INTEGRATING EXPERIENTIAL LEARNING AND LANDSCAPE ARCHITECTURE TO FACILITATE ENGAGEMENT AND AWARENESS OF WASTE LANDSCAPES

by

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(Under the Direction of Douglas Pardue)

ABSTRACT

This thesis examines the potential role that landscape architects can play in increasing awareness of waste practices from experiential learning perspectives. My research question asks, *how can landscape architecture facilitate experiential learning in waste landscapes?* Facing the great waste challenges around urban areas, people start to realize that waste has become an inevitable part of our lives. For the purpose of increasing understanding of waste and engagement in waste landscapes, landscape architecture design is applied to create an integrated design framework with experiential learning. Following case studies and the literature review, a discussion about the availability of conceptual design approaches will take place.

INDEX WORDS: Waste, Waste landscape, Landscape architecture, Experiential learning, Experiential learning space, Landscape engagement

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DEDICATION

I dedicated my thesis to my parents, who give incredible love and support all the way of my life, and many friends who have constantly encouraged me throughout this process.

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CHAPTER 1

INTRODUCTION

"If you want to change attitudes you don't begin by telling people something. You begin by creating a strong experience of it." - Jon Charles Coe, FASLA

The course project in which I participated, building the outdoor learning classroom at the Athens-Clarke County Landfill, has stimulated my interest and thought about the relationship between waste, education and landscape architecture design. Waste issues are not a new challenge. Throughout our history, they have reflected economic, social and environmental problems (Engler 2004). After many years of effort, along with advances in technology and improvements in human consciousness, however, fulfilling all the needs of society's total waste issues remains a challenge. Although problems in waste management can be attributed to many specific factors, such as public policies and knowledge, it is also significant to underline the role of humans: their attitudes, their wasting behaviors, and their interaction with waste. Waste management cannot be separated from public awareness and participation because they are both crucial to its understanding. The growing field of waste landscape design provides opportunities for professionals to be involved in human-environment relations, thus, enhancing the awareness of waste issues. In particular, from an experiential landscape perspective, waste awareness can be integrated into human behavioral and physical functions within the spatial and material world.

1.1 Background

Among global environmental issues, waste, especially municipal solid waste, has an great impact on the environment, the economy, and human health. The UN Environment Programme has pointed out that, “Humans are consuming resources and producing waste at a greater scale than ever before and per capita consumption levels are projected to increase with continued development” (UNEP 2009). Being a country with a rapacious and resource-intensive consumption-based lifestyle, the United States is particularly concerned with waste problems (Villoria, Kara, & Georgoulias 2015). Many interventions, including policies, management, and engineering approaches, have been applied to reduce waste and its associated problems, however, the amount of municipal waste generation remains increasing (OECD 2008, EPA 2015). The U.S. Congress has found that the primary factor influencing municipal solid waste generation involves social and cultural phenomena tied to social customs and personal preferences and lifestyles (U.S. Congress 1989). In general, waste is the result of human activities and the product of consumption-based lifestyle (Hoornweg & Bhada-Tata 2012). Therefore, developing dynamic and effective educational strategies to shape the public’s personal understanding of waste and waste practice behavior is necessary to respond to such a complex issue.

1.2 Problems

Admittedly, the public’s awareness of challenges related to waste issues has increased after decades of improvement in knowledge delivery, such as school education, on-line classes, and distribution of learning materials. However, even though the public is concerned with waste issues as an environment challenge, the public does not fully understand waste and the impact of their habits on waste generation (The Strategy Unit Cabinet Office 2002). Previous research in environmental attitudes and waste management behavior suggests that the role of consumption

patterns in solid waste generation has not been well recognized by the public (Davies 2005). More than that, the invisible waste management process has weakened public apprehension of waste as an urgent problem. Actually, most waste management and technology improvements are out of sight, since few people are afforded the chance to examine what happens on waste sites (Villoria, Kara, & Georgoulias 2015).

Even worse, because the speed of the waste process causes negligence of waste, the more efficient a waste process is, the more people tend to waste (Simmons 2016). This intentional separation from waste, whether in the form of physical distances or mental boundaries, prevents the public from having an ordinary connection with waste. It seems that the public needs a more participatory and adaptive learning strategy to understand the importance of inappropriate perceptions and practices related to waste that may carry a definite risk to public health.

The potential to apply an experience-based approach to address waste issues by inviting members of the public to explore their own impact on the environment has been widely discussed in literature and research (Dowell 2006). Experience learning approaches environmental issues by emphasizing the significant roles humans play in them. When people recognize an issue relevant to their lives in an experiential setting, they are more inclined to learn and change their behavior (Myers & Roberts 2004). Many studies have suggested that a considerable increase in environmental knowledge and willingness to take action following participation in outdoor experience-based learning (Palmberg & Kuru 2000, Powell 2002). Moreover, some research has found that experiential-based learning contributes to positive responses to environmental and lifestyle changes among subjects (Kirk & Thomas 2003). In particular, field experience can effectively motivate the public to participate in issues related to the environment (Smith 2007). Touching the “real waste world” helps the public see the

interdependence of social, cultural and environmental issues, and leads to increased dedication to environmental protection.

Outside of common learning spaces such as schools, waste sites provide a space that is unique and specific in which individuals can explore their own experiences with actual waste processes. This unconventional learning space illustrates the treatment and end results of human consumption.

Under the premise of safety and health, landscape architects have been involved in waste issues for many years, from waste disposal transformation and waste reuse to abandoned waste infrastructure transition. Most designs, after covering the nature of waste, are primarily concerned with ecological and recreational functions.

However, few existing designs have addressed education and interaction with waste as the main purpose of waste site transformation and design. Typical landscape architecture designs have not fully implemented education about and interpretation of waste issues in the waste sites. Developing experiential education strategies to address waste issues will become even more important in the future, particularly for the younger generation. As Engler said, "A dump can be held as a mirror to our culture. It also has a unique capacity to transform social consciousness and condition" (Engler 2004).

In this thesis, waste landscapes can be defined as places associated with and affected by actual waste and waste processing status. It is assumed that the waste landscape consists of four inner connections/aspects: waste, landscape, interaction and design (see Figure 1). With regards to waste processing status, waste landscapes are categorized depending on whether they are active (recycling/transfer center), dormant (closed waste facilities), reused waste places, recycled materials or mixed use.

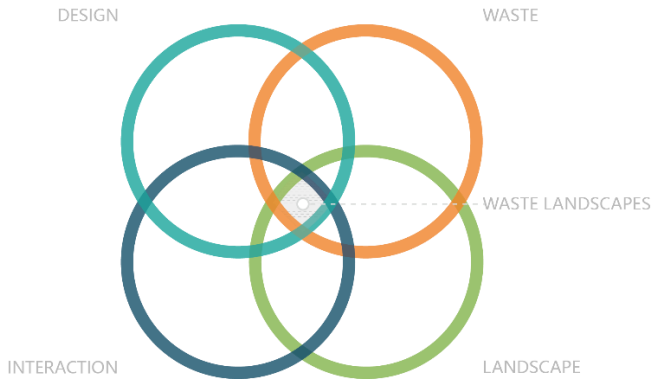


Figure 1: Inner relationship of concept of waste landscapes

1.3 Purpose and Significance

This thesis began with the desire to explore how landscape architecture can help people understand the impact of waste, opportunities related to it, and the various ways of transforming it. Then, the aim of this thesis is to advocate for people to be more mindful and less wasteful of waste issues, and be more open to new waste-related ideas by integrating the landscape with experiential learning approaches at waste sites. Hence, a conceptual design guideline has been crafted to improve waste sites and support experience-oriented waste places in order to increase awareness of the impact of waste practice on the environment through experience and learning. First of all, a literature review is conducted to examine the features of waste and the landscape. This thesis will also trace the evolution of human interaction with waste and evaluate current landscape implementation approaches to this interconnection. Furthermore, the concept of experience-based learning approaches is introduced and discussed to ascertain how they can be applied in waste issues with the help of landscape design.

Through my research, I want to understand how experience-based design approaches engage the public and encourage interaction with waste sites to address the public's own impact on the environment. Referring to James Corner in *Drawing And Making In Landscape Medium*,

“As a medium of symbolic representation, landscape architecture has provided humans with some of the most sacred and powerful places of embodied meaning" (Corner, 2014).

1.4 Delimitation and Limitation

Delimitation

Since waste has so many definitions, this study mainly focuses on urban household waste rather than hazardous waste, radiant waste or other dangerous waste. Discussions of the concept of waste are primarily draw upon the words of landscape architects, architects, urban planners and artists. Because this research intends to explore waste sites that have direct contact with actual waste, brownfields are not included in the scope of this thesis. Issues of land ownership, funding, and facilities management condition are not included in the present discussion. However, they are still significant segments for experiencing landscape in waste sites.

Although permitting and regulations affect the designs for waste landscapes, they are not the focus of this thesis and vary across countries and nations. To increase effective interactions with waste, this research only explores the design approaches that can be used for general design strategies and modified per specific regulations.

Limitations

One limitation is updating methods of waste detection. Current levels of technology and science limit our understanding of waste. As new waste treatments are constantly developed,, some design guidelines may be incomplete and outdated. Another primary limitation is the effect of integrated approaches to experiential learning and landscape architecture in waste landscapes. The assessment of increasing awareness at waste landscapes needs extensive data support. This may require long-term monitoring. Thus, this study’s design guidelines may vary based on each site's specific geographic and social conditions.

1.5 Research question

Thus, the primary research question can be stated as:

How can landscape architecture facilitate experiential learning in waste landscapes?

Meanwhile, the research questions can be divided into five sub-questions.

Sub-questions:

1. What is waste from the landscape architect's perspective?

2. What are the histories and roles of landscape architecture with respect to engagement with the waste landscape?

3. What are the challenges, opportunities and design strategies that landscape architecture can address in a waste landscape?

4. How can experiential learning approaches help facilitate interactions with waste?

5. What are the challenges of applying experiential learning to promote interaction with waste at waste sites?

6. How have landscape designers and other designers used experiential learning to engage with waste?

1.6 Methodology

To answer these questions, multiple research strategies can be applied: descriptive strategies, classification, and evaluation are used to explore the application of landscape as the main approach to address landscape design with experiential learning for waste.

The main methods of this research include (see Figure 2) :

Literature review

Case studies

Finding and discussion

Conceptual design approaches

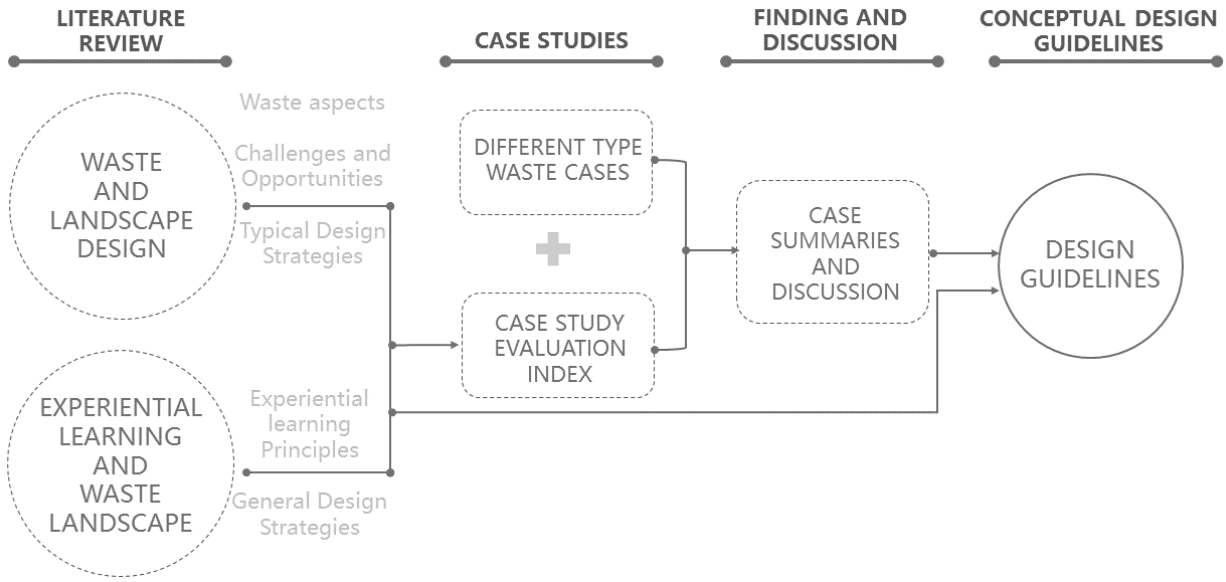


Figure 2: Thesis Methodology

First, using a descriptive research strategy, an extensive literature review was taken to ascertain the meaning and perceptions of waste; also discussed is the evolution of landscape design's efforts to engage the public. Moreover, information related to waste landscape approaches was collected through previous studies and from other sources. The experiential learning related to waste landscape is also discussed by literature review.

Secondly, the case studies explores the common or distinct design approaches of current landscape practices related to waste. Also, case studies can test the general design strategies created by former discussion.

The conceptual design approaches provide suggestions for a waste landscape to support multiple event modes. Site investigation and analysis will help to identify specific problems and design opportunities. The design will be evaluated for future waste landscape renovations to emphasize interactions with waste. Recommendations and suggestions for future design were developed.

1.7 Thesis Structure

Based on the scope of the study, this thesis is divided into six chapters.

Chapter 2 defines the concept of waste and describes the evolution of waste and its role within a landscape. There are discussions of challenges, opportunities and design strategies for f waste landscapes.

Chapter 3 defines experiential learning and identifies its main principles and methods. A discussion section suggests how experiential learning can be applied to engage people with waste issues.

Chapter 4 conducts several case studies of typical types of waste landscapes. This is to explore approaches that integrate experiential learning and landscape architecture to engage the people with waste landscapes. The lessons learned from case studies will be also addressed.

Chapter 5 generates conceptual design approaches based on the previous discussion of experiential learning and waste landscape practice.

Chapter 6 concludes this thesis and contains implications for the meaning of this research, and points to future prospects.

CHAPTER 2

WASTE AND LANDSCAPE ARCHITECTURE DESIGN

To better understand how waste is related to and affects people's lives, and what role landscape architecture can play in interactions with waste, it is crucial to examine the main approaches by which current landscape design is applied to interaction with waste. Thus, this chapter mainly discusses the relationship among waste, landscape and design (see Figure 3). First, there is a literature review to examine the concept and characteristics of waste, as well as human perceptions from the landscape architect's perspective. Secondly, waste landscape evolution is accompanied by a history of people's interaction with waste. This chapter will then summarize the typical landscape design approaches used in interactions with waste. Moreover, the challenges and opportunities that landscape architecture may encounter are also described.

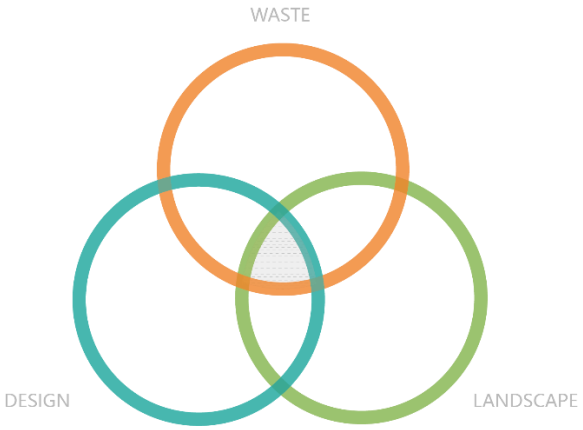


Figure 3: Chapter 2 discusses the relationship among waste, landscape and design

2.1 What is waste?

Waste is a complex topic and is usually considered a marginal theme in landscape studies. Its unique characteristics intrigued many landscape architects and planners and motivated them to address waste issues. Their discussion has led to many social and cultural inquiries into waste

concepts, the cultural role of waste, and possible solutions to coexisting with waste. Even though most scholars did not arrive at definitive answers to their questions, the understanding of waste cannot be separated from this growing body of knowledge and long-term education.

In his book, unfinished at the author's death in 1984, *Wasting Away*, planner and philosopher Kevin Lynch developed a longer view about waste from a sociocultural perspective. He believes that wasting is an indispensable process, "a necessary part of life," that includes the decline and decay of all materials and objects (Lynch & Southworth 1990). Waste reminds people of decomposition, degradation and the end of a cycle. Lynch defines waste as:

"What is worthless or unused for human purpose. It is a lessening of something without an apparently useful result; it is loss and abandonment, decline, separation, and death. It is the spent and valueless material left after some act of production or consumption, but can also refer to any used thing: garbage, trash, litter, junk, impunity, and dirt. As we have seen, there are waste things, waste lands, waste time, and wasted lives."

His concept of waste is quite broad, and includes a variety of social and cultural categories that are affected by essential elements such as time and space (Neuman 1992). Lynch recognizes that waste is usually linked to negative words by cultural transmission while waste is valuable to certain other groups, such as children and waste picker. This aspect may cause a fear and reluctance to know the real function of waste. But the more important question is how people perceive and think of waste. Because its negative connotations are deeply implanted in our mind, "our discomfort with wasting is the creature of our minds as much as a result of objective dangers in the process" (Lynch & Southworth 1990). He advocates people to change their minds and rethink waste issues instead of remaining ignorant of actual waste.

As a landscape architect and professor, Mira Engler's research partially continues Lynch's view and concentrates on the evolution of the waste process. She also emphasized the influence of cultural and historic contexts on the relationship between people and urban waste infrastructures. In accordance with the interpretation of waste from anthropologist Mary Douglas, the pursuit of hygiene and respect for tradition has formed some of the lasting perceptions and cultural taboos related to waste, namely that it is a substance characterized by a loss of functionality, and formlessness, and that it is emblematic of disorder, impurity, and death (Engler 2004, Douglas 1966). Hygiene and health considerations keep the public at a distance from waste. In the social context, waste seems to conflict with a civilization that advocates stability and order (Douglas 1966). However, despite being marginal and dirty, waste need not be merely defined as residue materials and objects that are no longer usable, functional and wanted by people (Engler 2004). Engler disagrees with the conventional concept that waste is a problem and a disturbance that needs "fix." Her book, *Designing America's Waste Landscapes*, identifies waste as a "cultural mirror" that reflects and expresses how people think about social issues and waste places that are closely linked to our daily lives (Engler 2004).

Under the premise of safety and health, Engler also explores the possibility of other purposes of waste. Environmental planners, artists and landscape designers are all involved in finding the cultural value of these marginal landscapes. Engler believes that design approaches could take a positive approach to current waste challenges even though some inherent idiosyncrasies and shortcomings of waste exist. The ultimate goal is to shorten the distance between people and waste. The result of this would be a greater awareness among people of the critical problems related to and solutions for waste. Engler summarized the ultimate goal of this

effort thus, “Designing waste landscapes should therefore become a potent act of recover and illumination” (Engler 2004).

The landscape architect and scholar Alan Berger has a larger vision of the physical waste landscape in urban planning. He introduced the concept of the *drosscape*, “the creation of a new condition in which vast, wasted, or wasteful land surfaces are modeled in accordance with new programs or new sets of values that remove or replace real or perceived wasteful aspects of geographical space (i.e., redevelopment, toxic waste removal, tax revenues, etc.)” (Berger 2007). This concept advocates a holistic perspective of urban planning. Berger is primarily concerned with the transformed waste landscape. He classifies waste landscapes into several categories, including the congregation of actual waste (municipal solid waste), wasted places (abandoned and contaminated place) and wasteful places (large parking lots) (Berger 2007). He uses aerial pictures as reference points to the perceptions of the urban waste landscape.

On a more practical level, the Harvard University professors and architects Leire Asensio Villoria, Hanif Kara, and Andreas Georgouliasare examine the relationship between architecture and waste management, especially waste infrastructures. They have noticed that there is a huge gap between the real status of waste development and the public awareness of it because few people are allowed to explore what happens at waste infrastructure sites (Villoria, Kara, & Georgoulias 2015). More than that, the interdisciplinary challenges also include poor building design , limited connections to the surroundings, and rare public engagement. However, they believe this is an opportunity to transform the facilities to create healthier communities with “innovative programming and welcoming and transparent architecture” (Villoria, Kara, & Georgoulias 2015).

In his master's thesis, Princeton University researcher and architect Curt Cambetta discussed whether waste belongs to the public. He maintains that waste, in the current cultural context, is a mostly private domain mixed with moral and technical features. Waste is an immutable presence in our lives, however, "waste remains an open secret, a process that society participates in but rarely acknowledges" (Cambetta 2009). Artistic and architectural approaches provide a way to examine waste more closely. Cambetta also initiates a program named *Producing waste Producing space* to explore the relationship between waste generation and urban space development.

In contrast, the Italian architect and scholar Sara Marini supports the neutral nature of waste. It is art and scientific research that alleviate the dark side of the waste process. To regard waste as an opportunity is better than to see it as a problem (Marini 2009).

According to the perspectives of these scholars and designers, a diagram of concepts of waste (see Figure 4) can be generated to explore their internal connections. Our knowledge level affects how we perceive waste in its cultural and social context. Design approaches aim to decrease its dangerous physical effects and find the value of waste.

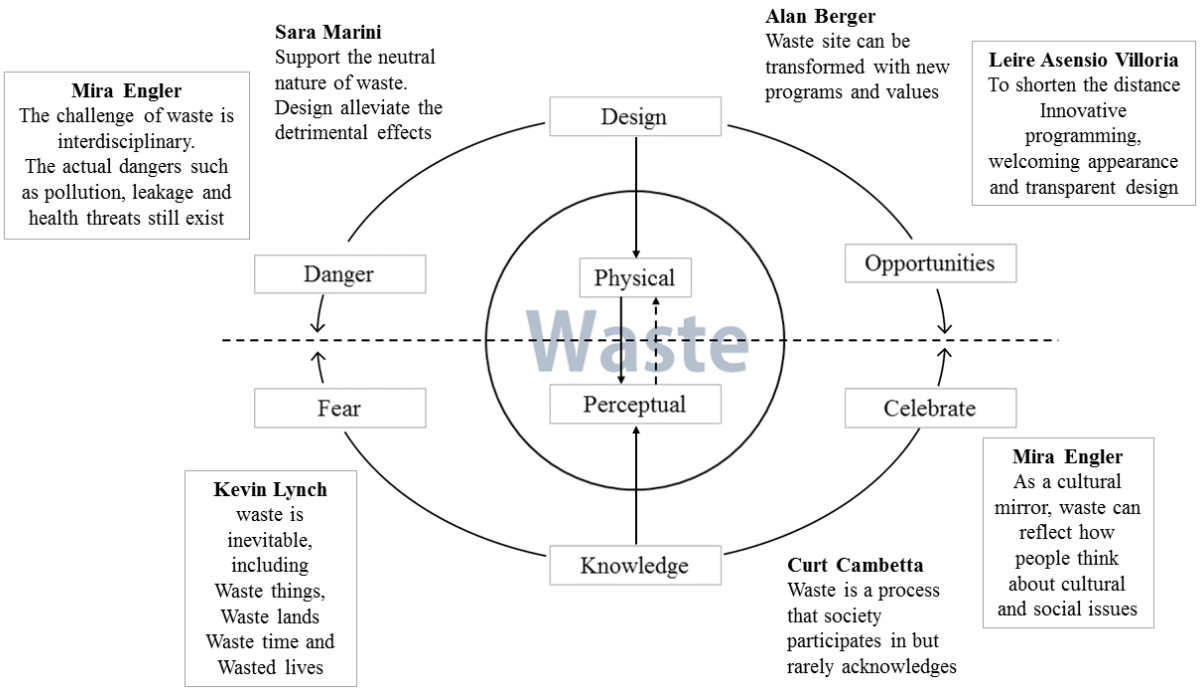


Figure 4: Diagram for concepts of waste. Drawn by author

2.2 Evolution of landscape architecture with waste

As people pay more attention to their living environment, landscape architecture has become gradually involved in significant social issues such as waste. Landscape architecture dealing with waste has experienced numerous changes due to economic, technological, cultural and social developments (see Figure 5). This evolution shows that landscape architecture has made progress in mitigating conflicts between waste effects and the living environment via a growing understanding of waste in human life. Also, there are many members of the public engaged in this process. However, there is a still much progress to be made in increasing awareness of waste rather than only remediating the environment.

