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## Technology, Mobility, and Security. Elements to Introduce in an App Mobile as a Strategy to Survive in Vulnerable Areas

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### Abstract

In Mexican and Latin American cities, the increase in insecurity in urban, intra-urban, and peripheral areas is alarming. In a context in which the use of information and communication technologies is essential in practically all socioeconomic strata and ages. We wonder if a mobile application could be a strategy to survive in this climate of insecurity in cities. The problem was analyzed using a methodology based on security urban perception and social cohesion indicators, comparative analysis of main apps used in secure mobility, and survey and interviews with a focus on daily journeys from 3 socio-spatially segregated neighborhoods of the Metropolitan Area of Guadalajara, Mexico as study cases. The results highlight the importance of daily security in cities, furthermore, allowed us to identify the main elements to integrate into the design of a mobile application with parameters in security and mobility as a key strategy to create and reinforce networks of social cohesion.

**Keywords:** Technology; Mobility; Security; Mobile App; Vulnerable Areas.

### 1. Introduction

"The present urban population is about 53% of the world's population and it is likely to reach 67% in 2050" (Fayens, A. 2023). This has brought with it that in cities and regions of Latin America, a territorial expansion of cities is generated, as well as effects on the territory due to its uneven growth, increasing socio-spatial weaknesses, connectivity, and insecurity, affecting especially vulnerable groups and territories (García Díaz & Junior, 2017; JAITMAN et al., 2015 extracted from García Díaz & Junior, 2017; and Luneke & Fernanda, 2020 and, AFZHOOL, 2019; Amen, 2021; Aziz Amen, 2022; Amen et al., 2023; Amen & Nia, 2020). In the case of Latin America is considered one of the most violent regions in the world since it concentrates the majority of crimes, registering 33% of homicides worldwide (JAITMAN et al., 2015 extracted from García Díaz & Junior, 2017 and Luneke & Fernanda, 2020), "...in addition, other types of violent crimes that feed insecurity stand out, such as attempted homicide, extortion, bodily harm, robberies" (2017 P. 441) so security in cities becomes one of the most important issues that need to be considered in the urban agenda.

On the other hand, in the last 30 years since the 90s the appearance of the analog cell phone and later with 3G technology, (Townsend, 2014, pág. 53) the use of these digital technologies has increased, allowing citizens to transit and move by the city "We are reorganizing our lives and our communities around mass mobile communications. (Townsend, 2014, pág. 2).". Mobile phone is most successful consumer electronic device of all time. Some 6 billion are in service around the globe. Three-quarters are in the developing world. In just a few years, it will be unusual for a human being to live without one" ... (Townsend, 2014, pág. 3).

With this new reality, what could be the best way to build cities? for Goldsmith & Crawford, (2014, pp. 57-59) "Digital tools, it turns out, are a good way to create that transformation", because the data allows all the groups of the city to participate actively in planning but only if the data is easily understood, and well visualized, and capable of being sorted and evaluated.

With this as a starting point, we wonder if a mobile application could be a strategy to survive in this climate of insecurity in cities? And which could be the key point to integrate into the design of a mobile application with parameters in security and sustainable mobility as a key strategy to create and reinforce networks of social cohesion? The objective of this article is to analyze urban security and the social perception of insecurity from daily routes of the habitants of three socio-spatially segregated neighborhoods to identify the principal components that can be integrated into a mobile app as a strategy to survive in vulnerable areas, to create new tools for urban analysis and planification.

For this research, the problem was reviewed using a methodology based on security urban perception and social cohesion indicators Lascuarin, Carrera, & Villafuerte, (2021) Hernández & Haro, (2021) (González & Reyes, 2019) Álvarez & Vázquez Vázquez, (2017) Giglia, Gómez, Ortega López, & Aguilar Vázquez, (2020): then we identified the vulnerable groups, taking as a study case the Metropolitan Area of Guadalajara in Mexico; subsequently, we made interviews to validate the users experience in their daily mobility. Daily mobility includes i) Proximity; ii) Vitality and diversity; iii) Autonomy and security; (Casanovas and Valdivia, 2013; Ciocchetto, 2017). At the same time, we

identified and evaluated the principal apps in mobility taking as reference the same parameters analyzed during the interviews and surveys to understand the implications and adoption of parameters of spatial security for the users. Using information triangulation, the study results in remark on the importance to know the experience of the users because they can validate the fragilities and challenges that we have in our actual cities in specifics ways, and how the technology makes an opportunity to improve and create new collective safety nets in real-time says Goldsmith & Crawford, (2014, págs. 56-59)

Digital tools also create a new type of community... Engaged citizens come to see themselves as facilitators of public services... Digital tools can help any citizen find others who share his or her concerns and motives to act... Digital tools, it turns out, are a good way to create that transformation...

