The Architecture of Keeping Animals: Preservation Responses to Changing Animal Welfare Ideals in Mid-sized American Zoos

Victoria McCollum
Clemson University, vmccollum12@yahoo.com

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THE ARCHITECTURE OF KEEPING ANIMALS: PRESERVATION RESPONSES TO CHANGING ANIMAL WELFARE IDEALS IN MID-SIZED AMERICAN ZOOS

A Thesis
Presented to
the Graduate Schools of
Clemson University and College of Charleston

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Historic Preservation

by
Victoria McCollum
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Amalia Leifeste, Committee Chair
Dr. Carter L. Hudgins
Dr. Ralph Muldrow
Abstract

Beginning in the mid-20th century, most of America’s Zoos began to re-evaluate the spaces which housed their living creatures. As advances in science and technology brought forward new information on animal welfare and care, zoos were soon faced with choices on the treatment of their current building stock. A range of preservation treatments emerged, from abandonment to demolition/new construction. This thesis examines the range of preservation treatments that took place in zoo buildings built prior to 1950 at the Lincoln Park Zoo (Chicago, IL), the Cincinnati Zoo and Botanical Gardens (Cincinnati, OH), the Toledo Zoo and Aquarium (Toledo, OH) and the Philadelphia Zoo (Philadelphia, PA). Revealing the building treatment response of each zoo to the continued changes in animal welfare unveiled that of the five zoos studied, renovation was the most common treatment for each zoo, followed by adaptive reuse. Thus, all zoos chose to simply renovate their buildings to better accommodate animals or adapt buildings for new zoo uses. A case study surveying the changes in each zoos Lion Houses as a response to the changing body of knowledge surrounding keeping large cats found that zoos were making timely changes regarding standards of felid care. While changes were timely, they varied greatly in quality. This represents that responses were largely to the unknowns in research rather than the knowns. Today there is a significant amount of historic building stock still extant in mid sized urban zoos. This information facilitated the discussion of recommendations for future uses of these buildings as animal welfare standards continue to change.
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CHAPTER 1: INTRODUCTION

Zoos in America began in the late nineteenth century as a form of entertainment and spectacle. Although humans had been keeping animals since ancient times, modern zoos stem from the tradition of the French “menagerie.”\(^1\) These early “menageries” were no more than ‘a curious collection of living wild creatures’ according to one British advertisement.\(^2\) Menageries were traveling collections of animals, established so that Victorian city dwellers could experience nature in an urban environment. These became so popular that cities began to incorporate them permanently into their landscape. The Zoological Society of London was established in 1826 with the mission of creating a permanent place for the study of natural history and zoology.\(^3\) The Victorians, obsessed with the pursuit of knowledge and scientific discovery, flocked to the newly established London Zoo to experience wild animals. Animals were organized by orders, or, taxonomically, which epitomized the contemporary scientific study of animals.\(^4\)

This concept prevailed in American Zoos. The Philadelphia Zoo, the first zoo in America, set the example in the United States for taxonomic organization (organization by species) of animals. However, as more zoos appeared in more cities, many zoos had neither the funding nor means to undertake large construction projects. The early acquisition of animals by zoos was often via donations from private entities like

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Nineteenth century architects designed and constructed buildings mainly in the picturesque style of the day, and only to house the zoos most important animals. The earliest zoos often constructed only one building, which housed all of the non-native species. Native animals and animals suited for the colder weather in northern climates were often given simple fenced in enclosures with sheds or barns that were not open to the public. As more zoos acquired funding for building projects, architecture in zoos became more prevalent, and zoos aimed to provide the best and most aesthetically pleasing buildings. These buildings were designed to provide the best visitor experience possible, with little regard to the animal experience.

Zoos experienced wide scale changes beginning in the early twentieth century. They shifted from cultural institutions that promoted spectatorship and the passive visitor experience to scientific institutions that promote species and habitat conservation, veterinary research and public education. Zoo goers could no longer justify simply seeing an animal at the zoo, captured from its natural habitat and transported into the urban center. Zoos struggled to justify keeping animals in captivity when information was surfacing about the endangerment and extinction of those same animals in the wild. Further, the exposure of poor conditions by animal welfare groups and the rise of the animal rights movement gained traction in swaying public opinion about zoos. Zoos were forced to modernize, naturalistic enclosures that mimicked an animals’ natural habitat became the standard for displaying animals. These changes both eased the visitors psyche and improved the animal spaces, making them more likely to breed.

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The query, then, becomes how these changing ideas were manifest in zoo architecture. For smaller urban zoos, historic buildings could either have been interpreted as hindrances to a new, modern and scientific zoo, reflecting a period of their history that most in the zoo community would rather forget, or as pieces of cultural heritage that represented how far society has come in the attention to and research of animal care. As buildings that were once representative of the best-known standards of animal care became obsolete, change became inevitable. But what exactly were these changes, and what did zoos do to shift their missions from simple institutions that displayed and housed animals, to institutions that display animals in small-scale replicas of their natural habitats?

This thesis explores the changes that four zoos have made to their historic buildings in response to surfacing knowledge and attention to animal welfare and behavior. By examining the changes made to pre-1950s (historic) buildings in the post-1950 decades at four zoos in America, this work can draw conclusions about which preservation treatments were chosen to respond to surfacing knowledge in the field of animal welfare. The nature of these changes can also be analyzed, in order to better understand not only building treatment as a general concept, but the visible and functional aspects of these changes.

A case study, which examines the changes to the Lion Houses at each zoo, addresses weather zoos were responding to published research at all in the twentieth century. This case study will also address the details of these changes, in order to better understand the specific features and qualities of these changes. This chapter will answer
some of the questions that numerical data cannot. These include: were zoo designers responding to scientific data published about specific species animal welfare? What aspects of a building were they changing? And, how much of the physical fabric was being altered? These questions are relevant to this study because they address the relationship between animal welfare research and building fabric, and how these may or may not be interrelated. The case study uses a narrative format to discuss specific aspects of changes, and draw conclusions based on a selective timeline for large cat research.

Understanding these overall changes to zoo buildings helps to understand how the human-animal relationship has changed in the twentieth century, and how those changes are manifested in the built environment. The findings from this study will also help to examine the future role that historic structures might have in Americas Zoos. The knowledge of the amount and character of existing fabric within mid sized urban zoos will facilitate the study of unique ways these structures might be used, which can address the ideals of both preservation and animal welfare.
CHAPTER 2: LITERATURE REVIEW

In order to examine the changes made to historic zoo buildings, there must first be an examination of the literature on preservation philosophy. This literature helps to guide the study of treatment to historic buildings in zoos, and provides background for why and how the use of historic buildings takes place. This chapter will frame the literature used to select preservation treatment categories for each building examined in all four zoos. The understanding of historic preservation philosophy is a vital component in examining not only how historic buildings have been treated, but also how they could be treated in the future. Thus, this chapter aims to provide the reader with selected knowledge on the philosophies that guide the practice of building treatment.

Some of the earliest literature surrounding historic preservation came from the discipline of city planning. Those interested in downtown revitalization began to argue for the renovation and adaptive reuse of a city’s current building stock, as opposed to new construction projects. These arguments were a response to the significant urban decay in many of America’s cities in the middle half of the twentieth century. Jane Jacobs was among one of the first to argue for historic building incorporation in city planning. She argues in *The Death and Life of Great American Cities* in 1961 that “cities need old buildings so badly it is probably impossible for vigorous streets and districts to grow without them.” Jacob argues broadly for the incorporation of all types of historic buildings in a city, from highly renovated expensive ones to low-value and even rundown

ones. She mentions the need for adaptive reuse in urban landscapes by claiming, “old ideas can sometimes use new buildings. New ideas must use old buildings.”

Author Kevin Lynch similarly argued for a historic preservation approach to city planning in his 1960 book The Image of the City. This work, similar to Jacobs, is focused on the revitalization of downtown city centers. Lynch agrees that the convergence of old and new architecture is vital, stating in What Time is this Place, “I prefer to emphasize the creation of a sense of local continuity – the tangible presentation of historical context, one or two generations deep, in all living space – over the saving of special things.” Lynch believed that in order to create thriving communities, preservation ideals should consider all eras of history as opposed to interpreting only one.

Preservation Attitudes in England

In the U.K, the dialogue was shifting from urban renewal to historic preservation philosophies in the mid – late 1970’s. A collection of essays published in 1976 in the book “The Future of the Past” address preservation theories like “Scrape vs. Anti-Scrape,” one of the earliest preservation arguments, which can be understood more broadly as restoration vs. conservation. Restoration techniques aim to aesthetically alter a building by restoring characteristics of one specific time period, while conservation aims to preserve all layers of manifested history on a building. Author Nikolaus Pevsner cites the first instance of this argument after the English Civil War in the 1660s, when cathedrals and abbeys were destroyed and the country had to make choices on how to

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treat them. The author makes note that the Victorian restorers, like Ruskin, were certainly the first to academically identify this preservation debate, and have created the path for the modern historic preservation movement. 9

In Osbert Lancasters’ article “What Should We Preserve?” many different theories are addressed to answer the question. Lancaster argues that we cannot save everything, and that economic necessity forces us into a choice of value. He argues that this should be left to the professionals, because private judgment cannot always be rectified. To answer the question “how should we preserve,” Lancaster does not agree with the restoration or “scrape” movement, arguing that buildings must meet a current modern function or they will fall into ruin. 10

*Technical Preservation*

Some literature written by historic preservationists takes a technical standpoint, but their discussion of the motives for preservation treatment often comes to a consensus; adaptive reuse and renovation are methods for solving the problem of changing spatial needs and preserving significance. 11 One of the first entities in the United States to provide both technical advice and a path for future studies in preservation philosophy was the National Parks Service with the National Historic Preservation Act of 1966. The NHPA established the Secretary of the Interiors Standards for Treatment of Historic Properties. Essentially a “user manual” for those tasked with caring for historic

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11 Jennifer Baehr, “The Protection and Preservation of Spatial Character During the Rehabilitation Process” (Thesis Clemson University, 2017), 17.
properties, these standards were separated into four categories: preservation, rehabilitation, restoration and reconstruction. The language of the secretary’s standards is both prescriptive and theoretical, providing the reader with more knowledge about historic preservation as a body of agreed upon principles as opposed to technical treatment of certain materials or features. While these standards are not enforceable by law, they are regulatory for those buildings benefitting from Federal Historic Tax Credits.

One group of authors took hold of these preservation philosophies early on and interpreted them so that that they were applicable to private enterprise in the 1978 book titled *New Profits from Old Buildings*. The book details a collection of buildings across the United States that are successful cases from the categories of adaptive reuse, continued use (renovations) and new additions. In the introduction, the authors note that the private commercial industry had traditionally been slow to adopt historic preservation applications. However, as resource depletion continued, more building owners were turning to renovation and remodel than ever before. The *Dodge Manual for Building Construction and Pricing Scheduling* published each year by McGraw-Hill cited remodel and renovation as a “popular segment of the construction industry” for the first time in 1977.\(^{12}\) For each case study, information is provided on an overall summary of the project, a building background, execution of the project, cost, problems, benefits, and company information.

In Peter H. Smeallie and Peter H. Smith’s book *New Construction for Older Buildings: A Design Sourcebook for Architects and Preservationists* published in 1990,

preservation is discussed from three foci, those being additions, alterations and new construction. In each section, the authors discuss the challenges and benefits of each form of construction, and include tactical advice for architects on how to create mindful additions to historic structures, how to treat interior renovations, and how to design modern buildings in historic settings. The book provides relevant case studies for each section to guide the dialogue. The book is able to combine tactical advice with theoretical approach, and makes a compelling case for what the authors believed successful treatment should look like. This work is one of the published books that marks the move in professional rhetoric from urban renewal towards historic preservation and designing specific examples with historic significance in mind.\(^1\)

David Kinkaid’s *Adapting Buildings for Changing Uses* provides a different type of technical guidance, that being guidance in the area of selecting the appropriate use based on certain variables like finance, building features and “robustness.” The technical evaluation offers various statistics and charts. These are meant to direct the reader to the best choice that both serves the needs of the user, the community, and protects the building itself. The book also contains non-technical arguments like dialogue surrounding the planning process, the benefits of mixed-use design, and working with a “management team” or balancing architects, engineers, contractors and all other concerned parties.\(^2\) This work is particularly insightful in identifying and discussing all of the variables that take place before a building project reaches the stage of construction. This book,


however, is exclusive to the field of adaptive reuse and fails to discuss factors that influence the decision of another form of preservation treatments.

The research presented offers statistics on what building owners and developers seek before beginning an adaptive reuse project, and a percentage of each building element changed during the renovation process. This research is particularly unique to this book. The author brings forward the argument of supply and demand of extant buildings, citing his quantitative research as “supply” of current buildings, and later uses a system coined “Use Comparator” to help fulfill the appropriate “demand.”\(^{15}\) The Use Comparator “is a decision aid that helps the decision-maker to: eliminate all non-viable change of use options, converge on a set of possible and potentially viable uses, and select the principle options for adaptive reuse.”\(^{16}\) This work approaches adaptive reuse technically, opposed to theoretically, and thus does not provide a compelling case for why an entity would choose preservation over demolition or new construction.

J. Stanley Rabun and Richard Kelso’s *Building Evaluation for Adaptive Reuse and Preservation* published in 2009 is an excellent example of how technical advice and preservation goals can converge. This book, which takes a very technical standpoint for evaluating buildings for their use potential, provides readers with a very clear guide for identifying architectural style and character, character defining features, and possible significance levels based on the National Register of Historic Places ranking (landmark, listed, not listed). The authors provide appropriate approaches based on these


designations, largely using rhetoric from the National Historic Preservation Act to convince readers of the significance of their property and which approach to take. The authors take care to note certain procedures that would be helpful for a non-preservation professional to be aware of, such as possible removal from the National Register due to improper renovations, the option of Federal Historic Tax Credits, Section 106, and historic zoning. This piece of literature, while highly technical, provides the novice with some theoretical background and awareness of the importance of character.17

Sharon C. Park makes a compelling case for retaining character in her article “Respecting Significance and Integrity: Approaches to Rehabilitation” in 2006. Park discusses how to balance the respect for character defining features and the need for a building change. She states that the first step in this process is to understand what is significant about a property. She argues that the National Register criterion for significance is the easiest way to do this, and that the level of significance should determine the buildings treatment throughout the renovation process. She also points out that spaces within a building that embrace more importance, such as the front elevation, original partitions or important character defining spaces, such as a lobby, should be considered more closely than secondary spaces. She notes that reversible changes should be used whenever possible, specifically when historic materials are contributing to the sites significance. One contribution this article makes is the discussion of Bob Miklos’ “four step methodology for design excellence for highly significant resources” which contain ideas like research and analyze, restore the idea, achieve mission and function,

and create a new identity.\textsuperscript{18} Miklos spoke specifically about libraries, and Park researches more in-depth to evaluate the changes made to three specific libraries in Boston. This work is successful in interpreting how a designer can successfully maintain historic integrity while giving a building a new use or features.

A third edition of John Earls’ \textit{Building Conservation Philosophy} first published in 1996 then republished in 2003 explores the question; “what are we setting out to do when we embark on the care of a monument, historic building or environment?”\textsuperscript{19} He begs the reader to try and answer the question of motive before undertaking a project on a historic building, because it will impact the choice of which preservation application is best suited for the particular site. In this book, Earl takes a multilateral approach to the topic in the form of “why, what and how?” That is, why do we embark on preservation projects, what buildings deserve our attention, and how do we treat them. He cites the fact that historic buildings are very often “useful resources capable of serving a modern purpose” as the most common reason for \textit{why} we preserve. In terms of what should be preserved, Earl believes there are many valid arguments, like the argument for significance, or the argument that a buildings need for intervention should surpass its importance to society.\textsuperscript{20}

He identifies different “Degrees of Violence” or degrees of intervention that may be options for historic building treatment. His degrees start from most invasive to least invasive, beginning with façadism, or, “skin-deep preservation”, that meaning preserving only the façade and removing and rebuilding the building behind it. He identifies this


method as highly controversial and, while it attempts to preserve instead of tear down, it is viewed by most preservation professional as distasteful and out of practice for providing a false sense of history. Next he identifies “Repair and Replacement” which is much less controversial but still important. Here he discusses the ideas of preventative maintenance, types of practitioners, modern materials, cheap fixes and modern methods, along with their influence on the dialogue of repairs and replacements. He claims “conservation is largely the art of controlling change,” and it is a very important control mechanism in building science. Next he identifies “restoration and reconstruction,” where he believes it varies from case to case whether this treatment is appropriate or not. He touches on degrees of restoration, like using substitute materials for aesthetic purposes, unraveling to a specific time period and doing visible or obvious repairs and trying to make them look historic. “Change of Use” and “Additions” are his last two preservation treatments. Here he emphasizes the need to communicate directly and articulately with all professionals involved, to reach a united goal.

Similar to Earls book, Donald Insalls 2008 book Living Buildings; Architectural Conservation: Philosophy, Principles and Practice provides an architects working knowledge of undertaking projects on historic buildings. His argument is that buildings are “alive” and have a lifecycle due to the interventions from the people that use them, the locality and materials, the styles chosen and the weathering they endure. Insall identifies the broad philosophy surrounding building culture today as “to keep” or “to make”, or, to preserve or to build new. Insall believes that this argument is very limiting,

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and that it is possible to do both. Although buildings are a product of their time, he believes that there are different degrees of treatment options professionals can utilize to meet the goals of all party members involved in the buildings treatment.

Similar to Earl, he identifies Ten Degrees of Intervention. These are criteria like architectural values, urban values and missing elements that can guide the selection of a building treatment. His first treatment, “day-to-day building care” is the least invasive method and can be done with minimal harm to the buildings character and materials. “Programmed Maintenance” comes second, that being regularly scheduled maintenance often identified by a formal plan. “Conservation” is the next degree, which entails only fixing what is no longer intact. He lumps many restoration techniques into this category. Next, “Major Repairs” is replacing a multitude of damaged material and will likely require great change. “Radical Improvement” is the next degree of intervention, which can most accurately describe a renovation project.

