Examining urban polarization in five Spanish historic cities through online datasets and onsite perceptions

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A B S T R A C T

At present, the planning and management of historic districts are faced with the challenge of striking a balance between the needs of residents and seasonal pressures from visitors. These socially bustling sites could also benefit from the data cross-referencing of cultural and social patterns in order to identify areas for improvement. This research analyses geo-referenced online datasets and data from social media applications, subsequently contrasting these with onsite data from in-person interviews. These specific variables highlight parallels and conflicts between districts designated World Heritage areas in five Spanish cities. The study provides a quantitative analysis of hotspots and coldspots within the built environment. This is followed by an examination of these two types of areas using qualitative data linked to the three most challenging issues: housing and the built environment; basic services; and cultural services. When analysing the future of historic districts three major challenges to management highlighted in the results should be considered. Firstly, even in socially active districts, imbalances and dysfunctional areas are highlighted by both online data and onsite perceptions. Secondly, the study of the dynamics of districts for observing how stakeholders adapt to this social, economic, and mobility-related polarization. Thirdly, while the study acknowledges the changes to the consumption of culture, there is still potential for improvement in hosting alternative or countercultural movements.

1. Introduction

While residential heritage spaces have undergone socioeconomic processes of adaptation in order to cater for seasonal tourism, the subsequent transformation of World Heritage Historic Centres (WHHCs) has also brought about major concerns (Chahardowli & Sajadzadeh, 2022). Within the urban context, Elkhidir et al. (2023) define resilience as the ability of a space or community to withstand, assimilate, accommodate, adjust, transform, and recover from adverse effects in a timely and efficient manner. This includes the preservation and restoration of essential core functions and structures. While according to Dignum et al. (2022) there is seemingly no distinction between problems in cities of different scales, the magnitude of the problem does vary, as drastic changes lead to imbalances that must be counteracted with active policies.

In the particular examples featured in this research, World Heritage declarations of historic cities have led to gradual depopulation and abandonment, usually followed by redevelopment, restoration and enhancement (Bellet and Cebrián, 2022; Larraz & García-Gómez, 2020).

As described by Buckley (2018), the original purpose of inscribing World Heritage sites is to identify, protect, conserve and present places of outstanding universal value through conceptualizations based on human perception. The existence of a range of values in historic urban settings has led to management mechanisms incorporating increasingly broader contexts based on participation, knowledge, planning, existing legislation and many other economic or financial tools (Roseland, 2000; Doratti et al., 2004; Zeayter & Mansour, 2018; van der Hoeven, A. 2020; Sanchez et al., 2020; Cremen et al., 2023).

Another parameter to be considered for the contemporary city is that of management mechanisms, as reflected in urban agendas which seek greener and more sustainable planning (Lucchi & Buda, 2022; Lucchi et al., 2023; Shehata et al., 2022). As Labadi, Giliberto, Rosetti, Shetabi, and Yildirim (2021) hold, urban regeneration processes provide a number of guidelines for cities and their communities. However, as Pourbahador and Brinkhuijsen (2023) point out, these agendas, conventions and treatises are usually combined into public policies or regulations which instrumentalize the preservation and continuity of some values over others.

In the context of historic centres, regeneration not only refers to physical threats to heritage, but also to risks to the social structure (Ralero, 2020; Wang & Aoki, 2019). To date, the concept of the function and impact of the World Heritage designation of a historic centre has hardly been explored combining quantitative and qualitative data. In spite of this, the scientific literature has identified a number of problematic issues stemming from these designations. Through Casagrande's (2016) studies on Venice, Larraz and García-Gómez (2020) highlight how World Heritage requirements have favoured the preservation of the historic built environment to the detriment of the needs of the local population. Finally, the authors detail the depopulation processes observed in historic cities over the last 30 years.

These are not isolated cases. González-Leonardo et al. (2023) observed a demographic decline both in protected heritage cities and medium-sized provincial capitals. According to Blanco et al. (2011), depopulation processes have led to the progressive deterioration of the built environment and increased poverty and inequality. Urban spaces have become increasingly complex and other issues, such as social exclusion and criminality, have also emerged. Gargiulo and Sgambati (2022) find that this progressive abandonment originates in unsuitable urban services, lower levels of accessibility, lack of green areas and the displacement of economic activities to the periphery of the city.

Seasonal pressure is another important factor in contextualizing WHHCs. The processes of globalization and mass tourism in historic environments (Adie et al., 2020; Amore et al., 2020; Anuar et al., 2019; Séraphin et al., 2019; Shoval, 2018), which have been extensively studied, constitute major threats to historic centres, severely condemning their relatively rigid structures and their lifestyle to pressure on society and services. At present, those most affected by these pressures are the residents, who are forced to witness the transformation of the city as well as the loss of services, harming the social, cultural and physical environment (Bobic and Akhavan, 2022; Cristiano & Gonella, 2020).

Vergori and Arima (2020) showcase how the seasonal fluctuation of people affects the dynamics of historic centres. Other examples, such as those described by Arcos-Pumarola, Paquin, and Sitges (2023), Zhao et al. (2023) or Montalto et al. (2023), show how seasonality can be countered through complementary uses and become a key resource for the provision of social spaces, while also providing visitors with unique and memorable experiences. Montalto et al. (2023) view regeneration policies based on innovative cultural activities as the main driving force of urban creativity and vitality (Fig. 1), while Ramires et al. (2018) reflect on how the full potential of seasonal influx can be harnessed to develop more efficient and sustainable management systems (see Fig. 2).

These are not the only processes identified. Other widely documented processes are the international influence modifying the urban morphology exposed by Carvahlo et al. (2019) and gentrification processes disguised as heritage valorization (De Cesari & Dimova, 2019). Similarly authors such as Hayes and Zaban (2020) and Jover and Díaz-Parra (2020) express the effects of transnational mobility. In the cities under study, transregional mobility has recently revaluated historic centres. In the words of Lalicic et al. (2021), the process helps the historic city to switch to a setting with emergence of business and commercial activities, while the concept of neighbourhood has undergone a cultural, economic and social revival (Sonkoly, 2023).