This paper is organized as follows:

Firstly, we make a brief introduction of the study, then in part 2 we explore the key concepts of technology, mobility, and security, then in part 3, we describe all the methods that were employed in this study, finally in part 4 we make a discussion about the principal results and conclusions.

## 2. Technology, mobility, and security

We are living in cities and territories where we can see that the total predominance of information and communication systems" - internet, television, and mobile phone (Montaner & Muxí, 2013, pp. 79-81), which has generated substantial changes in the daily life of people, where easy access to communication systems allows the inclusion of previously excluded realities.

The authors, Chase & Rivenburgh, (2019), mention that some of the needs that city managers should consider, as references for their design and planning are: connecting, communicating, inviting, inspiring, moving, and containing support networks for people. This is how cities today require spaces that can have flexibility in their use, proximity, mobility, physical and digital interconnectivity, as well as virtual means to operate in the world, locally and globally, in such a way that it is possible the achievement of the reduction of the digital gap and the socio-spatial segregation in the territory, participating in this space of interconnected and global flows.

Other authors like Alanazi, (2023) furthermore say that an intelligent transportation system (ITS) could have benefits not only to improve new opportunities for the people but also for the environment. In the same way as the intelligent infrastructure allows to "collect, store, and analyze data on nearly all parts of city operations", in addition, Türken & Eyüp Eyuboğlu, (2021, pág. 169) says that the form of communication in daily life have changed due this situation required the integration of participatory planning with digital technologies.

Likewise, Córdova and Díaz mention that to have greater development in Mexican cities, it is important to generate a technological platform and technological initiatives of national scope that integrate "...groups of entities from a specific sector led by the industry... to define a Strategic Agenda research" (Córdova Canela & Díaz Núñez, 2018, pp. 367-368) as an action strategy that allows reducing the conditions of vulnerability and segregation present in cities of different scales and their territory.

Where within the problems present in cities, violence, and **insecurity** in public spaces stand out, reporting crimes and acts that threaten to segregate collective spatiality (García Díaz & Junior, 2017) "...the environment of insecurity that generates violence and crime segregate collective life in the public space, fostering problems such as the disappearance of the feeling of collectivity, socio-spatial segregation, and the polarization between social spaces and their inhabitants." That is, cities and their public spaces become the scenarios become more fragile for people in their daily lives, and this increases especially for the most vulnerable groups such as women. With truly alarming statistics, in 2020, ECLAC mentions that "...at least 4,091 women were victims of femicide in 26 countries (17 in Latin America and 9 in the Caribbean)" (ECLAC, United Nations, 2022).

According to Caroline Moser, "There is no single definition of what constitutes violence, but from her conceptual proposal, she distinguishes four categories: political, institutional, economic, and social. Each of these is identified in terms of the motivation of the physical act that consciously or unconsciously is used to "gain or maintain power" This study focused specifically on the data around "social violence", that is, linked to the power relations in public space and "economic violence" defined as that which is associated with street crime, which includes assaults, robbery and violence linked to drugs and kidnappings (extracted from Colombara, 2011)

This problem has been spreading to various locations and scales, affecting individuals, in such a way that it modifies social behaviors, since public space is the place where relationships emerge, as Borja & Muxí, (2003) mention, public space does not cause or it generates dangers... these go beyond being spaces to circulate or interact, they are the representation of the city. They are owned domain and collective use. They are spaces intended for various uses and are the place where the problems of injustice are evident; however, "the public space is the city" which today is in crisis and at risk (Borja & Muxí, 2003) as it becomes a scene of weakness, especially in those hardest-hit spaces from the same territorial distribution, having greater affected in certain neighborhoods of the city due to the unequal conditions in which they develop (Luneke & Fernanda, 2020). As Colombara (2011) mentions, some manifestations

