Patterns of Interactions of the Complex City System: Emotional Urban Objects as Triggering Agents – A Secondary Publication

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Abstract: This article presents an analysis of the patterns of interactions resulting from the positive and negative emotional events that occur in cities, considering them as complex systems. It explores, from the imaginaries, how certain urban objects can act as emotional agents and how these events affect the urban system as a whole. An adaptive complex systems perspective is used to analyze these patterns. The results show patterns in the processes and dynamics that occur in cities based on the objects that affect the emotions of the people who live there. These patterns depend on the characteristics of the emotional charge of urban objects, but they can be generalized in the following process: (1) immediate reaction by some individuals; (2) emotions are generated at the individual level which begins to generalize, permuting to a collective emotion; (3) a process of reflection is detonated in some individuals from the reading of collective emotions; (4) integration/significance in the community both at the individual and collective level, on the concepts, roles and/or functions that give rise to the process in the system. Therefore, it is clear that emotions play a significant role in the development of cities and these aspects should be considered in the design strategies of all kinds of projects for the city. Future extensions of this work could include a deeper analysis of specific emotional events in urban environments, as well as possible implications for urban policy and decision making.

Keywords: Emotional events; Urban objects; Complex adaptive systems; Adaptive complex systems; City

1. Introduction

Cities can be described as dynamic systems made up of multiple agents and entities of different natures that constantly interact with each other, originating phenomena such as identities, imaginaries, or behaviors at global and collective scales. These notions underpin the approach of cities as complex systems [1-3], that is, dynamic systems that behave in a nonlinear way, where small perturbations can have large effects on the structure and function of the city. This approach is useful because it establishes that interactions, initial conditions, and time are variables that influence and explain the processes that give rise to various observable phenomena in cities, such as the emergence of behavioral patterns, the growth of urban areas, public health problems, and traffic flow.

In an urban adaptive complex system, urban objects can be conceptualized as physical or non-physical elements that are part of the system and interact with other components of the system to influence its behavior and adaptation [3,4]. They have a systemic function, either individually or as a conceptual whole (for example, cars in the city). Urban objects can include buildings, streets, squares, parks, transportation systems, communication networks, information systems, and digital services among others [4,5]. Therefore, the concept of an object is not only limited to the physical but also carries over to the intangible.

Urban objects can influence the emotions and behaviors of the people who interact with them. For example, a well-designed public transport app can facilitate mobility and reduce stress for people using the system, while an inaccurate or confusing information system can generate confusion and frustration in users [4]. The emotions of individuals interacting with urban objects can affect their behavior and decision-making within the system. If a person feels comfortable and safe in a public space, they are more likely to spend time there and interact with other users of the space [6]. Therefore, emotional urban objects can be defined as observable entities in the urban environment that generate a significant emotional response in the people who perceive or interact with them. Emotional urban objects can involve in their nature material, immaterial elements, eventualities, activities, and/or actions.

The importance of the topic lies in the fact that, at present, there is a growing concern among architects, urban planners, and designers about the role of social emotions in the configuration of urban environments [7]. Social emotions refer to feelings and attitudes that arise from social interactions, such as empathy, trust, and a sense of belonging [8]. When speaking of social emotions, we can identify them with collective emotions, as the concept points to an emotional state shared by a multiplicity of individuals in response to a common event, situation, or stimulus. Although urban planning and design often focus on functionality and efficiency, it is important to consider the impact of these factors on the social well-being and emotional experiences of city dwellers. Understanding the interconnections between urban objects and emotions can be important for designing more adaptive and sustainable urban systems [4].

The problem posed is that the omission of social emotions in urban planning and design can lead to a lack of social cohesion, a sense of isolation, and a reduced quality of life for city residents [9]. The central question of this article is as follows: "Are there patterns of coincidence in different emotionally charged objects or events within the urban system?" The purpose of this article is to explore the importance of emotions in the complex urban adaptive system by analyzing patterns in emotionally charged events, both positive and negative. In addition, recommendations for future research and practice in this area will be proposed.

2. Methods

In this study, qualitative research was performed based on observation and case analysis of urban emotional objects. The selection of the cases was done in a non-probabilistic way, using a purposive sampling of objects and events of high emotional charge in different cities.

The study population was the communities related to a sample of urban objects and 7 events of high emotional charge in different cities of the world, selected through purposive sampling. Cases were chosen on the basis of representing a diversity of urban and cultural contexts. The cases were selected based on the available information and accessibility to the places where the objects or events were located.

