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EXPLORING HISTORICAL ADAPTATIONS AND SUSTAINABILITY IN URBAN PLAY ENVIRONMENTS

A COMPARATIVE ANALYSIS OF TEN PLAYGROUND CASE STUDIES

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Abstract: *This research paper investigates the historical adaptation and sustainability aspects of diverse urban playgrounds and parks through a comparative analysis of ten case studies from around the world. The methodology involved selecting these playgrounds based on criteria including historical significance, diverse geographical locations, and sustainability approaches. Data for this study were predominantly gathered from pertinent websites and online databases, complemented by content from academic literature, and were organized into different categories such as scale, design approach, sustainable practices, historical links or adaptations, accessibility, community engagement and their unique features. Qualitative analysis is implemented to identify patterns and processes related to sustainability, historical adaptation or reuse over time, and user experiences within different urban contexts, while quantitative data is providing additional insights into physical features, surrounding environment, materials usage, safety, and accessibility. Findings reveal different approaches to playground design and adaptation strategies over time, highlighting the importance of community engagement, environmental responsibility, and innovative design practices in different settings.*

Keywords: *Urban playgrounds, sustainable planning, recreational spaces, play equipment, historical narratives*

1. INTRODUCTION

Children are a key force for future development, and the rapid urbanization and resulting environmental changes increasingly affect them [1]. In city settings, urban playgrounds play an important role in socialization, recreation, and childhood development within urban landscapes and neighborhoods within the communities. As cities grow and evolve, the design and sustainability of these playgrounds become increasingly important factors to consider. In today's world, building spaces for our children to play isn't just about fun; it's about the future. [2]. Outdoor play is universally recognized as a vital element in healthy physical and emotional development in children. The benefits to a child's physical development have long been recognized and are derived from increased activity levels and use of energy, growth and strengthening of large muscle groups through movements such as climbing, running, swinging, and jumping, plus an increase in cardiovascular endurance, and large and fine motor skills.[3].Despite the recognized importance of outdoor play for childhood health and development, the amount of time kids in the developed world spends playing outside is decreasing. On average, children now spend around half the time outside that their parents did.[3]. One prominent driver for the trend of decreasing time spent in outdoor play is the rapid rate of urbanization in many countries around the world.[3].As the world continues to urbanize, sustainable development depends increasingly on the successful management of urban growth, especially in low-income and lower-middle-income countries where the most rapid urbanization is expected between now and 2050.[4]

When designing urban play environments, it is imperative to highlight the importance of sustainability and historical adaptation in maintaining resilient urban play communities.

Historical adaptations give these open spaces a sense of heritage and connection to the past, fostering a deeper understanding of the cultural fabric and essence of the community. By integrating elements of historical significance, such as traditional architectural structures or traditional play equipment, urban spaces become living reflections of the historical value of the place, serving as educational tools for future generations.

Sustainable Urban Playgrounds are more than just play areas; they represent a conscious effort to integrate environmental responsibility and ecological principles into the very fabric of urban childhood experiences.[5] Urban landscapes play a significant role in supporting municipal, ecological and social systems. Besides, valuable environmental services and urban green spaces provide social and psychological services, very important for the livability of modern cities and the well-being of urban residents.[6] Crucially, these thoughtfully designed spaces serve as vital platforms for children's holistic development, fostering a deeper connection with nature and promoting environmental responsibility from an early age.

The UNICEF Child Friendly Cities Initiative (CFCI) brings UNICEF together with local stakeholders to establish safer, more just, equitable, inclusive and child-centered cities and communities. CFCI uses the UN Convention on the Rights of the Child as a framework to help local governments prioritize the needs of children and young people, combat discrimination and elevate youth voices in local governance and decision making. Through this flexible, dynamic, child rights-focused framework, neighborhoods become safer, schools and health systems function better, infrastructure is strengthened and communities are improved for all citizens.[7] Therefore, it is crucial to continually emphasize the importance of designing and developing urban environments that are not only child-friendly and inclusive but also prioritize the safety and well-being of children within their daily experiences.

2. LITERATURE REVIEW

The literature review for the research paper explores three key areas: the historical evolution of playgrounds design, adaptation and strategies, and sustainable urban development. Investigating the historical evolution of playground design reveals a progression from traditional to modern concepts of the playscapes , as discussed by Naomi Heller, [8] [9], offering insights into the revolution of play spaces throughout the history from the first concepts to the modern playscape designs. Larissa Larsen's [10] comprehensive review of urban climate and adaptation strategies highlights current practices and solutions that are crucial for reducing the impact of climate change in urban areas. This review highlights the importance of proactive decisions and frameworks to address the challenges caused by climate change highlighting common adaptation strategies that has been proposed by various stakeholders. Furthermore, literature on sustainable urban development, as discussed by Dr. Amira Mersal, underscores the significance of ecological planning to foster sustainability in urban built environments. With ecological planning human needs are supplied while natural resources are used in the most effective and sustainable manner.[11].

Urban spaces are more than just places where we live, work, and socialize — they influence our emotions, behaviours, and overall well-being. [12] Within the framework of the Child-Friendly City Initiatives (CFCI), the environment around the child's home that they access daily is in the first position of the priority list, because this environment greatly influences various aspects of child development, including physical health, cognitive growth, as well as emotional well-being. Poorly managed urban environments can expose children to pollution, noise, and lack of green spaces, all of which can have negative impacts on their health and ability to thrive and develop. In addition, access to facilities such as safe play areas, quality schools, and health services is essential to fostering an atmosphere conducive to child development.[13] Urban environments have a direct impact on the quality of life of their residents. A well-designed city can reduce stress, encourage social interaction, promote physical activity, and support overall mental health. [12]

2.1 *Defining Sustainability In Urban Playgrounds*

For the purpose of this study, sustainability in urban playgrounds is identified through the understanding of the environmental and social aspects, as widely discussed in urban planning and landscape architecture literature [14] [15] **Environmental sustainability** focuses on the use of eco-friendly materials (e.g., recycled, locally sourced, non-toxic), efficient resource management (e.g., stormwater harvesting, minimal energy consumption), and ecological benefits (e.g., supporting biodiversity). **Social sustainability** determined by accessibility and inclusivity for diverse user groups (age, ability), fostering community engagement, promoting physical activity, and ensuring safety.