of violence are observed in the logic of urbanism, from the new forms of residential segregation and especially in the marginal neighborhoods, this is how urban violence has become one of the central problems of today's societies. About crimes and their location, Luneke & Fernanda, (2020) mention that the "...distribution of crimes in the territory and their concentration in certain popular urban neighborhoods can be explained from variables at the neighborhood level" where according to Ruiz Tagle (2016, extracted from Luneke & Fernanda, 2020) based on the "Theory of the neighborhood effect", proposes a direct link between a concentrate on of poverty and social problems, which has given rise to multiple urban interventions, highlighting Arriaga (2019) who mentions that in Latin American countries, awareness of the need to incorporate segregation as an important factor in urban mobility and safety reforms has increased and this a phenomenon that needs to be analyzed (extracted from Luneke & Fernanda, 2020).

As part of the exposition of the problem raised, it is necessary to establish what is understood by **socio-spatial segregation**, being this "[...] the existence of differences or social inequalities within an urban group and, the grouping of subjects according to attributes specific (especially socioeconomic, cultural and/or racial) in agglomerates with a tendency to homogenize within and reduce interactions with the rest of the groups (LINARES, 2011, p. 5, extracted from García Díaz & Junior, 2017)". They are the involuntary effects caused by the existence of economic, social, and political differences or inequalities within the urban space where daily life is carried out, where some of the consequences are vulnerability, exclusion, and social discrimination, urban-housing deterioration, crime, and violence, which in turn generates another series of conditions with negative impacts in the quality of life in the neighborhoods (García Díaz & Junior, 2017).

These precarious conditions of the urban space in neighborhoods and urban security have been a topic of interest for society, companies, and governments, where the criminal problem occupies a central place in the political agendas (Silvana, 2008). However, the relationship between the city, technology, and violence is one of the least studied topics due to a methodological problem, where it is necessary to identify the social relationships that integrally arise in urban life (Colombara, 2011). In their "theory of violence in the urban margins", Luneke & Fernanda 2020 mention that this affects the dimensions of daily life, where in the last decade, it is possible to observe a set of studies that have sought to enrich these postulated from situated analyzes of differences kinds of violence in these contexts.

That's how mobility and security apps have a great potential to manage many of the concerns raised with security and daily routes from people in vulnerable areas. The design of a mobile app could be used to alert, and prevent other people in real time, and to strengthen the community by sharing advice and recommendations for security routes and taking actions to improve the other ones that are not. As a key factor in survival in vulnerable areas. The tools present in this app give a differentials factor in the design.

### 3. Material and Methods

Through the theoretical approach of authors such as Townsend (2014), Ciocoletto (2017), and Casanovas (2013) and using a methodology based on security urban perception and social cohesion indicators, daily mobility, and security of the habitants in their routes inside and outside their neighbourhoods.

For this study, it was important to develop an instrument to collect the data information of the three study cases in the Metropolitan Area of Guadalajara. For that reason based on the analysis of Lascuarin, Carrera, & Villafuerte, (2021) Hernández & Haro, (2021) (González & Reyes, 2019) Álvarez & Vázquez Vázquez, (2017) Giglia, Gómez, Ortega López, & Aguilar Vásquez, (2020), we create a survey and an interview that consider the three following parts:

Personal data: where it was considered, age, sex, time of living in the neighborhood, and level of studies.

Social cohesion considers i) Interpersonal trust and solidarity; ii) a Sense of belonging/social identity; iii) Participatory and collaborative behavior.

Open questions based on Casanovas; Gutiérrez, 2013 y Ciocoletto, (2017), and Goldsmith & Crawford, (2014) were about the use of technology and safety in daily mobility, and their neighbourhood was considered.

#### 3.1 Participants or subjects

For this study, we identified three territories characterized by socio-spatial segregation into the Metropolitan Area of Guadalajara in Mexico (Herrera, Castañeda Huizar, & Amparo Venegas, 2020). So, the communities involved in the study were the habitants of the neighbourhoods of San Andrés in Guadalajara, Jalisco, Mexico, Lomas del Centinela in Zapopan, Jalisco, Mexico, and Nuevo Israel in Tonalá, Jalisco, Mexico.