The study was carried out in different cities on different continents. The selected locations included public spaces, emblematic buildings, social and cultural events, and transportation systems. The locations were selected based on the presence of emotionally charged objects or events and their cultural or social relevance. These events included situations of social participation, art, symbolic objects, political situations, and even religious beliefs.

Table 1. List of selected cases of emotional urban objects for the analysis of the study

Emotional urban object	Location	Type of object	Meaning/background
Auschwitz Museum	Krakow, Poland	Historical	A memorial to the Holocaust victims during World War II.
Feminist protests at the Angel of Independence monument	Mexico City, Mexico	Historical	A commemoration of the beginning of the struggle for Mexico's independence in 1810.
Construction of the Macroplaza	Monterrey, Nuevo Leon, Mexico	Public plaza	A center for cultural and recreational activities in the city center of Monterrey, Nuevo León, Mexico.
Christ the Redeemer statue	Rio de Janeiro, Brazil	Religious Monument	It represents the faith and devotion towards the Catholic religion.
Fall of the Berlin Wall	Berlin, Germany	Historic	A symbol of the Cold War and the division between East and West Berlin.
The revolutionary painting *of Emiliano Zapata in Heels*	Mexico City, Mexico	Plastic art	Social criticism on the iconic character of the Mexican Revolution and gender roles.
Loma Larga Mural	San Pedro Garza Garcia, Nuevo Leon, Mexico	Urban art	It expresses the cultural identity and local history of the community.

Data was collected through observation and analysis of secondary sources, such as media and social media posts. The data recorded included the characteristics of the objects or events, their design, the social imaginaries surrounding them, functionality, interaction with the environment, and the emotional response of the people who interacted with them. Qualitative analytical tools were used to classify the data and establish patterns of coincidence in the different objects and events with high emotional charge. The emotional events were analyzed through focus groups, made up of citizens residing in northeastern Mexico, between 18 and 22 years of age, who were trained in emotional design studies. Each emotional event was analyzed in four steps. The steps followed in the analysis of each emotional event are as follows: (1) The origin of the emotional event was discussed and analyzed, identifying what triggered the emotions in people and how this affected their perception of the situation. (2) The actors involved in the event were identified, including both individuals and moral entities, and the role they played in the situation was analyzed. The ways in which an emotional event permeated other interactions and contexts were explored, generating new emotional responses and actions by the actors involved. (6) The timing and reasons for the dilution or alteration of the emotional event were determined, and the duration and evolution of the event and how this was reflected in the actors' responses and the environment were also analyzed. Qualitative content analysis was used to examine the data collected and establish emerging patterns and categories. Thematic and open-coding analyses were conducted to identify patterns and themes in the data collected.

3. Results

The results of the research indicate that emotional events can be triggered by different factors, such as visiting a historically significant place or analyzing a work of art that leaves an emotional impact on the viewer. The actors involved in these events may include both individuals and moral entities, such as institutions or social movements.

It was found that emotional events can have a significant impact on the perception and behavior of the actors involved at the individual level. Moreover, these events can extend beyond the time and place in which they occurred, transforming into collective emotions. For example, the emotion generated by a visit to a historical site can influence the way visitors interact with the world and can lead to new emotional responses and actions by the actors involved. From this, the observable factors of emotional urban objects were categorized,

i.e. the elements involved in the phenomenon: triggering event (emotional event, intervening actors, processes [consequent dynamic actions], interactions and emergent phenomena, and finally the adaptive logic of emotions [the transformation or non-transformation of meanings], or the dilution/duration of the emotional event).

The following is a summary of the analysis of each emotional object, which describes the factors according to the nature, condition, and information they generate (**Tables 1–8**).

3.1. Auschwitz Museum, Krakow, Poland

The origin of the emotional event at the Auschwitz Museum was the publication of images of visitors performing actions that were disrespectful toward the Holocaust victims. Social media also played an important role in spreading the emotional event.

The actors involved in the event were the visitors of the Auschwitz Museum and society in general, who expressed their opinions and feelings towards the event. The visitors in this case offended the victims of the Holocaust and the museum, while the society expressed its indignation and support for the museum.

The emotional event sparked a huge controversy, which led to a wider dissemination of the story behind the museum and an increase in the number of visits to the site. In addition, the event led to new emotional responses and actions by the actors, as the museum took steps to prevent the recurrence of such actions.

The impact of the emotional event diluted over time and with the action taken by the museum to avoid this type of event from happening again. Despite that, the museum will continue to be a place that will resonate with people due to its historical significance.