Further, “Restoration and Rebuilding” followed by “Rehabilitation” are more invasive, the latter can be identified as very similar to Earls idea of “skin deep preservation.” The eighth degree of intervention is “reincorporating existing buildings” or designing infill that is sensitive to its current built environment. In contrast, the ninth degree of intervention is simply constructing new buildings that are clearly modern and make no attempt to mimic their historic surroundings. Further, the last chapter is “conservation in a changing historic area” which attempts to consider how all these preservation treatments have coincided in the city of Chester. Almost all currently identified means of treatment for existing buildings are mentioned in one category or
another, making this work very encompassing but bias towards new design, and many of the examples used were designed by Insall’s firm.

*Historic Preservation Today*

Literature of late has been shifting towards the argument that historic preservation is a means for sustainability. With an increased national focus on environmental and sustainability issues, historic preservation professionals have begun to argue for practices like renovation and adaptive reuse as means of limiting the consumption of non-renewable resources and the environmental impact of building demolition and construction. This is especially relevant in zoos, where a vested interest in the environment has been a monumental shift in animal care philosophy and exhibition in the twentieth century. With zoos today aiming to spread the message of habitat degradation in connection to species endangerment, environmental awareness is paramount in all building practices. Historic preservation authors are able to successfully make the case that demolition and new construction are more harmful to the environment than engaging in building preservation. This knowledge can and should be used by zoos to engage in historic preservation practice.

Robert A. Young’s *Stewardship of the Built Environment: Sustainability, Preservation and Reuse* spans the categories of both sustainability and historic preservation by making the case that historic preservation is a means of minimizing the environmental impacts of new construction by using fewer resources. More broadly,

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Young asserts, “preservation and reuse conserves existing social, environmental and economic resources while revitalizing buildings, neighborhoods and communities.”\(^{23}\) He uses his SEE system (S - Social, E - Environmental, E - Economic) to identify “three pillars of sustainable design” and each is discussed in depth.\(^ {24}\) Essentially, Young is asserting that historic preservation is the ultimate form of recycling.\(^ {25}\)

In the chapter titled “Environmental Factors,” Young provides a brief history of energy consumption in building projects and explains the argument for preservation as opposed to demolition/new construction and its basis throughout history. Young cites the counter argument that historic buildings are not as energy efficient as new construction. He argues against this by claiming that more energy is used to build new, especially when coupled with demolition, and that a preservation treatment is a way to mediate both arguments. New, energy efficient features can be installed in older buildings, and older buildings can often function for the same variety of uses a new building can. To make this point, Young references the idea of embodied energy, which is essentially the energy recovery rate, or the rate of time it will take a building that is designed to be “sustainable” in recovering the energy it took to construct it in the first place. These numbers can range from 10 to 30 or even 50 years. A very strong argument for preservation as a sustainable practice lies in statistics like these.\(^ {26}\)


Bullen and Love are leading authors on the topic of renovation and sustainability of the built environment. They have published various research papers including “Adaptive Reuse of Heritage Buildings: Sustaining and Icon or Eyesore,” “Sustainable Adaptive Reuse of the Existing Building Stock in Western Australia” and “Adaptive Reuse and Sustainability of Commercial Buildings.” While the articles have different overall topics, the message of most all are the same, buildings must adapt to our changing societal understanding of topics like sustainability, development, and heritage. In “Adaptive Reuse of Heritage Buildings: Sustaining and Icon or Eyesore” these very topics are addressed from the perspective of professionals in the building industry. Those tasked with designing, building and maintaining structures were interviewed for insight on their motives in undertaking or not undertaking an adaptive reuse project. Statistics are presented in the form of percentages; what factors were of most importance to building practitioners versus which were least important. Overall, economics, sustainability and innovation were some of the factors cited as the most important throughout the process.

Similarly, the article titled “Factors influencing the adaptive re-use of buildings” offers a multitude of factors that influence (positively and negatively) the renovation process. Some factors include driving factors, lifecycle issues, perceptions of buildings, and incentives. Among the dialogue, they defend not only the case for energy recovery, but also the case for preservation and environmental impact. The vindication that preservation is better for the environment stems from the reduction in “the amount of disturbance due to hazardous materials, contaminated ground and the risk of falling materials and dust.” Further, preservation activities reduce the amount of unworkable
inclement circumstances due to weather, thus limiting the construction period.\textsuperscript{27} The authors also suggest that energy efficient renovations are a terrific alternative to new construction for those interested in minimizing the energy costs of buildings, specifically “operational costs.”\textsuperscript{28}

Very few sources mentioned the “do nothing” or neglect option, or the option for demolition, which will be included in the categories of building treatments discussed in this thesis. When an institution is faced with a building that may not be abandoned but simply no longer usable for its original function, these options often have a strong appeal. When zoos are faced with buildings that are no longer useable for the shelter and display of animals, the range of preservation treatments extends those mentioned by the Secretary of the Interior or authors like Earl and Insall. For private entities, demolition is often the most obvious choice for a building under no protection from zoning or review boards. This gap in the literature showcases a gap in the ideology of preservation professionals, who present only the favorable preservation treatments instead of the full range.

Overall, The literature written by city planners argued for incorporating historic buildings in cities but focused more on the overall argument for historic preservation as opposed to the argument for specific types of preservation treatments. The literature written by architecture professionals tended to focus on case-by-case examples of successful design work. The literature written by preservation professionals takes the form of technical assistance towards one method or another, or theoretical advice

\textsuperscript{27} Peter Bullen and Peter Love, “Factors influencing the adaptive re-use of buildings.” \textit{Journal Of Engineering, Design & Technology} 9, no. 1, (March 2011), 34.
\textsuperscript{28} Peter Bullen and Peter Love, “Factors influencing the adaptive re-use of buildings.” \textit{Journal Of Engineering, Design & Technology} 9, no. 1, (March 2011), 36.
regarding why buildings should be preserved and sustained. This literature was used to develop four distinct categories of building treatments, discussed in Chapter 3.
CHAPTER 3: METHODOLOGY

The methodology utilized for this work consists of three parts. The first part is to undertake research necessary in understanding what the changes in animal welfare standards were in the late twentieth century. The second part is a series of four case studies that analyze changes to each zoo’s Lion House. These case studies will interpret the known information on the care of one species and correlate this information with known changes to the buildings that housed this species. These case studies will address the question of whether zoos were responding to the emerging scientific research for specific species care in a timely fashion. The third part will chronologically order and label building changes using the range established in this methodology. These charts can be found in Appendix A. In this methodology, it is vital to establish which zoos building stock will inform the range of preservation treatments. These zoos are as follows: The Philadelphia Zoo, The Cincinnati Zoo and Botanical Garden, the Lincoln Park Zoo and the Toledo Zoo and Aquarium.

To better understand the changes in animal welfare standards in the mid–late twentieth century, source material such as research publications, books, and Association of Zoos and Aquariums documents are consulted. These sources provide not only changes to species care and management, but also an overall historiography of the movement that began roughly in the 1950s and continues today. Source material concerning the animal rights movement is chronicled and included as an important factor that guided change. The information studied generally covers the overall changes in the philosophy of animal care, and will encompass a discussion of changes for specific
species in chapter 5. The analysis of these macro changes in animal welfare knowledge is considered for its potential impact on the built environment of zoos over time. The term “animal welfare knowledge” is used to represent the information that would have been available to zoo designers and zoo keepers in the twentieth century. The term is used to encompass both research and trends in design that provided a better environment for animals at the zoo.

A case study is an important tool to understanding the general changes manifested in building stock for one specific species. This thesis will examine Lion Houses because each zoo in this study has housed big cats since their inception and continues to house them today. The case studies will engage in a longitudinal narrative of the changes to these structures over time, including photographs, descriptions and materials used throughout. These case studies will facilitate a discussion of the known changes over time and how they may or may not have responded to specific research or overall trends in animal care.

Selecting Zoos

The first step to understanding preservation treatments in zoos is to establish a sample of zoos from which information will be analyzed. The first criteria for sorting through the thousands of zoos worldwide are to study only accredited zoos. The Association of Zoos and Aquariums (AZA) has given accreditation since 1971 to institutions that follow certain guidelines for animal care standards. Zoos are required to follow these guidelines and in return, participate in a connected network of information and species sharing. Animals are often transferred between AZA zoos to participate in
breeding programs. Today, there are 230 AZA accredited zoos and aquariums in the world. However, the United States Department of Agriculture recognizes 2,800 “animal exhibitors” in the country. Some of the standards set by the accreditation process are the quality of animal care, welfare and management, veterinary care, conservation, education and scientific advancement, physical facilities, safety and planning. This criteria was chosen because all AZA accredited zoos have access to the same animal care information and are not only persuaded but required to make changes to their institutions based on the guidelines.

The second criteria for establishing a sample set is studying zoos only located within the continental United States. There are 13 AZA accredited zoos and aquariums not located within the continental United States. These will be omitted. The third criteria is selecting zoos located only east of the Mississippi. Historically, these zoos would have been better connected by geography than zoos located on the western half of the United States, and would have been consistent in their access to species and information. There are 123 zoos and aquariums located east of the Mississippi River. The fourth criteria is to select only institutions that are north of the Ohio River and the border of Pennsylvania and New Jersey. The rationale behind this decision is that zoos in this part of the country will have similar uses for buildings based on similar climates. Comparing a zoo’s use for buildings in a sub-tropical or tropical climate versus building uses in temperate climate will provide a vastly different study that would focus more on climactic considerations opposed to animal care standards. There are 68 AZA accredited zoos located within this geographical region.
The next geographical consideration is to include only zoos that are located directly within urban areas with populations over 200,000, and park acreage ranging from 25 – 75 acres. These moderate sized urban zoos are likely to have similar budgets, visitor numbers and spatial availability as opposed to zoos located outside of metropolitan areas. Zoos outside of metropolitan areas often have more freedom to expand than zoos located within metropolitan areas, and thus have a different narrative in the ease of change and adaption of their environments. This study aims to focus on mid-sized urban zoos that were founded as municipal institutions with goals of entertainment and discovery. The number of zoos within this geographic requirement is 6.

Furthermore, only zoos established before 1940 will be considered in this study. These zoos will have a well-established building stock prior to the modern change in animal care standards. This is an important factor when studying preservation treatments, as it allows for an accurate study of the treatment of extant building stock, zoo plans and features. There are 5 zoos that will meet all the criteria for this study. Those zoos are The Philadelphia Zoo, The Henry Vilas Zoo, The Toledo Zoo and Aquarium, The Cincinnati Zoo and Botanical Garden, and the Lincoln Park Zoo. The Henry Vilas Zoos, while meeting all the criteria established, had to be eliminated from the study due to the lack of information available on both building treatments and the nature of those treatments.

Selecting Preservation Treatments

Using the literature surrounding preservation treatments presented in Chapter 2, five categories of treatments are established for this study: neglect,
conservation/preservation, renovation/addition, adaptive reuse, and demolition/new construction.

![Figure 1: Spectrum of Building Treatments](image)

These five treatments were selected because they represent the broad range of treatments that could be enacted by a zoo board or committee when faced with an outdated historic structure. Selecting broad categories of treatments allows for the focus of the study to stay on the range and nature of treatments in numerical data as opposed to qualitative analysis of specific treatments. Qualitative analysis of specific treatments will be discussed in Chapter 5: Narratives of Changing Felid Care. Definitions will be supplied for each building treatment, and will be used to place each structure into a respective category in Chapter 6: Findings.

The category of neglect will focus only on buildings that featured a known period of disuse with no known regular maintenance being performed on the structure. The Secretary of the Interiors Standards define the preservation/conservation category as having regular maintenance conducted but generally making very few or no changes to the buildings fabric. In this approach, building materials should not be removed unless they are too severely damaged to fulfill their purpose. Changes over time are to be preserved, and replacement of in kind materials is permissible. No changes should be
made to spatial arrangements or character defining features. Simply stated, there should be no excess removal of materials and no excess changes, and leaving the building as close to how it was found should be the utmost priority.

Renovation can include many different preservation treatments. Here, it will include treatments ranging from restoration to adding additions. Donald Insall's definition of “Restoration and Rebuilding” can be explained as renovation. Here, building materials that have weathered or aged should be replaced. New materials should be significant features within their own right, displaying new advances in technology and style. Renovation entails the replacement of materials that may be too weathered to repair, or, more often, are simply out of date. Adding an addition to assist the function of the building will also be classified under renovations here. In application to this specific thesis, renovations may have taken place in response to changing animal welfare standards.

Adaptive reuse is the third category of preservation treatment. Adaptive reuse can simply be defined as changing the use of a building that has otherwise fallen into disuse. This building treatment can be utilized using many degrees of preservation interventions. Some choose to change a building's use while engaging in the least invasive measures possible, while other new uses may require significant change to the interior or sometimes exterior to satisfy the new function. Demolition/new construction is the last preservation treatment. This treatment involves the removal through demolition of an

extant building and replacing it with a new building to serve the same function. In application to this thesis, a separation of the two categories is utilized, because it is sometimes the logical case that buildings are demolished and never rebuilt or newly constructed without the previous structure being demolished. The criteria for placing buildings into their selected category are described below.

*Categorizing Zoo Building Changes*

The next step creates a table that provides the findings from this study. Each pre-1950 building at the zoo will be studied and placed into the category of one of the preservation treatments. The dictionary definition of a “building” is a “usually roofed or walled structure built for permanent use.”31 This is the definition that will be used when classifying structures. The definition for “exhibition” is “an act or instance of exhibiting” and “exhibiting” means “to show publicly especially for purposes of competition or demonstration.”32 Pertaining to this study, only buildings that are used for exhibition will be studied. Many zoos used small barn like structures to house native species, but exhibited the species in outdoor pens, pits or fenced in areas. These are not exhibit buildings and do not pertain to this study.

The buildings used for the study had all began construction before 1950, because 1950 represents the start of a new period of scientific and biological studies on animal care. Some buildings had begun construction before 1950 but completed construction after 1950, and will be considered here as post-1950’s structures. Buildings built before

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1950, thus, qualify here as “historic building stock” and were extant long enough to present a timeline of change significant enough to be studied. Only known and researched changes will be considered in this study. It is likely that there were undocumented and small-scale renovations that occurred, and for the purpose of the study they will not be considered because they are often not discoverable in research. The materials and spatial qualities of changes are also listed when discovered. These will be used in the analysis section to help value the nature of the historic fabric still present in the historic zoo buildings. This is relevant to making recommendations in the final chapter.

Buildings will fall under the category of neglect if they endured a period of known disuse with no maintenance for no shorter than 1 year. If building maintenance is not performed annually, a building begins to display signs of wear rather quickly. Finishes can quickly lose their protective qualities and lose aesthetic appeal. Finding new uses for the building within a specified budget can become increasingly difficult. Buildings will be placed into the category of preservation/conservation if they are in continued use and are currently being used for the purpose that they were designed and constructed for, with no known renovations or major changes.

Renovation/addition is a more difficult category to examine and quantify. For the purpose of this study, only renovations/additions that pertain to animals will be considered. Renovations done for the sole purpose of enhancing the visitor experience will not be considered unless the building is adaptively reused (ex: restroom renovations, new interpretive panels, etc.). This criterion is in place because renovations done to enhance the visitor experience cannot be justified as a response to changing animal
welfare standards. Renovations/additions done on buildings constructed post-1950 will not be listed or considered, because they do not pertain to this study. Two buildings had begun construction before 1950 but completed construction after 1950, and subsequent changes to those buildings will be considered.

Sequences of demolition and new construction present a unique problem to this study, and thus, a unique set of parameters has been created for their inclusion. Demolitions and new constructions done prior to 1950 on a specific building will be noted within the study, because it is important to make note that the original building has been replaced before the cutoff date of 1950. While they are noted in the charts, they do not contribute to the pie charts created for pre-1950’s materials and spatial qualities, because these charts only represent the materials and spatial qualities of the original building that stood for the purpose of housing a specific species (by name).

Further, structures that were both constructed and demolished (but never rebuilt) before 1950 will not be considered. Cases of new construction following an adaptive reuse of a previously extant building will also be considered, so long as the new construction is done to house the same species the adaptively reused building did. Separation of the categories of demolition/new construction from one label into two categories will be used for the pie charts, because while sometimes a demolition directly followed by a new construction is evident, they often do not happen subsequently. For example, a building that once housed all species of pachyderms may still house pachyderms, but new exhibits may have been built for the larger members of the species.
The original building will be considered adaptively reused and the new building will be noted and considered as a new construction in the study.

These charts are not fully encompassing of all changes that happened to zoo buildings since the zoo was established. They are encompassing of known information that assists the study of changes in animal care through time and its manifestation in building stock. They encompass information that assists the study of the changes to buildings as a response to changing animal welfare standards, which are discussed in Chapter 1. They will also assist an analysis and discussion of possible uses for historic buildings in zoos. The unique parameters set for the building treatment selection and categorical placement only aim to quantify the changes that were happening to buildings post 1950, in order to analyze this information and better understand the built environment of our zoos today and the role of historic buildings in them.
CHAPTER 4: ANIMAL CARE AND ITS IMPLICATIONS ON ZOO ARCHITECTURE

Around the turn of the twentieth century, many zoos were still using principles of the menagerie to house animals. Menageries were travelling collections of exotic animals, kept in small moveable cages inside buildings. The only difference between the menagerie and the circus was that the animals in the menagerie did not perform, but were kept to feed the curiosity of the enlightened mind. Soon, cities began to realize that menageries were so popular that a permanent animal exhibiting institution could be established. The earliest modern stationary menagerie was established by Emperor Franz I in Vienna in 1752, and copied by the French in 1794, who called theirs The Menagerie du Jardin des Plantes, in Paris. The Zoological Society of London, established in 1826 set an example for cities in America looking to establish their own permanent collection of exotic animals.33

Many zoos, including all those studied except the Philadelphia Zoo began as public institutions operated by the city parks system. Animals acquired were often donations, and housed in pens or temporary enclosures. It was common for people to reach in and feed, pet and play with animals, and many animals that were considered not dangerous by zookeepers were left to roam around the premises and interact with guests. Baby animals were dressed up and pushed around in strollers at the Toledo Zoo, and a sick monkey was allowed to roam around the premises all summer in 1923.