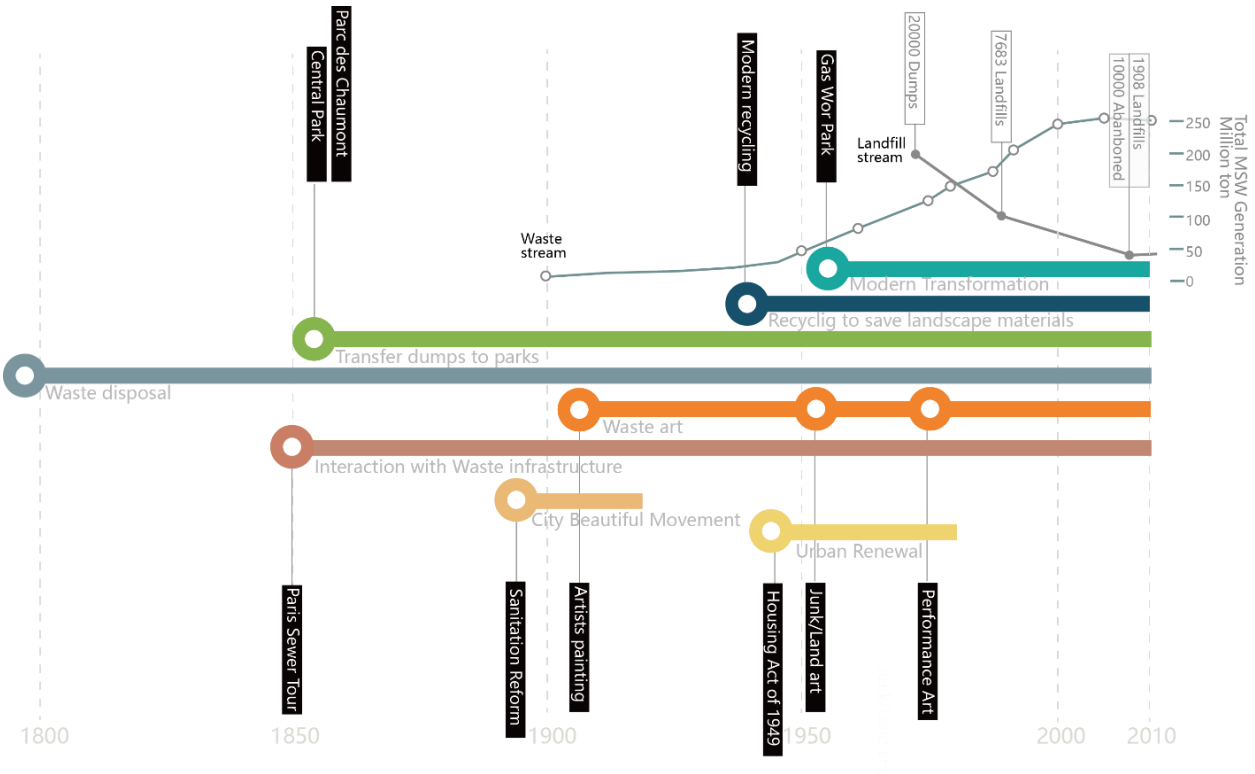


Figure 5: Evolution of landscape engagement with waste.
Drawn by the author. Data is from the EPA.

2.2.1 Waste disposal

As more cities became industrialized and urbanized in the nineteenth century in most developed countries, waste issues became increasingly manifest, whether in the large volume of animal manures or ashes and garbage on public streets and private property (Dunson 1999). Much scientific evidence had proven the correlation between disordered waste disposal and the spread of disease during that time. Due to hygiene and sanitation considerations, waste experienced a shift in location, from private places to concealed public areas (Engler 2004). An even more pressing issue was the necessity of waste management to the health of the natural environment due to severe pollution. In addition, it is very commonly thought that the existence of waste disrupts the overall visuals of the urban landscape. Therefore, the main purpose for landscape design was to screen and cover the waste disposal sites to protect public health and

preserve urban aesthetics. On the planning scale, waste disposal sites such as waste dumps were located in marginal urban areas, far from the high-population-density districts.

2.2.2 Waste sewer tour - tour at waste infrastructure

Even though waste sites were usually marginal and invisible, it turned out that they still held an attraction for the public. Starting in the mid-1800s, the Paris sewer tour was the first program of note that exhibited features of waste infrastructure besides those related to sanitation purposes.

Paris's underground sewer system has a long history beginning in the 14th century (Schwartz 2001). With the rapid population growth and urban expansion of the first half of 19th century, the old sewer system could no longer support increasing waste use and pollution streams. In 1853, Haussmann's Renovation of Paris took place to tackle urban development problems such as waste and underground sewer systems (Jordan 2004). This plan separated drinking water and waste sewage by using iron piping and building new sewer tunnels (Jordan 2004). Furthermore, the advanced sewer system had expanded to a length of 360 miles by 1878 (Schwartz 2001).

The organized sewer tour became a popular tourist attraction after the sewer system was constructed. Visitors explored this extraordinary underground sewer system by riding in boats or carts (see Figure6, 7). This new sewer system also became the pride of the citizens of Paris .

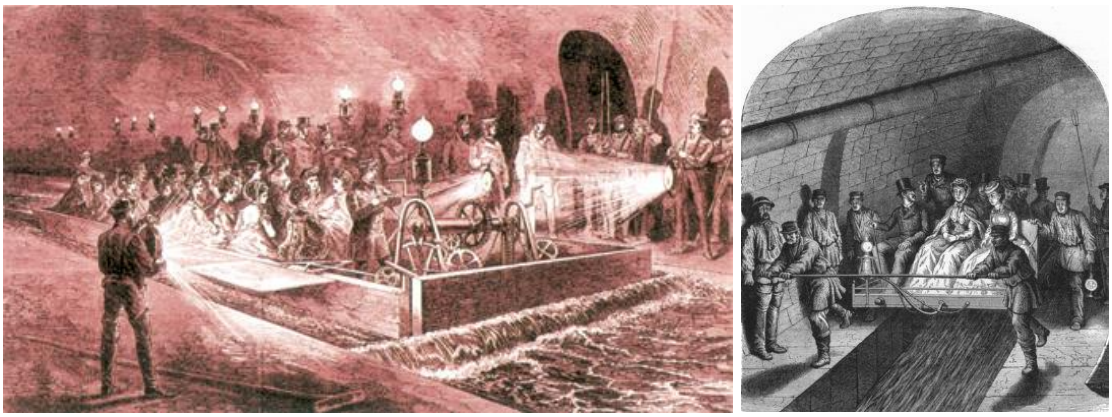


Figure 6: A The boat ride tour in Paris Sewers.

Source: http://www.museumofthecity.org/project/haussmann-and-revival-of-paris/

Figure 7: The pushing cart tour in Paris Sewers.

Source:http://www.antiquemapsandprints.com/paris-excursion-in-the-paris-sewers-old-print-c1878-67084-p.asp

2.2.3 Transfer Dumps to parks

As mentioned previously in this section, primary waste disposal methods in public areas remained chaotic during this period. Dumping waste into water and vacant land still prevailed, resulting in many polluted places and unregulated dumps (Melosi 2000). With rapid urban expansion and waste growth, there was a correlation between unchecked urban waste disposal and spreading health issues. The word “dump” now only refers to old-fashioned holes in the ground. Thus, the government paid more attention to building up basic sewage systems, setting up more comprehensive regulation, and encouraging dump transformation projects (Engler 2004). Waste infrastructure construction and landscape architecture were integrated to "transform dumps into parks," tackling the everlasting waste burdens in urban areas. Viewed as aggregate areas of disease and crime, dump sites had the opportunity to become welcoming outdoor places after being closed and transformed. Moreover, due to limited open public space in the early 19th century, the earlier success of garden cemeteries as popular gathering spaces also hinted at the possibilities of transforming dumps into parks (Williams 2014).

Accordingly, several landscape architects and engineers began to work together on improving waste dumps. Parc des Buttes Chaumont, Paris and Central Park, New York are two good examples (see Figure 8). As a part of Haussmann's Renovation of Paris plan, Parc des Buttes Chaumont was transformed from a notorious dump and quarry into a beautiful English-style park for recreation purposes during the 1860s (Culture& Stuff 2011). Jean-Charles Alphand, an Engineer of Bridges and Roads, and Jean-Pierre Barillet-Deschamps, a gardener and landscape architect, combined their talents to design new parks. These designs first removed all the garbage from a site then planned recreation areas with lakes, streams, temples, bridges and a variety of plants (Strohmayer 2006).

During the same period in the United States, Frederick Law Olmsted, using innovative design approaches and technology, had successfully reconfigured a dump site as Central Park in 1857. By removing massive amounts of dirt and slaughterhouses, reforming the topography, and establishing grand avenues and activity spaces, the park raised living standards in the large urban city (Engler 2004). Central Park was not only the first landscaped public park in the United States, it also turned a marginal urban waste ground into a public greenspace for the first time.

As executive secretary of United States Sanitary Commission in the early 1860s, Olmsted linked his park design to waste and sanitary issues. He and many other landscape architects hold the view that the landscape, especially parks, can play a great role in complementing the living environment and improving mental and physical health, as he explained: "Parks in the central city not only enhanced the livability of the city and the moral standings of its citizens but also literally erected barriers against diseases and mental distress" (Engler 2004).

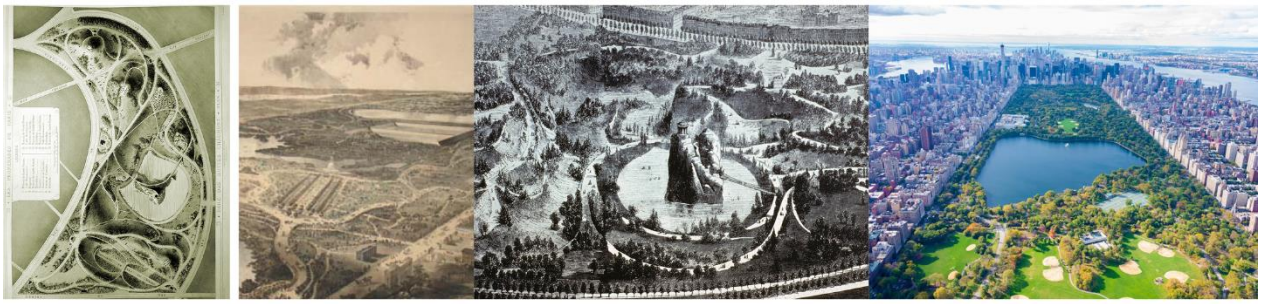


Figure 8: Dumps to Park: Parc des Buttes Chaumont and Central Park.
Left to the right: Parc des Buttes Chaumont Alphand 1867. Before Central Park. Built Butte Chaumont. Modern Central Park
(Source: https://commons.wikimedia.org/wiki/File:Parc_des_Buttes_Chaumont_Alphand_1867.jpg
https://www.georgeglazer.com/archives/maps/archive-nyc/martel.html
https://courses.cit.cornell.edu/lanar5240/524STOREHOUSE06HD/ModernFrance/ButteChaumont.jpg .
http://www.feldmangallery.com/pages/artistsrffa/artuke01.html)

2.2.4 City Beautiful Movement

In the late 1800s to the 1920s, based on the Sanitary Reform and Park System Movements, the City Beautiful Movement asserted that waste was not merely a health problem, but also an aesthetic and civic issue in urban cities (Melosi 2000, Gerckens 1975). Because of civic improvements and cleaning up the physical environment, there is a tight connection between Sanitary Reform and City Beautiful Movement (Melosi 2000). The emphasis on visual appeal and city aesthetics was a guiding principle, promoting pleasant parks, city attractions, and broad tree-lined boulevards. Olmsted was a prominent figure in this movement. He and Daniel Hudson Burnham, the leader of the City Beautiful movement, believed that parks were central to its success. It was an assumption of urban planning at that time that the beautification of cities promotes cultural equity and positive social and moral behavior. This movement encouraged the revival of city planning, but failed in many areas, such as class awareness, housing and investment (Gerckens 1975).

2.2.5 Demolition and waste of "Urban Renewal"

When the economic recovery started after World War II, consumer-oriented society promoted a greater volume and diversity of production material output. At the same time, "urban renewal" also produced a considerable amount of waste due to large-scale urban demolition in the thirty years from 1950 to 1980 (Ammon 2016). This concept of "urban renewal" arose from three legislative acts: the Housing Act of 1949, the Housing Act of 1954, and the Federal-Aid Highway Act of 1956 (City Lab 2017). The initial purpose of "urban renewal" policies was to rebuild urban communities by stimulating investment in order to attract residents with strong purchasing power by tearing down poor and degenerated neighborhoods (Badger 2016). However, along with the rise of the "culture of clearance," this idea, though it seemed like progress, eventually belied its original intention. From 1950 to 1980, around 7.5 million dwelling units were demolished in the United States (Ammon 2016). The pace of waste clearing and new construction could not keep up with the speed of community destruction. Waste exceeded the capacity of urban dumps, and few places could be found in which to dump it, which often led to its burial on site, which endangered the environment and future construction. Even worse, the policies broke the social and cultural connections that existed in what used to be African American and Hispanic communities (Ammon 2016). From the physical and social perspective, this project was ultimately destructive one.

2.2.6 Waste art

Waste became a symbol of a consumer society and great medium for the transmission of attitudes about social phenomena. The prevailing consumption culture has contributed to the development of waste art by providing and lending a far-reaching significance to its thematic elements (Hawkins 2002). Through their creative work, artists often try to remind people of the

environment and the planet's future. When waste is combined with art, this trend goes beyond art innovation and reflects a rethinking of the cultural values of consumer society regarding environmental protection and human behavior.

Throughout the 20th century, a waste aesthetic emerged under the umbrella of contemporary art and cultural influences. With an understanding of the inherent features of so-called “waste”, designers have organized waste into small scale and large scale art in landscape projects. On small scales, many more materials have been applied in sculpture, decorations, and facilities that integrate a greater variety of functions related to leisure and performance. On large scales, artists can use the landscape as a sculptural medium and can create a meaningful space that emphasizes waste volumes and unique textures.

In the early 1920s, many pioneer artists had explored the possibilities of transforming waste into art for the creation of pieces that eschewed traditional art materials. Picasso, Braque, and other modern artists began to create collages by applying recycled waste from such sources as newspapers, magazines and textured fabric (Collins 2008). In the 1960s, the concept of “junk art” was named and defined to include artworks made from materials that had outlasted their supposed uses, such as broken-up machinery, rags and other detritus from abandoned factories and waste lands (Collins 2008). As a pioneer in waste art and a multimedia artist, Mierle Laderman Ukeles championed waste as “a rich, awesome zone, highly charged and vibrating, awaiting the entry of art” (Ukeles 1992). After her remarkable performance artwork, *Touch Sanitation*, Ukeles’s *Social Mirror* (1983) addressed the urban and social disconnect from waste through public participation (Justin 2011, Feldman 2009). By covering garbage collection trucks with hand-tempered glass mirrors, this artwork captured, via people’s reflections on the side of sanitation vehicles, their own implication in the waste process as the truck moved through the

city (see Figure 9) (Ukeles 2007). Her work inspired later artists to capture the social, cultural and landscape aspects of waste sites in a variety of art forms (Drexler 2015).

Among art movements, Land Art exerted the greatest influence on industrial landscapes in the 20th century. In 1960-1970s, land art emerged when artists such as Robert Smithson attempted to create massive land-based art to arouse people's awareness of humanity's relationship with the natural environment. Following this trend, artists Agnes Denes and Mel Chin began to create art pieces at landfills (Drexler 2015). In 1982, Denes' art project *Wheatfield - A Confrontation* planted and harvested a 2-acre wheat plot at Battery Park Landfill in Downtown Manhattan. Her impetus was to provoke thought about complex issues, including misplaced waste, food, hunger and waste management (Denes 1982).

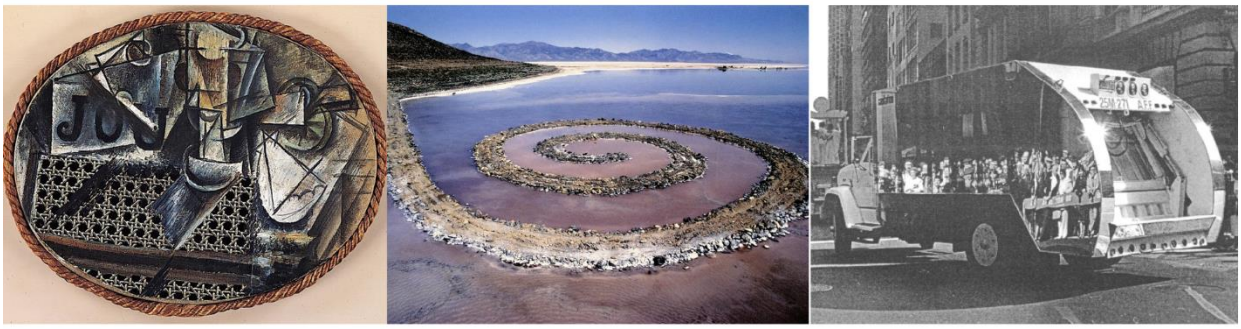


Figure 9 : Waste Art from early art painting, land art to performance art.
Left to Right:. Still Life with Chair Caning, Pablo Picasso, 1914. Land Art. Spiral Jetty. Robert Smithson, 1970
Performance art to reflecting public perception of waste. Social mirror, Mierle Laderman Ukeles, 1983
(Source: Estate of Pablo Picasso/Artists Rights Society; http://alpsartacademy.ch/en/land-art/;
http://www.feldmangallery.com/pages/artistsrffa/artuke01.html)

2.2.7 Modern transformations of waste landscapes

As an effectively controlled dumping method, sanitation landfills became popular after many states made an effort to draft laws to protect the environment. Sanitary landfills have remained the primary waste disposal approach since the 1940's (Engler 2004). According to the EPA, due to the dual forces of reaching waste capacity and urban expansion, some urban

landfills were abandoned or moved to suburban areas, leaving some dead places in urban areas (EPA 2010). Some were endowed with new functions and refitted as parking lots, shopping plazas or industrial sites; the others gained new life as designed landscapes and art works. Post-industrial landscape design started to explore an integrated approach to benefit ecological and social functions.

The revolutionary project, *Gas Works Park*, built in 1965, was the first project to celebrate old abandoned industrial infrastructures that were previously considered waste (Way 2013). Since then, landscape architects began to adaptively form alternative functional landscape facilities and amenities. It was notable that bioremediation was first used for cleaning polluted soil as well. Derived from waste or industrial sites, some discarded devices and equipment were kept and become emblematic icons of the site's history. A variety of waste materials can be taken apart and reassembled to serve the public as functional facilities. The planners try to nurture sustainable ideas to enhance environmental balance, public awareness, social engagement and cultural adaptation. New York's massive Fresh Kill Park project, for example, will experience a long-term process of transformation to create its own sustainable balance (see Figure 10).

Figure 10: Modern transformation of waste landscape
Left to Right: Gas Work Park; Byxbee Park; Fresh Kills Park
(Source: Courtesy of Richard Haag Associate; Courtesy of Hargreaves Associates; Courtesy of the New York Parks Department)

2.2.8 Recycling to save materials and preserves waste identity

Modern recycling became a new trend as waste soared in the last 50 years of the 20th century. As growing social support and public participation drove increasing concerns about waste reuse and recycling, landscape architects became cognizant of the opportunities for landscape integration with waste recycling (Engler 2004). Using salvaged materials in a landscape can reduce on-site construction waste. Also, introducing former waste to a landscape allows for the maintenance of the identity of the waste. The creative application of materials asks visitors to recognize and think about reclaimed materials as“ discarded waste.” For instance, the Lions Park Playscape in Alabama is made of 2,000 55-gallon galvanized drums. Drawing on the characteristics of drums, the playscape designed sound tubes and sensory rooms to emphasize exploration and imagination (Rural Studio 2010). Increases in organic and food waste also suggest composting as an additional form of waste recycling.

2.2.9 Summary

The concurrent development of landscape design and waste reflects social and cultural attitudes, as well as perceptions of waste. Increasingly, landscape design is asked to develop effective approaches to alleviate the pressures between waste sites and the environment. With growing awareness of the relationship between the environment and human health, the truth of waste can be recognized and better reintegrated in our lives. From the initial waste dumps to massive landfills to waste materials recycling to waste site renovation, each stage in the evolution of waste and design reflects the progress of understanding waste usage. Moreover, the design of waste sites, particularly landscapes, increasingly highlights environmental sustainability. The urban landscape can corporate with dump sites and other waste-related areas. Also, public art has contributed to a broader awareness of and public participation in waste

though it is still in need of people's attention. Waste landscape design has increased as designers focus finding new ways to engage public interaction.

2.3 Challenges and opportunities of waste landscape for design

In pointing out that "our discomfort with wasting is the creature of our minds as much as a result of objective dangers in the process," Lynch is correctly asserting that the challenges of waste for designers are both physical and perceptual in nature, and these aspects determine how people treat waste (Lynch & Southworth 1990). To organize challenges and opportunities related to design, the author conceptualizes them along major topics that each has physical and perceptual qualities.

2.3.1 Health & safety

Clearly, physical health and safety dangers exist in activities involved with waste. There are many factors that cause health and safety dangers. Some raw waste contains toxic and infectious materials. Also, waste may change over time into harmful substances or release hazardous materials that could cause severe maladies. Additionally, during the process of waste collection, from processing to final disposal, dangers lie in every step because of residuals, air, and wastewater distributions (Cointreau 2006). Another health risk waste carries is the spreading of diseases, which may arise from the pathogenic bacteria and viruses that can survive in waste (Thomas 2001). With the persistent development of consumer industries, increasingly diversified waste is being produced and brings constant challenges to the design of waste management and to our wider lives.

From a perceptual point of view, smell is a possible indicator of whether any waste is harmful. The odor of waste signals people to a possible danger to health and biological safety. According to Engler, smells can remind people of waste and degeneration, and a "strong smell

has been associated with animality, decay and death" (Engler 2004). In addition to the threatening feeling brought on by the odor of waste, the smell itself is difficult to deal with. Moreover, whether stuff appears visually impure or not contributes to the perception of waste. There are aspects of waste, such as colors, shapes and forms, that may contrast from the normal landscape. The appearance can trigger the perception of a potential negative impact on health.

Opportunities: There are opportunities for new scientific and ecological approaches, integrated with landscape design experimentation, to decrease the harmful impact of waste places. The most direct way is to remove the waste from the site. Also, waste needs to be framed or covered to reduce intact interactions with people. It is also essential to decrease exposure times in waste contexts through better circulation and site planning (see Figure 11).

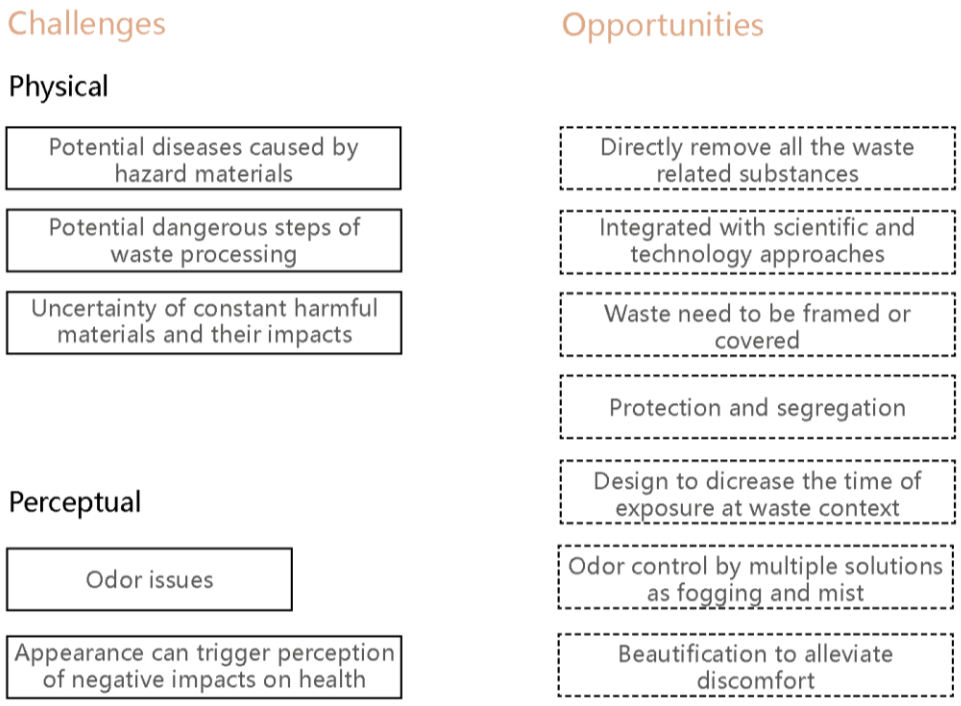


Figure 11: Diagram showing connections between the challenges and opportunities for health and safety.

2.3.2 Environmental Pollution

Integral to human needs and experiences, waste also has an impact on the physical environment. All these waste features potentially threaten environments through issues such as gas emission, toxic substance leachate, waste and soil contaminations (El-Fadel, Findikakis & Leckie 1997). Even though waste facilities such as landfills are ultimately closed and sealed, it is difficult to ensure total safety and absolute prevention of harmful pollutants, and even harder to erase the stigma of waste histories (Erdem & Nassauer 2013). On site, adjacent habitats and communities are vulnerable to environmental pollution.

As a major threat to the environment, continual polluted waste generates a perception of health risk, and along with it impediments to future living spaces and other life forms. In order to ensure environmental safety, waste pollution makes people aware of the shrinking and lapse of activity spaces. The pollution also arouses the sense of the limitations of resources, such as soil, water, air, and plants, and the consequences of their loss

Opportunities: That the existence of waste pollution reminds us of systematic and sustainable designs that better manage material streams is a great opportunity (Chesebrough 2016). Many intervention approaches, such as remediation, can be introduced to neutralize harmful substances. Because of safety considerations, some buffers are required while retaining the freedom to integrate with aesthetic and ecological consideration (see Figure 12).