The origin of the emotional event was found to be related to the presence of stimuli that are historically or culturally significant. These stimuli can be places, objects, or symbols, among others. The analysis of the role of the actors involved in the emotional event allowed us to identify that the perception and reaction of individuals are influenced by their cultural background, previous experiences, and belief systems.

Table 2. Observable factors of the urban emotional object: Auschwitz Museum, Krakow, Poland

Factors	
Emotional event	Posting selfies and frivolous actions at the Auschwitz Museum.
Actors	Museum visitors, society
Processes	Using social media and visiting the museum
Interactions triggered	Opinions and feelings of the society, debates on social media, visits to the museum
Emerging phenomena	Increase in museum visits, change in visitors' attitudes
Adaptive logic of emotions	Emotions will always be triggered when visiting a place with a painful and significant history like the Auschwitz Museum.

3.2. Feminist protests at the Angel of Independence monument, Mexico City, Mexico

The actors involved were women who came together to fight against gender violence and the collectives that have supported them. In this case, the report of alleged rape by Mexico City police officers and the lack of action by the Secretariat of Citizen Security (SSC) served as a trigger for the emotional event.

The processes that took place included the protest at the Independence Monument, the graffiti on the monument, and the subsequent marches. Women played the leading role in the protest and in spreading awareness of gender violence and the need for radical measures.

The interactions and emerging phenomena of this case include a greater number of women joining the movement each year, the increasing attention of the authorities on the parades, and the police groups that have

stormed the demonstrations. In addition, the emotional event has led to greater public awareness of gender-based violence and has encouraged many women to fight for their rights.

This emotional event has not been diluted over the years, and the fight against gender violence persists, with the Independence Monument retaining its symbolic significance as a site for advocating against this issue. In this case, women have decided to continue fighting until they are heard and there is a change in the country.

Table 3. Observable factors of the urban emotional object: Feminist protests at the Angel of Independence monument, Mexico City, Mexico

Factors	
Actors	Women and groups fighting against gender-based violence.
Role of the actors	Protest at the Independence Monument, graffiti on the monument, and parades.
Interactions triggered	Increase in women joining each year, accompanied by increased attention from authorities during the marches, and instances of police groups forcibly entering demonstrations.
Emerging phenomena	Increased public awareness of gender violence and women's rights.
Duration of the emotional event	The event has not fizzled out and the fight against gender-based violence goes on.

3.3. Construction of the Macroplaza, Monterrey, N.L., Mexico

This is an example of analysis where the actors involved are the government headed by the governor, those affected (homeowners and business owners), and public opinion. The emotional trigger was the demolition of historic buildings and homes for the construction of the Macroplaza.

The processes that took place included the construction of the Macroplaza, the protest of those affected and the general public, and the constant adaptation of citizens to the new reality. The interactions and emergent phenomena of this SCA include the creation of a culture and heritage in Nuevo León through important events in the city and monuments, fountains, and green areas that have helped to recover and compensate for the territory and the environmental and socioeconomic impact of its decade. The adaptive logic of emotions in this case was the constant adaptation of citizens to the new reality, accepting the progress and growth of the state through works such as the Macroplaza while preserving the culture and heritage of the region. The emotional event was diluted through this constant adaptation and the acceptance of the citizens.

Table 4. Observable factors of the urban emotional object: Construction of the Macroplaza, Monterrey, N.L., Mexico

Factors	
Origin of the emotional event	Demolition of historic buildings and homes for the construction of the Macroplaza.
Actors	The government, the affected parties (homeowners and business owners), and public opinion.
Role of the actors	The construction of the Macroplaza, protest by those affected and the general public, and constant adaptation of citizens to the new reality.
Interactions triggered	There were arguments between those who supported the construction of the statue and those who opposed it.
Emerging phenomena	The creation of a culture and heritage in Nuevo León through significant events in the city, monuments, fountains, and green areas have helped recover and offset the territory and the environmental and socio-economic impact of its decade.
Adaptive logic of emotions	Constant adaptation of citizens to the new reality, accepting the progress and growth of the state through works such as the macroplaza, while preserving the culture and heritage of the region.
Dilution of the emotional event	The event was diluted through the constant adaptation of the citizens to the new reality and the acceptance of the progress and growth of the state through works such as the Macroplaza. There is no exact date since it was a matter of constant adaptation of the citizens of the region.