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There was little to no information available to zookeepers or directors about animal habitats, diets, diseases, enrichment or breeding requirements. The earliest zoo buildings were used to house only the zoo’s non-native species. These buildings often mimicked the regional architecture of the animals’ original country. Mosques, for example, were common for elephants and grassy hut structures were common for primates.

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Bar-less exhibits were a common choice for native animals that were acclimatized to the colder, wetter climates of zoos in this study. The earliest bar-less exhibits were wooden and chicken wire fenced enclosures, similar to a pen for farm animals. However, most members of the zoo community believed that African and jungle animals, some of the best and most exotic attractions, had to be kept in buildings if they were to survive through the cold northern American winter. Some smaller municipal zoos only housed
native animals because they lacked the financial and logistical means to acquire and house larger exotic animals.\textsuperscript{36}

Figure 4: "Bar-less" Enclosure at The Toledo Zoo (Photo Courtesy of Toledo-Lucas County Public Library)

Zoos in the first half of the twentieth century had no mission of species conservation like they did in the second half. Zoos were initially created for the purpose of entertainment and animal welfare was not of high concern. Early zookeepers simply fed and cared for animals and were not involved in scientific research about a species or specific animal under their care. There were high mortality rates in zoos due to unsanitary conditions. The first zoo research laboratory was in Philadelphia in 1902, which was

\textsuperscript{36} Jeffrey Nugent Hyson, “Urban Jungles: Zoos and American Society” (Thesis: Cornell University, 1999), 230.
created for necropsies and quarantines. Any research conducted, however, was kept exclusively internal with no sharing of information between zoos.

Ultimately, the visitor experience was placed above animal welfare when it came to making building changes. Zoo officials early in the twentieth century became aware that visitors were often repelled by the crude smells that animals created. Additionally, officials were concerned with keeping very expensive animals alive and free of disease, which caused animal enclosures to take on a form of design that mimicked the modernist principles that were emerging.\textsuperscript{37} These new animal enclosures began to appear as early as the 1930’s, when many small municipal zoos were finally acquiring better funding to address issues with their earliest buildings. Author David Hancocks labels this new era of construction as the “Disinfectant Era.”\textsuperscript{38}

\begin{footnotesize}
\begin{itemize}
  \item [38] David Hancocks, \textit{A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future} (Berkeley: University of California Press, 2001), 76.
\end{itemize}
\end{footnotesize}
The twentieth century ushered in a new era of architecture. The modern movement began to take hold first in Europe and quickly moved to America. The general characteristics of modernist architecture included geometric forms, clean lines, smooth surfaces, modern materials, and open and expansive spaces. By the post-depression era,
zoos had also begun to adopt these principles on a wide scale thanks to New Deal relief money for new buildings in multiple struggling zoos across the country. Zoos were a controversial choice for federal relief funds, and many people criticized the choice of zoos and zoo animals over schools or more broadly, people. A member of an anti-tax group in Detroit claimed “idle animals are kept in luxury while Detroit people starve.”

Other community members were able to see value in investing in zoos, which were a “cost effective way to provide a vital public service.” Ultimately, the New Deal was able to transform many of America’s zoos from small municipal menagerie style institutions to institutions of cultural exploration.

The Great Depression caused a severe financial crisis that led to a lack of maintenance and ability to care for animals. Most zoo buildings extant at the time were wooden structures that had become damaged by “gnawing, urine and weather.” Wooden structures were often subject to fires, so frequent that at the Central Park Zoo in New York City, zookeepers carried guns around the park so that in the event of a fire, animals could be shot. Animals were at high risk of disease and the spreading of disease due to a lack of “lighting, heating, ventilation, drainage and water”. Further, budgets were designed to care for animals at the surface level (food, zookeeper salaries), and rarely had money set aside for construction or maintenance.

New Deal funding meant increased attention to construction projects in zoos. Authors Jesse C. Donahue and Erik K. Trump note that “dilapidated structures with

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39 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression: A New Deal for Animals (Jefferson NC: McFarland & Company Press, 2010), 68.
40 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression, 69.
41 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression, 20.
42 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression, 142.
design flaws that actually threatened animals health were replaced with ‘modern’ buildings and enclosures that featured technical innovations to promote sanitation and…improve animals’ mental health.”43 The materials designers chose included stone, brick, concrete, and tile. These materials were permanent, longstanding, and easy to clean. Buildings were sometimes equipped with heating and proper ventilation, and often decorated with faux materials to mimic natural environments. were incorporated, These, however, were not common.44

Concrete was undoubtedly the material of choice for designers because it could be easily shaped and cleaned. Wall finishes were clad in tile, which was a modern design choice that promoted a sterilized and disinfected surface. Large panes of manufactured glass were installed in exhibits to emphasize the effort to include more natural light and ventilation. Enclosures featured very little (if any) organic material. Enrichment, or, providing animals “physically and mentally stimulating toys, activities and environments,”45 was not considered in the design process. Cages had no toys or moveable pieces. Diets included “prefabricated vitaminized biscuits” which kept animals healthy with shiny coats and strong bones, but were unnatural in texture and ingredients, and insensitive to the animals’ natural diet. Zoo animals in this era exemplified a large gap in the human animal experience. Animals were physically healthy and visibly

43 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression, 139.
44 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression, 141.
beautiful, however, these physical features would have been afforded to very few animals in the wild.\textsuperscript{46}

Taxonomical organization of zoo animals was still the chosen layout during this era, because of the trend set in the London Zoo. In a taxonomical organization system, animals are organized throughout the zoo according to their biological grouping, for example, carnivores, primates, or birds. Buildings were constructed with names like “Carnivora” or “Pachyderm” carved in stone above the door, or pictorial carvings of the species housed inside.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{reptile_house_carving.png}
\caption{Stone Carving Above Entrance to the Reptile House at the National Zoo (Photo Courtesy of Library of Congress)}
\end{figure}

\textsuperscript{46} David Hancocks, \textit{A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future} (Berkeley: University of California Press, 2001), 76 – 77.
These phrases were used to represent a scientific organization as opposed to a natural or ecological one. Zoos who utilized this exhibit style housed all cats, hooved animals, aviary species, reptiles, etc. in their own buildings. There was little regard for an animals specific habitat desires (example: tigers enjoy water, birds nest). There was also no regard for the notion that in the wild, one would never come across certain animals together, like a lowland gorilla and a marmoset, both primates who live in vastly different climates.

During this era zookeepers still understood very little about animal welfare. While keepers were concerned with caring for animal’s physical health, there was no emphasis on breeding, which was one of the only known indicators of poor mental health in animals. Animals were seldom given any area of retreat from large, noisy and unfamiliar crowds, which caused great amounts of stress. Donahue and Trump argue that “mistaken beliefs about proper care also influenced design.”

For example, Tropical birds were housed permanently indoors to protect them from the colder northern climate, although this practice was not defended by research. Building changes in this era emphasized established ideals that animal welfare was limited to physical health, and zookeepers chose modern materials and design upgrades to try and protect it. Repairs to construction included attention to vermin problems, drainage and standing water problems, and exposed electrical wiring which all could have presented threats to animal physical health. However, Donahue and Trump make special note that most of these “newly

47 Jesse C. Donahue and Erik K. Trump, American Zoos During the Depression, 142.
designed modern buildings” were still simple enclosed cages, and there was no known knowledge that this was wrong to professionals in the zoo community.48

The philosophy that drove this type of design was one that emphasized human animal interactions. The most important ideal was the ease of the animal care as it related to the human experience. How easy can one clean the cages? How easy can one get in and out of the cages? How well can visitors see the animals? Can they smell them? These were questions designers and zoo directors were asking. Steel doors became the only way for zookeepers to access animal enclosures. Enrichment activities were too dangerous for zookeepers. Feeding rituals that used live bait or real hunting simulations were too controversial for crowds.49 Thus, it can be concluded that the care of animals during this era was dictated in entirety by the zookeepers, directors and visitors, and not by research, science or ethics.

*Wild Animals In Captivity*

By 1950, a new author emerged as the leading source for understanding animal welfare. Heini Hediger was the director of the Basel Zoo in Switzerland and the Zurich Zoo in Germany. Hediger published his book titled *Wild Animals In Captivity: An Outline of the Biology of Zoological Gardens* in 1950 and *Studies of the Psychology and Behavior of Animals in Zoos and Circuses* in 1955. In *Wild Animals In Captivity*, Hediger provided zookeepers with biological research on the animals they were caring for. He provided information on subjects like territory in the wild, sociological relationships with

other animals, necessary space, problems with confined space, factors that affect animals when they are transferred from the wild into captivity, quality of the environment, feeding rituals, and the proper relationship of man and animal.\textsuperscript{50}

Hediger called for the improvement of animal spaces. His argument was that zoo designers needed to stop keeping animals in what were essentially human spaces.\textsuperscript{51} Human materials like concrete, tile, and manufactured metals were not appropriate for keeping animals, nor were human architectural styles which were completely unnatural forms of space for animals. He criticized former principles of “natural” design as “pseudo-naturalness,” where “the best guarantee of complete naturalness is assumed to be a faithful copy of a piece of natural scenery.”\textsuperscript{52} However, Hediger was aware that all zoos may not have had the means to acquire the proper vegetation and materials needed for a holistic natural habitat for every animal in their care. In this situation, Hediger recommended as little human interference as possible; give the animals any amount of organic material and they will create a habitat for themselves that will be natural and comfortable to them.\textsuperscript{53}

Above all, Hediger argued for an increased attention to animals natural behaviors and needs. He prescribed giving animals the most organic experience possible. He emphasized focus on both physical and mental needs and behaviors. He urged zookeepers to learn animals patterns and try not to disrupt them. If an animal naturally


\textsuperscript{51} Hediger Hediger, \textit{Wild Animals In Captivity}, 71.


\textsuperscript{53} Hediger Hediger, \textit{Wild Animals In Captivity}, 73.
lives in trees, like a sloth, give them more arboreal space than you would give the bear, who roams.\(^{54}\) He stressed giving animals proper infrastructure to accommodate their needs. Cats must scratch their claws somewhere, hooved animals must have proper space to walk or their hooves will grow too large, birds must sharpen their beaks.\(^{55}\) Inorganic and unnatural materials to the animal will kill them, Hediger pointed out. Animals will ingest poisonous plants unknowingly and eat spare bits of metal left in their enclosures.\(^{56}\)

Above all, Hediger argued that the animal experience should be valued, with as little interference from humans as possible.

**Zoos and Animal Rights**

The American Society for the Prevention of Cruelty to Animals was founded in 1866 when American diplomat Henry Bergh stopped a man from beating his horse in Russia. It was the first and only Humane Society in the Western Hemisphere. Many of the organizations earliest efforts surrounded workhorses, including an ambulance and veterinary clinic for injured and sick horses. The ASPCA soon became widely successful in passing federal laws that protect animals. These had a direct impact on zoo animals. In 1873 a law was passed requiring animals being shipped to have access to food and water. The 1966 Animal Welfare Act was passed largely because of ASPCA support and lobbying, and again in 2003 with the Human Farm Animal Care organization which helped the USDA accredit humanely raised farm animal products.\(^{57}\)

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54 Hediger Hediger, *Wild Animals In Captivity*, 93.
During the period known as the “Disinfectant Era” or the era of “Sanitary
Modernism,” a new animal rights movement began to respond to conditions seen in zoos
across the country.\textsuperscript{58} In 1968 zoologist Desmond Morris wrote an editorial piece that was
published in both \textit{Life} and \textit{Readers Digest}, criticizing the state of zoo architecture,
claiming that architects were merely using the standards of all other contemporaries and
not designing unique spaces suited for the animals they house. Years later, the Humane
Society conducted a survey of the conditions at over 70 zoos in the United States. The
Society found shocking results, claiming animals were "languish[ing] in filth and strait-
jacket cages," the Society took to the press to publish reports such as "U. S. Zoos Often
Chambers of Horror." These articles were published in both the Washington Post and
Readers Digest. Zoo director Peter Batten also undertook a study of zoo conditions in
1974, and published hundreds of shocking images and narratives of animal abuse and
neglect.\textsuperscript{59}

Further, in 1975 philosopher Peter Singer published a groundbreaking book titled
\textit{Animal Liberation}. Singer makes a philosophical argument, grounded in logic, for the
rights of animals. The basis of his argument was the same argument historically used for
women’s rights and civil rights. He argued that similar to how we understood in the
twentieth century the wrongness of treating people different because of skin color, we
also should understand the wrongness of treating animals poorly because of their
difference in genetic makeup. Suffering, he claimed, is universal, and thus, there can be

no moral argument made for ignoring or even perpetuating this suffering. He further argued that we should not be participating in “speciesism” or the idea that one species is morally superior over another. Singer’s work was widely circulated and Singer himself highly respected, working at the University of Melbourne and Princeton.  

The animal rights organization PETA or People for the Ethical Treatment of Animals formed in 1980 to fight animal testing in labs. Soon, they were able to branch out and influence all parts of the animal industry by conducting protests and lawsuits against cases of animal abuse and neglect. In 2002 they conducted a lawsuit against a Florida exotic animal training center that was using ax handles to beat big cats, and were able to influence the USDA to better regulate animal training facilities. They have also been largely successful in fighting against the use of animals in circuses, exploiting the conditions in which they are kept and the methods used to train them. They have also had success in discovering and shutting down a number of illegal private exotic animal displays and collections across the country. Today, PETA takes a strong stance against zoos, circuses and other facilities that use animals for entertainment purposes.  

The New Zoo  

The zoo community was slow to adopt Hediger’s principles, and for decades after his publications, the conditions that had prevailed for so many years prior continued on. By the 1960’s, however, zoo directors began to make changes in most zoos across America. Author Vicki Croke argues that nature programs such as “Wild Kingdom”  

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began to appear on television, and grassroots movements began for wildlife conservation, which took hold in the animal community. She also argues that zoos began to understand the importance of captive breeding as morally superior to collecting animals from the wild, as well as less expensive. Animals’ mental health began to shift into focus as enhanced mental health and successful breeding were linked. Advances in biological and veterinary science during this era, Croke debates, had a major impact on the care of animals. Jane Goodall was undertaking her research on chimpanzees with Louis Leaky. Hediger’s book was being recognized for its research comparing wild animals to those in captivity. Animal rights became a growing concern, and many zoo goers could no longer justify supporting an institution that used animals for entertainment. All of these factors combined, Croke argues, helped usher in the new era of change for zoos.  

Author David Hancocks argues that a shift in attitude towards ecological concerns prompted zoos to focus on conservation as their main goal. There was a further push beginning with Seattle’s Woodland Park Zoo in the 1970s to create “landscape immersion” exhibits, which displayed animals in a site that replicated their natural landscape holistically, opposed to mimicking in only certain elements of an animals landscape like “rocks” (often concrete) and flora. This change in zoo design philosophy was recognized by Landscape Architecture magazine who asserted the claim that society was finally departing from the traditional understanding that we should conquer nature,

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63 David Hancocks, A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future (Berkeley: University of California Press, 2001), 111.
animals and landscapes. Suddenly, zoos became focused on bringing humans into the animal experience, as opposed to bringing animals into the human experience. This caused drastic changes in the built environment of zoos, causing many historic buildings to fall into disuse. Zoo directors were forced to make choices on what to do with these buildings throughout the post-1950’s decades, which are examined in the Chapter 6.

These new “immersion” exhibits allowed zoos to address conservation by giving animals a better overall living environment. The idea was that happier animals were more willing to breed. Jon Coe, often cited as the founder of this practice asserts in Irus Bravermans book Zooland that “we do not know what animals need…so the closer you can recreate the environment in which they evolved, the more apt you are to meet needs which you did not know existed.” These exhibits went further than simply adding native plant species or water features. They incorporated topography, increased spatial attention (example: more space for roaming animals and more height for arboreal creatures), lighting (or lack of), sound, humidity, and scent. They gave animals dens to retreat from the public eye, especially imperative for those mothering newborns. Zoos also began to bring attention to the importance of habitat conservation for endangered and threatened species using interpretation panels and other techniques. If the animal was hiding from the visitors, visitors were urged to turn towards these interpretation mechanisms, which explained the importance of the animal’s habitat for its survival in the wild.

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64 David Hancocks, A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future (Berkeley: University of California Press, 2001), 118.
67 Hancocks, A Different Nature, 117.
In 1973 the Endangered Species Act was passed. This forced zoos, who kept many endangered and threatened species in their care, to address their efforts of conservation. The Association of Zoos and Aquariums (1971) was developed from the American Association of Zoological Parks and Aquariums (1924) and functioned as the police for all accredited zoos and aquariums. Accredited zoos were required to meet strict standards of animal care and in return could participate in different programs and have access to scientific information databases.

Scientist Nate Flesness published a research paper in 1977 on the issues of inbreeding in Przewalski’s horses. Research proved that many of the inbred horses were infertile and had nervous disorders. Further, research by Katherine Ralls, Kristin Brugger
and Jonathan Ballou at the National Zoo in 1979 proved that inbreeding could be linked to high rates of juvenile mortality in zoo animals.\textsuperscript{68} With the morality of taking animals from the wild and placing them in zoos in question, membership in the AZA meant zoos could participate in breeding programs with other zoos. They adopted a code of ethics in 1976, demanding that animals were not sold to hunting reserves. Today, accredited zoos are reviewed every 5 years on financial stability, conservation efforts, education, scientific research and care of animals.\textsuperscript{69}

No era proved more fruitful for changes to animal welfare standards than the 1980’s. In 1981, the AAZPA, now the AZA created Species Survival Plans, which were a shared body of scientific research about a species that was dedicated to conservation. Prior to this decade, zoos kept scientific research almost completely internal, and viewed other zoos with healthy species as competition.\textsuperscript{70} By 1989, 50 species had SSP’s developed that were widely shared with zoos around the country. Norman Myers, working in Africa in the mid 1970s, published the shocking statistic that between 1600 and 1900 humans have caused the extinction of 75 species of wildlife.\textsuperscript{71} It became evident that conservation of a single species could not take place without the careful conservation of the animals’ natural habitat.\textsuperscript{72} The impact on zoo design was visible. The introduction of landscape architects like Jones and Jones and Jon Coe in zoo design had a

\begin{thebibliography}{99}
\bibitem{70} Vicki Croke, \textit{The Modern Ark}, 163.
\bibitem{71} David Hancocks, \textit{A Different Nature: The Paradoxical World of Zoos and Their Uncertain Future} (Berkeley: University of California Press, 2001), 154.
\bibitem{72} Hancocks, \textit{A Different Nature}, 154.
\end{thebibliography}
significant influence on the introduction of the new immersion exhibits on a more widespread scale.