2.2 *Historical Adaptations in Play Environments*

"The 'link with the historic environment' and 'historical adaptation' in urban playgrounds refer to how these spaces acknowledge, integrate, or evolve within a historical context. Factors that affect the adaptive reuse decision process are life cycle assessment, and heritage significance of a site, as well as its ability to meet Sustainable Development (SD) benchmarks. Economic, environmental, and social sustainability are key considerations, alongside the value the project brings to the local community, the orientation of the building, its influence on the local economy, the inherent ability of the building to adapt, and the views of various stakeholders. [16]

Whether the social or environmental contexts of the case studies influenced their adaptive reuse decisions is investigated in this study. Any instances where these factors clearly led to an adaptive reuse approach will be identified and discussed within the analysis. It is acknowledged that not all case studies demonstrate historical adaptation throughout their lifespan.

By synthesizing these diverse strands of literature, this research paper intends to contribute to a comprehensive understanding of historical adaptation and sustainability in urban playgrounds and parks in different geographical contexts.

3. METHODOLOGY

The ten urban playgrounds for this comparative analysis were diversly selected by different criteria to ensure various yet comparable dataset. The primary criteria for inclusion were:

- **Diverse Geographical Locations:** Case studies were chosen from various continents (Europe, Asia, America) to capture a broad range of urban contexts, cultural influences, and climatic conditions affecting playground design and use.

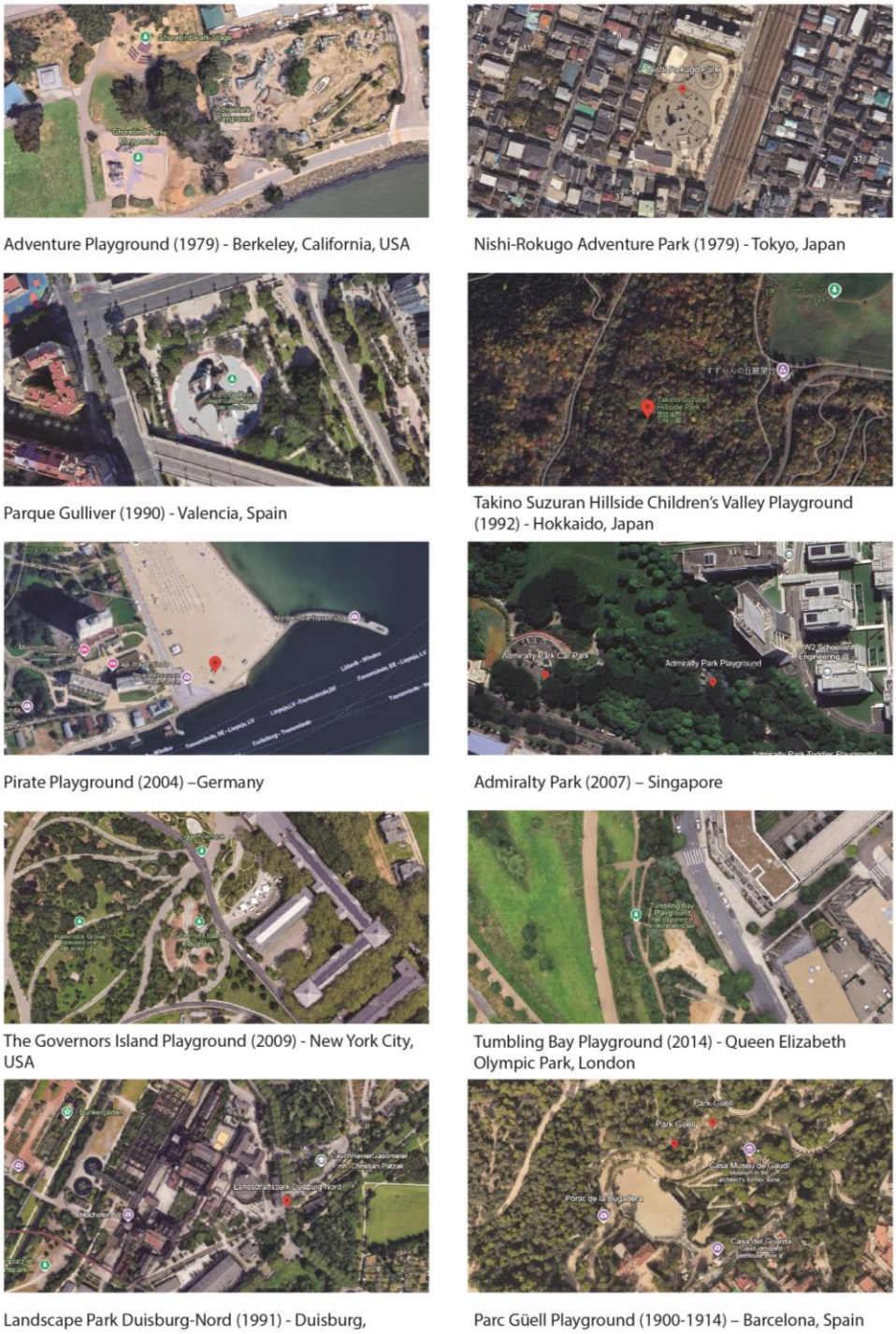

Figure 1. Playgrounds and Parks' locations in different contextual settings.
Source: https://earth.google.com/web/ (accessed on 4th June 2025).

- **Demonstrated Historical or Adaptive Resue Approaches:** Playgrounds that either preserved historical elements, were located on historical sites, or underwent adaptive reuse from a previous function.
- **Sustainability Approaches:** Playgrounds that are recognized or documented for incorporating at least two distinct aspects of environmental, social, or economic sustainability.
- **Public Accessibility:** All selected playgrounds are publicly accessible urban spaces.

These playgrounds are: (Adventure Playground, Takino Suzuran Hillside Children's Valley Playground, Tumbling Bay Playground, Nishi-Rokugo Adventure Park, The Governors Island Playground, Parc Güell Park/Playground, Admiralty Park, Landscape Park Duisburg-Nord, Parque Gulliver, and Parc Güell Playground).