Managing the side-effects of these transformative processes is key to the equitable transition between districts within the historic city. Second homes and the emergence of short-term rentals have proved detrimental to historic cities (Bresciani et al., 2021; Gutiérrez et al., 2017; Nieuwland & Van Melik, 2020). This study aims to analyse how this process of economic revivalization in WHHCs acts to the detriment of housing and services.

Many historic places worldwide have been transformed, often with processes which, as Cocola-Gant (2023) points out, can strain and even break the ties between inhabitants and their environment. The study uses geo-referenced data to verify these social and structural tensions. These are combined with the opinions of residents, which can be useful in understanding the capacity of these urban systems to adapt, maintain continuity, and recover while the administration aims to identify formulas for improving residents' quality of life (Bautista-Puig et al., 2022; Escudero, 2018; Leszczynski, 2018).

While Cocola-Gant (2023) sees these processes as realities found in the character of different cities and their inhabitants, Kourtit et al. (2022) correlate these phenomena to the processes of change of city life, as they are dependent on residents' perception of their home or urban environment, and the quality of life in their neighbourhood. Kourtit et al. (2021) hold that these sensations are related to concepts such as citizens' well-being, urban quality of life, environmental satisfaction, urban happiness and preference for cities, which have recently increased in popularity.

Accordingly, the objective of this research is to understand the existing imbalances in World Heritage cities using data and the inhabitants' perception of these processes. The novelty of this study lies in the contribution of new perspectives to identify and examine polarization. Researchers employ a hybrid method cross-referencing quantitative and qualitative variables to improve the identification of polarization in three steps. Antonucci and Marella (2018) already asserted that urban density is a critical aspect of greater social polarization which increases with the absence or the unsuitability of services and facilities, while Gorning and Goebel (2016) referred to age and income as other vectors for identifying structural polarization in cities.

This analysis focuses on five WHHCs in Spain: Avila, Cuenca, Salamanca, Segovia and Toledo, all nominated for their historic centres and monuments. These are low-density regional cities with populations of between 50,000 and 150,000 inhabitants, which share historical cultural links and geographical and demographic similarities (Table 1). These five cities were selected based on the criteria for their World Heritage (WH) nomination and share geographical and demographic parallels, architectural assets and cultural bonds. All five WH areas present similar urban configurations and were founded at the same time

Fig. 1. Technology meets arts and crafts to boost local culture as an asset towards enhancing the values of today. Pictures used in SVS. Source: inimage.com 2021. The first picture belongs to an institutional light outdoors performance in Toledo. The second one is an indoor art performance from teamLab, a collective of digital artists (https://www.teamlab.art/).
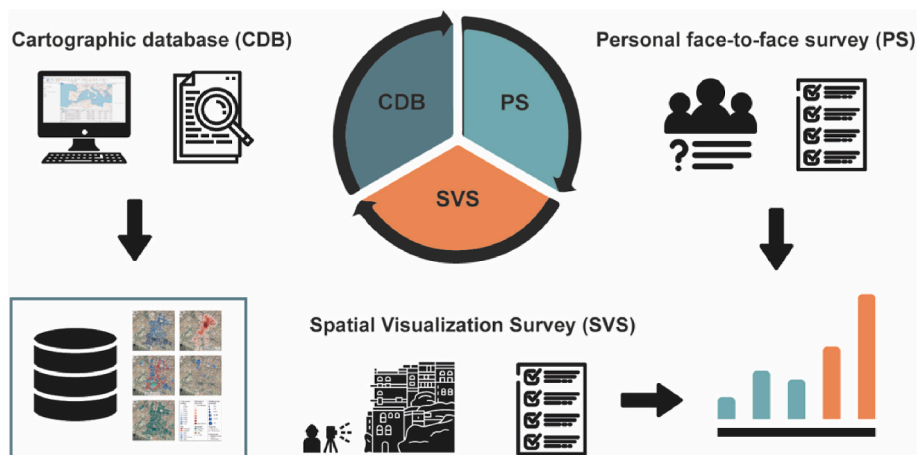
Fig. 2. CDB, PS & SVS data analysis.

but display different physical characteristics. Their location, on the top of a hill or surrounded by a u-shaped river bend has conditioned accessibility and historical expansion.

The initial hypotheses are based on several previous studies which clearly showed the need for more in-depth data treatment (García-Esparza, 2022; García-Esparza & Altaba, 2022, pp. 1–13; García-Esparza, et al., 2023). The first of these hypotheses (H1) states that the pressure of visitors affects the organization and distribution of assets and services in the built environment, which in turn affects population distribution. The second (H2) establishes that WH areas are fragmented due to neglect of the social needs of inhabitants in certain areas, while the third (H3) assumes that cultural production and consumption in these cities rely solely on service-based industry.

2. Sources and methodology

The methodology proposes data verification based on the interpretation of geo-referenced results. All three levels are made up of quantitative data available online in combination with another two sources of qualitative and quantitative data provided by onsite users. This model builds on other purely digital models tested in other urban settings such as those presented by Chen et al. (2019), Qian (2022) and Saker (2017). This methodology aims to focus on the analysis of the material and socio-cultural reality of historic centres, as stressed by Calle (2023) in his thesis on intelligent historic city destinations. The specific variables studied in this analysis reflect parallels and conflicts between different districts (Table 2), while the data collected informs a comparative analysis of five WHHCs in Spain.

The main reason for the use of cartographic information is to successfully identify the locations of basic services such as healthcare, education, grocery stores, and other public services within the context of these WHHCs, while also establishing the percentages of primary housing, the average age of the inhabitants, and the state of conservation of the buildings. These data are then used to create a thematic cartography that can be interpreted and compared using tabular data. The use of a face-to-face personal survey also makes it possible to interpret various parameters linked to life in WHHCs, including the analysis of the perception of the state of housing or access to services in historic centres. Respondents are offered a series of plausible scenarios in their cities based on pre-selected images with varying degrees of performance in the building stock, states of conservation, and images linked to essential services and leisure and cultural activities.

A cross-referencing methodology based on keywords by topic is proposed using the sources described above. The researchers assume that each of the three data sources is an interpretable and conclusive source of information. However, the literature review suggests that the use of online data may require contextualization through onsite interpretations contrasting information. The cartographic database (CDB) reflects a reality which is eventually supported by a spatial visualization survey (SVS), although an in-person survey (PS) can at times also be contradictory. Thus, the researchers establish a verification cycle to determine the usefulness of the sources by contrasting and cross-referencing information.

