

Original Research Article

## Applying Gamification to Urban Spaces to Improve Autistic Children's Presence Tendency

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**Abstract** | Cities in today's world have failed to meet the needs of certain groups despite the progress and development in their various dimensions. One of these groups is children, especially those who have autism spectrum disorder. Cities should be planned and designed in such a way as to allow the presence of this group of people. This paper examines examples of gamification in urban environments from many places throughout the world. Also, it summarizes the relationship between autism, gamification, and urban spaces by examining several examples of autism and offers suggestions for gamifying urban spaces for autistic children. This qualitative research employed the descriptive-analytical method to investigate the desirability of using the urban gamification approach for autistic children's comfort and relaxation. For this purpose, the data were collected from samples applied and previously implemented cases on this issue. The results are offered as suggestions for the gamification of urban places that are appropriate for autistic children so that the process of playing in the city can be implemented for autistic children while taking psychological, mental, and physical issues into account.

**Keywords** | Urban space, Autism, Gamification, Game, Presence.

**Introduction** | Today, most of the cities in the world and the cities in Iran, while facing many problems and issues, have forgotten mainly to address the desirable and habitable city for groups with special physical and mental characteristics and clear discrimination can be seen in this regard. One of the reasons for this discrimination is the lack of a comprehensive and equal view in such areas. Cities are designed to be responsive to the needs of ordinary people but fail to meet the needs of certain groups of people (Basouli, 2020, 9). One of the special strata that suffer from mental health problems is children with an autism spectrum disorder. The most common challenge these children are faced with is their social characteristics. However, in addition to disabilities in social skills, autistic children also have retarded motor skills (MacDonald, Hatfield & Twardzik, 2017,

29). Autism, more simply 'Autism Spectrum Disorder (ASD)', is rooted in the Greek concept of 'living within oneself,' which the Greek psychiatrist Bleuer used in 1911 to describe such patients' behaviors as expressing isolationist and introverted tendencies in social settings. Autism in Persian is also known as 'autism.' These disorders often affect growing children and their symptoms vary, ranging from mild to severe (Mojahedi, Ghasemi Sichani, Forouzandeh & Bahramipour, 2014). Autism is considered to be a spectrum since its features and symptoms are very diverse and non-uniform. For example, cognitive and verbal disabilities are very acute in some of these patients; at the same time, others have a certain mental genius and are very talented (Jiujias, Kelley & Hall, 2017).

Regarding the severity of autism spectrum disorder, it can be said that it is generally divided into three categories: 1) the need for double support, 2) the need for relatively

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double support & 3) the need for support (American Psychiatric Association, 2013). As mentioned, sensory processing disorders are one of the most common symptoms among these children, including many problems in various areas of the child's life, such as daily activities, self-confidence, and social coping skills, and play (Cosbey, Johnston & Dunn, 2010). In addition, children with autism pay less attention to faces and have difficulty recognizing close and familiar people. These people have impaired facial processing, and the inability to recognize faces can be used as a key tool in recognizing these children (Science Daily, 2001). Autism affects one in every 42 boys and one in every 189 girls. In other words, boys have a four times higher prevalence of this disease than females (Christensen et al., 2018, 2). In the United States, the prevalence of ASD was 45 per 1,000 in 1990, 45 per 150 in 2007, 1 in 91 out of 91 in 2013, and 1 out of 50 in 2013 (Ghaffari, Mousavinejad, Riahi, Mousavinejad & Afsharmanesh, 2016). According to the statistics provided, the upward trend in the prevalence of this disorder in the coming years could become a matter of concern and naturally, in addition to their negative effects on the process of family life, they will also be deprived of presence in urban spaces and communities even if parents accompany them. The reason is that the physical and mental conditions of these children are not compatible with the environmental characteristics of cities.

Regardless of the different environmental needs of autistic children, the city, as an integral part of the environment around these children, must play its role in assisting them effectively; this has not been achieved even partially so far. Medical science has so far conducted extensive research into the treatment or at least rehabilitation of autistic children. However, research by psychologists has shown the great impact of 'playing' on the physical and mental abilities of any child, especially autistic children. Scientific research has revealed that games have significant effects on health and should be considered as one of the main pillars of health (Klasnja, Consolvo & Pratt, 2011). However, when playing games is withdrawn from its special environments such as game city, Luna Park, game center, etc. and it is performed in an environment that is not designed to play (such as different urban spaces), this is called gamification and its environment is called a gamified space (Marczewski, 2014; Huotari & Hamari, 2017; Koivisto & Hamaria).

