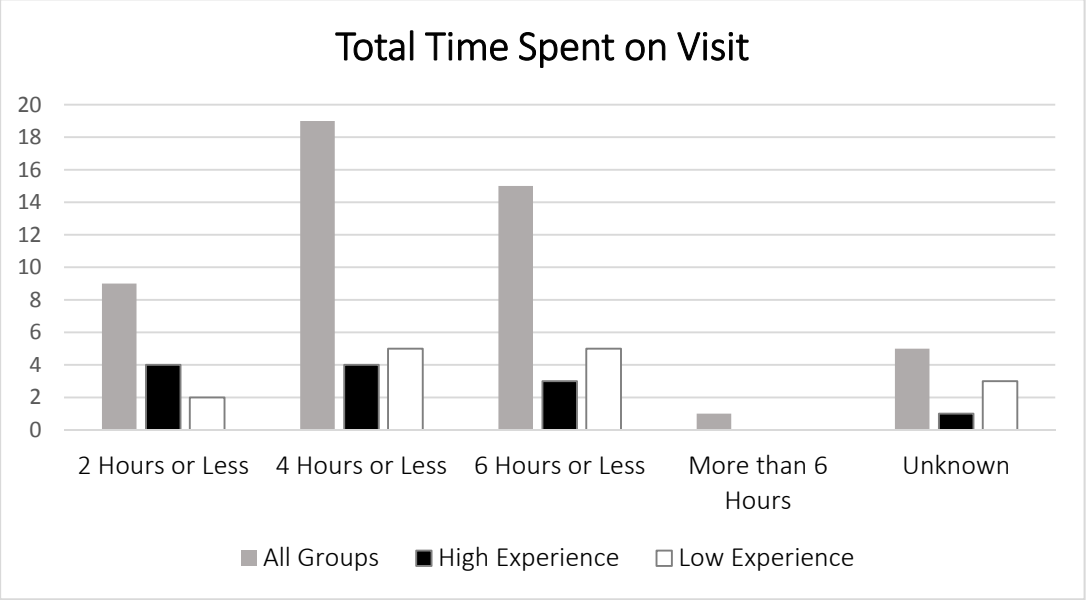
Group size ranged from one to nine people, with an average group size of 3.6. Groups of 2 and 4 were most common, each representing 26.5% of the sample.

The research was carried out between the months of July 2012 and January 2013. Forty percent of the visits occurred in the months of July and August 2012 with the remaining 60% taking place in Autumn 2012/Winter 2013. About two-thirds of the visits were carried out on weekdays and the remaining one-third on weekends (Figure 3).

Figure 3 – Visitor Study Participants: Day of Visit



Figure 4 – Visitor Study Participants: Total Time Spent on Visit



While challenges with data collection made it difficult to assess the exact length of time spent, a general measure of the visit length of each group was obtained by taking the time of their first waypoint and that of their last waypoint. This assumes that the first waypoint was made shortly after arrival and the last shortly before departure. While not entirely accurate, these measures provide a general idea of the length of stay for 44 of the 49 groups (Figure 4). The shortest visit was 1 ¼ hours and the longest 6 ¾. The average length of visit was 3 ½ hours.

The number of waypoints each group added ranged from a low of 6 to a high of 93. On average, groups created a waypoint, including associated comments and photographs 29.8 times during their visit. The total number of waypoints for the 49 groups was 1460.

Of the 184 people that participated 53% were adults, 27% children, and 10% did not state their age (Figure 5). Just over half of participants were female and 38% were male (Figure 6). The participants were quite highly educated (Figure 7) with almost all adults having completed a course of study at a college or university, including graduate studies. A large proportion (22%) of participants had never attended school, which reflects the high numbers of young children represented in the sample. Another 13% were enrolled in or had completed an elementary education.

Just over one-quarter of the sample visited in “adults only” groups, and the remaining groups were composed of adults with children of various ages (Figure 8). Groups were composed of Zoo Members only (28%), non-members only (46%), and a mix of both Members and non-members (18%) (Figure 9).

Figure 5 – Visitor Study Participants: Age Composition

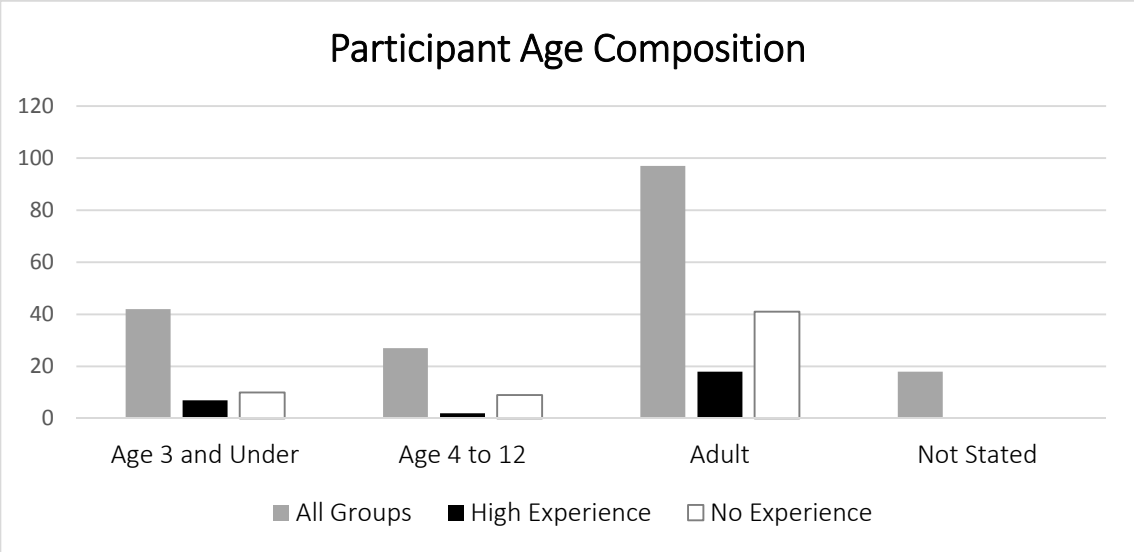


Figure 6 – Visitor Study Participants: Sex

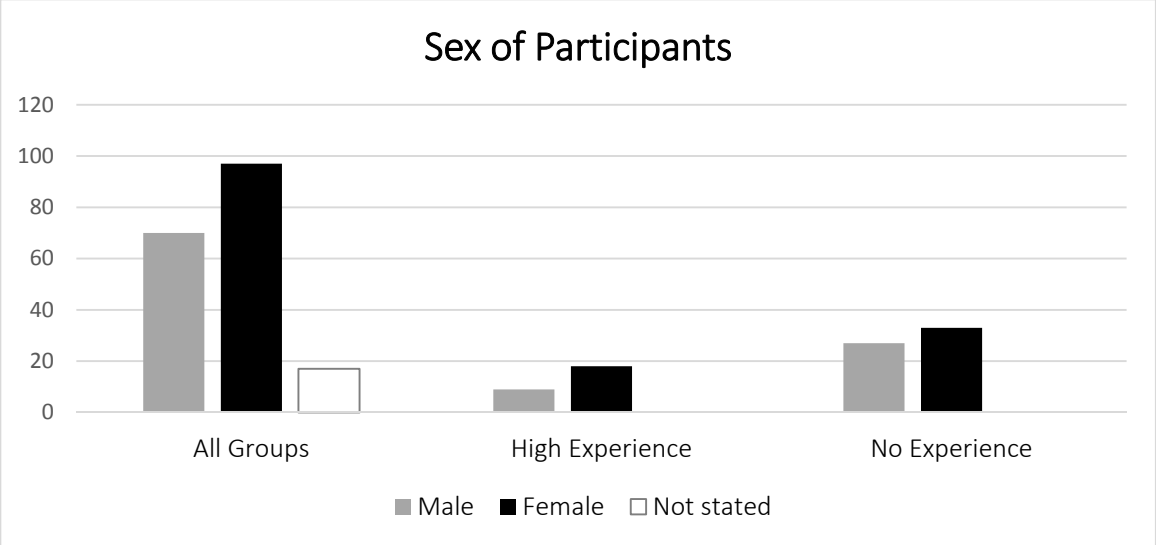


Figure 7 – Visitor Study Participants: Education Level

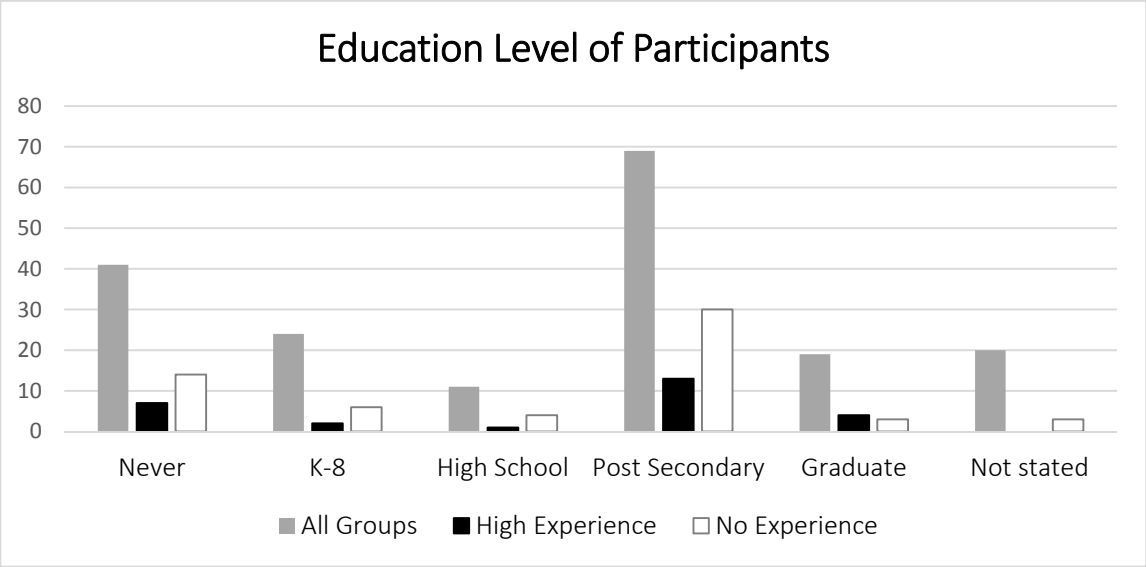


Figure 8 – Visitor Study Participants: Group Composition

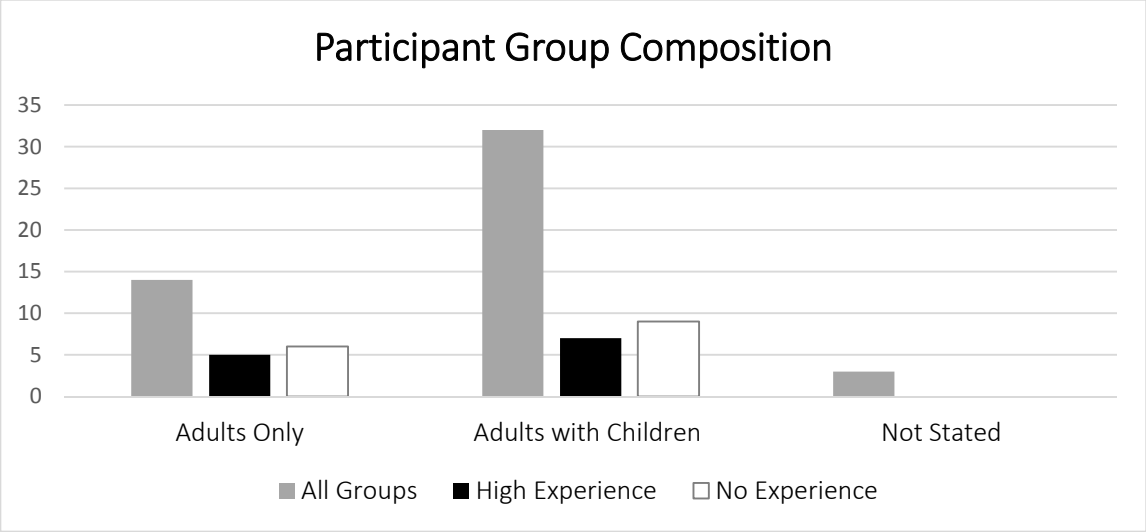
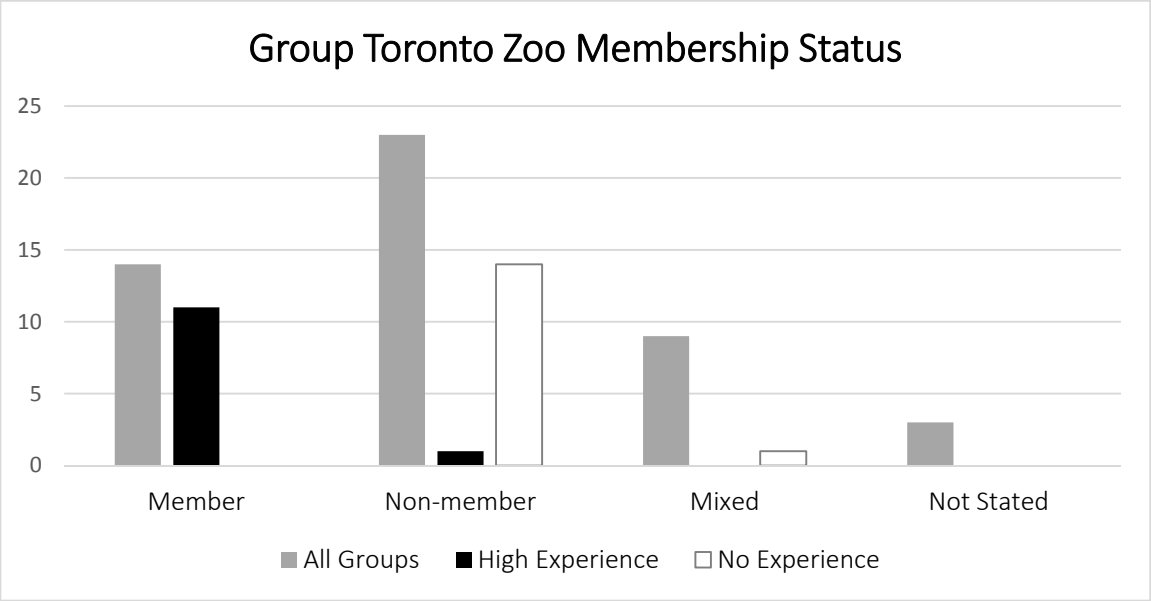


Figure 9 – Visitor Study Participants: Membership Status



Prior Visitation

Over 70% of participants had visited the Zoo in the past, which aligns to the trend seen in Toronto Zoo's visitorship as a whole. Close to half of all participants had not visited the Zoo in the past year, however. Of the remaining participants, slightly more than 17% had visited one to three times in the year previous, and just over 20% had visited four or more times in that period. When examining prior visitation at the group level, the results change slightly as many groups in the sample included participants who had visited in the past year, with various frequencies, as well as those who had not visited at all. Roughly one-third of groups were composed entirely of participants who had not visited at all in the previous year. Groups that included participants who had visited one to three times or made up about 8% of the sample each while 22% of groups had visited four or more times in the past year. Groups made up of participants with mixed prior visitation made up 26% of the sample. Six groups (12% of the sample) did not state the prior visitation for any of their members.

Characteristics of Participants in Subgroups

High Experience Group - The twelve groups, twenty-seven individuals in total, in this sample had all visited the Zoo at least four previous times in the year prior to their participation in the study. As study participants, four of the groups visited on a weekday and the remaining eight on a weekend. Seven of the visits took place from July to September (peak season) and five from October to January (non-peak season). Eighteen females and nine males took part, which included eighteen adults and nine children. Seven groups were composed of adults and children together and five were adult-only groups. The majority of participants were either Zoo Members or young enough to receive free admission (age 2 and younger). Two participants were non-members. Of the adults, all but one were University or College educated including some adults with a graduate level education.

No Experience Group - The fifteen groups, sixty individuals in total, in this sample had not visited the Zoo at all in the year prior to their participation in the study, and several had never visited. As study participants, twelve of the groups visited on a weekday and the remaining three on a weekend. Thirteen of the visits took place from July to September (peak season) and two from October to November (non-peak season). Thirty-three females and twenty-seven males took part, which included forty-one adults and nineteen children. Nine groups were composed of adults and children together and six were adults-only groups. The majority of participants were not Zoo Members or were young enough to receive free admission (age 2 and younger). Of the adults, the majority were University/College educated including some educated at a graduate level.

3.2.3 Visitor Study Details

The Visitor Study focused on the visitor experience of general visitors, as opposed to

school or organized groups. While both types of audiences have been studied in a zoo context previously, it seemed as if the present focus on meaning-making was better suited to general visitors since school or organized groups often have specific agendas, which are more cognitive-based and not representative of a casual visitor. Also, casual visitors make up the vast majority of the Toronto Zoo's 1.3 million yearly attendance so this seemed like a fruitful audience to investigate. Furthermore, the Toronto Zoo's annual Visitor Survey indicates that, outside of organized groups, most visitors attend in groups of two or more (Toronto Zoo 2012). The decision to study groups as opposed to individuals was also congruent with a socio-constructivist approach. As such, the study focused on meaning-making as emerging from the collective experiences of each group, rather than as individual in nature, and so focused on the group's collective experiences via their comments and photographs rather than attributing comments or photos to one group member in particular.

Participant groups were recruited from the general public and from the Toronto Zoo's membership via the Zoo's communication media, mainly e-mail lists. Groups used the "MobilyTrip" application[5] (app) (www.mobilytrip.com) on their personal mobile devices to create a personalized travel journal of their visit. Through the app's online interface, users can view and share their travel experience with friends and/or the general public (e.g. Figure 10).

Groups were asked to "Add a Place" using the app each time a group member/members stopped to look, listen, smell, feel, taste or participate with Zoo

[5] Mobily Trip is a multi-media travel diary available for mobile devices. It allows users to share the route, photographs, comments, general impressions, and ratings of their travels in real time. It also uses the mobile device's Global Positioning System to accurately track the location, movement, and pinpoint the waypoints made by travelers.

content during their visit, thereby creating a journal entry. This entry was to include at least one photograph of the element and a written comment about why they stopped at this element and their thoughts and/or feelings about it (see Figure 11). The use of an app into which visitors entered their own data enabled a naturalistic, "in the moment" and "moment by moment" glimpse into the groups' experiences and meaning- making that has been seen as beneficial by some academics (e.g. Allen 2002).The app automatically recorded the location of each entry via GPS. Participant groups were required to share their journals with the primary researcher via an automatic email sent through this application.

Figure 10 – Mobily Trip Online Interface

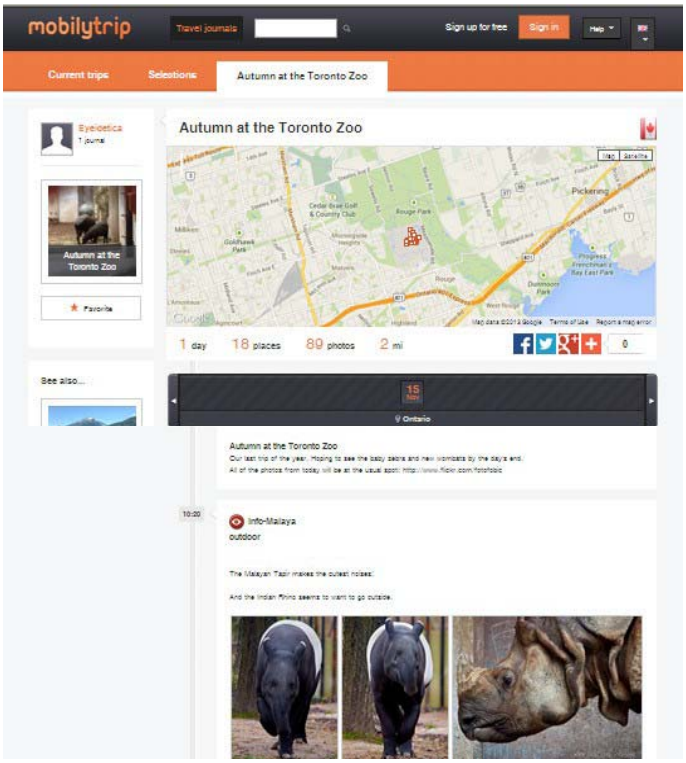
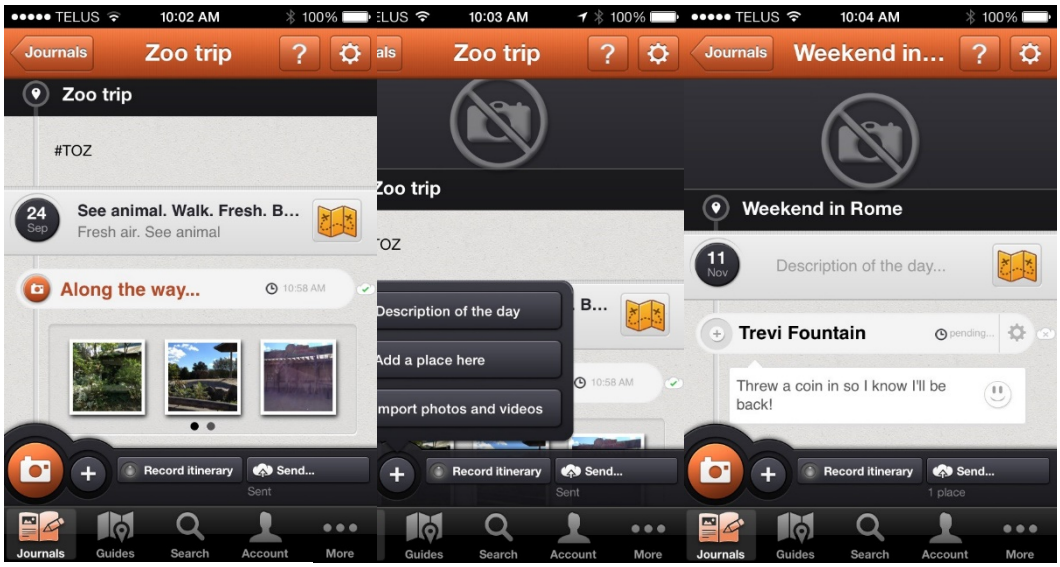


Figure 11 – Mobily Trip Application Screen Shots



Groups received a pre-visit orientation package explaining the project and the terms, conditions, and consent to participate. A pre-visit questionnaire was also used to obtain relevant demographic information on each participant and the group as a whole. Each participant signed an informed consent form (Appendix A). Parents/Guardians of participants under the age of 18 signed this form on behalf of their child(ren).

