Spatial Analysis Applied on Play Area's Urban Configurations to Enhance the Safety of Children. Case of New Urban Pole of Hamla in Batna

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Abstract: This research aims to enhance the safety of children in play areas of urban spaces. The concerns about child security have been raised especially in the outdoor urban space of the collective habitat. Nowadays, Risks and dangers are still dominant phenomena that become a parental first preoccupation towards their children. In this regard, several solutions and proposals have been adopted for safer environmental conditions for children. Through the analysis of outdoor urban areas of collective habitat in Hamla districts as a case study, we try to extract what faces of children living in these neighborhoods. Two research techniques are used, the first research technique is an onsite non-participatory observation used to collect data of the urban space plays area and child activities. The second research technique is the space syntax method, used to evaluate urban space using quantitative measures of the connectivity (C), the Integration (I) and Intelligibility. The security system is structured using security smart devices such as surveillance cameras, and alarms… etc., these devices permit a distance parental control of the play areas and child. The socio-cognitive system is rooted in the design of play areas, incorporating digital access and social games. Results demonstrated that the peak values of the typo-morphological measured properties, such as: Visual global Integration (12,01), Visibility Connectivity (262) and Intelligibility (0,74), of spatial analysis demonstrated the strong and weak points in the organization of play areas to provide the safety and protection of children. The design of the play areas can be easily used by children through smart technologies for safety and has an imminent impact on the safety and can strengthen this weakness of play spaces to offer a higher degree of protection to children. The integration of a structured security system with smart devices and a socio-cognitive system based on play area design can result in a comprehensive approach to community safety. By combining advanced security measures with user-centric design principles, these systems can work together to create an environment that not only safeguards against potential risks but also enhances the overall well-being and enjoyment of the community.

Keywords: Children play areas; Smart security system; Space syntax; Hamla quarter; Batna.

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Introduction

The concerns about the child security have been raised especially in the outdoor urban space of the collective habitat. Nowadays, Risks and dangers are still dominant phenomena, its become a parental first preoccupation towards their children, such as: Kidnapping, beating, traffic accidents, abuse, addiction...etc. In this regard, several solutions and Proposals are adopted for safer environmental conditions for children. According to Dolto (1987), the environment is the collection of factors that define a place and influence how a human population exists. The environment is a system, which is a networked collection of components that communicate with and influence one another (Merlin and Choay, 2005). The idea of a child's environment encompasses not just their immediate surroundings, and their built environment, but also their physical, psychological, economic, social, and cultural environments. Children's outdoor environments need to have these physical components that take into account their physical, emotional, cultural, economic, and even political life (Bao et al., 2021). However, initiatives to a significant extent are based on child protection and sovereignty (United Nations Children's Fund (UNICEF, 2018).

The word "space" has many different meanings. For instance, when we use it in our daily lives, we refer to our living space, my space, our location's room, etc. However, they also indicate the hierarchy of expropriation (from public to private) and the type of use of spaces (Marzloff, 2005). A child's growth and development into a healthy adult are significantly influenced by their physical environment and the urban spaces (especially urban open spaces) with which they interact (Henderson et al., 2015). The perceptions, feelings, aspirations, and interests of children are molded across spatial boundaries. Children are drawn to places for their own site of socialization - a location other than a physical one where they form emotional bonds and engage in certain interactions (Loit, 2021).

Social security and road safety are two different aspects of the word "safety" that are discussed (Rakitina, 2021). The number of people in metropolitan areas or the clear view of the streets from home windows can both serve as social security indicators (Bagattini, 2019). The kids would feel secure in this way. A busy street is a safe street, according to Kaufmann (2004), who also underlined the connection between social security and the number of people living on the streets. He adds, an empty street is often risky. According to Ouv (1995), safe cities are places where crime is consistently fought, criminals are brought to justice, opportunities to commit crimes steadily decline, unplanned illegal housing is nonexistent, and people are prepared to advance to the level of modern civilizations in order to meet their needs and have a higher quality of life. Two separate components of "urban security" need to be taken into account: first, the idea of urban security originated with the process of urbanization and the development of pertinent measures (Tahir and Damla, 2017). According to this viewpoint, urban security primarily refers to an understanding of urban security that is distinct from rural security (Rakitina, 2021). With the advancement of human rights in contemporary times, the idea of a "safe city" emerged as a sign of civilisation, and "urban rights" was born.