Given the methodology justification, the process for data collection and verification was established as follows:

1. The CDB used National Statistics Institute (NSI) data extracted from the Population and Housing Census viewer. Data from Foursquare and Google online applications were also incorporated to identify concentrations of commercial activity and services using Esri ArcGIS

Table 1
Cities, population, surface areas and tourist flows. Source: Spanish Inspire Cadastre.

		Ávila	Segovia	Salamanca	Cuenca	Toledo
World Heritage Inscription (Year)		1985	1985	1988	1996	1986
Total area World Heritage (WH) (Ha)		34.67	134.28	48.93	22.79	259.85
Built area in WH zone (m2)		484,525	976,826	748,293	348,021	1,836,247
Residential dotation in WH areas (%)		67.20	70.91	55.57	69.44	65.39
Inhabitants living in the city (n)		58,369	52,057	144,825	54,621	85,811
Inhabitants living in the WH areas (n)		1608	5611	2038	1662	12,533
Population of the city living in WH areas (%)		2.75	10.78	1.41	3.04	14.61
Average age in WH zone		44.60	43.70	46.45	42.30	43.56
Tourism inflow Traveller (n)	National	215,875	194,015	439,843	150,775	405,417
	International	33,424	51,039	213,442	22,031	136,762
Tourism inflow Overnight stay (n)	National	319,161	338,553	736,061	277,649	625,571
	International	70,328	145,223	334,724	42,181	258,249
Overnight tourists/Inhabitants living in the WH areas (n)		**242.22:1**	**86.22:1**	**525.41:1**	**192.44:1**	**70.52:1**

Table 2
Comparative analysis of data between districts with higher and lower density in WH areas. Source: NSI, Spanish Inspire Cadastral, Foursquare and Google Maps.

|		Ávila		Segovia		Salamanca		Cuenca		Toledo	
		District 1	District 2	District 1	District 2	District 1	District 2	District 1	District 2	District 1	District 2
District Density (p/km²)		**53.50**	**45.50**	**99.90**	**32.80**	**63.30**	**29.60**	**115.20**	**21.60**	**133.30**	**70.10**
Basic Services(n)		36	3	13	20	18	14	4	21	7	16
Foursquare locations (n)		43	1	44	32	76	32	2	36	18	60
Accesses	Road (%)	91%	100%	91%	82%	67%	74%	71%	73%	70%	86%
	Pedestrian (%)	9%	0%	9%	18%	33%	26%	29%	27%	30%	14%
	Height (m)	37.93	16.1	54.4	50.31	28.21	32.3	28.25	71.22	66.15	89.73
Non-principal housing (%)		38.40	38.91	33.03	37.08	48.83	70.52	36.12	71.50	28.67	19.53
Population average age (years)		43.82	43.48	39.15	50.42	39.63	46.25	43.00	48.16	39.27	38.85
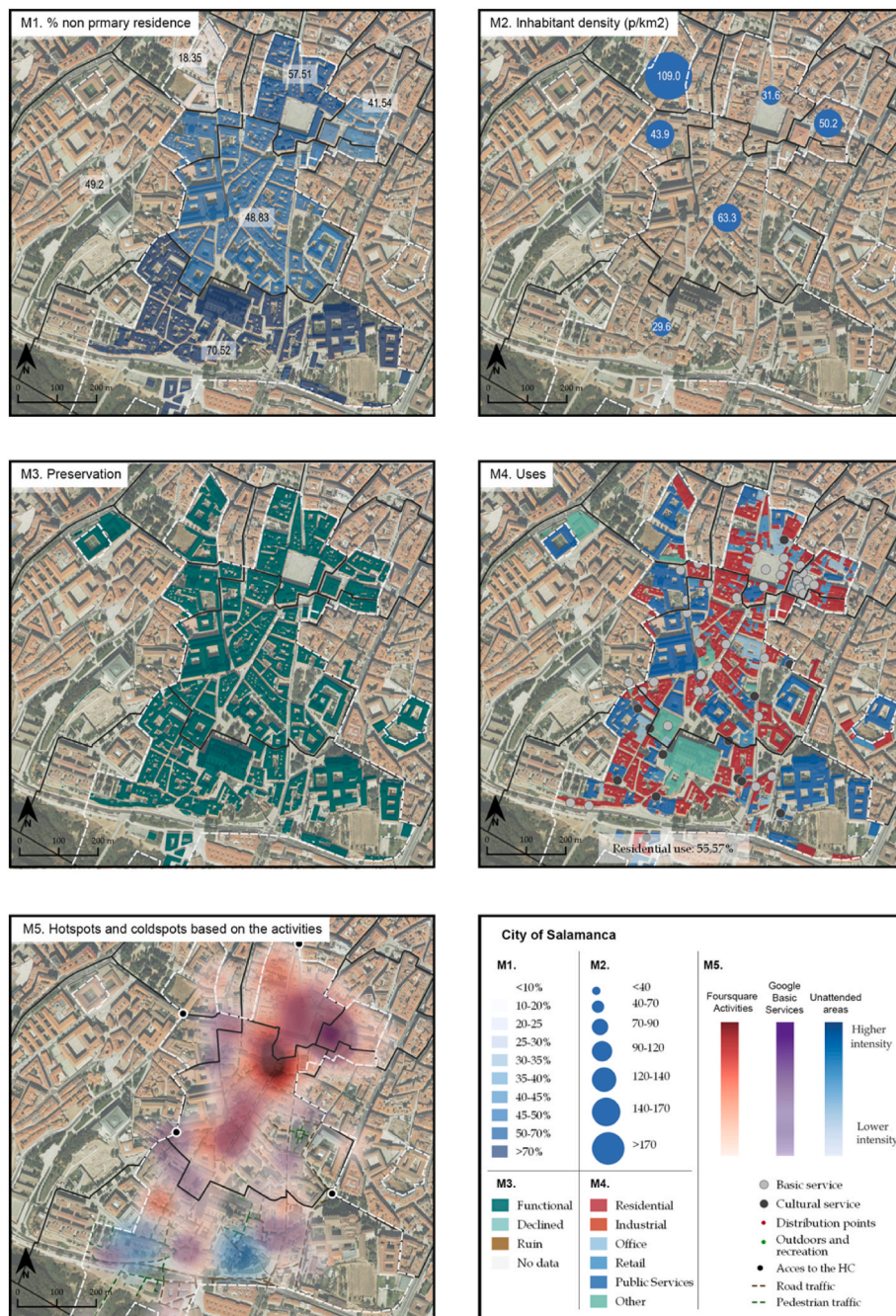
Fig. 3. CDB quantitative data of Salamanca.

mapping. Visualization of census data on maps by cities and districts showcases the interactions of stakeholders with the built environment based on the distribution of activities, services and facilities. It also helps interpret the cadastre data relating to the social structure of World Heritage areas (Table 2 and Fig. 3). The researchers chose the two more polarized districts in each city for analysis.