Once on-site, participant groups met briefly with a study representative to ensure the app was correctly installed and that they understood the activity and how to use the application. The pre-visit questionnaire was administered at that time. A pocket tip sheet was also provided (Appendix B).

The following data were collected via participants' use of the application: track taken; location of waypoints added; clock time each waypoint was added; photograph(s) and comment associated with each waypoint; general comments about their visit.

The application automatically tracked the movement of each group as they carried out

their visit and rendered this track, as well as the associated waypoints, on a Google Maps™ mapping service interface, which could be viewed online once the journal was uploaded to the internet. Although it has been noted that tracking visitors is a method that does not provide a full, rich picture of how visitors are experiencing museums, it is still regarded as a basic method that should be included in any study of visitor behaviour in an exhibit setting (Klein 1993).

3.3 Intended Curriculum of the Toronto Zoo

In order to explore how the educational intentions of the Zoo were translated in the lived experiences of its visitors, information on the Zoo's intended curriculum was gathered using the Zoo's Strategic Plan (Toronto Zoo 2009), the Conservation, Education, and Wildlife Division's Goals & Objectives (Toronto Zoo 2013), and a site inventory completed by Education Branch staff. In the inventory, management staff in the Zoo's Education Branch were tasked with locating on the Zoo map specifically at which content (e.g. exhibition, interactive feature) they would expect or hope that visitors would be highly engaged vis a vis their educational goals, as well as, the type or types of engagement (cognitive, affective, psychomotor) they would hope to see. In this manner, both the broader educational goals of the Zoo along with the specific educational messages emphasized were plotted on the Zoo map.

In addition, the Zoo's Education Branch management staff created a list of words they would hope to be included in the journals of those partaking in the visitor study, words that would indicate that their educational goals were being realized. These words were later compared with the most common words used in the journals to ascertain the level of alignment between the Zoo's goals and the visitor experience.

3.4 Spatial Characteristics of Toronto Zoo Site

3.4.1 Space Syntax

This study adapted two of the more qualitative methods of space syntax to explore the integration and morphology of the Zoo site. Firstly, the site was interpreted as a series of justified graphs, constructed for each space in the layout. A departure was taken from traditional space syntax analysis in that the convex spaces used to create the graph were divided not based on visual accessibility alone, but mainly on actual physical accessibility[6].

A justified graph is a schematic representation of space with circles depicting spaces and lines depicting connections between spaces. It allows for a visual representation of the depth of a particular layout, as seen from any of the spaces within it and, it has been argued, makes unobvious patterns clear by bringing structures to the surface and using them as ideas to think with (Hiller and Tzortzi 2011). As shown in Figure 12 (a & b), deeper layouts are often tree-like and usually represent more segregated layouts whereas shallower, bush-like graphs depict more integrated spaces (Klarqvist 1993).

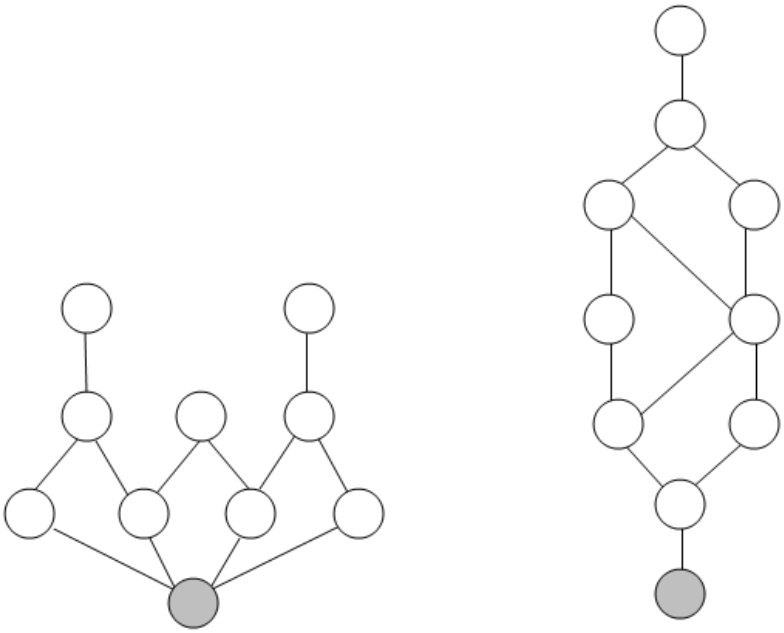
Spatial Typology

From the justified graph, spaces were categorized based on their spatial type (see Table 1) to determine, at a qualitative level, both the local and global properties of the Zoo's spatial configuration. D-spaces are the most integrated and usually see the most

[6] Although some units could not be taken in in a single glance, they were deemed to be discrete in that the entire unit was physically accessible and followed a prescribed route. For example, the African Savanna was categorized as a single convex space as, while the large area cannot be seen all at once, it can be treated as a single "room" in the layout as you must move through it or backtrack to get to other areas in the layout.

occupation and movement, followed by C-spaces. Spaces categorized as A and B are more segregated and are predicted to be less well travelled. By determining the typology of the Zoo site, it was hoped that certain patterns of movement might be better explained and that the underlying framework and philosophy of the Zoo as evidenced in its spatial type might be illuminated.

Figure 12a – Justified Graph of Integrated Space – and 12b – Justified Graph of Segregated Space (Hillier and Tzortzi 2011)



a) *b)*

Table 1 – Space Syntax Spatial Types (Hillier and Tzortzi 2011)

Spatial Type	Description
A	Spaces with only one outward connection. As such, A-spaces are dead-ends.
B	Spaces with more than one connection but located on the way to one or more "A" spaces, so one must backtrack through a "B" space to get to the rest of the layout.
C	Spaces that lie on at least one circulation ring and are connected to two other spaces.
D	Spaces that are connected to more than two other spaces and are found on at least two circulation rings in the layout

Integration Analysis

Justified graphs were then created for each space in the Zoo layout (see Figure 29 for sample) and the total depth of each space was measured by counting the total number of spaces radiating from that space at each level of depth. The resulting figures represent the total depth of each space. Total depth allows for a comparison between spaces based on their integration in relation to the entire layout. Spaces with higher values are more segregated and those with lower values more integrated.

3.4.2 Site Analysis for Wayfinding (Interactive Visual 1)

From an environmental design point of view, the site was categorized and mapped using Lynch's (1960) five categories of the environmental image (paths, edges, districts, nodes, and landmarks). A site analysis for wayfinding was also conducted as a method for gathering further information on how the environmental design of the site might influence movement patterns. This method involved travelling the Zoo site and photographing the various nodes (points at which movement decisions would be

required). Variables including directional and district signage, visibility, and path characteristics were noted. Both the space syntax analysis and site analysis for wayfinding constitute a spatial inventory of the zoo site.

3.5 Data Analysis

Both the spatial and visitor study data analysis was undertaken primarily from a qualitative perspective, using some quantitative data. As one of the main research questions for this project is to examine the contributions of visual representations of data to better understand the Zoo visitor experience, data analysis for this research was primarily undertaken from a visual point of view.

The analysis focused on the following questions:

- What do visitors' patterns of movement and spatial viewing sequences reveal about the types of experiences realized at the Toronto Zoo?
- Where, specifically, are the concentration points of movement and of meaning-making on the Zoo site? What content is present at these locations?
- What meaning-making processes emerge and at which locations?
- How do these lived experiences compare with the Zoo's intended curriculum? How does the visualization of these experiences assist in a more holistic understanding of the meaning-making potentials actualized at the Toronto Zoo?

3.5.1 Mapping and Thematic Analyses

Mapping tracks and waypoints

The tracks of each group were transposed and layered onto a schematic map[7] of the

[7] This map was based on an interpretation of a Google Maps™ mapping service satellite image of the Toronto Zoo from the http://maps.stamen.com/ web site. Using Adobe® Photoshop®, various major Zoo features were added to create a simple yet detailed image of the Zoo site as a plan view.

Zoo in order to visualize the collective movement sequence of all of the groups in the visitor study. The waypoints of each group were then transposed and layered onto that map to visually represent the points of experience for the sample as a whole. These tracks and waypoints can be seen in Interactive Visuals 3 and 4. In the context of this participatory study, the resulting maps might be conceived of as an "externalization" of visitors' experiences. The collective movement and experience sequence was then overlaid on the environmental image map of the site and then the space syntax map to visually explore what, if any, patterns might emerge (Interactive Visual 1)

Thematic analysis of waypoints

Waypoints were analyzed further by coding them based on type (Table 2) and theme(s) (Table 3 and 4) to determine the types of features that were engaged with, which themes emerged, and in which areas and proportions.

Similar to Allen (2002), the thematic codes assigned to comments and photographs were created in an emergent manner, iteratively derived by categorizing each into exclusive thematic units based on the thoughts, feelings, and behaviours they reflected. This study also attempted to be open to the many different types of experiences visitors might have. These themes were grouped into three categories, as relevant, based on Bloom's (1956) taxonomy of educational objectives: cognitive, affective, and psychomotor (Table 5). Bloom's taxonomy correlates well with the types of experiences that visitors have in cultural institutions: knowing, feeling, and doing (Allen 2002).

Each type of waypoint was colour-coded and these colours were added to the schematic map showing tracks to explore whether any patterns emerged. Photographs taken by visitors were used to cross-reference their location and the feature they were focusing on. This helped if GPS data was unavailable or inaccurate. Waypoints with high

cumulative cognitive, affective, and/or psychomotor responses were highlighted on the schematic visitor experience map of both the high experience and no experience sub-groups (Interactive Visuals 3 and 4). Photographs taken and comments recorded at these locations of high engagement are shown in relation to their physical situation.

Table 2 – Coding Scheme for Waypoints

WAYPOINT TYPE	DESCRIPTION
Animal	Any animal, either in the Zoo's collection or naturally occurring on site.
Décor	Themed features of a visual nature. Could not be interacted with.
Interactive	Any non-animal feature that could be interacted with (e.g. feature designed for children to play on, photo opportunity).
Nature	Elements naturally occurring on site (e.g. native tree).
Plant	Any plant in the Zoo's collection.
Service	Element designed to fulfill a basic need (e.g. washroom, restaurant).
Signage	Visual representation of information (may or may not include text), mainly in the form of a sign or graphic element.
Staff	Seeing or interacting with staff.
Volunteer-led Interpretive	Interacting at a designated interpretive area, with or without the presence of a Volunteer.

A total of 29 themes relating to cognitive, affective, and psychomotor responses were coded using inductive methods from the thoughts, feelings, and behaviours demonstrated by visitor comments and photographs. Cognitive responses were categorized as those that elicited a mainly intellectual response ranging from a simple observation about the visual characteristics of an animal, to relaying factual information, to inferring reasons for an animal's behaviour or questioning an animal's characteristics, to relating content to prior knowledge, experience, or beliefs. Affective responses were those that related mainly to an emotional response including feelings

of excitement and enjoyment, sensory comments related to smells, sounds etc., and aesthetic responses. Psychomotor responses were those that related mainly to actions or behaviours carried out by visitors and included moving, picture taking, interacting with objects, and viewing animals. Of the 29 themes, 24 were separated for deeper analysis, as they were identified, based on previous studies (e.g. Allen 2002, Borun, Chambers, and Cleghorn 1996, Packer 2006), as those that were more closely linked to learning/meaning- making. Eight could be grouped as affective, eight as cognitive, and eight as psychomotor.

Collective analysis

As a final method of both analyzing and visually representing the data collected, the major variables were plotted on the schematic map of the site. The tracks and waypoints for each group were overlaid and colours and symbols were used to reflect the themes and their frequencies at each location. Using interactive Adobe PDF technology, the data were visually represented for analysis and presentation (see Interactive Visuals 1 to 5), allowing for the juxtaposition of certain variables with others with the aim of revealing any patterns between: Type of waypoint (e.g. animal, interactive, service); Spatial characteristics (e.g. nodes, integration score of area) ; Specific content (e.g. polar bear underwater viewing) ; Frequency of visitation; Level of engagement.

In analyzing the resulting maps, Abrams & Hall's (2006) cautions about maps and map analysis were taken into consideration.[8]

[8] Sequence: a map does not stand in isolation, it is part of a sequence of those that have come before and after; Power: maps are expressions of power; Dichotomy: maps show certain things (e.g. movement) and suppress others; Context: a map is a discrete view of a discrete place and time, and fails to show the broader surroundings.

Table 3 – Coding scheme of thematic analysis of comments for thoughts/feelings

THEME	DESCRIPTION
Anticipation	Looking forward to or wishing to do something
Behaviour Change	Expressing an intention to change a behaviour or stating that a behaviour change has already occurred.
Excitement/ Amazement	Demonstrating enthusiasm, astonishment, surprise.
Evaluation	Positive or negative appraisal.
Fear	Being afraid of something or to do something.
Goals	Relating to the goals of the visit.
Heat	Demonstrating high temperature-related discomfort.
Beauty/Aesthetic/ Restoration/Inspiration	Expressing reverence or a sense of renewal and/or inspiration.
Knowledge	Gaining new factual knowledge or relating to existing factual knowledge.
Appealing/enjoyable	Expressing an attraction, pleasure, and/or affection of or for something.
Memory/Tradition	Relating thoughts/feelings/behaviours to memories or repetitive acts.
Observation	A simple statement relating to what can be concretely seen or experienced.
Questioning/ Wondering/Inferring	Asking questions related to the content and/or speculating on reasons for what is being experienced.
Relating/ Connecting	Linking what is being experienced to the personal and/or social experience of the participant(s).
Sadness	Expressing sorrow.
Wayfinding	Relating to navigation.

Table 4 – Coding scheme of thematic analysis of comments for behaviours

THEME	DESCRIPTION
Searching	Looking for an animal in an exhibit.
Eating	Partaking in a meal or snack.
Facilitating	Helping another participant experience the content.
Interacting	Physically manipulating or using an element.
Laughing, singing	Expressing an auditory response.
Moving	Any motion (e.g. walking, climbing).
Picture taking	Any waypoint where three or more photographs were taken; any posed photograph of a group member; any mention of taking a photo.
Reading	Reading textual material (e.g. signage).
Sensing	Use of the senses (smell, taste, touch, hearing, sight).
Resting	Taking a break.
Viewing	Watching or seeing an element (usually but not exclusively, an animal).
Waiting	A delay beyond the participant's control.
Washroom stop	Visiting a restroom.

Table 5 – Grouping of Themes into Learning Categories

CATEGORY	THEMES GROUPED
Cognitive	Behaviour change Knowledge Memory Observation Questioning/Wondering/Inferring Relating/Connecting Reading
Affective	Appealing/Enjoyable Beauty/Aesthetic/Restoration/Inspiration Excitement/Amazement Fear Sadness Laughing/Singing
Psychomotor	Facilitating Interacting Moving Searching Sensing Wayfinding

3.5.2 Visual Analyses

Quantitative analysis of photographs

Microsoft Windows Photo Gallery® was used to tag the photographs with each relevant thematic code, as well as, the associated waypoint codes, and then sort the photographs into groups for analysis. The more that variable was photographed both in an individual group and for all groups collectively, the more emphasis it was seen to have received in the sample.

Qualitative analysis of photographs

Photographs were grouped for analysis based on a sub-set of the thoughts, feelings, and behavioural thematic tags. Based on the research of Borun, Chambers, & Cleghorn (1996), the themes "questioning/wondering/inferring" and "relating/connecting" were selected as both mapped well onto the highest level of cognitive learning that the group classified in their research (i.e. interpreting/applying). The themes "excitement/amazement", "appealing/enjoyable", "beauty/aesthetic/inspiration", and "interacting" were chosen based on research that has shown that these heightened emotions can contribute to positive learning outcomes (Falk and Gillespie 2009). "Memory" was also selected for qualitative analysis as Falk and Dierking (2013) have hypothesized that learning in free-choice settings is represented by the experiences that visitor remember. The theme "behaviour change" was chosen as it is a specific goal of the Zoo.

Photograph sequencing was also undertaken (Interactive Visual 5). Two groups from the high experience sample and two from the no experience subgroup were selected based on the high degree to which they typified the movement sequences of those in their respective subgroups. The photographs from each of these groups were arranged

linearly according to the time and sequence in which they were taken. It was hoped that these sequences would provide evidence of the actual lived experiences of visitors that might be difficult to capture in a map. While bird's eye views can be seen as comprehensive (Cosgrove 2006), the directed focus of in situ views provides a more qualitatively personal and unique perspective (Davis n.d.) on how that route/visit actually looked for that group.

3.5.3 Textual Analysis

Word clouds[9] were used in this context to ascertain the words emphasized in the journals and what these words might reveal about the types of experiences visitors had at the Zoo, about the types of thoughts, moods, and behaviours the Zoo invokes, and to compare the words used in the journals to the educational intentions of the Zoo.

Word clouds were created for the entire sample of journals, as well as, each of the two sub-samples (Figures 35, 38, 39) using the Wordle™ web site (www.wordle.net). A visual examination of each word cloud individually and compared to one another was completed to determine the words most frequently used in the journals. The top 20 words based on frequency were pulled for each of the samples as well. Finally, words that were deemed to represent visitor behaviour (except for words related to watching, seeing, viewing) and those that indicated cognitive engagement, including their frequencies, were pulled from each sample to compare the variety of words used and their frequency both within and among each sample.

[9] A word cloud is "an image composed of words used in a particular text or subject, in which the size of each word indicates its frequency or importance" (Oxford University Press n.d.)

3.6 Data Representation

Interactive Adobe® Acrobat® PDF was used to present the data, allowing for the juxtaposition of certain variables with others with the aim of revealing and representing trends (see Interactive Visuals). The use of interactive media was used to capture the dynamic qualities and idiosyncrasies of the information collected, to represent the "flowing nature of existence" (McKinnon 2011, 456) in ways that traditional paper-based maps are unable to, and also to reveal the relationships between different variables and mappings. In making cartographic choices, this thesis acknowledges that each choice of what to include or exclude or how to symbolize the external world, carries implications for the viewer, as maps tend to be taken as literal and objective truths of the world (McKinnon 2011).

4. Findings

4.1 Overview

Results of the wayfinding and space syntax analyses along with the Visitor Study suggest that there may be a link between the spatial aspects of the Toronto Zoo site and visitor movement, especially for those visitors who are less familiar with the site. In this manner, the visitor experience may be tied to the geography of the Zoo.

Visitors with ample experience on the Zoo site traverse it differently, engage and focus on a different array of displays, and emphasize slightly different physical experiences than those without recent experience. However, in general, visitors with both high and low familiarity with the site had relatively similar cognitive and affective experiences.

The Zoo's intended curriculum seems to be partially realized in the lived experiences of its visitors. These lived experiences also point to the rich array of alternate and oblique curricula carried out by Zoo visitors.

4.2 Wayfinding Analysis (Interactive Visual 1 & 2)

4.2.1 Summary

The Zoo is organized into six main zoogeographic regions situated around a core wooded area at the east of the site. Animals and plants from each region of the world are grouped together into these regions. Major pedestrian paths and nodes connect each district. Access to many areas is made possible only by complex routes and wayfinding choices.

The Zoo's existing wayfinding system consists of a handheld visitor's map, on-site signage, and zoomobile (open-air people-mover), along with various environmental cues. The Zoo does feature some iconic architecture and a small number of distinctive landmarks to aid visitors in wayfinding, however, overall, the complex layout and repetitive and uniform nature of the landscaping, built environment, and other design features make wayshowing and wayfinding a challenge. While the natural features of the site, especially the abundance of mature woods and trees, create a restorative, outdoorsy feel, they also obstruct views that might increase the legibility and imageability of the site and assist visitors in forming useful cognitive maps to facilitate wayfinding. Signs that may be clearly visible in winter could be obscured by vegetation in the summer. Distinctive landscaping in the warmer months may act as landmarks that disappear in winter. After a snow fall, the site may be even more homogeneous.

This site analysis examines the Zoo on a macro level and does not look in detail at the indoor exhibit areas. In most cases this analysis does not reference the popularity of animals or marketing of various attractions/exhibits although these factors, of course, play a part in the circulation and wayfinding decisions of visitors as visitors often plan their route at the outset of their visit to include these features.

4.2.2 Layout (Interactive Visual 1)

Districts

While the Zoo Visitor Map (Figure 21) groups some regions together, highlighting, through the use of colour, six districts in total, during the period of study, this analysis found that in actuality the Zoo is divided into eight districts: Indomalaya, African Rainforest Pavilion, African Savanna, Canadian Domain, Americas, Tundra Trek, Australasia, and Discovery Zone. Each district is differentiated from the next by subtle

environmental changes, namely district gateways, signage style, and, in some cases, style of décor.

Paths

Paths at the Zoo are mainly asphalt with some use of interlocking brick pavers. The system consists of two intersecting loops (a figure eight, grounded by the central core wooded area of the site). While this loop is evident on the Visitor Map, it is not well-defined for visitors in situ. Most of the districts are situated off of this main loop and consist of heavily prescribed pathways, either looping back to the main path or dead-ending, requiring visitors to backtrack to their starting point.

Landmarks

Due to the natural elements and topography of the Zoo site, there are few landmarks that can be seen from all areas within each district and no landmarks that are visible site-wide. Some local landmarks do exist.

Major Nodes

For the purposes of this analysis, major nodes are defined as decision or gathering points. There are two major nodes on-site.

1. Front entrance courtyard (Figure 13)

Potential landmarks: Conservation Carousel, Zootique Gift Shop, Greenhouse Gift Shop, Peacock Café signage

Upon entering the Zoo, visitors are in a large treed courtyard. Directional signage here is limited (a single directional map and one directional sign board). The most recognizable elements are the Conservation Carousel, Peacock Café, and the Greenhouse Gift Shop in the foreground, and distinct architecture of the Zootique in

the background. Visitors can choose from two main pathways in this node, one branching to the south, towards the Indomalayan exhibits and the other to the north, towards the Discovery Zone. The shape of the courtyard, round with a bottleneck to the far west, obscures both of these major circulation routes. However, with even a moderate amount of visitors present, movement of visitors tends to draw incoming groups towards these routes. Alternatively, visitors may board the Zoomobile to the south. If visitors are not familiar with the Zoomobile or are distracted by the competing features in this area, they may not be drawn towards it.