The connection between a child's environment and urban play areas is integral to fostering healthy development and well-being. Urban play areas serve as essential spaces where children can engage in physical activity, social interaction, and imaginative play, contributing significantly to their cognitive, emotional, and physical growth. Research studies emphasize the importance of well-designed and accessible play environments in urban settings to positively impact children's mental and physical health (Fjørtoft, 2004; Veitch et al., 2006). Factors such as proximity, safety, and the presence of diverse play equipment play crucial roles in shaping a child's interaction with their environment. Moreover, urban planners and designers should consider incorporating nature-inspired elements and green spaces within play areas, as they have been associated with enhanced cognitive function and reduced stress levels in children (Wells, 2000; Kuo, 2001). By recognizing the intricate link between a child's surroundings and urban play areas, communities can create inclusive, stimulating environments that promote the holistic well-being of their younger residents.

The application of Space Syntax in analyzing children's play areas proves to be a valuable tool in understanding the spatial configuration and its impact on play behavior. Space Syntax, a theoretical

and analytical framework developed by Hillier and Hanson (1984), focuses on the spatial layout of environments and the relationships between different elements within a space. In the context of children's play areas, this approach allows researchers and designers to assess how the spatial arrangement influences accessibility, visibility, and overall usage patterns. By employing Space Syntax techniques, such as axial analysis and integration analysis, researchers gain insights into the connectivity and permeability of the play space, helping to identify areas that may attract or deter children's engagement (Hillier, 1996; Turner, 2001). This methodology facilitates the creation of more inclusive and dynamic play environments by optimizing spatial layouts to encourage diverse play activities and enhance children's overall experience within these spaces.

child environments and urban spaces to the critical aspect of social security reflects the integrated nature of community well-being. The quality of a child's environment, especially within urban spaces, is fundamental to their physical and cognitive development (Fjørtoft, 2004; Veitch et al., 2006). The design of urban play areas, as a subset of these environments, is crucial in fostering the holistic development of children. Transitioning from this focus on child development to the broader perspective of social security emphasizes the interconnectedness between individual well-being and community safety. Integrating structured security systems into urban planning is essential for creating secure environments that promote a sense of safety and harmony for all residents (Cozens, Saville, & Hillier, 2005). This integrated approach acknowledges that child-friendly spaces are not isolated entities but integral components of urban landscapes that contribute to the overall social resilience and security of a community.

1. Research methodology

The research methodology comprises two techniques. Firstly, there is a preliminary non-participatory observation of the population primarily concerned with the research topic, which includes children and their daily play area space between residential blocs. This has resulted in the creation of a play areas map. Additionally, a marking system called "black dots" has been introduced to indicate physical elements in the space that pose risks to children. These "black dots" help identify problematic areas that require further detailed explanations concerning the specific urban space being studied. Throughout the study area of Hamla, a total of 16 "black dots" have been identified, serving as markers for various dangerous locations. The daily "play areas" space is depicted on an accompanying map, showcasing both the black dots for hazardous areas and markings for suitable or enjoyable activities, along with justifications for each.

The analytical strategy employed in this research case is designed to align with the security and safety needs of the child. The second technique involves spatial syntax analysis using the "Depth-Map" program. The technique of spatial syntax analysis (SSA), formulated by Bill Hillier and Julienne Hanson during the 1980s, serves as a crucial method in our investigation for comprehending and examining the spatial arrangement of urban settings. Our investigation emphasis lies in exploring the connections between different spaces and their impact on human conduct, with a particular focus on play areas and child safety.

The approach of Spatial Syntax Analysis (SSA) underscores the correlation between spatial arrangements and human movement, behavior, and perception. This characteristic renders it pertinent for urban designers and planners aspiring to craft spaces that are both intelligible and functional (Hillier and Hanson 1984, Thaler 2020). Utilizing quantitative metrics, spatial syntax enables a meticulous and systematic examination of spatial configurations, enhancing the objectivity and replicability of studies (Yamu et al. 2021). The theory asserts that the spatial structure significantly impacts social interactions and movement patterns, providing a foundation for predicting how individuals utilize and traverse urban spaces. Spatial Syntax Analysis is versatile, applicable to various scales, ranging from individual buildings to entire cities, making it adaptable for diverse urban planning and design scenarios. However, it is noteworthy that the syntactic representation of space in spatial syntax tends to be simplified.