Gamification is also known by translated terms such as gamification or "playfulness". However, due to the lack of research in this field in Iran, no more precise phrase or term can be found in the translations. Therefore, in the remainder of this study, it is preferred to use the word gamification.

What emerges from the principle and logic of gamification is that it is utilized in different economic areas (attracting regular customers, product sales), organizational (increasing work efficiency, timely attendance of employees), Instructional (memory enhancement, interest in lessons), entertainment (Increased vitality in society, mobility of children) and even military areas (simulation of war cases and flights). Moreover, the increasing growth of technology has complemented the development of this emerging phenomenon. The current study is an attempt to determine the relationship between these three components to provide solutions for usage in the city by examining instances of urban rehabilitation from various countries throughout the world and some cases of autism rehabilitation.

### Research questions

The questions that are raised from the mentioned topics are:

- What are the requirements and dimensions of the presence of autistic children in urban spaces?
- How can gamified urban spaces be used to improve the presence of children with autism?

### Review of literature

To date, various psychological, medical, and sociological studies have been conducted on autism. However, in the following section, references are made to environmental studies related to autism and rehabilitation. To better explain the issue, in general, three environmental components, including physical/morphological, functional/activity, and perceptual/mental, have been identified, which can include the whole subject of previous studies in this field:

The environment is the cause of children's social movements and behaviors. Encouraging autistic children to perform desirable movements and social functions with different tools and methods can pave the way for the social development of these children in urban environments. For instance, in their research examining children aged 4 to 10 years with autism and in two experimental and control groups, Kazemi Shishvan and Sharif Khajeh Pasha (2019) found that the following environmental factors can significantly reduce the severity of autism symptoms: the use of natural light, visual contact, listening to the space outside the house, having a view of nature through the window of the child's room, the positive effect of using the range of pink and purple colors, allocating enough space to engage in physical activity, encouraging the child to do their activities and homework in the natural and open as well as engaging in purposeful games in the natural and green environment outdoors, the presence of small

plants and shrubs in the yard and the possibility of the child interacting with them. Zarghami, Nasiri, Ajdehfar, & Ajdehfar (2013) studied the effect of architectural components on the physical and mental condition of autistic children in two phases. Finally, they developed a series of criteria in this regard (physical/ morphological). In a review study on virtual environments (Irish, 2013), discovered that creating a virtual environment with real-world characteristics can benefit instructing aides to children and adolescents with autism. He also realized that this isn't the only or greatest option, but it does have a beneficial impact. Zhao, Zhang, Wang and Yang (2021) examined the impact of virtual reality on cognitive exercises in children with autism using three checklists. The results demonstrated that autistic children, contrary to expectations, make effective use of virtual reality technology, which may enhance their behavior and simulate real-world urban environments (functional / activity). In a similar study, Fornasari et al. (2013) measured the presence of such children through testing. These children were in a virtual environment (using virtual reality technology), which was an adaptation of real urban environments through testing two groups of normal children with autism, and designing two stages of orientation and search. The results revealed in the first stage (orientation), autistic children were less inclined to roam the environment than normal children. But in the second stage, a significant difference was found between the two groups (functional / activity and perceptual/mental). Regarding the motor skills of this group of children, another study was conducted to tap into the relationship between gross motor skills and social behavior in children with autism spectrum disorders. The results showed that the better the motor skills performance of children is, the more likely the child will achieve social independence (Pan, Tsai & Chu, 2009, 1694). Regarding the relationship between sensory characteristics and the presence of this group of children in activities in different places such as the city, Dunn, Cox, Foster, Mische-Lawson, and Tanquary (2012) carried out a study which was concerned with paying attention to the sensory patterns of children with autism and making the necessary adjustments to the environment following their sensory patterns as one of the components of ten sessions of intervention. It was argued that paying attention to the patterns of sensory processing and relating it to the daily activities of life in the city, can boost the participation of children with autism (Perceptual / mental). Also, Sartipzadeh, Ghasemi Sichani and Mojahedi (2017) examined the architecture of Instructional spaces and autism in Isfahan. They concluded that Instructional spaces studied in Isfahan had achieved success in terms of Instructional methods