3.4. Construction of a religious statue (Christ the Redeemer), Rio de Janeiro, Brazil.

This example of analysis where the emotional trigger was the construction of a religious statue, which caused controversy and protests in the communities of the region. The actors involved were the communities of the region and the committee for the construction of the statue. The protests and controversies permeated at the legal and social levels.

The processes that took place included the construction of the statue, the protests of the communities, the legal defense by the Attorney General of the Republic, and the adaptation of the committee for the construction of the statue to the criticism received. The interactions and emergent phenomena of this SCA include the legal defense and social criticism surrounding the statue, and its subsequent acceptance once completed. The adaptive logic of emotions in this case was the adaptation of the committee for the construction of the statue to the criticism received, which led to changes in the design of the statue. The emotional event was diluted once the communities in the region saw the beauty of the end product and the message it conveyed.

Table 5. Observable factors of the urban emotional object: Construction of a religious statue (Christ the Redeemer), Rio de Janeiro, Brazil

Factors	
Origin of the emotional event	The construction of a religious statue (Christ the Redeemer) in the region caused controversy and protests.
Actors	The communities of the region were the main actors and opposed the construction of the statue.
Role of the actors	There was controversy over the construction of the statue, including its legality and the form it would take.
Interactions triggered	There were arguments between those who supported the construction of the statue and those who opposed it.
Emerging phenomena	The construction of the statue had a significant religious and cultural message, so it was eventually accepted.
Adaptive logic of emotions	The stakeholders adapted to the situation and accepted the statue once it was built.
Dilution of the emotional event	The emotional event faded when the community saw the beauty and significance of the end product.

3.5. Fall of the Berlin Wall, Germany

The example of the fall of the Berlin Wall can be taken into account in this analysis because it involves multiple interrelated actors, processes, and emerging phenomena. The main actors in this event include German citizens, the East German government, the West German government, and international governments. Processes that contributed to the fall of the wall include popular pressure, the political opening of the East German government, the elimination of political repression by the Soviet Union, free elections in Poland, and the opening of borders in Hungary.

The interactions that resulted from the fall of the wall were extensive and varied, including the unification of the Germanys and the dissolution of the Soviet Union, which ushered in a new world order. In addition, the event also permeated popular culture, international politics, and socio-spatial dynamics in Germany, as there are still noticeable differences in the German territory. As for the dilution of the emotional event, it is difficult to establish a specific time, as the fall of the wall had a lasting impact on global history and culture. However, it can be said that the initial shock of impact from the fall of the wall gradually diminished as people began to face the challenges of the reunification of the two Germanys and the socio-economic differences that persisted.

Table 6. Observable factors of the urban emotional object: Fall of the Berlin Wall, Germany

Factors	
Origin of the emotional event	The fall of the Berlin Wall and the series of political events that preceded it.
Actors	German citizens, the East German government, the West German government, and international governments.
Role of the actors	Governments made political decisions, while citizens protested and demanded their rights.
Interactions triggered	The unification of the two Germanys, the end of the Cold War, and the fall of socialism in Eastern Europe.
Emerging phenomena	A new world order, the dissolution of the Soviet Union, the preservation of parts of the wall as a historical symbol, and the persistence of the socio-spatial division in Germany.
Adaptive logic of emotions	The event unfolded over several decades, but the fall of the wall itself occurred in November 1989.
Dilution of the emotional event	The event has lost some of its emotional impact over time, but it remains a significant historical milestone in modern German and world history.

3.6. The revolutionary painting *Emiliano Zapata in Heels*

The event analyzed involves different actors, such as the museum, the LGBTQ+ community, the descendants of Emiliano Zapata, the president of Mexico, the author of the painting, and Mexican society. The exhibition of the painting generated an emotional reaction in Mexican society due to the distortion of the image of a national hero and the prejudice towards the LGBTQ+ community. The interactions between the actors were diverse and complex, including protests and artistic manifestations on social media. This event resulted in the questioning of toxic masculinity and the reconsideration of history and its heroes, in addition to the growth in popularity of the artist. The emotional event lasted approximately two weeks and its relevance diminished over time, but the reflections and questions generated continue to be present in Mexican society.