2. The SVS was developed using freely accessible photographic databases to gather more information on the highlights in CDB. The ArcGIS Survey 123 application stores the survey data, while its geolocation algorithm stores the survey location. The responses of the survey, conducted on a representative sample of 203 citizens, are analysed using graphs to determine whether the given data set is the result of a specific theoretical distribution. A neutral framework is set up and compared to the survey results (Fig. 4). Thus, the data obtained through SVS helps interpret and corroborate CDB data on contrasting outputs from the three main topics: Housing and Environment, Basic Services and Cultural Services.

3. Interviewers conducted the PS with 1079 individuals from the five cities, 46.3% male and 53.7% female, with a sampling error of 2.98% and a confidence level of 95%. Interviewers retrieved 25% of the total sample from the World Heritage areas (270 surveys), the remaining 75% in other districts of the cities. The survey, entitled "World Heritage Historic Centres 2022. The cases of Avila, Cuenca, Segovia, Salamanca and Toledo" was carried out individually by a specially appointed team. It consists of a questionnaire of 23 questions relating to housing and quality of life, basic and cultural services, citizen participation, heritage and socio-demographic characteristics of the World Heritage areas (Fig. 5). This survey was finally used to cross-reference the CDB and PS.

Researchers mapped and analysed all data by exporting datasets to a
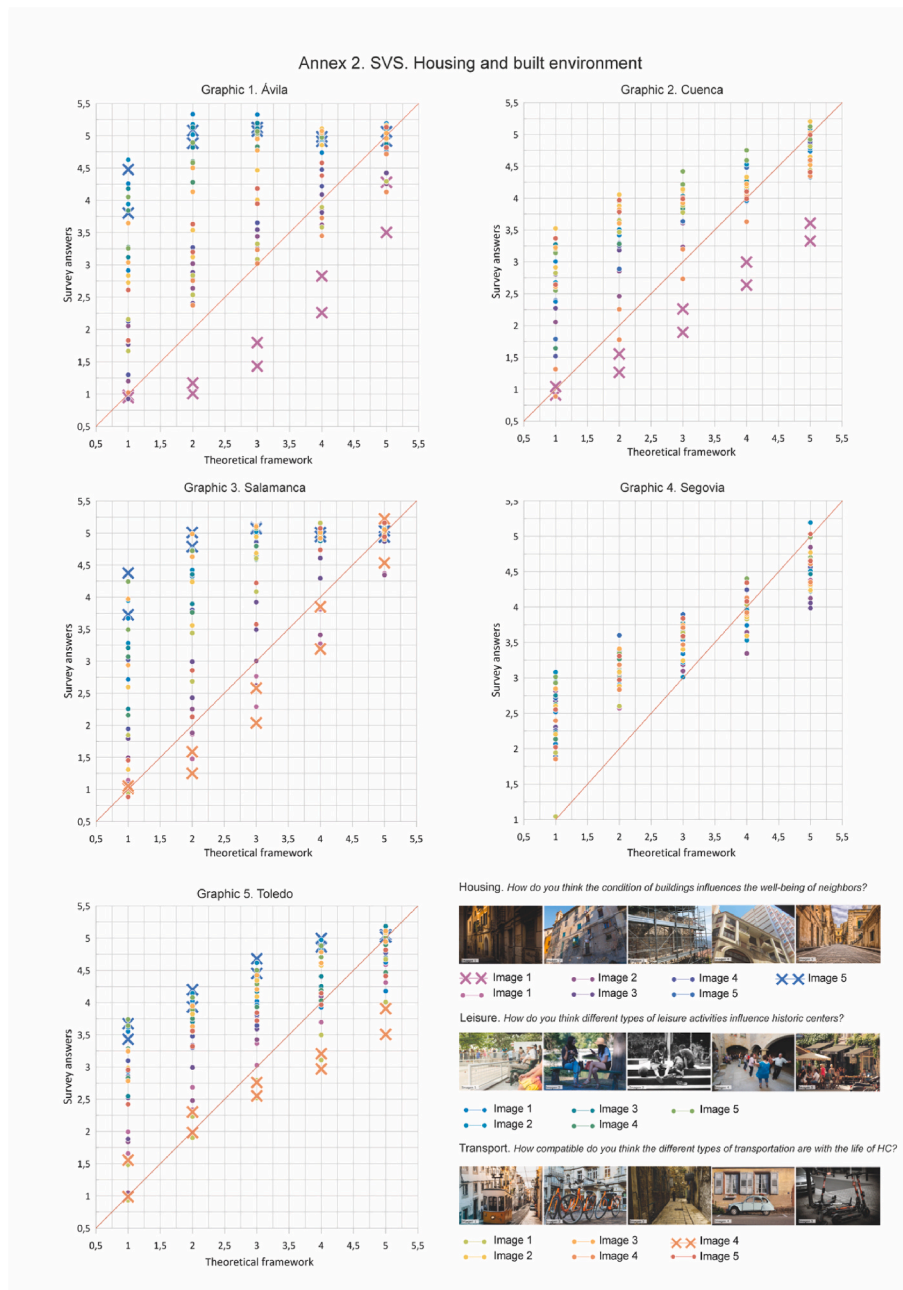

Fig. 4. Data processing of SVS on housing and the built environment.

geo-referenced database, aiming to represent the patterns of individual cities, creating five maps for each (Fig. 3). Map 1 represents the percentage of non-primary residences, which refer to vacant housing, B&B hosting, and second homes that are occasionally occupied; map 2 the distribution of activity according to Foursquare data; map 3 the basic uses and services from Cadastre and Google Maps; map 4 population density from NSI data; and map 5 the state of conservation of the buildings from Cadastre data.