It is important to note that not all selected case studies necessarily fulfill every single criterion listed. Instead,

these criteria serve as a framework for identifying and analyzing the commonalities and distinctions across diverse urban playgrounds, parks, and playscapes, allowing for a comprehensive comparative analysis of their historical adaptation and sustainability approaches.

To comprehensively explore the role of these aspects in creating a sustainable reslient playgrounds, a multifaceted methodology was employed. Data encompassed a comprehensive exploration through diverse sources, including academic articles, researsch, and online databases. Diverse categories were taken into consideration when these playgrounds were compared, imcluding their design and sustainable approaches,as well as the community engagement. The methodology adapted two approaches :

- Qualitative analysis is implemented to identify patterns and processes pertinent to the sustainability aspect , historical evolution or adaptive reuse, and user experiences across diverse urban contexts and geographical locations.

- Quantitative data is providing additional insights into a spectrum of factors including physical features, surrounding environmental conditions, materials usage, safety parameters, and accessibility considerations.

Research Questions include:

1. How do urban playgrounds and parks exhibit varying approaches to historical adaptation and reuse across diverse geographical and contextual settings?
2. What distinct sustainable practices are evident in the design, materials, and implimentations of these urban playgrounds and parks, and how do they vary across different case studies?
3. What commonalities and differences in design philosophies, material choices, and community engagement strategies emerge from a comparative analysis of these diverse urban playgrounds?

4. CASE STUDIES

To facilitate a structured comparative analysis, the ten selected playgrounds have been grouped into distinct categories based on their primary scale, dominant function, and integration with broader recreational activities. This grouping highlights commonalities and divergences within similar types of urban play environments and parks . The categories are as follows:

GROUPING CATEGORY	DESCRIPTION	CASE STUDIES
ICONIC & INTEGRATED URBAN PARKS	Large-scale parks where play areas are a significant, but integrated, component within a broader, often historically or culturally significant, urban green space.	Parc Güell Playground, Parque Gulliver
ADAPTIVE REUSE & INDUSTRIAL TRANSFORMATION PLAYSCAPES	Playgrounds developed on former industrial sites or brownfields, demonstrating significant historical adaptation through repurposing and reusing existing structures.	Landscape Park Duisburg-Nord, Nishi-Rokugo Adventure Park
NATURE-BASED & LANDSCAPE-INTEGRATED PLAY AREAS	Playgrounds that deeply blend with natural topography or ecological features, often within larger national or regional parks,	Takino Suzuran Hillside Children's Valley Playground, Tumbling Bay Playground, Admiralty Park

	emphasizing natural play.	
COMMUNITY- DRIVEN & UNSTRUCTURED PLAY ENVIRONMENTS	Playgrounds emphasizing user-built elements, loose parts, and community involvement, often fostering a sense of freedom and informal play.	Adventure Playground, The Governors Island Playground
THEMED & DESTINATION PLAYGROUNDS	Playgrounds with a strong thematic narrative designed to be a primary destination, often reflecting local cultural or historical identity.	Pirate Playground

Table 1 Case Studies Grouping System. Source: Made by Author

The comparative analysis of the case studies encompasses three distinct aspects:

1) User experiences across diverse urban contexts, Physical Features, Materials Usage and Surrounding Environment
2) Historical Adaptation and Processes pertinent to the sustainability aspect
3) Accessibility Considerations & Safety

4.1. *Parc Güell Playground (1900-1914) – Barcelona, Spain*

Park Güell in Barcelona stands as one of Antoni Gaudí's most colorful and unique works. Originally intended as a residential garden city, it is now a public park filled with whimsical sculptures, intricate mosaics, and architecturally distinct buildings. The park also offers panoramic views of the city from its main terrace, bordered by a long, undulating bench covered in vibrant tilework...[17].
The park actually started as a development project initiated by Eusebi Güell and the idea was to create a park with 60 homes for Barcelona's upper class. Eusebi got Gaudi on the project as a designer and Gaudi worked on the project for 14 years from 1900-1914.[18].
The mosaic works and patterns throughout the park add an aesthetical value to the natural landscape setting. The playground integrates seamlessly with its surroundings, demonstrating a wholistic design approach throughout the park.

Figure 2 Parc Güell Playground , Source: https://parkguell.barcelona/en

The playground at Park Güell provides a distinct, more natural play experience. Unlike the park's famous mosaics, it uses simpler, natural elements like wood and ropes. This creates an organic environment for children that blends smoothly with the surrounding nature, yet offers its own unique, earthy character.

Figure 3 Antoni Gaudí, Park Güell, Barcelona (photo: Jorge Franganillo, CC BY 2.0)
Source: https://smarthistory.org/antoni-gaudi-park-guell/

The park has unique blend of architectural features,rich green spaces and panoramic views. It includes terraced gardens, trails, plazas providing various opportunities for exploration and socializing. It incorporates iconic mosaic sculptures in the deign and different textured facades , tranquil gardens and scenic viewpoints with a sensory experience. Sustainable materials are used such as locally-sourced stones reflecting an eco-friendly approach. The park started as a development project to incorporate organic shapes and sustainable construction techniques , including shaded areas, natural ventilation systems, and water management features, it allows diverse activities and uses over time and it has cultural heritage value as a UNESCO World Heritage Site. It includes wheelchair ramps, smooth pathways, accessible facilities and zones, ensuring inclusivity for visitors with mobility challenges.

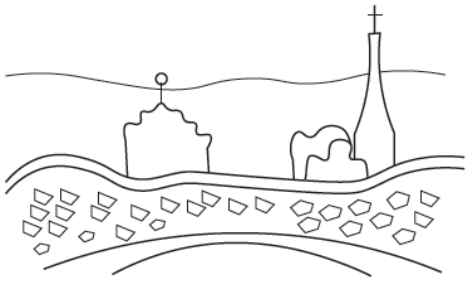

Figure 4 Sketch representing Parc Güell's character Source: Made by Author

4.2. *Adventure Playground (1979) - Berkeley, California, USA*

Adventure Playground is an urban park and adventure playground in Berkeley California. The playground is uniquely situated at the Berkeley Marina, providing an urban waterfront context. The park opened in 1979, based on the ideas of Danish architect Carl Theodor Sørensen, who used scrap yards for playgrounds when Copenhagen was under occupation during the Second World War.[19]. This park was also called "junk playground ",which offer children an open opportunity to build their unstructured own play spaces freely with no restrictions, and empower them to learn cooperation, meet physical challenges and gain self confidence. The playground provides diverse urban spatial experiences characterized by interactive play, creativity, and exploration. It offers a unique blend of physical features including custom-built play structures, climbing elements, and natural materials such as logs and ropes, recycled wood , tires, fostering imaginative and unstructured play within the landscape setting. It offers a great social interaction and provide a holestic approach for play and recreation which promotes social sustainability.