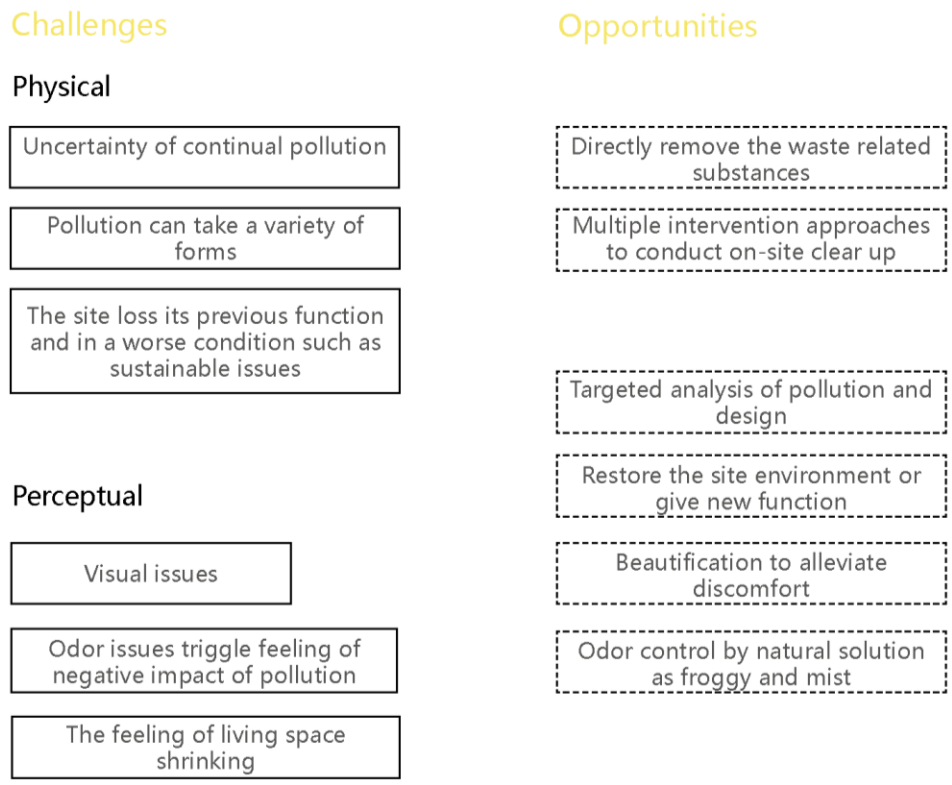


Figure 12: Diagram showing the challenges and opportunities of environmental pollution.

2.3.3 Waste location incompatibility

With increasing waste production, waste places that can accommodate waste as a final destination face certain challenges: limited capacity, site abandonment, and incompatibility with urban contexts. The capacity issue is usually resolved by building other larger and more distant waste places, while many smaller and scattered ones are closed after their capacity is met (Patrick, Ford, & Quarles 1987). This change did not only result in large "junkscapes" in urban contexts, but also generated giant and remote landfills that require more transportation input (Knechtel 2007). After achieving their main purpose, waste places whether abandoned or closed are in a poor state, suffering a lack of post-management, ecological decline and social isolation. Moreover, these problems result in many land resources "frozen," which is not utilized within the fences and walls. More recently, waste places have been embraced in urban contexts as an aspect of urban sprawl, but the problems arising from function loss, zoning hurdles, and form

and appearance inconsistent with the surrounding environment fragment the integrity of the urban landscape .

Even though “urban sinks” are those waste places physically closer to urban districts, , they remain perceptually marginal areas (Southworth 2001). The concept of marginality is easily aligned to weakness, unnecessity, heterogeneity and potential risk (Engler 2004). The current desired material culture promotes maintaining distance from unstable situations. Thus, there are challenges strongly tied to the perceptions of the decreased value of the properties surrounding waste sites.

Opportunities: Since it is rooted in urban contexts, waste site design carries great potential to redefine and integrate waste sites into the urban fabric. Even though they are considered unattractive, these lands can be adapted adaptation for future changes (Southworth 2001). Based on the tremendous number of waste sites, waste sites that now seem passive can come to be seen, through transformation, as vital spaces. A large scale waste site is suitable for variety of programming and design opportunities, such as land art. Waste sites can become more accepted when subject to an innovative reuse. Also, the peculiarity of waste places in relation to other typical urban symbols can evoke people’s attraction. Simultaneously, they have the potential to represent the heritage of industrial culture (see Figure 13).

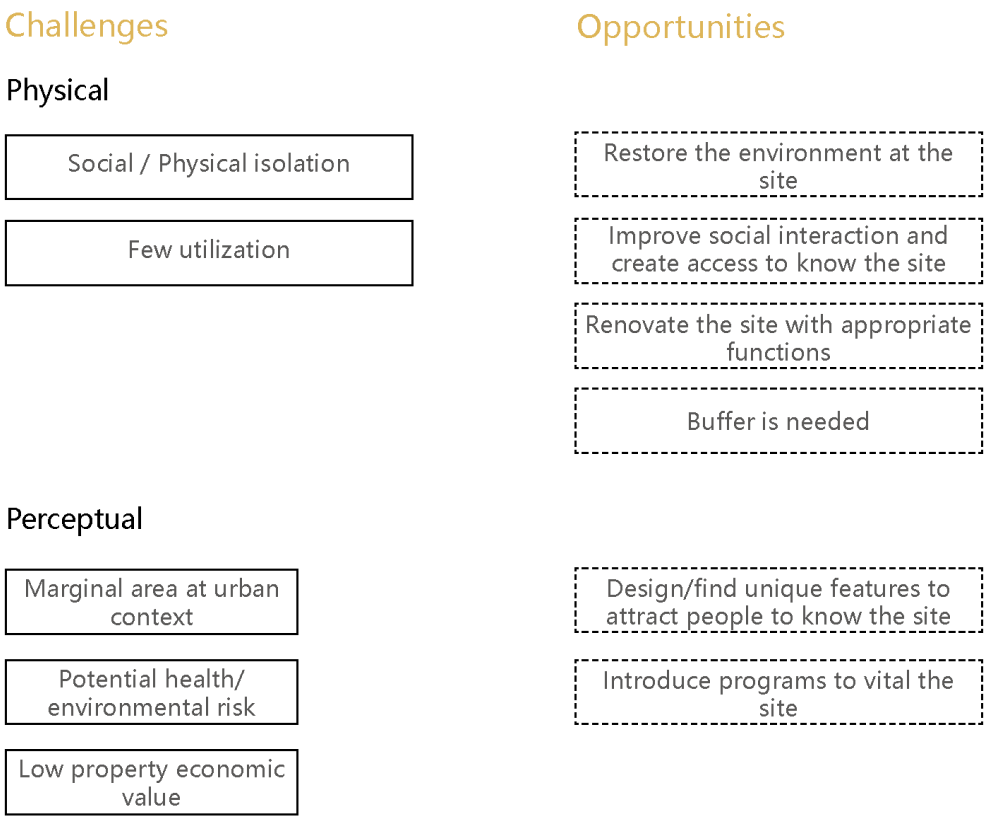


Figure 13: Diagram of the challenges and opportunities of waste location incompatibility

2.3.4 Waste Identity

Beginning with the perceptual aspects, the fear of waste has been deeply implanted in our culture. Waste culturally implies low value, an ever-present threat, and an inevitable ending (death). According to Engler's research on the cultural context of waste, waste's connection to negative effects seems quite solid in our minds. She expands upon this by saying, "waste and dirt involve the feeling of pollution, a sense that something foul has attached itself to our body, things, or place - a feeling hard to shake" (Engler 2004). This feeling drives people to clean, to maintain hygiene and to eliminate any surrounding waste .

However, as an indispensable component of life, waste cannot be thoroughly eliminated. Hence, in the process of managing waste, the concept of border/screening is established to define a safety zone. This intentional or unconscious border of waste gives rise to the invisibility of

waste places and processes. All the issues and fears surrounding waste are confined and often concealed, which divorces waste from our daily lives. And waste management facilities are usually enclosed and isolated from the public; not everyone knows what happens to waste after it is placed in the trash bin.

The invisibility of waste processing and disposal is an obstruction to enhancing public understanding of real waste situations (Villoria, Kara, & Georgoulias 2015). Inadequate awareness of waste and improper wasting behavior echoes a lack of waste knowledge. How to convey updated information, whether in the form of technology innovation or improvements in treatment, to the public is a challenge.

Opportunities: Design has the potential to build connections and access between waste places and the general public. Moreover, designers have extensive opportunities to increase people's awareness and understanding of waste They have the chance to witness real waste and the waste process. Waste facilities can offer educational programs and training in "reduce, reuse and recycle" training. It is crucial to remark upon and establish waste places as meaningful places by explaining their cultural and historic context (see Figure 14).

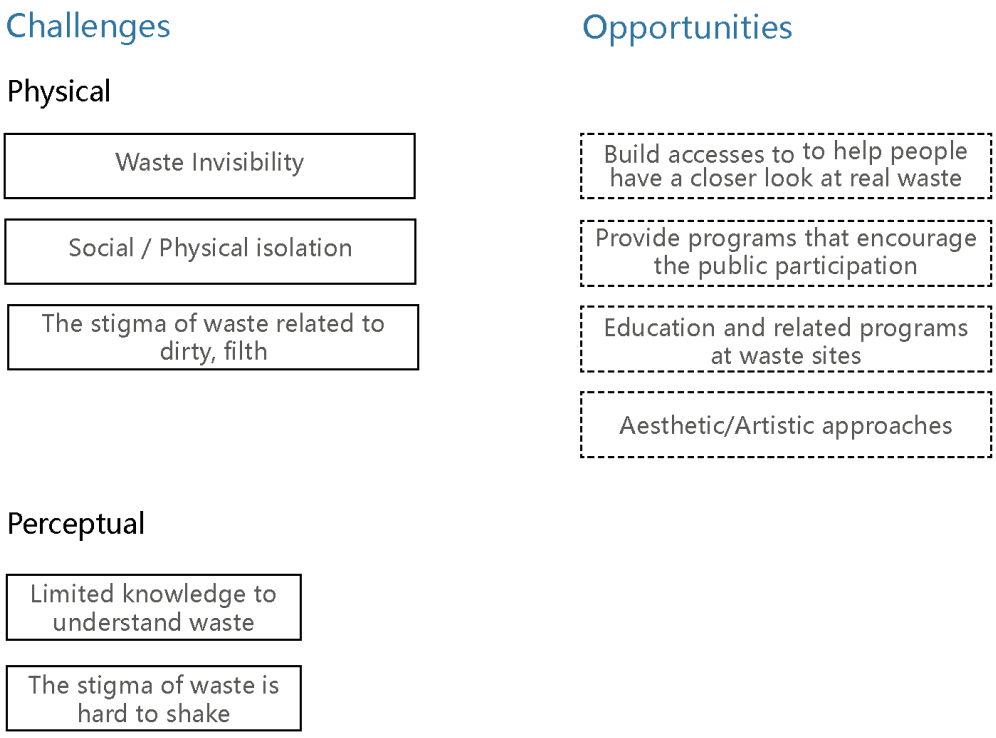


Figure 14: Diagram of the challenges and opportunities of waste identity

Reviewing the challenges and opportunities as presented in the literature, the author has identified several challenges, both physical and perceptual, but also many opportunities that designers should consider in the development of design strategies.

2.4 Landscape architecture design strategies with waste

With the guidance of waste and technological progress, landscape architecture has become more involved in issues related to waste. In order to decide between multiple design options, landscape designers need to understand those factors that are likely to influence human behavior and site spirit--- the sense of place. The basic steps of waste management are essential for designers in order to think about a landscape's educational significance. More information and education through designed spaces are the best media to encourage people to realize how they can play a role in this process.

2.4.1 Hide-Make waste invisible

Initially, due to the negative impression of waste sites, easily linked to oppressed and marginal groups, traditional design strategies mainly concentrate on disguising sites for the entire urban landscape. Then, capping and planting is the typical pattern of waste site design. In order to maintain some distance from the public, some dumps and waste places are screened and buffered with massive, living plants. The others are totally covered and sealed so that new construction can occur (Engler 2004, Knechtel 2007). Admittedly, this is an effective method of preventing people from conceiving of the existence of waste. The beautification of waste sites usually hides their original appearance. However, this approach also has its own problems: the sites are isolated from their urban context. These sites may be covered by other land uses, such as parks, parking lots, shopping centers and industrial lands. Hiding the site does not radically change the social and cultural perception of waste as threatening and harmful. Interactions with waste remain brief and limited.

2.4.2 Removal waste

This approach seeks to restore and return the waste place to its former condition by moving waste out of the site. Generally, the priority task of a waste landscape is dealing with the negative impacts of waste. Thus removing extreme toxic materials, polluted water, and leakages becomes significant. This practice includes excavating polluted soil, disposing of harmful substances in qualified landfills and pumping out waste water (Coviello 2016). These methods are relatively expensive and disruptive to the site environment, even though this approach is no different than ordinary waste disposal, except for the volume and characteristics of the waste involved.

2.4.3 Neutralize waste

Through a series of waste treatments at site, this approach tries to achieve an inner-site digestion/assimilation of waste harmful impacts. Most of these waste sites focus on a typical "Clean-and-Green" design approach, using ecological restoration, bioremediation and scientific clean-up plans to wait for natural purification. During this process, the contaminants are converted to nontoxic and nonreactive substances (Crawford 2001). As a small material life cycle, organic waste like food and can be used at the site after composting. These approaches are more environmentally and economically friendly, with the potential of continual site use (Knechtel 2007). The dynamic changes at waste landscape are attractive to people who can explore and witness the process of landscape implementation. The interaction may take slowing by its nature. The hidden problems of this approach are the persistent need for supervision and control, and the added time needed to buffer the area from the public.

2.4.4 Frame waste and celebrate it

Other than hiding waste out of sight, framing waste provides opportunities to make contact with waste without safety and health concerns. After waste is confined so that it is not able to effect people and the environment, this approach encourages more meaningful action at waste sites, such as cultural, educational and social participation. Since it has unique features inherited from its historic and cultural properties, waste highlights cultural nodes and ritual properties. Referring to Ukeles, a “landfill is a fascinating hub of activity and a significant cultural milieu” (Engler 2004). This approach also serves to provide on-site education and tours. Inviting people to experience the real matter of waste and its processes can evoke their awareness of waste and thought about their own behaviors. There are some programs that

encourage public participation. On the other hand, such social activities may not apply to all venues, and may place even more pressure on authorities (Bell, Herlin & Stiles 2012).

2.4.5 Using waste as a medium

As a symbol of urban products and artifacts, waste is a perfect medium to express people's diverse understandings of life using design. There are many broad meanings and implications that can be interpreted from waste that reflect people's attitudes and behaviors on such a controversial issue. Because of the complexity and interdisciplinary features of waste landscapes, waste has a "distinct, recognizable and consistent pattern of elements" for landscapes (Ode 2008). This approach emphasizes waste features to try to attract more attention to the creativity of waste from the public. Waste materials can be recycled and reused as art in special designs, by modifying their form, pattern and even volume. Appealing to the contrasting aesthetic, the public's interest in multiple possibilities of waste can be triggered. On the other side, this aesthetic approach might lose sight of the main discussion of waste itself due to focusing too much on appearance.

2.4.6 Design strategies Diagram

The array of landscape designs provides different design strategies to tackle each landscape challenge brought up by waste. Design strategies also indicate various experiences with waste. A broad framework of landscape approaches to tackling and addressing waste based on challenges and strategies (see Figure 15).

To sum up, the objective and perceptual aversion to waste creates a need to consider distance, buffers, filters, and other modes of interference, transition, and transformation between waste and those who would engage or interact with it.

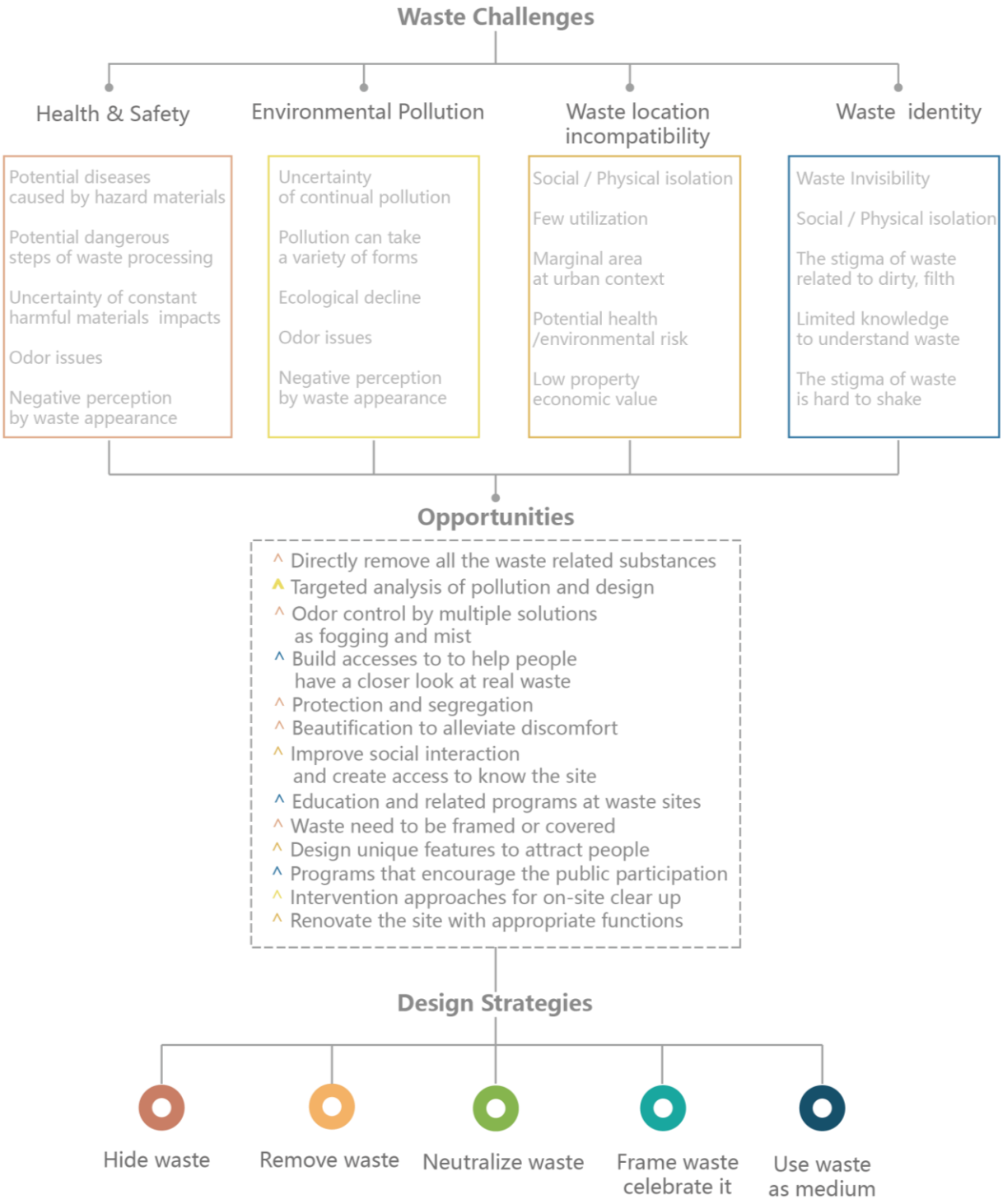


Figure 15: The broad framework of landscape approaches to tackling and addressing waste based on challenges and strategies.

2.5 Summary

From this discussion, it is apparent that waste is quite a broad and complicated issue that requires additional research from multiple perspectives to gain a better understanding. Design is put forward as a potential approach to changing cultural perceptions. Then, the evolution of landscape and waste was examined, and the process of how a gradual understanding of waste affects their interaction was discussed. In addition, the objective and perceptive challenges and opportunities of waste were identified and discussed specifically. Accordingly, multiple landscape architecture design strategies were introduced to address each waste challenge. However, there remains a demand for the interpretation of waste in more dynamic ways, as educational purposes have not earn enough attention in previous practice. The exploration of a potential educational approach will be argued in Chapter 3.

CHAPTER 3

EXPERIENTIAL LEARNING AND WASTE LANDSCAPE

"What must count then is not primarily the designed shape, spaces, and forms of all great planning and design. What counts is the experience."- John O. Simonds 1961

This chapter will review the theory and empirical studies of experiential learning to explore how experiential learning builds connections between the public and the outdoor environment. Thus, this chapter also explores the relationship among experiential learning interaction, waste and landscape (see Figure 16). Learning about outdoor environments through experience will be discussed to discover the essential factors and components from previous practices. In addition, given this thesis' particular focus on waste landscapes, this chapter will discuss learning from "Hazardous/Negative spaces" and the implications of experiential learning within waste landscapes. With an emphasis on key experiential learning components, the suggested design strategies aim to highlight and facilitate advanced experiences within waste landscapes for learning purposes. With the goal of encouraging people to better understand waste and increase awareness, integrating landscape design with experiential learning has the potential to extend their active and intuitive learning at waste sites.

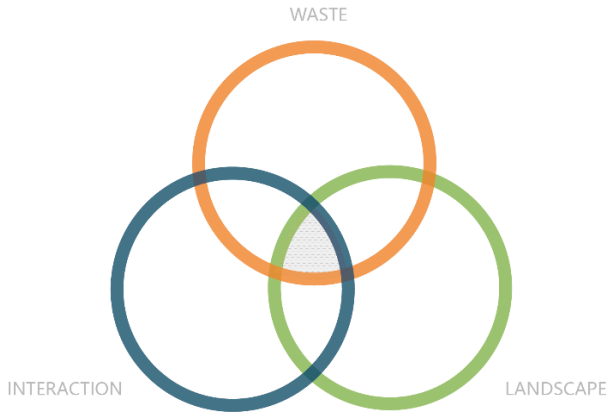


Figure 16: Chapter 3 discusses relationship among interaction, waste and landscape.

3.1 Defining experiential learning for outdoor environment

3.1.1 Concept

Outside of the traditional classroom, the standard educational setting, learning in an outdoor environment is a process that is composed of an experience-based approach and an outdoor site context, which advocates adventure, experience, and self-environment education. Bansal stated that outdoor experiences contribute to improving environmental awareness and behaviors (Bansal 2016). and outdoor environmental learning has been integrated with experiential learning for some time (Adkins & Simmons 2004).

There are a variety of terms that are used to describe the process of learning from experience. Notable psychologist and education reformer John Dewey did influential work for experiential learning, suggesting that individuals should, “learning by doing” and “learning through experiences” (Dewey 1938). Wolf and Byrne(1975) preferred “experience-based learning” in real world setting (Wolfe & Byrne 1975). Association for Experiential Education stressed the role of the learner in the process, defining experiential education as “ a process through which a learner constructs knowledge, skill, and value from direct experiences” (AEE 2002). In his 1984 book *The Experiential Learning*, David Kolb supported John Dewey’s idea and defined experiential learning as“ a process whereby knowledge is created through the

transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb 1984). Built upon the groundwork of Dewey, Kurt Lewin, and others scholars, experiential learning proposes a dynamic learning approach based on a learning cycle that arises from forces moving in opposite directions: grasping experiences and transforming experiences. Kolb emphasizes a learning process that starts with awareness of a problem, getting an idea, trying out a response, experiencing the consequences, and either confirming or modifying previous conceptions (Kolb & Kolb 2009).

3.1.2 Why experiential learning can work for outdoor environment issues

Experiential learning approaches build a bridge between people and the outdoor environment context, inviting visitors to perceive, participate in explore and understand critical environmental issues via actual and the first-hand experience. Thwaites and Simkins expressed this notion by stating that "human experience must be given greater prominence in how we understand outdoor places and how we can make a new one" (Thwaites & Simkins 2007). Jay Appleton suggested that human behavior has been influenced by the environment, especially by their attitude towards the environment (Appleton 1996). More than that, many scholars in environmental education are concerned with the role of experience in the education process as it relates to environmental issues (Higgins 1996, Lugg 2007, Stewart 2008). Dewey also pointed out experiential learning's potential in personal cognition reconstruction and bias elimination, which can improve the public's understanding of environmental issues such as waste (Lewis & William 1994). Additionally, there is some evidence that outdoor activities combined with experiential learning have a positive influence on environmental knowledge in many studies (Higgins & Nicol 2002). Considered the most durable and active approach to advocating for people's dedication to environmental protection by experts, experiential learning extends

learning and also has a lasting impact on changing people's lifestyles and behavior afterwards; some even experienced permanent changes (Kirk & Thomas 2003, Calkins 2012). Therefore, landscape architecture is constantly seizing opportunities for to create spaces that advocate interactions and experiences (Simonds 1961, Clements & Dorminey 2011).