Once the major aspects of the CDB study data had been compiled (Table 1, Fig. 3 and Annex 1), researchers prepared the surveys for the SVS analysis using images. These surveys followed an index of sections to be surveyed with an unbiased direct link to the cities, using images from outside the cities. The researchers then created three categories. An initial section on housing and the built environment incorporates images showcasing different states of preservation. This was combined with another two questions on public spaces and different forms of transport (Fig. 4). The same was done for basic services, incorporating images of different types of businesses, uses and workplaces. The final section addresses alternative, traditional, innovative and creative cultural services (see also Annex 2).

SVS and PS data were collected both inside and outside the World Heritage area. As all surveys referred to the protected area as a whole and not to specific districts, geo-referencing these responses was not considered useful, a limitation to be overcome in future studies. It should be noted that the differences between the population inside and outside the World Heritage areas rely on two clear and distinct lines of
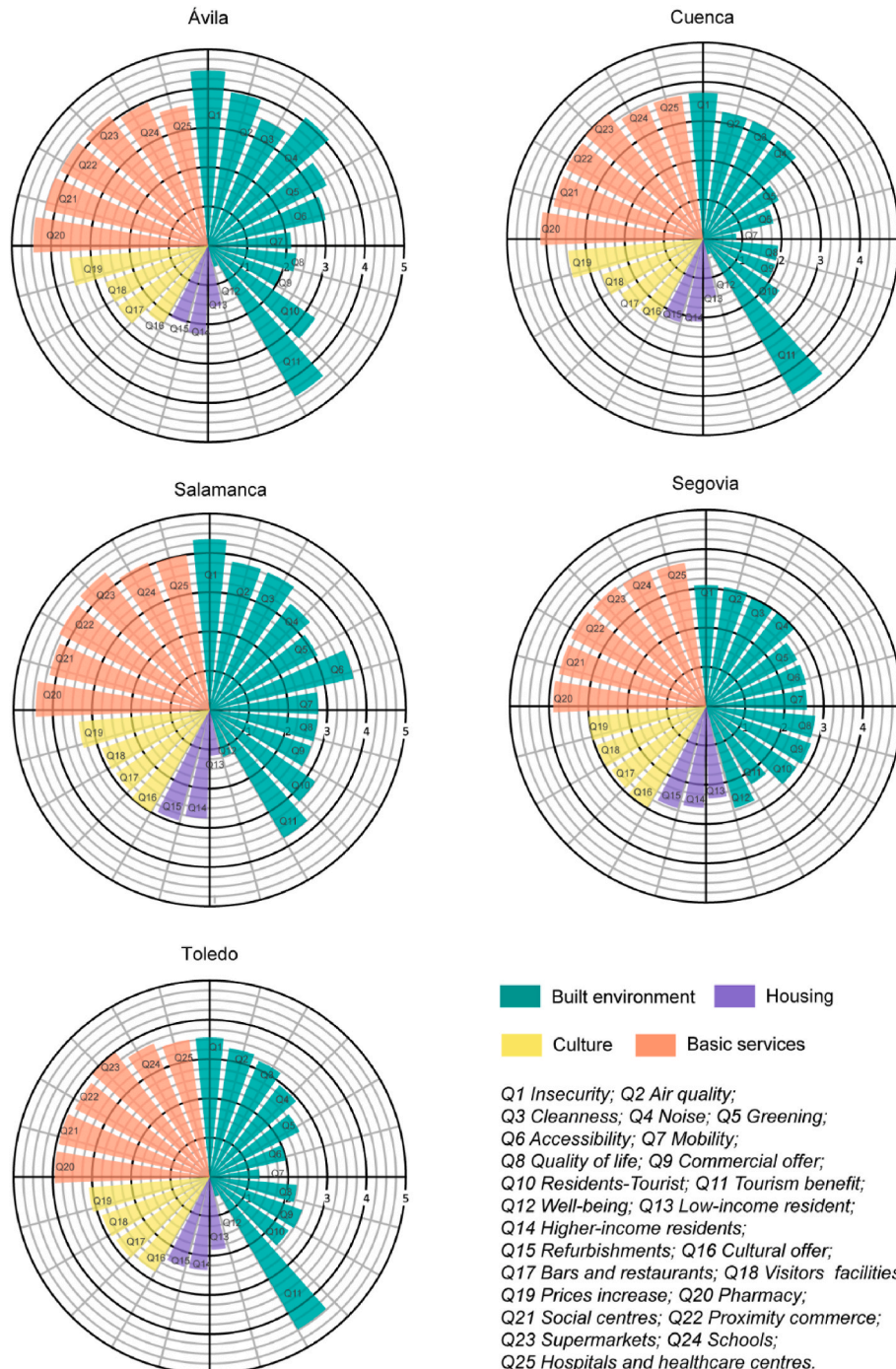

Fig. 5. PS responses processed.

thought. The population inside the protected area tends to react more forcefully to any issue. Great importance is attached to cleanliness, the restored city, and businesses of any kind, favouring public transport that is clean or quieter as well as a rich and varied cultural programme. The responses from the sample outside the historic centre tend to be more uneven, perhaps showing a greater degree of indifference towards specific questions on life in historic districts.

In short, this three-stage method intends to detect and explain what urban polarization is and how it occurs in WH areas. Quantitative data are used to help understand the geographical distribution of outputs through hotspots and coldspots. This digitalized polarization is later endorsed or contested onsite to validate it through SVS and PS.

3. Results

CDB results are grouped into hotspots and housing and coldspots and services. Hotspots are the most visited sites defined by Foursquare activities. In this research, hotspots are the geolocation repetition of Foursquare activities, which are classified and labelled. The analysis of these hotspots for all five cities shows an average of 51% of topics relating to bars and restaurants, 14% linked to culture, 13.5% connected to shopping, 12% associated with hosting services, and finally, 9.5% representing outdoor and recreational activities. The computation of all these factors in the more or less dense districts of each WH area can help provide a clearer explanation of polarization. According to Table 2, Salamanca and Segovia are the most equitable cities in balancing basic services among districts, but Segovia is the only city where hotspots are found in both types of district. In this case study, polarization is also indicated by the percentage of non-primary residence, especially in Salamanca and Cuenca, and by the average age of citizens, which is most different in Segovia. Polarization is thus confirmed by the differences in data on densities between districts within the same urban area.