With its treed garden beds, large, bright signage, and multiple attractions, there is much competition for the visitors' attention in the front entrance courtyard. In the low season, this configuration may benefit the Zoo as having visitors mill about in this holding area may draw them towards some of the paid attractions. At busier times, the holding effect of this area may make the courtyard overly congested and even more difficult to navigate.

2. Caribou Café Courtyard (Figure 14)

Potential landmarks: Biplane, Caribou Café, Tundra Trek sign

Four separate pathways converge on/diverge from this node that is anchored by the Caribou Café restaurant and a small biplane display to the south. Standing here, visitors may choose to visit Tundra Trek or head towards Australasia, Americas/Africa, or the Discovery Zone and front entrance.

The restaurant and its outdoor patio, the biplane, and the large carved wooden directional sign pointing to Tundra Trek are the most distinctive features of this node. If the wolves are active or howling, they would also draw visitors' attention northward. If

entering this node from the west or south it is likely that the view of the Tundra Trek will draw visitors northward. Entering the node from the east the biplane draws sightlines away from Tundra Trek.

Overall the layout and landmarks of this node, surrounded by a uniform background of trees, tend to draw visitors towards Tundra Trek. The placement of other signage makes it difficult for all of those entering/exiting this node to choose a pathway (except Tundra Trek) and anecdotal evidence seems to support this. The only directional signage is set on the far south side of the node and directs visitors southward toward the Discovery Zone and front entrance. There are no signs at all in this node directing visitors east towards Australasia or west towards Americas. There is one directory map in this node. The openness of this node tends to mask the potential paths of movement, especially when approaching from the south, making the space function as a holding area and further compounding the signage issues by dwarfing and deemphasizing the scale of the environmental graphics in the space.

Minor Nodes

Minor nodes are defined in this study as areas where the path branches in two or more directions and visitors must select a route. The Zoo has six minor nodes.

1. Discovery Zone (Figure 15 a & b)

Potential landmarks: District gateway, Zootique Gift Shop, Splash Island

Just to the north of the Zootique visitors may select to enter the Discovery Zone District or continue on the main pathway into the woods or towards the main entrance (depending on the direction of their approach). This district is clearly demarcated with a large arch and sign including various carved wooden animals. Once inside the courtyard of the Discovery Zone visitors during the study period could choose to enter the Splash

Island water park, the feature Stingray Bay hands-on animal exhibit, the Kids Zoo, or the Waterside Theatre.

During the high season, the camel rides operate immediately opposite the Discovery Zone entrance. For visitors heading in this direction from the Courtyard these are the first live animals they encounter. This draw may cause them to focus their attention away from the Discovery Zone. However, the district gateway and sound of water and voices from Splash Island may also catch their attention.

2. Australasia (Figure 16 a & b)

Potential landmarks: Globe, building identification sign.

This node provides access to two paths (one heading west towards the core woods and south entry of Tundra Trek and the other heading north towards the Wetlands exhibit, Americas Zoomobile stop, and east entry of Tundra Trek). Entering this node from any direction, visitors are most likely to be drawn to the architecture of the Australasia pavilion. If visitors exit Australasia from this point, the biggest visual draw is from the Wetlands Kiosk across the bridge. Directional signage in this node is plentiful and effective at showing visitors the variety of areas that can be accessed from this location, however placement favours visitors who enter the node from the north (Wetlands). Various visual cues drive visitors entering from the west towards the different attractions. This node features one large globe and one directory map.

3. Americas/Africa Hill (top) (Figure 17 a & b)

Potential landmarks: Africa restaurant sign

The centre of this node is dominated by a large treed area that obstructs sightlines from all four converging pathways. Entering this node from the east, visitors must decide between two pathways. To the right, signage directs them to the

restaurant/washrooms and Africa and Indomalayan exhibits. The stylized sign of the Africa restaurant is visible. To the left, visitors can choose to follow the African Savanna or Grizzly Bear trail (note, this is one of the few areas that mentions the footprint trails). This pathway is steeper and does not have any visual draws. Once visitors reach the top of this pathway they must choose again between a southerly and northerly route. There is no signage in view here to aid their decision. Approaching from the south, directional signage is effective at outlining the potential routes and includes one directory map. From the north, directional signage is also effective however the directory map is not visible.

4. African Savanna north side (Figure 18 a & b)

Potential landmarks: Giraffe shade structures, Kesho Park district gateway, Twiga Duka store/Africa Zoomobile stop

This smaller node, allows visitors to select from three pathways (towards Africa Zoomobile stop and Canadian Domain, towards penguins, or into the African Savanna). Entering from the south, signage and visual cues draw visitors towards the Africa Zoomobile stop. With its large carved “Africa” sign, this may lead visitors away from the main Savanna loop. Entering from the west, directional signage is absent however environmental cues (i.e. towering shade structures) tend to usher visitors towards the giraffe exhibit directly ahead. The single directory map is located adjacent to the Africa Zoomobile station.

5. Indo/Africa Boardwalk (Figure 19 a & b)

Potential landmarks: District gateway, boardwalk surface, stairs to elephants, Burrows and Caves exhibit entrance, globe.

The African Savanna, African Rainforest Pavilion, Burrows and Caves exhibits, and Indomalayan Pavilion are all accessible from this node. Entering from the north, signage and environmental cues (colourful district gateway, boardwalk leading down, globe, wall obstructing views to other pathways, movement of other visitors up and down boardwalk) may tend to lead visitors down the boardwalk towards Indomalaya. From the east, colourful signage ushers visitors into Africa and directs them towards the Pavilion or Savanna. The signage for Savanna and the visual cues at the top of the hill would likely draw visitors in that direction. Visitors entering from the south may be drawn down the boardwalk to Indomalaya by the large and colourful district gateway and the wide welcoming pathway compared to the smaller asphalt path leading to the African Rainforest Pavilion. Colourful signage here also highlights the Rainforest. Visitors exiting from the Burrows and Caves exhibits in the lower level of the African Rainforest Pavilion are immediately confronted with the boardwalk in front and Indomalaya district gateway. They must search harder to determine the other routes that are possible from this node, although colourful signage does stand out here more than other places. There is no directory map here.

6. Americas/Africa hill (bottom) (Figure 20 a & b)

Potential landmarks: First Nation Art Garden sign.

Visitors may choose between three pathways in this node (leading to Africa, Americas, or the north east side of the site). Entering from the west, directional signage is absent however the large and colourful First Nation Art Garden sign is a likely attractor. This would lead visitors into the Americas district (no district signage is present). Further along in the sightline is the biplane that may help orient visitors to their location in the Zoo if they have traversed this area previously. Entering from the north, signage directs

visitors westwards up the hill to the various exhibits but not eastward towards Tundra Trek, Australasia etc. Entering from the east, various generations of permanent and temporary signage outline the exhibits accessible from each pathway. The Americas pathway is likely the least attractive as it necessitates a hard right and is usually hidden by vegetation. There is no directory map in this node.

Edges

The orientation of the areas surrounding the Zoo's paths (mainly wooded areas or animal exhibits) functions as barriers to movement. Wooded areas are either enclosed with fencing or left open but clearly demarcated from paths with the use of concrete curbs. In the latter, the edge is permeable yet one rarely sees visitors traveling through the woods that form the core of the Zoo site. In most districts, the edges of the animals' exhibits themselves, be they glass, concrete, rock, mesh, or simulated natural features form the boundaries.

Figure 13 - Front Entrance Courtyard Node (MA1)



Figure 14 - Caribou Cafe Courtyard Node (MA2)



Figure 15 (a & b) - Discovery Zone Courtyard Node (MN1)





Figure 16 - Australasia Node (a & b) (MN2)





Figure 17 (a & b) - Americas/Africa Hill (top) Node (MN3)





Figure 18 (a & b) - Africa North Node (MN4)



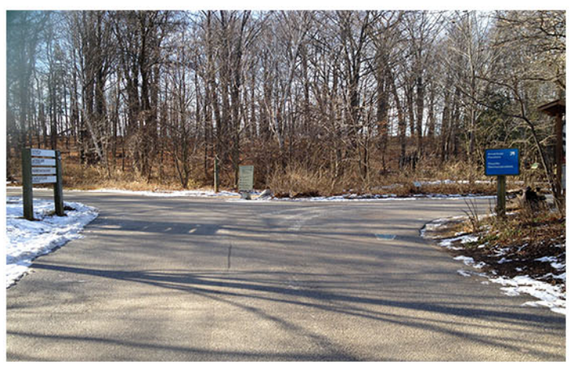


Figure 19 (a & b) - Indo/Africa Boardwalk Node (MN5)





Figure 20 (a & b) - Americas/Africa Hill (bottom) Node (MN6)





Interactive Visual 1 - Spatial Analyses

WAYFINDING

DISTRICTS

Americas
Tundra Trek
Australasia
Discovery Zone
Indomalaya
African Rainforest
African Savanna
Canadian Domain

CORE PATH SYSTEM

LANDMARKS X

NODES

Major
MA1: Front Entrance Courtyard
MA2: Caribou Cafe Courtyard

Minor
MN1: Discovery Zone Courtyard
MN2: Australasia
MN3: Top of Am/Africa Hill
MN4: Afric. Savanna North Side
MN5: Indo/Africa Boardwalk
MN6: BoÃom of Am/Africa Hill

WAYFINDING

SPACE SYNTAX

INTEGRATION ANALYSIS

LOW
HIGH

SPATIAL TYPOLOGY

A
B
C
D

SYNTAX

VISITOR EXPERIENCE

WAYPOINTS

Less Visitation — More Visitation

TRACKS

Less Travelled — More Travelled

EXPERIENCE

SHOW ALL



MAP NOT TO SCALE

4.2.3 Components of Toronto Zoo's Wayshowing System

Visitor Map & Guide (Figure 21)

The visitor map is the centerfold of the 2012 Map & Guide, a full-colour fold-out pamphlet 42 cm x 56 cm in full size. Five zoogeographic regions and the attraction-based Discovery Zone are differentiated on the map based on colour. The Guide also includes supplementary information about Zoo attractions and services. In many cases, the architecture of key buildings such as the pavilions and restaurants is visually represented on the visitor map.

Directional Signage (Figure 22 a,b & c))

Most wayfinding-related signage on-site is directional. District/building or animal names (often accompanied by pictograms) and arrows direct visitors towards main or popular attractions. Signage exists from various stages of the Zoo's history, sometimes all in the same spot! Signage materials range from cedar trailheads, to white laminate, to more modern metal structures. Colour is minimal except on the original cedar trailhead signage.

District Gateways (Figure 23)

Entrances to some zoogeographic regions (e.g. Indomalaya, Africa, Tundra Trek, and Discovery Zone) are demarcated with colourful signs. The scale of these gateways and their attempt at a distinctive feel (e.g. many feature animals found in the district) might help to orient visitors and provide a sense of ambience.

Building Identification (Figure 24)

Exhibit buildings are labelled with simple white lettering. The African Rainforest Pavilion also has a carved wooden sign. Restaurants are labelled with colourful signs.

Footprints (Figure 25)

Four types of coloured footprints are painted yearly on the Zoo pathways. Each footprint corresponds to a suggested tour that appears on the Visitor Map but is widely highlighted or reinforced via on-site signage.

Directory maps (Figure 26 a & b)

Scattered throughout the site, these are medium-sized (approximately 3 ½' square) colour reproductions of the visitor map with "you are here" markers.

Zoomobile

The Zoomobile is an open-air tram that operates in the high and shoulder seasons. Its main purpose is to aid in transporting people throughout the large site, while providing an educational commentary. Zoomobile stops are located at the front entrance courtyard, Canadian Domain, African Savanna, and Tundra Trek.

Environmental cues

Pavilions (Figure 27) - The iconic architecture of the Indomalayan and African Rainforest Pavilions clearly represents these as main attractions with a large diversity of displays inside. The remaining three Pavilions (Malayan Woods, Americas, and Australasia) are less striking but echo this architectural form.

Animal exhibits (Figure 28) - While the styles and materials are varied, the barriers around animal exhibits (e.g. chain link fences, concrete and wooden stanchions) clearly cue visitors. Many animal exhibits also include topographical features such as large rocks, climbing structures, grassy hills, and feeding stations.

Topography - The west side of the Zoo site sits atop the Rouge Valley. As visitors make their way towards Africa, they climb steep hills. Making their way back down these hills could help them orient and situate themselves on-site.

Figure 21 - Toronto Zoo Visitor Guide



Figure 23 - Example of District Gateway



Figure 24 - Example of Building Identification



Figure 22 - (a,b,c) - Directional Signage







Figure 25 - Example of Footprint



Figure 26 (a & b) - Directory Maps





Figure 27 - Iconic Pavilion architecture



Figure 28 - Example of animal exhibit cue



4.2.4 Wayfinding Analysis Results

Based on the analysis, at the macro level, the following "hot", "neutral", and "cold" spots emerge. "Hot" spots are those where we would expect high levels of visitor traffic, "neutral" spots where we would expect neutral levels of visitor traffic, and "cold" spots areas where traffic would likely be lower (see Interactive Visual 2)

Hotspots

Indomalaya – Visitors starting their journey southward immediately enter this district and must pass through it to reach other areas of the Zoo. This district has direct access to the Courtyard and exit as well so we would expect to see a lot of movement through here as well as a good amount of focus on its various animal features, especially for those visitors who enter this district at the beginning of their visit before "museum fatigue"[10] has set in.

Tundra Trek – The placement of the entrance to this exhibit (directly off of a major node) along with the large, colourful district gateway and full-sized biplane combine to make it a likely focus. The topography of the exhibit makes it possible for visitors to see animal movement (e.g. wolves) from a distance. With this being one of the newest Zoo exhibits and a baby polar bear on display it is likely to be a destination that visitors consciously seek out as well.

African Savanna – Africa is accessed directly either from Indomalaya or the north

[10]Museum fatigue can be thought of as the tendency for visitors to decrease the time attending to displays and increase the selectivity as the length of their visit increases. It may include factors beyond physical exhaustion including satiation, stress, information overload, competition, limited cognitive capacity and decision making (Bitgood 2009).

section of the main loop. The layout of the junction node between Indomalaya and Africa tends to usher visitors towards the elephant exhibit and African Savanna entrance. While layout does not favour entry into the Savanna from the north end of the site, visitors searching specifically for the new African penguin exhibit and/or feature white lion exhibit may begin their journey here. The visitor map emphasizes the south- west route and shows the east and west loop of the core path system as one continuous route.

African Rainforest Pavilion – The south entrance of this pavilion may be slightly more popular as an entry point as it is situated directly in the pathway towards the elephants. The north entrance is immediately adjacent to one of the two main restaurants and features an outdoor gorilla exhibit and interactive ropes climb attraction for visitors, which might draw visitors who are travelling in the northern side of the site. The iconic architecture of this Pavilion is striking for visitors travelling in this area as well.

Camel rides – Sightlines from the pathway and large, moving animals make this a likely focus for visitors both entering and exiting the Zoo or the Discovery Zone. For visitors who begin their journey by on the north side of the main loop, the camels are the first live animals they encounter.

Discovery Zone – With its large distinctive archway and the sound and movement coming from Splash Island, this district is eye-catching for visitors coming from either direction. Waterside Theatre is home to, in the high season, three different animal shows daily and the popular seasonal Stingray Bay exhibit is also accessed from this spot.

Neutral Spots

Australasia – Wayshowing and the layout of the Zoo site combined tend to focus movement away from this district. The visitor map does highlight the Great Barrier Reef exhibits in the Australasia Pavilion so visitors may seek this attraction out.

Wetlands – If visitors do make their way to Australasia they are likely to notice the wetlands area so we might see a correlation between the two.

Front Entrance Courtyard – All Zoo visitors must enter and exit through the courtyard so we are likely to see a lot of movement here however, as visitors focus on the more basic needs of orienting themselves to the site or leave-taking, they might be less likely to focus on any particular feature or messaging in this area.

Cold Spots

Canadian Domain – This district is the most difficult to find, the furthest from the front gate, and must be accessed by climbing down (and back up) a very long, steep hill. For these reasons, it is expected that this region will see the least movement. However, for those that do venture into the Canadian Domain, the idyllic scenery of Weston pond, distinctive animals are likely to evoke feelings of restoration and connection to nature.

Americas (indoor and outdoor) – The Zoo's layout and wayshowing system actively work against visitors exploring this district. With little ambience, a lack of a clear district gateway, or eye-catching exhibit features, this area is one of the least likely to draw visitors in.

4.3 Space Syntax Analysis (Interactive Visual 1 & 2)

4.3.1 Spatial Typology

The space syntax analysis of the site reveals two main rings of high integration consisting of D-spaces (those with two or more links to other spaces in the layout and that lie on at least two rings). These two rings constitute the most integrated central arteries of the Zoo and we might expect that visitor routes and waypoints will be concentrated along this core.

These main loops then link to a small number of spaces with moderate integration and a large number of spaces with very low integration, revealing a site that is strongly centralized and privileges main pathways and certain Districts, namely the African Savanna and African Rainforest Pavilion, at the exclusion of others. From this main integration core the visit is then structured, especially in the north-east end of the site, based on various decisions to be made by visitors to travel into areas of low integration that then link back to the main core. Interestingly, all of the C- and B- spaces on the site are located in the north-east section and the north-east section has a slightly higher number of choices of poorly integrated A-spaces that visitors might choose to traverse as well.

The most integrated spaces consist mainly of pathways, with few opportunities for viewing animals, while the less integrated spaces are mainly zoogeographic districts where animal displays predominate. The African Rainforest Pavilion and African Savanna are among the most highly integrated areas on site, with the African Savanna district constituting one of the core, integrated circulation routes as well.

Table 6 – Spatial Typology of Toronto Zoo

Type	Spaces	
D-Spaces: Most integrated	Front Entrance Courtyard	South Path
	North Path	African Rainforest
	Indomalaya Courtyard	African Savanna
C-Spaces: Moderately integrated	Tundra Trek	North-west Path
B-Spaces: Moderately poorly integrated	Americas Pavilion	
A-Spaces: Least integrated	Malayan Woods Pavilion	Indomalaya Pavilion
	Canadian Domain	Americas Outdoor
	Australasia Pavilion	Discovery Zone

4.3.2 Integration Analysis

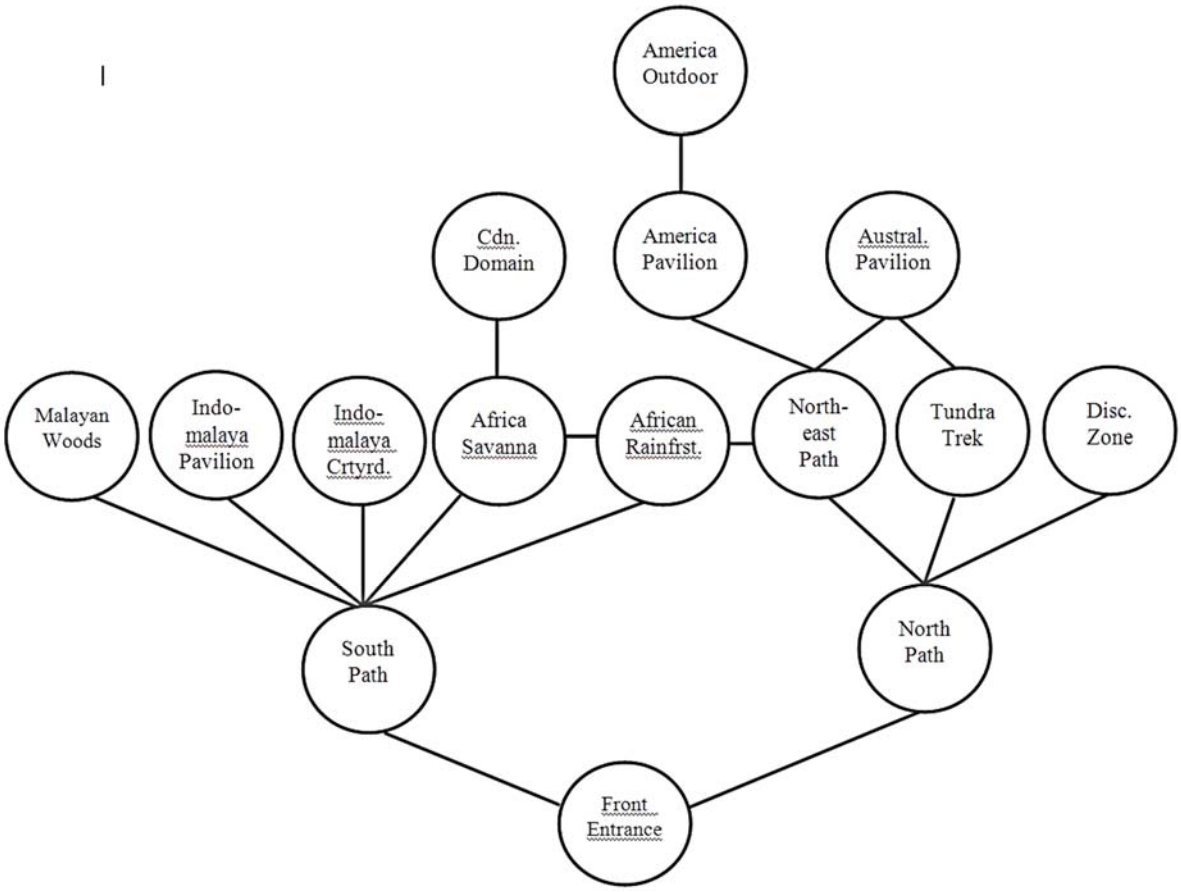
Integration analysis revealed the underlying characteristics of each of the spaces within the Zoo in terms of its degree of integration or segregation from the rest of the layout. Figure 29 shows the justified graph of the site, with the Front Entrance Courtyard as the root. Table 7 lists each space ordered from most integrated to most segregated.

These results, for the most part, mirror those in the spatial typology analysis. Two differences do emerge however, in that the A- space of the Canadian Domain, what one would think is the most segregated area of the Zoo as it is accessed only through the African Savanna, is not as segregated when compared to the rest of the site, perhaps precisely due to its link to the Savanna. Also, the D- space of the Indomalaya Courtyard is poorly integrated in relation to the rest of the site. Since integration analysis measures the number of spaces one must traverse to reach all other spaces in the system, this result indicates that many of the spaces on the site are more deeply situated from this area.