3.2 Experiential learning and outdoor environment

3.2.1 Experiential learning

Experiential learning developed a holistic model (see Figure 17) of the learning process that incorporates in cognition and behavior (Kolb, Boyatzis & Mainemelis 2001). According to Kolb's experiential learning theory, experiential learning is comprised of four stages: concrete experience, reflection, conceptualization and application (Kolb & Kolb 2009). These four components can be interpreted as sensing, remembering/thinking, idea explaining, and testing (Gilmore 2016). Other scholars believe that there are two groups of components: concrete components (referring to steps 1 and 4) and conceptual ones (steps 2 and 3) (Oxendine, Robinson & Willson 2004). All these four stages work as a learning cycle that operates perpetually. In addition, learning can start at any step in the cycle and visitors' active engagement is the core of all these experiences (Gilmore 2016).

As the basis of achieving exploration, concrete experiences are required in authentic situations (Fägerstam 2012). Whether these are individual or group experiences, this stage requires actually doing or performing activities with little or no help from instruction or guidance. The senses and emotions are strongly engaged .

The "reflection" stage advocates learners share and discuss their reactions and observations in groups or independently. Their thoughts, feelings, and different perspectives are

generated from their previous experiences. The participants can talk freely and provide plenty of information for people to consider (Kolb 1984).

"Conceptualization and Application" tries to explain and test the previous experiences, which can deepen understanding and generate new ideas about them. Abstract Conceptualization is a step in which issues and problems are addressed and framed by analysis and systematic thinking (Kolb 1984). Emphasis is placed on the definition and classification of abstract ideas and concepts, aiming at precise conceptual categories. There are opportunities to connect the experiences to the real world (Kolb 1984). Active experimentation seeks problem-solving ideas and approaches, which sometimes contain risk-taking solutions. This is a step that calls for participants to apply what they learned from previous experiences.

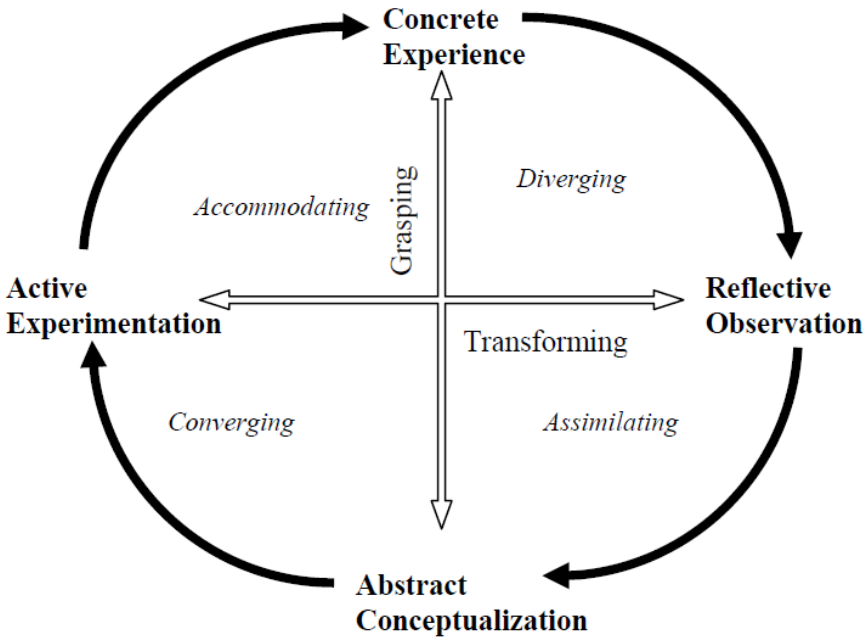


Figure 17: David Kolb's "Experience Learning Cycle" (Kolb & Kolb 2009)

Of all the steps, concrete experience is the key and the first step to establishing a learning cycle in environmental education. For some scholars, a quite effective learning strategy for environmental learning utilizes direct experiences as learning materials (Georgopoulos & Birbili

2011). These experiences need to be real. According to research and surveys conducted by Higgins and Nicol, experiential learning relies on "first-hand experiences which connect the learner with real people and real issues" (Higgins & Nicol 2002).

Kolb believes that experiential learning is influenced by the learner's characteristics and learning spaces (Passarelli & Kolb 2012). Even though learners may have different preferences for receiving information, the core of experiential learning is the public's active involvement and engagement, the process of which offers extensive useful information from the surrounding environment.

However, outdoor experiences and activities alone are not adequate to achieving the purposes of environmental learning automatically without instruction and guidance regarding the major subject (Higgins 2002). The instruction helps makes certain the experience is completed and finalizes the introduction to thinking about the causes of and solutions to environmental issues. Therefore, experiential learning promotes education through paring experience and instruction.

3.2.2 Spaces for Experiential Learning

Learning needs space to take place. Learning places support holistic learning processes that direct learning in many ways. For learners, learning places can accommodate the four modes of the learning cycle: sensing, remembering/thinking, idea explaining, and testing as interpreted (Kolb & Kolb 2009). Experiential learning spaces broaden multiple learning spaces while increasing flexibility and diversity of learning. Based on how people experience the environment and practice research, scholars have created several experiential learning principles to address the essential components of foster experiential learning in physical environments. According to Passarelli and Kolb's research, experiential learning spaces have multiple dimensions: physical, cultural, psychological, social and institutional (see Figure 18) (Passarelli

& Kolb 2012). Since the physical and psychological aspects are most prominent for learning, this thesis mainly focuses on these two dimensions (Passarelli & Kolb 2012).

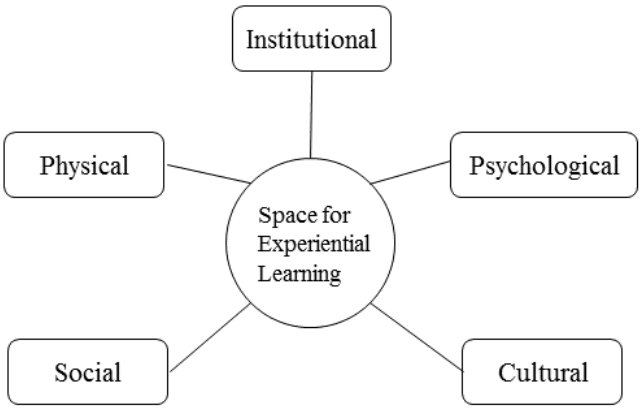


Figure 18: Multiple dimensions of space for experiential learning. Adapted from (Passarelli & Kolb 2012)

Physical

Some principles embody physical aspects. Experiential learning's priority is to create a safe, hospitable and supportive space. This notion is supported by Rogers and Freiberg perspective: "Learning which is threatening to the self (e.g., new attitudes or perspectives) is more easily assimilated when external threats are at a minimum. Learning also proceeds faster when the threat to the self is low" (Rogers & Freiberg 1994). Moreover, it is easier for learners to face conflicts in safe circumstances. In addition, certain instructions are required to guide learners to organize their experiential sequence and incorporate it into the learning process. Admittedly, The impressions of our ambient environment are influenced by its entire spectrum of physical characteristics (e.g., luminosity, sound, scents, temperature) in a dynamic and interactive way (Schreuder, Toet & Kallen 2016). As a result, experiencing and learning at waste sites should lend prominence to the identifiable characteristics of learning sites.

Based on his previous work, Kolb has summarized several principles that advocate experiential learning for education which is helpful for the improvement of the environment.

These principles mainly address the topics of experiential learning spaces and their corresponding aspects (Kolb, 2005). Hospitability and flexibility are top characteristics of learning spaces, which can allow for multiple conversations, activities, reflections and thinking on the site.

Psychological

However, with regards to the psychological aspects, some challenging aspects and threatening differences can trigger a learner's interest. Andresen, Boud and Choen's criteria for experience-based learning agrees that learning spaces need to respect the learners and their experiences. Learners do not only input their intellect, but also their feelings, senses and even their personalities when they are fully involved in experiential learning (Andresen, Boud & Cohen 2000). Furthermore, self-oriented learning is encouraged to enhance the learner's learning ability and produce a more positive and less passive approach. As Rogers and Freiberg put it, "people believe more in knowledge discovered themselves than in knowledge presented by others. Self-initiated learning is the most lasting and pervasive" (Rogers & Freiberg 1994) .

Group learning is also highlighted in learning spaces since research has demonstrated that it produces great strides in learning effectiveness. This notion supported by Rogers and Freiberg: "It is easier to change in a group than when alone. We accept new systems of action, thought, attitude and behavior patterns when we accept membership in a new group" (Rogers & Freiberg 1994). Kolb also pointed out that it is natural for human society to convey knowledge and make meanings through conversation. Creating conversational places can encourage reflection and thought about former experiences, ultimately building up meanings and maximizing learning effects. Moreover, there are opportunities for reflection and making meaning about experiences (Kolb & Kolb 2009).

Many principles can reveal learning spaces' multiple dimensions. According to the information collected for each dimension of the learning place , there is a description of principles (see Table 1) that summarizes the important aspects of experiential learning spaces.

	Physical	**Psychological**
Principles	• Safe space with low external threat • Hospitality and flexibility space can allow multiple activities, conservation and individual learning	• Group learning is beneficial for learning efficiency • People need to be personally-engaged in and participate in learning • Self-oriented learning is the most lasting and pervasive • Intellect, feeling, and the senses are all involved

Table 1: Principle of physical and psychological aspects for experiential learning spaces

Learning in outdoor environment through experience

When it comes to learning environmental values and issues, physical outdoor natural and built environments provide powerful information for the public's experience. That environment learning can be incorporated within an outdoor environment is not a new concept. The public has opportunities to experience and recognize the environment that results from the human activities. Therefore, these environments offer great chances for them to explore multiple facets of environmental issues and gain a full understanding of environmental interaction (Measham 2007).

As states, effective environmental learning usually comes from a connection to real life. How we learn about the surrounding environment shows the process of human-environment interaction. Previous studies confirm that the concerns about the environment are usually affected by direct contact and independent exploration within the environment (Stoecklin 1999). Based on his former research, Measham summarized eight ways people learn about the environment via experiences (see Table 2) (Measham 2007). From his observations and previous research, he asserted that recognition of the environment is a lifelong experience that

occurs in multiple experiential ways. Despite early life experience and family involvement being the main concerns for children's education, the remaining themes also reveal multiple kinds of personal experiences with the environment.

The real life experiences plays a significant role in delivering information. Real life experiences are essential for us to collect information about the environment since they can build connections between us. Also, experiences can also enhance sensory exploration and awareness. There is research indicating that we recollect information more effectively when it is intertwined with real-life experiences and "perceived as a connection to our own everyday lives" (Knapp & Benton 2006). More than that, some other scholars have stated that experiences are also affected by intellectual, physical, emotional, aesthetic and spiritual factors (Higgins & Nicol 2002). Learning in outdoor environments is also associated with stimulus and a subject's level of concentration (Higgins 2002).

The sensory awareness approach forms the basis of what is called the experiential way of knowing things; that is, to create knowledge through the transformation of the experience (Kolb 1984). There are four learning modes (see Figure 19) through which learners can effectively acquire information through sensory means. Working holistically, senses like sight, hearing, smell, tactile and touch give people multi-experiences in their environment (Bell 2012). Compared with the other senses, studies have found that the function of visual communication can primarily affect the impetus of environmental learning. Our vision processes 80% of the information that surrounds us. As a result, visualization can maximize the conveyance of information to address the real consequences of human behavior and environmental changes (Sheppard 2006).

Table 1 Ways of learning about environments – from Measham (2006)	
Theme	**Summary**
1. Childhood experiences	The most frequently occurring theme in this research involved learning about places through childhood experiences. People who grew up in the place of the interview learned about their environment through playing and exploring. People who grew up elsewhere drew on their experiences of their childhood environments when moving to other locations.
2. Learning from elders and family	Participants learned about their environment from family and elders. This theme overlapped with theme 1, and included children accompanying parents as they went about their work and cultural activities. For people of urban backgrounds it included going to visit family in the country for vacations, and sometimes deciding to stay.
3. Action and observation	This theme concerns experiential learning that is strongly tied to action and observation. Whilst the theme overlaps with theme 1, it was not restricted to childhood experiences, and includes observation through day to day work and recreational activities such as farming, bush walks, bike rides and picnics.
4. Comparisons between places	Many participants learned about their environment by comparing it to other places they had lived and visited. The theme was very strong for participants who had moved to the country from the city and were struck by ecological and social differences. The theme also applied to people from rural backgrounds who had moved around for personal and economic reasons.
5. Learning about places from festivals and community events	People learned about their environments through participating in community events such as festivals. These events took people out of their every day circumstances and helped them to share experiences. Festivals were particularly important for developing a shared sense of place.
6. Learning about places from external sources	Local media and local histories played a role in developing an understanding of an environment for many participants. These sources provided a context in which to situate individual experiences.
7. Seeing a place under different conditions	One of the ways that people developed their learning about places as adults was through seeing places under different conditions. These included flood and fire events, which though traumatic, revealed new insights about the environment in which they lived.
8. Continuity in connection to a place	This theme represented a trigger for renewed learning. In some circumstances this involved spending extended periods of time in a place reflecting upon it. In other cases participants renewed their learning about their environment through repeated visits to special places.

Table 2: Ways of learning environment from experiences (Measham 2007)

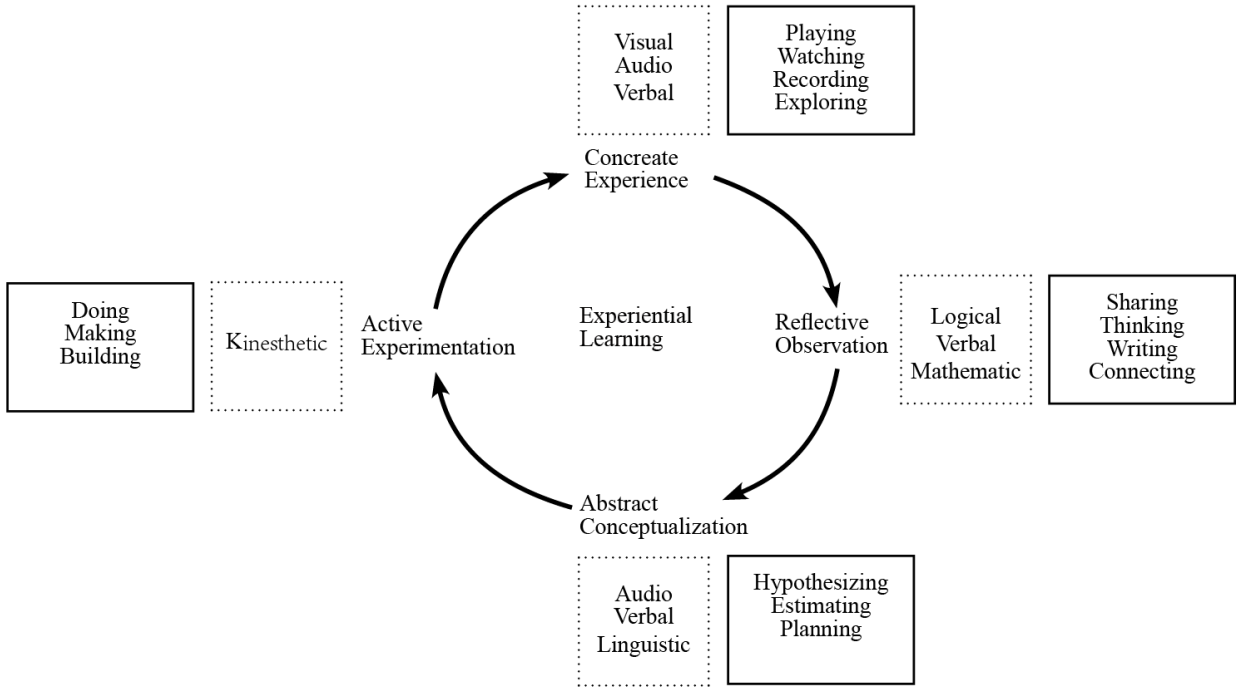


Figure 19: outdoor experiential learning involved with senses (Kolb 1984) Drawn by author

3.2.3 Experiences support experiential learning of outdoor environment

There are many categories of experiences that support experiential learning. Interaction with the outdoor learning environment performs differently based on the experience type and focal point.

According to his research on the relationship between the outdoor environment, experience and learning, Rubens proposed two concepts of the interaction, "narrow" adventure and "broad" adventure, that vary according to timescale, challenge level, effort input and visitor responsibility (Rubens 1999). The "narrow" adventure prefers a high level of excitement in a short time. In contrary, "broad" adventure needs constant effort and the input of personal responsibility. His study assumes that "broad" adventure can have a lasting impact on action and responsibility after learning. However, a further study conducted by Higgins and Nicol does not support this assumption. They suggested, rather, that "the trend in outdoor education is towards

the provision of short duration, high excitement experiences of the type noted above." (Higgins & Nicol 2002). Short but high-excitement experiences also contribute to stirring up feelings of responsibility toward environmental issues. This perspective contains the potential to develop on-site observation in some special-featured places.

A variety of activities are able to provide direct experiences and interactions with the natural or man-made environment, with consequences for real environmental issues. The purpose of these activities is to maximize the visitor's participation and interaction with the site so that people are engaged in realizing the power of their actions and behavior (Vaske & Kobrin 2001). Currently, the primary interaction with the outdoor environment takes the form of physical activity at the sites. Experiential learning applies many participation methods to facilitating the outdoor learning environment such as "field visits, role-plays, group discussions, problem-solving and enquiry approach" according to Bansal's study (Bansal 2016).

It has been a long tradition that a visit to an outdoor environment can give the visitor the experience of being part of an environmental system. These environments can have varying impacts on our lives. These kinds of physical activities are less formal and stressful compared to learning at school or in a classroom. Some visitors can explore and appreciate the natural elements, while others may recognize a problem and try to solve it. For environmental issues, visitors can more closely observe problematic items. Therefore, there are good opportunities for the real causes and effects of environmental issues to be explored more comprehensively at the sites.

The field survey approach aims at collecting direct information under the guidance of instructions. This information is useful for future problem identification and solving. Visitors can

use a checklist for clues to trace the key features of the site. They can collect data related to their daily lives .

Group discussion is the stage in which visitors share their findings and thoughts, which is similar to the following step of reflection in the experiential learning cycle. Contrary to individual exploration, group discussion asks for more engagement and group ideas to formulate action strategies at the site.

Role play activities offer people the rare chance to witness what actually happens at places with environmental issues. As they see and experience the routine lives of workers and researchers, it will deepen their understanding of the conflict between environmental needs and the impacts of human behavior. These kinds of activities can provoke in the visitor a sense of responsibility. They can choose and test new environmental behaviors and subsequently share their experiences with others.

The ultimate goal for the whole outdoor environment learning for waste is the problem-solving discussion stage. After the site visit, survey and group discussion, visitors can generally identify the current waste issue. Then the experiment stage provides the opportunity to gather together all this information and propose a solution plan for the issue. Even a short initial experience can contribute to future environmental decision making.

There are more activities that are applied to experiential outdoor environmental learning: environmental games, on-site surveys and project plans. These variety of experiences are able to encourage visitors to realize their roles and effects on the natural and built environment. Experiential learning can help them to recognize their strengths, weaknesses, opportunities and possible threats they may pose to environmental issues (Higgins 2002).

3.2.4 General strategies of outdoor environment experience learning

Based on the previous discussion of experiential learning and the outdoor environment, the most crucial component is concrete experience, which emphasizes people's active and complete physical and intellectual involvement. Forming a special relationship with environment requires us to visit the site, and to experience and explore it to finally respect and understand the environment. How to get people to have an experience with the environment is the first step for successful experiential learning in an outdoor environment. Thus, a series of general strategies is created to facilitate experiential learning in an outdoor environment:

- The place itself must support experiential learning. The place should embody relevant to environmental issues or be an impressive urban or natural environment (Littoral et vie 2008).
- Establish the theme and purpose of experiential learning in an outdoor environment.
- Engage people's active participation via experiences that are both physical and perceptual.
- Design multiple activities that require direct contact with the environment.
- Consider a variety of sensory experiences in design to better perceive the environment.
- Include sharing and group discussion to convey feelings, ideas and observations of the environment

3.3 Waste landscape related to experiential learning

As a critical dimension of learning involves discerning between positive and negative information, experiential learning can play valuable roles in helping educate people about waste landscapes (Ewert & Sibthorp 2009). Learning about environmental issues may be promoted within problematic or compromised landscapes. Many experiential activities have traditionally taken place in botanical gardens, parks, and forests, often pleasant and physically appealing places, illustrate the environment issues. In contrast, as one of the most complex environmental issues, waste landscapes offer a learning process that enriches exploration and thinking about the "problems" of the subject itself.

3.3.1 Valuable role of waste landscape

Interactions with the environment are not merely solely confined to positive experiences; instead, they can encompass divergent observations of what happens in an environment. As Higgins stated, "the design of the learning experience includes the possibility to learn from natural consequences, mistakes and successes" (Higgins 2002).

Places like natural disaster areas and waste sites are usually neglected as key areas through which to explore environmental issues. However, Measham believes that interest in environmental issues can be prompted by some naturally hazardous places. He chose an area that had suffered from flooding and earthquakes. On the one hand, the main goal is to encourage direct observation of what happened in such areas so as to identify the real problem. On the other hand, the findings will prompt people to realize that these sites had witnessed great changes and have features that people had previously taken for granted (Measham 2007). Furthermore, hazardous places do not mean activities necessarily carry real risks, conversely, they can remind the public of possible risks (Higgins 2002).

From this perspective, it is essential to point out important components for learning from hazardous spaces:

- Direct observation of waste sites.
- The experience can reveal the transformation of the value of waste and features ignored previously.
- Hazardous places convey a sense of risk while learners remain safe.

Considered a special learning space, waste landscape serves as ideal places for collecting information about waste. The special characteristics of waste landscapes provide abundant stimulus for experiential learning exploration. Largely invisible, such sites are carved with traces of waste practice, which is composed of many new materials and allows for learning-related adventures. Lynch and Southworth also noted that such screened and isolated places have "ruinous attraction" that offers mystery, free play opportunities, and varied sensations (Lynch & Southworth 1990). The emphasis of these waste characteristics can trigger interests in learning.

In particular, waste sites can reflect the impact of human wasting activities and the public's understanding of waste (Sevenant 2009). Waste not only impacts how we understand its surrounding context, but also can introduce environmentally responsible behaviors. Many waste sites have experienced tremendous ecological and cultural changes and many can be adapted to new purposes with new value.

Based on the discussion of hazardous spaces, the foremost concerns regarding applying experiential learning to waste landscape involve encouraging observation, reflecting value transformation and managing the sense of risk.

3.3.2 Challenges of applying experiential learning to waste landscape

Experiential learning also has challenges related to waste landscape. People often interpret waste as great threat to the living environment because of uncertainties and ambiguities surrounding waste consequences (Eiser & Bostrom 2012). In addition to actual risk, the challenges usually come from people's perception, especially holding biases against waste that are linked to its perceived negative and degrading impacts. Rarely do people have the chance to see the real amount of waste generated by human activities and management processes. Some aspects of waste sites are considered hazardous and threatening to human health and environment, the proposed learning experiences need to face a potential harmful learning space. Experiential learning is an effective way to a develop a better understanding of waste wherein people see the transformation and value of waste.

Another challenge is that most of these interactions are confined to limited routes and spaces. The topic of waste in experiential learning is explored, often accompanied with discussion of solutions (Higgins & Nicol 2002). However, there are not many places that provide programs related to experiential learning, not to mention the whole process of learning. After scheduling an appointment at the waste sites, the visitors are gathered by the waste tour guide. In a modular process, visitors see how operating landfills work and what closed landfills look like, and to look at the amount of waste generated by human activities (Midland Volunteers for Recycling 2011).

In the setting of waste landscape, learning process may be subject to disturbance from characters of waste, such as odor, noise and poor environments that learner mat resist. Also, learners own waste knowledge at different levels require concerns for learning groups with different target.

3.4 Key Design aspects related to experiential learning in waste landscape

Synthesizing the concepts of experiential learning, physical spaces for experiential learning, and issues and challenges related waste landscape and experiential learning, illuminates four key design aspects that designers should consider in the design and application of experiential learning in waste landscape. All these components support integrated design strategies that encourage multi-dimensional experiences with the waste landscape (see Figure 20). Each component and its corresponding and specific potential strategies that are illustrated later in design guideline.