Materials usage emphasizes sustainability and hands-on construction for recreation and forming new compositions, with recycled and repurposed materials contributing to the playground's eco-friendly design. The playground includes accessible pathways with soft surfacing ensuring equal access to all kind of abilities among

different users. Well-maintained structures, and continous staff supervision, promote a secure environment for children to engage in unstructured play and exploration.

Figure 5 Adventure Playground, Berkeley, California, USA
Source: https://www.californiabeaches.com/attraction/adventure-playground/

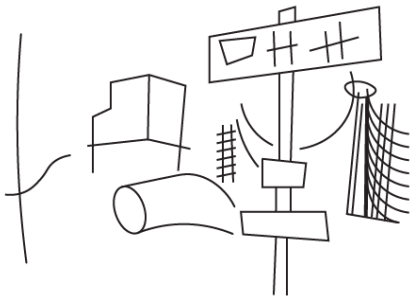

Figure 6 Sketch representing Adventure Playground's character Source: Made by Author

4.3. *Nishi-Rokugo Adventure Park (1969) - Tokyo, Japan*

In the Tokyo metropolitan area, where nearly everything is crammed for space, about 40,000 square feet of land is designated for Nishi Rokugo Park, one of the strangest and most innovative playgrounds world-round—made nearly entirely out of tires.[20]. At Nishi-Rokugo Park, about 3,000 old tires have been transformed into playground equipment, such as a swing and a jungle gym, as well as monsters, robots and other monuments.[21]. Nishi-Rokugo Adventure Park was uniquely established through the creative reuse of industrial waste, the tires, demonstrating how urban waste can be sustainably transformed into vibrant public play spaces.

The park is situated in a quiet neighborhood within Tokyo's Ota Ward, specifically in the Kamata area, and positioned near the Tamagawa riverbed and alongside a train line

Figure 7 Nishi-Rokugo Adventure Park
Source: https://www.hellotravel.com/japan/nishi-rokugo-park

Nishi-Rokugo Adventure Park is distinctive for its innovative use of around 3,000 tires in its construction. These tires serve as the primary material for composing the main structure of the site. Various physical features were built including seating areas, structures and artistic giant installations. It forms an urban recreational hub for the visitors allowing kids to explode the spaces among different forms that are made almost entirely from those tires. The creative use of materials not only promote a unique aesthetic to the park but also enhances sustainability by reusing discarded tires.

The park was established through a significant community effort, transforming urban land into a unique playground. This demonstrates how community-driven initiatives can sustainably transform urban spaces into vibrant public play areas.

Nishi Rokugo Park is not used solely by children; elderly frequently visit the park to enjoy the scene and admire the tire sculptures. It is accessible to everyone , and the ground surface is durable and slip resistance. Pathways and facilities are smoothly accessible for wheelchair users as well.

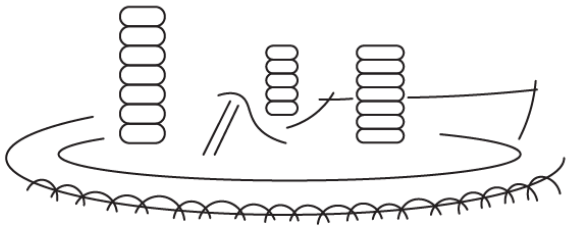

Figure 8 Sketch representing Nishi-Rokugo Adventure Playground's character Source: Made by Author

4.4. *Parque Gulliver (1990) - Valencia, Spain*

The Gulliver Park is located in the Jardín del Turia in Valencia, which was formerly the bed of the river. The main attraction element in this park is a monumental sculpture of Gulliver with height of 70 meters, from which many ramps, slides and stairs come out that will delight the children. It represents the moment when Gulliver has been tied up by the Lilliputians. The figure is made on a scale such that the visitors resemble the inhabitants of Lilliput when they walked on the body of the character.[22].
The spacious composition and the design of the spaces represents that the attraction can be used by the children accompanied by their parents, and one of the slides is very wide that it allows the whole family to use the space and enjoy their time together.

Figure 9 Parque Gulliver , Source : https://vivevalencia.net/en/gulliver-park/

The park provides a mesmerizing urban experience with its circular central attraction, a large sculpture of Gulliver from "Gulliver's Travels," containing slides and ramps for interactive and explorative play. The unique playground is constructed from durable materials like concrete and steel, ensuring a safe and engaging experience for children and families. Its vibrant colors and playful design invite exploration, and it ensures safety and longevity for all users , it incorporates vibrant colors and playful designs. It is surrounded by lush greenery in a central form containing different elements for the children and families to explore and enjoy the space.

The park's transformation from a former riverbed into a recreational space demonstrates it's adaptive reuse, transforming an existing urban feature to meet contemporary needs while preserving historical elements of the landscape. In terms of sustainability, the park includes features such as enegry-efficient lighting, and water efficient landscaping as it serves an important function within the Turia Gardens: to drain rainwater.It has slides of all kinds of different length and height. The longest ones also have a special non-slip coating, which reduces speed to make them safer. It is also easily accessible to all kind of users.

Figure 10 Sketch representing Parque Gulliver's character Source: Made by Author

4.5. *Landscape Park Duisburg-Nord (1991) - Duisburg, Germany*

Landscape Park Duisburg-Nord, located in Germany's industrial Ruhr region, transformed a former Thyssen Steelworks into a public park, demonstrating a unique approach to industrial heritage reuse.