Table 7 – Integration Analysis of Toronto Zoo

Space	Total Depth	Mean Depth (TD/# spaces)	Spatial Typology
African Savanna & North Path	27	1.8	D
African Rainforest Pavilion	28	1.9	D
North-east Path	30	2.0	C
Front Entrance Courtyard	31	2.1	D
South Path	32	2.13	D
Canadian Domain & Tundra Trek	40	2.7	A,C
Americas Pavilion & Australasia Pavilion	41	2.73	A
Discovery Zone	42	2.8	A
Indomalaya Pavilion & Indomalaya	45	3.0	A,D
Malayan Woods Pavilion	50	3.3	A
Americas Outdoor	54	3.6	A

Figure 29 – Justified Graph of Toronto Zoo (root: Front Entrance Courtyard)



Interactive Visual 2 - Spatial and Meaning-Making Hotspots

PREDICTED vs ACTUAL MOVEMENT/ ENGAGEMENT

Hotter  Colder

WAYPOINTS

Less Visitation  More Visitation

WAYFINDING	SPACE SYNTAX	MEANING MAKING	ALL HOT SPOTS

4.4 Visitor Study: Mapping and Thematic Analyses

4.4.1 High Experience Sub-Group (**Interactive Visual 3**)

Tracks

Two-thirds of the groups in this sample conducted their visit entirely in the east side of the Zoo site. The remaining one-third of groups in this sample used the entire main loop of the Zoo, visiting both east and west sides of the site. Of these, three-quarters made additional diversions from the main loop, visiting areas away from the main path. None of the groups in this sample visited the Canadian Domain.

Waypoints

In total, groups marked an average of 23.6 waypoints each. There was much diversity in the places the groups chose to note with only a few notable commonalities: over three-quarters of the groups stopped at the polar bear exhibit and half of the groups made waypoints at the orangutan, tiger, lemur, lion, and Darwin's Dreampond fish exhibits. Waypoints were most dense in the indoor pavilions as well as around the polar bear exhibit and Discovery Zone. They were relatively equally distributed along the routes taken, except for lower density in the south-east region of the Zoo. Animal stops made up the vast majority of stops (68.3%), followed by interactives and signage (see Figure 30).

Thematic Analysis

Thoughts/Feelings (Figure 31) - Groups in this sample exhibited all themes coded except for goal-related. The themes with the highest amount of reoccurrence were, in order, observation, appealing/enjoyable, relating/connecting, and evaluation. Moderately common themes were excitement/amazement, knowledge, and

questioning/wondering/ inferring.

Behaviour (Figure 32) - Picture taking and interacting are the most common behaviours with viewing, reading, and sensing being moderately common.

Figure 30 - Waypoints by Type

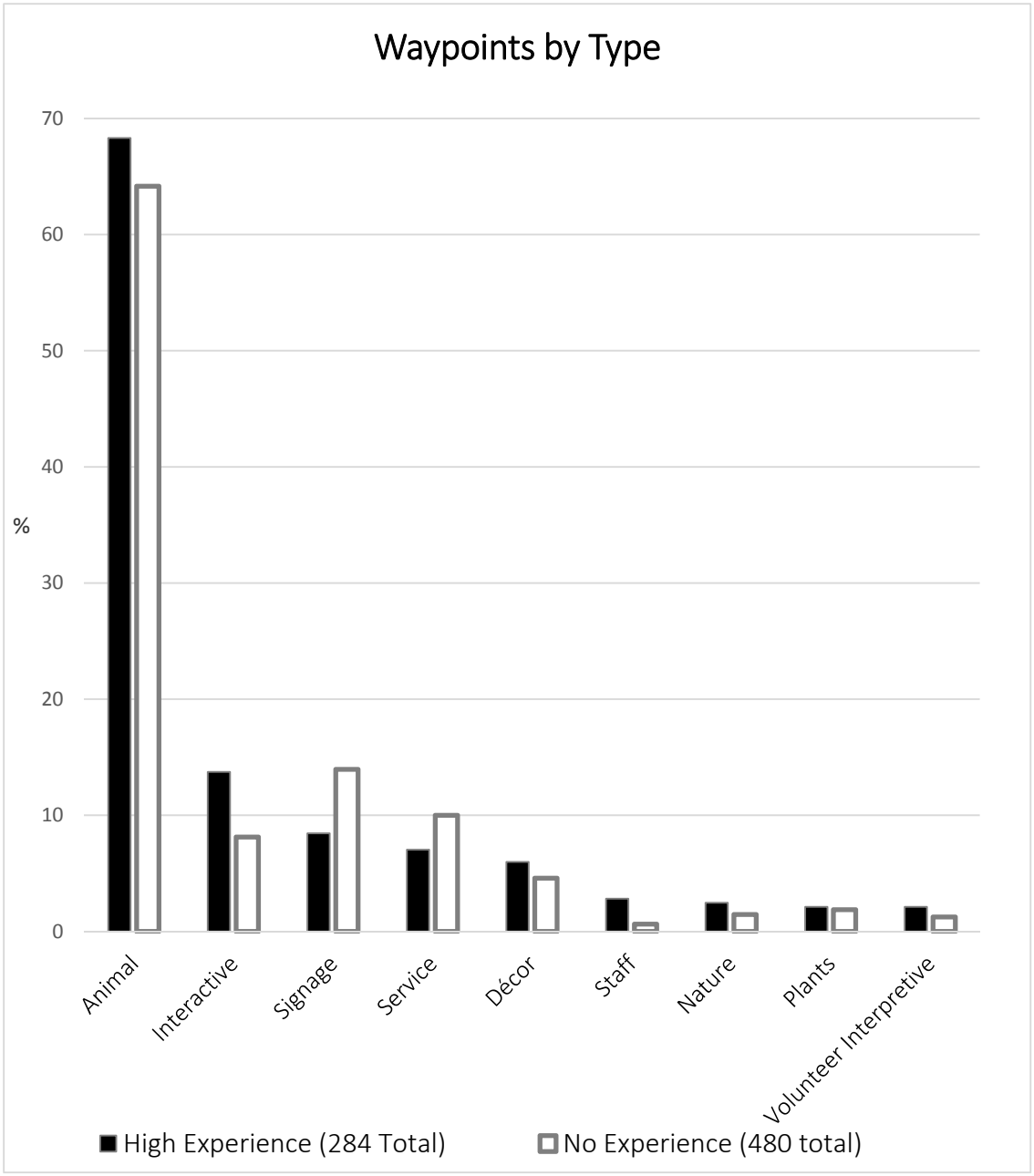


Figure 31- Thematic Analysis - Thoughts/Feelings

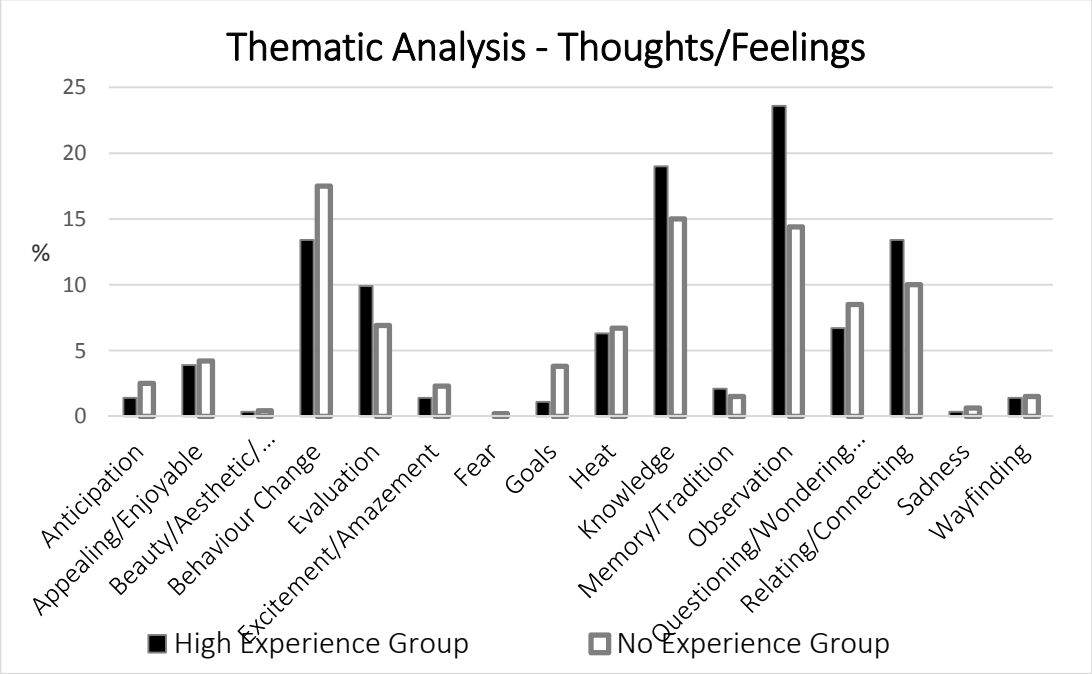
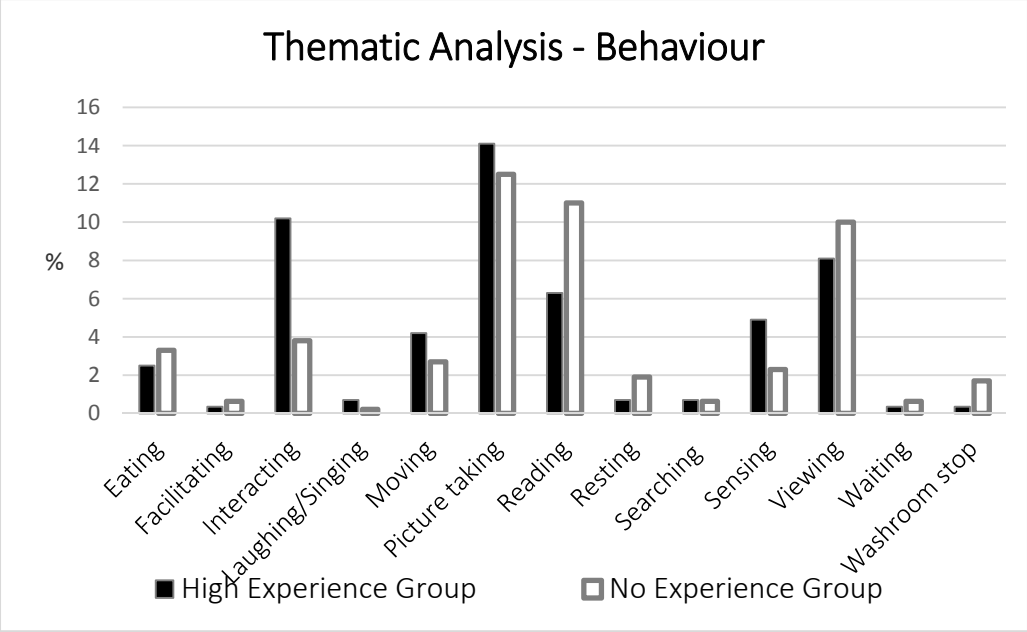
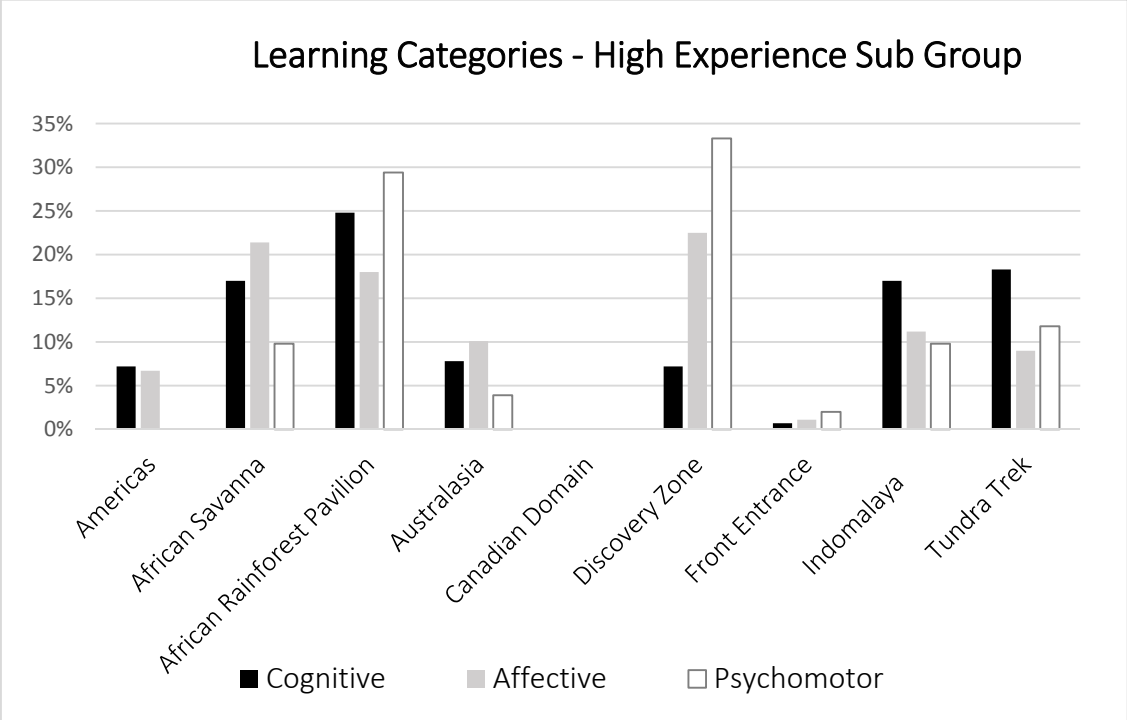


Figure 32 - Thematic Analysis - Behaviour



Learning Categories (Figure 33) - In terms of the cumulative learning categories (cognitive, affective, psychomotor), overall a large number of Zoo districts produced high responses. The African Rainforest Pavilion, Discovery Zone, and African Savanna all provoked 15% or more of the total cognitive, affective, and psychomotor responses for the groups. The African Rainforest Pavilion, Tundra Trek, and African Savanna/ Indomalaya Districts provoked the most cognitive responses. In the affective category, the Discovery Zone, African Savanna, and African Rainforest Pavilion provoked the highest responses, respectively and the highest psychomotor responses were seen at the Discovery Zone, African Rainforest Pavilion, and Tundra Trek.

Figure 33- Learning Categories in each District- High Experience Sub Group



Interactive Visual 3 - Visitor Experience High Experience Subgroup

VISITOR EXPERIENCE

WAYPOINTS

Less Visitation ●●●● More Visitation

- Animal
- Decor
- Interactive/ Interpretive
- Nature/ Plants
- Signage

ENGAGEMENT

High Engagement — ROLL OVER FOR DETAIL

TRACKS

Less Travelled — More Travelled

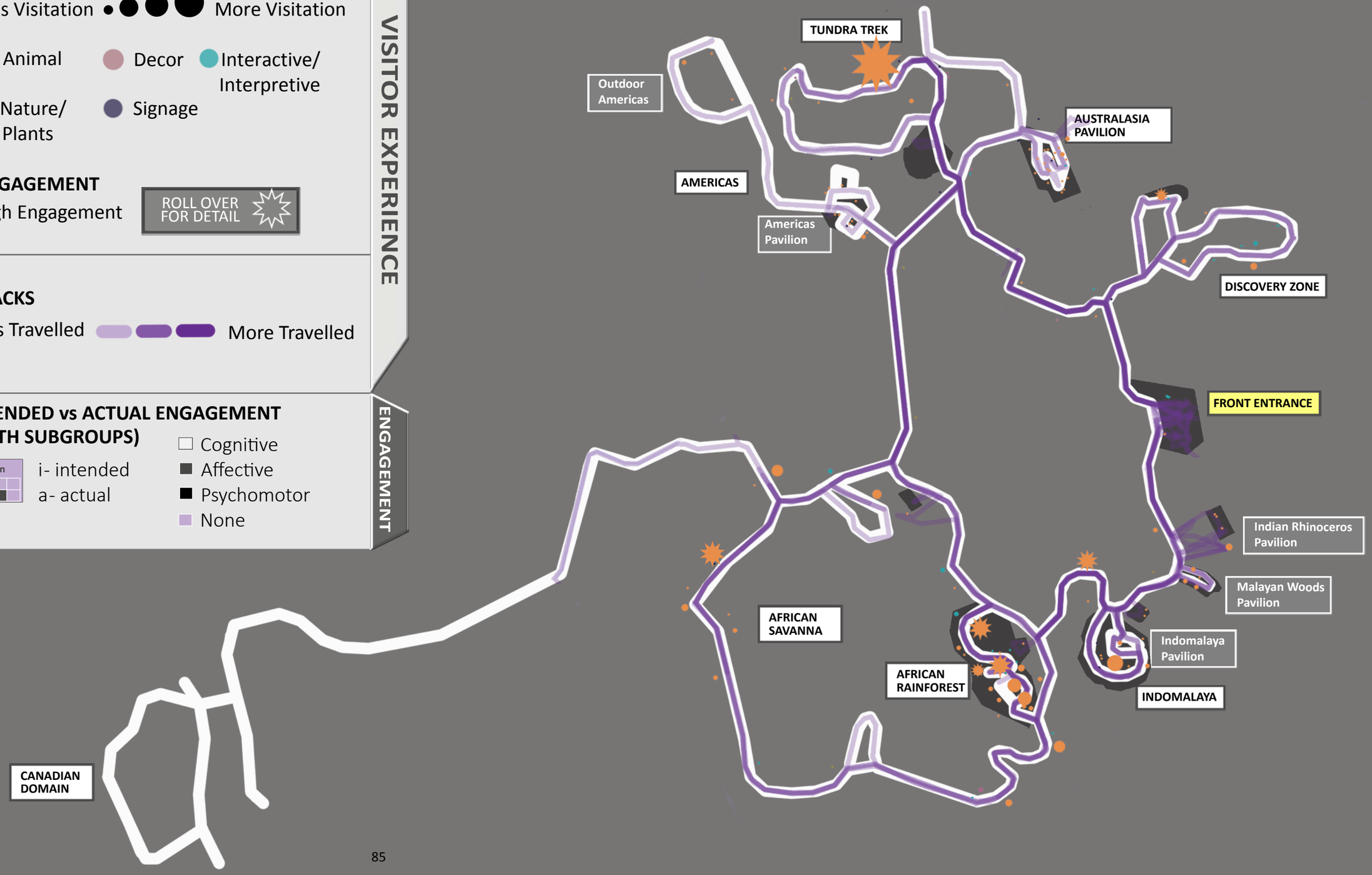
ENGAGEMENT

INTENDED vs ACTUAL ENGAGEMENT (BOTH SUBGROUPS)

Lion
i
a

i- intended
a- actual

- Cognitive
- Affective
- Psychomotor
- None



MAP NOT TO SCALE

4.4.2 No Experience Sub-Group (**Interactive Visual 4**)

Tracks

Overall, an examination of visitor tracks and waypoints in this sample reveals that the south-west section of the Zoo site is highly privileged as is the south-east route of travel. Also emerging is the Zoo's highly used central figure-eight path system (**Interactive Visual 1)**. Over half of the groups in this sub sample used this core path system with the majority of these visiting other smaller regions located off of the loop as well. One-quarter of the groups concentrated their visit in the west side of the Zoo site, either accessing it from the south or north route, with one of these groups visiting smaller regions on the way. One group in the sample visited the north side of the site only.

Waypoints

This sample noted an average of 32 waypoints per group. Waypoints were more concentrated on the south side of the site, especially the south-west, as well as, inside the pavilions and around the lion exhibit. There was a high amount of agreement in the spots where groups made their waypoints with over three-quarters noting the olive baboon, giraffe, tiger, polar bear, zebra, and elephant exhibits. One-half or more noted the lion- tailed macaque, lion, orangutan, and river hippo exhibits. Visitors in this sample stopped predominantly at animals (over 64% of stops). Signage, services, and interactives were the next most abundant types of stops (see Figure 30).

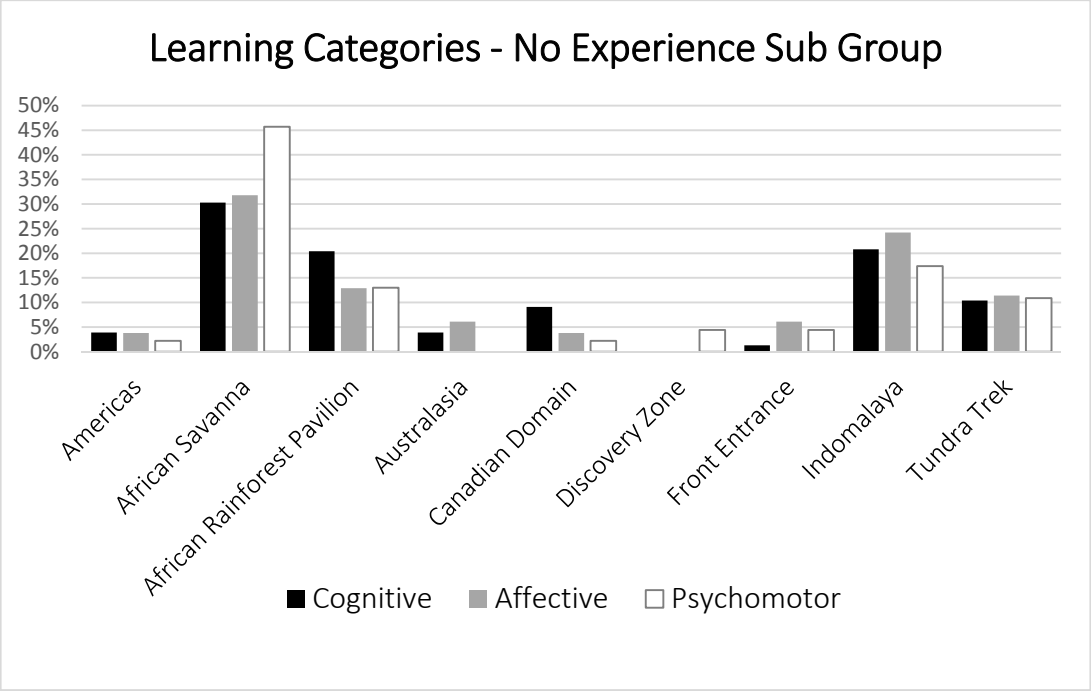
Thematic Analysis

Thoughts/Feelings (Figure 31) - The most common theme emerging out of this sub sample was evaluation. Moderately mentioned themes were appealing/enjoyable, observation, relating/connecting, questioning/wondering/inferring,

excitement/amazement, and knowledge.