used in instructing children with autism. However, these spaces are not suitable for people with this type of disorder. Their findings indicated that none of the three autism centers in Isfahan were able to control separate light. Curved walls are not used in the layout of space in 100 percent of these centers. There is no room equal to 22.76 cubic meters per child (physical/morphological) in these institutes regarding privacy and personal space. What is certain is that the environment, in general, has a significant impact on autistic children's performance. For example, Rahimian, Amin Yazdi, and Adalatmanesh (2016) discovered that environmental enrichment therapy successfully alleviated symptoms for autistic children compared to numerous standard interventions for autism spectrum disorders.

Various games and software also have a significant impact on the memory of children with autism. For example, in a study aimed at determining the effectiveness of let's face it (LFI) Instructional software to improve facial recognition skills in people with autism, it was found that using this software can be effective in Instructional development and face recognition of patients with autism and contributing significantly to their improvement and treatment (Jafari, Najafi & Mohaki, 2015) (perceptual/ mental). Also, Pokémon Go's apparent success showed a wide community appeal that relies on urban space. Moreover, early evidence suggests that users of the game will become more active, at least in the short term (McCartney, 2016; Liu & Ligmann-Zielinska, 2017, 348). It should be noted that there is a lack of quantitative and qualitative studies of internal and external issues and the issue of gamification in urban spaces or gamification for autistic children. Consequently, more extensive studies have to be conducted. In this regard, Harris (2019) believes that public health programs, including game-based approaches that aim to promote public health, have attracted considerable attention. Individualistic, smartphone-based applications are the most frequent, and few studies of community-based interventions have been done. He assessed the impact of a community-based gamification intervention known as 'street beating' on levels of physical activity one and two years following the intervention (between 2014 and 2016). He found that this kind of intervention could encourage initial support. He noted that the game may be effective in reducing physical inactivity. He concluded that the game design mechanisms could encourage behavior change. Alsale and Alnanih (2020) adopted a therapeutic perspective and examined gamification and its effect on children with diabetes aged 6 to 12 years. The findings of this research might help designers understand how children can change their behavior and make the right decisions in life. In their study, the authors used a game-

based health program designed and built for this study to assess the behavioral changes of children with diabetes in their daily lives.

The previous study has revealed an absence of research that integrates all three aspects of autism, gamification, and the environment (especially the urban environment). Therefore, the present study seeks to establish a favorable link between these components to make cities a desirable place for autistic children.

## Theoretical foundation

### • Presence of autistic children in urban spaces

A new treatment for autism is environmental enrichment (EE) therapy or sensory enrichment, which is based on the findings of the use of environmental enrichment in animal models of autism spectrum disorders (Rahimian et al., 2016). Obviously, the city and its architecture have a significant impact in this respect. The city may be both healing and pathogenic, acting as two sides of the same coin. Therefore, it can be said that autistic children need to be twice as much in urban environments since, in addition to being merely present, it will also be instructive for them. In different countries of the world, significant progress has been made in designing and creating Instructional spaces suitable for children with autism spectrum disorders. Items such as acoustic state of space, light status, height proportions, control and security, texture and materials, colors, etc., should be designed following the needs of affected children (Sartipzadeh et al., 2017, 10). Research has shown that, in most cases, the functions of certain places, such as residential houses, are changed to use their free space for child care centers with autism spectrum disorders. Moreover, these centers are built by adding several partitions to the free space of the aforementioned places. Meanwhile, former studies have indicated that the environment has a significant impact on the therapeutic interventions of these children (Mojahedi et al. 2014, 35).

Today, research points to the important role of nature in-game space and the significant effect of nature on learning and creating a meaningful world for children (Sachs & Vincenta, 2011). Therefore, it is necessary to pay double attention to nature and soft elements in designing urban environments. The design of windows or high ceilings, which allow the use of daylight and natural light, promotes the physical health and ability of the child.