Significant research by Jane Goodall was first published in 1965 in the form of a dissertation and in 1969 in the form of a book titled *My Friends the Wild Chimpanzees*. She continued to publish research throughout the 1980’s and 1990’s, which impacted the care of chimpanzees in zoos and ultimately all primates. The Dallas Zoo opened a new gorilla exhibit in 1989 that provided higher standards of care than previously seen across the country, setting a new bar. Zoo Atlanta in 1988 became the first zoo to exhibit gorillas in “contiguous social groups.” The San Diego Zoo, a model zoo for American zoo standards, opened their renovated gorilla exhibit in the early 1990’s. Goodalls’ research not only produced new information on primate behavior and psychology, but also brought awareness to the needs of primates in a captive setting.73

One of the most significant changes during the post 1950’s decades was the incorporation of “zoogeography” or “the zoo [providing] its visitors with a highly visualized local experience of a disappearing global nature.”74 Zoos were shedding the traditional method of displaying animals taxonomically (by species) and began displaying animals geographically, by region. Throughout the 1970s, 80s and 90s, zoos were moving animals out of traditional buildings like “Carnivora” and into landscape immersion exhibits like “African Savannah” or “Arctic Adventure.”75 It should be noted, however, that this change benefitted animals only at the discretion of zoo designers, and certain

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exhibits were better designed than others. This change in landscape, while second
handedly ushering in more naturalistic enclosures for animals, was primarily done for the
benefit of the zoo-goer.

Figure 8: Map of the Toronto Zoo's Ecological Zones (Photo Courtesy of Toronto Zoo Website)

In 1993 the Wildlife Conservation Society (formerly the New York Zoological
Society) was established with a new mission. Scientists and research fellows from all
over the country worked around the world on research dedicated to conservation of
species and habitats. Zoos began to focus more on the efforts to educate the public on
species, not merely display them. The physical changes were more construction projects
that interpreted and educated visitors on the animals they were seeing. Throughout the
1990’s, Michael Robinson, director of the National Zoo, advocated for the “biopark.” This concept focused on zoos as educators of all types of biology, namely the “connections and interdependencies between plants and animals.”

The 1990s also birthed the new idea of enrichment. Vicki Croke succinctly remarked that the question of the 90s was: “is it morally acceptable to maintain wild animals in peak physical condition but in a state of behavioral bankruptcy?” The presence of stereotypic behavior (i.e. pacing for large cats) began to represent boredom and monotony for many zoo animals. Enrichment activities like bouncy balls, ropes, and other toys were soon incorporated into exhibits. These were usually non-permanent and easy to change in order to add another layer of enhancement for an animal. Today, some zoos incorporate permanent enrichment infrastructure, like a tree with holes that zookeepers can place food into at the Cincinnati Zoo.

Today, the focus of many zoos continues to be conservation and education. Many zoos are opting out of keeping animals that notoriously spark controversy in the animal community, like elephants, polar bears and gorillas. Exhibits are becoming even more focused on bringing the humans into the world of animals. Zoos that cannot expand physically are forced to rethink their exhibits altogether. Modifications to exhibits can be seen in the form of innovative ways of using space, like in the Philadelphia Zoo where tigers now roam throughout the zoo, towering above the zoo goer in a “mesh engineered

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overhead passage” which allows big cats to roam about the zoo from overhead. They have incorporated this infrastructure for other arboreal creatures as well.

By the 1990s, these wide scale changes in animal keeping philosophy were being adopted by virtually every accredited zoo across the country. Zoos went from being Victorian institutions, keeping animals in prison-like structures to modernized institutions that attempted to replicate the natural ecosystem entirely in the built environment. Ultimately, it was the change in layout design from taxonomy to zoogeography, the momentum of the animal rights movement, and burgeoning information on habitat destruction and endangered species that sparked change in zoos.

For small municipal zoos located directly within an urban area, these changes in philosophy presented a unique problem. These municipal zoos lacked the proper space necessary for incorporating landscape immersion exhibits for every single animal in their care. Paradoxically, they were faced with a plethora of now outdated buildings that no longer represented the best-known standards of animal care. Historic municipal zoos were grappling with updating their landscape design to reflect the most modern principles, but in the wake of change was the choice of how to treat extant buildings. These choices will be examined in Chapters 5, 6, and 7. Ultimately, an understanding of the changes that took place in American Zoos throughout the twentieth century facilitates the examination of the treatment of historic properties and what their future role might be.

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Figure 9: Timeline for Major Zoo Animal Welfare Standard Developments

- **1874** Philadelphia Zoo is the first zoo in America
- **1902** First zoo animal research lab established at the Philadelphia Zoo
- **1933 – 1937** New Deal funding allocated for zoo improvements
- **1940 – 1950** The Disinfectant Era
  - **1950** Heine Hediger’s *Wild Animals in Captivity* is published
- **1963** “Wild Kingdom” first airs on NBC
- **1966** Animal Welfare Act regulates the treatment of animals in research and exhibition
- **1968 - 1974** Animal Rights publications expose poor zoo conditions
- **1969 - 1986** Jane Goodall and George Schaller publish significant primate and felid research
- **1971** AZA (Association of Zoos and Aquariums) is established
- **1973** Endangered Species Act is passed
- **1975 - 1977** Seattle’s Woodland Park Zoo utilizes immersion exhibits for the first time
- **1977 – 1979** Information on the dangers of inbreeding animals is published
- **1980** PETA (People for the Ethical Treatment of Animals) is founded
- **1981** AZA Species Survival Plans are written to provide species specific guidelines for animal care
- **1990** Environmental enrichment introduced as an important animal husbandry practice
- **1993** New York Zoological Society becomes the Wildlife Conservation Society
CHAPTER 5: NARRATIVES OF CHANGING FELID CARE

Timeline of Knowledge for Care of Tigers and Lions

Figure 10: Timeline for Major Felid Care Standard Development

- **1907** Carl Hagenbeck introduces “cat grottos” at the Tierpark Hagenbeck
- **1950** Heine Hediger’s *Wild Animals in Captivity* is published
- **1966** Animal Welfare Act regulates the treatment of animals in research and exhibition
- **1972** George Schaller publishes *The Serengeti Lion*, the first modern author to live and study Serengeti lions in the wild
- **1981** Species Survival Plans established by the AZA
- **1986** Jon Coes African Savannah exhibit is unveiled
- **1992** Big Cat Rescue is established to shelter, rehabilitate and research big cats in captivity
- **1992** The Shape of Enrichment Journal publishes first edition
- **1992** African Lion Species Survival Plan created
- **1994** AZA Husbandry Manual for Captive Tigers created
- **1997** Research is published demonstrating that big cats likely pace when hungry
- **2003** Research suggests that animal welfare (health, breeding difficulties, psychological state) is decreased for wide-ranging carnivores in captivity due to the restraint on natural behavior
- **2007** Research is published tying environmental conditions to pacing and stereotypic behavior
Felid Care Narrative

In this chapter, a study of the changes made to one type of building housing one species offers an in depth analysis on whether scientific research was aiding designers in making changes to zoo buildings. The research drawn from both the Tiger and Lion Species Survival Plans (SSP) created by the AZA was used to create a selected bibliography on relevant research within the post-1950’s decades. This is located in Appendix B. Then, the changes to the “Lion House” buildings at each zoo were examined for their timeliness on making changes based on the research. It is imperative to include this case study, to examine not only the changes made to each Lion House, but to understand whether zoos may or may not have been consulting research to make these changes. Further, the examination of Lion Houses and felid research helps make the connection between the study of animals in the scientific community, and the care for animals in captivity. Understanding if these two disciplines were working together is important to the study of zoo building evolution in the second half of the twentieth century.

Carl Hagenbeck introduced the earliest known “cat grotto,” or moated exhibit used to enclose large cats, most often lions and other savannah cats, in 1907. Hagenbeck was a German animal trader and circus owner who sought to create a permanent exhibition for his animal collection. Hagenbeck kept animals in “bar-less” exhibits to show the public that wild animals are often docile and timid, not ferocious and fearful. He also aimed to demonstrate that contrary to popular belief, exotic animals do not need
to be kept indoors in climate-controlled spaces. Hagenbeck understood that all wild animals prefer outdoor areas even in colder weather.\textsuperscript{80}

The development of animal care standards for large cats (felids) happened in conjuncturce with surfacing knowledge that brought awareness to the endangerment of felids, mainly connected with habitat loss and environmental degradation. The public became aware of the fact that habitat degradation was the main cause of loss of life for the species. Zoos also took note that it was necessary for the survival of the species to display these animals within a replica of their native environment.\textsuperscript{81} This not only enhanced visitor awareness of ecological issues like deforestation in connection to species population decline, but also transformed zoos priorities completely from entertainment to science. Naturalistic exhibits supposedly prepared animals bred in zoos to be transferred to wildlife conservation facilities, which burgeoned in the second half of the twentieth century. These large wild land type facilities prepared animals born in captivity to be released into the wild in the hopes of someday repopulating endangered species populations. It became evident by the 1970s that naturalistic enclosures were imperative for any zoo that claimed to have an interest in species conservation.

Further, the Association of Zoos and Aquariums, which had been operating since 1924, appointed a committee to address the growing need for standardization of care in the animal industry in 1971. They had concurrently begun to focus on conservation as it related to zoos and aquariums around the country. The AZA created

Species Survival Plans in 1981 to help address the monumental task of species conservation and the role of zoos and aquariums. “TAG” or Taxon Advisory Groups created a compilation document containing research, management techniques, breeding rules and regulations, and other information pertaining to a certain species that could assist a zoo in providing expert care. These SSP’s were used throughout the 1990s to create Care Manuals that provided standards for animal care in zoos that were accredited through the AZA. These care manuals are updated and still used today. A select bibliography from the Tiger Care Manual and the Lion Care Manual served as the basis for the timeline on published research for care of large felids listed above. Care manuals for many other subspecies of felids exist and are available online through the AZA website.

The 1990s saw many changes in the care of large felids. Most notably, research was being published that showcased the positive effects of enrichment on the lives of captive animals. Joe Coe, often credited with developing the idea of “immersion exhibits” in 1975, is quoted arguing that immersion exhibits “are still a fraction of what [animals] have in the wild and they are still bored out of their skins most of the time. So then we realized that you have to have enrichment and training.” Enrichment activities for large felids include activities that promote natural behavior like “stalking, pouncing, running, chasing, climbing, scratching and scent marking.” Sensory opportunities should also be

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included, as well as changing the animals environment regularly. Today, enrichment programs are a part of all four zoos in this study.

Studies continued to be published on large felids throughout the early 2000s. The topics of stress, behavior, and effects of captivity were common. However, Care Manuals for both tigers and lions include a section that outlines research that still needs to be undertaken. Most zoos are active in sharing networks through the AZA and other groups dedicated to large cat research. Below are narrative descriptions and timelines for known changes in each zoo's facility that houses/housed large cats. These narratives can be used to better cognize specific changes for one type of building meant to house one species.

The Philadelphia Zoo Lion House

Philadelphia Zoo constructed a building specifically designed to house large cats in 1876 called The Carnivora House. The building, designed by Charles M Autenreith was constructed with brick walls and a timber roof system. Additionally, it had 2/2 horizontal pivoting windows on the second story and 2/2 double hung windows on the first floor. The design combined a mixture of Victorian features, including towers, scrollwork on the cornice, and decorative carved woodwork between cages. Its form and mass were Italianate in style. Its interior featured multiple cages for animals on the side of the building that received the most sun (northwest). Standard wood floors, glazed brick walls and iron bars were featured in the animal enclosure space, and tile floors and plaster

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walls were featured in the viewing area. This building continued to house large cats until 1951, with no known major renovations until it was demolished in 1965.84

In 1951 a new Carnivora House was constructed. The building was uncharacteristic in style with a stone façade. Small hatches were located on the exterior façade, which linked animals from their cages to an outdoor grotto. Two known grottos were designed, one for lions and one for tigers. The grottos contained built up rock structures and dirt beds with a large moat around them designed to keep animals away from visitors. No flora was present in the exhibit. The interior of the building featured iron cages lined with sterile tiles, and a stainless steel raised bench for animals to lie on.

84 Clark DeLeon, Americas First Zoostory, 125 Years at the Philadelphia Zoo (Virginia Beach: The Donning Company, 1999) 70 – 71.
A small door was located at the front of the enclosure. No known renovations took place until 2006, when the zoo discontinued the keeping of large felids within the building and constructed “Big Cat Falls.” Big Cat Falls was an adaptive reuse of the original 1951 interior cages and space. An educational and interpretive area featuring panels, videos, sounds and photographs of big cats natural habitats was installed within

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the building. The exhibit, opening in 2006, featured updated spaces for the animals, namely the introduction of flora. This exhibit won the AZA Exhibit of the Year Award.\(^6\)

![Figure 13: Philadelphia Zoo Lion Exhibit (Photo Courtesy Valkrye131 Flickr)](image)

The most innovative renovation happened in 2014 when a series of large wire-mesh enclosed bridges were designed for large cats to roam about parts of the park. These bridge structures are connected to the cats enclosures allowing them to roam about the zoo at the leisure of the zookeepers. This design is a response to the idea of “animal rotation,” developed in the 1980’s and presented to the public on a panel in 1995 after research conducted in the Toledo Zoo showed primates were ultimately more stimulated when exposed to a variety of exhibit areas. This idea focused on the need for animals to

experience new habitats and spaces when kept in captivity. The Philadelphia Zoo has also incorporated this type of design for other species, including primates.

When comparing changes to Philadelphia’s large felid enclosures to the timeline presented at the beginning of this chapter, a claim can be made that the Philadelphia Zoo did not respond at all to the changes in care standards taking place for large felids. The addition of “bar-less” grottos in 1951 and the addition of bridges as an enrichment activity can be seen as their most progressive additions to the landscape. The Zoo housed large cats in enclosures that were already thought to be extremely out of date by the 1970’s until 2006. While given access to outdoor “grottos,” the cats are still only given free roaming access through the mesh enclosed bridges at the discretion of the zookeepers.

The Philadelphia Zoo demolished the original 1875 Carnivora House in 1965. Its period of vacancy represents the only known period of vacancy in original Lion Houses of the four zoos studied. The 1951 building, a product of its time, used sanitary materials and traditional methods for containing animals on the interior. Overall, the changes at the Philadelphia Zoo to the structures that housed large cats can be characterized as generally mixed in their response to changing standards of care. While the Zoo incorporated naturalistic grottos for cats in 1951, there were no known major renovations to those spaces until 2006. The interior tile lined and iron barred enclosures were also still used to house animals, with no known changes, until 2006.

1874 - Construction
Materials: brick, wood, iron
Spatial Qualities: Caged, enclosed, not climate controlled

1951 - New Construction
Materials: iron, concrete, tile, organic material (dirt), water, rocks, flora
Spatial Qualities: caged and not caged, enclosed and open air, unknown climate control

1951 – 1965 - Period of Neglect of 1873 Lion House

1965 - Demolition of 1873 Lion House

2006 - Renovation
Materials: gunite, flora, glass
Spatial Qualities: caged (glass), open air, not climate controlled

2014 - Renovation/Addition
Materials: Steel (beams, wire)
Spatial Qualities: caged, open air, not climate controlled
The Cincinnati Zoo Lion House

The Cincinnati Zoos original Lion House was constructed in 1875 and designed by architect James McLaughlin. The building was styled in the neoclassical style; with Corinthian columns on the interior between each cage and on the exterior between each window. The building featured 16 indoor cages and 8 outdoor ones. The outdoor cages contained wood floors and stone walls, and the indoor cages had wood floors and wood and brick walls. The building was heated using steam. In 1930 a 100-foot tunnel was added to connect the structure to an outdoor grotto area. The tiger grotto included concrete “rocks”, and flora. It was not caged but moated, and on the day of its opening, a tiger immediately jumped into the moat and started swimming. Zoo designers claimed to have no prior knowledge that tigers liked to swim. The lion grotto had very minimal flora and was also constructed of synthetic rock.88

In 1952 the Cincinnati Zoo demolished the 1875 Lion House and constructed a new one, designed by Kruckemeyer and Strong. The building was designed with glass-fronted enclosures for both big and small cats. In 1978, the small cats were given access to outdoor cages. Persian leopards were given a den area. In 1985, the space was
renovated to make the cages larger. Snow Leopard enclosures were climate controlled to below 20 Celsius. Siberian Lynx cats were given a den area. Glass widths were 2 – 3 cm for large cats and 1.5 cm for small cats. Artificial gunite rockwork and trees were incorporated and soil types from the animals natural habitat were brought in. Skylights were added so that live plants could be incorporated. Dried plant material like fallen leaves was sometimes used as ground substrate. Exhibits for the ocelot, fishing cat, rusty-spotted cat, marbled cat, jaguar and serval contain permanent water fixtures like ponds or waterfalls. The HVAC system was also updated to include separate systems for animal enclosures and visitor areas, to minimize disease, as well as high velocity airflow, which helped eliminate smell.\footnote{Barbara Brady, Jack Heulsman, Edward Maruska “Cats in Context: Cincinnati Zoo Cat Exhibit” International Zoo Yearbook 29, no. 1. (January 1990): 169 – 174.}
Special lighting was designed to mimic the cats natural habitat, such as broken light for jungle cats and steadier streams of light for savannah cats. Special drinkers were designed to “flush” four times every 24 hours to ensure clean drinking water. Finally, paint sealants were lab tested (as a sealant for murals as the backdrop for enclosures) by spraying tiger urine and repeated cycles of water onto it for 1 year and a product called Hydrozo 16 was selected. The exhibit was award winning. In 2011 it was again renovated to include the addition of new species and a new visitor experience. There were few changes to the animal enclosures. Unfortunately, it is unknown when big cats

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were permanently moved out of the structure and into their 1934 grottos, but it can be concluded that it was during the 1952 demolition/new construction. This speculation can be made based on the smaller size of the indoor exhibit spaces in the 1952 building.