Behaviour (Figure 32) - Picture-taking, reading, and viewing were the most common behaviours exhibited by groups in this sub sample with the remaining behaviours exhibited being relatively evenly spread throughout the rest of the thematic categories, in low percentages.

Figure 34 - Learning Categories in each District- No Experience Sub Group



For the no experience sub-group, the African Savanna evoked remarkably more cognitive, affective, and psychomotor responses than any other district in the Zoo. Indomalaya was second-strongest in all of the three categories. The consistently high cognitive, affective, and psychomotor responses bundled in each of these districts are interesting and point to both spatial and content factors.

Interactive Visual 4 - Visitor Experience No Experience Subgroup

VISITOR EXPERIENCE

WAYPOINTS

Less Visitation ●●●● More Visitation

- Animal
- Decor
- Interactive/ Interpretive
- Nature/ Plants
- Signage

ENGAGEMENT

High Engagement — ROLL OVER FOR DETAIL

TRACKS

Less Travelled — More Travelled

ENGAGEMENT

INTENDED vs ACTUAL ENGAGEMENT (BOTH SUBGROUPS)

Lion
i
a

i- intended
a- actual

- Cognitive
- Affective
- Psychomotor
- None

TUNDRA TREK

Outdoor Americas

AUSTRALASIA PAVILION

AMERICAS

Americas Pavilion

DISCOVERY ZONE

FRONT ENTRANCE

Indian Rhinoceros Pavilion

Malayan Woods Pavilion

Indomalaya Pavilion

INDOMALAYA

AFRICAN SAVANNA

AFRICAN RAINFOREST

CANADIAN DOMAIN

N

MAP NOT TO SCALE

4.5 Visitor Study: Photographic Analysis

4.5.1 High Experience Group

Groups in this sample took an average of 38 photographs each. The content that received the highest number of photographs was, in order, the polar bear (9%), lion (6.3%), orangutan (4.2%), indoor gorilla (2.8%), stingray (2.4%), and zebra (2.2%) exhibits, as well as, the Splash Island water park (2.0%). Themes eliciting high numbers of photographs were observations (25.2%), relating/connecting (24.5%), and appealing/enjoyable (20.4%). Table 8 shows the detailed photographic analysis based on theme.

Generally, the waypoints that received the highest percentage of photographs in this group were those at which many groups chose to stop, which is not surprising. The polar bear, orangutan, lion, and indoor gorilla exhibits were all visited by at least half of the groups and all had high numbers of photographs taken. Waypoints that elicited a relatively high number of photographs in relation to the number of groups that stopped there were Stingray Bay, the Creepy Critter Cave special Halloween display, Splash Island, and the capybara, elephant, marmoset, meerkat, penguin, and zebra exhibits. In some cases, even though only a small number of groups marked one of these waypoints, a relatively high number of photographs were taken.

There does not appear to be any strong trends with regards to the amount of cognitive, affective, or psychomotor responses and the numbers of photographs taken. Some areas with a high amount of each of these responses elicited relatively few photographs (e.g. Stingray Bay) and others elicited many (e.g. polar bear). Other areas with relatively

few cognitive, affective, or physical responses still elicited high numbers of photographs.

Table 8 – Photos Based on Theme

Theme	High Experience	No Experience
Appealing/ Enjoyable	Animals and interactive in equal proportions	Animal and non-animal elements Highly frequented exhibits and also
	"Popular" and less popular animals (e.g. gila monster) Activity-centric (animal movement or people using interactive	those traditionally less appealing (e.g. scorpion) Slightly more interactives, signage, and décor than high experience group (e.g. Kesho Park Interpretive area)
Beauty/ Aesthetic/ Restoration/ Inspiration	Traditionally "beautiful" content (e.g. wolf in the snow) Non-traditional beauty also represented (e.g. warthog)	Traditionally "beautiful" animals (e.g. bald eagle) Natural elements, interactives, and décor
Behaviour change	One element (signage) Comment reveals effectiveness of the information for that individual ("This sign plus the other one to the side of the exhibit have got me checking groceries for palm oil. Don't buy anything with palm oil anymore".)	One group noted two elements (Crisis in African bush meat sign and New Life from Decay sign). The former sign created awareness of the issue and the latter revealed that behaviour change had occurred ("read this the last time i came around here… … i am more careful now not to disturb the forests when i go hiking /camping")
Excitement/ Amazement	Frequently and non-frequently visited animals both included Décor and interactives (e.g. District gateway at Discovery Zone, replica bowhead whale skeleton)	Highly and less frequented animal exhibits Signage, plants, nature, and even a service (the gift shop!)

Interacting	Interactive elements (e.g. baobab tree, Stingray Bay) Animal elements that were somewhat interactive by nature (e.g. camel rides, petting rabbits)	Interactive elements (e.g. baobab tree, photo opportunity at chameleons) Used as opportunities for participants to take photos of each other interacting with the content
Memory	Animal and non-animal elements Tradition of often frequenting a particular element (e.g. "we do this every time we come") Recall of an experience or feeling from the past	Animals, signage, décor, and an interactive element Prompted memories of prior experiences or challenged prior knowledge
Questioning/ Wondering/ Inferring	Almost exclusively animal elements Highly and less frequently visited animals Related mainly to observable characteristics or behaviours of content being viewed (e.g. "Meerkats are very cool, why do they sleep in a bundle?").	Equal numbers of animal and non-animal elements Many less frequently visited animals (e.g. tomato frog, raccoon, bat) Signage predominates non-animal elements
Relating/ Connecting	Frequently visited animals Also interactives (e.g. replica gorilla hand)	Popular and less frequently visited animals Non-animal elements included were mainly signage but also décor items (e.g. replica polar bear trap)

Photo Sequence

Interactive Visual 5 shows the photo sequence for a selection of two "typical" groups in this sample. Both of these groups followed the typical pattern of concentrating their visit on the east portion of the site and both started their visit via the north pathway. However, the idiosyncrasies of the visits are immediately evident in the subjects and

numbers of photos in each of the groups. Group 31 took relatively few photos and the subjects of those photos seem to be evenly distributed between those of animals, especially primates, and those of people. Photos of people indicate the interactivity of their experience. The animal photos, focusing on primates might reveal particular interests of the visitors. This group visited with two small children so their choices to visit the Kids Zoo and the highly interactive nature of their visit is understandable.

Group 53 took a high number of photos that were almost exclusively of animals with a wide range of subjects from mammals, to birds, to fish. Photos of interpretives/ interactives, while small in number, do indicate a somewhat interactive experience. This group often took multiple photos of many of the animal exhibits at which they stopped.

4.5.2 No Experience Group

Groups in this sample snapped an average of 38.7 photographs each. The content that received the highest numbers of photographs was the polar bear (3.8%), elephant (3.1%), giraffe (2.8%), and lion, penguin, orangutan, and tiger (2.2% each) exhibits. Themes represented by high numbers of photographs were evaluation (17.2%), observation (15%), appealing/enjoyable (14.8%), reading (11%), and relating/connecting (11%). Table 8 details the thematic analysis of the photographs.

Generally, there was a higher variety and number of waypoints at which groups chose to take photos, with a smaller percentage of photos being taken at each waypoint, compared to the high experience group. Waypoints that elicited higher numbers of photographs in relation to stops include the Asian Turtle Breeding Centre in the Indomalayan Pavilion and the Komodo dragon statue outside the Australasia Pavilion.

Again, there does not appear to be any strong trend between the amount of cognitive,

affective, or psychomotor response a given exhibit elicited and the number of photographs taken there. In some cases, areas with high responses received few photographs and in others they received many, and vice versa.

Photo sequence

A representative selection of two groups from this sample were chosen to look deeper at the photographs and sequence for a qualitative analysis (Interactive Visual 5). The photos of Group 17 reveal an experience that seems to focus on animals and on family, with many of the subjects of the photos being animals on display, often multiple photos of the same animal, and just as many being of the human members of the group either interacting with elements or posing by animals or signs.

The photos of Group 29 reveal a slightly different experience, even though a similar route was taken. This group was very thorough, viewing animals, reading signage, and taking photos of group members. While this group was comprised of a dyad of only two adults, they still managed to create an interactive experience for themselves by touching props, visiting an interpretive station, and interacting with signage.

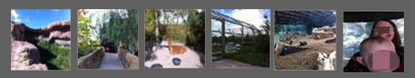
Interactive Visual 5 - Visit Sequence in Photographs

Group

ROLL OVER THUMBNAILS FOR MORE DETAIL

HIGH EXPERIENCE

31

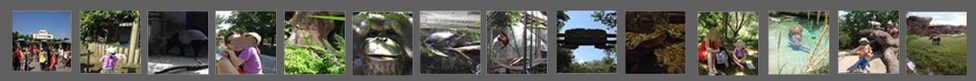


53



NO EXPERIENCE

17



29

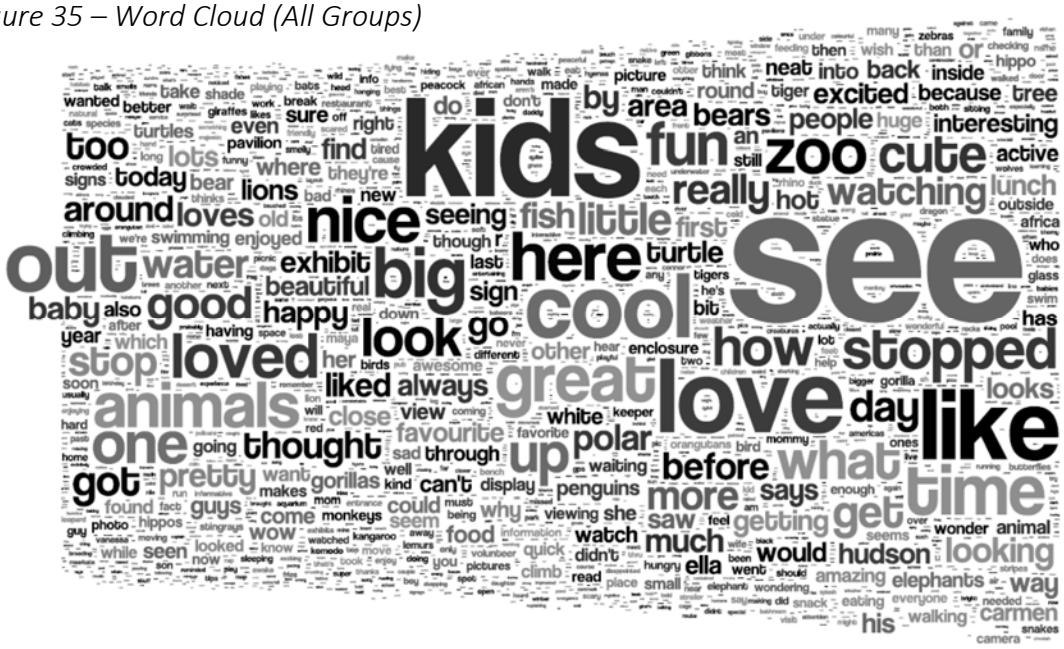


4.6 Textual Analysis

4.6.1 Word Cloud Analysis – All Groups (Figure 35)

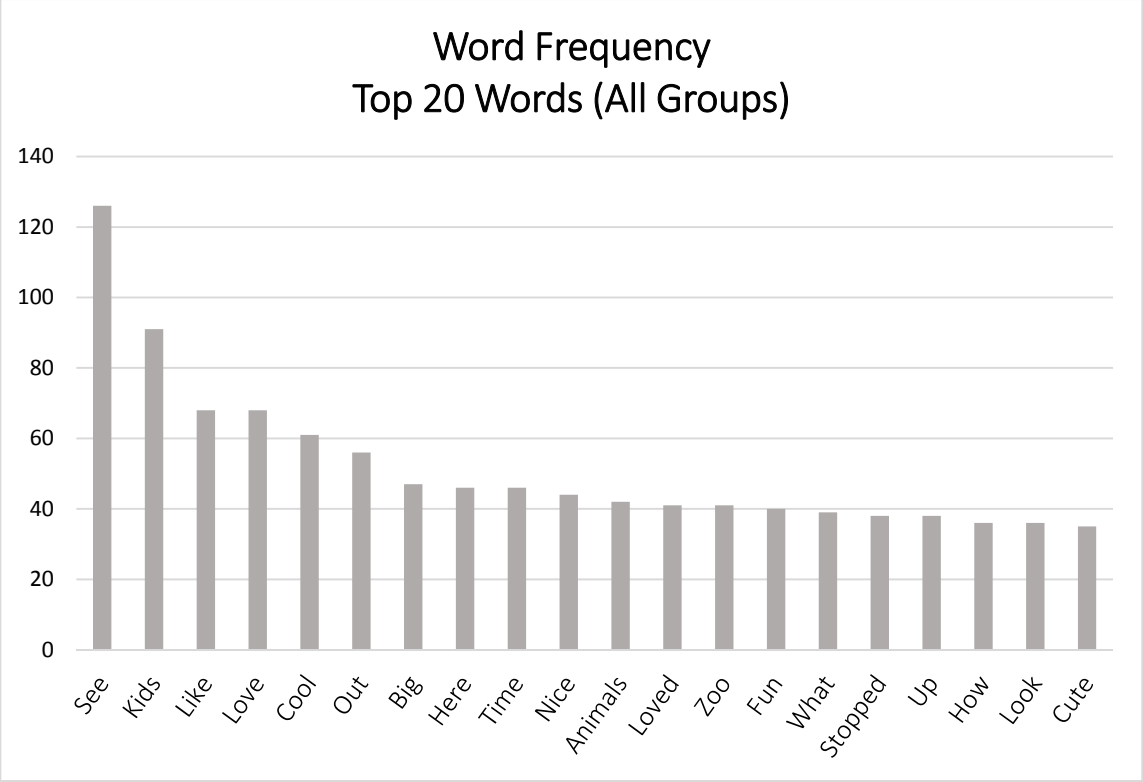
The word cloud analysis for the entire sample (all groups) revealed some strong trends in terms of the types of words used in visitors' journals. The words that were most emphasized (i.e. most common) (Figure 36) reveal Zoo experiences that are satisfying, and that focus on seeing/viewing the Zoo (mainly the animal collection), evoke positive emotions and impressions, provoke some thought, and that centre around children. Frequently used words such as stopped and go, also characterize Zoo visits as experiences involving movement. As has been discussed in other research (e.g. Silverman 1990, Falk and Dierking 2013) experiences are concrete, as revealed by the use of descriptive words related to animals (e.g. little, huge, fish) and the places of the Zoo (e.g. pavilion, signs, exhibit). Social factors also play a role in the visit revealed through the use of people's names and words such as “people”, “we”, and “us”.

Figure 35 – Word Cloud (All Groups)


kids
see
zoo
fun
love
cool
here
stopped
like
time
animals
great
watching
cute
nice
big
out
good
loved
look
how
what
get
looking
hudson
elephants
polar
penguins
favourite
thought
pretty
gorillas
monkeys
bears
tiger
people
interesting
lions
turtles
water
exhibit
beautiful
happy
seeing
fish
little
turtle
sign
go
stop
liked
always
close
view
white
keeper
before
more
says
getting
saw
much
would
went
ella
amazing
eating
everyone
walking
carmen
snakes
camera
his
wonder
animal
looks
day
up
through
can't
display
food
watch
she
why
could
seem
come
wow
seen
looked
quick
climb
read
small
place
didn't
you
pictures
volunteer
information
viewing
waiting
sad
well
kind
makes
guys
found
photo
hippos
while
now
sleeping
pavilion
signs
today
bear
around
loves
baby
also
year
which
soon
hard
one
going
got
home
guy
lots
too
even
right
sure
find
where
they're
bad
new
old
swimming
enjoyed
africa
who
does
glass
swim
has
bit
bigger
gorilla
looks
enclosure
other
different
her
birds
awesome
never
though
last
beautiful
exhibit
big
here
cool
see
fish
little
first
seeing
nice
really
hot
watching
lunch
outside
active
interesting
huge
because
excited
tree
back
inside
hippo
neat
into
than
or
zebras
family
wish
then
checking
think
picture
round
by
area
do
don't
made
peacock
african
wanted
better
bake
shade
break
restaurant
giraffes
likes
work
playing
babs
head
info
wild
walk
hanging
beats
ever
snake
green
gloves
meet
under
many
feeding
wet
checking
walked
bath
along
wolves
dragon
rhino
underwater
cold
each
need
statue
camera
snakes
carmen
walking
his
eating
everyone
needed
snack
did
should
wondering
elephant
hear
elephants
amazing
hudson
would
went
ella
much
didn't
watch
she
why
could
seem
come
wow
seen
looked
quick
climb
read
small
place

Amongst the top words used in the journals, the words "how" and "what", that hint at questions being asked, begin to reveal that there is some intellectual engagement included in Zoo visits.

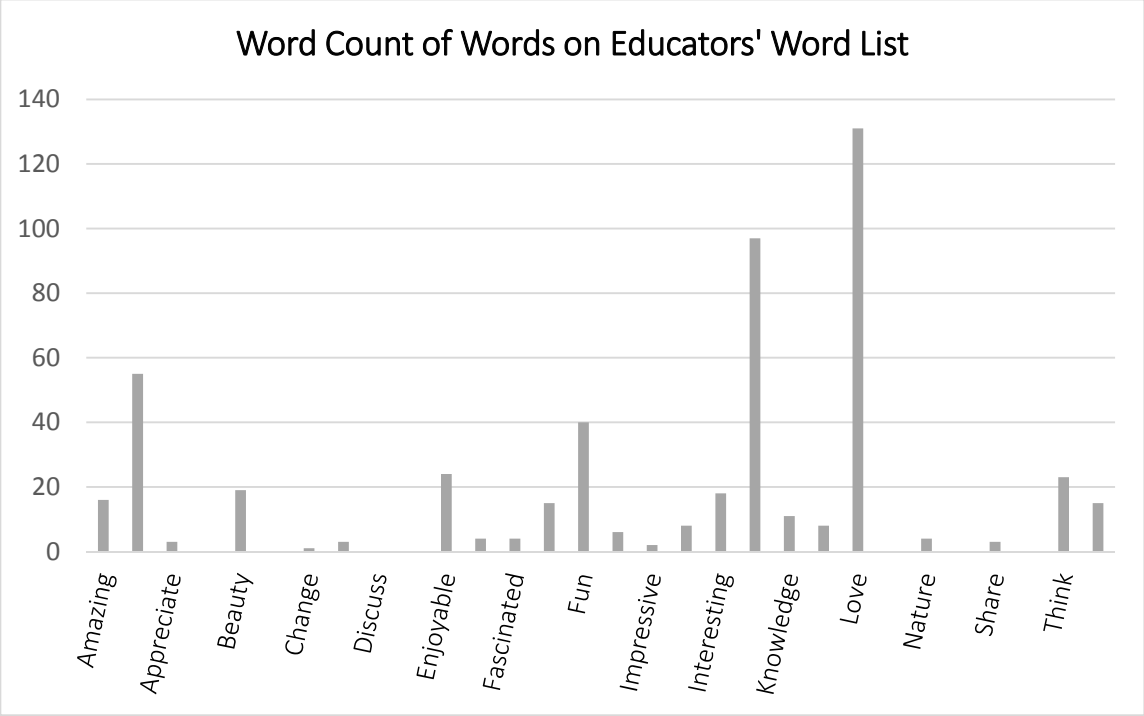
Figure 36 – Words Emphasized in Visitor Journals (All Groups)



When compared to the educational intentions of the Zoo (Figure 37), all but seven of the thirty words educators hoped to be mentioned in the journals were indeed included, although in some cases only in low frequencies. This seems to indicate that Zoo visits are meeting some of the educational intentions of the Zoo's educators for some visitors. The words not included may partially be due to the fact that these words might not be the everyday language visitors might use to describe their experiences. In fact, words and themes that hint at the type of experiences the words represented, but not the words themselves, were indeed included. It might also reflect the age or

aptitude of participants who entered data into the Mobily Trip app on each group's behalf, or it could hint at a real need for the Zoo to focus on providing the types of experiences they wish visitors to have on-site.

Figure 37 – Frequency of Words from Educators' Word List Actually Occurring in Journals



4.6.2 Word Cloud Analysis – High Experience Group (Figure 38)

The word cloud analysis for the high experience subsample similarly reveals Zoo visits that are characterized predominantly with viewing animals and with a variety of positive emotions.

Most striking in this subsample is the emphasis on the words "always" and "says", as neither of these words are highlighted in the journals of the no experience sub group (e.g. “A favourite, and always saved for last, today the rays were especially affectionate.

And when I told one of the big sharks that it was my birthday, it came close enough to let me touch its fin. :) Restoring my zen here on a regular basis."; "Gorillas are outside today. Its pouring so maybe they'll be in soon. Always entertaining."; "R says "that was so fun. bumping on the camel."). For those who visit the Zoo often, the word "always" might indicate that these visitors repeatedly engage in certain experiences on each Zoo visit. The word "says" hints at the dialogue that may occur within groups during visits to the Zoo.

Figure 38 – Word Cloud (High Experience Sub Group)



Only three of the twenty most frequently used words (love, fun, animals) from this subsample match the words chosen by Zoo educators to echo their educational intentions. Words that were highly used include see, like, love, time, big, and nice.

4.6.3 Word Cloud Analysis – No Experience Group (Figure 39)

The word cloud analysis for groups with no recent experience at the Toronto Zoo also emphasizes seeing animals, positive emotions, and concrete, physical experiences. Notable in this word cloud is the very high frequency of the word "kids" (almost half of all the mentions of the word from all journals appear in this subsample). Two words that can be interpreted as reflecting "cognitive" engagement (what and how) also appear in high frequency in this sample. In fact, over 60% of the overall mentions of the word "what" appear in this sample, and 50% of the mentions of the mentions of the word "how" (e.g. “Can't figure out what kind of animal this is right away. Found the sign after a couple of minutes.”; “ We were wondering how these things survive in waters populated by nile crocodiles , with a soft shell? wouldnt u need a hardshell to arm against sharp Croc teeth?!”).