Coldspots are identified through the analysis of primary and cultural services along with other indicators such as accesses, type of buildings, and population density. They denote locations that receive fewer visitors but can also encompass areas with declining population or places that are overlooked and disregarded by both local authorities and inhabitants, mostly vacant and neglected areas with acute ageing population (Table 2). In terms of the services found in World Heritage areas, basic services account for 63% of the total while the remaining 37% is made up of cultural spaces, museums, and traditional centres. Grocery stores make up 55% of the basic services, while education and health account for 17% and 12%, respectively. When researchers cross-reference, compute, and visualize coldspot data in a GIS environment with cadastre data, these provide a clear depiction of the spatial implications of their distribution, relating mainly to the less dense districts (Fig. 3 & Annex 1).

In terms of basic services, while in all five cases health facilities are adequate they may not necessarily be easily accessible to groups with impaired mobility. In three of the five cities, Avila, Cuenca and Segovia, the administrative services are located outside the historic centre. In contrast, the World Heritage area of Salamanca is mainly occupied by administrative and corporate buildings and is home to 1.41% of the city's population, while in Toledo this figure rises to 14.61%.

The SVS analyses three main areas: housing and environment, basic services, and cultural services. When examining housing and quality of life specifically, practically all cities include aesthetically pleasing environments which stand out (Fig. 4. Blue crosses). The above-average scores in the graphs represent this general tendency. The assessment is more moderate in only one of the cases and is considered to be similar to the rest of the housing environment options. In all cases negative assessments are attached to images representing a well-preserved environment, which is seen as more deteriorated or decadent (Fig. 4. Purple crosses). This is particularly the case in three of the five cities - Salamanca, Cuenca and Avila. In terms of other elements of the environment, leisure is rated particularly highly in all the cities, with mobility

and clean energy options also receiving higher ratings. In two cities in particular, Salamanca and Toledo, the incompatibility between neighbourhood life and traffic is especially criticized.

Fig. 4 shows two variables for services. The image of an abandoned business or activity is generally rejected, while in contrast, any other type of business is viewed positively in practically all cases. All options are accepted for the uses of the buildings and some of these are highly valued. The adaptation of historic buildings through contemporary architectural solutions may have provided a balanced response which has made it possible to remain within neutral parameters. In the case of workplaces, the responses are very favourable across the board and there is no indication that new forms of occupation with innovative activities such as coworking offices are being rejected. In addition, well-established basic businesses like traditional bakeries are highly valued (Annex 2. SVS. Basic services).

The results obtained show the value that respondents attach to cultural services, from the traditional to the most innovative. While forms of cultural expression are generally well received, in three of the five cities certain forms of street art are rated very negatively. In the other two cities, these score somewhat lower than the rest of the options, although the responses are within the normal range. Nevertheless, one of these cities stands out for accepting this street art more openly, or at least for viewing it as an equally valid form of cultural expression. In terms of both the cultural programming of more local-cultural activities and that of the more innovative ones, all cities value the variety of available services positively (Annex 2. Cultural services).

PS results are used to contrast the accuracy of previous CDB and SVS data analysis (Table 3). When verifying the survey with the data obtained by CDB and SVS, only the three fields mentioned are extracted. In reference to housing and quality of life, most of the population surveyed report a good sense of safety, no pollution or bad smells and an efficient street cleaning system. The main complaints refer to the lack of green areas (54%) and problematic accessibility (60.4%). According to 45.7%, housing in these areas has helped to attract neighbours with higher income levels, displacing young people. However, a similar percentage (48.7%) also feels that the quality of life of the residents has improved thanks to this. In this sense, 53.4% say that it has facilitated the rehabilitation of residential buildings.

In the case of basic services, the individuals consulted consider administrative services and other essential services such as pharmacies, social centres, local shops, supermarkets and schools to be close or very close. They also feel that these services are of good or excellent quality. 67.7% speak of a better cultural offer in general, while 70% report good relations between residents and tourists. However, between 75.8% and 78.4% say that this benefits the tourist sector more than the residents. This situation has led to the appearance of businesses more geared towards tourist collectives so that bars and restaurants, for example, have raised prices considerably (see Fig. 5).

The content of the questionnaire in Fig. 5 and annex 3 is taken from the PS and is divided into the following categories: housing and the built environment, primary services, and cultural services. A Likert scale was used, where '1' means strongly agree and '5' means strongly disagree (Fig. 6). Using the data obtained from the survey and cross-tabulation tables in the SPSS Statistics program, the means were calculated based on the opinions provided. As this is a parametric study based on cities with nominal responses, for the purposes of comparison one graph was created for each city.

4. Discussion

Researchers use CDB quantitative data to map and analyse the five World Heritage areas by exporting datasets to a geo-referenced database. These data provide important information on contemporary challenges to habitation. Given the ever-changing nature of World Heritage areas due to seasonal pressures, certain habitation patterns at district level can benefit from an initial cross-referencing of hotspot

Table 3
CBD quantitative data and PS qualitative and quantitative perception of services and the characteristics of the built environment.