A renovated enclosure area of the original tiger grotto was designed for Malay Tigers, White Tigers and Snow Leopards in 2011. The space features artificial rockwork, tree stumps, flora, a waterfall and a heated rock at the front of the enclosure for the tigers and an air-conditioned rock at the front of the enclosure for snow leopards.91 In 2013 the Lion exhibit was moved into the Africa area of the zoo, and was expanded to include more space and new enrichment activities. These were added to mimic the type of natural enrichment lions may participate in in the wild.92

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The Cincinnati Zoo displayed the most timely changes in buildings and space in connection to the timeline of changes in animal welfare standards. A noticeable lack of enrichment activities in the enclosures of small animals should be noted, as should a general focus of building activities on spaces for smaller cats. The Zoo won a prestigious award in 2015 for their work with the endangered sand cat, developing reproductive technologies for the endangered small cat. The zoo is one of the leaders today in small cat research. The Cincinnati Zoo has also undergone the most changes to their spaces that house animals of the four zoos studied. Their use of space remains standard today in comparison to the Philadelphia Zoos “Big Cat Falls,” and many of the modern renovations are done to improve spaces for visitors with less construction devoted to
animal spaces. The zoo has been successful, however, in rotating habitats with their many campaigns of building renovations and construction projects.

1875 - **Construction**
- Materials: Iron, plaster, glass, wood, stone, brick
- Spatial Qualities: caged, enclosed and open air, climate controlled

1930 - **Renovation/Addition**
- Materials: gunite/concrete, organic material (dirt, water), flora
- Spatial Qualities: not caged, open air, not climate controlled

1952/1950 - **Demolition/New Construction**
- Materials: glass, flora, fauna, organic materials (dirt), gunite, water
- Spatial Qualities: caged (glass), enclosed, climate controlled

1978 - **Renovation/Addition**
- Materials: metal
- Spatial Qualities: caged, open air, not climate controlled

1985 - **Renovation**
- Materials: glass, organic materials (tree stumps), gunite, flora, chemical sealants, water
- Spatial Qualities: caged (glass), enclosed, climate controlled

2011 - **Adaptive Reuse of 1950 building**
- Materials: Glass, flora, organic material (dirt, tree stumps), fauna
- Spatial Qualities: Caged (glass), enclosed, climate controlled

2011 - **Renovation (Tigers)**
- Materials: flora, gunite
- Spatial Qualities: not caged, open air, not climate controlled

2013 - **Renovation (Lions)**
- Materials: Flora, gunite
- Spatial Qualities: not caged, open air, not climate controlled

**Lincoln Park Zoo Lion House**

The Lincoln Park Zoo’s current Lion House was constructed in 1912. Prior, lions and all other animals were kept in a single wooden building with moveable iron cages containing one ledge. The firm Perkins, Fellows and Hamilton designed the new Lion House and modeled it off of the quarters for big cats at the London Zoo. The building was constructed of brick, with cages lining only one side of the interior and exterior. The
building contained 2/2 horizontally pivoting windows at the roof eave and 2/2 double hung windows on the cage-less side of the hall area. The building had 13 cages, each containing one shelf and one tree. The walls were constructed of green glazed brick, which acted as a tile-like surface, and the floors were made of concrete. A drainage shelf was added on the exterior ground level of each cage, which quite literally acted as a gutter for water and animal waste. The exterior cages were walled with regular brick and the floors were both wood and concrete. Each cage had 1 access door at the front of the cage. Cages were iron or steel bars or fencing. 

Figure 18 Left: Unknown Tiger in Exhibit 1933 (Photo Courtesy of Chicago History Museum)

Figure 19 Right: Unknown Lion in Exhibit 1964 (Photo Courtesy of Chicago History Museum)

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The first known renovation of the building happened in 1971. Glass replaced the iron bars in the front of the enclosures, and two barless exhibits were added for the lions and tigers on the north side of the building. No flora was placed within the exhibit, but dirt and other organic materials were used. In 1991, the building underwent another renovation where the interior cages were redone to look like natural habitats. Different painted murals were incorporated inside exhibit spaces that were meant to mimic a specific animals native scenery.

Figure 20: Interior of Kovler Lion House Today (Photo Courtesy David B. Gleason Flickr)
Remaining iron was replaced with stainless steel wire, and flora was added to the exhibit spaces, along with painted murals in the background. The building now only houses five types of large cats, African Lions, Amur Leopards, Snow Leopards, Pumas and Eurasian Lynxs. Today, cats have access to both interior and exterior exhibit space, per the discretion of the zookeepers. The building is currently undergoing a renovation, but the nature of the changes is unknown. Animals have been moved out in phases, and the zoo has announced they will no longer keep tigers. The zoos CEO claimed that tigers are very difficult to keep in a group and they tend to be asocial. They will use the space once used for the tigers to expand space for all other cats.

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The Lincoln Park Zoo has taken the most conservative path of all four zoos, choosing only multiple series of renovations to the exhibits, which house their large cats. Working in constrained space, the zoo has chosen to get rid of certain animals to make room for other animals as opposed to keeping larger quantities of animals in smaller quarters. Their response to published research on keeping large cats was timely, with two renovations in 1971 and 1991. The material choices are in line with the materials all other zoos were using to create their naturalistic lion enclosures. The Lincoln Park Zoo is the only zoo that still displays lions and tigers in interior exhibits. Their renovations have been careful to preserve the buildings structure and original materials, most of which are still present aside from those in the animal enclosures. The Commission on Chicago
Landmarks granted the building an award in 2006 for preservation excellence. The building contains no known permanent enrichment infrastructure.

1912 - Construction
Materials: Iron, brick (green glazed), organic material (tree), glass
Spatial Qualities: caged, enclosed and open air, climate controlled

1971 - Renovation & Addition
Materials: glass, water, gunite, organic material (dirt)
Spatial Qualities: caged (glass) and not caged, enclosed and open air, unknown climate control

1991 - Renovation
Materials: Stainless steel (wire), organic material (tree, dirt), flora, gunite,
Spatial Qualities: Caged and not caged, enclosed and not enclosed, unknown climate control

2016 - Renovation (Currently Being Renovated)

The Toledo Zoo Carnivora House

The Toledo Zoo originally kept lions and all other animals in a single wooden building. Animals were caged using permanent iron barred enclosures and had access to indoor and outdoor space. Floors were constructed with wood and walls utilized a stone surface. The building was demolished in 1934. In 1928 the zoo built another Lion House, called the Carnivora House. Architects Stophlet & Stophlet designed the building in the Spanish Colonial Revival style. Interior and exterior cages were constructed, exterior cages on both the east and west of the building. The exterior cages had a stone sitting ledge and small den area for lions. This building also housed the kitchen and the hospital for animals at the time. The main hall had 6/3 double hung windows with horizontally pivoting windows at the eave. Skylights were used to light the interior animal spaces, and a very large window above the entrance of the building provided additional light. A row
of columns were placed in front the recessed cages. Little is known about the interior animal spaces.96

Figure 22: Toledo Zoo Carnivora House, 1936 (Photo Courtesy of Toledo-Lucas County Public Library)

The building underwent no major renovations or changes until 1993. In 1970 big cats were slowly phased out of the structure. In 1970 the cheetahs were given their own separate outdoor enclosure. In 1971 a cheetah gave birth to four cubs, becoming the first in North America. In 1989, Lions and leopards were moved to their own exhibit spaces outdoors, permanently. Exhibit spaces included flora, gunite rockwork as well as some authentic rock pieces, and a water moat. In 1988 as some cats were being phased

96 Ted Ligibel, The Toledo Zoo’s First 100 Years: A Century of Adventure (Virginia Beach: The Donning Company, 1999), 39 – 40.
out of the building, the zoo secured an exhibit from the Chinese government to display pandas. The pandas were exhibited for six months.

![Figure 23: Toledo Zoo Lion Exhibit, 1990 (Photo Courtesy of Toledo-Lucas County Public Library)](image)

The Toledo Zoos Amur tiger exhibit is enclosed with steel mesh, and contains organic material (leaves, tree stumps) as well as synthetic rockwork and a synthetic river and pool. The snow leopard exhibit has similar features. By 1993, all cats were moved to permanent outdoor locations. The Carnivora House was adaptively reused into a café for zoo goers. The space still contains the original iron bars on both the interior and exterior, and the spatial quality of the building was preserved. Today the building still features a large open hall with cages on one side and skylights and eave windows lighting most of the building.
The Toledo Zoo also took a conservative path in not permanently relocating many animals to naturalistic enclosures until 1993. However, the Toledo Zoo has had many births of big cats, including 12 cheetah cubs from 1971 – 1999, all of who lived to adulthood.97 Two Amur tigers were born in the zoo in 2012 and 1 snow leopard born in 2017.9899 This may demonstrate a well-designed exhibit space. Enrichment activities do take place at the zoo today, but are not permanent fixtures in the animals’ enclosures. With respect to the four zoos in this study, the Toledo Zoo followed a comparable timeline, making fewer changes to their enclosure space but ultimately deciding not to exhibit big cats indoors at all in 1993. The Toledo Zoos progress can most easily be compared to the Lincoln Park Zoos, who chose to keep fewer animals in larger spaces as opposed to more animals in smaller spaces.

1907 - Construction
Materials: wood, stone, iron,
Spatial Qualities: caged, open air and enclosed, unknown climate control

1934 - Demolition

1928 - New Construction
Materials: Iron, Concrete, stucco, stone, glass
Spatial Qualities: caged, open air and enclosed areas, climate controlled

1970 - New Construction
Materials: Steel (wire, beams), flora, fauna
Spatial Qualities: Caged, Open air, not climate controlled

1989 - New Construction
Materials: gunite, organic material (dirt, tree stumps), flora, water, steel wire,
Spatial Qualities: caged, open air, not climate controlled

1993 - Adaptive Reuse of 1928 Lion House
*restaurant

2003 - Renovation (Tigers)

97 Ted Ligibel, *The Toledo Zoo’s First 100 Years: A Century of Adventure* (Virginia Beach: The Donning Company, 1999), 123.
Materials: gunite, flora, fauna (white lions)
Spatial Qualities: not caged, open air, not climate controlled

Analysis

Through the study of spaces that housed big cats at the four selected zoos, trends can be observed and an analysis can take place. Overall, the main change in space that occurred for animals from the period of 1950 to present was not the incorporation of naturalistic enclosures, but rather the separation of cats of all types. Today, all zoos in the study now have separate facilities to house big cats and small cats. Prior, all cats were kept in one building. A separation of species as they occur geographically was also a major change almost all zoos underwent, with all zoos except Lincoln Park now housing lions and cheetahs with other African animals, and tigers within jungle or other areas of the zoo. Lincoln Park’s building is also the only exhibit that still operates under the traditional name of “Lion House,” although the current renovation plans are unknown.

Some evidence dictates that zoos were focusing heavily on following trends of other zoos as opposed to responding to published research on felid welfare. This can be seen in the case of the cat grotto. The two earliest cat grottos, in Cincinnati and Philadelphia, feature very similar designs. For Lions, both were moated and contained artificial rocks and a flat landscape with a dirt floor. Cincinnati’s original 1934 grotto for tigers was also moated, as there was no awareness that tigers could swim. Their 1931 grotto for lions contained two small shrubs. In 1952 the Philadelphia Zoo opened their grotto, with no vegetation. In 1950 Heini Hedigners book *Wild Animals In Captivity*

expresses the need for vegetation in animal exhibits, because it has significance to the animal that humans may not be aware of. Research conducted by F.W. Champion on tigers in 1934 studies the meaning of clawing trees by the tiger. The Lincoln Park Zoo is the only zoo known to have kept a tree in their indoor tiger enclosure. Around the 1970’s, all zoos turned their efforts to species conservation. Research about habitat degradation being linked to loss of species populations became widely known in the 1990s. Zoos vowed to bring awareness to these topics by displaying animals in their natural habitats. However, today the Cincinnati Zoo and the Toledo Zoo use the same grass that covers golf courses and suburban lawns as the ground substrate in Cincinnati’s Lion and Toledo’s Cheetah exhibits. The Lincoln Park Zoos Lion grotto is crawling with English Ivy.

Trends in space which houses large cats can largely be seen as a response to the general lack of research that has been done on the amount of space big cats need to feel content. This is likely to blame for the high variations in the spaces at all four zoos that house these animals. There are many unknowns in the field of large felid care, and one of those may be spatial requirements. Of the four zoos, none actively participate today in research on large felids. The Cincinnati Zoo is the only zoo to take part in research of felids at all, and focuses their efforts on cats less than 50 pounds. In turn, the Cincinnati Zoo was the only zoo to display small cats in their own exhibit with light that only mimicked moonlight, due to the nocturnal nature of these animals.

However, when compared with the timeline presented at the beginning of the chapter, the argument can be made that zoos were indeed responding to published research. Within 2 years of the publication of *Wild Animals In Captivity*, two zoos, Philadelphia and Cincinnati, had constructed new buildings with more outdoor space for big cats. Toledo and Lincoln Park both made changes to Lion Houses in the 1990’s, which proved a fruitful decade for research on big cats behavioral needs. In 2007 research tying environmental factors to pacing of big cats was published. Within 10 years every zoo but the Toledo Zoo made changes to their big cat enclosures. Notably Philadelphia gave animal’s arboreal space to roam further distances, a natural behavior for some cats.

The narratives here exemplify the fact that zoos generally were making changes to respond to animal welfare knowledge. While no structure went without change in the second half of the twentieth century, these changes happened not all during one decade but many. Cincinnati was presumably the first zoo to house large cats permanently in naturalistic exhibits, followed by The Toledo Zoo, then The Philadelphia Zoo. The Lincoln Park Zoo still houses lions indoors, with some access to outdoor naturalistic enclosures. Generally speaking, this chapter can be used to emphasize the fact that zoos overall were responding to changes in animal welfare knowledge, but likely when access to funding or other reasons allowed them to do so. There was no one date or building treatment that every zoo used to respond to changing animal care standards, even species specific ones. Instead, a variety of changes to buildings and exhibit spaces done in a variety of years caused them to have the aesthetic qualities they have today.
The reason that there are no specific dates or building treatment types for big cats is unknown. However, it is possible that the lack of an advocate for big cats may be one reason. For example, three out of four zoos made changes to exhibits that housed primates in the 1970’s. This could be attributed to Jane Goodall’s highly publicized primate research in this decade and subsequent decades. No big cat researcher was ever as public or influential. Further, most research conducted by big cat researchers pertained to big cats in the wild, not in captivity. These suggestions may have contributed to the looser patterns in construction for big cat buildings, opposed to primate buildings.

Table 1: Number of Felid Building Changes Per Decade

<table>
<thead>
<tr>
<th>Decade</th>
<th>Number of Building Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950's</td>
<td>3</td>
</tr>
<tr>
<td>1960's</td>
<td>1</td>
</tr>
<tr>
<td>1970's</td>
<td>3</td>
</tr>
<tr>
<td>1980's</td>
<td>2</td>
</tr>
<tr>
<td>1990's</td>
<td>2</td>
</tr>
<tr>
<td>2000's</td>
<td>2</td>
</tr>
<tr>
<td>2010's</td>
<td>5</td>
</tr>
</tbody>
</table>

102 George Schaller’s research on Serengeti Lions was influential to the zoological community, but this research detailed Serengeti Lions in the wild, not in captivity.
CHAPTER 6: FINDINGS

In this chapter, timelines were created and are presented in the form of charts. These charts can be found in Appendix A. They were used to create a series of pie charts which detail the overall trends that each zoo exhibited in regards to building treatments. These will be used in the following chapter for analysis. To inform these various charts, online archival records, mainly in the form of photographs were used. General written histories of each zoo were used to find dates and sometimes details of specific building treatments. These histories are cited within the References section of this work. They were also used to write a small paragraph of history and introduction for each zoo, which is meant to introduce the reader to the zoos location and general background. A map is provided for further aid.
Figure 24: Map of Zoo City Locations
The Toledo Zoo was founded in 1900 in an area known as Walbridge Park in Toledo, Ohio. The City of Toledo, gifted with a woodchuck, decided to put the woodchuck on display for the community to enjoy. Within the first year they acquired 17 other animal species. A stone and shingle structure already on the site was used to house all exotic species until 1907, when another building was built. The new building also housed all exotic species including lions, gorillas, and an elephant. The building featured floor to ceiling iron barred cages, in which animals were kept during bad weather. Outdoor cages were used at zookeepers’ discretion. This building was demolished in the early 1930’s, and all materials were used in the Works Progress Administration buildings constructed in the 1930’s and 1940’s.  

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103 Ted Ligibel, *The Toledo Zoo's First 100 Years: A Century of Adventure* (Virginia Beach: The Donning Company, 1999), 17.
In January 1923 architects Sophet and Sophet created a master plan under which four buildings were constructed, the Carnivora House, The Herbivora House, the Primate Building and the Elephant Building. All buildings except the Herbivora House still stand today. The zoo benefitted greatly from the Works Progress Administration funding. They were able to construct five buildings, an aviary, reptile house, aquarium, museum and amphitheater, plus and one naturalistic exhibit for monkeys. All of these exhibit buildings still stand today. The zoo continued to grow with a new African exhibit in 1989 and Arctic exhibit in 2000. The zoo featured three major construction campaigns, one by Sophet and Sophet, one by the WPA and another one in the late 1990’s as part of the zoos master plan.
Figure 26: The Toledo Zoo, Toledo Ohio (Photo from Google Maps)
The Toledo Zoo utilized various building treatments throughout the post 1950 decades. Relative to other zoos, they undertook more adaptive reuse projects. The Carnivora House became both a restaurant and an exhibit space for giant pandas, and The Elephant House became an event space. The Toledo Zoo also had the most varied building treatment numbers of all four zoos, with each treatment category having between one and four instances. The Toledo Zoo has relatively low numbers of demolitions, only two. They are also the only zoo to have an instance of preservation amongst all four.