Figure 39 – Word Cloud (No Experience Sub Group)



4.7 Toronto Zoo's Educational Intentions

Education of their visitors is one of the main goals of the Toronto Zoo as identified in the Zoo's Strategic Plan (Toronto Zoo 2009) and Conservation, Education, and Wildlife Division plan (Toronto Zoo 2013). Interactive Visuals 3 and 4 and Table 9 demonstrate the areas where Zoo educators hoped to see high levels of visitor engagement, including the type of engagement (cognitive, affective, or physical) they hoped to find. Some type of visitor engagement (i.e. at least one waypoint) was noted during the Visitor Study at slightly over 50% of the areas where Zoo educators hoped visitors to be engaged. While educators hoped that visitors would be highly engaged at the Wetlands Interpretive Station, bird show, impromptu animal encounters, and interactive amphibian display in the Americas Pavilion, no waypoints were added at these locations/offerings.

Table 9 – Areas Zoo Educators Hoped to See Engagement

Element	Intended Engagement	Actual Engagement From Results
Polar bear	Affective	Cognitive, Affective, Psychomotor
Penguin	Cognitive, Affective	Cognitive, Affective
Kids Zoo	Psychomotor	Affective, Psychomotor
Keeper talks	Cognitive	-
Research Station/Kesho Park	Cognitive, Psychomotor	Affective, Psychomotor
Wetlands	Cognitive, Psychomotor	-
Lion	Uncertain	Cognitive, Affective
Darwin's Dreampond/ Indomalaya Community Tank	Affective	Cognitive, Affective
Great Apes (gorilla/ orangutan)	Affective	Cognitive, Affective
Bird Shows	Cognitive, Affective	-
Impromptu animal encounters between visitors and staff	Affective, Psychomotor	-
Pond wall in Americas	Cognitive, Affective, Psychomotor	-

Some interesting differences did emerge between the intended meaning-making experiences planned by the Zoo and the carrying out of these experiences by visitors. Educators hoped that visitors would experience high affective responses at the polar bear, Darwin's Dreampond, and Great Ape displays and they did however; in actuality, high cognitive responses were also seen in these areas. The Kids Zoo was seen as being mainly psychomotor while the visitor study revealed it to be highly affective as well. Kesho Park HQ was thought to be cognitive and psychomotor while it was experienced as more affective and psychomotor. Also interesting, the educators thought the lion exhibit should be engaging to visitors but had difficulty articulating in what way. In actuality, the display was translated as both cognitive and affective by visitors.

5. Synthesis

5.1 Spatial Morphology

Both the wayfinding and space syntax analyses reveal a site with a layout, environmental design, and wayshowing system that privilege a set of two intersecting core paths, namely an east and west loop that form a sort of "figure-eight" core path system, constituting the central arteries of the Zoo (Interactive Visual 1). Both analyses also reveal how the site places an emphasis on certain districts and nodes over others, namely the outdoor Indomalaya, African Rainforest, and African Savanna districts, all of which directly intersect with the core path system (Interactive Visual 2).

The wayfinding analysis exposes the Indomalaya, Tundra Trek, African Savanna, African Rainforest, and Discovery Zone districts (Interactive Visual 2) as areas where we would expect high traffic, all located along the "figure-eight" core path system. The orientation, scale, and colour of signage, path design, and visual characteristics of the visitor map are the major factors that differentiate these areas from the others.

The space syntax analysis (see Interactive Visuals 1 & 2). reveals a site that is highly centralized; a highly integrated core consisting of two major paths, ringed by animal-viewing areas that are much more segregated. The core path system is the most integrated and thus most likely to experience dense traffic. With regards to animal areas, the space syntax analysis presents a slightly different perspective from the wayfinding analysis. Based on integration, this analysis indicates a tendency for higher traffic to occur in the well-integrated African Rainforest, African Savanna, Canadian Domain, and Tundra Trek districts and lower traffic to occur in the Americas,

Indomalaya, Australasia, and Discovery Zone districts, which are most segregated. Most of the areas of high integration do occur along the core path system, with the exception of the Canadian Domain. The more segregated Indomalaya districts does however occur along the core east loop.

The most integrated spaces of the Zoo appear to function as areas for movement and circulation, and also in some cases for viewing animals, as they link the various other less integrated but more animal-centric areas. Of the most highly integrated spaces, only three are areas that exhibit animals, the remainder being hubs of services and orientation and pathways. This finding mirrors space syntax research, which found that the layout of Zoo Atlanta reflected a shift in philosophy toward more individual, up-close encounters with animals, which contrasted with the zoo experiences of the past (Wineman and Choi 1990), which were more focused on the social experience of visitors.

The patterns of movement evident from participants in the Visitor Study are consistent with space syntax principles which show a tendency for layouts that are more segregated, as we see at the Zoo, to result in more selective viewing and less evenly distributed routes (Interactive Visuals 1 & 2). While spatial characteristics alone may not explain all of the reasons for the ways in which the layout is used (for example, the attraction of feature exhibits may override certain configurational properties), they have been shown to exert a very strong influence that guides movement (Psarra 2005).

5.2 The Lived Experience of Visitors

5.2.1 Patterns of Movement (Interactive Visuals 1 and 2)

The Visitor Study shows a trend in visitor movement that seems to be consistent with

the results of the wayfinding and space syntax analyses. Visitors in both sub groups concentrated their visit around the Zoo's central arteries. These traffic patterns reveal the potential narratives the Zoo presents to visitors. These narratives seem to differ idiosyncratically both between and among visitor groups with varied amount of experience on the Zoo site, however, on the whole, regardless of the visit sequence and waypoints made, these narratives seem to produce similar meaning-making processes as evidenced in the similarity of themes for both sub-groups in the Visitor Study.

With the no experience group, the space syntax analysis seemed to strongly match the movement characteristics of actual Zoo visits. The most integrated central arteries of the Zoo, the two main loops that form a figure-eight of circulation, were most highly traversed as were the D-spaces of the African Savanna and African Rainforest Pavilion, the former which constitutes one main loop in its own right and the latter which lies at the intersection of both main loops. In the high experience sample more highly integrated north and north-east paths were more highly traversed. As these paths lead to a higher number of segregated areas, it is possible that those with high experience use these routes to see as much as they can in a short amount of time. For this sub group the highly integrated African Savanna was only moderately visited and the well-integrated Indomalaya outdoor exhibits were not well visited at all.

The integration analysis revealed the Canadian Domain to be moderately well integrated in relation to the rest of the site; however, not many groups visited this area. The Domain may have received a moderate score in terms of integration due to its direct link to the highly integrated African Savanna district. This would make us assume a higher rate of visitation. However, the long trek up and down a steep concrete pathway with little to entertain or entice visitors might be negating this factor.

In terms of the wayfinding analysis, when both samples were combined, the African Savanna, African Rainforest and Tundra Trek, all identified as probable areas of high visitation, were indeed more likely to be visited. However, the Malayan Woods and Discovery Zone, which were also identified as potential areas of dense traffic, were more moderately or even poorly visited in actuality. This result suggests the importance of using combined spatial and non-spatial techniques for examining movement patterns and experiences.

5.2.2 Level of Familiarity & Movement

*Navigation Routes (**Interactive Visuals 1 & 2**)*

Groups with little recent Zoo experience seemed to be guided by the core figure-eight path system and patterns revealed in the space syntax analysis more strongly, traversing both the east and west sides of the loop. Their visits also spanned more of the Zoo site more evenly than their high experience counterparts. The traffic patterns of the high experience sample were more closely aligned with the findings of the site analysis for wayfinding, and more selective in their visit and tending to concentrate on the east loop of the core path system.

The movement of the high experience group contrasts with the findings of the space syntax analysis in that the Discovery Zone, a more segregated area from a space syntax point of view, was more moderately visited in this subgroup. The integrated Canadian Domain was not visited at all by these groups. Visitors who attend the Zoo often might not feel the need to visit the entire site in one day, taking their time in select areas only. As many visitors in this subgroup came with children, it makes sense that they would both be aware of the many offerings for children in the Discovery Zone and be willing to

spend some time there while their children explored and played. Also, visitors who know the site well would know that the Canadian Domain is a long walk from the Front Entrance up and down steep hills.

While the Indomalaya Pavilion had a low integration score, it was one of the hotspots in both the wayfinding analysis and actual experience of visitors in this subgroup. It may be that the physical situation of the Indomalaya Pavilion, abutting the south path and marked by an attractive and prominent bronze orangutan statue give it more presence than purely spatial factors might predict (Figure 40). The content in this Pavilion might also affect movement as it contains one of the Zoo's two main primate displays, the orangutans, as well as, the tiger exhibit, a visitor favourite (Toronto Zoo 2012).

Figure 40 – Indomalaya Pavilion



It has been found that as individuals become more and more familiar with an environment, they are able to take in more of its character and enjoy the visual and sensory qualities in which they move (Lynch 1960). The more concentrated visit of those with a high degree of familiarity with the Zoo site might be reflective of this trend.

In the no experience subgroup, actual visitation to the Discovery Zone aligned with its low level of integration as indicated in the space syntax analysis. Visitors in this sample may be looking to get as much value out of their time and money as possible and therefore might be more interested in visiting a large variety of displays but not spending as much time in each area (indeed, length of visit was slightly higher in the no experience subgroup). The Discovery Zone is full of experiences that take time; including playing in the Kids Zoo or waiting in line and then spending time interacting with Stingrays.

*Spatial Scope of Visit (**Interactive Visuals** 3 & 4)*

Groups in the no experience sample seemed to visit more of the site, more evenly, while groups in the high experience sample demonstrated more idiosyncrasies in the routes taken, some traversing a relatively small area and others covering the entire east loop quite extensively. Looking at groups in both samples, those that used both loops of the core path system were more likely to explore and make additional diversions.

That the groups with no recent Zoo experience covered more of the Zoo site on their visit perhaps is not surprising as visitors who are at the Zoo for the first time or are making a "once in a while" visit might want to see the entire collection and get a higher value out of their visit. For the high experience sample, one might expect that those with a good amount of familiarity with the site, and those that visit more frequently, to be more selective in what they see and do. With the east loop being closer to the main

entrance/exit, the high experience group could be basing their visit on a shorter time frame and wanting to not get too far from the exit. Almost 60% of these groups kept their visit to two-and-a-half hours or less, compared to 33% of those in the no experience sample. However, due to technological issues and issues associated with users entering their own data, these times are merely estimates and cannot be seen as being accurate enough to make any concrete conclusions.

5.2.3 Patterns of Spatial Use (Interactive Visuals 3 and 4)

In terms of the content visitors focused on, groups in the no experience sample marked a higher number of waypoints relative to groups in the high experience sample. Perhaps groups in the high experience sample might be more likely to bypass content they have seen before or have more directed visit goals than those in the no experience sample who might be more attracted to a wider variety of content as they would not have seen it before and whose visit goals might differ (e.g. those attending the Zoo for the first time might plan to stay all day and see as much as possible).

From a general spatial point of view, elements did not need to be large or prominently placed to be noted. Waypoints that were highly traversed in both samples were the polar bear, orangutan, tiger, lion, and Darwin's Dreampond fish displays. The polar bear and orangutan exhibits are both placed in more segregated areas however; we might expect these exhibits to have been well-visited for a few reasons. During the period of study, the Toronto Zoo had a polar bear cub on display and this exhibit was advertised in several areas on-site. The orangutan display also features several young animals. As infant animals have been shown to increase viewing times (e.g. Bitgood et. al. 1998) this might explain some of the reasons why we see a lot of guests not only stopping here but also a high amount of response via comments and photos. Also, both polar bears

and orangutans are regular draws and highlights for visitors to the Toronto Zoo (Toronto Zoo 2012).

During the period of study, three white lion cubs were the feature exhibit and also heavily advertised throughout the site. In addition to the "infant factor", the lion display is also a very prominent feature in the landscape, consisting of a towering simulated rock kopje that stands out from the rest of the landscape. Highly visually accessible objects or elements, especially those visible from various locations and many directions, have been shown to be more likely to draw attention (e.g. Kaynar 2005; Peponis et. al. 2003; Wineman and Peponis 2010).

The tiger exhibit may have been emphasized as it has been noted as one of the most memorable for visitors (Toronto Zoo 2012), and the exhibit is located along one of the most integrated and highly travelled paths.

Finally, the Darwin's Dreampond fish display is likely highlighted for its placement in one of the most highly integrated areas, for its situation in the Pavilion (coming from the south, which is where many visitors did approach, visitors are immediately face-to-face with the display), and for its size and visual attractiveness. Animal exhibits that feature active animals have been shown to result in higher stop rates of visitors (Bitgood et. al 1998, Margulis, Hoyos, and Anderson 2003).

5.2.4 Level of Familiarity and Spatial Use Patterns (Interactive Visuals 3 and 4)

In terms of differences between samples, the no experience sample frequented a wider variety of animals, most located in the highly integrated and traversed African Savanna or African Rainforest districts. Their waypoints were concentrated more on the south-

west side of the site, within the most integrated indoor pavilions, and around the lion exhibit, all areas that were highly traversed by their members.

The high experience groups exhibited a more concentrated, yet more idiosyncratic visit in terms of elements at which they stopped. The waypoints of this sample were denser around the polar bear exhibit and Discovery Zone, as well as, the indoor pavilions, all areas accessed from the east loop and all areas that this group traversed frequently.

For both samples, animal stops were the most frequent (see Figure 30), probably not surprising as the most common goal for visiting was to see animals, followed by spending time with family. Many of the Zoo's most memorable animals (e.g. polar bear, large cats, primates) (Toronto Zoo 2012) were draws, however many waypoints also occurred at the more obscure animals (e.g. thorny devil insect). Animals were most highly photographed, followed by interactives, perhaps reflecting two of the trends resulting from the word cloud analysis: viewing animals and spending time with people. Signage and natural elements were also well documented in photographs taken. This is encouraging as it indicates that visitors do pay attention to signage and it also underscores that the natural setting of the Zoo is not overlooked by visitors.

After animal waypoints, the no experience sample marked signage and services next most frequently. In fact the no experience sample marked signage almost twice as often as the high experience sample (16.4% vs. 8.5%). This might be explained by the infrequent visitation by members of these groups. As these participants had either never been to the Zoo or had not visited recently, interpretive/educational signage might have been more attractive and piqued more curiosity for them than for groups which visit frequently and may have seen the signs already.

In contrast, the high experience sample marked interactives as the next most frequently type of waypoint, followed by signage. When looking at the areas where this sample visited, the highly interactive Discovery Zone, as well as, moderate visitation in the African Rainforest Pavilion and Savanna districts where the no experience sample also marked more interactives, this is not surprising.

For both sub-groups, it is important to be mindful that a lack of emphasis on certain content is not necessarily a "true" representation of actual experience. Some content may have worked in ways that prevented or deterred participants from recording that content. For example, if that content was highly engaging, if the participants were distracted immediately before or after their experience, if a particular piece of content disturbed the participants, or if certain social or cultural norms deterred certain participants from recording an element (one can imagine that animals mating might be something that is consciously suppressed by some visitors, although it might equally be highlighted by others!).

5.2.5 Space and Meaning-Making (Interactive Visuals 2 & 5)

High Experience Sub Group

The spatial "hotspots", found along the eastern loop of the site, align closely to the meaning- making hotspots of the groups in this high experience sample, which also map well onto the areas that the wayfinding analysis identified as such. The simple fact that more traffic occurred in this area may certainly be a contributing factor to the increased meaning- making responses here; however, certain spatial and non-spatial commonalities do exist between at least some of these animal displays, which may be reinforcing stronger reactions.

For the waypoints that received high responses yet were less well-visited content-specific factors may be at work. These waypoints were either interactive or featured active animals (e.g. meerkats) or animals in close proximity to the viewers. The high experience sample saw high cognitive responses in many of the areas they frequented (i.e. African Rainforest, Tundra Trek), as well as, less moderately visited areas (i.e. African Savanna and Indomalaya) The Discovery Zone rated highest in both affective and physical response categories, and based on its highly interactive features including touching live stingrays and other animals, seeing animals up close, and interacting with other highly physical interactives, probably makes sense. African Savanna and the African Rainforest were next highest in affective responses and the Rainforest and Tundra rounded out the physical category's top responses. It is interesting that, while fewer groups visited the Savanna, this area was still in the top three for demonstrating a cognitive and affective response in this group. This trend, along with the fact that it was the number one area for cognitive responses in the no experience group, deserves a deeper look.

The "hot spot" phenomenon seen in the African Savanna District might be due to a combination of spatial and non-spatial factors. From a spatial perspective, this district received one of the highest integration scores and is directly related to many other highly integrated spaces on the site. Within this integrated district, space is configured in such a way as to offer intimate viewing experiences and encounters of a large variety of both animal and interpretive features, increasing the possibilities for visitors to note content due to the simple plethora of content to note, as well as, the variety of types of content, which might appeal to different styles of learners. The topography and exhibitry of the site are almost larger than life and feature mixed-species exhibits, large rock work, and rolling hills (Figure 43 a & b). This creates a visually dynamic and

engaging environment. The African Savanna was also home to two feature exhibits during the period of study: the white lion and penguin, displays visitors may consciously seek out. In this large area, animal displays are more dispersed, which might perhaps allow visitors more time to digest information and transition to the next display where they might have another meaningful response. Serrell (1997) argues that a good exhibit will slow the pace of visitors, so that they make more stops and spend more time at exhibit elements. It is possible that the combination of content and spatial setting in the African Savanna is embodying this notion.

Figure 41 a



Figure 41 b



No Experience Subgroup

The spatial and meaning-making "hot spots" in the no experience sample were very strongly concentrated in the African Savanna, Indomalaya, and African Rainforest districts. As with the high experience subgroup, concentrations of cognitive, affective, and psychomotor meaning- making coincide closely with the spaces that were most frequently visited for the no experience subgroup. Again, the African Savanna is an area that is both highly traversed and evokes high meaning-making responses.

Waypoints that were highly visited also evoked high meaning-making responses. A number of less frequently visited waypoints also elicited high meaning-making responses (i.e. baobab tree interactive, Shamba farm interpretive, elephant graveyard interpretive, turtle/monitor display, Prospector Tent, and bald eagle display). Most of these waypoints are found in the highly visited and response-rich African Savanna. The

interactive nature of some of this content (i.e. baobab tree, Shamba farm and elephant graveyard interpretives) may be contributing to its higher level of response relative to visitation. Both the Prospector Tent and the bald eagle display seem to have connected to the personal experiences of participants in that they prompted the recall of past experiences in the visitors who commented on them. The prominent situation of the Nile monitor/turtle display makes it surprising that more groups did not mark waypoints here.

5.2.6 Meaning-Making Processes (Interactive Visuals 3 and 4)

Cognitive themes made up the majority of those expressed by visitors, followed by affective, and then physical (see Figures 24 & 25). That more cognitive and affective themes were prevalent is perhaps not surprising as visitors were asked to comment on their thoughts and feelings, and not their behaviours, so physical responses were coded by using the subtext of comments and photos rather than explicit comments.

Themes reveal visitor meaning-making at the Zoo as characterized by making simple observations of the content on display, positive emotions, evaluations, taking photographs, and relating and connecting content and experiences to themselves, their prior experiences, and what they already know or believe. Visits are also about viewing animals, engaging with interactives, and cognitive experiences such as reading signage, questioning, wondering, inferring, and gaining factual information. These findings are similar to other research which found descriptive statements related to the animals on display to be the most common subject of visitors' discussions, followed by inferences, seeking information, and positive evaluations (Clayton, Fraser and Saunders 2009).

It is encouraging that the analysis did reveal themes that hint at deeper cognitive

engagement, such as questioning and inferring, relating and connecting, and knowledge, although in moderate amounts, as this indicates that some of the goals of the Zoo's educators are being met. It also supports previously cited research in the broader context of informal science education, which has asserted that visits to animal-based institutions likely do spur meaning-making beyond the superficial. Although comments related to specific conservation- related behaviours that visitors have adopted, or expressed an interest in adopting based on their Zoo visits, were extremely low in number, that they appear at all is also encouraging. While only mentioned twice (once in each sample), both mentions were by adults-only groups.

There seemed to be a trend towards more engagement, in general, at waypoints where animals were active. Visitors expressed positive emotions at both popular (i.e. highly traversed or "traditionally" popular zoo animals) and more obscure or less traditionally appealing animals (e.g. reptiles, warthog, scorpion). The more interactive or fewer barriers to the animals, the more excitement increased. Visitors were also excited about many non-animal elements as well, ranging from signage and interactives, to services such as the souvenir shop!

Questions and inferences centre on the observable characteristics or behaviours of an animal, feature, or element. Comments in the relating/connecting thematic category centre on those that relate to what participants saw, did, or read to their prior knowledge or experience, popular culture, or connecting animals to humans, oftentimes making anthropomorphic comments.

These results are consistent with Allen's (2002) findings, which demonstrated that visitors engaged most often in talk that centered on honing in on specific features or elements via the processes of identifying or naming observable features. This type of

language was seen as related to learning "because it [was] an act of identifying and sharing what [was] significant in a complex environment (2002, 21). This "perceptual" talk made up upwards of 65% of the comments coded in the Zoo Visitor Study (i.e. observation, knowledge, and some comments in the questioning/wondering/inferring category).

As the Visitor Study results show, the Zoo does also evoke Allen's higher level "connecting" talk, [i.e. "connections among exhibit elements, connections to previous knowledge, and personal stories or associations" (2002, 31)], also in the lower frequencies that she found. "Connecting" talk is "often regarded as a powerful and ubiquitous means of learning in informal settings" (2002, 32).

The rich and varied meaning-making at work during a Zoo visit is evident when examining visitor comments and photographs from the waypoints that received the highest cognitive, affective, and psychomotor responses. The majority of these waypoints were outdoor animal displays featuring infant or juvenile mammals. Commonly, the displays are large in nature and feature many different viewing points and expansive views and/or varied exhibitry (e.g. rock work, pools). The content often also elicited remarks about the display or animals being the favourite of the participants. Photographs and comments also indicate the significance of the proximity of the animals to the visitors in some of these displays. For example, at the polar bears, visitors encountered infant “Hudson” and the other bears moving and swimming or very close to the viewing glass. With the highest responses overall seen at the polar bear exhibit (almost double of that at the next highest waypoint), and with the vast majority of comments being focused on baby polar bear “Hudson”, it is evident that his presence had a large impact on visitors.

The above results are congruent with past research that had indicated that exhibits that are more naturalistic or aesthetic and offer opportunities to view active animals up close (Bitgood, et. al. 1998, Tofield, et al. 2003) result in longer viewing times.