One of the characteristics of autistic children is that they develop visual disturbances faster than normal people. As the visual complexity of the environment increases, so does the purposeful search on autistic children (for example, to find the target element) decreases (Kawa

& Pisula, 2010). However, Fornasari et al. (2013) argue that children who wander around aimlessly and freely in urban environments are not sufficiently active. Rather, setting a goal for the child's environmental mobility can be an effective factor (perceptual/mental). In this regard, Beaver believes that curved walls assist some autistic children in finding their way into the building; since they tend to follow the curvature and avoid sharp corners (Beaver, 2006, 116). Curved walls also aid mobility and can benefit autistic children with visual processing disorders, particularly spatial processing. It is difficult for them to recognize the location of the place they are situated, which might serve as a guide (White & White, 1987, 1989). Some autistic children are terrified of large, open spaces and tend to retreat to smaller spaces. On the other hand, some may avoid small and cramped spaces. Providing a combination of large and small spaces can end children's anxiety (Mashhadi Fathali, 2016). On the other hand, personal and small spaces have benefits these children with disabilities can take advantage of to avoid activities that make them feel tired, uncomfortable, or crowded (Lowery, 1993). But there are also big gaps in terms of rules and regulations. There is currently no comprehensive document specifically addressing environmental and architectural conditions for people with autism and the few textbooks in this area generally refer to people with disabilities (Zarghami et al., 2013). Instructing dynamics, interaction, speech, behavior, and even how to deal with obstacles like crossing the street, meeting strangers, hissing noises, physical collisions, mental disturbances of street walls and building architecture, and the like, are all dual interpretations of opportunity, threat, and reward in a city evokes a game in our minds more than anything else but a game in the dimensions and context of a city. Table 1 summarizes the theoretical summary of the relationship between the environment and autism.

In Table 2 are some examples of how to employ gamification with autistic children.

### - Application of gamification in urban spaces

Today, our realities and lives are increasingly similar to games, not just because games have become a large part of our lives but also because activities, systems, and services are becoming increasingly gamified (Koivisto & Hamaria, 2019). Meanwhile, as one of the most important biological human phenomena, the city has been inspired by the effects of the game world and, at the same time, has had a significant impact on shaping its structure. In the city, we may not feel these gamified principles and regulations immediately and objectively. However, we unconsciously meet many of these principles throughout the day, and they substantially influence our judgments. One such technique is "gamification,"



Table 1. Theoretical summary of the relationship between environment and autism. Source: Authors.

No	Criterion	Index	References
1	Physical/Morphological	<ul style="list-style-type: none"> <li>- Having a view of nature through the window of the child's room</li> <li>- The effect of dimensions and size of architectural and urban environments considering autistic child's mental conditions</li> <li>- Acoustics of space, light condition, elevation proportions, control and security, texture and materials, color, and.....</li> <li>- Use of natural light</li> <li>- Having visual and auditory communication with outdoors</li> <li>- The use of curved walls, which facilitates movement, and for those autistic children who are impaired by spatial processing.</li> </ul>	(Kazemi Shishavan & Sharif Khajehpash, 2019, 153; Sartipzadeh et al., 2017; Zarghami, et al., 2013, 189; White & White, 1987, 89; Zarghami, et al., 2013, 191)
2	Perceptual/Mental	<ul style="list-style-type: none"> <li>- Difficulty in knowing the spatial location</li> <li>- Positive effect of using pink and purple color spectrum</li> <li>- Measuring the presence of these children in a virtual environment (through virtual reality technology) with the aim of orientation and search in real urban environments</li> <li>- Paying attention to sensory processing patterns and its relationship with daily activities of city life and its effect on the participation of children with autism</li> <li>- A combination of large and small spaces due to autistic children 's fear from large spaces, while avoiding small and cramped spaces</li> </ul>	Kazemi Shishavan & Sharif Khajehpasha, 2019, 153; Jafari, Najafi, Mohki, 2015; Fornasari, et al., 2013, 956; Dunn, et al., 2012; Heschong, 1999, 59; White & White, 1987, 89; Lowry, 1993, 132)
3	Active / Functional	<ul style="list-style-type: none"> <li>- Allocating enough space to engage in physical activity</li> <li>- Encouraging children to do their activities and homework in a natural and open environment</li> <li>- Playing targeted games in the natural and green environment outdoors</li> <li>- Direct relationship between child's motor functions and behavioral independence in urban environments</li> <li>- Performance improvements through a combination of large and small adjacent spaces</li> </ul>	(Kazemi Shishavan & Sharif Khajehpasha, 2019, 153; Zhao Zhang et al., 2021, 1; Fornasari, et al., 2013, 956; Irish, 2013, A24; Pan, Tsai & Chu, 2009; Ghasemi Sichani, 2013; Lowry, 1993, 132)