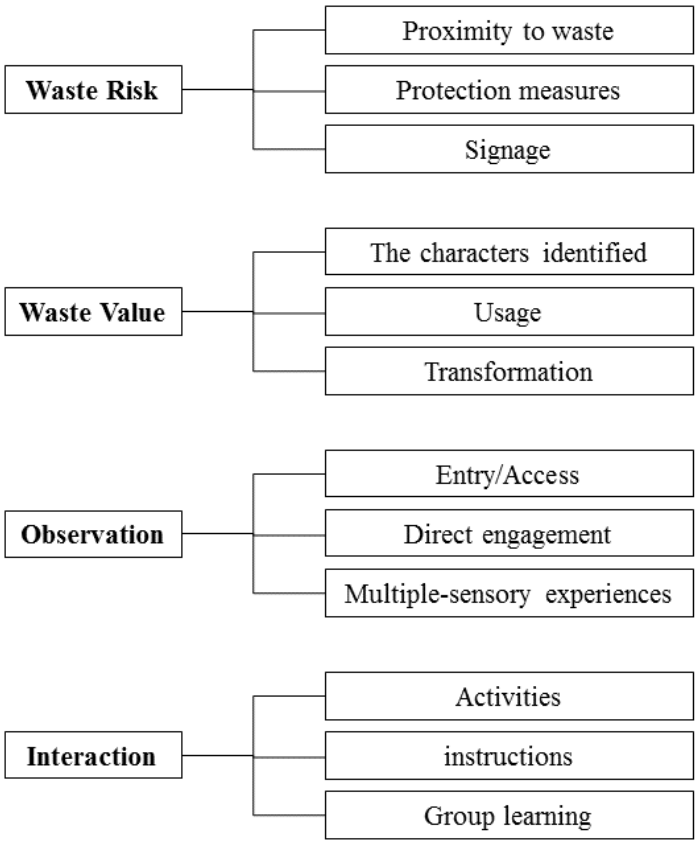


Figure 20: Design strategies to facilitate experiential learning at waste landscape. Drawn by author

The whole learning process, in whatever waste landscape, needs to be mindful of safety and health concerns as space for experiential learning requires. However, waste sites, especially

active ones, do have some particular constraints and threats to human health and safety. The proximity to waste determines how close people come to waste. Protection measures delineate the safety scope of contact with waste. Signage informs visitors of the dangers and conveys a sense of risk. How to balance between safety requirements and learning demands is a challenge.

Waste value is the learning goal of the experiential learning at waste landscapes. It is the waste setting that provide the stimulus of learning. An improved understanding of waste and the correct recognition of waste value are inseparable. Once people identify the character of waste and witness the transformation of waste as it is endowed with new function and usage, they then understand the potential of waste through experience. Design approaches are applied to show waste values in numerous experience types.

As previously discussed, observation is the first step in experiencing the waste landscape. The design of entry or access determines whether people can approach and perceive waste as learning materials. Experiential learning relies on direct engagement to truly explore and learn about waste. Multi-sensory stimuli provide the opportunity to gain a comprehensive perception of waste.

Other than observation, interactions aspect aims at increasing people's participation and involvement. This provides more perspectives to understand waste. Activities encourage participation, and sharing and action require specialized spaces. Some group learning spaces also require guidance and instruction. Even special events can spark interest in waste. For some waste landscapes, it is not realistic for visitors to remain on-site stay for a long. Therefore, how to create experiences of short duration but high excitement at waste sites is quite challenging .

3.5 Summary

After reviewing the concept of experiential learning and its relationship to the outdoor environment, the key functions and general strategies of experiential learning for the outdoor environment are identified. Based on the characteristics of the waste landscape, the valuable role of the waste landscape to experiential learning about the environment was also discussed, along with the challenges of applying experiential learning to waste landscapes. With the integration of experiential learning principles and waste landscapes, key design aspects related to experiential learning in waste landscape were generated. In Chapter 4, case studies will be used to illustrate these design aspects that address experiential learning in a variety of waste landscape types.

CHAPTER 4

CASE STUDIES

4.1 Case Studies Introduction

4.1.1 Why case studies

Case studies are a great descriptive methodology for the exploration of the success and limits of landscape architecture design approaches (Swaffield & Deming 2011). Through the discussion of the last two chapters, it has emerged that design is the primary mechanism and approach to achieving integration of all aspects of the waste landscape. To demonstrate the significance of design, the case studies provide great materials for a variety of landscape designs and experiential learning elements that engage people in waste landscapes. Also, explorations of previous design practices help us to identify the successes and failures of applying certain design characteristics. In the end, using the experiential space framework, case studies can also evaluate the application of multiple landscape approaches in waste sites. Integrated with the discussion of experiential landscape design, the lessons learned from case studies will generate the conceptual design framework for the site design.

4.1.2 Case Selection

Based on my focus on waste related design and experiential programs, I chose the following requirements in selecting case studies. First, does this project have a variety of concerns regarding creating experiential learning paths and access to waste? Second, does this project use multiple landscape approaches to address experiences with waste? Finally, are these cases located in close proximity to an urban context.

In addition to these conditions, waste landscapes can be classified into five different categories . This thesis mainly focused on three representative types as exemplars of design for analysis and comparison, including a waste recycling and transfer facility, a comprehensive waste landfill and a recycled waste park (see Figure 21).

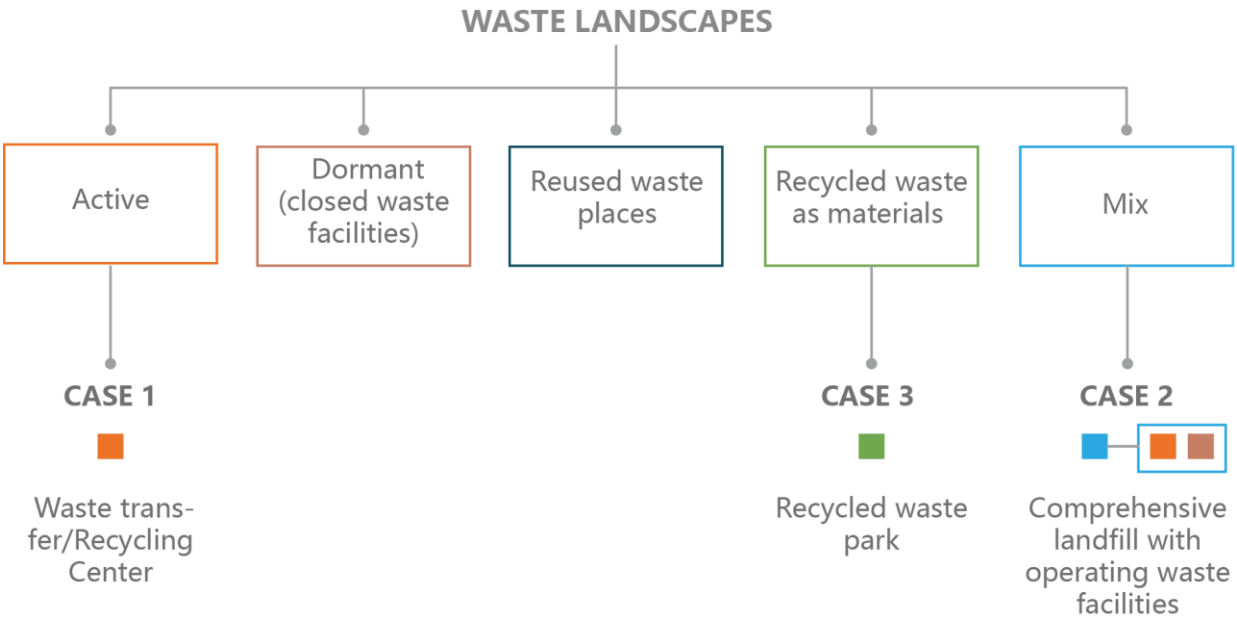


Figure 21: Case selection

4.1.3 Case Studies Evaluation: Evaluation Index

Several aspects and elements of each case will be studied and used to evaluate the cases qualitatively. First, the background and waste context are introduced. Then, it mainly review challenges and opportunities for design based on site features. Moreover, based on the previous discussion of research about waste landscapes and experiential learning, the applied design strategies will be identified according to experiential learning aspects. Finally, the features of approaches to the application of experiential learning will be summarized (see Figure 22).

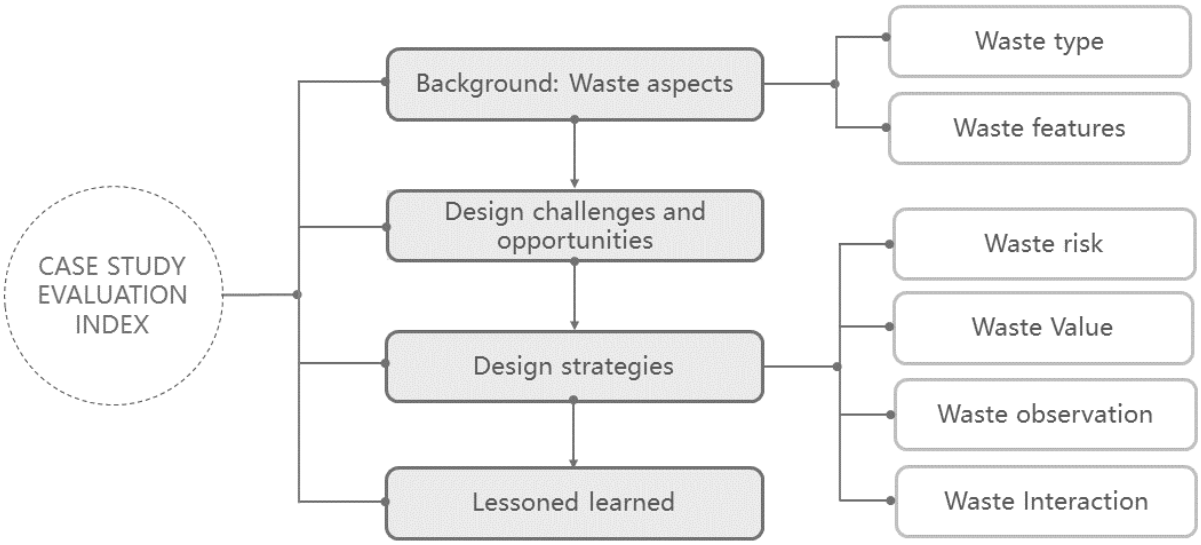


Figure 22: Case studies evaluation index

4.2 Case Studies

4.2.1 Operating waste facility: 27th Avenue Solid Waste Transfer and Recycling Center

4.2.1.1 Project Background

Project Name: 27th Avenue Solid Waste Transfer and Recycling Center

Location: Phoenix, Arizona

Size: 25 acre

Current Use: Solid Waste Transfer and Recycling center with public involvement

Date Designed/ Completed: 1989 -1993

Cost: $ 18 million

Client: the Phoenix Arts Commission and & Phoenix Department of Public Works

Design Team: Michael Singer and Linnea Glatt

The 27th Avenue Solid Waste Transfer and Recycling Center (see Figure 23, 24) is one of the largest, most innovative waste management facilities in the United States, and one that incorporates art and public involvement (The City of Phoenix 2017). The waste facility, located

adjacent to the downtown corridor, has served the city of Phoenix for 20 years. he design of this dynamic waste transfer and recycling made great progress in encouraging industrial transparency and public engagement (Michael Singer Studio 1993). This center successfully integrates landscape planning, structure, and architectural design with public involvement in industrial facilities.

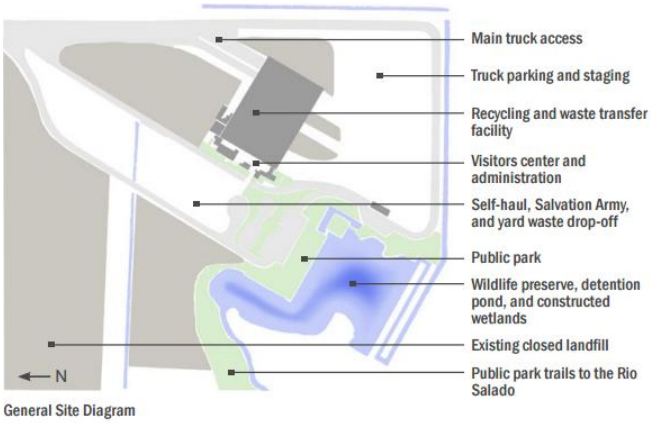


Figure 23: Bird's eye view of 27th Avenue Solid Waste Transfer and Recycling Center (Image courtesy by City of Phoenix)

Figure 24: General Site Plan (Image courtesy by Environment Defense & Michael Singer Studio)

4.2.1.2 Challenges and opportunities for design based on site features

As one of two main transfer stations in Phoenix, the 27th Avenue Solid Waste Transfer and Recycling Center serves more than 350,000 households and processes 60 percent of all residential trash for Phoenix (GREENLIVINGGAZ 2015, Tracy-Noren 2014). Next to an existing closed landfill and a retention pond, the waste facility will be taken to into a big plan in the future.

The primary goal of this facility is temporarily holding solid waste. The main functions include solid waste transfer, recyclable material sorting, composting and solid waste division (see Figure 25, 26). In order to reduce dust and noise pollution, solid waste transfer and recycling share the first floor of the station. The space can be divided into stations for solid waste transfer

and recycling, a self-haul area, and an organic composting and solid waste division (Reimage Phoenix 2015). Accepted waste materials include residential trash, green organic materials, and recyclable materials such as paper, glass, metals and plastics.

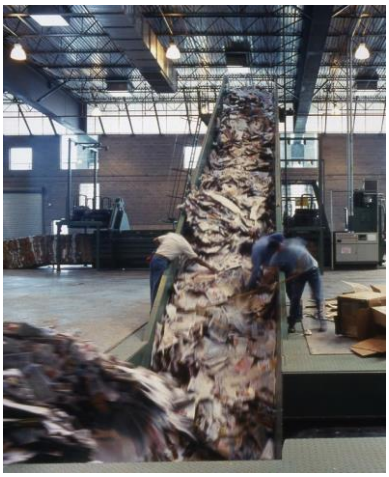


Figure 25: Recyclable materials processing on the first floor of the building
(Image by courtesy of Michael Singer Studio)

Figure 26 : Solid waste division (Image by courtesy of Phoenix Police Department)

Regarding public engagement at the site, the complexities of site features and waste characteristics contributed to challenges and opportunities for site design and experiential learning (see Table 3).

CHALLENGES	**DESIGN FOR EXPERIENTIAL LEARNING WITH WASTE LANDSCAPE**
Health & Safety	• Long time exposure to toxic substances conveyed from the waste streams and air • Difficulties accommodating the public during real waste processing • The circulation of waste transportation flows • Smells from outdoor waste storage and composting • Possible danger from operating machines and equipment that

	process waste
Environment Pollution	Outdoor waste storage and composting may cause polluted runoff to soil and water
Waste Location	• The disconnection to the urban landscape • Located in industrial district far removed from residential areas • Conceptually marginal place
Waste Identity	• Invisibility of waste • The facility are usually enclosed and not open to the public • The inherent view of waste as negative
OPPORTUNITIES	**DESIGN FOR EXPERIENTIAL LEARNING IN A WASTE LANDSCAPE**
Health & Safety	• Certain separations from waste already exist: the main waste processing streams are in the transfer building • Separation of pedestrian and waste transportation flows • Odor Control • Guidance is necessary
Environment Pollution	• Buffers are needed • On-site demonstration
Waste Location	• Unique features of site may establish cultural connections • Not far from the downtown district
Waste Identity	• Multiple programs are introduced such as environmental learning • Site visitation • On-site activities

Table 3 Challenges and opportunities for design of 27th Avenue Solid Waste Transfer and Recycling Center

4.2.1.3 Design Strategies for experiential learning in waste landscape

Responding to the challenges and opportunities for design, the design strategies of this site applied a series of approaches to enhance public engagement and create experiential learning spaces at the operating waste sites. These design approaches included: increasing industrial transparency and visibility, emphasizing public access and circulation division, building elevated observation pathways and providing many types of outdoor learning spaces.

Waste risk design strategy

To tackle the actual and perceptual risk from waste, especially possible injuries from the waste processing machines and excessive exposure to waste, this project designed an elevated public pedestrian pathway. This approach lower the risk by separating people and waste in different levels. Moreover, this way does not affect the close look at the waste.

Elevated public pedestrian pathway

As on-site observation are one of design purposes, designers planned an elevated walking pedestrian pathway around the main transfer station (Michael Singer Studio 1993). With glass windows arranged on building's each side, the elevated walking pathway (see Figure 27) greatly facilitate visitors to have a closer exploration at internal waste management operations. Visitors can walk through the whole building to observe solid waste transfer and waste recycling processes without any security concerns and impact on normal work.

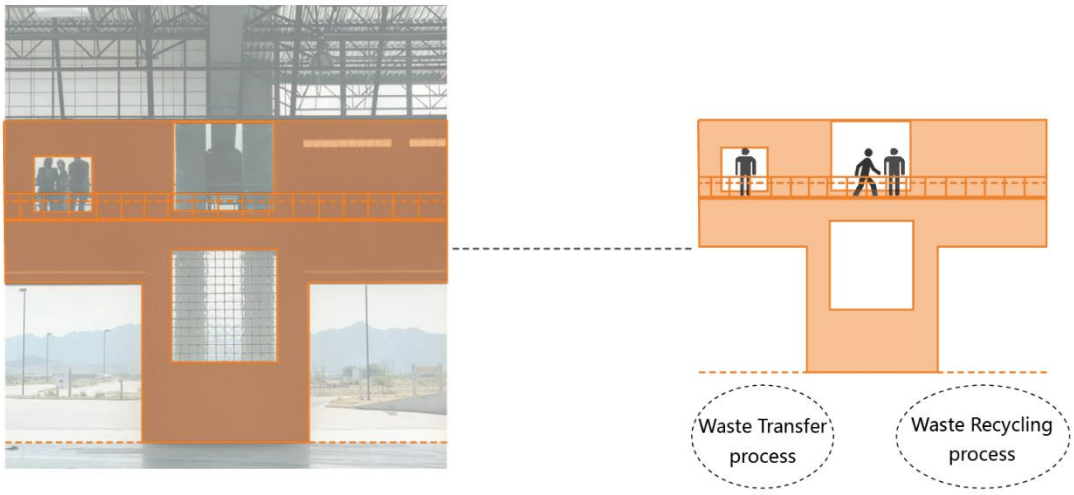


Figure 27: Elevated public pedestrian pathway. (Photo by Courtesy of Michael Singer Studio, image redrawn by the author)

Waste observation strategies

To better achieve the observation purposes, this project increased industrial transparency and designed public entrances and access to waste. Even though actual separation exists for safety and hygiene considerations, the approach enlarges the visual scope and provides more comprehensive viewing opportunities. The exclusive public access builds easier connections between the public and the waste sites without disturbing waste transportation flows.

Industrial transparency and visibility

Contrary to traditionally concealed waste facilities, the 27th Avenue Waste Transfer Station was designed to expand visual connections and increase transparency. The usage of huge central trusses supports a flexible working space and gives this structure an iconic feature that can be seen from far away. The benefit of this approach a is more welcoming and flexible space for both city departments and the public (Graddy 2010). Skylight, solar tracking mirrors and increased glass windows (see Figure 28) bring more natural light, reduce energy consumption and also showcase the waste management processes inside to visitors. Moreover, glass blocks

were embedded into the wall to create another façade to separate the working and administrative areas (see Figure 29). As a result, industrial transparency increases the communication between people and venues, creating educational opportunities for visitors.

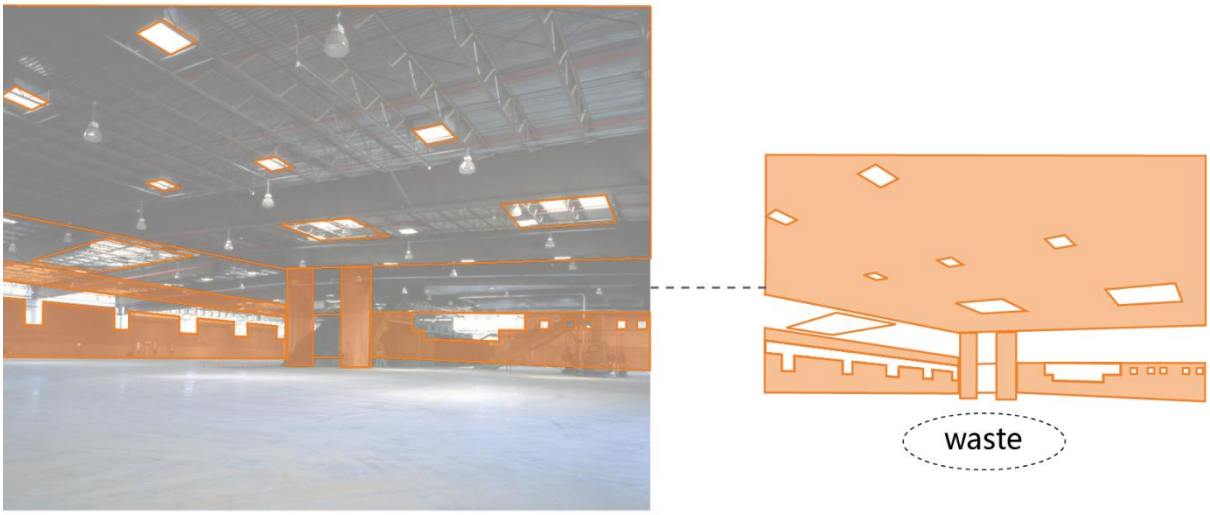


Figure 28: Industrial transparency: bring more light in multiple ways

(Photo by courtesy of Michael Singer Studio, image redrawn by the author)

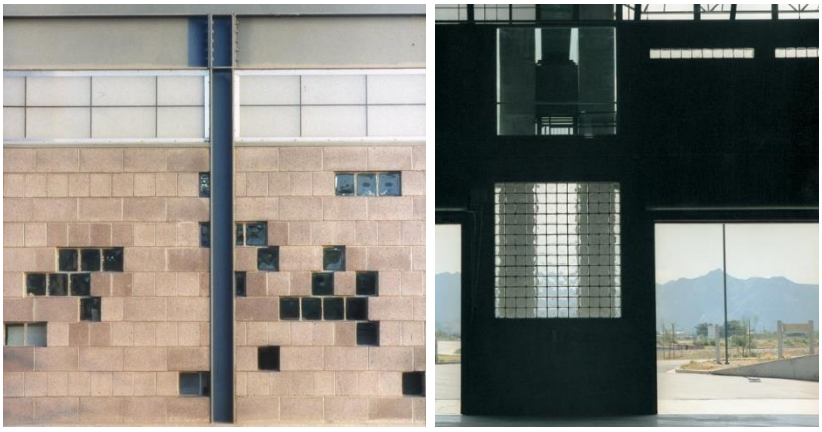


Figure 29: Industrial transparency: large windows, sky lights and glass blocks(Photo by Courtesy of Michael Singer Studio

Exclusive public access division/circulation

The designers, Michael Singer and Linnea Glatt, intended to allow the public direct contact with waste facilities. In order to invite people to participate in an experiential space, it is

essential to ensure attractive and safe public access first. The site separates traffic streams from visitors and employees to lower traffic conflicts while the self-haul area is connected to the visitor entrance by a pedestrian overpass. This pedestrian overpass (see Figure 30) brings visitors another perspective when waste trucks drive through and pile up dumps (Brown 2014). The visitor entrance is designed as a terraced landscape, which not only corresponds to the topography, but is also removed from truck traffic (see Figure 31).

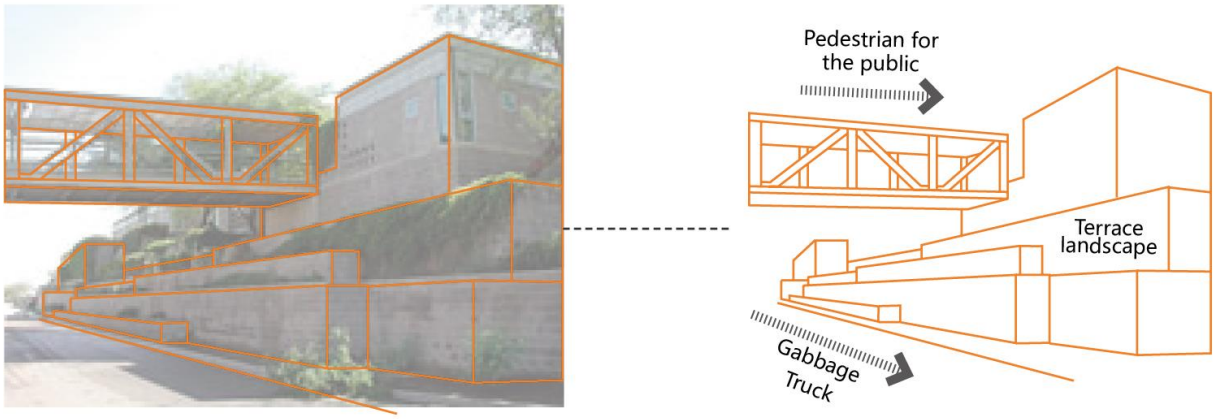


Figure 30: Public access and circulation division

(Photo by Courtesy of Michael Singer Studio, image redrawn by the author)

Figure 31: Public entrance and terraced landscape (Photo by Courtesy of Michael Singer Studio)

Waste interaction strategies

To strengthen the identity of waste, waste interaction strategies encourage a better understanding of waste by designing space for waste education events, sharing perspectives on waste, and other related activities. Multiple outdoor learning spaces take advantage of different characteristics of the space to support a variety of activities.

Multiple outdoor learning spaces

The team planned an exterior amphitheater space (see Figure 32), which can accommodate gathering, communication and educational events. Additionally, there are large windows in front of the amphitheater so that visitors can watch the lively waste transfer and recycling processes (Environment Defense & Michael Singer Studio 2007).