Visitor responses were most often related to directly observable characteristics of the animals on display, commenting on, expressing positive emotions, and asking questions about what they were seeing and sensing, as well as, relating their own personal experiences and human attributes to the animals. Anthropomorphic comments were especially prominent at the gorilla exhibit. This mirrors previous research that found that primate exhibits were the most likely to prompt feelings of connection between visitors and the animals on display (Clayton, Fraser and Saunders 2009).

5.2.7 Level of Familiarity and Meaning-Making (Interactive Visuals 3 & 4)

Themes were relatively evenly expressed between the high experience and no experience groups with a few exceptions. Visitors in the no experience group made slightly more evaluative comments and read more signage than those in the high experience group, and those in the high experience group made more observations, expressed slightly more enjoyment, related and connected slightly more often, and displayed a much higher amount of interaction when compared to the no experience group.

One might expect that the groups would show more differentiation between themes, especially those that might hint at a deeper level of cognitive engagement. Those with more experience on the site might be hypothesized as being more likely to express deeper engagement due to their familiarity with the site and ability to get beyond the novelty of simply viewing the animal or content. Those with no recent experience might

also be hypothesized as having a higher likelihood of deep engagement due to the newness of what they are experiencing. Conversely, those who are unfamiliar with the site might be thought of as being more concerned about navigating, resulting in a smaller focus on thinking, feeling, or doing. At any rate, that there is little difference between the samples in most respects is very interesting.

Furthermore, it is interesting that the groups with a high level of experience are those who made more observations. As observations might be thought of as indicative of a more simple level of cognitive engagement[11] one might expect the reverse to be true. That those with more experience expressed more feelings of enjoyment might be explained by their familiarity with the content and repeat visits to certain favourite animals as many comments in this category centered on a particular animal or display as a group member's favourite or as a much loved feature.

5.2.8 Educational Intentions of the Zoo, Space, and Meaning-Making (Interactive Visuals 3 and 4)

While Zoo educators might be disappointed that the "knowledge" theme was not highly prevalent in the comments of either sub group, the relatively frequent amount of "relating/connecting" and "questioning/wondering/inferring" are hopeful as they do point to cognitive engagement. The frequent repetition of the themes "appealing/enjoyable" and "excitement/amazement" point to potentials for learning and emotional responses, which some studies have shown to be precursors to learning (e.g. Packer 2006, Falk and Gillespie 2009).

[11] Many studies in the field of informal science education place observations in the lowest category of learning (e.g. Borun, Chambers, and Cleghorn 1996).

In terms of the differences between the cognitive, affective, and psychomotor intentions of Zoo educators on the Zoo site, visitors seem to be using some areas as Zoo educators intended. However, the visitor experience that emerged in these areas was actually much richer than that explicitly designed by the Zoo. Where the Zoo expected one type of response (i.e. cognitive, affective, or psychomotor), the lived experiences revealed multiple reactions.

Of the areas where Zoo educators hoped for responses yet none were recorded, it might seem that both spatial and visitor characteristics might lend some explanations. Both the Wetlands Kiosk and Amphibian Wall are in more segregated areas. The Bird Show takes place in the Waterside Theatre of the relatively poorly integrated Discovery Zone. Shows are offered in the afternoon, when visitors might have already travelled more deeply into the site and might be unwilling to backtrack to this attraction. Meet the Keeper talks occur at specified exhibits and times and Zoo statistics indicate that they are usually well attended. While none of the groups in our samples explicitly mentioned that they visited a talk, they did frequent areas where talks occur and may have visited but not recorded these visits. Impromptu animal encounters are not carried out at specified times or locations, rather staff take specific animals out on site as much as possible to interact with the public. As these encounters are brief and transient it is possible that participants in the visitor study may not have encountered any. Where visitors did encounter staff, while not planned or intended to be educational, it is clear from the visitors' responses that these were a meaningful experience.

In terms of the Zoo's broad intended curriculum, the "lived curriculum" of visitors seems to be fulfilling some of these goals, but not others. That the Zoo provides an

enjoyable learning experience for its visitors seems evident from the Visitor Study results. Depending on one's definition of "learning" the visitor experience may or may not be strongly living up to this goal. If learning is viewed as gaining cognitive knowledge, then this goal is only weakly realized however, if one thinks of learning as meaning-making, the trends revealed in the Visitor Study, as discussed above, do map well onto this goal.

The Zoo also aims to "activate people to become better Environmental Citizens". It is encouraging that two related comments were made by visitors in the Visitor Study, a snapshot revealing that some of this activation goal is being realized. Although perhaps weakly achieved, at best, it differs from previous zoo research that found no information in visitor statements that inferred an intention to change behaviour (Clayton, Fraser and Saunders 2009).

6. Conclusion

6.1 Summary of Findings

At the outset of this exploration of space and learning, the research questions focused on exploring how the intended curriculum and meaning-making potentials of a cultural institution translated in the lived experience of its visitors, both those familiar and unfamiliar with the site. They focused on space as a key aspect and on visual representations as lenses through which to view this experience. Returning to these research questions, what has this thesis revealed?

How can visitors' experiences to the Toronto Zoo be mapped spatially using mobile technology? What is the value of this type of analysis?

The findings of this research suggest that meaning-making might be helpfully linked to the institution's spatial characteristics, including both its configuration and visual design qualities. The space of the Toronto Zoo can be seen as having guided route-choice and visit sequence, prioritizing focus on some areas of the layout and some content over others, as well as, the modes of meaning-making (Interactive Visuals 1 – 4), all variables that have been previously linked to meaning-making in cultural institutions. These attributes further contributed to qualitative aspects of the visit including the locations and qualities of meaning-making. The density of both meaning-making and movement patterns align positively with integration values in most cases.

The layout of the site and its syntax seem to have contributed to different experiences for those with varying experience and familiarity with the Zoo, in the way that they seem to have contributed to the movement of participants to different areas, where different meaning-making opportunities were made available (see 5.1, 5.2.1, 5.2.2). This

impacted the different modes of meaning-making visitors were involved in.

The contrasting alignment between the "objective" and "subjective" analyses suggest that spatial configuration may be a stronger driver for those with little to no familiarity with the Zoo site. Prior experience with the Zoo, its wayfinding system, and visual qualities may have more influence on those who visit more frequently (see 5.2.2). This differentiation points to the varied potential narratives and narrative sequences different types of visitors are exposed to during their visit and it demonstrates the contrasting cognitive-spatial behaviour of these two segments of the Zoo's audiences.

The Toronto Zoo's layout would seem to encourage "private and idiosyncratic" (Psarra et. al 2007, 070-14) visits, allowing for more concentrated focus on the displays, and its design to present ideas in a more constrained, preconceived, and/or didactic manner (e.g.Tzortzi 2011; Rohloff et al 2009). This investigation has revealed Toronto Zoo's distinct spatial character, which consists of a core circulation route ringed by periphery areas of animal exhibits. The more integrated spaces functioned as areas for movement and travel and only sometimes for animal viewing, as they linked to more segregated, more animal-centric areas (see 5.1). The unique configurational placement, visual qualities, and layout of the Zoo's African Savanna district made it both a spatial and meaning-making "hot spot" (see 5.2.5.). This unique combination of factors function to drive visitor traffic to this area while providing a meandering experience with private moments along the way. This finding points to the potential of space in creating concentrations of meaning-making by encouraging high amounts of traffic while offering a setting and opportunities where high engagement is also possible.

Space may have contributed to the qualitative aspects of the visitor experience in the way that it shaped the pace and scope of the visit, along with both social factors and

connection to animals via the animal-people interface. The visual qualities of the environment along with factors over and above the spatial (e.g. attraction of displays, visit goals) overrode space syntax, especially for those with greater familiarity with the site (see 5.1, 5.2.5, 5.2.6).

How do the lived experiences of Zoo visitors compare with the Zoo's intended curriculum?

The study revealed that the intended curriculum of the Toronto Zoo was partially realized, although perhaps in an alternate or more oblique manner than Zoo educators might anticipate or have planned. Realization of the Zoo's educational intentions was perhaps more successful where this curriculum aligned more closely with that of the visitors. Results, in the way that they point to a mosaic of meaning-making modes and processes, appear to show that Zoo visits provide more diverse and wide-ranging meaning-making opportunities than those explicitly set out by the Zoo (see 5.2.6, 5.2.7, 5.2.8).

The lived experiences of visitors are often more multi-dimensional than perhaps the Zoo would consider, including cognitive, affective, and psychomotor responses, as well as, all of the stimuli that come with visiting a large, mainly outdoor venue with a group of family or friends. At any given moment, the Zoo visitor is bombarded with outside distraction and personal and sociocultural needs and obligations, in addition to their primary focus. This finding points to the potential of considering how one might slow down or quiet the experience more to remove distractions and create a space that fosters better focus or concentration on the part of the visitor (see 5.2.6, 5.2.7, 5.2.8).

Lived experiences are interpretational and uniquely personal to the group (e.g. 4.5.1, 4.5.2). This is contrasted to an intended curriculum that is more straightforward and less diverse. As shown in sections 4.4, 4.6, 5.2.6, and 5.2.7, visitors use the Zoo's

displays to observe and connect to animals. In this manner the "connecting" goal of the Zoo's Conservation Education mission is being realized. There is a strong focus in visitors on the concrete aspects of the content that is before them, which is a mismatch with the abstract concepts, such as respect and protection, the Zoo wishes to deliver. However, the displays do appear to spark visitor curiosity, and create feel-good experiences, affects that align well with the Zoo's Vision. Cognitive experiences are probably more superficial than hoped. The inclusion of comments that indicate behaviour change has occurred as a result of a Zoo visit are encouraging.

The highly idiosyncratic and personal nature of Zoo visits emerges from participants' self- reports of their lived experience (see Interactive Visuals 3-5, 4.4, 4.5, 4.6, 5.2). Juxtaposed with the more "objective" wayfinding and space syntax analyses, these reports of actual lived experience highlight the value of exploring subjective measures of meaning-making in that they provide an incredibly rich snapshot of what people do, think, and feel during their visit to the Zoo. This has the potential to truly connect Zoo educators with their clients within the new meaning- making paradigm being explored in the field of informal science education.

On a broad scale, neither meaning-making nor the visitor experience seems remarkably different based on the visitors' level of familiarity with or experience on the site. Visitors' meaning-making processes were similar, whether or not they were familiar with the site (see 5.2.6, 5.2.7); however their lived experiences and modes of meaning-making were quite distinct (see 5.2.2, 5.2.3, 5.2.4, 5.2.5). Those with no recent experience at the Zoo visited more of the site and more content but tended, broadly, to visit the same displays as one another. Visitors with more familiarity visited fewer displays, likely spending more time at some content, tended to concentrate their visit on the same areas, and engaged in a more diverse selection of displays from one

another. While the experience of visitors who frequent the Zoo often can be described as being selective, in contrast, visits by those with no recent Zoo experience are characterized as wide-ranging yet, broadly, homogeneous. They visit a larger variety of animals in a larger spatial scope than their counterparts, but also seem to focus on the same animals as one another. They visit the entire site more uniformly.

Overall, outdoor exhibits of active, charismatic, large mammals, or animals that can be viewed in close proximity to the visitor, as well as, displays that include infant or juvenile animals create strong draws that may override the pull of space in shaping the visitor experience and meaning-making (see 5.2.7).

How might visual representations of the visitor experience move us toward a more comprehensive understanding of meaning-making on the Zoo site?

Within this research, visual representations have allowed for an examination of visitors' use of space and meaning-making that includes both scope and perspective. Without the visual nature of the data representation (see Interactive Visuals), it would be difficult to take in a bird's eye view, both literally and figuratively, while also focusing on the details of the visitors' experiences. In doing so, the space of the Zoo and the visitors' lived experiences are revealed in relation to one another.

Visual representations have allowed for the juxtaposition of both "objective" and "subjective" measures of space and experience, to provide a richer sense of the meanings imbued in the landscape and contributed to each measure a quality that was previously lacking. They have allowed for a comprehensive and holistic visual and intellectual examination of the visitor experience and their meaning-making at the Zoo (see Interactive Visuals), which would have been highly difficult to achieve in traditional forms. They have also proven to be an effective method for

analyzing the qualitative aspects of the visitor experience, which might have been difficult to accomplish by more traditional means. Visual representations made possible the comparison of the different modes of data (words, maps, photographs) in a combined format.

Christian Nold's Biomapping project asked the question "can we really blend together our emotions and experiences to construct a totally shared vision of place?" (Nold n.d.). Though perhaps intended to be a rhetorical question, in the context of the work described in this thesis, it seems that the answer Nold's question is at once a "yes" and a "no". We can visually blend together visitors' Zoo experiences so that, from afar, a broad but shallow picture of their lived curriculum emerges. When we zoom in more deeply, however, it is clear that the idiosyncratic details of each Zoo visit cannot, and perhaps should not, be blended.

6.2 Recommendations for Toronto Zoo

While the Zoo might be criticized with regards to the way its configuration creates obstacles for navigating to a large array of segregated animal-viewing areas, this spatial organization is beneficial in some ways as it allows visitors to be more focused on the content with which they engage. It has been shown that lower levels of distraction and higher levels of learning result from concentrating exhibits in less-travelled areas (Maxwell and Evans 2002). Research has also shown that stop times at elements is longer when visual information is limited as well (Kaynar 2005). The distinctive phenomenon of the spatial and meaning-making "hot spot" that emerged in the African Savanna district might be noted by the Zoo in the way that it points to potentials for designing future areas that attract a high number of visitors and also create rich meaning-making experiences. Within the Toronto Zoo's Vision and Conservation

Education mission these qualities might be seen as being advantageous. It is important to consider, however, that a site have varying levels and types of experiences as visiting an institution with high intellectual, emotional, and physical engagement in all of its areas could quickly overwhelm its visitors.

From an environmental design standpoint, the site analysis revealed the complexity of wayfinding and wayshowing on the Zoo's large, mainly outdoor site. The size of the site, the relatively complex path system, high number of districts, lack of consistency in form, material, and graphics of directional signage, and high occurrence of minor nodes, necessitating regular decision-making by visitors, makes wayfinding on the Zoo site challenging. As such, it has the potential to distract visitors to the detriment of the intended curriculum of its staff.

The site could benefit by strengthening district characteristics in situ and echoing these distinctions on the Visitor Map and vice versa. The introduction of coloured banners or paved areas (with paint or pavers) could help mark the districts more clearly and make a stronger connection between the various wayfinding components (map and signage). Clearly marking the entrance and exit of all districts would improve wayfinding. Subtly differentiating the built environment (perhaps through the use of colour or addition of distinctive features) may also help. For example, the African Savanna includes some unique interpretive features such as "the equator" painted on the path and vernacular signage that reinforce its zoogeographic location.

Adding and/or increasing district and directory maps would assist visitors in orienting themselves and provide advance organizers when entering a district, facilitating the formation of an effective cognitive map. Signage could include both types of maps to allow visitors to orient themselves on site as well as find their way through a district.

Adding directory maps at all nodes is recommended.

The orientation of directional signage privileges some areas and pathways over others. In particular, visitors are well guided when entering the Zoo, but, in many of the most heavily used pathways, are given little to no direction into other districts or towards the exit. Directional signage on site almost completely ignores Australasia, and, to a lesser extent, Americas (especially the outdoor exhibits). Directional signage and environmental cues are also largely lacking upon exiting each pavilion making it unclear how visitors should continue. In many cases, simply changing the angle of some directional signs will help ensure they remain in the sightlines of visitors. Altering the signs/adding more signage or perhaps, more preferably, adding more environmental cues in other areas will help guide visitors to the more hidden districts.

Signage in each district could be aesthetically distinct while maintaining the same overall look, including the same typeface. This would provide continuity but also do a better job of differentiating each district for wayfinding ease. Signage could match the district colours on the visitor map. The scale of signage should also be examined. As this is an outdoor site, over-scaled signs are more likely to attract attention. It is important, however, to be conscious of over-signing the site.

While previous environmental design highlighted the suggested walking trails represented by the footprints, the current system largely ignores them. Explicitly highlighting these trails along with supplementary information (e.g. approximate length of time to follow each trail, animal and plant highlights) to visitors on the map as well as throughout the site will facilitate a pleasant and navigable experience. It may be useful to incorporate the footprints into some of the newer exhibits and to introduce new footprints that allow visitors to explore based on demographics or general interests as

opposed to zoogeographical focus (e.g. tour for families with small children). It is important, however, not to overwhelm the pathway (and the visitors) with too many different footprints. Additional tour suggestions could be located within the Visitor's Guide and at the front entrance where visitors are planning their day (e.g. tours for people that like reptiles, tours for people that like cats). Care needs to be taken not to confuse visitors with overlapping coding systems such as the colours of districts and those of the footprints.

This thesis has highlighted the lived meaning-making of Toronto Zoo's visitors as rich, varied, and multi-dimensional, in contrast to the more restrictive intended curriculum of the Zoo. As such, the Zoo might do well to broaden their vision of what constitutes education and meaning-making on-site, and consider the importance of the varied interpretations made by visitors of their experiences by incorporating more opportunities for a wider array of meaning- making processes and outcomes. This could include more varied opportunities and messaging in the cognitive, affective, and psychomotor domains. This strategy would appeal to Falk's personal context as each visitor would bring with her a preferred style of learning, affecting how she might engage with a display (Falk and Dierking 2013). It also hints at Boon's (2011) analogy of visitors as "poachers", taking from each display what they want and remixing it with new views and perspectives that suit their own needs.

The Zoo should be aware that space may be detracting from some of their valuable intended experiences (e.g. visits to the Bird Show). These spatial obstacles could be mitigated in other ways, perhaps by ensuring feature exhibits are well advertised throughout the site, including at the orientation area as visitors enter the Zoo, or by adding or changing environmental design elements to visually highlight these offerings. They might also consider moving these displays to areas that do receive

more attention from visitors. For example, when designing new exhibits or exhibit areas, the Zoo might consider including opportunities for different modes of meaning-making and designing the layout in such a manner as to allow for both a faster paced visit (which may be preferred by first time or "once in a while" visitors), as well as, the opportunity for more concentrated and slower paced engagement.

The Zoo might also consider how new exhibit areas fit into the entire configuration of the site in creating their objectives for meaning-making. A highly integrated area will likely see more traffic, especially if it is located within a short distance from the Front Entrance. Ensuring that this area is also designed to allow for a slower paced experience with opportunities for private or personal experiences might further increase its impact. By planning ahead to feature content that supports its educational intentions, and locating this content in spatially integrated areas, the Zoo might create better fulfillment of its goals.

The concrete nature of visitors' experiences was also strongly evident in this project pointing to the importance of addressing visitors at this concrete level before attempting to move into more abstract thoughts and concepts. The relatively high levels of inquiry and relating/connecting discourse amongst visitors points to the importance of both promoting and supporting these types of experiences. This could be accomplished by using exhibit design, live interpreters, and signage to spur thoughtful connections with the animals and bridge that connection to encourage deeper engagement supportive of the Zoo's educational objectives. Furthermore, results seem to indicate that behaviour change is possible via a Zoo visit, at least for adults. This is a promising outcome that deserves more attention by the Zoo. The comments regarding behavior change made by Visitor Study participants indicate that personally relevant and accessible actions are important ones to feature.

All in all, the Zoo might consider acknowledging the importance of spatial configuration and the visual qualities of their site in impacting meaning-making. Identifying the areas where high engagement is expected would allow them to concentrate the varied opportunities available for meaning-making in and around this content. Being aware of the spatial, visual, and content-specific qualities that encourage meaning-making in visitors would also allow the Zoo to specifically design exhibits and experiences that incorporate increased opportunities for impact.

6.3 Limitations

It is key to note that this research is exploratory and not conclusive in nature. As such, it does not point to decisive evidence of one thing or another. On the contrary it explores the potentials of various techniques for data collection, analysis, and representation, reveals patterns that provide a holistic picture of the Zoo visitor experience, and prompts a variety of questions for future research.

Due to its qualitative position, the results of the study tend towards those of subjectivity, making their significance for other institutions more fragile. The benefits of embracing that subjectivity (the rich and insightful picture it produces) and the general applicability of the methods tested and trends revealed, outweigh its potential disadvantages.

It should be noted as well that, while researchers now call for a more holistic view of visitor learning from museum visits, one that necessitates a broader view of the visitor including pre and post visit measures (e.g. Falk and Dierking 2013), the scope of the present research precluded such a long view. This was mainly due to this project being undertaken in a limited- time Master of Arts program that would not allow for such a

long timeframe completing, analyzing, and reporting on data.

Due to the exploratory nature of the study, the small sample size, and the heavy emphasis on qualitative data, the use of statistical analysis was avoided in this study. This was limiting in that any "true" correlations could not be made and could be mitigated in the future by increasing the sample size and minimizing some of the challenges that come with using new media for these types of studies.

The main limitation of the Visitor Study portion of this research from a data reliability point of view was the technology. The varied topography of the study site resulted in loss of GPS signal for some groups making it challenging in some instances to ascertain the route taken. While this only occurred in a limited number of cases, and was mainly mitigated by the written and photographic data collected at waypoints, it did result in some inefficiencies in recording routes.

It is also important to note that relying on visitors to enter each waypoint opens up the potential that some waypoints would not be recorded in any manner (i.e. electronically, comments, photos). For example, it is possible that visitors may have been so engaged at an element that they did not remember or did not want to add a waypoint. However, Rainbolt, Benfield, and Loomis (2012) demonstrated that visitor self-reports of their circulation while in a museum were accurate and a feasible and efficient way to gather such data, and that visitors often provided more details than what were required.

While the instructions to visitors were tested in various ways, it was clear that some groups interpreted the tasks and questions asked of them differently than others. An in-person training and orientation, even brief, in which a clear framework of the project goals was provided may have helped.

It should be noted that elapsed time at each waypoint was not measured and that the

decision not to include these data was one borne of both practical and theoretical reasons. Firstly, the Mobily Trip app will record elapsed time spent at a waypoint provided that users accurately add their waypoint when they arrive at a destination and end it directly upon leaving. As this was one of the less user-friendly functions of the app, we did not feel the timing results measured in this manner would be accurate enough to be useful. Furthermore, some researchers have flagged the limitations of timing stops at exhibit elements in truly describing exhibit effectiveness, having as much to do with the type of audience and exhibit content as the design of the element itself (Doering and Pekarik 1997).