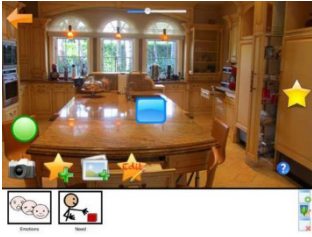
which is the method used in this research. Introducing the process of engagement and enjoyment of the game-like process into activities beyond the framework of the game is gamification' according to the definition of gamification". In other words, a design approach is to use game elements in different types of systems and services based on providing gaming experiences (Huotari & Hamari, 2017). Another definition is "the use of game design patterns and its psychology in non-game settings and coordinates, to engage the target audience and create mobility in their specific behaviors" (Marczewski, 2014). Game development is concerned with the design of information systems to gain experiences and motivations similar to those found in games and therefore refer to efforts to influence user behavior. In recent years, the popularity of gamification has been evident in the growing number of game applications as well as the many studies that have been done (Koivisto & Hamaria, 2019).

Gamification refers to the use of game mechanics (e.g., goal achievement, scoring, progressing in the game, and performing a task) to interact and motivate people to achieve an ultimate goal (Harris, 2019, 37). But it should

be noted that gamification is not just about points and symbols. Instead, today various organizations and companies utilize it to achieve their business goals (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). The 'buy one, get two tigers' plan, or things like presenting a gold card to select customers, are instances we see in the market every day because of their competitive capacities., scoring and other activities are portrayed as gamification. This phenomenon is still in its early stages, but it is proliferating. But what is known about this phenomenon is the fact that finding and expanding its branches with the help of its fragmented parts enable us to examine it from a different perspective (Koivisto & Hamaria, 2019).

According to the above definitions and explanations, playful patterns, or gamification, can be implemented in different urban environments. In fact, in general, gamification has a wide application in human life. Gamification can improve the process of a business (Shi et al., 2017; Yilmaz, O'Connor & Clarke, 2016). It can also be used in the field of education (Lee & Hammer, 2011). As a result, restoration can be said to be a useful and low-cost solution to tackle many

Table 2. Global examples of gamification in Autism. Source: Authors.

No	Examples	Image	Description
1	Minecraft School		<p>The Minecraft game confirms that in the contemporary world and with technological advances, there are still demands for games with less sophisticated graphics and square-shaped blocks.</p> <p>Minecraft, which has been released for a few years, remains one of the world's best-selling video games.</p> <p>Now, the Tohum Autism Foundation in Turkey has built a virtual school inside the Minecraft game.</p> <p>In this way, children who suffer from autism and, according to research, only 2% of them can go to school (Davidson, 2021), by bringing the school into the game, they try to kill two birds with a stone.</p> <p>They both provide education for these people and provide a fun, entertaining, and healthy video game for autistic children (Tohum Otizm Vakfi, n.d.)</p>
2	Autcraft Game		<p>Another successful example of Minecraft is Autcraft game, which is made from the combination of the words Autism and Minecraft.</p> <p>The creator of this game has created a world that fits the moods and characteristics of autistic children in the Minecraft game. For example, instead of attacking and killing spiders, the user, earns titles such as "bravest" or "kindest" and eventually earns the golden sword by helping others. The interesting thing about this game is that its creator, himself and his child, both suffer from autism! Therefore, the qualities and patterns presented in this game can best match the characteristics of autistic children.</p> <p>But the point is, at first glance, this is just a game, and it's not considered gamification. Additionally, because the context and purpose of this work are to establish a connection between autistic children and help them grow and develop in the first place, and then entertainment; Therefore, it can be considered as a criterion for gamification (Davidson, 2021).</p>
3	Autismate Program		<p>One of the simplest examples of autism that comes with rewards is Autismate software that is available for mobile phones. The program provides a series of tasks for the autistic person defined by the parent. The autistic child successfully passes stages after performing defined tasks and receiving a reward (Moore, 2012).</p>

urban problems, from large-scale planning to building architecture. Gamification and modeling games have many applications in health and should be considered part of the basic elements in this field (Klasnja, Consolvo & Pratt, 2011). The above-mentioned four components can be used for the gamification of the environment. Three criteria may be identified based on Table 3 and the theoretical underpinnings presented in the realm of gamification: Instructional, dynamism/liveliness, and gamification awareness. The importance of instruction in all games and gamification is considered to be undeniable (see Table 2). The instances in Table 2 are excellent illustrations of this. There are also some other examples of the game application, which seek to create dynamism and liveliness in urban environments through the game's rules. Others have emerged to educate people and encourage them to do or not to do something in the


environment. Table 3 provides real and international examples of these criteria.