This showcases a strong historic preservation ethic and desire to preserve their cultural history. Likewise, their website states “As an institution with a more than 100-
year history, The Toledo Zoo understands the need to preserve the past even as it reaches out toward the future.” The Encyclopedia of the Worlds Zoos also notes that the Toledo Zoo likely has the largest collection of Works Progress Administration architecture still preserved on a single site today. The zoo is an example of how mid sized urban zoos, often thought of as scientific institutions, have incorporated the preservation of cultural heritage into their goals and strategies. Table 3 below demonstrates that the 1980’s and 1990’s were the decades with the most building changes. This showcases major growth during these decades and attention to construction projects that benefitted animal welfare.

Table 3: Toledo Zoo Building Changes Per Decade

![Table showing building changes per decade]

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Cincinnati Zoo and Botanical Gardens

The Cincinnati Zoo was the second zoo (after Philadelphia) to be established in the United States. A group of German bird enthusiasts decided, after missing the songbirds of their native homeland, to import various aviary species from Germany in 1873. Upon the popularity of these birds, more animals were imported and the Zoological Society of Cincinnati was founded. The Zoological Park first opened its doors in September 1875. The Zoo was known as an early leader in naturalistic exhibit design philosophy, likely due to the large German population in Cincinnati (the Germans were international leaders in natural exhibit design i.e. Hedinger). They constructed many early buildings in the romantic style, including the early Monkey House, which exists today as the oldest extant zoo building in the country. Today, they continue to incorporate natural exhibits as part of their mission for conservation and research. A new natural gorilla exhibit and a hippo exhibit opened in 2016.

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Figure 27: Cincinnati Zoo Reptile House, Oldest Extant Zoo Building in the Country (Photo Courtesy of Ohio History Connection)
Figure 28: The Cincinnati Zoo, Cincinnati Ohio (Photo from Google Maps)
The Cincinnati Zoo utilized mainly renovation projects to respond to surfacing animal welfare knowledge. They also conducted more adaptive reuse projects than any other zoo. They had no instances of neglect or preservation. Cincinnati also has two buildings listed on the National Register, the Elephant House and the Reptile House (former Monkey House). Two other buildings were formerly on the National Register, the Aviary and a log cabin significant to the cities history. Recently, the zoo restored the roof of the Monkey House to its original aesthetics.\footnote{“Cincinnati Zoo Historic Structures” National Register of Historic Places, National Parks Service, originally listed 1987}
This demonstrates that the Cincinnati Zoo also has a strong preservation ethic, like the Toledo Zoo. They are able to find innovative uses for historic buildings, and have been able to respond to updated animal welfare standards while still preserving cultural artifacts. With only two known instances of demolition, the zoo has proven a goal of stewardship of the built environment. This is not expressed in their mission or marketing material, however. This demonstrates that although preservation may not be part of a zoos core mission or values, they can still participate and incorporate it into common practices. Table 5 below demonstrates that the 1950’s and 1970’s were decades with many building changes, which is earlier than the Toledo Zoo but similar to the Philadelphia Zoo.

Table 5: Cincinnati Zoo Building Changes Per Decade
The Philadelphia Zoo

The Philadelphia Zoo is the oldest zoo in the United States, first opening in 1874. They constructed many early buildings including those for big cats, monkeys and birds. They continued to expand in the twentieth century constructing more buildings, like the first zoo laboratory in the country in 1902. The Zoo found that poor diet was leading to deaths and created vitamized biscuits to feed zoo animals that would be used by the zoo community for years after.\textsuperscript{108} Philadelphia undertook many projects within the “Disinfectant Era,” having “flushable” cages in their Lion House in the 1950’s and 60’s.\textsuperscript{109} These cages were designed like a roof with gutters, water would release from the back of the cage and move towards the front to be collected in a permanent gutter. They “flushed” every four hours.

They have since incorporated many naturalistic exhibits like “Big Cat Falls” and an innovative exhibit style called “Zoo360” which guides arboreal animals through sets of wire mesh bridges that connect throughout the zoo. The Philadelphia Zoo had two major construction campaigns, one upon its opening in 1874, and one in the 1950’s. They had the largest number of exhibit spaces from the disinfectant era, but have all since been renovated today. The WPA created some sculpture pieces for the zoo, but constructed no buildings.

\textsuperscript{108} Clark DeLeon, \textit{Americas First Zoostory, 125 Years at the Philadelphia Zoo} (Virginia Beach: The Donning Company, 1999), 67.
\textsuperscript{109} Clark DeLeon, \textit{Americas First Zoostory}, 139.
Figure 29: The Philadelphia Zoo, Philadelphia Pennsylvania (Photo From Google Maps)
The Philadelphia Zoo also undertook many renovation projects. They also undertook many demolitions and new constructions, and only two instances of adaptive reuse and two instances of neglect. Their renovation projects are in the middle range for the four zoos, having more than the Toledo Zoo and less than The Cincinnati Zoo or Lincoln Park Zoo. They were the only zoo who had buildings that underwent known periods of neglect, both periods were neglect of a 19th century building in the 1950’s. Both periods also ended with the building being demolished. Philadelphia has the weakest preservation ethic of all four zoos studied, with four instances of demolition and two instances of neglect.
Today, only one originally constructed exhibit building is still standing, the Antelope House, which is used today as part of the Children’s Zoo. To contrast the zoos generally weak preservation ethic, they have taken steps for the careful preservation of both the inside and outside of this building. The buildings interior still contains the original 1877 truss and wall systems, which had been carefully maintained by the architectural firm who undertook the 1985 adaptive reuse project. This demonstrates that while Philadelphia’s general preservation ethic is weak based on many demolitions and neglected structures, they have tried to remedy this by making preservation a priority for only one historic building. Table 7 below shows the majority of building changes were made in the 1950’s, 1960’s and 1970’s. This aligns with a major building campaign during this time period. The larger numbers of demolitions in the 1980’s may demonstrate a desire for a “clean slate” when designing new exhibits. The chart shows that the zoo experienced steady growth during the mid-twentieth century, and turned to a variation of building treatments in response.

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110 Clark DeLeon, *Americas First Zoostory, 125 Years at the Philadelphia Zoo* (Virginia Beach: The Donning Company, 1999), 54.
Table 7: Philadelphia Zoo Building Changes Per Decade

<table>
<thead>
<tr>
<th>Decade</th>
<th>Neglect</th>
<th>Preservation</th>
<th>Renovation</th>
<th>Adaptive Reuse</th>
<th>Demolition</th>
<th>New Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950's</td>
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<td>1960's</td>
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<td>1970's</td>
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<td>1980's</td>
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<td>1990's</td>
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<tr>
<td>2000's</td>
<td></td>
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</tbody>
</table>
Figure 30: Philadelphia Zoo Antelope House/Treehouse Interior, 2010 (Photo Courtesy of John Seidman Flickr)
The Lincoln Park Zoo

The Lincoln Park Zoo is a zoological park in Chicago, Illinois. The Zoo began when coffins from a cemetery began surfacing after a flood in Chicago’s Lincoln Park. The city’s population was disgruntled and requested that the city remove the cemetery and use the area for something better. When two swans were donated to the parks system in 1868, they constructed a building and began to acquire other animals native to the upper Midwest. Throughout the twentieth century they constructed more buildings and natural exhibit spaces, all while maintaining a free admission to the public. They have had success with breeding gorillas, notably higher after the incorporation of a new gorilla exhibit in 1976. In 1995 the Zoo shifted to a private institution ran by the Lincoln Park Zoological Society. They had no notable campaigns of building construction, but seemingly constructed buildings at various times through the twentieth century.

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Figure 31: The Lincoln Park Zoo, Chicago Illinois (Photo from Google Maps)
The Lincoln Park Zoo utilized proportionally high amounts of renovation projects. They had only two demolitions and one instance of new construction and adaptive reuse in the post 1950 decades on pre 1950 buildings. Their choices are similar to the Cincinnati Zoo, though the Lincoln Park Zoo did not employ as many adaptive reuse instances to respond to surfacing animal welfare philosophies. Generally the Lincoln Park Zoos preservation ethic is somewhat strong, with only two instances of demolition. Their major building campaign 1990’s was similar to the Toledo Zoos campaign in the 1990s to adaptively reuse two significant animal buildings.
Table 9 shows the major campaigns of building changes being in the 1980’s and 1990s. This is similar to the Toledo Zoo. It is likely the Lincoln Park Zoo was experiencing growth during this time period, as well as a shift from a public to a private institution. This may be the cause of the proportionally higher amount of changes in the 1990’s than any other decade. It is also possible that the zoo was making similar changes to other zoos like the Toledo Zoo in the 1980’s and 1990’s.

Table 9: Lincoln Park Zoo Building Changes Per Decade

![Graph showing building changes per decade]
CHAPTER 7: ANALYSIS

In this chapter, pie charts help analyze the changes made to buildings, and their relativity to the buildings condition when it was constructed. Charts are labeled as either “Pre-1950” or “Post-1950,” indicating whether the information is for the buildings original conditions or the conditions from the culmination of changes made in the second half of the twentieth century. This information is used to assess what types of changes were being made to buildings generally, and specifically what materials and spatial qualities were being changed. This is important to gauge not only whether zoos are participating in preservation activities, but at what level. It is important to understand how animal welfare ideals have impacted the built environment of zoos today. This assessment will guide the recommendations in the next chapter titled “Conclusions and Recommendations.” The information presented in this chapter will be used to establish the status of preservation in zoos and what the future of historic zoo buildings could look like.
Overall, 29 renovation/additions took place, making it the most common known building treatment, encompassing 48% of all changes made in the post 1950’s decades. New construction and adaptive reuse were the second most popular building treatments with ten instances each (16% each), followed by demolition with nine (15%). This demonstrates that zoos were expanding and undertaking many building projects in the post 1950 decades. Adaptive Reuse was expected to be the largest category. There were only two cases of neglect and one case of preservation. This data demonstrates that most zoos were implementing multiple series of smaller changes as opposed to large-scale changes in the post 1950 era. Changes were made to both interiors and exteriors, and often included changes to house new animals, except in new construction projects. There were seven cases of historic buildings that were renovated to house the smaller animals in
a species. Larger animals were moved into newly constructed exhibits. This was most common in cats and primates. Adaptive reuse projects to convert buildings into restaurants and event space were documented four times.

Overall, preservation ethic is very high in mid sized urban zoos. However, when investigating specific instances in each zoos Lion House, it is evident that “skin deep” preservation or “facadism” is the most common type of renovation. This refers to making invasive changes to the interior of a building while preserving the building’s exterior or original form. Most buildings were renovated multiple times in the twentieth century and many still house the same species they housed when originally constructed. Ultimately, zoos are engaging in various levels of preservation practice, but were using “skin deep” renovations to ensure animal welfare standards are as high as possible. Zoos have missions and core values of animal welfare and species conservation, but are able to engage in historic preservation at various levels in mid sized urban zoos.

The Encyclopedia of The Worlds Zoos cites eight distinct reasons for renovation projects at zoos. Those include:

1. To accommodate a change in species
2. To address animal behavioral needs
3. To accommodate changes in organizational styles or systems
4. To create cost savings or historical importance
5. To increase the educational messages of the exhibit
6. To accommodate the reduction in the numbers of species
7. To correct problems in existing exhibits
8. To compete with other zoos and leisure-time activities

This list is a useful tool in understanding why renovation projects may have taken place at all four zoos. Of known renovations, seven were done to accommodate a change

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in species, #1 on the list, although #2, addressing behavioral needs was assumed would be the largest category. Many renovation projects were also utilizing #4, creating historical importance. Competing with other zoos and leisure time activities was a common reason for renovations in the pre-1950 decades, like the incorporation of flushing exhibit spaces at the Philadelphia Zoo to decrease the strong smells of animal urine and feces.

Renovation projects that facilitate better housing standards for animals were the most common building projects overall. This is demonstrated using the Lion House case studies, where 11 renovations occurred to better house big cats. Renovations are often less expensive than new construction, and can be finished quicker with less disruption to the zoo goers or animals. Renovations are most often a responsive practice in the zoo industry. As new information began to surface or new events unfolded, many mid sized zoos responded by making multiple series of small-scale changes to historic buildings. For example, disease transfer from animals to people (or vice versa) caused many zoos to replace traditional iron bars with glass in the 1980’s and 1990’s, like the Cincinnati Zoos Cat House in 1985. In the 1970’s and 1980’s, the push towards displaying animals in their natural environments created a large number of renovation projects that added naturalistic additions to extant buildings, like the Lincoln Park Zoos Lion House in 1971. Indoor exhibits of this era were often painted with mural scenes that mimicked the animal’s natural habitat. Flora and dirt were added to exhibits, both dead and alive in the Toledo Zoos Panda exhibit in 1988 and the Cincinnati Zoos Monkey House in 1978.  

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Accommodations for new animals or different animals categorize most adaptive reuse projects in this study. The Cincinnati Zoo undertook several projects of this nature. Most notably, the zoo adaptively reused the original 1875 Monkey House in 1951 to accommodate reptiles. The building’s roof and skylight were restored in 2013, and it exists today as the oldest zoo building in the country. The Cincinnati Zoo also renovated their 1950 Lion House multiple times in order to accommodate new species of small cats and other nocturnal creatures. The Toledo Zoo also reused part of their Carnivora Building in 1988 to house pandas from China. This demonstrates that changes were being made to respond to the new practice of animal rotation in zoos. Since the inception of the AZA in 1971, zoos had gained the opportunity to receive new animals from other zoos who were breeding them. Zoos needed somewhere to house these travelling species, and made changes to their buildings to do so.
**Materials**

### Pre 1950 Materials

![Pie chart showing materials used before 1950](image)

#### Table 11: Pre 1950 Building Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>45%</td>
</tr>
<tr>
<td>Glass</td>
<td>15%</td>
</tr>
<tr>
<td>Wood</td>
<td>10%</td>
</tr>
<tr>
<td>Concrete</td>
<td>10%</td>
</tr>
<tr>
<td>Brick</td>
<td>10%</td>
</tr>
<tr>
<td>Stone</td>
<td>5%</td>
</tr>
<tr>
<td>Stucco/Plaster</td>
<td>3%</td>
</tr>
<tr>
<td>Flora</td>
<td>2%</td>
</tr>
<tr>
<td>Dirt</td>
<td>2%</td>
</tr>
<tr>
<td>Metal</td>
<td>1%</td>
</tr>
<tr>
<td>Tile</td>
<td>1%</td>
</tr>
</tbody>
</table>

### Post 1950s Materials

![Pie chart showing materials used after 1950](image)

#### Table 12: Post 1950 Building Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flora</td>
<td>20%</td>
</tr>
<tr>
<td>Gunite</td>
<td>15%</td>
</tr>
<tr>
<td>Dirt</td>
<td>10%</td>
</tr>
<tr>
<td>Wood</td>
<td>10%</td>
</tr>
<tr>
<td>Concrete</td>
<td>10%</td>
</tr>
<tr>
<td>Water</td>
<td>10%</td>
</tr>
<tr>
<td>Glass</td>
<td>5%</td>
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<td>Tile</td>
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<td>3%</td>
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<tr>
<td>Steel</td>
<td>2%</td>
</tr>
<tr>
<td>Iron</td>
<td>1%</td>
</tr>
</tbody>
</table>
Of the materials found, iron and glass were the most common materials in the original construction of buildings prior to 1950. Flora was the most common material in post 1950 changes, followed by gunite or concrete and organic material (dirt). Wood was common, but was seen mainly in the form of tree stumps and other natural fixtures within the enclosure area. Most iron fronted cages were replaced with glass fronts, to both protect the humans from the animals and the animals from the humans (It was common for visitors to throw food, stones and other objects into enclosures, which are potentially dangerous to animals, and people could easily reach hands and other parts of their bodies into early iron barred animal enclosures as well). Further, glass protected people from the smells that were percolating inside the enclosure area.\textsuperscript{115} Glass is most common for animals that cannot be kept in their enclosures using a moat, because they can swim.

These changes in material are further evidence that zoos were taking animal welfare into consideration when making changes. Incorporating natural materials into exhibits helps provide an animal with the closest experience to the environment it should have in the wild. With flora, gunite, dirt and wood being the four largest categories of new materials in post 1950’s buildings, this is evidence that animal welfare was being considered, and changes in material was a common way to address this idea.

Pre 1950 Spatial Qualities (Caging)

Table 13: Pre 1950 Spatial Qualities (Caging)

Post 1950 Spatial Qualities (Caging)

Table 14: Post 1950 Spatial Qualities (Caging)
Caged enclosures remained the most common of the known spatial features throughout time. Generally, most caged enclosures are either glass fronted or steel wire fronted. Most non-caged exhibits were either aviaries or used a moat or ledge to keep animals within the enclosure. Moats were likely introduced in the Hamburg Zoo sometime in the early twentieth century, and have been used to contain animals that cannot swim. Moats have to be specifically designed to keep animals enclosed, but prevent them from drowning. This style of exhibit was often seen in exhibits for lions, giraffes, elephants, and gorillas. Non-caged exhibits are also potentially dangerous for humans and animals at the zoo. In 2007, a Siberian tiger at the San Francisco Zoo jumped over a dry moat and scaled the enclosure wall to chase down and kill a 17-year-old boy and maul two other, who had been teasing the animal. In 2016, a child jumped the fence to enter a gorilla enclosure at the Cincinnati Zoo. In both cases, the animals were killed.