Table 7. Observable factors of the urban emotional object: Painting "The Revolution" by Emiliano Zapata with heels

Factors	
Origin of the emotional event	Exhibition of a painting depicting Emiliano Zapata with female features.
Actors	The museum, the LGBTQ+ community, the descendants and followers of Emiliano Zapata's ideals, the Mexican president, Fabián Cháirez (the author), social media, and Mexican society.
Role of the actors	Each actor reacted emotionally to the exhibition of the painting, generating diverse responses and protests
Interactions triggered	Protests at the museum by peasant groups and Zapata's relatives, protests in favor of the work by the LGBTQ+ community, press and social media coverage, artistic demonstrations, and social media tributes for and against the painting.
Emerging phenomena	Questioning of the concept of "macho" and toxic masculinity in Mexican society, reconsideration of history and its heroes, increase in popularity and recognition of the artist Fabián Cháirez.
Adaptive logic of emotions	Approximately two weeks.
Dilution of the emotional event.	The relevance of the theme gradually diminished until it was diluted over time, although the reflections and questions generated by the exhibition of the painting are still present in Mexican society.

3.7. Loma Larga Mural, Monterrey, N.L., Mexico

This example of analysis involves multiple actors and processes that interact with each other, generating emergent phenomena. The main actors in this system were the neighbors of the area, the painter, the mayor, and society in general. Each of them played a role in the dynamics of the system, contributing different perspectives and opinions that influenced the way the emotional event was perceived.

The processes involved include the creation of the mural, society's reaction to it, decision-making by the authorities, and society's response to those decisions. These processes are interrelated and affect the final outcome of the system. The interactions between actors and processes generated controversy surrounding the mural, the creation of alternative proposals, and the persistence of the issue in society over time.

Regarding the adaptive logic of emotions, these are a natural response of the organism to situations perceived as threatening or stressful. In this case, the negative emotions that arise when viewing the mural are a form of adaptation to an environment that is perceived as dangerous or threatening. Through emotional reaction, people stay alert and avoid situations that may put their safety at risk. In this sense, emotions are an adaptive tool that helps the organism to face and adapt to its environment.

Table 8. Observable factors of the urban emotional object: Loma Larga Mural, Monterrey, N.L. Mexico

Factors	
Origin of the emotional event	The use of explicit symbols and somber techniques in a city mural.
Actors	The neighbors, the painter, and the mayor of San Pedro.
Role of the actors	The neighbors generated disgust and fear, while the painter and mayor were criticized for the choice of the mural.
Interactions triggered	Conversations and debates on social media platforms, proposals for new designs for the mural, and critical analyses of the work.
Emerging phenomena	Fear and stress among people living near the mural, controversy, and debate among the public.
Adaptive logic of emotions	The controversy started in September 2017 and continues to be a topic of conversation in society.
Dilution of the emotional event	The mural remained in place despite criticism, but different proposals were allowed to be used on it.

4. Conclusion

After analyzing the examples presented in this article, we can conclude that there are patterns of coincidence in emotionally charged objects or events within the urban system. It is important to highlight that the emotional event can influence the emergence of other phenomena and generate new emotional responses different from those that gave rise to it. For example, the creation of new communities, as in the case of the Loma Larga Mural, or the feeling of guilt, as in the case of the Auschwitz Museum. This is explained by the complexity of the emotional experience, which involves multiple factors and is not limited to a single situation or context. Moreover, the duration and evolution of the emotional event may vary depending on internal and external factors, such as the presence or absence of certain stimuli, the social and cultural context, as well as the individual's capacity to process and regulate his or her emotions. In addition, it was found that the reactions of the actors during the emotional event can lead to the formation of groups that last beyond the duration of the event and act as initiators of new communities or groups where other interests are pursued, maintaining contact. On the other hand, emotional events that have a media impact or greater reach tend to destabilize system beliefs

and challenge the status quo, giving rise to new dynamics. Understanding the emotional phenomenon is of great importance to understand how it influences the perception and behavior of individuals in various situations in the urban environment. This can have relevant implications in different fields, from psychology to anthropology and sociology, as well as in decision-making and public policy.

In short, the patterns depend on the characteristics of the emotional charge of the urban objects, but the patterns of interaction in which they coincide can be generalized as follows in the complex city system: (1) immediate reaction by some individuals; (2) emotions are generated at the individual level which begins to generalize permuting to a collective emotion; (3) a process of reflection is detonated in some individuals from the reading of collective emotions; (4) integration/meaning in the community both at the individual and collective level, on the concepts, roles and/or functions that give rise to the process in the system.

These findings contribute to the knowledge about the relationship between emotional events and their influence on the urban system. Therefore, future research should delve deeper into the emotional dynamics of the groups generated during and after these events, as well as the role of the media in the destabilization or consolidation of a system and its influence on decision-making and public policies.

Disclosure statement

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