The design of Park Duisburg-Nord by Latz + Partner can be regarded as benchmark for the redevelopment of former industrial brownfields into mixed-use use complexes where ecological and socio-cultural objectives blend. The whole park is now a big adventure playground. Old industrial structures are transformed by adaptation and new interpretation. The steel factory was abandoned in 1985, leaving behind an assortment of monstrous structures and polluted soil.[23]. The idea was to integrate, shape, develop and interlink the existing patterns that were formed by

its previous industrial use, and to find a new interpretation with a new syntax. The existing fragments were to be interlaced into a new "landscape".[24]. The great concrete bunkers and various concrete storage structures that surround the factory buildings were also left in place. They are now put to creative use either as playgrounds featuring gigantic sand boxes and twisting slides, or as climbing walls.[23].

Figure 11 Park Duisburg-Nord Play Area, Source : https://www.duisburg.de/microsites/visit_duisburg/discover_the_city/industrial_heritage/landschaftspark-duisburg-nord.php

The user experience in this park is a unique blend of industrial heritage with recreational opportunities. The physical features are characterized by repurposed industrial structures , pools,canals and railway tracks, smoothly integrated into the landscape to create unique play zones and scenic viewpoints. Materials usage highlights the preservation of industrial elements while incorporating modern facilities, with steel, concrete, and recycled materials. The landscape is surrounded by industrial ruins, providing visitors with a unique blend of multisensory experience that stimulates their curiosity and fosters an appreciation for the site's history. The park's transformation from a disused industrial site into a recreational space demonstrates adaptive reuse, preserving and repurposing historical industrial structures while creating new opportunities for public use. Sustainable design approaches are considered in the park's development represented by including the use of recycled materials and where ecological and socio-cultural objectives were considered as well.

The park includes well-maintained pathways and ramps, providing easy access for users with mobility challenges or disabilities. Safety measures such as handrails, barriers, and lighting are implemented to prevent accidents and ensure people and children's safety.

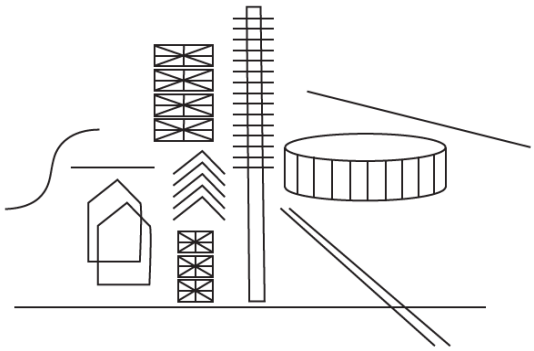

Figure 12 Sketch representing Park Duisburg-Nord's character Source: Made by Author

4.6. *Takino Suzuran Hillside Children's Valley Playground (1998-2000) - Hokkaido, Japan*

Takino Suzuran Hillside National Government Park is the only national government park in Hokkaido. Within the 400-hectare grounds across the site, there's a colorful flower garden, large playground equipment, three waterfalls, and a forest that's very suitable for a stroll, making it a favorite destination for Sapporo tourists and

citizens. There are various facilities in the park: Auto Resort Takino is for camping, Youth Mountain House where accommodates 400 guests, Children's Valley with unique outdoor playground equipments, nature athletics in Forest House and Takino Forest among others.[25]. The playground blends seamlessly with its surroundings and emphasizes harmony with nature. It incorporates local materials to promote sustainability.

The playground does not appear to have a historical adaptation in the sense of repurposing or transforming a site with a historical past. However, it was designed with the fundamental aim of creating a place where children can play freely within a bigger natural environment. It is also important to understand play spaces within their natural context, even if they do not possess significant historical value. The playground's materials include engineered structures (truss walls) and artistic textile installations (hand-crocheted nylon nets).

Figure 13 Takino Suzuran Hillside National Park Slides, Source : https://www.visionsoftravel.org/takino-suzuran-hillside-national-park-sapporo/

Figure 14 Takino Suzuran Hillside National Park Hills, Source : http://www.tlp.co.jp/en/detail/11

Figure 15 Takino Suzuran Hillside National Park Meadows Area , Source : https://www.sapporo.travel/en/spot/facility/takino_suzuran_hillside_park/

Figure 16 Takino Suzuran Hillside Children's Valley Playground, Source : https://www.shift.jp.org/guide/sapporo/others/takino-suzuran-park.html

This expansive natural park holds significant importance. It serves as a crucial green oasis accessible to a highly urbanized population, providing residents and tourists with invaluable access to extensive natural landscapes without the need for extensive travel into more remote areas.

The user experience offers a smooth blend of natural beauty and innovative design within the landscape setting. The physical features are characterized by organic play structures integrated harmoniously into the park's landscape, including wooden climbing structures, swings, and slides nestled among trees and hillsides. Materials include locally sourced wood , eco-friendly ones, rocks and stones. The surrounding environment offers panoramic views of the city's countryside, providing rich sensory experience with its lush vegetation as well. The sustainability aspect involves the preservation of natural landscapes, including forests and colorful meadows alongside the incorporation of playground features to minimize ecological impact and providing recreational opportunities. Sustainable materials like locally sourced wood and recycled materials are utilize in construction which enhances the natural environment character.

The park has well-maintained pathways and ramps, providing easy access to all types users. Handrails, barriers, and soft landing surfaces are implemented in the deisgn to ensure the safety of the visitors as well.

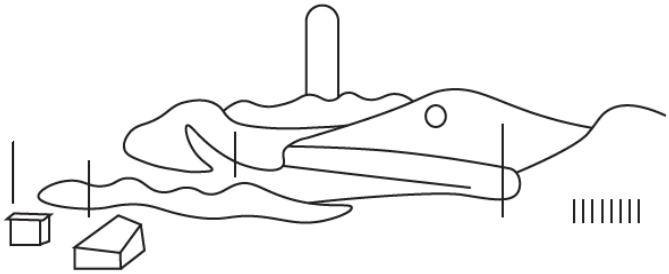

Figure 17 Sketch representing Takino Suzuran Hillside National Park 's character Source: Made by Author

4.7. Pirate Playground (2004) –Germany

The pirate playground right on the beach at the Nordermole is a permanent institution in Lübeck-Travemünde. The themed playground is a popular and sought-after destination for children on holiday or from the region. Annual pirate festivals and performances use the pirate village, treasure island and boat building site as a backdrop. The main attraction of the playground is the pirate ship "Wilde 13".[26]. Entirely crafted in wood, the partly planked, partially open construction allows for it to be climbed both from the side and from the inside up. With different decks connected by ropes, nets and stairs, a steering wheel, and telescope bring about all possible kinds of adventures.[27]. This playground transport children into a world of adventure while fostering appreciation for the cultural heritage of the context.