Connected to the amphitheater, the outdoor garden landscape uses native plants and reclaimed wastewater to reduce water consumption. This is another gathering space for both visitors and employees. Spaces like this reveal to the public that attractive landscapes can coexist with waste sites.

Figure 32: Amphitheater and garden (Photo by Courtesy of Michael Singer Studio)

Self-haul area and other experiential spaces

Next to the facility, the self-haul, material recovery, and composting areas are the main place where individuals can drop off their waste. Therefore, visitors can witness actual wasting activities and large amounts of waste. In addition, the site also has other functional learning spaces, such as a multipurpose community room, galleries, and exhibition spaces for engaging different purposes (Michael Singer Studio 1993).

The design priority is to take public involvement into consideration. The public are invited to visit a waste facility that would usually be isolated from the community so that they may learn more about waste issues at the site. They can observe and learn the operation processes: what happens to trash once it is sent to the site, how waste is sorted, managed and recycled, and mulching and composting. In addition, presentations and speeches are held at random for public. There are also education staff and workers that provide instruction and information about waste. The current education tour usually accepts 20 -100 people at a time. Nearly 5,000 children come for field trips tour the facility every year (Graddy 2010).

Based on the experiences and senses involved, a diagram of experiential learning for this case is created (see Figure 33).

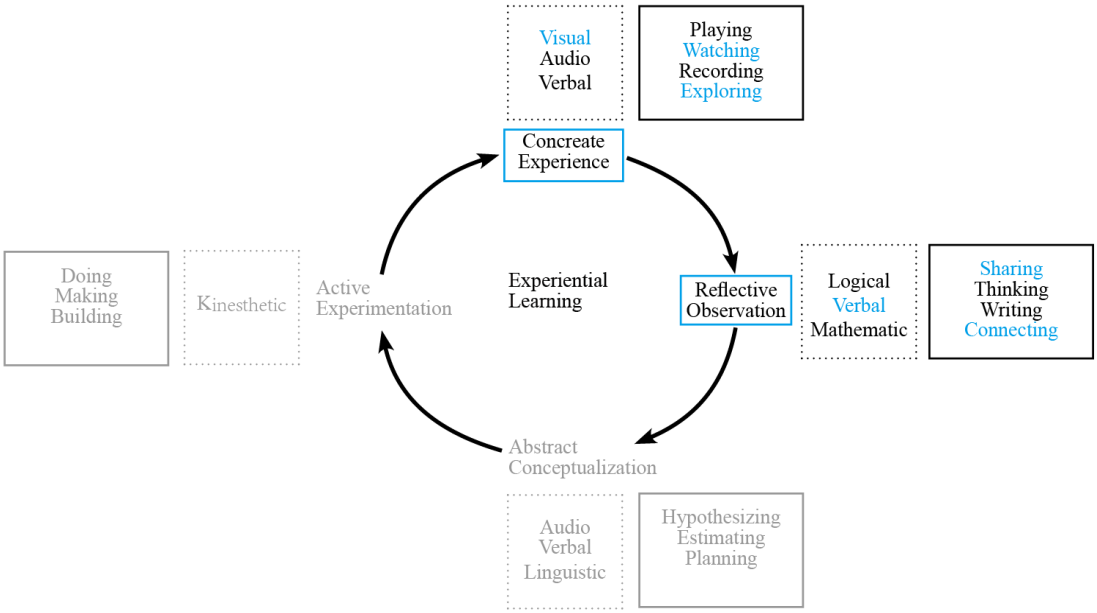


Figure 33: Experiential learning stage involved (image by the author)

4.2.1.4 Lesson learned

The 27th Avenue Waste Transfer and Recycling Center is an excellent example of how a waste facility emphasizes public engagement and encourages learning more about waste process through functional and aesthetic design approaches (Muschamp 1993). The facility is credited with integrating infrastructure function, community considerations, and landscape design with education. It also demonstrated how industrial transparency could be applied to create an effective experiential learning space to inform the public with respect to waste disposal and recycling. Moreover, the innovative application of elevated walkways expanded opportunities for the public to view active waste management processes. Furthermore, its outdoor learning spaces, amphitheater and garden play important roles in group learning and discussion. The terraced landscape not only functionally divides people and vehicle streams, but also corresponds to the history and culture of the city of Phoenix.

4.2.2 Comprehensive Landfill: Hiriya Mountain- Ayalon Park

4.2.2.1 Project Background

Project Name: Hiriya Mountain

Location: Tel Aviv, Israel

Size: 118 hectares - 2000 acres

Former Use: landfill

Current Use: park includes transfer station, recycling park, and waste education center

Date Designed/ Completed: 2004 - 2020 (projected)

Cost: estimated $ 250 million

Client: Park Ariel Sharon Ltd., Beracha Foundation

Design Team: Peter Latz & Partner

Hiriya mountain (See Figure 34) is a redeveloped processing landform transformed from the largest landfills in Israel. This mountain plays a significant role in urban space development, urban appearance and environmental quality. The site is located within the urban area of Ben Gurion Airport and the three main highways in Tel Aviv, and it also sits at the intersection of two rivers at Ayalon Plain (Isenberg, Peterson, & Sternberg 2004).

Situated on top of 25 million tons of waste, the 200-feet-high Hiriya mountain was composted of accumulated waste (Silverstein 2015). Seen as “Garbage Mountain” and closely adjacent to Tel Aviv for half a century, this giant landfill has been developed into a park that includes a large-operating transfer station and recycling park, an environmental education center, a new urban park and multiple activity facilities. The ambitious transformation is planned to create a eco-friendly park that will become an “Urban Oasis” at Tel Aviv’s urban center, which lacks green spaces, by 2020.

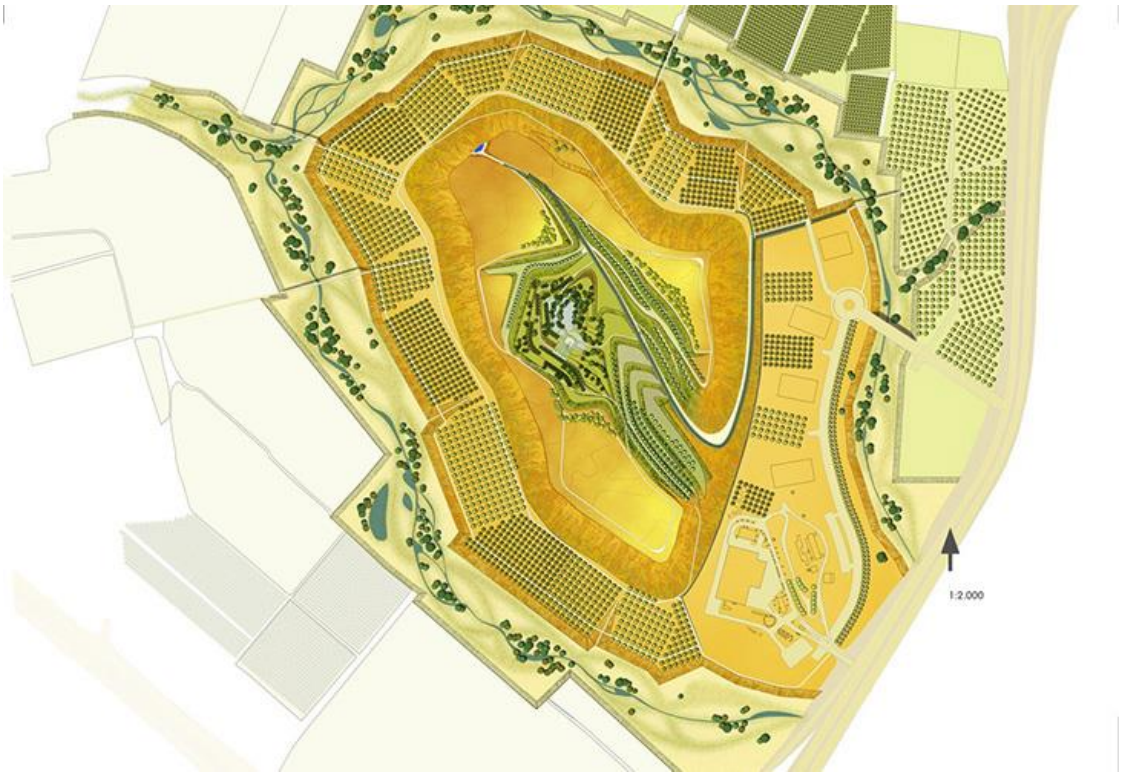


Figure 34: Master Plan of Hiriya Mountain (Image by courtesy of Peter Latz & Partners)

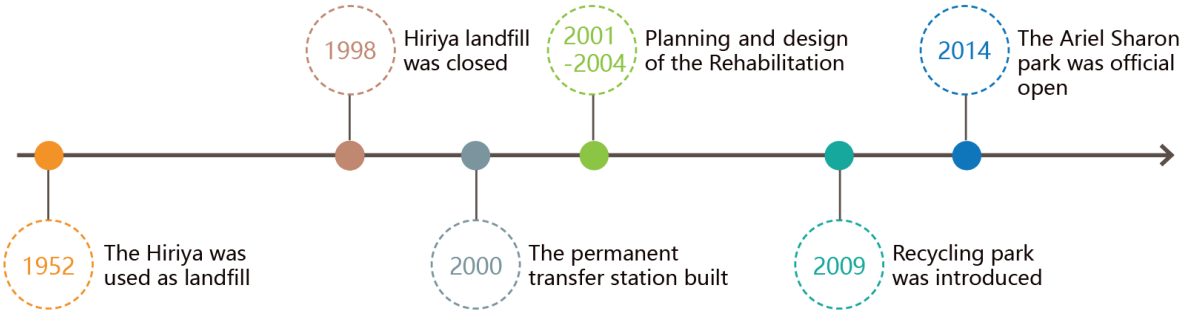


Figure 35: Timeline of the Hiriya mountain. Image drawn by author (Data source: http://www.hiriya.co.il/len/)

4.2.2.2 Challenges and opportunities for design based on site features

From 1952 to 1998, the Hiriya mountain was used as the city's primary municipal waste landfill, serving the whole metropolitan area of Tel Aviv (see Figure 35). Its large size--half a mile long and 200-feet high-- poses formidable challenges for human health and the environment. As the amount of household waste produced by the area grew rapidly, the site needed to take in ever more waste, peaking around 3,000 tons per day in 1998, the last year it accepted waste (see

Figure 36). The transfer station built in 1999 processes household, construction, and green waste. These waste features produced dormant and operating waste problems at the same time. With no protection measures taken when the site was built, the half-century old waste practices resulted in contamination, drainage, an unattractive appearance and life disturbance issues (see Figure 37) (Weilacher 2008).

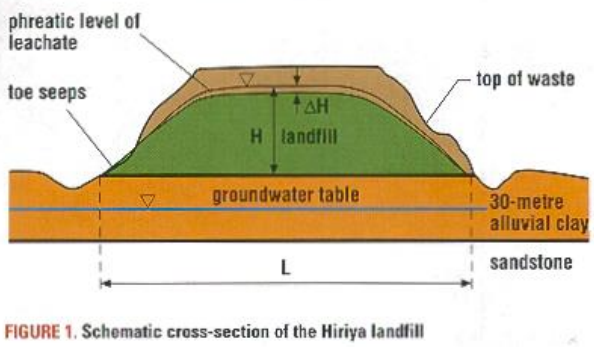


Figure 36: Previous Hiriya Mountain before transformation(Image by courtesy of Peter Latz & Partners).

Figure 37: Schematic cross-section of the Hiriya landfill. (Isenberg, Peterson, & Sternberg 2004)

These waste features left numerous traces on Hiriya mountain, which contributes to the many challenges and opportunities for the development of this site (see Table 4).

CHALLENGES	**DESIGN FOR EXPERIENTIAL LEARNING WITH WASTE LANDSCAPE**
Health & Safety	• The huge volume of the waste mountain • Potential water and soil pollution from landfill mountain that threaten human health • Unstable mountain edge slope poses safety concerns • Strong smell affects surrounding district and highway. • Unstable conditions for learning

Environment Pollution	• Threatening factors include landfill leachate, blowing waste, waste runoff and methane • The proximity of waste site to Ayalon and Shapirim rivers causes easier waste runoff pollution (Isenberg, R., E. Peterson & D. Sternberg 2004) • The bare mountain surface produces a feeling of ecological decline
Waste Location	• Adjacent to the Ben Gurion International Airport only 2 miles away, birds attracted by trash may cause aviation collision (Weilacher 2008) • The site is located in the floodplain of two main rivers • Adjacent to agriculture plain • Perceived as a marginal place
Waste Identity	• Eye-catching, notorious large landform visible by travelers to Tel Aviv from both land and the air • Hiriya became "a visual reminder of consequences of mismanagement and lack of civil responsibility" (Weilacher 2008) • Hiriya is identified as a waste symbol
OPPORTUNITIES	**DESIGN FOR EXPERIENTIAL LEARNING WITH WASTE LANDSCAPE**
Health & Safety	• Frame/Cover the waste • Use biogas as new energy • Odor Control • Materials for environmental and waste-related educational lessons
Environment Pollution	• Frame/Cover the waste

	• Restore the environment of the Hiriya area • Materials for environmental and waste-related educational lessons
Waste Location	• No residential housing area included • Integration with surrounding environment • On-site waste facility • Suitable for a specific experiential learning place • Convenient transportation due to nearby main highway
Waste Identity	• Being cultural landmark of waste • A gateway to Tel Aviv on-site observation • Serving as an example (learning material) • Many programs can be introduced for learning and observation

Table 4: Challenges and opportunities for design of Hiriya Mountain.

4.2.2.3 Design Strategies for experiential learning with waste landscape

Waste risk design strategies

A safe and flexible space with few external threats is the first requirement for experiential learning. Thus, the priority is to ensure the safety and stability of waste sites. For a landfill mountain in a dormant waste status, the design strategy mainly employs protection measures such as capping the waste, wastewater treatment and edge slope stabilization.

Waste treatment concerns

The treatment strategy was straightforward: cover the waste. After the Hiriya mountain had been exposed to strong wind and the sun's radiation for decades, the first step was to stabilize the mountain and tackle waste problems such as leachate, methane and odor problems. The design team decided to cap the waste mountain by applying a layer of "bio plastic" under heavy crushed concrete and three feet of soil (see Figure 38) (Silverstein 2015). This capping model allows planting and vegetation to grow on top of the plateau.

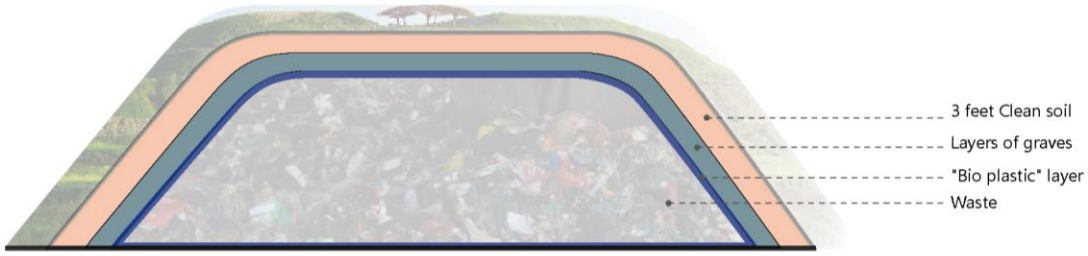


Figure 38: The design for capping the waste (Silverstein 2015). Drawn by author

In addition to solid waste and biogas control, a system for waste effluents treatment was designed to purify multiple pollutants from landfill leachate, run off from waste processing, and garbage truck runoff at the foot of Hiriya mountain (see Figure 39). As a natural filter with a SFW system (horizontal subsurface flow), the constructed 6135 square-foot wetland garden with 5 cells has the capacity to deal with 40,000 liters of effluence each day (Weinstein Vaadia Architects & Peter Latz 2007). It is an aesthetic and functional design that provides a good view and allows for long-term work on waste effluents. Next to the environment education center, this system is a good example illustrating for visitors how waste effluents are treated for the visitors.

Figure 39: Waste effluent treatment (Weinstein Vaadia Architects & Peter Latz 2007)

Environmental concerns

The environmental strategy is to maintain the integrity of the mountain and reduce disturbances in the environment from waste impact. The mountain side slope is unstable, and many cracks and slides occur. In order to maintain the unique sloping incline, multiple layer of terraces were designed to stabilize the mountain base. The main approach excavated solid waste from the upper level to lower the slope and conveyed it to consolidate the foot of mountain and then form the terrace (see Figure 40).

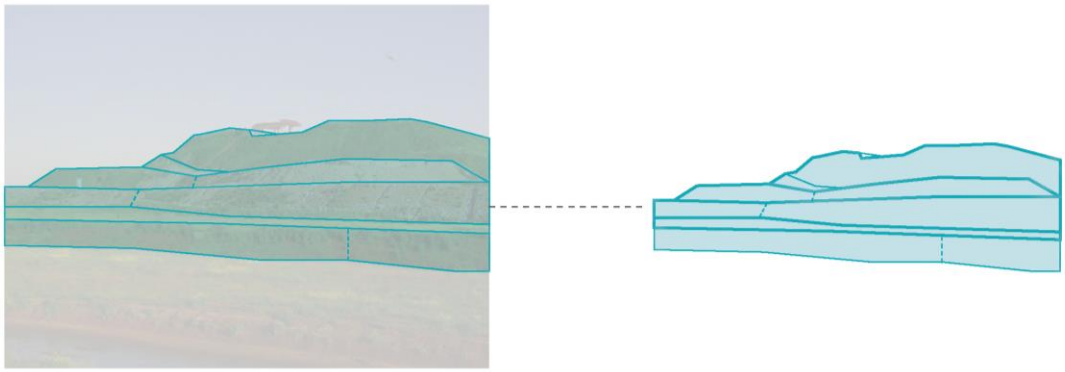


Figure 40: Multiple layers of terraces were designed to stabilize the mountain base

(Photo by courtesy of Latz & Partners Associate. Redrawn by author)

Waste value strategies

As methane produced by garbage is a new type of green energy (see Figure 41), 80 wells have been drilled into Hiriya mountain to collect the methane (NoCamels 2015). To retain the corresponding waste characteristics and traces, the design converted the waste traces into a cultural value of the continuation of previous waste practice.

This project also intended to integrate waste practice traces and relics to produce a new interpretation of or metaphor for a waste site. The former route of the garbage trucks and dumping activities naturally resulted a basin hollow with staged edges at the center of the plateau terrain(see Figure 42). Latz & Partners employed a concept of “green oasis in the desert,” which

began to bring hope and green growth on the “dead” trash mountain (Weilacher 2008). The water, vegetation and terrace edge worked together to become an oasis.

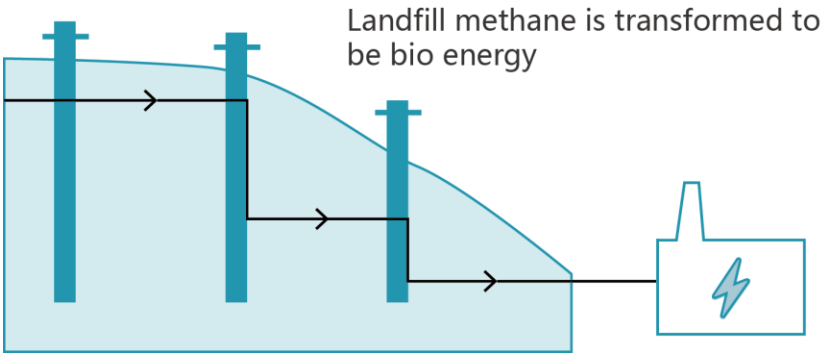


Figure 41: Landfill methane is transformed to be bio energy. Drawn by author

Figure 42: Green Oasis at the plateau of Hiriya Mountain(Photo by courtesy of Peter Latz & Partners Associate)

In addition, the design also emphasized the visual connections between waste and the public. As an iconic landmark, the viewpoint’s canopies allow the public explore the differences between Hiriya mountain and the Tel Aviv urban area. Also, on the other side of the mountain, the waste facilities at the foot of the mountain are conspicuous when visitors are on their way to the top. In order to have a safe but clear observation of the process of waste, a special walkway with a partial screen was designed.

Waste observation strategies

The Hiriya mountain had extensive contact with people before its transformation, including explorations by experts and artists, bird watching, scenery viewing, and dumpster

picking (Weilacher 2008). However, all these activities did not fully achieve the goal of raising public awareness about environmental and waste issues. The new design reflects a variety of characteristics of experiential learning aspects, especially in multiple programs related to waste and comparison experiences.

Contrast of the waste places

The richness of the site design brings diversity to the experiences people have there. The two different statuses and forms of waste sites in the same context, the transformed landfill and the operating waste facilities, informs the distinct stages and results of waste management (see Figure 43). In a short time period of time, 2.5 hours or a half-day tour, visitors can experience the site visually, as well as smell the waste volume and status differences. Moreover, the fact that the waste site was transformed into park and waste is being utilized as green energy also impart to people new information about waste. These differences can trigger observations of the waste landscape. This is a learning process that enables visitors to recognize real waste landscapes caused by human behavior.

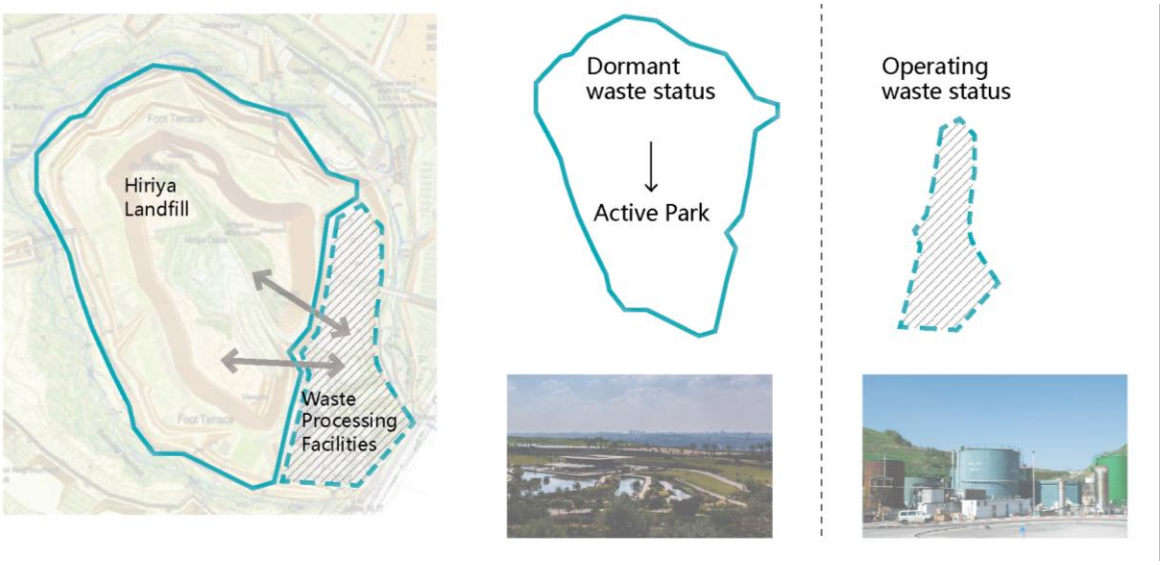


Figure 43: Experience from comparisons of dormant and operating waste status.

(Photo by courtesy of Peter Latz & Partners, Waste department, redrawn by author)

Open view of waste facilities

Since the waste facilities are located at the foot of Hiriya mountain, they are unavoidably visible from the route along the edge slope to the plateau. Latz and Partners did not want to take the common approach, in which planted vegetation blocks the view of the facilities. They believe that the facility's visibility is an undeniable part of experiencing waste processing. The viewing walkway with its open guardrail was placed on the edge of the waste facilities (Weilacher 2008). This unique view also creates a strong contrast to the city skyline, which can be seen from the iconic canopies' viewpoints (see Figure 44).