DepthMapX stands as a widely employed software tool in spatial network analysis, as highlighted by Al-Sayed and Turner in 2012. This tool empowers users to construct depth maps, visually

represent spatial configurations, and assess diverse metrics related to spatial integration and accessibility (https://www.spacesyntax.online/software-and-manuals/depthmap/tutorial/). In parallel, the Space Syntax Toolkit (SST) presents itself as a collection of open-source resources for spatial analysis, encompassing the generation of depth maps. This toolkit offers Python scripts and utilities for computing various spatial syntax measures (Space Syntax Toolkit). Additionally, the Python package NetworkX serves as a versatile tool for examining complex network dynamics, structures, and operations. Although not specifically designed for spatial syntax, NetworkX proves adaptable for network analysis tasks, including depth-map generation, as noted by UCL Space Syntax in 2022 and Turner in 2004.

In what follows, we will present reasonable axial maps highlighting the grid planning logic of children's play areas in collective housing. This approach will allow a graphical analysis of the different access points and the tertiary framework, followed by an overall comparison and juxtaposition of these elements in terms of space syntax. The spatial syntax of urban spaces will then be correlated to safety aspects and measures. By implementing this methodology, Spatial syntax involves modeling based on indicators and the analysis of visibility, integration, and intelligibility graphs (Van Nes et al., 2021; Bendjedidi et al., 2018; Chibane et Hamouda, 2022). Both approaches aim to test the assertion that there is a connection between the characteristics induced by spatial configuration and the safety of children in urban play area spaces.

2. Presentation of the case study
2.1 District location

Situated in a basin surrounded by mountains, Batna, positioned at an elevation of 1,058 meters, emerges as a significant urban center in Algeria, hosting 375,000 residents and ranking as the country's fifth-largest city (Guedoudj, 2020). Consistent with the urban development patterns observed in many Algerian cities, Batna, located in the eastern part of the nation, exhibits a distinct mass housing neighborhood extension, prominently situated in the southwest (Cote, 1991). Specifically, the new Hamla urban center, an extension area, is home to a population totaling 60,000 individuals, including 1,260 children with an economic and touristic potentials environment site (Kherrour et al., 2018).

Fig.1. the studied district location within the new urban pole of Hamla

Source: PDAU batna treated by author, 2023

2.2 Play areas studied

Child-aged youngsters between the ages of 3 and 14 are the focus of this study. There are 420 housing units in the area, along with a few public and administrative structures (a high school, a bank, and a clinic, a collection of private homes, an office, and a gym). Additionally, it has a sizable surface of open areas that are left-over plots and are in poor physical condition with no furniture. These "remaining plots" in the context of playgrounds and children's safety reside in their potential to contribute positively or pose risks. If properly designed and repurposed, these spaces can become valuable additions to playgrounds, providing children with more opportunities for recreation and social interaction. However, if neglected or poorly designed, these plots can become neglected or potentially hazardous areas, exposing children to dangers. Therefore, proper planning and utilization of the "remaining plots" are crucial to ensure that they enhance playgrounds and contribute positively to children's safety in urban environments.

The first is a preliminary observation, conducted in September 26th, 2023 between 8am to 8pm, of the population most interested in the research topic (the children and their play area space); as a result, and of the courses a non-participant observation. Additionally, it enables the depiction of all the locations this time that were problematic and were mentioned from the survey conducted. On all of Hamla's play areas; there are a total of 10 "play areas" that are listed in the studied district, punctuating the space like so many important locations.

- la nature des espaces de jeux des enfants du quartier selectionné sont des espaces rarement amnagé et équipé selon les normes de celles-ci, leurs formes varies selon le mode e le nombre de batiments qui les entoures, et la majorité des revêtements de ces espaces sont similaire par des matériaux de qualité modérées tells que : le béton, briques et asphelt bitumé et sont toujours positionnés par des voiries et des blocs de bâtiment d'habitation.

- 10 "play areas" that are listed in the studied district.

- 3 types of "play areas" space: A. Open space, B. Semi-open space and C. Semi-closed space.