In addition to the above, the popular Pokemon Go game, which is an augmented reality urban game, may be added to the list. However, because our country lacks gaming users' essential infrastructure and capacity, it is not addressed.

## Methodology

In the initial stage, the current study attempted to investigate the concepts connected to autism spectrum disorder. Then, it aimed to tap into the function of the environment in general, and urban design in particular, in improving this group of children's performance in activities. To this end, the indicators that explained the association between urban design and autistic disorder were offered by assessing and explaining the relevant

Table 3. Global examples of successful urban development of gamification in the city. Source: Authors.

No	Examples	Image	Description	Compliance with gamification criteria
1	Piano Stairs in Stockholm		To reduce the density of using escalators in the metro station in Stockholm, Sweden, they have taken advantage of the idea of converting stairs to piano stairs. Research in this area indicated that more than 66% of people preferred to use these stairs instead of escalators.	Awareness-raising
2	Musical swing in Montreal		In downtown Montreal, Canada, an idea similar to piano stairs has been used to promote public spaces. In this way, one of the musical notes is played each time you swing, and when a set of people use these twists as a group, it leads to the creation of a piece of music (TwistedSifter, 2012).	Dynamism/Vitality
3	Optical Piano in Iceland		In Reykjavik, the capital of Iceland, the urban space is gamified on a building facade, with creative lighting connected to a piano by a sensor. Thus, when a citizen presses the piano keys, a red, green, or blue line of light appears on the façade of the Harpa Music Hall for a few seconds. This action is also accompanied by the sound of piano music, which attracts the attention of other passers-by and can ultimately lead to vitality in the urban space (Ainley, 2016).	Dynamism/Vitality
4	Snake Game in London		The fountains of London's Granary Square have become the bedrock of the snake's memorable game. The audience can determine the direction of the snake's movement, which is the water fountains, by installing the relevant software on their mobile phone and turning the phone around at different angles. The game is also accompanied by colored light at night (Bishop, 2015).	Dynamism/Vitality
5	A survey on cigar trash in the UK		Another entertaining as well as encouraging element of people and passers-by (both of whom are key components of gamification) is the use of cigarette butts counters to conduct citizen surveys. The mechanism of this cigarette waste bin is such that a two-choice question is asked on the counter and passers-by drop their cigarette butts in these counters to determine the vote for each option! A special advantage of this practice is in the survey of people in different neighborhoods of a city in relation to urban planning decisions and actions of local municipalities. This in turn can be a factor in making the right decisions for the urban management system (Ballotbin, n.d.).	Awareness-raising

Rest of Table 3.

No	Examples	Image	Description	Compliance with gamification criteria
6	Dancing traffic lights in Lisbon		In the capital of Portugal, they used the trick of red light dancing to persuade citizens to stand behind traffic lights. In this way, people voluntarily enter a chamber where the physical movement of their body can be seen on the traffic light when they move their hands at the same time. People behind the lights see these red lights dancing, which ultimately leads more than 81% of people to voluntarily stand behind the red lights (Newatlas, 2014).	Awareness-raising
7	Playing behind traffic lights in Germany		In the town of Hildesheim, northern Germany, they have somehow tried to persuade citizens to stand behind traffic lights by installing a device to play with people standing on different sides of the street. This is an obvious example of the presence of games in urban spaces, which is gamification (Boer, 2014; Eckardt, 2014).	Awareness-raising

studies which were conducted based on the perceptual, physical, and functional criteria.