This demonstrates that even though some experimentation has led to different forms of keeping animals in their designated areas, cages are still the most common way to do this. In the Lion House case studies, research was published in 2007 that linked pacing to environmental conditions. Within 10 years, each zoo besides the Toledo Zoo

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116 It should be noted that spatial features are considered more than once for each building. For example, if the building underwent three post 1950 renovations, and the spaces that housed animals remained caged throughout all three renovations, “caged” was incorporated into the statistics and pie chart three times for that building.


made changes to their exhibit spaces. The Cincinnati Zoo expanded exhibits for big cats and the Philadelphia Zoo created wire mesh bridges for animals to roam throughout the zoo. The nature of the changes at the Lincoln Park Zoo are unknown as the exhibit is still being renovated. This demonstrates that important research was being published regarding the effects of cage size on animal welfare, and zoos were responding to it.
Enclosure

Pre 1950 Spatial Qualities (Enclosure)

Table 15: Pre 1950 Spatial Qualities (Enclosure)

Post 1950 Spatial Qualities (Enclosure)

Table 16: Post 1950 Spatial Qualities (Enclosure)
Enclosed exhibits were the most common spatial feature in the category of enclosure at all four zoos, followed closely by open-air exhibits. Enclosed exhibits are enclosed within a roof and wall system, while open-air exhibits have no roof. In open-air exhibits, animals who are not native to cold temperatures are commonly moved into a holding area located somewhere within the zoo during harsh winters. Other animals that are more acclimatized to winter weather have small sheds or den areas they can retreat to during storms or poor weather. In the National Zoo in Washington D.C., flamingos are given a heated pool, big cats are given heated rocks, and orangutans are given extra blankets to accommodate for extreme cold. However, most animals, even tropical and African animals, are allowed outside during periods of snow and cold.119

The evidence here proves that zoos were incorporating outdoor space into naturalistic exhibits in the post 1950 decades. The percentages of open air (27%) enclosed (39%) and exhibits with both (29%) are close in numbers, demonstrating that this category has a high level of variation, likely based on species requirements. For example, all bird houses and reptile houses at each zoo are fully enclosed, likely because some of the housed species are sensitive to extreme temperatures. Contrarily, all primates are given access to some open-air space in their exhibits.

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Climate Control

Pre 1950 Spatial Qualities (Climate Control)

Table 17: Pre 1950 Spatial Qualities (Climate Control)

Post 1950 Spatial Qualities (Climate Control)

Table 18: Post 1950 Spatial Qualities (Climate Control)
The category of climate control contained the most variation of all spatial qualities. Smaller animals such as birds and reptiles remained in climate-controlled spaces throughout the twentieth century. Larger animals were generally moved out of climate-controlled spaces into open-air enclosures. This can be seen in the Toledo Zoo and the Cincinnati Zoos primate exhibit. In both instances, animals were moved to holding areas during the winter or during bad weather. Climate control proved the most difficult group for research, and there were more unknowns in this category than in others.
As animal welfare began to shift into focus, building changes overall matched the trends for changes in knowledge about animal care. It can also be stated that all four historic zoos were extremely variable in making changes to enclosures responding to animal care standards in the second half of the twentieth century. Larger species were often favored for change over smaller species. The Philadelphia and Cincinnati Zoos, the two oldest in the study made changes in the 1950’s, 1960’s and 1970’s. The Toledo and Lincoln Park Zoos, the younger two, made changes in the 1980’s and 1990’s. This may demonstrate that the level of establishment and age of buildings could have been reasons for building change campaigns. Building changes were not always linear, and did not always fall into a prescribed category. Smaller animals were usually the first to receive flora and organic materials in their enclosures, however, and some enclosures had these materials incorporated at the time of their construction, like the Toledo Zoo Reptile House.

The incorporation of natural elements happened progressively over time. This can be seen in the Cincinnati Zoo’s Elephant House. Upon construction the exhibit included outdoor areas, which had dirt substrate. In a 1971 addition, a water feature was added so the elephants could wade in the water. In 2008, flora was incorporated in the exhibit permanently. This reveals that not all designers simply chose to incorporate naturalistic exhibits all at once, but many chose to do this over time. Cincinnati’s choices map on to the dates when Jon Coe was creating immersion exhibits at the Woodland Park Zoo in Seattle. Cincinnati may have been incorporating a water fixture in 1971 in response to this change in zoo exhibit design practice.
Zoo architecture in the twentieth century shifted from formally designed spaces to regionally specific ones. The use of formal Romantic or Classical styles was replaced with design that was meant to blend into the landscape of the zoo. These new buildings sometimes took the form of a region's vernacular traditions, like the Lincoln Park Zoo's African exhibit which features grassy hut structures. Often buildings were designed to blend into the exhibit space as a whole, like the Cincinnati Zoo's Tiger exhibit, where the viewing area is blended into the rockwork of the exhibit. However, it is important to note that changes in exhibit spaces did not always correlate with animal welfare. Changes to an exhibit did not always mean that animal welfare standards were improved. There were likely many changes made to exhibit spaces in the twentieth century that can be attributed to other reasons that were not studied in this work.

The rate of adoption of new standards is also difficult to attribute causation to. Assessing how long a zoo took to incorporate new exhibit spaces for animals based on research is studied in Chapter 5. A study of the rates for changes made to exhibit spaces based on overall trends and general development of better animal care standards cannot be done without further study into the processes and reasons for changes made to each individual zoo exhibit (master plans, finances, natural disasters, etc). In each case, evidence would need to exist for why each building change was made. Without this research, it is problematic to state that overall zoos were making timely changes to every single exhibit space based on new information about animal husbandry. However, the building itself and the overall trends of building design can still provide the information needed to analyze the options for continued use of zoo architecture.
Overall, it can be determined that there was no one building treatment that took place as a response to the changes in animal welfare standards, but an accumulation of many different changes over many years. Often times, the unknown rather than the known guided changes to animal spaces. The 1980’s and 1990’s saw the most changes to buildings, followed by the 2010’s and the 1970’s, then the 1950’s. Most agree that the 1960’s and 1970’s\textsuperscript{120} were the decades that zoos began to implement wide scale naturalistic changes to their animal enclosures. It can be determined here that for smaller urban zoos it was the 1980’s and 1990s. Many different treatments over many different years have caused zoos to look the way they do today. Smaller urban zoos were overwhelmingly turning to renovating existing structures to fit their needs, and engaging in different levels of historic preservation practice to do so.

\textsuperscript{120}See Vicki Croke, David Hancocks.
Throughout the twentieth century, the human animal relationship has changed significantly. This is reflected in the layered built environment of the Philadelphia Zoo, The Cincinnati Zoo, The Lincoln Park Zoo and the Toledo Zoo. Each zoo has changed and shaped its structures in some way to represent the best-known standards of animal care. Working with limited physical space and climate restrictions, mid sized urban zoos overwhelmingly turned to renovation projects to solve the concerns that new animal welfare standards and modernization presented in the decades post 1950. The natures of these changes were variable, with new materials containing more variation than spatial qualities. Overall, this thesis can determine that there is still a sizeable amount of extant fabric within zoos, and while new materials were incorporated frequently, many exhibits designs today still utilize similar spatial qualities as they did in the pre 1950 decades.

The table below shows the number of buildings constructed at the time of 1950 in comparison to the number of buildings that exist today. As evidenced, each zoo has a different level of preservation ethic.\(^\text{121}\) The numbers vary for each zoo, but overall represent the fact that there are still a proportionally larger number of extant historic buildings in zoos than demolished ones. These numbers can be compared with maps below which show the number of historic buildings in zoos proportional to all buildings. These maps demonstrate that while historic buildings may still be extant in mid-sized urban zoos, they range in their proportionality to overall building population. As such,

\(^\text{121}\) While these numbers may seem small, it should be mentioned that many buildings and exhibits were demolished and never rebuilt before 1950, excluding them from this study.
these buildings should be revered for their endurance through many decades of changes to animal welfare philosophy. They represent a cultural significance to the history of animal care and the history of each institution specifically.

**Table 19: Number of Historic Buildings at 1950 and Today**

<table>
<thead>
<tr>
<th>Zoo Name</th>
<th>The Philadelphia Zoo</th>
<th>The Cincinnati Zoo</th>
<th>The Lincoln Park Zoo</th>
<th>The Toledo Zoo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Animal Houses extant in 1950</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Number of Pre-1950 Animal Houses Extant Today</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>
Figure 32: The Toledo Zoo Today, Historic Buildings Highlighted
Figure 33: The Cincinnati Zoo Today, Historic Buildings Highlighted (Yellow)
Figure 34: Philadelphia Zoo Map, Historic Buildings Highlighted
Figure 35: Lincoln Park Zoo Historic Buildings Highlighted
As shown in Figures 32 - 35, The Toledo Zoo, the Lincoln Park Zoo and the Philadelphia Zoo have proportionally high historic building stock when compared to all buildings on the zoo grounds. Cincinnati has a proportionally low amount of historic building stock on their grounds. At each zoo, historic buildings represent less than half of the total number of buildings on the property. These figures, in addition to Table 19 are able to showcase that generally there is a proportionally low number of historic buildings still extant in mid-sized urban zoos, when compared to overall building population. However, the extant buildings today have undergone changes in the second half of the twentieth century that range in John Earl’s “Degrees of Violence” from “skin deep preservation” to “repairs and replacements”. As zoos continue to evolve and push into the future, it is important to explore uses for historic zoo buildings that transcend their suitability for housing animals.

The research in this thesis can be used to examine the role that these extant buildings could play in the future for mid sized urban zoos. The knowledge that many pre-1950’s zoo structures are still standing today may be a dilemma for designers. Increasingly, zoo designers are the ones faced with the question of what to do with outdated buildings that no longer represent the best standards for animal care. It is imperative that designers understand the opportunities historic zoo buildings can have in the zoo environment. Zoo architecture is culturally significant to both specific city or neighborhood communities and the zoo community overall. Historic buildings offer a historical perspective of the human animal experience throughout the twentieth century. When contrasted with new zoo exhibits, historic buildings have educational and cultural
value. They have prospects both within and outside the realm of animal lodging. Some of the opportunities for use are examined in the subsection “Historic Buildings in Zoos: Recommendations.”

**Zoos Today and in the Future**

The challenges that designers face today when tasked with outdated historic buildings in zoos is similar to those all stewards of the built environment face. The binary issue becomes either preserving a piece of heritage that represents a philosophy no longer in place, or modernizing and revolutionizing an institution. However, the pressure for zoos to update and modernize is rapidly becoming stronger. Many journalists, scholars and activists are asking society the question “are zoos ethical?” Author and assistant professor of history at St. Josephs university in Philadelphia tells NPR “there is a tension between the desire to see the animals one would never get to see naturally in the wild, and the feeling of pity for them as they are held in captivity.”

PETAs statement on zoos clearly says:

> Animals in zoos, pseudo-sanctuaries, traveling shows, and roadside displays are forced to spend their lives behind bars just to entertain the public…don’t pass a few hours at a place where animals will languish in misery long after you’ve gone home. Please don’t buy a ticket. Instead, explain to your children why your family does not support cruelty to animals.

As zoos are pushed into the future, the relics of their past become even more in danger of being demolished or eviscerated, removing all concept of their cultural value.

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Ecotourism is now the fastest growing facet of the tourism industry, today the largest industry in the world. Ecotourism can be defined as travel and tourism activities that promote conservation, sustainability and education with a low visitor impact. This type of tourism can present a direct threat to zoos, specifically those keeping animals in historic buildings. Today, as society becomes more aware of issues pertaining to wildlife conservation, many will begin to grapple with the issue of seeing an otherwise wild animal who is completely reliant on his/her human caregivers. In response, many zoos such as Disney’s Animal Kingdom have begun to move towards a built environment that mimics a wildlife safari, with large open tracts of land as opposed to staged exhibit spaces.

Studies prove that these animal viewing experiences warrant a more positive reaction than traditional zoo exhibits do. Further evidence suggests that traditional zoos are often perceived as unpleasant environments for animals. In one study, visitors were asked to rate concepts like “gracefulness,” “freedom,” “security,” “happiness,” “dignity,” and “naturalness” of animals in a fully natural, semi-natural (wildlife safari) and zoo environment. Animals were perceived as having the lowest quality of each concept in a zoo environment. As visitors and other animal rights groups continue to perceive traditional zoos as poor stewards of wildlife, historic buildings will be placed under a

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direct threat when zoos are looking to incorporate modern concepts like ecotourism.

Historic buildings often represent what zoos were and not what they are or will be. However, these buildings have possibilities that extend beyond housing animals, and these possibilities can align with a changing direction for zoos.

**Historic Building in Zoos: Recommendations**

Extant historic zoo buildings began as state of the art facilities that represented the best-known standards for animal care at the time. Today, they pose the unique problem of balancing preservation ideals and providing the highest quality of animal care standards. Sometimes, this can be legally conflicting as well as morally conflicting. For example, the Lion House at the Bronx Zoo, constructed in 1905 is a part of Astor Court Historic District, and the New York Landmarks Commission protects its façade. However, the zoo abandoned the building in 1972 after zoo industry standards began to change. The building sat abandoned until 2008 when the zoo chose to adaptively reuse the building to house another exhibit for small mammals. However, the building's protected status made it problematic for the removal of outdoor open-air cages. The zoo was able to compromise with the commission by preserving the original shape and features of the cages, while enclosing them to provide climate control and new flora and fauna.\(^{128}\)

Examples like this are evidence that historic preservation and animal welfare can coexist in the zoo environment. As stated by the Encyclopedia of the Worlds Zoos, preserving historic architecture is one major motive for renovation projects in zoos. As

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animal welfare standards continue to evolve, historic preservation may be devalued in the zoo environment. Recommending and undertaking alternative uses for historic zoo buildings can help address the needs of historic preservation and animal husbandry. Historic preservation laws do not have to impede zoo designers from making sensitive and appropriate building changes to better house animals. Contrarily, animal welfare standards need not force a zoo into making a decision to demolish or neglect a building. Animal welfare and historic architecture can coexist in a zoo, and do not have to conflict each other.

Figure 37: Bronx Zoo Lion House 1906 Postcard (Photo Courtesy Wildlife Conservation Society Archives)
One approach that no zoos in this study have taken but should be mentioned is the option to use zoo buildings as indoor viewing spaces for outdoor exhibits. Most zoo exhibits utilize some sort of indoor or sheltered viewing area for their exhibits. These viewing areas encourage zoo goers to stay and marvel at the animal for longer, and provide shelter from inclement weather. Historic buildings provide an excellent opportunity to be used as viewing areas because many zoos, like Lincoln Park, have simply added naturalistic enclosures onto the side of their original historic buildings. Adding viewing windows along one of the facades would give visitors the opportunity to see the animals outdoors while being protected and climate controlled indoors.
Yet another opportunity for zoos is utilizing preservation techniques in order to better tell the story of the increased conservation efforts of the last half of the twentieth century. This practice can serve as marketing material, or a way for zoo professionals to express to visitors: “look how far we’ve come.” Professor Jeffrey Hyson believes that zoos have a responsibility to zoo goers to address issues in the animal care community head on. Hyson argues:

The bad old zoo of bars and cages and bathroom tile design was, in some ways, less of a lie about what kind of an institution the zoo is. I think that's maybe a little harsh, but I think there is a need for zoos to really foreground the ambiguity of the institution, to actually say, 'Yes, we are sort of wild, but sort of artificial. We are sort of educational, but we're also entertaining.'

Older zoo goers may remember a visit to the zoo when they were children, and may remember seeing animals in traditional caged enclosures. Today, a new generation of younger zoo goers without this experience can become educated on the history of animal welfare and care through extant historic buildings. Zoos can interpret historic buildings with messages concerning the increased attention to animal welfare, habitat conservation and enrichment in the last half of the twentieth century.

The Toledo Zoo, for example, has used their historic Carnivora building to do this, indirectly. The structure was adaptively reused into a restaurant in 1993, after the zoo made the decision to move towards a zoogeographical organization of their animals. Lions were moved to the “Africa!” exhibit which showcased a replica of an African prairie habitat. Some changes to the building were made to convert it into a restaurant, including new floors, furniture and paint, as well as the addition of a kitchen and serving

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counter. However, most cages remained in their original location and were opened up to become a seating area. Here, the role of zoo goer and animal has been reversed. This provides a unique learning opportunity, where visitors can place themselves in the position of the zoo animal, and become educated on the history of animal welfare. It allows the zoo goer to not only see but also truly experience in a sensory way what it was like to be a zoo animal. This is a powerful mechanism to display the evolution of animal welfare, and is seemingly widely popular with visitors.
Figure 39: Toledo Zoo Carnivora Building (Photo courtesy of Toledo Zoo Twitter Account @toledozoo)
Another example of transforming a historic building to fit new uses can be seen in St. Louis’s original Elephant House. Built in 1917, the zoo had realized by 1950 that the building could no longer be used to house elephants. Zoo directors opted to build a new exhibit for pachyderms, and the building sat in a state of neglect for close to 60 years. In 2010, the building was adaptively reused to host events, travelling exhibits of both animals and art, and educational spaces for school groups. This reuse facilitates the preservation of the structure while still serving the purpose of a new function.

Reusing or renovating buildings shows visitors that a zoo is serious about sustainability and stewardship of the environment. Zoos can successfully combine their goals of conservation with the goals of historic preservation in this way. Author Sophie Townsend argues that zoos should be leaders in sustainable practices. Today, we understand that there is no greater impact on species extinction than habitat destruction. Conservation efforts, thus, should extend to environmental and ecological conservation and not only species conservation. Similarly, author Robert A. Young argues that historic preservation activities such as renovation or adaptive reuse are ecologically superior over demolition and new construction. Zoo professionals can use these two arguments to prove to zoo goers that they are actively engaging in sustainable building practices.

Mid sized urban zoos have a rich cultural heritage that is representative of how the human animal relationship has changed over the course of the nineteenth and twentieth century. Many in the zoo community have made choices to actively preserve their tangible history, and to see opportunities in structures that may represent a problematic period in their history. Designers who are able to work within the parameters of extant fabric will provide zoo professionals with a diverse layer of importance within their institutions. The establishment in this thesis of the amount of existing fabric already within zoos, and the nature of this fabric can facilitate further study on innovative uses for this fabric.