Fig.2. Play areas listed in the studied district.
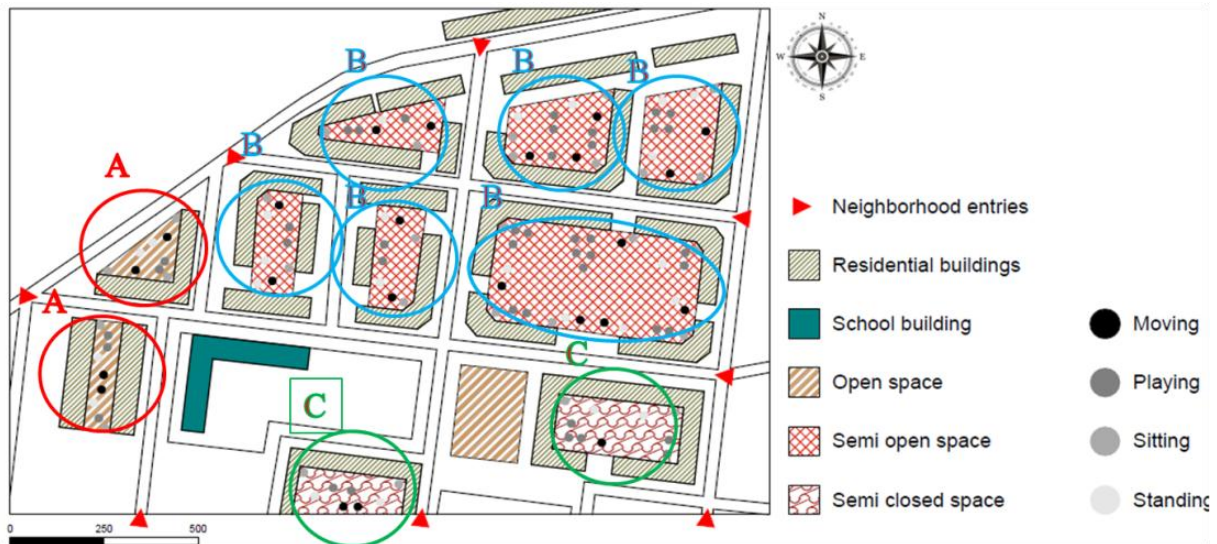
Source: author, 2023

based on non-participative observation, In the play areas of the studied district, children engage in a vibrant array of activities that reflect their boundless energy and creativity. These spaces serve as dynamic environments where youngsters can be observed moving, playing, sitting, and standing, showcasing a rich tapestry of interactions. Eager youngsters can be seen darting around in joyous games of tag or hide-and-seek, embodying the spirit of active play. Simultaneously, other children find delight in quieter moments, sitting on swings or benches, engrossed in imaginative activities or simply enjoying the company of their friends. The play areas thus become hubs of diverse activities, fostering both physical and social development among the youth in the community. Whether in

boisterous play or serene contemplation, these spaces cater to the multifaceted needs of children, providing a holistic and enriching environment for their growth and development.

2.3. Spatial characteristics of play areas

The spatial characteristics of play areas for children in collective residential buildings can vary based on factors such as available space, building design, and the needs of the community. However, some common spatial characteristics to consider include: Size and Layout, Safety Zones, Accessibility, Seating and Observation Areas, Varied Play Equipment, Flexibility in Design, and Safety and Security Measures. The table provided summarizes whether play areas of these types exhibit the mentioned spatial characteristics.

The spatial characteristics of play areas for children in collective residential buildings can vary based on factors such as available space, building design, and the needs of the community. However, some common spatial characteristics to consider include:

Size and Layout:
- Design a layout that optimizes the available space efficiently while ensuring adequate room for various play activities.
- Create zones for different age groups and types of play equipment.

Safety Zones:
- Include safety surfaces, such as rubber or soft material, under play equipment to minimize the risk of injuries from falls.
- Ensure that play structures are appropriately spaced to prevent overcrowding and collisions.

Accessibility:
- Incorporate accessible pathways and ramps to ensure that the play area is inclusive for children with disabilities.
- Ensure that the play equipment is usable by children with diverse physical abilities.

Landscaping:
- Integrate greenery, trees, and plants to provide a natural and aesthetically pleasing environment.
- Consider using landscaping elements to create shaded areas for comfort during sunny days.

Seating and Observation Areas:
- Include seating areas for parents, caregivers, and other observers.
- Designate spaces with good visibility for supervision while ensuring that seating does not obstruct pathways.

Varied Play Equipment:
- Incorporate a diverse range of play structures, including climbing equipment, swings, slides, and imaginative play areas.
- Ensure that the equipment is age-appropriate and caters to the developmental needs of children.

Shade and Shelter:
- Designate areas with natural or built-in shade to protect children from excessive sun exposure.
- Consider installing shelters or covered areas for protection during adverse weather conditions.

Flexibility in Design:
- Design the play area with flexibility to accommodate different activities and play preferences.
- Consider movable or modular play elements that can be rearranged for variety.

Safety and Security Measures:
- Install appropriate fencing and gating to secure the play area.
- Consider lighting for evening use, ensuring safety and security.