The study utilized gamification as a beneficial element in enhancing the physical, mental, and psychological performance of autistic children. Moreover, it aimed to extract criteria and indicators connected to this field by detecting successful worldwide instances of gamification in urban contexts. Documentary studies were used to collect the data. In other words, 'the presence of autistic children in urban spaces' and gamified urban spaces' constituted the theoretical framework of the present study. However, there has not been extensive research on the multifaceted relationship between autism, recreation, and the city. Available research has either indicated the role of gamification in the physical and mental condition of autistic children. Nonetheless, the relevant studies have not focused on the conditions of urban environments. Moreover, they have not separately examined the gamification conditions in cities. Finally, these studies have not investigated the presence of autistic children in urban and architectural spaces. Therefore, this study attempted to simultaneously explain and refine these concepts by establishing connections between the city, autism, and gamification in urban spaces. Finally, it provided a set of solutions to the aforementioned problems by explaining the relationship between gamification and environmental characteristics of autistic children. It offered these solutions to deal with the relevant problems in urban spaces of the country.

## Results

As discussed in the theoretical framework section,

autistic children have different physical, mental, and psychological conditions for living. Living in a city that is tied to a variety of social activities makes it even more difficult to make a constructive presence of this group of children. These children do not even have the right to be with their parents in most cities nowadays. Gamification may help improve the presence of children with autism in the city and pave the path for their social activities if proper precautions are taken. According to the principles and background related to gamification, as well as the study of global examples (see Table 3), playmaking is divided into three sections from the perspective of purpose, in addition to entertainment, which is a single principle in all of its components: education, dynamism, and liveliness. The study revealed certain characteristics of the interaction between gamification in urban areas and environmental design criteria for autistic children. This connection is formed as shown in Fig. 1.

Fig. 1 shows how instructional game-based activities are linked to the perceptual and functional criteria of environmental features for autism; since it aims to teach specific autistic children about their environment's perception or activities. As a result, autistic children's perceptual and functional qualities can be enhanced by playing instructional games. Furthermore, there is a two-way interaction between gamification, which attempts to improve the environment's dynamism and liveliness, and the performance of an autistic child. In fact, the child has a lot of freedom and flexibility when it comes to movement and activity in situations that have grown more dynamic due to gamification. The



environment's physical and structural aspects provide challenges and limits for autistic children. However, gamification, with its power of awareness, may be useful in determining the best course of action in the face of a variety of physical obstacles (for example, piano stairs, where topographic conditions and high height differences, led most people to use escalators, but due to gamification and reuse of normal stairs, the population density was reduced. Finally, to provide appropriate solutions, following the framework created in Fig. 1, a matrix including brief suggestions is presented in Table 4 to improve the quality of cities for the use and optimal presence of autistic children.

## Conclusions

The city can have a dual function regarding the issues and needs of children with autism spectrum disorders. On the one hand, it can be a factor in the physical and mental development and strengthening of these children. On the other hand, it can keep them in deplorable and isolated conditions more than before. The findings of the present study showed that considerable and tremendous efforts are needed to improve autistic children's play conditions. Furthermore, based on the results, the different buildings in urban surroundings, which are related to the above-mentioned play conditions, have to be renovated to increase the autistic children's presence in these places without affecting regular city users. Autistic children may not adjust to any physical or mental condition due to their unique circumstances. The study began with an explanation of the theoretical foundations and literature review in the fields of autism and urban and landscape design, as well as criteria and indicators from three categories: physical, functional, and perceptual, which account for the

majority of autism and urban design studies. After that, criteria and indicators, including three key criteria of education, awareness, dynamism, and liveliness, were extracted by examining successful global examples of gamification implemented in urban environments. It should be noted that entertainment was a universal standard among all. However, because every game and game development must have this feature, and without it, one of the key foundations of the game's concepts vanishes, it was not included among the environmental criteria. Finally, the relationship between environmental gamification criteria and autism-related environmental circumstances was explored, and ideas for using gamification in urban places were presented to improve the presence of children with autism. The lack of explicit criteria in the above-mentioned urban planning rules on how to deal with autistic children makes the current research essential in the Iranian city. No standard addresses the characteristics and barriers to the presence of autistic people in urban environments, even though accommodations have been established for the disabled and the blind. The need for urban spaces' inclusiveness increases the importance of paying attention to incentive strategies such as gamification. The answers offered in this study may involve Iranian-Islamic cultural settings due to the lack of substantial physiological variations and diseases in these children. However, future studies can use the case study design and may examine the usefulness of this design to collect data on certain substrates. Moreover, they can make an effort to discuss their findings in more detail. Furthermore, the current study can serve as a foundation for future research, allowing researchers to increase the effectiveness of playfulness in the presence of children by undertaking limited research in this area.