At the same time, we made identification and comparison of the principal apps in mobility taking as reference the same parameters analysed in the interviews to understand the implications and adoption of parameters of spatial security for the users. The applications analyzed were: SOSMEX, Vivo Segura, Jalisco emergency button, 911 Nacional, Panic alarm, Ellas (Colombia), and Life 360.

### 3.2 Data collection

The Selection of the sample size for the 3 neighborhoods, a sample was defined with 92% confidence where 113 surveys and interviews were applied in San Andrés, 118 in Lomas del Centinela, and 101 in Nuevo Israel. For each of the neighborhoods, the simple random sample formula was applied. 5 margin polls were left.

### 3.3 Cleaning and accommodation of data

Once the surveys were answered, the data was cleaned, to maintain homogeneity in the presentation of the data and avoid misinterpretations in the result.

### 3.4 Descriptive statistics of each neighborhood

In each part of the survey, a different statistical study was carried out.

Personal data: frequency tables were used, and the results are presented as percentages.

Social cohesion: direct average of the Likert-type scale.

Open questions: analysis of textual data by coding, which consists of synthesizing and quantifying data.

### 3.5 Variable correlation matrix.

In each of the neighbourhoods, the correlation matrix between the dimensions of social cohesion was calculated, to compare the three neighbourhoods and contrast the results with the theoretical part.

Giving the following results:

## 4. Results

The results obtained in New Israel, show that the majority does not manage to have a university education, only reaching 3 of 106 people surveyed, and the majority only reach secondary school (40%), verifying the disconnection that the area has with access to education, within the occupations the majority works outside the neighborhood 39%, the rest do housework, study or other, which shows us the little accessibility to work, they have an average of 12 years living in the neighborhood, however, this neighborhood particularly has a high social cohesion index of 84.95%, probably because it is a small neighborhood, located on the edge of the ravine in Tonalá, and nearby it has a neighborhood with a high level of insecurity, so they have their dynamics of internal guards among the same inhabitants of the neighborhood to locate external people. This neighborhood has an average age of its inhabitants 32 years and uses 94% of the use mobile technologies such as WhatsApp and Facebook to be notified about a situation in the neighborhood, which speaks of the adoption of technology as a means of generating new digital community networks. 80% of those surveyed have received and given me type of help to their neighbors, 83% feel safe within the routes of their neighborhood, but not when leaving it, and 85% have not had any security incidents within their neighborhood. 80% of those surveyed use public space and 82% help to maintain it. This reinforces the sense of community, collaboration, and participation, it is even possible that being a group that professes the religion known as the Light of the World, this is a factor of social cohesion present in the neighborhood of Nuevo Israel. Well, according to the 2020 census in Jalisco, 89.2% of the population is Catholic, 4.7% is Protestant and Evangelical Christian (this percentage includes La Luz del Mundo), and in third place are people without religion. with 4.6 percent. (INEGI, 2020)

On the other hand, San Andrés has a percentage of the majority population between 41 years of age, which makes it a mature zone of the city, in this case, 38% of the population manages to study for a degree, and 42% are workers inside or outside the neighborhood, they have an average of 22.5 years living there, the main form of communication is through social networks such as WhatsApp 55% but 35% prefer not to communicate by any means. Only 51% must give or receive help from their neighbors, likewise, only 51% feel safe during trips in their neighborhood, and more than half of the population has had a security incident, they mention that the main reasons why they do not feel safe are the perception of insecurity, harassment, lonely street, lack of lighting. However, 79% do use public spaces, 82% help maintain and care for them, and the main form of mobility within the neighborhood is walking. It had 64.31% about social cohesion, which represents an average percentage.

Finally, the Lomas de Centinela neighborhood, with 5,728 inhabitants (according to INEGI, 2020) has an average age of 38 years, in this neighborhood the majority of the inhabitants only reach secondary school studies 69%, and only 4 people out of the 120 surveyed they reach a university level, they have lived in the neighborhood for an average of 12 years, the main form of communication between the settlers is WhatsApp groups, but 40% do not communicate by any means; 49% responded that they do not feel confident to receive or give help among neighbors, only 51% feel safe within the routes in their same neighborhood, and more than half of those surveyed have had some issue of insecurity in the neighborhood, among the main reasons why they do not feel safe they mention the

perception of insecurity, the presences of drug addicts, lonely street, poor lighting. Only 13% use public spaces, 84% of those surveyed mentioned that they do not help with the maintenance or care of public spaces that are few, as well as the main form of mobility within the neighborhood is walking.