By incorporating these spatial characteristics, designers can create play areas that enhance the overall living experience for children and families in collective residential buildings.

Table 1 : Spatial characteristics factors by type of the play areas studied.

| Spatial characteristics factors	Type A Open space	Type B Semi-open space	Type C Semi-closed space
Size and Layout	- -	+	-
Safety Zones	-	+	++
Accessibility	+++	++	+
Landscaping	-	+	-
Seating and Observation Areas	+	+	+
Varied Play Equipment	-	-	-
Flexibility in Design	-	-	-
Safety and Security Measures	- - -	- -	-

Source : Author, 2023

3. Discussion
3.1 Non-participatory observation analysis

The results of the analysis demonstrate that the aspects that significantly influence children's movements in play area in Hamla are comparable to those described in the literature on urban safety. The majority of the time, the presence of a sidewalk, the lateral distance of motorized traffic, the volume and speed of motorized traffic, vehicles (such as trucks and buses), and the physical barriers dividing the lane of walkers from that of cars are the most crucial factors for pedestrians.

Fig.3. Physical factors affect the movements of children along their outdoor space
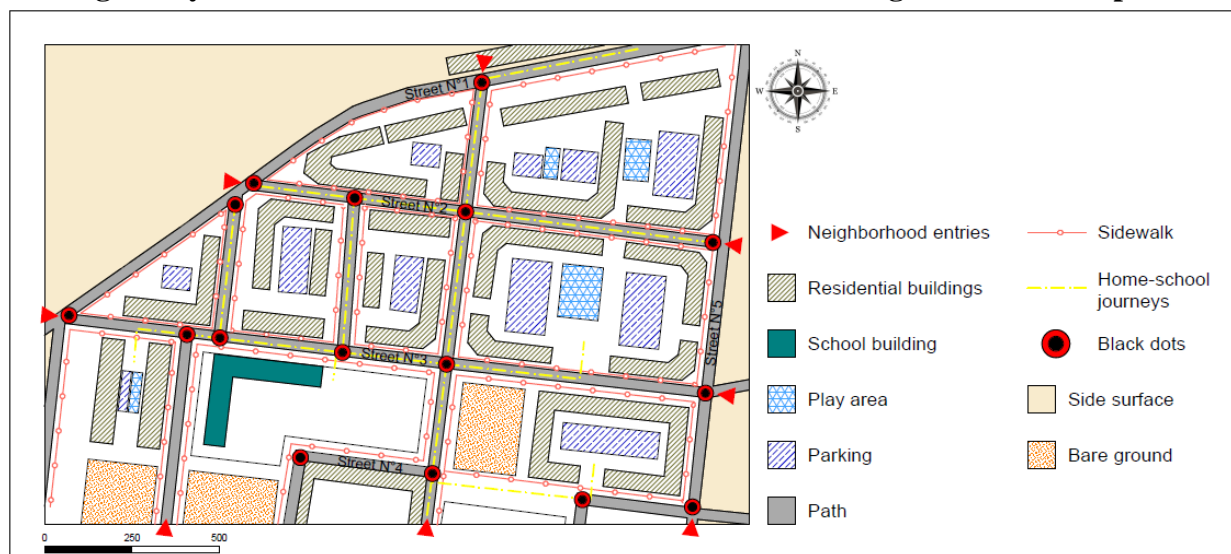
Source: author, 2023

A sidewalk's presence, a high volume of motorized traffic, the absence of a buffer between children and the residential blocks, the absence of barriers between blocks and the street, the presence of parking spaces around play area, and the absence of a cycle path are all elements that can be used to determine whether or not there is a lateral separation between children and motorized traffic. The authors analyze the conflict between two different sorts of places and users: the road, which is a surface designated for cars, and the playgrounds, which represents the children. We arrive to comparable conclusions through induction. Parents vehemently reject these two sorts of areas as well as the conduct that are unique to them, like walkways, waiting spaces, and even children crossings that provide challenges with traffic.

Fig.4. Child safety in urban spaces

Source: Author, 2023

The children from Hamla undoubtedly prefer to walk to move anywhere. This observation does not, however, imply that the excursions are not fraught with hazards; as we have already mentioned, a dozen black dots are dispersed along every route chosen. It is important to respect the language and terminology of the locals! It can be argued, however, that the most common "feelings" are directly related to conflicts between:

- Users and/or types of spaces,

- A perception of the fast speed of motor vehicles,

- A lack of security, and a sense of danger.