Figure 18 Pirate Playground
Source : https://landezine.com/pirate-playground-by-tgp/

Figure 19 Pirate Playground's Play Experience
Source : https://landezine.com/pirate-playground-by-tgp/

The playground stands as a vibrant hub for community engagement. As a popular destination for both local children and tourists, it actively fosters social interaction and a sense of shared identity.

The playground offers diverse urban experiences characterized by imaginative play and exploration within a maritime-themed environment. It includes features such as pirate ships, climbing structures, and themed play areas, fostering creativity and adventure. Materials include wood, ropes, and nautical-themed elements contributing to the immersive play experience. The surrounding environment is within a coastal area, provides a scenic outdoor play and social interaction enhancing exploration and discovery.The playground reflects the historical adaptation and sustainability by incorporating maritime heritage into its design, promoting cultural preservation, and fostering community involvement. Through educational initiatives, and adaptive reuse of historical elements, the playground serves as a focal zone for both local residents and tourists through recreational activities.

Accessibility and safety are prioritized ensuring that it offers an inclusive and secure environment for all types of visitors. Safety measures include regular inspections, secure play areas, as well as educating visitors about safe play practices.

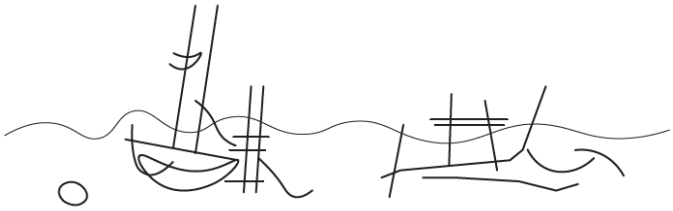

Figure 20 Sketch representing Pirate Playground's character Source: Made by Author

4.8. *Admiralty Park (2007) – Singapore*

Admiralty Park is a national park located in Singapore that is 27 hectares in size. Its uniqueness lies in by its river valley shaped hilly terrain. It comprises both a nature area and an urban area in one park. The nature area has mangroves around Sungei Cina, and the urban area has a playground for children of different ages and abilities. It features an inclusive playground, as part of an initiative announced by NParks in 2015. Inclusive playgrounds provide the physical structure, or 'hardware', that supports play between children with and without special needs.[28].The Park reflects Singapore's continous efforts to optimize the green spaces and support the urban biodiversity serving as a model for sustainable urban park design. The playground is a free outdoor playground with climbing nets, swings and 26 different slides.

Figure 21 Admiralty Park Playground
Source : https://landezine.com/pirate-playground-by-tgp/

Figure 22 Mangroves of Admiralty Park
Source : https://wildshores.blogspot.com/2009/04/mangroves-of-admiralty-park.html

The user experience at the park spans diverse urban contexts, offering a various recreational facilities and natural beauty. The features involve variety of attractions such as playgrounds, fitness stations, and walking trails, targeting visitors of all ages and interests. Materials usage includes recycled plastic, natural wood, steel, concrete and stone. The surrounding environment is characterized by rich greenery, ponds, and scenic vistas, providing rooms of different outdoor activities and relaxation. Historical adaptation focuses on preserving the site's ecological heritage while integrating modern design approaches. It involves the restoration of the natural ecosystems within the park, such as wetlands and native vegetation, to promote biodiversity and ecological resilience.

The materials used are eco-friendly and sustainable. Community engagement is another aspect that is considered in maintaining this park through education initiatives that raises the awareness about the environmental issues.Children can climb on small mounds and play with slides on gentle slopes offering a very safe play area. The playground provide inclusive play equipment for children with special needs.

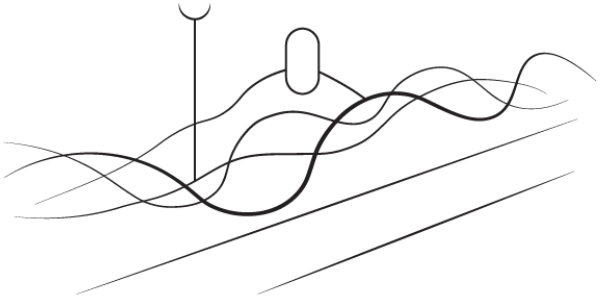

Figure 23 Sketch representing Admiralty Park's character Source: Made by Author

4.9. *The Governors Island Playground (2009) - New York City, USA*

Governors Island is a 172-acre island in New York Harbor, nestled between Lower anhattan and the Brooklyn waterfront. For almost two centuries, the Governors Island was closed to the public, operating as a military base for the U.S. Army and later, the Coast Guard. In 2003, the federal government sold 150 acres of Governors Island back to the people of New York.[29]. The Yard is a kids only space guided by trained playworkers. The primary play area is recommended for young people ages 6 to 12 and the family play area welcomes children under 5. The Yard supplies young people with loose parts materials for building, forming compositions, exploring, imagining, navigating and destroying.

The Governors Island Playground, known as "The Yard," stands as New York City's only adventure playground. This unique play space is designed for children to engage in self-directed play and spontaneous exploration, embodying a philosophy of free play.

Figure 24 The Governors Island Playground
Source : https://brooklynbridgeparents.com/a-look-inside-the-junk-yard-playground-on-governors-island/

Figure 25 The Governors Island Playground's Play Equipments
Source : https://www.govisland.com/things-to-do/recreation/the-yard

The user experiences may vary based on the age group, and individual preferences. The spatial experience provides a sense of wonder and exploration, interaction with different features and engage in imaginative play. The physical features include climbing structures, slides, and interactive elements offering different opportunities for physical activity and social interaction. The materials used in the playground are sustainable and durable, with eco-friendly approach such as recycled plastic, reclaimed wood, and natural elements like sand and stone being incorporated into the design. The surrounding environment situated across different views of the city skyline, waterfront access, and lush greenery, the playground offers a unique blend of urban and natural elements enhancing the biodiversity. The design reflects the space evolution from a former military based area to a modern recreational space emphasizing on community engagement.