Therefore, it can be identified that the Nuevo Israel neighborhood, being a small community, seems to be easier to establish links, weave networks of trust, and is a neighborhood on the edge of the ravine and adjacent to La Jalisco neighborhood (known as one of the most dangerous in the state) forces them in a certain way to create security dynamics within the neighborhood based on guards and patrols by the inhabitants themselves. However, it presents deficit or basic urban services, as well as education and work, but it is interesting that more than 80% of the population already uses some digital tool as a means of creating ties and community.

On the other hand, San Andrés, although it has greater access to education, and a mature population, as well as having lived in the neighborhood for longer, has low trust among neighbors; however, although they do not feel safe, most use public space and maintains it, which shows an appreciation for their neighborhood, but little trust between them. Likewise, although the use of digital tools to communicate is less, more than half do so through some digital means to create ties and community. What reinforces this new reality of employment and permeability of the use of technology in communities.

To finish the analysis, Lomas de Centinela has a population of over 9,063 inhabitants (INEGI, 2020), unlike San Andrés with 21,460, and Nuevo Israel with 729 inhabitants. However, very few of the inhabitants have access to university education, making clear the disconnection and inequality of opportunities. Although they have lived in the neighborhood for an average of 12 years, they have not developed a sense of community, or appreciation for it, this is reflected in the fact that the majority do not use public space or maintain it, however, there is a very special group of women who have built a really strong sense of community and mutual help in the neighborhood, and more than half of the people has already chosen to use digital communication as a means of creating a link or creating ties with the inhabitants of the neighborhood.

Finally, in the relationship matrix of the literature, the analysis of the 3 neighborhoods based on the variables analyzed shows that there is a relationship between trust, social ties, and a sense of belonging, but it is necessary to reinforce the shared values of the neighborhoods to improve participatory and collaborative behavior within them (see table 3).

Table 1. Result index of the 3 colonies. The following table shows the calculated social cohesion index of the 3 neighborhoods, a classification was made with the following intervals from 0% to 33% low cohesion level, from 33% to 66% medium level, and from 66% to 100 % high level. Source: authors elaboration

NEIGHBORHOODS	SOCIAL COHESION INDEX (SCI)	CLASSIFICATION
NUEVO ISRAEL	84.95%	high
SAN ANDRÉS	64.31%	medium
LOMAS DEL CENTINELA	64.71%	medium

Table 2. Summary of results. The following table shows a comparative statistical summary of the 3 colonies. Source: Authors' elaboration

	Nuevo Israel	San Andres	Lomas del Centinela
<b>Population</b>	729	21,460	9,063
<b>Sample</b>	106	118	120
<b>SCI (Social Cohesion Index)</b>	<b>84.95%</b>	<b>64.31%</b>	<b>64.71%</b>
<b>Average age</b>	32	41	38
<b>women</b>	58%	62%	100%*
<b>Study Level</b>	Elementary school 38%	University 38%	Elementary school 58%
<b>Occupation</b>	Worker 39%	Worker 42%	Housewife 51%
<b>Years of living there (average)</b>	12	22.5	12.33%
<b>% Help between neighbors</b>	80%	51%	49%
<b>% loans between neighbors</b>	88%	52%	52%

<b>% favors between neighbors</b>	84%	59%	59%
<b>% feeling of security</b>	83%	51%	51%
<b>% security incidences</b>	15%	42%	29%
<b>% space public use</b>	80%	79%	13%
<b>% Help in maitance</b>	82%	82%	13%
<b>Popular mobility</b>	Walking 79%	Walking 80%	Walking 59%

**Table. 3 Correlation matrix**

The following correlation matrix shows that the variables involved in the study are directly related, with the shared values variable being the one with the least relationship with the others.