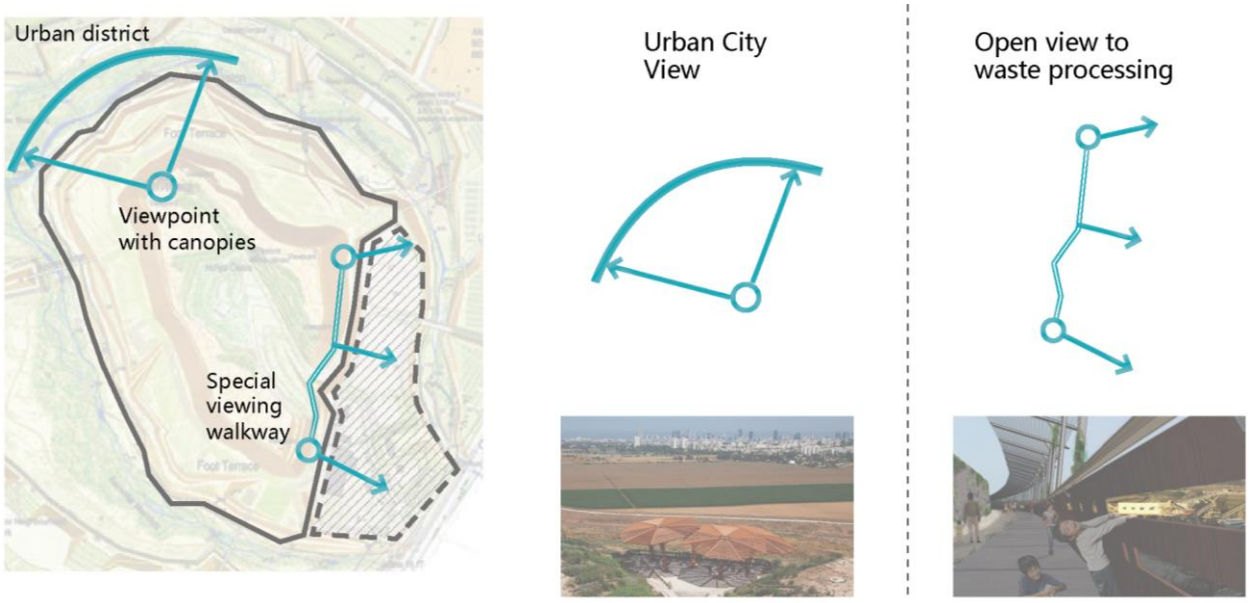


Figure 44: Comparison of view experience between urban city and waste processing

(Photo by courtesy of Peter Latz & Partners, Waste department, redrawn by author)

Waste interaction strategies

This project incorporated specific spaces to support a series of activities, including education programs, lectures, handcrafting workshops, art festivals and exhibitions about waste issues.

Specialized waste education center

The establishment of a waste education center was motivated by the vision to conduct waste education to prompt visitors to recognize waste issues, reduce waste production and promote waste recycling (see Figure 45). The waste education center itself is a good example of the reuse of an abandoned transfer station building. Also, many programs and activities are held there, including artwork seminars, education workshops, lectures about waste and recycling and further education for workers (Dan Recycling Authority 2009). Adjacent to the transfer station, the recycling park and waste effluent garden, there are many opportunities for outdoor guided tours.

Figure 45: Multiple learning experiences from specific environment learning center.
(Photo by courtesy of Peter Latz & Partners, Waste department, redrawn by author)

Exhibition and art festival

Unscheduled exhibitions and arts festivals are another approach to persuading the public to visit the waste landscape. They provide opportunities to exchange understandings and interpretations of waste in its cultural, social and lifestyle aspects by manipulating recycling materials and other forms of waste (see Figure 46).

Figure 46: Experience come from exhibition and art festivals

(Photo source: inhabitat,; Weinstein Vaadia architects)

The transformation process is also an excellent avenue for waste learning. People can witness the changes year by year. The plethora of experiences and the unique features provided by the site help convince the public to visit.

Based on the experiences and senses involved, a diagram of experiential learning for this case is created (see Figure 47).

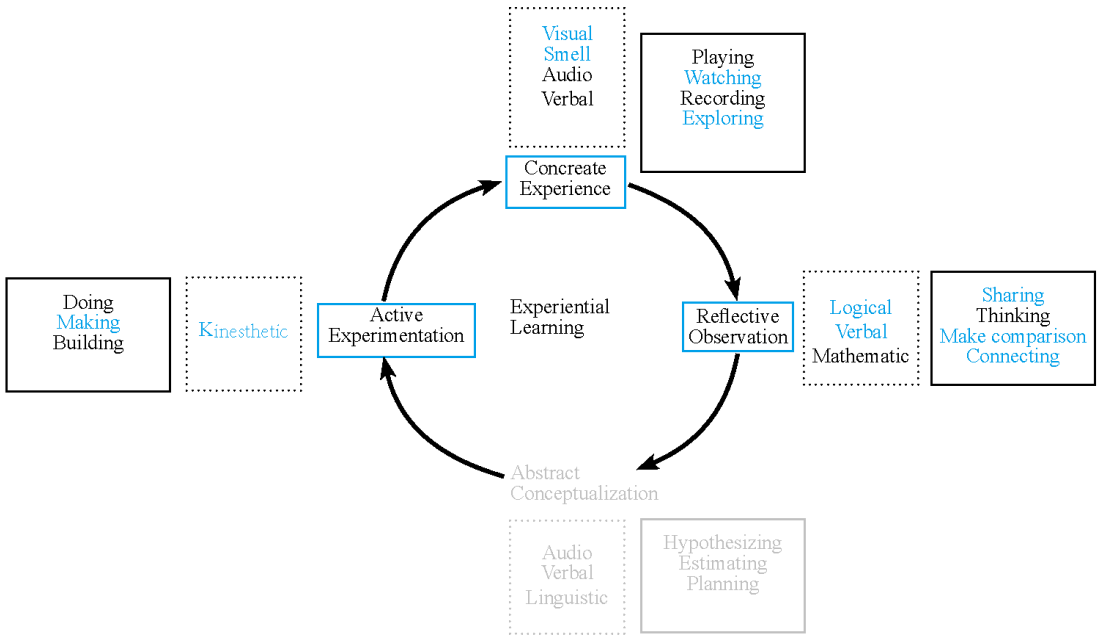


Figure 47: Experiential learning stages involved in Hiriya mountain (image redrawn by the author)

4.3.2.4 Lesson learned

Hiriya mountain provides an great illustration of how waste and experiential learning can be integrated with landfill transformation design by emphasizing waste footprints, waste identity and the waste process. Comprised of a huge volume of waste relics, Hiriya mountain was designed to both retain the original man-made landform and to be transformed into a cultural symbol of material production. The transformation stages represent a conversion from an "urban death zone" to a "green oasis". On the other hand, the variety of waste forms comprise the most vivid teaching materials. The site features landfill transformation, a waste transfer station, recycling park, and an waste education center. Through this comparison of different waste places, people are informed of a variety of possible developments of waste. Because of the visual direction, spatial arrangement, and programs the site provides, the success of the design of Hiriya mountain lies in its capacity to attract many people and provide them an opportunity to explore the waste landscape.

4.2.3 Recycled waste park- Lions Park playscape

4.2.3.1 Project Background

Project Name: Lions Park

Location: Greensboro, AL

Size: 40 acres

Former Use: public park

Current Use: public park

Date Designed/ Completed: 2010-2011

Cost: $ 500,000

Client: The Lions Club, the City of Greensboro, Hale County

Design Team: Rural Studio of Auburn University

As the largest park in Hale County, Alabama, Lions Park is a 40-acre revitalized public space in the town of Greensboro. From 2004, Rural Studio, the out-campus extension of Auburn University's Architecture College, began to renovate the park and improve its outdated and unwise planning. The Children's play at Greensboro was neglected because of limited site access and suitable outdoor spaces. Following a series of successful redesigned programs like baseball fields and a skatepark, a new playscape was designed to replace the older damaged one (Rural Studio 2010).

The Lions Park playscape (see Figure 48, 49) created an eye-catching and multi-functional shaded play space by re-appropriating 2,000 discarded steel drums (Boyer 2012). Approximately 7,500 square feet of the site addressed environmental concerns, the characteristics of waste materials, and extended functions of children's play. The specific emphasis of this project looks at how the sources of waste materials can be reused and integrated into open spaces and children's play areas.

Figure 48: Masterplan of Lions Park Playscape.
(Source: Architype Review http://architypereview.com/project/lions-park-playscapeissue_id107/)

Figure 49: The Lions Park Playscape (Rural Studio 2010)

4.2.3.2 Challenges and opportunities for design based on site features

For this design, waste features come from the waste used for landscape design elements. The use the barrels was not intentional; in fact, this was a design challenge that resulted from a company donation. The I.P. Callison & Sons company contacted Rural Studio to donate the 55-gallon drums, previously used for storing mint oil, because they needed to dispose of these one-time use items (LionsParkscape 2010). These drums, with their superior galvanization layer, were in good and usable condition (Rural Studio 2010). Admittedly, there are plenty of recycled waste materials that can be utilized for landscape design purposes. However, the different features of various materials bring their own challenges and opportunities for design(see Table 5).

CHALLENGES	**DESIGN FOR EXPERIENTIAL LEARNING WITH WASTE LANDSCAPE**
Health & Safety	• Possible danger caused by waste • Question for the durability and stability of waste materials used in landscape • Problems arising from the material features of waste, such as overheating under sunlight • Safety concerns
Environment Pollution	
Waste Location	• Location in the public park means more consideration for people's use of the space and intimate connections • In a child's play space, more consideration is needed of children's demands.
Waste Identity	• Maintain the identity of waste after being designed • How to arrange waste to match people's feelings of safety • Fear of waste for landscape use • People may not recognize waste materials as what they are
OPPORTUNITIES	**DESIGN FOR EXPERIENTIAL LEARNING WITH WASTE LANDSCAPE**
Health & Safety	• Targeted analysis of the waste material placed in the outdoor environment • Load test for design purposes

	• Easy installation and construction • Materials for environmental and waste education
Environment Pollution	• Materials considered for environment and waste education
Waste Location	• Unique features of waste trigger that interest in playing and knowing about waste • The site is suitable for children and families' environmental education • Many play and experiential programs can be integrated with the waste theme
Waste Identity	• A pile of waste is eye-catching in the landscape • Integration with aesthetic approaches • Lower cost of construction • This a good example of waste reuse and recycling

Table 5: Challenges and opportunities for design of Lions Park playscape.

4.2.3.3 Design Strategies for experiential learning in waste landscape

Waste risk strategies

This design fully took account of the possible dangers of waste as a landscape design element. Since the site incorporated intimate contact with waste, testing and protection measures were needed. First of all, it was essential to demonstrate galvanized drums' applicability for the design. In the early stage of design, the designer group took a load test to see whether the stability of the drums was affected by strong external forces (see Figure 50). They discovered

that one barrel can withstand a weight of 200 pounds, so they offered great stability (LionsParkscape 2010). This allowed the installation of shade for the playscape.

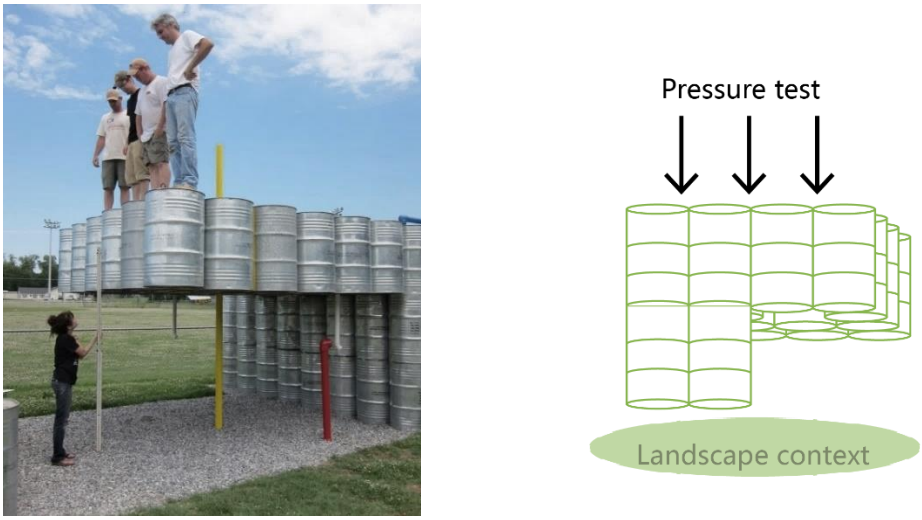


Figure 50: The load test for the barrel roof: The roof can hold 3200 pounds (LionsParkscape 2010).

Waste value strategies

This project conducted transformation of waste for new purposes. The primary approach to integrating waste into the outdoor space was repurposing followed by implementation as a basic element of landscape design, such as a piece of tile or brick. The assembly and different arrangements of barrels form the ground, walls and roofs, which constitute multiple outdoor three-dimensional spaces (see Figure 51). For some portions of the roof, barrels' tops and bottoms were removed to invite light into these spaces. Also, the roof was functionally designed to mitigate the impact of hot weather, including ground barrel overheating and possible burn injuries (see Figure 52).

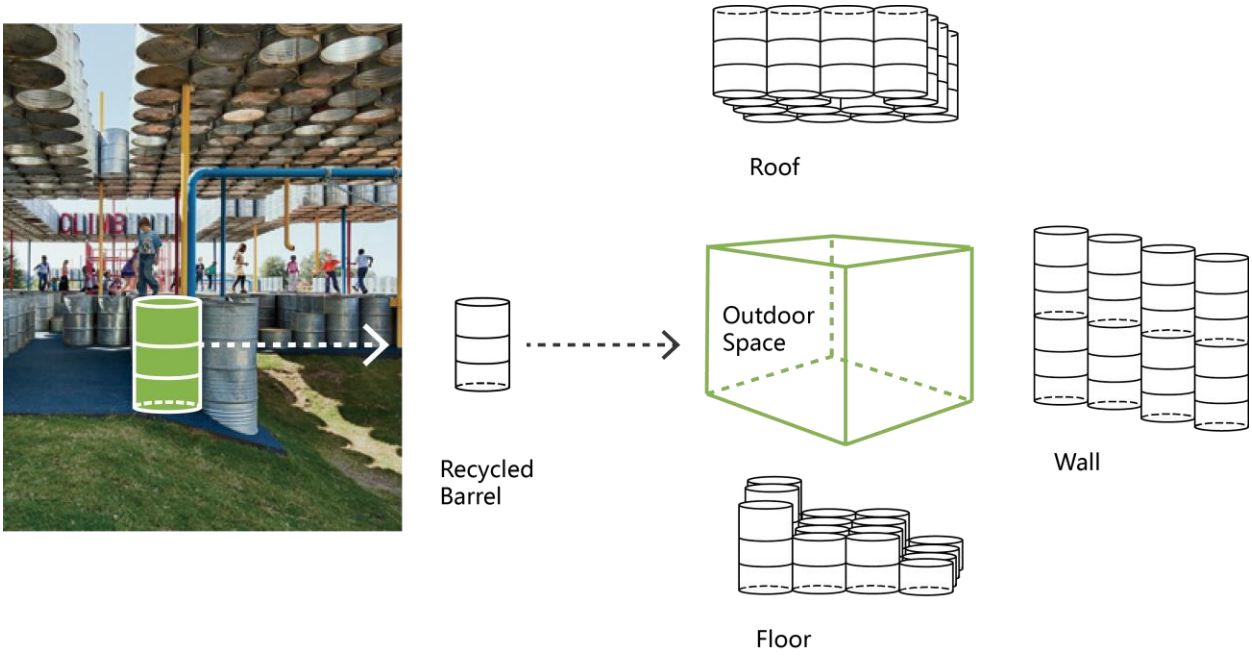


Figure 51: Recycled barrels constitute the outdoor space.
(Photo Source: http://lionsparkplayscape.ruralstudioblogs.org. Drawn by the author)

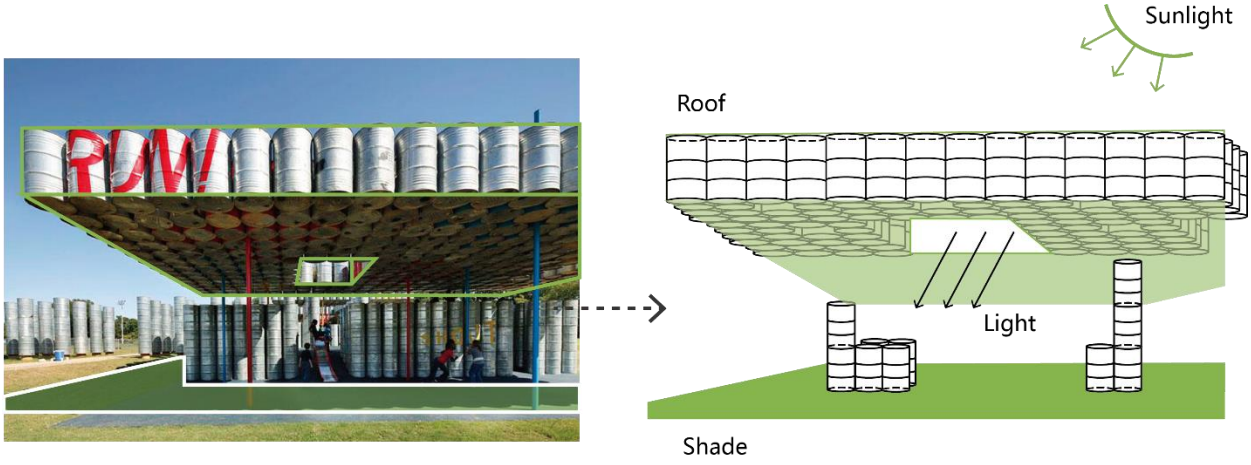


Figure 52: Roof provides shade to protect from hot weather while allowing light as well.
(Photo Source: http://lionsparkplayscape.ruralstudioblogs.org. Drawn by the author.)

Waste observation strategies

The designers kept the original appearance of all the barrels, unless they were filled with dirt for the ground or lost their bottoms and tops to form part of the transparent roof (see Figure 53). The piles of barrels are eye-catching in the landscape context. The trace left by their

previous industrial use attracts visitors to take a closer look at the landscape space made of former “waste”.

Figure 53: The original appearance of barrels shows the trace of previous use.

(Photo by courtesy of Rural Studio)

Waste interaction strategies

There are designed outdoor spaces for both physical & mental activities, with multi-sensory engagement. The concept of this site design is that playing is not confined to equipment, but also suitable in a larger space and environment. Guided by this idea, the site design does not only meet the requirements of physical practice, but also extends to the intellectual level to cultivate skills (LionsParkscape 2010). A variety of spaces created by drums are arranged to support running, climbing, jumping and other exploration activities. The large and colorful signage painted on the drum walls informs visitors about corresponding activities.

Meanwhile, mental experiences take place in the installation of sound tubes and sensory rooms where children can enrich their sensory experiences through visual, auditory, and kinesthetic stimulation. The characteristics of drums also lead to some spontaneous activities, such as percussive musical performances. These experiences prove the potential versatility of waste as landscape materials (see Figure 54).

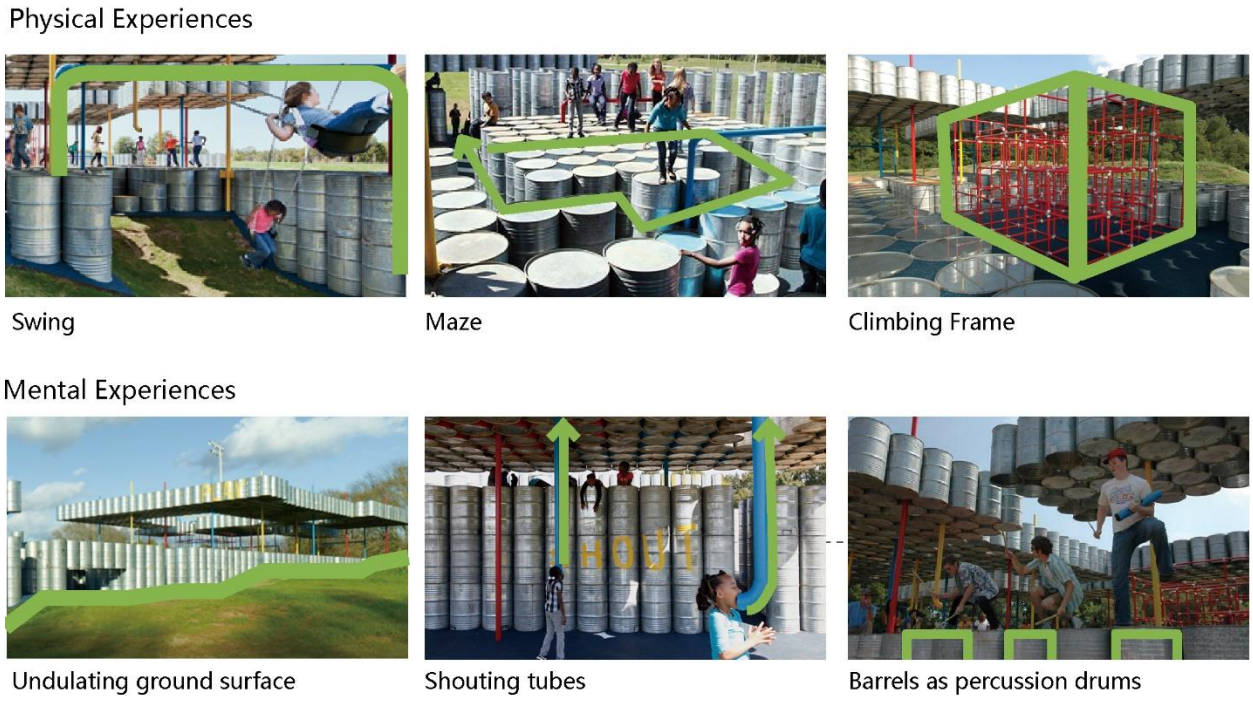


Figure 54: Design elements for physical and mental experiences.

(Photo source: Rural Studio. http://www.ruralstudio.org/projects/lions-park-playscape)

Based on the experiences and senses involved, a diagram of experiential learning for this case is created (see Figure 55).

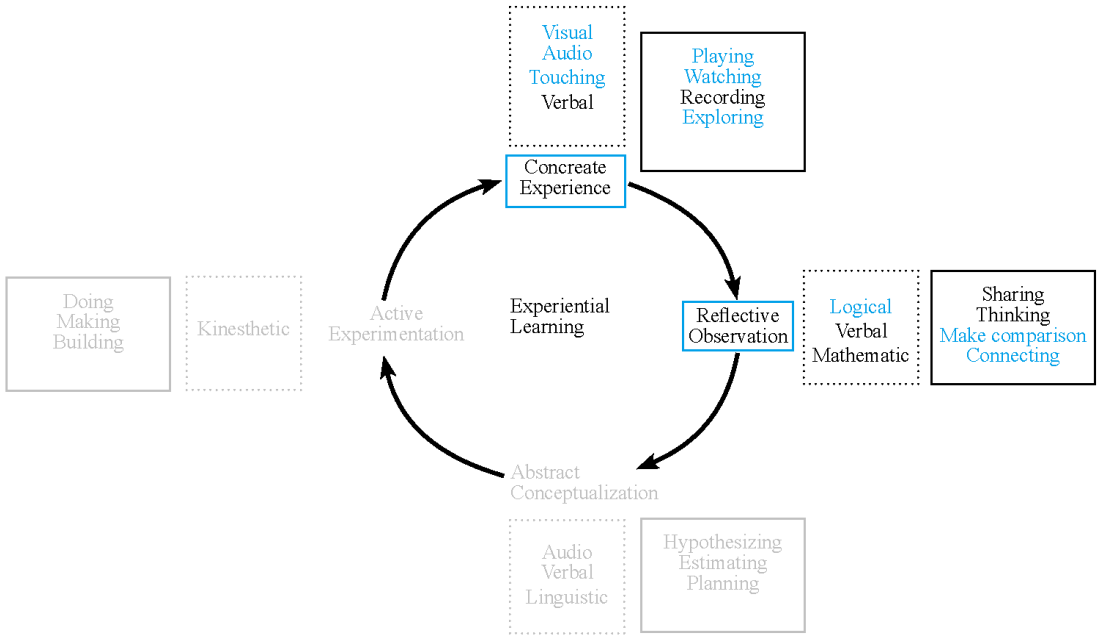


Figure 55: Experiential learning stage involved in Hiriya mountain (image redrawn by the author)

4.2.3.5 Lesson learned

The success of the Lions Park playscape largely comes from the creative application of and approach to of waste materials, in this case barrels, as the main landscape element. The preliminary test guaranteed the safety and stability of waste utilization. The design maintained the waste identity of barrels without changing their appearance. A variety of three dimensional spaces built with the barrels informs the potential of waste materials when incorporated into a good design. The emphasis on mental experiences and playing to develop skills extended the traditional playground design. Moreover, the playscape expanded opportunities for creating outdoor open spaces incorporating a large volume of waste.

CHAPTER 5

DISCUSSION AND CONCEPTUAL DESIGN APPROACHES

This chapter will discuss the lessoned learned from the previous cases, including limitations and challenges that have yet to be solved. Based on the previous discussion of design strategies for waste landscapes and experiential learning principles, one can generate a series of conceptual design approaches that will produce better learning engagement in waste landscapes.