Accessibility considerations and safety measure prioritize inclusivity and the well- being of the visitors. The playground offers wheelchair accessible pathways and inlusive play equipment.

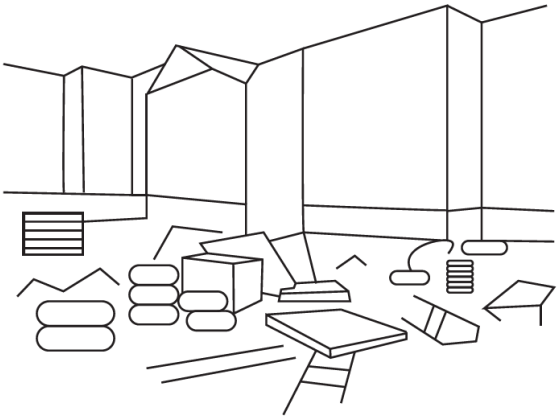

Figure 26 Sketch representing The Governors Island Playground's character Source: Made by Author

4.10. *Tumbling Bay Playground (2014) - Queen Elizabeth Olympic Park, London*

Designed by LUC, the Tumbling Bay playground was developed to be a destination play area within the Queen Elizabeth II Park, created for the 2012 London Olympics. Part of an emerging community, the park and play area was one of the first things completed, and over the years that followed the area has been heavily developed, with many housing blocks, retail centres and cafes.[30]. The conceptual approach behind the design development of the café and play area is based upon ideas of succession and lifecycles. The play zone includes extensive sand and water play. This playground features ignites the immagination of children,where the play structures inspire children

with the beauty of the outdoors. The playground blend smoothly with it's surrounding creating an engaging environment that stimulate creativity and play.

Figure 27 Tumbling Bay Playground
Source : https://davisla.wordpress.com/2013/09/24/tumbling-bay-playground-queen-elizabeth-olympic-park/

The user experience is enriched by its diverse urban setting, engaging natural physical features, and rich harmonious surrounding environment. The playground offers a dynamic blend of natural and man-made elements, fostering users of all ages. Physical features include adventure wooden play structures, water elements, sand pits, and climbing areas, encouraging exploration, creativity, and active play. The surrounding environment is characterized by rich vegetation, scenic waterways, and panoramic views of London's skyline. The historical adaptation and sustainability aspects are interconnected with its location within the Queen Elizabeth Olympic Park. Historically, the park was the site of the 2012 Olympic and Paralympic Games, and the playground's design approach reflects this heritage while implementing sustainable practices by involving the reuse of the existing infrastructure minimizing waste and reducing footprint of construction. Conservation measures are integrated into the playground's maintenance and design.

Figure 28 Tumbling Bay Playground's Water Feature
Source : https://www.erectarchitecture.co.uk/projects/timber-lodge-and-tumbling-bay/

The park prioritize inclusivity and well-being for all visitors. The playground features wheelchair-accessible pathways and ramps, ensuring that users with mobility challenges can move around the space comfortably. Safety measures such as soft ground surfaces in the play zonez and handrails on elevated structures are executed to prevent accidents and minimize risks, especially for young children.

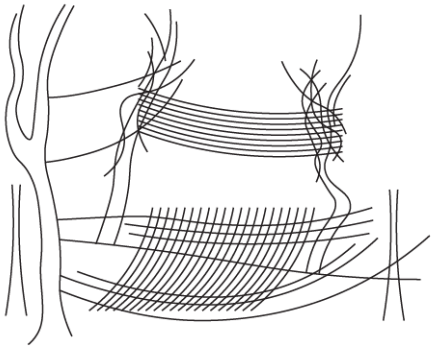

Figure 29 Sketch representing Tumbling Bay Playground's character Source: Made by Author

5. COMPARATIVE EVALUATION FRAMEWORK

To ensure a systematic and comparable analysis across the ten case studies, each playground was evaluated against a predefined set of criteria derived from the established definitions of sustainability and historical adaptation, alongside key design and various aspects.