3.2 Spatial syntax analysis
a. All line analysis and the axial map

In order to analyze the actual residential environment, space syntax was utilized. To understand children's space safety and behaviours, it offers a useful quantitative indication of spatial configuration. The visibility graph analysis is one of the space syntax analysis techniques used to examine metropolitan outdoor areas. For the data analysis, connectivity, integration, and understand-ability were evaluated. The metropolitan outdoor areas refers to open spaces and public areas within a metropolitan or urban environment. These spaces can include parks, plazas, pedestrian walkways, and other outdoor settings found in large cities. The term encompasses various types of open areas within the broader context of a metropolitan landscape. The visibility graph analysis is a technique employed to study and understand the spatial configuration and connectivity of these outdoor areas in the metropolitan setting. Essentially, it is a method used to analyze how visual relationships and accessibility contribute to the overall structure and design of outdoor spaces within a metropolitan context.

Fig.5. (a) Connectivity, (b) Integration through the all line analysis (scenario with roads)
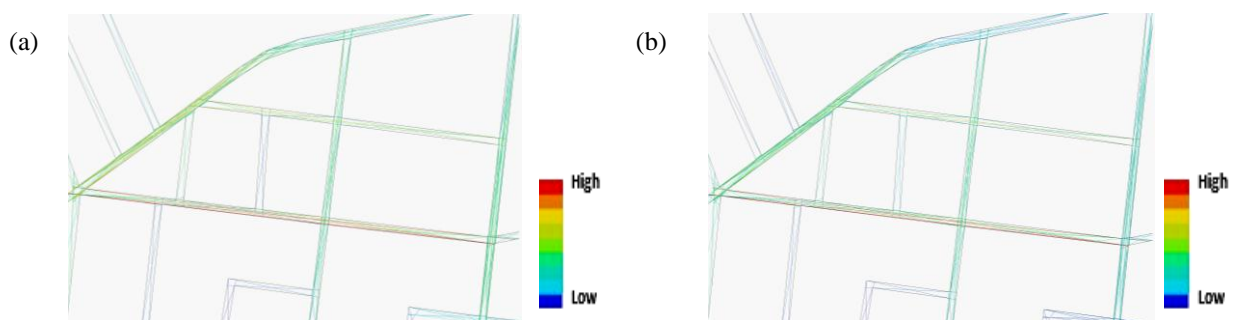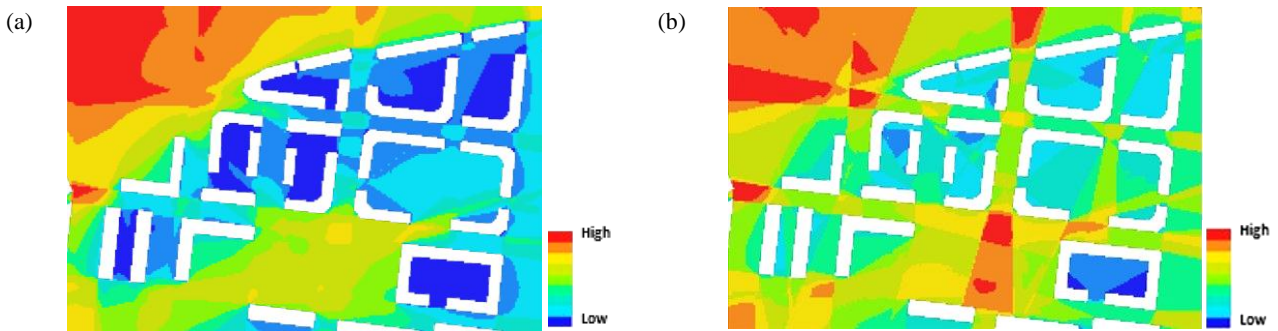

Source: author

b. Scenario VGA roads (Installation of blocks in the study area)

We then developed a second scenario since our work will be based on the relationship between the building of the urban conformation and the play area in question, by removing the

traffic lanes in this scenario, we gave some freedom to the user (he will move around easily), we have freed him from all the constraints relating to the overall configurationally composition of the site.