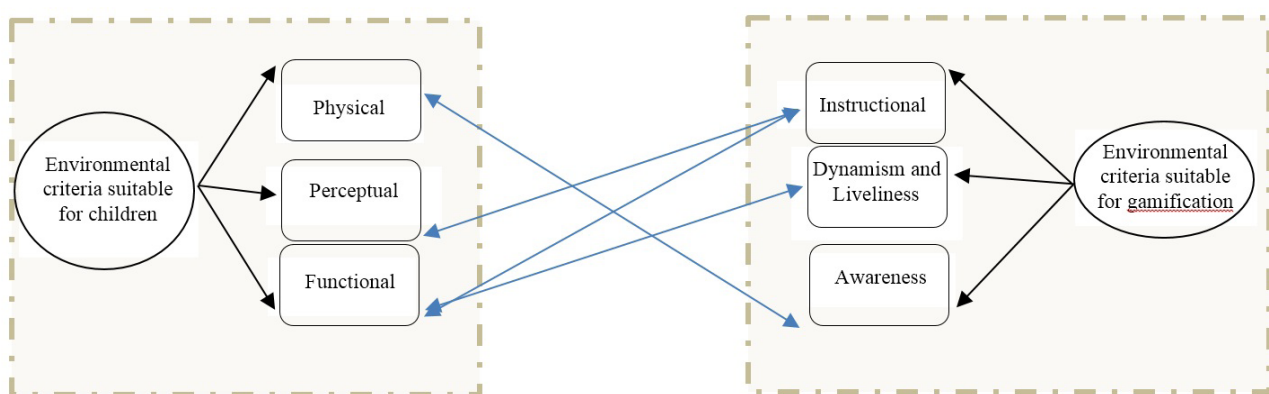


Fig. 1. Relationship between environmental playfulness criteria and appropriate environmental criteria for children with autism. Source: Authors.

Table 4. Offering suggestions in the form of different environmental. Source: Authors.

Environmental Criteria of Autism				
Gamification environmental criteria		Physical	Functional	Perceptual
		<ul style="list-style-type: none"> <li>- Obstacles and stages of the game should be selected using soft and light parts that are not physically and mentally vulnerable to the child.</li> <li>- Encourage the child to build a house using recycled and reusable materials during play</li> <li>- Some of the structural elements of the walls can be separated or changed so that, like a jigsaw puzzle, the child can get acquainted with the principles of construction and architecture by putting these elements together.</li> </ul>	<ul style="list-style-type: none"> <li>- Encourage daily environmental behavior for autistic children.</li> <li>- Pay attention to incompatible uses adjacent to the educational spaces of these children.</li> </ul>	<ul style="list-style-type: none"> <li>- Play tools should be free of any complexity or difficulty so that the autistic child does not feel unable to solve them.</li> <li>- The necessary education should be considered according to the conditions of these children.</li> <li>- For a better understanding, the step-by-step game stages from basic to advanced should be generally designed to be very simple.</li> </ul>
		<ul style="list-style-type: none"> <li>- Pay attention to topographical conditions and reduce the number of stairs as much as possible in the game design environment.</li> <li>- Provide a space for parental presence and supervision outside the playground.</li> </ul>	<ul style="list-style-type: none"> <li>- Running the game in the environment does not disrupt other people's traffic. Inform the social norms and behaviors of the community during the gamification process.</li> </ul>	<ul style="list-style-type: none"> <li>- Improve the child's recall by making the play environment legible.</li> <li>- Use quiet ambient music and sounds to be aware of choosing the right path.</li> </ul>
		<ul style="list-style-type: none"> <li>- Turn the walls into a play screen by lighting various and cheerful colors in the view of the buildings.</li> <li>- The design ground should be as smooth as possible without slopes to cause the effective presence of the child in that space.</li> </ul>	<ul style="list-style-type: none"> <li>- The stages of the game should be designed at intervals that make people move as much as possible.</li> <li>- Games should be designed as a combination of individual and group so that the autistic child learns to interact with other children while being independent of individual action.</li> </ul>	<ul style="list-style-type: none"> <li>- Use natural elements (water, soil, ambient noise, etc.) in the design of the game stages.</li> <li>- The game focuses more on the cooperation of autistic children in urban settings in achieving rewards than the competition between them. Because competition causes stress and anger in children.</li> </ul>

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