| City		Ávila	Cuenca	Salamanca	Segovia	Toledo
Basic Services	CDB Foursquare (n)	46	29	148	101	181
	CDB Google (n)	36	16	39	56	44
	PS interview Q20-25	4.13	3.91	4.25	3.83	3.84
Cultural Services	CDB Foursquare (n)	17	10	35	26	65
	CDB Google (n)	11	10	15	11	23
	PS interview Q16-19	2.32	1.66	2.50	2.64	1.96
Housing and the Built Environment	CDB Green areas (n)	8	3	17	12	25
	PS interview Q5	1.58	2.82	1.90	2.38	2.42
	CDB Road access sections (n)	156	194	228	196	209
	CDB Pedestrian-only sections (n)	10	54	66	31	40
	CDB Height difference (m)	37.39	71.22	32.3	54.4	89.73
	PS interview Q6	1.9	3.15	1.22	2.37	2.99
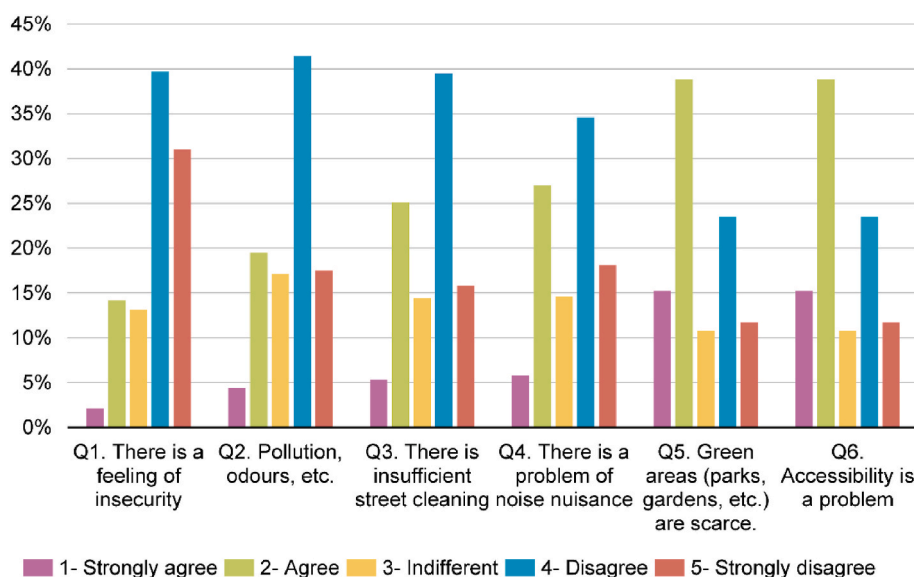
Fig. 6. Example of PS content of questions for Housing and the Built Environment section with outputs for the entire sample, the five cities.

activities against population density and the quantity of non-primary housing, before cross-referencing coldspots against the type of services, population density and accessibility. CDB data reveal parallel functions of districts that can be further analysed by cross-referencing three parameters: hotspots, housing and the built environment, and the quality and quantity of basic and cultural services near coldspots.

Following CDB data, the contemporary World Heritage area still has social values relating to leisure and recreation in addition to historical and architectural ones. At the same time, it seems that districts not subject to seasonal pressures receive less attention and thus evolve and decay at a different pace. Accordingly, this paper conducts additional data testing of stakeholders' perceptions of hotspots and coldspots because, while online data reveal information not easily detected through onsite analysis, these cannot faithfully depict the specificities of daily life. Therefore, here the CDB preliminary study is contrasted to SVS and PS for the most relevant of the socio-cultural spheres.

4.1. Hotspots, housing and the environment

Given that the urban landscape is under considerable pressure from seasonal demands it has become difficult to balance pressures between districts, particularly in those accommodating permanent neighbours. Thus, hotspots and coldspots illustrate the tensions which result when activities and services in a given district have the opposite effect in the neighbouring ones (Figs. 7 and 8).

The CDB approach shows how hotspot activities normally present two main point clouds in two or three districts of each area, primarily in denser districts which are perhaps more appealing in terms of mainstream forms of habitation and lifestyle. Within this study the exception to this is Cuenca, an anomaly explained by the parameters of morphology and accesses (Fig. 3 and Annex 1. Hotspots & Coldspots maps). CDB quantitative data are corroborated by SVS qualitative data where respondents emphasize the idyllic built environments positively but penalize the coldspots in decaying settings (Fig. 4 and Annex 2). PS qualitative responses back the previous results by ensuring that, whether the environment is aesthetically pleasing or decaying, interviewees perceive cities as safe and clean (Fig. 5 and Annex 3).

Other elements that offer options for leisure in the built environment, such as open-air facilities, parks, squares, and other forms of meeting points, are present and available to some extent in every city. However, distance-based CDB data show that while some districts are not close to these public areas, they are highly valued in SVS results. PS respondents are critical of the shortage of green areas, as well as highlighting accessibility problems in any green areas found. In addition, SVS answers show a preference for zero-emission transport, with the cities of Salamanca and Toledo being particularly opposed to traffic within the World Heritage area. PS data further confirms that public transport is insufficient.

During this process, researchers wanted to know how perception figured in a semi-structured section of the PS survey and as Ms. Marta

Fig. 7. A historic retail store currently also selling tourist souvenirs in a hotspot location of the WH area. Ávila, 2021.

Laguna, a local economist and key informant in Segovia, explained:

"Segovia has experienced a significant decline in population, particularly affecting the number of residents in the historic centre, where most residents are older. Consequently, they lack the necessary means and motivation to coordinate their efforts for mobilization. Additionally, the high cost and limited availability of land in the centre of Segovia have resulted in a mass exodus, primarily among the younger population."

4.2. Coldspots and basic services

CDB analysis reveals an interesting pattern in which many services, both basic and cultural, are located in or beside less dense districts. Maps show that although services are found in coldspots, they are well connected to the corridors of main hotspots. This fact is backed by feedback from PS respondents who feel that services are close or very close and are of good or excellent quality (Fig. 5).

In any case, maps show that the basic services are few and scattered, usually in line with the population densities of coldspot districts. SVS perceptions further support the CDB findings as stakeholders negatively value anything associated with the neglect of services and activities (Annex 2. Basic services). This reaction is similar in all cities, while the promotion of new enterprises tends to be welcomed regardless of type and use.

When referring to building uses and the urban scene, SVS stakeholders are less prone to accept innovative buildings and architectural solutions, confirming that residents prefer idealistic settings for mainstream cultural consumption such as those found in hotspots. In this context, the incorporation of new uses for buildings as workplaces, irrespective of the type (e.g. coworking, craft studios, factories run by smaller entrepreneurs, etc.) is favoured, although traditional businesses tend to be better received. This shows how district imbalances are not usually welcomed by neighbours and highlights the fact that underused buildings in coldspots require attention from town planners.

Ms. Isabel Ralero, an anthropologist and key informant for the PS in Toledo explained:

"As a long-term resident of the historic centre, both my family and I have deep roots in this area. My personal history is closely intertwined with the historic neighbourhood. Last November, I completed a book entitled "Visitors and Residents: Exploring New Approaches to Coexistence in Toledo." Through this work I aimed to connect community engagement and basic services in the historic districts with sustainable tourism policies. My objective was to examine the impact of these factors on depopulation."