Fig.6. (a) Visual Global Integration map (VGA); (b) Visual Connectivity map (VGA)

(a)   (b)

Source: author

Regarding integration, the correspondence reveals that the most connected area is the same district that has the highest values in terms of integration with maximum values around 15.47, we notice the appearance another integrator axis on the axis that delimits the play area with the same maximum values, this axis there, offers average integration values all along the road axis on average of 13.11. The values of integration decrease slightly, especially in the spaces that constitute the heart of the block, however the values of integration will remain the same, except for the block built in the south-east of our district.

c. Intelligibility of the neighborhood

The resulting intelligibility in this case represents an R^2 value of 0.757 which is more than 0.5 which means that the urban fabric is intelligible as a whole except for the part of the heart of the islets, of this makes the users of the space move in spaces where connectivity and integration are average.

Fig.7. Intelligibility of the neighborhood
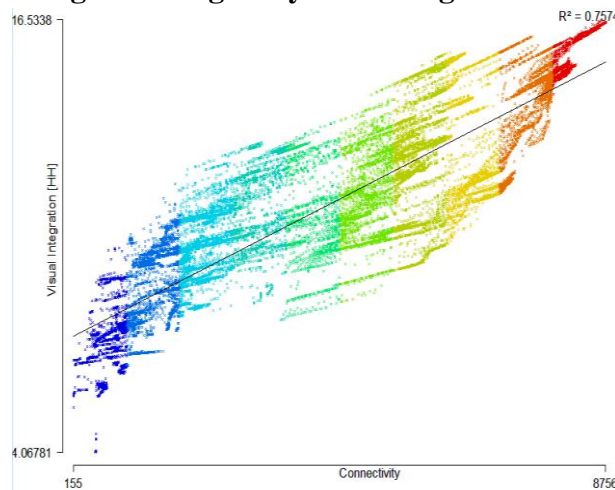
Source: author

The intelligibility in this case is the best, since it has an overall value of 0.94 very close to 1, so the urban composition according to this result is very intelligible (Table 2).

Table 2. The peak values of the Typo-morphological measured properties.

Typo-morphological properties	The measure	The peak values
VGA	Integration	16,47
	Connectivity	8756
	Intelligibility	0,940
All line analysis without road	Visual global Integration	12,01
	Visibility Connectivity	262
	Intelligibility	0,74

Source: author

4. Smart system suggested

A development of a primary smart system adapted to our case study urban data. The strategy of a smart environment is developed in relation to smart technologies based on a model of a smart playground's urban area. This primary smart system is developed to ensure both security and socio-cognitive development of children. The security system is structured using security smart devices such as: surveillance camera, alarms, Smartphone, Wi-Fi… etc., these devices allow a distance parental control of playgrounds area and child , while the socio-cognitive system are based on playgrounds space design using a digital access and social and cognitive games. The design of the playgrounds is based on simple shapes and colors that can be easily controlled and used by children.

Fig.8. Smart systems used in play areas for children safety
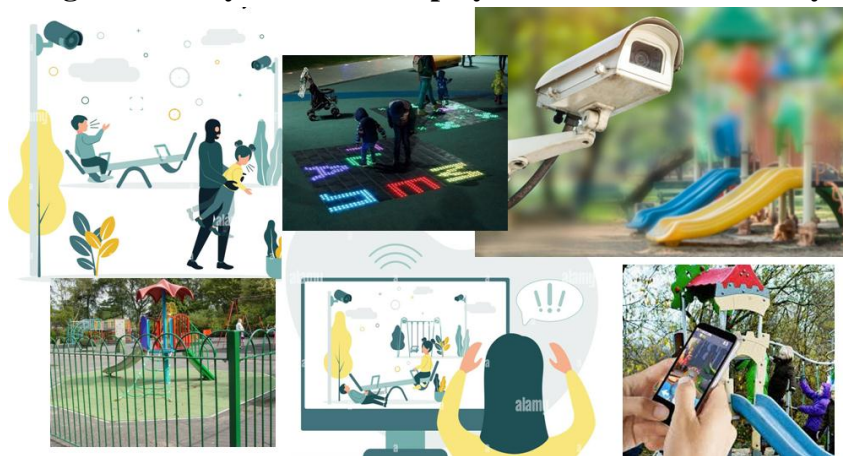
Source: Internet varied website links accessed Nov 22, 2023.

Efficient utilization of smart technologies in controlling children's play areas has revolutionized the way we approach safety, entertainment, and overall management. Integrated sensors and monitoring systems ensure a secure environment, detecting potential hazards or unauthorized access in real-time. Smart surveillance cameras equipped with facial recognition technology enhance security measures while desreasing significantely black dots risks. Furthermore, interactive play structures and augmented reality features powered by smart technologies contribute to a dynamic and engaging play experience, fostering both physical activity and cognitive development. Centralized control systems allow for remote monitoring and adjustments, optimizing resource allocation and minimizing operational costs. By harnessing the power of smart technologies, we not only create safer play spaces but also cultivate an environment that adapts to the evolving needs of children, promoting a healthy and enjoyable play experience.