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APPENDICIES

Appendix A
### Raw Data of Historic Building Changes

**The Toledo Zoo**

<table>
<thead>
<tr>
<th>Building</th>
<th>Year</th>
<th>Timeline of Building Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lion House/Carnivora</strong></td>
<td>1907</td>
<td><strong>Construction (1907)</strong>&lt;br&gt;Materials: wood, stone, iron, spatial qualities: caged, open air and enclosed, unknown climate control</td>
</tr>
<tr>
<td></td>
<td>1928</td>
<td><strong>Demolition (1934)</strong>&lt;br&gt;<strong>New Construction (1928)</strong>&lt;br&gt;Materials: Iron, Concrete, stucco, stone, glass spatial qualities: caged, open air and enclosed areas, climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>New Construction (1989)</strong>&lt;br&gt;Materials: gunite, organic material (dirt, tree stumps [wood]), flora, water, steel wire spatial qualities: caged, open air, not climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Adaptive Reuse (1988)</strong>&lt;br&gt;Materials: glass, concrete, organic material (tree stumps [wood], dead leaves [flora]) spatial qualities: caged, enclosed, climate controlled</td>
</tr>
<tr>
<td>Elephant/The Lodge</td>
<td>1923</td>
<td><strong>Construction (1923)</strong>&lt;br&gt;Materials: Stucco, wood, iron, glass, stone, concrete, plaster&lt;br&gt;spatial qualities: caged, open air and enclosed, climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>New Construction (1989)</strong>&lt;br&gt;Materials: gunite, organic material (dirt, tree stumps [wood]), flora, water, steel wire&lt;br&gt;spatial qualities: caged, open air, not climate controlled</td>
</tr>
<tr>
<td>Aviary</td>
<td>1930</td>
<td><strong>Construction (1930)</strong>&lt;br&gt;Materials: glass, structural glass block, brick, flora</td>
</tr>
<tr>
<td>Building</td>
<td>Year</td>
<td>Construction</td>
</tr>
<tr>
<td>-----------------------</td>
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<td>----------------</td>
</tr>
<tr>
<td>Aquarium</td>
<td>1939</td>
<td>Construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1939)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renovation</td>
</tr>
<tr>
<td>Reptile House</td>
<td>1934</td>
<td>Construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1934)</td>
</tr>
<tr>
<td>Giraffe House</td>
<td>1928</td>
<td>Construction</td>
</tr>
<tr>
<td>(Herbivora Building)</td>
<td></td>
<td>(1928)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demolition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1984)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New Construction</td>
</tr>
<tr>
<td>Primate House</td>
<td>1929</td>
<td>Construction</td>
</tr>
<tr>
<td>(1929)</td>
<td></td>
<td>(1929)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renovation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1998)</td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
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</table>
*A new building was constructed for large apes in 1979*
The Cincinnati Zoo

<table>
<thead>
<tr>
<th>Building</th>
<th>Year</th>
<th>Timeline of Building Treatment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Construction (1875)</strong></td>
</tr>
<tr>
<td>Monkey House/</td>
<td>1875</td>
<td>Materials: Stone, plaster, iron</td>
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<tr>
<td>/Reptile House</td>
<td></td>
<td>Spatial Qualities: caged, enclosed and open air, unknown climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Adaptive Reuse (1951)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: glass, flora</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged (glass), enclosed, climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Demolition (1974)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>New Construction (1978)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: plastic, concrete, flora, organic material (dirt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: Caged, open air and enclosed, no climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation/Addition (2008)</strong></td>
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<tr>
<td></td>
<td></td>
<td>Materials: water, concrete, flora, organic material (tree stumps [wood])</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: not caged, open air, no climate control</td>
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<td></td>
<td><strong>Construction (1936)</strong></td>
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<td>Reptile House</td>
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<td></td>
<td><strong>Construction (1875)</strong></td>
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<td></td>
<td></td>
<td>Materials: Wood, iron, stone</td>
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<td></td>
<td></td>
<td>Spatial Qualities: caged, enclosed and open air, unknown climate control</td>
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<td><strong>Adaptive Reuse (1953)</strong></td>
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<td></td>
<td>Materials: Tile, concrete</td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td><strong>Renovation (1982)</strong></td>
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<td></td>
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<td></td>
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<td>Spatial Qualities: not caged, open air, no climate control</td>
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</tr>
<tr>
<td>---------------------------------------------</td>
<td>-----------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Adaptive Reuse (1996)</strong></td>
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<td></td>
</tr>
<tr>
<td>Materials: Wood, concrete, plastic, glass, flora</td>
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<td>Spatial Qualities: caged, enclosed, climate controlled</td>
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<tr>
<td><strong>Renovation (2017: Currently Under Renovation)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials: electronic lighting, metal</td>
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<td></td>
</tr>
<tr>
<td>Spatial Qualities: caged, enclosed, climate controlled</td>
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<table>
<thead>
<tr>
<th>Carnivora</th>
<th>1875</th>
<th><strong>Construction (1875)</strong></th>
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<td></td>
<td></td>
<td>Materials: Iron, plaster, glass, wood, stone, brick</td>
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<td>Materials: gunite/concrete, organic material (dirt, water), flora</td>
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<td></td>
<td><strong>Demolition/New Construction (1952/1950)</strong></td>
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<td>Materials: glass, flora, fauna, organic materials (dirt), gunite, water</td>
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<td><strong>Renovation/Addition (1978)</strong></td>
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<td></td>
<td>Materials: metal</td>
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<td></td>
<td></td>
<td><strong>Renovation (1985)</strong></td>
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<td></td>
<td></td>
<td>Materials: glass, organic materials (tree stumps [wood]), gunite, flora, chemical sealants, water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged (glass), enclosed, climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Adaptive Reuse of 1950 building (2011)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: Glass, flora, organic material (dirt, tree Stumps [wood]), fauna</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: Caged (glass), enclosed, climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation (2011) (Tigers)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: flora, gunite, wood, water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged, open air, not climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation (2013) (Lions)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: Flora, gunite</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged, open air, not climate controlled</td>
</tr>
</tbody>
</table>
## The Philadelphia Zoo

<table>
<thead>
<tr>
<th>Building</th>
<th>Year</th>
<th>Timeline of Building Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Building Year</td>
</tr>
<tr>
<td>Monkey House</td>
<td>1874</td>
<td>Construction (1874)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demolition (1898)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New Construction (1896)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: iron, concrete, organic material (dirt), wood, mesh wire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged, enclosed and open air, unknown climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renovation (1950)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: tile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged, enclosed, unknown climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renovation/Addition (1985)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Period of Neglect of 1898 Monkey House (1950 – 1984)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demolition of 1898 Monkey House (1984)</td>
</tr>
<tr>
<td>Lion House</td>
<td>1873</td>
<td>Construction (1874)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: brick, wood, iron</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: Caged, enclosed, not climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New Construction (1951)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: iron, concrete, tile, organic material (dirt), water, rocks, flora</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged and not caged, enclosed and open air, unknown climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Period of Neglect of 1873 Lion House (1951 – 1965)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demolition of 1873 Lion House (1965)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adaptive Reuse (2006)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: gunite, flora, glass, plastic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged (glass) and not caged, open air, climate controlled and not climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renovation/Addition (2014)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: Steel (beams, wire)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged, open air, not climate controlled</td>
</tr>
<tr>
<td>Bird House</td>
<td>1916</td>
<td>Construction (1916)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renovation (1969)</td>
</tr>
<tr>
<td>Building</td>
<td>Construction Dates</td>
<td>Details</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Reptile House       | 1874 – 1876        | Construction (1874)  
Renovation (1984)  
Renovation (2009)  
Materials: flora, wood, concrete  
Spatial Qualities: not caged, enclosed, climate controlled |
|                     |                    | Construction (1950’s – 1960’s)  
New Construction (1971) |
| Small Mammal House  | By 1889            | Construction (by 1889)  
Demolition (?)  
New Construction (1965) |
| Antelope House      | 1877               | Construction (1877)  
Materials: wood, organic material (dirt)  
Spatial Qualities: Unknown, unknown, Not climate controlled  
Adaptive Reuse (1987)  
Materials: Metal, wood, concrete, plastic, flora, dirt  
Spatial Qualities: Caged, enclosed and open air, climate controlled and not climate controlled |
|                      | By 1889            | Construction (by 1889)  
Materials: brick, iron, wood  
Spatial Qualities: Caged, enclosed, not climate controlled  
Demolition (1940)  
New Construction (1940)  
Materials: iron, concrete, glass, organic material (dirt), stone  
Spatial Qualities: caged, enclosed and open air, unknown climate control  
Adaptive Reuse – Children’s Zoo (2013)  
Materials: Plastic, concrete, steel, wood, glass  
Spatial Qualities: caged, open air and enclosed, unknown climate control |
Materials: iron, tile  
Spatial Qualities: caged, enclosed, unknown climate control  
Demolition (1985)  
New Construction (1985)  
Materials: organic materials (dirt), flora, water  
Spatial Qualities: Not caged, open air, no climate control |
## Lincoln Park Zoo

<table>
<thead>
<tr>
<th>Building</th>
<th>Year</th>
<th>Timeline of Building Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal House</td>
<td>1888</td>
<td><strong>Construction (1888)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: iron, wood, brick, organic material (dirt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged and not caged, enclosed and open air, unknown climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation (?)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Demolition (1999)</strong></td>
</tr>
<tr>
<td>Lion House</td>
<td>1912</td>
<td><strong>Construction (1912)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: Iron, brick (green glazed), organic material (tree stumps [wood]), glass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged, enclosed and open air, climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation &amp; Addition (1971)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: glass, water, gunite, organic material (dirt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: caged (glass) and not caged, enclosed and open air, unknown climate control</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation (1991)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: Stainless steel (wire), organic material (tree, dirt), flora, gunite,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: Caged and not caged, enclosed and not enclosed, unknown climate control</td>
</tr>
<tr>
<td>Aviary</td>
<td>1904</td>
<td><strong>Construction (1904)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: iron</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: ***</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation (1963)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: wood, tile, concrete, glass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: Caged, enclosed, not climate controlled</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Renovation (1991)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: flora, organic material (dirt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial Qualities: not caged, enclosed, climate controlled</td>
</tr>
<tr>
<td>Small Mammal</td>
<td>1927</td>
<td><strong>Construction (1927)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials: Iron, concrete, brick</td>
</tr>
<tr>
<td>Building Name</td>
<td>Year</td>
<td>Type</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------</td>
<td>---------------------------</td>
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<tr>
<td>House/Primate House</td>
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<td>Renovation/ Addition (1971)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adaptive Reuse (1992)</td>
</tr>
<tr>
<td>Large Mammal Building</td>
<td>Construction (?)</td>
<td>gunite, organic material (dirt, tree stumps [wood]), water, flora, fauna, wood</td>
</tr>
<tr>
<td>Reptile House</td>
<td>1922</td>
<td>Construction (1922)</td>
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<tr>
<td></td>
<td></td>
<td>Adaptive Reuse (1998)</td>
</tr>
</tbody>
</table>
Appendix B

Suggested Research on Felid Care in Captivity

In CSE (Counsel of Science Editors) Format


Appendix C

Pie Charts
Table 2: Toledo Zoo Building Treatments

Building Treatments (Toledo Zoo)

- Renovation
- New Construction
- Demolition
- Adaptive Reuse
- Preservation
- Neglect
### Table 4: Cincinnati Zoo Building Treatments

<table>
<thead>
<tr>
<th>Building Treatments</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Renovation</td>
<td>80%</td>
</tr>
<tr>
<td>Adaptive Reuse</td>
<td>10%</td>
</tr>
<tr>
<td>New Construction</td>
<td>5%</td>
</tr>
<tr>
<td>Demolition</td>
<td>2%</td>
</tr>
<tr>
<td>Preservation</td>
<td>1%</td>
</tr>
<tr>
<td>Neglect</td>
<td>0%</td>
</tr>
</tbody>
</table>

![Pie chart showing the distribution of building treatments at the Cincinnati Zoo.](chart.png)
Table 5: Philadelphia Zoo Building Treatments
Table 6: Lincoln Park Zoo Building Treatments
Table 7: Post-1950 Building Treatments (All)
Table 8: Pre 1950 Building Materials

Pre 1950 Materials

- Iron
- Glass
- Wood
- Concrete
- Brick
- Stone
- Stucco/Plaster
- Flora
- Dirt
- Metal
- Tile

Table 9: Post 1950 Building Materials

Post 1950s Materials

- Flora
- Gunite
- Dirt
- Wood
- Concrete
- Water
- Glass
- Tile
- Plastic
- Steel Wire
- Stone
- Steel
- Iron
Pre 1950 Spatial Qualities (Caging)

Table 10: Pre 1950 Spatial Qualities (Caging)

Post 1950 Spatial Qualities (Caging)

Table 11: Post 1950 Spatial Qualities (Caging)
Table 12: Pre 1950 Spatial Qualities (Enclosure)

Table 13: Post 1950 Spatial Qualities (Enclosure)
Pre 1950 Spatial Qualities (Climate Control)

Table 14: Pre 1950 Spatial Qualities (Climate Control)

Post 1950 Spatial Qualities (Climate Control)

Table 15: Post 1950 Spatial Qualities (Climate Control)
Appendix D

Other Figures and Tables

Figure 1: Spectrum of Building Treatments
Figure 9: Timeline for Major Zoo Animal Welfare Standard Developments

- **1874** Philadelphia Zoo is the first zoo in America
- **1902** First zoo animal research lab established at the Philadelphia Zoo
- **1933 – 1937** New Deal funding allocated for zoo improvements
- **1940 – 1950** The Disinfectant Era
  - **1950** Heine Hediger’s *Wild Animals in Captivity* is published
- **1963** “Wild Kingdom” first airs on NBC
- **1966** Animal Welfare Act regulates the treatment of animals in research and exhibition
- **1968 - 1974** Animal Rights publications expose poor zoo conditions
- **1969 - 1986** Jane Goodall and George Schaller publish significant primate and felid research
- **1971** AZA (Association of Zoos and Aquariums) is established
- **1973** Endangered Species Act is passed
- **1975 - 1977** Seattle’s Woodland Park Zoo utilizes immersion exhibits for the first time
- **1977 – 1979** Information on the dangers of inbreeding animals is published
- **1980** PETA (People for the Ethical Treatment of Animals) is founded
- **1981** AZA Species Survival Plans are written to provide species specific guidelines for animal care
- **1990** Environmental enrichment introduced as an important animal husbandry practice
- **1993** New York Zoological Society becomes the Wildlife Conservation Society
Figure 41: Timeline for Major Felid Care Standard Development

- **1907** Carl Hagenbeck introduces “cat grottos” at the Tierpark Hagenbeck
- **1950** Heine Hediger’s *Wild Animals in Captivity* is published
- **1966** Animal Welfare Act regulates the treatment of animals in research and exhibition
- **1972** George Schaller publishes *The Serengeti Lion*, the first modern author to live and study Serengeti lions in the wild
- **1981** Species Survival Plans established by the AZA
- **1986** Jon Coes African Savannah exhibit is unveiled
- **1992** Big Cat Rescue is established to shelter, rehabilitate and research big cats in captivity
- **1992** The Shape of Enrichment Journal publishes first edition
- **1992** African Lion Species Survival Plan created
- **1994** AZA Husbandry Manual for Captive Tigers created
- **1997** Research is published demonstrating that big cats likely pace when hungry
- **2003** Research suggests that animal welfare (health, breeding difficulties, psychological state) is decreased for wide-ranging carnivores in captivity due to the restraint on natural behavior
- **2007** Research is published tying environmental conditions to pacing and stereotypic behavior
Table 1: Number of Felid Building Changes Per Decade

<table>
<thead>
<tr>
<th>Decade</th>
<th>Number of Felid Building Changes Per Decade</th>
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</thead>
<tbody>
<tr>
<td>1950's</td>
<td>3</td>
</tr>
<tr>
<td>1960's</td>
<td>2</td>
</tr>
<tr>
<td>1970's</td>
<td>3</td>
</tr>
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<td>1980's</td>
<td>2</td>
</tr>
<tr>
<td>1990's</td>
<td>2</td>
</tr>
<tr>
<td>2000's</td>
<td>2</td>
</tr>
<tr>
<td>2010's</td>
<td>5</td>
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Table 3: Toledo Zoo Building Changes Per Decade

![Graph showing Toledo Zoo Building Changes Per Decade]
### Table 9: Lincoln Park Zoo Building Changes Per Decade

![Bar chart showing building changes per decade.]

### Table 16: Number of Historic Buildings at 1950 and Today

<table>
<thead>
<tr>
<th>Zoo Name</th>
<th>The Philadelphia Zoo</th>
<th>The Cincinnati Zoo</th>
<th>The Lincoln Park Zoo</th>
<th>The Toledo Zoo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Animal Houses extant in 1950</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Number of Pre-1950 Animal Houses Extant Today</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>
Appendix E

Maps
Figure 26: The Toledo Zoo, Toledo Ohio (Photo from Google Maps)
Figure 28: The Cincinnati Zoo, Cincinnati Ohio (Photo from Google Maps)
Figure 29: The Philadelphia Zoo, Philadelphia Pennsylvania (Photo From Google Maps)
Figure 31: The Lincoln Park Zoo, Chicago Illinois (Photo from Google Maps)
Figure 32: The Toledo Zoo Today, Historic Buildings Highlighted
Figure 33: The Cincinnati Zoo Today, Historic Buildings Highlighted (Yellow)
Figure 34: Philadelphia Zoo Map, Historic Buildings Highlighted
Figure 35: Lincoln Park Zoo Historic Buildings Highlighted
References


https://www.flickr.com/photos/jpellgen/9775766356/in/photolist-fTRmKN-bjwtFy-q69e7-P5DLN-fTQd9X-fTQkpj-4PSW68-fTRFkF-P5Edd-fTRcyE-6uokiX-4PXbJw-96Yv3L.