5.1 Lessons learned from case studies

5.1.1 Case summaries (Table 6)

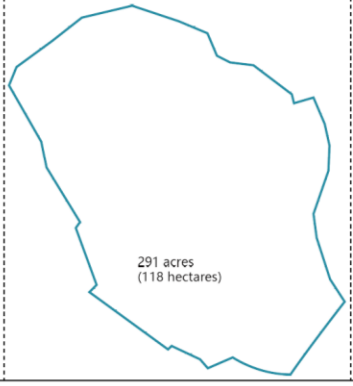
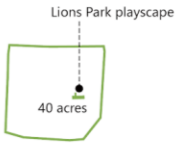
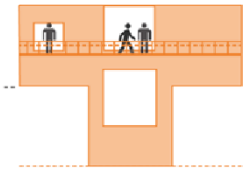
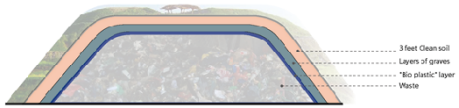
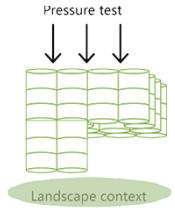
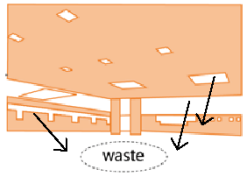
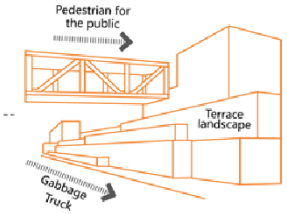
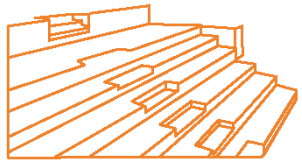
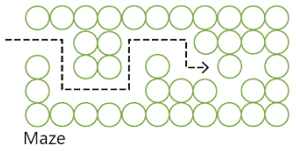
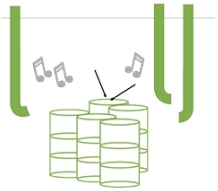
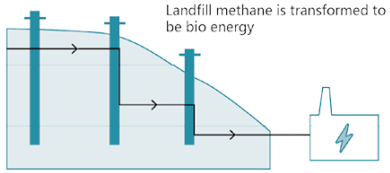
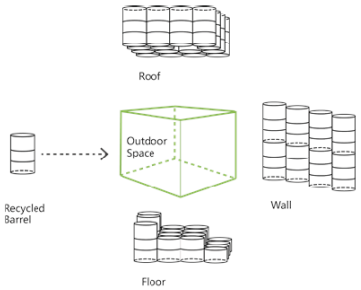
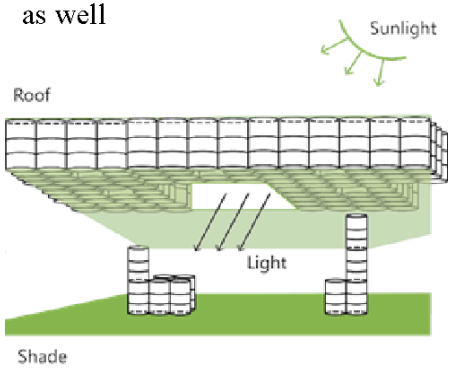
Project Name	27th Avenue Transfer and Recycling Center	Hiriya Landfill-Ayalon Park	Lions Park Playscape
Project Name:	27th Avenue Solid Waste Transfer and Recycling Center	Hiriya Mountain	Lions Park
Location:	Phoenix, Arizona	Tel Aviv, Israel	Greensboro, AL
Former Use:	Transfer and Recycling Center	Landfill	Public park
Current Use:	Transfer and Recycling Center	Park includes transfer station, recycling park, waste education center	Public park
Date Designed/ Completed:	1989 -1993	2004 - 2020 as planned	2010-2011
Cost: estimated	$ 18 million	$ 250 million	$ 0.5 million
Client:	the Phoenix Arts Commission and & Phoenix Department of Public Works	Park Ariel Sharon Ltd., Beracha Foundation	The Lions Club, the City of Greensboro, Hale County
Design Team:	Michael Singer and Linnea Glatt	Peter Latz & Partner	Rural Studio of Auburn University
Size:	25 acre\ 100,000 foot square 	118 hectares - 2000 acres 	40 acres 

Table 6: Case Summaries

Project Name	27th Avenue Solid Waste Transfer and Recycling Center	Hiriya Landfill-Ayalon Park	Lions Park Playscape
Design Strategies for experiential learning with waste landscape **Waste Risk**	• Elevated pedestrian pathway 	• Cover the waste and waste water treatment 	• Waste material safety test 
Waste observation	• Increase transparency to the waste 	• Contrast of waste places  Comparion between operating and dormant waste status	• Keep the original appearance of waste  Original appearance
	• Public Access division 	• Contrast of open view  Comparison of view experience between urban city and waste processing	
Waste Interaction	• Multiple outdoor learning spaces  Outdoor Amphitheater	• Specialized waste learning center  Multiple learning experience provided by specific environment learning center	• Physical experientces 

Project Name	27th Avenue Solid Waste Transfer and Recycling Center	Hiriya Landfill-Ayalon Park	Lions Park Playscape
Design Strategies for experiential learning with waste landscape **Waste Interaction**	• Outdoor waste water garden • community gathering space	• Outdoor art • Art festival • Exhibition	• Mental experientces 
Waste value	• Waste recycling	• Waste by-product mathene transformation to energy  	• Waste become landscape materials by reuse and recycling 
		• Multiple layer of terraces were designed to stabilize the mountain and preserve the waste trace 	• Waste Roof provide shade to prevent hot weather impacts while giving light as well 

5.1.2 Lessons

The case studies contribute valuable information that shows how design practices can integrate experiential learning with waste landscapes. These three cases represent typical waste status and its relationships with the site. It is possible to derive design approaches from successful design practices.

On-site waste features heavily influence the content of experiential learning, especially regarding waste risk considerations. The design of waste landscapes for experiential learning must be safe and stable enough to facilitate people's observations and activities while retaining a sense of risk-taking. The level of waste danger to humans and the environment determines the capacity for human contact with the landscape. The status, scale, and volume of waste offer a variety of challenges and opportunities to observe the potential of real waste. Large scale waste landscapes are more concerned with their particular district planning level, along with plenty of ecological, cultural and social considerations. Smaller scale projects pay attention to closer communication between humans and the specific waste design.

The different types of waste landscape also indicate the specific design approaches. For waste landscapes within or next to infrastructure, the structures and auxiliary landscapes are introduced to blend with the main facility functionality. The experiences are usually confined by the scope of the designed structures. For transformational waste landscapes, landscape design approaches are usually integrated with environmental engineering. The primary goal of the design is to provide a suitable safe learning site. The experience areas are more scattered and open in this mode due to the volume, time periods and changing processes involved in the site. When waste is embraced in the landscape context, the unique features can trigger creative design uses of waste. This can also promote participation in waste learning.

The design of experiential learning in waste landscapes mainly concentrates on the concrete experience stage, accompanied by reflective observation and active experimentation. This access combined with experiential learning spaces contributes to an experience flow that emphasizes waste processes, which are as significant as learning products. The sensory design mainly focuses on visual access for waste status observation. Passive sensory experiences, such as the odor of waste and ambient noise, are causes of additional design concern.

5.2 Conceptual design approaches for experiential learning with waste landscape

The case studies provide examples of many feasible design approaches and also reflect a variety of possibilities for the application of experiential learning within waste landscapes . When these valuable suggestions are integrated with key design aspects derived from the previous literature review, a general and comprehensive list of design approaches can be created.

Being a unique learning space, the design of waste landscape play a significant role in educating the real threats and potentials of waste by experiential learning. Due to the complexity of waste, a range of conceptual design approaches are introduced to improve health & safety, to interpret the meaning of waste and to conduct learning activities. Therefore, the integrated design approaches (see Figure 56) presents further information on specific strategies which can implement experiential learning with waste landscape in a structured way.

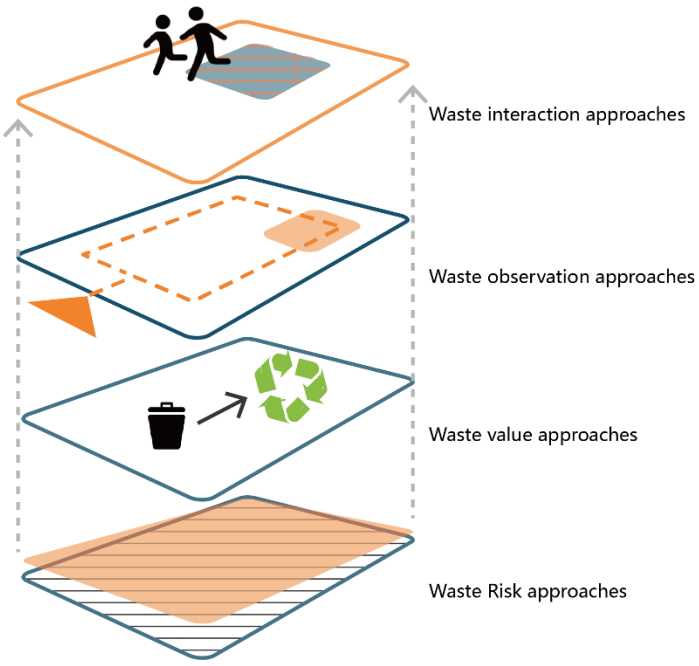


Figure 56: Conceptual design approaches for experiential learning within waste landscape

After reviewing the design practice of waste landscapes, design strategies from the experiential learning perspective and specific requirements for experiential learning within waste landscapes are more clear. The essential components are waste risk strategies, waste value strategies, waste observation strategies, and waste interaction strategies.

5.2.1 Waste risk approaches

Facing the actual risks and perceptual fears of waste, these kinds of strategies aim to decrease the impact of health threats, environmental pollution, and possible harm from accidental fire. Also, the strategies provide a safe place in which a sense of risk-taking can be aroused. The external environment, waste exposure, group pressure, and appropriate signage are critical for waste risk perception (Krallis 2007). An effective strategy should to reduce people's exposure to waste and reduce the waste spread channel. Therefore, waste risk strategies take the proximity of waste, protection measures and signage into consideration (see Figure 57).

Closer distance to waste

The proximity to waste determines the level of exposure to it. Reasonable horizontal and vertical distances provide a balance between visibility and safety concerns. In compliance with safety standards, the closer people are to waste items, the more genuine their perceptions of waste will be. Using vegetation buffers and elevated pathways, designated distant viewpoints offer a more comfortable experiential process of learning about harmful waste. This strategy also supports observing waste from a variety of perspectives.

Protection measures

Dealing with waste risk, particular attention also needs to be paid to protection measures such as framing, neutralizing and covering the waste. Framing the waste provides a barrier between waste risk and learners. Designing for visual access to the frame, including small openings, windows, and glass walls, is feasible for observation of waste features from outside . Neutralizing the waste at the site provides opportunities to explore and learn still-developing processes through different remediation methods, so that visitors gain an understanding of human activity's severe effects on the environment. This enclosure strategy would supply a protective layer for the public, with a green appearance. Meanwhile, certain environmental assessments and safety tests are also important. These protection measures can work simultaneously to build a safe experiential space.

Waste landscapes have different forms with identifiable characteristics some of which may not be suitably integrated with experiential learning, such as the health and safety threats of heavy pollution and its attendant hazards. Some of the indirect risks accompanying waste need be identified as well, for example: odor, dust dispersion, and possible harm from heavy machinery. The waste may remain in the transit process, terminate at a final point, or transform

its original usage purpose. All these characteristics are possible learning materials for waste and await corresponding design solutions, with the help of science and technology.

Instructive waste Interpretation

Risk understanding can be increased through the many methods of conveying of waste information and waste interpretation, such as signage. The failure to supply sufficient instructional signs, and a lack of consideration for their visual and verbal impact, may cause people to be unconcerned with environmental issues and fail to pay attention to risk warnings (Verdonk, Chiveralls & Dawson 2017). It is apparent that placing and developing signs with illustrations and images at key waste sites can effectively convey instruction to the public and achieve waste manage purposes. The color, size, information forms, and images used in signage are influential factors in the transmission of essential waste messages.

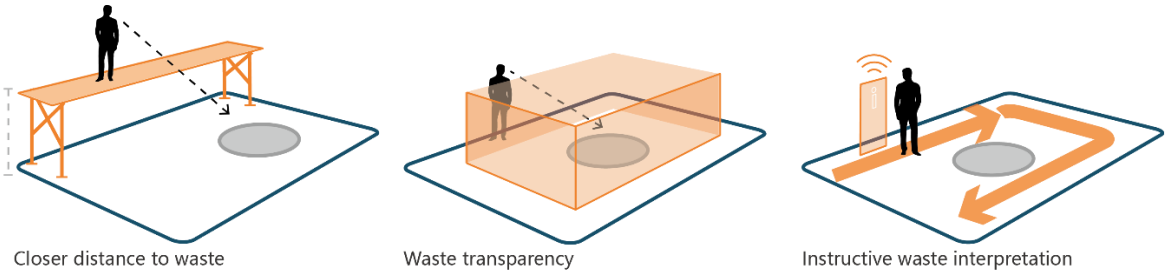


Figure 57: Waste risk approaches

5.2.2 Waste value approaches

Waste value is the core of experiential learning within waste landscapes. The value of waste derives from it being an indispensable stage of the life cycle. The goal is to compel the public to witness how actual waste is processed and how the possible future of waste is linked to individual awareness and behaviors. The valuable characteristic of waste lies in its distinctive appearance (see Figure 58). Also, this process may provide some solutions to human and

environmental threats through advanced technology. Waste types, waste volume, and existing disposal or recycling options are all great avenues for learning (Bagchi 2004).

Waste transformation

The transformation of waste is the most intuitive way to show the versatility of waste. By promoting different treatments, waste transformation can yield three different types of results : material, fuel, and energy. Fuel and energy come from the by-products of waste landscapes, such as methane, and are refined through increasingly advanced technology at facilities. The design can lead visitors to witness the processes and products of waste transformation. On-site waste can be selected and applied with respect for public amenities, play structures, sculptures, and other landscape purposes. Assessment of waste features is required to ensure durability and stability.

Waste as medium

Waste reuse and recycling can prove to be great inspirations for art and creative interpretations of waste as a medium. Waste feeds many ideas in art since it touches many topics relevant to the economic, social, and cultural issues in our daily lives. There are many possible interpretations of the meaning of waste, which are reflective of people's attitudes and behaviors towards such a controversial issue. As a symbol of urban products and artifacts, waste is a perfect material to express people's diverse understandings of the different facets of the things humans discard.

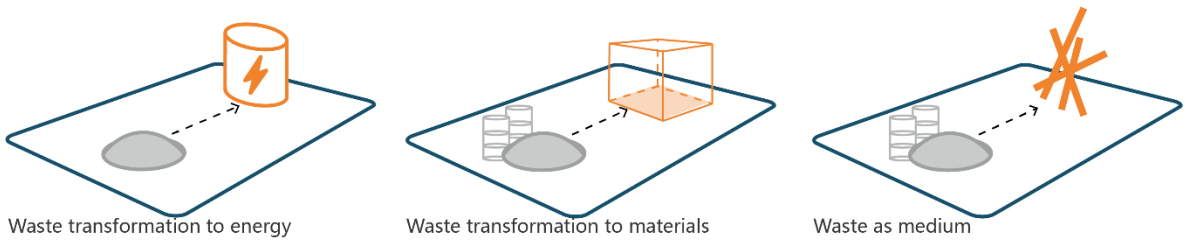


Figure 58: Waste value approaches

5.2.3 Waste Observation approaches

Specific entrance and easy access

To build a lasting bond between waste landscapes and their urban context, a specific entry or gateway is needed for easy access to waste landscapes that are mostly isolated from the public. People are more likely to feel they are welcomed to waste sites if the entryway is designed to facilitate the interpretation waste. The exploration can start at the entrance, with instruction signage that informs visitors about the waste landscape and its learning content and purpose. Maintaining just one major route of circulation increases clarity. In order to support direct engagement, direct entrances to major waste features and experience spaces should be favored. If allowing multiple access conduits at the site, the visitors' entrances and walkways need to be separate from the site's working traffic due to safety considerations. Open-viewing access make it easy to observe all the waste landscape features. Due to the unique features of waste , some routes may include protective barriers that allow several viewpoints. Wayfinding systems can direct individuals to explore freely.

Safe direct engagement

Direct engagement needs to be embedded in each featured waste space. When learners to expose themselves to new and updated knowledge of real waste, the site's effectiveness is increased. As the more direct links to waste, primary routes lead to focal points, which enable easier exploration and engagement. and engagement. The design should help to build learning spaces for visitors to rouse their feelings and stimulate their senses. When a design utilizes direct engagement, the excitement sparked encourages further exploration and active investigation.

Multiple sense of experience

Supporting direct engagement and exploration, offering a variety of sensory stimuli to visitors is conducive to an appealing experience at the waste site. For waste landscapes, visual connection is essential. Design should incorporate viewpoints that allow visitors to observe waste from different perspectives. Visual access should be confined to outside the enclosed waste landscape. Control of waste odors that can arise from fog and mist can reduce the smelly impact of the waste landscape. Close contact with waste offers tactile experiences when recycled waste is repurposed and incorporated into amenities, aesthetic forms, and art workshops (see Figure 59).

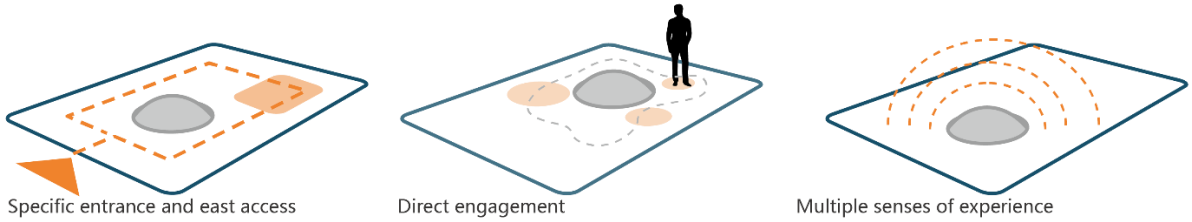


Figure 59: Waste observation approaches

5.2.4 Waste interaction approaches

Variety of activities

All the activities are open to the public. In addition to observation, many activities help to convey waste information and maximize waste understanding. Lectures, project designs, art workshops, waste education, and waste internship comprise the active and passive activities. Enclosure spaces will be created for individual reflection. Specific activities centered around children and school students' needs for understandable instruction about waste will be included. Special events like art festivals and other cultural events pique interest in the site as well.

The group learning

Outdoor learning spaces are encouraged; amphitheaters, playgrounds, outdoor gardens and an environmental learning center provide opportunities to share understandings of waste. Integrated with the landscape, outdoor group learning spaces can offer flexible educational methods . After closer observation of waste, reflection stages are conducted along with group discussion. Occasional closures of these spaces for group learning will not disturb the learning process (see Figure 60).

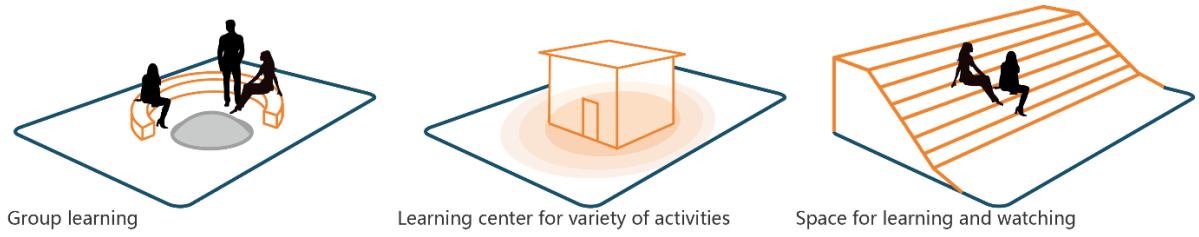


Figure 60: Waste interaction approaches

At the end, Figure show the summarized design approaches (see Figure 61). This provide a reference for potential application of experiential learning in waste landscapes. These general conceptual design approaches provide important design aspects that can support analysis of waste characteristics, evaluation of design scenarios, and comparison of alternative design configurations. Based on each of the project's unique context and features, future waste landscape designs can leverage the advantages of these approaches and choose suitable approaches to creating a specific design strategy.

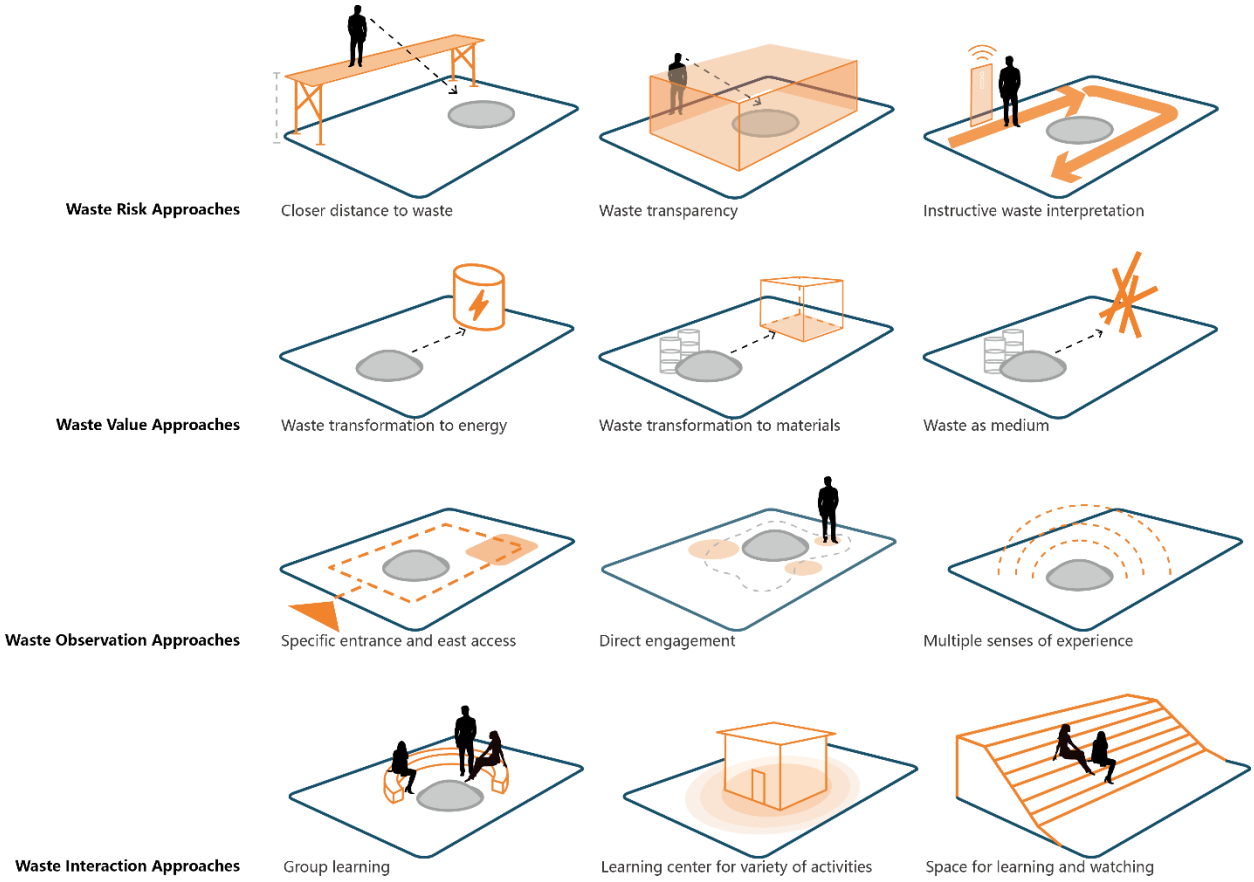


Figure 61: Design approaches with specific strategies

CHAPTER 6

CONCLUSION

Taking into account the complexity of waste issues and their impact on the living environment, the educational aspects of waste, and the role landscape architecture has to play in this involvement, have not yet garnered enough attention. To improve understanding and increase awareness of waste, this thesis has explored possible design strategies for experiential learning within waste landscapes. As the public's understanding of waste issues has increased, the evolution of waste and its role in landscape design was examined to address the challenges, opportunities and design strategies for such landscapes. The discussion of experiential learning theory's perspective on outdoor environments and waste landscape characteristics has generated relevant design strategies with an emphasis on learning about waste through experience. Then, the case studies offered many valuable approaches and design elements that have proven promising in considering how experiential learning about waste can operate in waste landscapes. Combined with waste features, experiential learning principles and lessons from case studies, an integrated design guideline was created.

This research has several implications for waste landscapes in an urban context, which has the potential to engage the public, convey waste knowledge and increase environmental awareness. Experiential learning provides a new perspective to looking into the relationship between people and waste landscapes via experience-oriented learning. Public perception of waste that was previously biased by cultural and social norms can be updated. This informal educational approach is capable of improving the individual's understanding of waste and

promoting public engagement. This approach can also help waste landscapes become more fully embraced within urban contexts. Thus, the challenging work of this thesis concerns balancing the creation of experiences with real waste and the various issues that accompany a waste landscape. After examining the literature, possible design strategies that addressed both waste characteristics and experiential learning aspects were offered.

There are also limitations to the application of conceptual design approaches. One limitation is that the effects of experiential learning can be unclear and varied. It is difficult to define the effect of learning within waste landscapes. Moreover, these design approaches are insufficient to address the entirety of characteristics and requirements of experiential learning within waste landscapes.

Therefore, a potential future design could incorporate strategic assessments to trace the learning process and its results in the future. A self-awareness tool, like a questionnaire or group evaluations, could be conducted at the site. This could introduce more interactions between the public and waste. And experiential learning is an adaptive process that could include long-time monitoring.

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