The use of self-reports was used in this research as a means by which to better understand the visitor experience from the visitor's point of view, despite the potential intentional or unintentional data manipulation by participants. Indeed, it was the only method for obtaining this information. It has been noted that the key to valid self-report data lies in the precision of the question(s) being asked (Baldwin 2009) so the questions used were carefully considered. The value of participants reporting their thoughts and feelings in the moment was also seen as being advantageous as it avoided memory errors of retrospectively reporting this information (Tourangeau 2009). However, of course, reporting these data in the moment does have its limitations including the demand on the participants' time to do so, making it possible that they would not provide full responses.

6.4 Suggestions for Future Work

This thesis project revealed the interaction between the spatial aspects of the Toronto Zoo, the educational intentions of its staff, and the lived experiences of Zoo visitors. Several interesting results emerged, not least of which was the interesting spatial and

meaning-making "hotspot" of the Zoo's African Savanna district. Future work might wish to zoom in more closely on this area (or indeed any other in the study) to examine more directly how space and meaning-making processes and outcomes function there. The results of such an investigation might reveal the unique spatial, visual, and content-specific qualities that combine to create the "hotspot" phenomenon, which would assist in designing future displays. The methodology used in this study could also be applied to studying space and meaning-making at the District-level, more closely examining the configuration and environmental design of both the exterior and interior spaces with regards to how they relate to meaning-making.

Equally, with many large animal exhibits providing multiple viewing areas and communication media (e.g. signage, video displays etc.), a spatial and meaning-making examination of a single display might also be fruitful, especially if that display was one of the highlights of the study (for example, the polar bear exhibit), or one where the Zoo has noticed their intentions are not being realized. This would provide further information about how design, on a more micro level, is influencing the visitor experience in the hopes of creating displays that do fulfill the Zoo's educational goals.

This study seemed to indicate that level of experience and familiarity with a site do not have a great impact on the meaning-making of its visitors. This finding could be more deeply examined to more finely understand if differences in meaning-making between these two types of visitor exist or not, and the reasons why.

This project examined the Zoo visitor experience using the meaning-making paradigm, a perspective that is absent from most studies on learning in zoos. Future work in other zoological institutions using the same framework would add more depth and perspective to meaning-making in institutions that exhibit animals. Using the Mobily

Trip app, the Toronto Zoo, or other institutions, could implement a general promotion encouraging visitors to create journals of their visits. While less targetted than the study reported on here, these journals could be a valuable source of information on the visitors' experiences, and would be a resource-efficient method.

Leaders in the field (e.g. Falk and Dierking 2013) have called for a more longitudinal perspective on meaning-making in sites of informal science education. Future work at the Toronto Zoo might attempt at a more holistic long-term investigation of how the meaning-making that takes place on Zoo visits translates, extends, and is remembered. This could be accomplished by following repeat visitors to an institution over multiple visits to understand how their meaning-making functions through time. It could also include following up with visitors weeks or months after their visit to investigate their memories and subsequent activities related to the visit. This might provide a deeper examination of behaviour changes in particular. Such work would surely add to the store of knowledge on meaning-making in zoos and aquariums, allow the Zoo to better focus its efforts vis a vis its purpose in the community, as well as, add further support for the value of such institutions to society as a whole.

Finally, the mapping methods used in this thesis have potential to be further developed and expanded to better aid cultural institutions in efficiently and effectively investigating the experiences of their visitors. This could include using both broad, holistic plan views of an entire site along with both plan and perspective views of specific areas (e.g. displays or districts of high or low engagement), allowing for viewing these variables in relation. Additional variables could be added to each map as well, for example, notations to denote visiting sequence (e.g. numbering waypoints) or perspective views at select or each location. Adding more variables might allow for a deeper investigation of the visitor experience by linking disparate types of information.

Extending the applicability of the information to actual visitors, specific maps could be created that appeal to different visitor types (e.g. visitors with young children, adult visitors). These could be available in paper or electronic versions to assist different audiences in getting more out of their experiences on-site. To enable a "layman" to better understand the data, the Toronto Zoo Visitor Map & Guide could also be wholly reimagined using the results of the visitor study. The map could depict altered spatial layout and graphically emphasize or demphasize certain content to create a view of the Zoo as experienced by its visitors.

As is, the methods are advantageous for cultural institutions with smaller budgets as they are low in cost and relatively easy to implement, while yielding a rich data set. Viewing visitors' experience cartographically allows for an examination applicable to both the education/visitor experience and design/ wayfinding functions and departments of an organization, creating a higher return on investment and business case for support. Through the use of emerging technology such as Near Field Communication and Indoor Positioning Systems, greater accuracy in tracking the movement of people in indoor environments will soon be available for smaller, indoor sites.

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Appendix A - Informed Consent Form for Visitor Study Participants

Informed Consent Form

Study Name: Visualizing the Zoo Visitor Experience

Researchers: Kelly Bentley
Graduate student, Interdisciplinary Studies, York University
kbentley@torontozoo.ca 416-392-5943

Purpose of the Research: This project will assess the educational experiences of general visitors to the Toronto Zoo by gathering information about the physical, cognitive, and affective characteristics of their visit as they view, listen, read, act, and otherwise engage with the content of the Zoo (e.g. exhibits, signage, new media, architecture, wayfinding, attractions, services etc). In particular, this research will explore how Zoo visitors move through the Zoo, the elements of the Zoo's content that are most notable to these learners, and their cognitive/affective responses to these elements. What will result is a comprehensive understanding of how and what learning takes place on the Zoo site.

The results will be reported in a Master of Arts thesis document and in internal reports and presentations at the Toronto Zoo. The results may be presented at scholarly conferences or in academic journals as well.

What You Will Be Asked to Do in the Research: Participant groups will be required to download the Mobilytrip application (which is free of charge) on their personal mobile devices (i.e. iPhone, iPad, or Android smartphone. This application is not available on Blackberry devices at this time). They will generate a personal account on this application and use it to create a personalized travel journal of their visit to the Toronto Zoo. Mobilytrip is a multi-media travel diary available for mobile devices. It allows users to share the route, photographs, comments, general impressions, and ratings of their travels in real time. It also includes an online interface for users to view and share their travel experience with friends and/or the general public, if they wish. Users may choose to hold their journals privately as well. The main source of data will be obtained by tracking participants' movement and self-recorded responses via this application. Participant groups will be required to share their journals with researchers via an automatic email sent through this application.

Participant groups will receive a pre-visit orientation package which will explain the project and include terms, conditions, and consent to participate. A pre-visit questionnaire will also be included to obtain relevant demographic information.

Once on-site, participant groups will carry-out their Zoo visit as normal (i.e. as they would if they

were not participating in the study). They will be asked to create an entry in their Mobilytrip journal each time they stop to look, listen, smell, feel, taste or participate with Zoo content during their visit (e.g. observe an animal, interact at a touch table, read a sign, buy an ice cream bar, consult the Zoo map etc). This entry will include at least one photograph of the element and a written comment about why they stopped at this element and what they are thinking or feeling about what they are engaged with. The entry will also include a simple rating from a 4-point likert scale in the form of emoticons (very happy, happy, neutral, unhappy).

The time commitment for participation is 4 to 9 hours (2 to 3 hours to read and complete the pre-visit materials and 2 to 6 hours visiting the Toronto Zoo on one occasion).

Upon receipt of data by researchers, each participant will receive a pass for half-price admission to the Toronto Zoo to be used by March 31, 2013, as compensation for their involvement with the project. Participants will also be entered into a draw for various Zoo-related prizes (e.g. one year family membership pass).

Risks and Discomforts: We do not foresee any risks or discomfort from your participation in the research. Participation in this research requires participants to share some limited information and hold it on-line with Mobilytrip. It also requires participants to share their travel journals with researchers. These journals will be held on-line in the study's private account. Please see Appendix 1 for Mobilytrip's privacy policy.

Benefits of the Research and Benefits to You:

Voluntary Participation: Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the project or the nature of your relationship with the Toronto Zoo, researchers, study staff or York University either now, or in the future.

Withdrawal from the Study: You can stop participating in the study at any time, for any reason, if you so decide. If you decide to stop participating, you will still be eligible to receive the promised compensation for agreeing to be in the project. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, York University, or any other group associated with this project. In the event you withdraw from the study, all associated data collected will be immediately destroyed wherever possible.

Confidentiality: Data collected, including photographs and comments will not be associated with any identifying information of the participants. All information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Photographs will be altered to conceal identifying features of participants (e.g. faces will be blurred). Data will be collected via hand-written or electronic survey and through the Mobilytrip application on participants' personal mobile devices. Participation in this research requires participants to share some limited information and hold it on-line with Mobilytrip. It also requires participants to share their travel

journals with researchers. These journals will be held on-line in the study's private account. Please see Appendix 1 for Mobilytrip's privacy policy. Data shared with researchers will be safely stored in a locked facility and only research staff will have access to this information. Participants' personal information will be destroyed upon completion of the study by shredding hand-written documents and deleting electronic information. Researchers' copies of the Mobilytrip travel journals will also be deleted upon completion of the study. If you so indicate, data will be removed from the study's on-line Mobilytrip account for analysis and researchers' copies of Mobilytrip travel journals will be deleted with one week of receipt. Other data, including photographs and comments, will be archived by the Toronto Zoo, either electronically or in hard copy. All identifying features (e.g. faces in photographs) will be removed before storage. Confidentiality will be provided to the fullest extent possible by law.

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact me or my Graduate Supervisor - Dr. Steve Alsop either by telephone at 416-736-2100 x 20665or by e-mail (salsop@edu.yorku.ca). You may also contact my Graduate Program - Interdisciplinary Studies, 027 McLaughlin College, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3, Canada, Phone: (416) 736-5126, E-mail: gradinst@yorku.ca. This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 5th Floor, York Research Tower, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Signatures:

I *(fill in your name here),* consent to participate/give permission for my child to participate in the *Visualizing the Zoo Visitor Experience Project* conducted by Kelly Bentley and the Toronto Zoo. I have understood the nature of this project and wish to participate/allow my child to participate. I am not waiving any of my legal rights or those of my child by signing this form. My signature below indicates my consent.

Signature _____ Date _____
Participant

Signature _____ Relationship to Child _____ Date _____
Parent/Guardian (if applicable)

Signature _____ Date _____
Principal Investigator

List of Appendices: Appendix 1: Mobilytrip Privacy Policy

Appendix 2: Draft Questionnaire for Participants

Appendix 1: Mobilytrip Privacy Policy

MobilyTrip is a Service allowing people to describe their travels in real time, to store their memories online and to share them with their friends, family and more generally, with any visitor of the Website. We understand that providing information online involves a great deal of trust on your part, so we make it a high priority to ensure the security and confidentiality of the personal information you provide to us. Before submitting your personal information to our Web site, please read this Policy carefully to learn about our privacy practices.

What information we collect from you:

In General

We receive and store any information you enter on our Web site or give us in any other way. This includes information that can identify you ("personal information"), including your first and last name, telephone number, postal and e-mail addresses, user name and password. We also collect information about your travel experiences, places you visit to store your travel journals. We may also request information about your travel plans, style, and preferences, including meal requests, seat selection, frequent flyer/hotel/car rental program information, and flight class, luggage, and ticketing options. You can choose not to provide information to us, but in general some information about you is required in order for you to enjoy the benefits of being a registered member. For example, only registered members are able to store their travel journals, and to contribute to the Website content, participate in discussion forums, access members-only newsletters and travel planning content, and enter surveys, contests, or sweepstakes.

Travel journals

MobilyTrip collects information about your travels through the travel journal feature. MobilyTrip provides you a way to set privacy settings to your journal, and to the photos included in your journal, both from the mobile applications and on the Website. It is your responsibility to manage the privacy settings, to grant access to your contacts and to not set content as public if you do not want MobilyTrip to use it publicly. You grant MobilyTrip and its affiliates a nonexclusive, royalty-free, perpetual, transferable, irrevocable and fully sublicensable right to use, reproduce, modify, adapt, translate, distribute, publish, create derivative works from and publicly display the content (included, but not limited to : texts, photos, geolocation, sound, video) set as “public” in your journals throughout the world in any media, now known or hereafter devised; those rights remain valid as long as the Content is public, and you may change this setting at any moment.

Automatic collection of information

We automatically collect some information about your computer when you visit MobilyTrip. For example, we will collect session data, including your IP address, Web browser software, and referring Web site. We also may collect information about your online activity, such as content viewed and pages visited. One of our goals in collecting this automatic information is to help us understand the interests of our users and customize your user experience.

Cookies and other web technologies

Cookies are small data text files and can be stored on your computer’s hard drive (if your Web browser permits). MobilyTrip use cookies for the following general purposes:

To help us recognize your browser as a previous visitor and save and remember any preferences

that may have been set while your browser was visiting our site. For example, if you register on our site, we may use cookies to remember your registration information, so you do not need to log into our site each time you visit. We also may record your password in a cookie, if you checked the box entitled "Keep me signed in on this computer unless I sign out." Please note that member IDs, passwords, and any other account-related data included in such cookies are encrypted for security purposes. To help measure and research the effectiveness of website features and offerings, advertisements, and e-mail communications (by determining which e-mails you open and act upon).

The Help portion of the toolbar on most browsers should tell you how to prevent your browser from accepting new cookies, how to have the browser notify you when you receive a new cookie, or how to disable non-essential types of cookies. Please note that if you refuse to accept cookies, you may not be able to access many of the travel tools offered on our sites.

Our sites also may use Web beacons (also known as clear gifs, pixel tags or Web bugs), which are tiny graphics with a unique identifier, similar in function to cookies, that are placed in the code of a Web page. We use Web beacons to monitor the traffic patterns of users from one page within our sites to another, to deliver or communicate with cookies, to understand whether you have come to our site from an online advertisement displayed on a third-party Web site, and to improve site performance. We also may allow our service providers to use Web beacons to help us understand which emails have been opened by recipients and to track the visitor traffic and actions on our site. This helps us measure the effectiveness of our content and other offerings.

Display of advertising

MobilyTrip is committed to providing you with relevant content and information across our site. To do this, we may collect information about your past travels, in particular through the travel journal feature, and your travel-related searches, such as whether you are looking for information about destinations, airline flights or hotels, and use this information to serve you with ads on our sites or elsewhere online that match your interests. We do not share your personal contact information (such as email addresses) with unaffiliated third parties so they can serve you with advertisements.

How we use your information

MobilyTrip uses the information we collect about you for the following general purposes: for registration and to manage your account, including to facilitate your access to and use of our site; to store your travel data; to communicate with you in general, including to provide information about MobilyTrip and invitations from the MobilyTrip community; to enable us to publish your journals, comments, forum posts, and other content to the MobilyTrip community; to respond to your questions and comments; to measure interest in and improve our products, services, Website and Mobile applications; to notify you about special offers and products or services available from us or our partners that may be of interest to you; to otherwise customize your experience with MobilyTrip; to solicit information from you, including through surveys; to resolve disputes or troubleshoot problems; to prevent potentially prohibited or illegal activities; to enforce our Terms of Use; and as otherwise described to you at the point of collection. Email communications

We want to make it easy for you to take advantage of travel-related opportunities on our website. One way we do this is by sending you email messages that contain information about

your apparent travel-related interests. We believe these email messages will provide you with useful information about travel-related special offers available through our site. Please note that you will have the opportunity to choose not to receive these email messages in any such email we send. With whom we share your information

If you choose to create a profile on MobilyTrip, certain information in your profile will be publicly viewable and identifiable by clicking your screen name. MobilyTrip will not share your email address with any other members nor display it in any public manner. Other than as set out above, you will be notified when personal information about you will be shared with third parties, and you will have an opportunity to choose not to have us share such information. We also may share aggregate or anonymous information with third parties, including advertisers and investors.

How you can access your information
We endeavor to ensure that your information is relevant to its intended use, accurate, and complete. You can access and update your contact information by visiting your subscriptions page on the MobilyTrip Website. You have the possibility to close your MobilyTrip account at any time. Note that after you close an account, you will not be able to sign in or access any of your personal information. However, you can open a new account at any time too. Please also note that we may retain certain information associated with your account in our archives, including for analytical purposes as well as for recordkeeping integrity. If you do not hold an account with us, or wish to contact us in relation to any personal information that is not displayed in your account, you may ask us to access, delete and modify the information that we hold about you by contacting us via the contact form.

Your choices with respect to the collection and use of your information

As discussed above, you can choose not to provide us with any information, although it may be needed to take advantage of certain features offered on MobilyTrip, in particular the storage of your travel data. You also can add or update information and close your account as described above.

You have a possibility to set privacy rights to the content you provide. At a given point in time, MobilyTrip will only use the public content.

When you register as a member on MobilyTrip, you will be given a choice as to whether you want to receive email messages from MobilyTrip. As a registered MobilyTrip member, you can modify your choices at any time through the Email Settings of your subscriptions page. Whether registered as a MobilyTrip member or not, you also will be given the opportunity to unsubscribe from promotional messages in any such e-mail we send. Please note that we reserve the right to send you other communications, including service announcements and administrative messages relating either to your MobilyTrip account, without offering you the opportunity to opt out of receiving them.

The Help portion of the toolbar on most browsers will tell you how to prevent your browser from accepting new cookies, how to have the browser notify you when you receive a new cookie, or how to disable cookies altogether. Please note that if you refuse to accept cookies from MobilyTrip, you will not be able to access portions of our site.

How we protect your information
We want you to feel confident about using MobilyTrip, and we are committed to protecting the information we collect. While no Web site can guarantee security, we have implemented

appropriate administrative, technical, and physical security procedures to help protect the personal information you provide to us.
Children's privacy

MobilyTrip is a general audience site and does not offer services directed to children. Should an individual whom we know to be a child under age 13 send personal information to us, we will delete or destroy such information as soon as reasonably possible.

External links
If any part of the MobilyTrip Website links you to other Web sites, those external Web sites do not operate under this Privacy Policy. We recommend that you examine the privacy statements posted on those other Web sites to understand their procedures for collecting, using, and disclosing personal information.

Changes to this Privacy Policy
MobilyTrip may update this Privacy Policy in the future. We will notify our members about material changes to this Privacy Policy by either sending a notice to the e-mail address you provided to us or by placing a prominent notice on our Website. How you can contact us

If you have questions about this Privacy Policy, please contact us by using the contact form available on our Website.

Appendix 2: Draft Questionnaire for Project Participants

As participants will complete the project as a group, we will gather information on all project participants. We will ask the primary group contact to take responsibility for completing the questionnaire. They will have three options for completing the questionnaire: on-line, via email, or handwritten and mailed. Below is a list of sample questions which will be included. Formatting will change depending on the format of the questionnaire. The survey should take 30 to 60 minutes to complete.

Information about primary group contact

Name (first & last):

Mailing address:

Telephone number:

Mobile telephone number:

E-mail address:

Age:

Sex:

Highest grade or year of school completed (check one):

Never attended school or only attended kindergarten Grades 1
through 8(Elementary)
Grades 9 through 11 (Some high school)
Grade 12 or GED (High school graduate)
College 1 year to 3 years (Some college of technical school
College 4 years (College graduate)
Graduate School(Advance Degree)

Have you read, signed, and submitted an informed consent form? (Yes/No)

Information about other project participants in your group (please complete one set of questions for each participant:

Name (first & last):

Age:

Sex:

Highest grade or year of school completed (check one): Never
attended school or only attended kindergarten Grades 1
through 8(Elementary)
Grades 9 through 11 (Some high school)
Grade 12 or GED (High school graduate)
College 1 year to 3 years (Some college of technical school
College 4 years (College graduate)
Graduate School(Advance Degree)

Has this participant read, signed, and submitted an informed consent form? (Yes/No)

3. Information about your group

How would you describe your group (check one)?
Parents with children
Grandparents with children
Friends
Couple
Other: _____

Where is your group from (check the most accurate answer)?
Toronto
GTA
Ontario
Elsewhere in Canada
United States
International

Other than this visit, have you ever visited the Zoo before? Yes/No

If yes, when did you last visit? <
1 year ago
1 – 3 years ago
Over 3 years ago
Don't remember

How often have you visited the Zoo in the past year? 0
times
1-3 times
4-6 times
7 times or more

Do you have a Toronto Zoo membership? Yes/No

If yes, how many, out of the past 5 years, have you held a membership to the Toronto Zoo?
1
2
3
4
5

Have you ever visited the Zoo's web site? Yes/No

Did you/will you use the Zoo's web site to plan your visit? Yes/No

Please describe why you have decided to visit the Zoo.

Please describe the goals for your Zoo visit.

Appendix B - Mobily Trip Pocket Tip Sheet (for Visitor Study Participants)



"Send journal to MobilyTrip"

At the end of your visit:

#TOZ: Ensure this code is entered into the *description* of your trip.

Android: Click "Send journal to MobilyTrip".

iPhone: Click "synchronization", then "Send journal to MobilyTrip"

This will send the information to your online account and share your journal with the Zoo.

At Home: Sign into your account and view your journal.

Manage your settings and share your journal with friends and family.

*Don't forget to send your completed survey, with information about all of the group members who participated to edresearch@torontozoo.ca

Contact Info

On your journey if you have any **questions** or **problems** feel free to contact us:

Phone us at: 416-392-5943

Come Visit us at:
The Education Centre

Email us at:
edresearch@torontozoo.ca

toronto zoo

Zoo Visitor Experience Study Tip Card

1. "Save Itinerary"

Please turn this on when you begin your visit and off when you leave the Zoo. This will automatically record your path around the grounds via GPS. (Same as "Record my Path" on older versions of app)

2. "Day Notes"

Write a brief description of your goals for your visit today. Feel free to add other comments, if you wish.

3. "Add a Place"

Add a place every time you stop to look, listen, smell, feel, taste or do something in particular.

Place: Brief description of what you are taking note of.

Comment:
Name of group member who initiated the stop, if any.

Answer these questions:

What made you stop here? What are you thinking/ feeling about this place?

Add any other comments/ name of person in your group who initiated the stop.

Rating: Select a face that represents how you feel about this place.

Category: This is optional

Android Users Remember:
Touch "End Now" when you are ready to move on to a new place!

iPhone Users Remember:
Sorting your photos (see #4) will end your place. Please do not sort until you are ready to move on to a new place.

4. "Take a Photo"

Please take at least **one** photo and add it to a place.

Android Users: Take a photo at a place and it will automatically save to that place.

iPhone Users: Take a photo at a place and sort photos once your finish at the place.