<i>Correlation matrix</i>	<b>Social ties</b>	<b>Confidence</b>	<b>Sense of belonging</b>	<b>Shared Values</b>	<b>Participative behavior and collective</b>
<b>Social ties / vínculos Sociales</b>	1				
<b>Confidence/ Confianza</b>	0.9988	1			
<b>Sense of beloging/ Sentido de Pertenencia</b>	0.9998	0.9978	1		
<b>Shared Values/ Valores compartidos</b>	0.7567	0.7877	0.7450	1	
<b>Participative behavior and collective / Comportamiento Participativo y colaborativo</b>	0.9868	0.9778	0.9896	0.6410	1

## 5. Discussion and Conclusions

Townsend, (2014) explains that the use of technological tools is increasing, which is a catalyst for the technological boom was the cell phone. Likewise, Batty (2018) mentions that, although the future of the city cannot be predicted, it is possible to invent it. However, the short or immediate term is more predictable than the long term, since it is not possible to control what inventions might arise. The point is to generate enough information to identify the trends and possibilities of the dynamics and structures that we use.

On the other hand, it should be mentioned that through the use and adoption of digital tools, new forms of community have been created, as mentioned by Goldsmith & Crawford, (2014) "digital tools also create a new type of community" where said tools can be a good path for transformation. The data can be actively used in planning. But this data must be easy, well visualized, and capable of being evaluated.

Likewise, Türken & Eyüp Eyuboğlu, (2021), mention that such data can help the planning and design of cities because they are generated in real-time by the community.

This will allow active citizens, not just passive ones (Goldsmith & Crawford, 2014) to detect improvement opportunities, identify the problem, and visualize vulnerable groups.

Now, if we take as a reference that for a city the fundamental base is its citizens as well as connectivity and mobility and taking as a reference that the percentage of people living in urban areas has increased from 30% in 1950 to 54% in 2014 (ZEYBEKOGLU, 2019) whereas cities grow, social, cultural and economic opportunities expand with them, at the same time the centers of social and territorial exclusion, poverty, unemployment, insecurity, privatization of land and housing grow. Where, in addition, the main affected people turn out to be the people who live in areas of informal settlements and slums. It is estimated that one-third of the population lives in slum areas located in geographically dangerous areas (ZEYBEKOGLU, 2019, p. 4).

For this reason, it was important for this study to identify the socio-spatially segregated communities and neighborhoods to carry out the analysis, this is because this very disconnection from the city makes access to hard data difficult, as well as the experience is completely unknown. To the user to the level that they remain invisible. Therefore, the results obtained from the application of the survey and interview indicate that, when analyzing social ties, trust, the sense of belonging, shared values, and collaborative participatory behavior, are a fundamental part

of the study of social cohesion, as well as to strengthen networks using digital technologies in the daily journeys of the inhabitants.

Therefore, in summary, we can affirm that the use of digital technologies and tools is a fundamental basis for the design and planning of cities since they allow the creation of information and data in real-time, likewise, the population chooses to use these tools to create ties and strengthen security ties and community. By achieving neighborhoods with greater social cohesion, it is possible to improve the perception of security within the neighborhood, as could be seen in the New Israel neighborhood.

However, to generate more participation and trust, as well as social ties and a sense of belonging, it is necessary to create shared values within the community, to strengthen social cohesion within the neighborhood.

When doing the analysis and identification of the applications and tools that have been designed for mobility in cities with a security focus, the following is concluded:

For greater adoption of technology, it must be very simple and intuitive (as is the case with WhatsApp) to create networks, but if the application is also intended to provide a sense of social identity, interpersonal trust, and participation, as well as collaborative behavior, it is necessary to establish at least 3 elements to integrate into a mobile app as a strategy to survive in cities that is based on mobility in daily journeys and use of public space:

1. Security: the possibility of monitoring routes with schedules and types of transport, sharing routes with selected contacts or groups, visualization of routes and safe places, panic buttons, and emergency numbers.
2. Diagnosis: the possibility of evaluating public spaces or equipment according to quality and safety parameters, generation of a collective diagnosis of the urban space, and accident reporting.
3. Network building and community strengthening: chat, information sharing in groups

These strategies can be found partially individually in the mobility applications analyzed as support; I live safely, the help button, among others, as well as in communication applications such as social networks, but it is necessary to continue permeating to strengthen these new digital links. Through the development of new applications that include tools for assessing the urban environment and where neighborhood trust is strengthened and consequently social cohesion and attend to this new reality that is occurring in Latin American cities.

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