5. Interpretation of the results

The provided analysis of the peak values of the typo-morphological measured properties underscores a multifaceted approach to enhancing safety and fostering a conducive environment within play areas. Firstly, the insistence on security barriers in the absence of parental control reflects a prudent emphasis on safeguarding the premises. This precautionary measure acknowledges the importance of controlling access, preventing unauthorized entry, and maintaining a secure environment even when personnel are not physically present. Secondly, the suggestion for parental control over access through intelligent systems for neighborhood residents speaks to the integration of technology in security management. the type C (semi-closed play area) facilitate the integration of such system and offer a safer play area. This implies a collaborative effort between technological advancements and parental involvement to regulate access, thereby enhancing community safety. Lastly, the emphasis on developing play areas with equipment and games aligned with the cognitive and socio-cultural needs of children reflects a holistic approach to education and recreation. By incorporating activities that align with developmental milestones and cultural values, such spaces can contribute to the overall growth and well-being of children, creating an environment that nurtures both physical and intellectual aspects of their development.

Conclusion

The concepts and goals of sustainable urban development are emerging and seem to be permeating nearly every aspect of daily life: The present design of urban districts favors an integration of the many functions, modes of transport, and play area spaces, in particular by reducing the number and severity of accidents and offer safety for children. By casting such anxious glances on children in general, the parental and societal discourse frequently serves to perpetuate this integration challenge. Another is the growth of specialized, uniform, and extremely secure children's play areas.

La relation entre le développement urbain durable et la sécurité des enfants dans les aires de jeux est cruciale pour créer des environnements urbains qui favorisent le bien-être des enfants. Un aménagement attentif, des espaces verts bien conçus, des équipements sûrs et une accessibilité universelle contribuent à assurer la sécurité et le développement sain des enfants. Il est impératif que les initiatives de développement urbain intègrent des normes de sécurité strictes pour garantir des aires de jeux adaptées, durables et propices à l'épanouissement des plus jeunes membres de la communauté.

However, in today's discourse, autonomy is emphasized in both family and educational contexts. We then wanted to know if work on the public highway would be evaluated at the scale of residential spaces and along a specific district, the one of play areas, and if the child space in morphological terms (forms and structures) might have its own responsibility. We confirm the urgency of performing a set number of redevelopments in these locations in light of the number of black spots found but more importantly in light of their concentration in the safety of the children against extrinsic dangers.

The analysis of spatial syntax reveals the necessity to ensure the security of three distinct play area types. The semi-closed play area, characterized by optimal visibility, connectivity, and intelligibility, demonstrates the most suitable urban configuration. This specific layout facilitates the seamless integration of advanced security smart systems, making surveillance more effective and efficient. Conversely, the configurations of open play areas and semi-open play areas exhibit vulnerability in terms of safety. In such cases, the application of smart technologies appears ineffective and futile, as these configurations compromise the overall security measures.

The urban planning configuration and technologies - intelligent system mostly used nowadays - can be helpful in comprehending and better comprehending this complexity. The use of smart technology has an imminent impact on the safety and the socio-cognitive development of children in outdoor urban playgrounds. Our study and the resulting cartographic findings demonstrated the need of taking into account the viewpoint of the inhabitants. The role of participatory leverage is

crucial in the management of child spaces, but caution must be taken to avoid the dangers of overly narrow interests.

This study on urban play areas and children's safety has provided valuable insights, it is essential to acknowledge its limitations to guide future research. One limitation lies in the potential variations across different urban contexts, as the findings may not be universally applicable. Additionally, the study may not have accounted for specific cultural or socioeconomic factors that influence children's use of play areas. Furthermore, the focus on safety may have overshadowed other equally important aspects of children's well-being and development in urban environments. To address these limitations, future research could explore a more diverse range of urban settings and incorporate a cross-cultural perspective. Additionally, a comprehensive investigation into the multifaceted aspects of play, such as the impact on cognitive and social development, could provide a more holistic understanding. The integration of emerging technologies and smart urban design principles to enhance safety features in play areas also warrants exploration. Ultimately, future studies should aim for a more nuanced and inclusive approach to inform urban planning and design strategies that prioritize the well-being of children in diverse urban landscapes.

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