Playground Name (Case Study)	Grouping Category (e.g., Scale/Function)	Scale (Approx. Area)	Primary Design Philosophy/Function	Key Sustainable Features / Materials	Historical Link/Adaptation	Accessibility & Inclusivity	Community Engagement	Surrounding Environment	Unique Features
Parc Güell Playground	Iconic & Integrated Urban Parks	Large (part of wider park)	Artistic, integrated landscape	The bigger park has locally-sourced stone, natural ventilation, water management, while the playground has natural materials mainly wood , and other natural elements like stone and ropes	The bigger park - Gaudí's Modernist architecture, original garden city intent	High (ramps, smooth paths)	High public use	Urban park, city views	Mosaic sculptures, unique architecture in the park, the playgound has simpler functions and more natural looking
Adventure Playground	Community-Driven & Unstructured Play	Medium	Unstructured, free play	Reclaimed/natural and recycled materials, DIY elements, ropes, recycled wood , plastic , tires , steel , as well as having social sustainability aspect emphasized by the community engagement	Post-WWII social initiatives, community empowerment	Varied	High (user-built structures, supervision)	mainly residential, urban	Emphasis on child-led design
Nishi-Rokugo Adventure Park	Adaptive Reuse & Industrial Transformation Playscapes	Large	Creative play with recycled materials	Extensive use of recycled 3000 tires, natural elements (creative reuse of industrial waste (tires))	Innovative material reuse, transforming unused tires into a vibrant play environment	Standard	High (local volunteers, community hub)	Urban and residential	Rubber tires as main play equipment
Parque Gulliver	Iconic & Integrated Urban Parks	Large (part of Turia Gardens)	Themed, imaginative play, iconic sculpture	Integrated into existing riverbed, public art, using durable materials like concrete and steel	Adaptive reuse of former riverbed	High (ramps, wide slides)	High public use	Urban park, city center	Giant Gulliver figure
Landscape Park Duisburg-Nord	Adaptive Reuse & Industrial Transformation Playscapes	Very Large	Post-industrial landscape, adventure	Reclaimed industrial structures, ecological restoration using materials like concrete, steel and recycled materials	(UNESCO site)	Varied (some challenging access)	Active (events, educational programs)	Former industrial site, now park	Repurposed industrial relics, climbing walls and slides
Takino Suzuran Hillside Children's Valley Playground	Nature-Based & Landscape-Integrated Play Areas	Very Large	Nature-based, sensory, large-scale	Integrated into natural topography, using local materials : locally sourced wood , eco-friendly ones, rocks and stones. engineered structures (truss walls) and artistic textile installations (hand-crocheted nylon nets)	Natural landscape, national park	Good	Moderate	National park, hilly terrain	Unique themed play structures
Pirate Playground	Themed & Destination Playgrounds	Medium	Themed, imaginative role-play	Durable materials, ship-like structure entirely crafted in wood , using ropes and nets (nautical-themed elements)	Local maritime history, port area	Moderate	Moderate (Vibrant hub for community engagement , annual pirate festivals and performances)	Waterfront, tourist area	Large pirate ship structure
Admiralty Park	Nature-Based & Landscape-Integrated Play Areas	Very Large	Nature-based, multi-generational, slides	Integrated into natural terrain, eco-friendly and sustainable materials. Materials usage includes recycled plastic, natural wood, steel, concrete and stone and using native vegetation.	N/A (new development focus)	High (inclusive zones, diverse slides)	High (family destination)	Park, natural landscape	Largest collection of slides in Singapore
The Governors Island Playground	Community-Driven & Unstructured Play Environments	Medium	Adventure, free-play, recycled materials	Materials aresustainable and durable, with eco-friendly approach such as recycled plastic, reclaimed wood, and natural elements like sand and stone being incorporated into the design.	Former military base, adaptive reuse	Varied (some challenging structures)	High (design based on community ideas)	Island, waterfront, green space	Large-scale, non-prescriptive play elements
Tumbling Bay Playground	Nature-Based & Landscape-Integrated Play Areas	Medium	Nature-based, integrated, multi-age	Using natural materials (timber, stone), water features . Reuse of the existing infrastructure minimizing waste and reducing footprint of construction.	Legacy of Olympic Park development	High (ramps, varied textures)	Moderate	Urban park (Olympic Park)	Climbing frames, wobbly bridges, water play

Table 2 . Comparative Evaluation Framework for the 10 Case Studies

6 . DISCUSSION

Studying these playgrounds provides insights into how historical and contemporary approaches to playground design have responded to sustainability concerns throughout history. By exploring these playgrounds, they reflected an understanding of how playgrounds have adapted to their needs throughout history and how modern designs through time prioritized sustainability in their design approach. The study contributes to ongoing discussion in playground urban planning and their design by raising awareness into the importance of the historical aspect, sustainability, and design approaches in developing resilient and inclusive communities. It is important to have a comprehensive approach when designing playgrounds, taking into consideration the intersection of history, sustainability, inclusivity aspects together and user-centered design in shaping urban play environments.

Most of these playgrounds are likely integrated into their natural landscape contexts, such as hillsides, parks, defined by buildings, certain terrian, urban features, or waterfronts. This natural integration enhances the play experience by providing opportunities for exploration, and interaction with the natural landscape, which improves the overall quality of the experience.

Ultimately, the construction of child-friendly cities is a process of protecting children's rights, aiming to optimize urban spaces, environments, and policies to provide children with a safe, healthy, equitable, and inclusive environment for growth. As urbanization accelerates globally, the building of child-friendly cities should not only focus on improving the basic living conditions of children but also on ensuring their voices and rights within society. Future research must focus on how interdisciplinary collaboration and innovation can promote the practical realization of child-friendly cities, ultimately forming a more comprehensive and sustainable development model.[1]

7. CONCLUSION

Sustainability features implemented across the 10 case studies revealed both similarities and differences. Common themes were observed, reflecting varient approaches of different practices in sustainable development thoughout the history. This comparative analysis has revealed key insights into their approaches to historical adaptation, sustainable design, and unique contextual integration.

The analysis demonstrates varied approaches to historical adaptation and reuse across the selected urban playgrounds and parks. For instance, Landscape Park Duisburg-Nord represents a profound transformation of an industrial site, preserving monumental structures and repurposing them for new recreational and ecological functions. Similarly, Parc Güell showcases the adaptive evolution of a residential concept into a public park, where the playground, with its natural approach, integrates with the park's overall architectural and heritage within the larger park setting. In contrast, cases like Nishi-Rokugo Adventure Park do not reflect a site-specific historical adaptation but rather illustrate innovative material reuse, transforming urban land and industrial waste (like tires) into vibrant play spaces, thereby adapting materials rather than an existing historical structure.

A comparative analysis reveals both commonalities and diverse approaches in design philosophies, material choices, and community engagement. While many playgrounds, like Takino Suzuran and the Pirate Playground, lean towards natural materials such as wood and ropes, others like Parque Gulliver utilize highly durable, engineered materials like concrete and steel for longevity and unique sculptural forms (Gulliver's large scale play sculpture). Design philosophies range from unstructured, child-led adventure play (Governors Island Playground, Adventure Playground) emphasizing risk-taking, free-play and creativity, to more structured, thematic designs that foster engaging experiences (Parque Gulliver, Pirate Playground). Furthermore, community engagement plays a varied role; in some cases, it is fundamental to the park's concept (Nishi-Rokugo Adventure Park), while in others, the playground serves as a crucial site for ongoing community activities and social cohesion (e.g., Pirate Playground's festivals).

In summary, this study underscores that successful urban play environments and playscapes, whether through historical adaptation or innovative contemporary designs, contribute significantly to city livability and child well-being ;thus, improving children's health and physical activity. The diverse case studies demonstrate that while specific approaches vary, the integration of context-sensitive design, sustainable practices, and opportunities for meaningful engagement (either with the site's past, its materials, or the local community) are fundamental for creating resilient and impactful play spaces within the bigger urban fabric.

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