4.3. Coldspots and cultural services

CDB shows how some unattended or peripheral coldspots display an occasional concentration of activities. This is mostly due to the fact that some locals tend to show interest in places relevant to their daily life activities (Fig. 3 and Annex 1. Hotspot & Coldspot maps). In SVS, neighbours report positive feelings towards almost any form of cultural representation. However, respondents from three cities, Ávila, Cuenca and Salamanca, expressed some disagreement with certain forms of artistic and cultural expression usually associated with young people (Annex 2. Cultural services, image 1). Rather surprisingly, this does not occur in one of the cities studied. This is an encouraging sign for alternative forms of culture, which may be welcome, opening up new avenues moving away from the widely accepted images of the sophisticated heritage city.

SVS respondents positively value cultural programming and traditional and innovative activities and services. This reflects how residents accept and appreciate a mainstream cultural offer if available at a reasonable price. Equally, the PS poll reflects residents appreciating a better cultural offer since hotspot services have resulted in greater numbers of newcomers to World Heritage areas. Emphasis is also placed on the need to improve relations between locals and foreigners as it is widely accepted that although World Heritage areas have benefited from the tourist sector, it has also had a negative effect on the local

Fig. 8. A historic retail store now closed in a coldspot location. Ávila, 2021.

lifestyle (Fig. 5). While this might seem a contradiction in terms, it reflects the rising cost of living and the displacement of some strata of the population, particularly the young and the elderly, as seen in CDB analysis (Fig. 3 and Annex 1).

Finally, it should be noted that while all five cities display similar CDB imbalances, the two smallest ones, with less population but more services per person, Ávila and Cuenca, are more critical than the bigger ones of all the parameters under assessment except for transport. This shows reveals that the scale of the city affects perception when similar problems are being considered.

This final point is confirmed by the interview of Mr. José Luis Villagarcía, an architect and key informant in Cuenca, who spoke about the pandemic:

"The residents in this area have experienced a period of calm. There was a noticeable absence of people, and life was incredibly enjoyable. It was a topic of conversation among all of us who live here. It was delightful to have the old part of town empty of crowds, allowing us to freely explore and enjoy everything. We could visit the Plaza Mayor, bring our children along, take leisurely walks without encountering many people. That was definitely a positive experience. (…) I'm not certain that we have considered the implications of only relying on tourism. It presents a challenge because there is a lack of permanent residents, and the prevailing approach seems to be reducing everything to a service-based industry. Personally, I don't believe that will be a sustainable solution or outcome because there aren't any alternative options available."

Accordingly, the potential biases in the management of WH areas is undeniable given the scant attention given to documenting online data and onsite polling in relation to people's experiences, perceptions, and activities in these sites. The analysis demonstrates that the success of protected areas is dependent on several factors and the pre-existing characteristics of places. These elements influence which districts are more visually desirable to live in or are in worse physical and social conditions. In general, data reveal the pressures of mainstream cultural consumption, as well as the existence of spatial disparity between districts depicted by hotspots and coldspots. Fig. 9 belongs to an unattended area for tourists where street art is the cultural expression of young locals. This place is controversial because it is not subject to the canonical preservation of the urban fabric and provides space for alternative relationships. Paradoxically, in these areas, the social value gains more relevance than the historical one and permits its flourishing.

4.4. Theoretical contribution

Following the first hypothesis on the pressure of visitors, CDB online data representation shows how hotspot and coldspot distribution affects the presence of assets and services and in turn creates uneven habitational patterns between districts. This shows the challenges to management in balancing pressures through the redistribution of assets and services. The CDB approach highlights the concentration of hotspot activities in denser and more aesthetically pleasing districts, with a few exceptions based on morphology and accessibility. This is in line with the findings of Buzzacchi et al. (2021) on the key factors connected with the distribution of activities.

The SVS and PS qualitative data reinforce the importance of an attractive built environment and penalize decaying environments or coldspots, the absence of green areas and the ease of access for the benefits of inhabitants, following the analysis of Curado et al. (2021). This is corroborated by other studies focusing on the need for quality urban green spaces, reflecting user perceptions (Stessens et al., 2020). The cross-referencing of data supports the idea that management affects stakeholders' perception. In addition, while stakeholders admit the importance of the aesthetics, they also call for a functionality which is not to be found.

Functionality refers to the existence of facilities and availability of

Fig. 9. A controversial space in the buffer zone of the WH area in Salamanca, 2021.

services. As defined by the second hypothesis, lack of attention to certain areas affects the quality of life between districts and fragmentation which is exacerbated by contemporary non-data-driven management. Here, divergences can be observed between PS respondents and CDB maps supporting the hypothesis that coldspots are not functional. SVS perceptions reinforce this idea, while also stressing how imbalances between districts are not welcome, since this situation affects societal structure in terms of both density and marginalization.

Similarly, following the third hypothesis, the availability of cultural services is determined by the intensity of tourism and the resident population typology. The CDB clearly expresses this, but according to SVS and PS data it is widely accepted that the cultural offer for locals is lacking. Equally, respondents state that World Heritage areas have benefited from the tourist sector at the expense of the locals' lifestyle, leading to rising living costs and population displacement, as seen in previous studies (Gannon et al., 2021). In cultural terms, a relevant outcome behind SVS responses is the positive opinion towards almost any form of cultural performance in a historic site. Nevertheless, polarization does exist: while most responses do not accept occasional cultural expressions, others, possibly from particular districts, are open to new avenues of cultural representation.

All in all, the findings of this study contribute to both the literature on historic cities and the understanding of transversal analysis techniques for participatory planning projects. While the results are focused on specific locations, they shed light on a global and multifaceted discourse and demonstrate how digitization and perception translate into the reality of planning and social sciences. In terms of urban planning, the analysis of the five historic cities moves beyond the use of digital technologies such as online datasets and Geographic Information Systems (Chen et al., 2019; Saker, 2017). This progress in digital planning has demonstrated the need for greater stakeholder involvement in placemaking processes.

Additionally, the results support previous scientific studies emphasizing the perils of relying solely on digital methods to understand urban patterns. Currently, there is a lack of comprehensive application of digital participatory planning in historic cities due to the developing use of digitization in placemaking processes (Smaniotto et al., 2023) and the absence of a holistic approach to conservation and management plans. This study supports the findings of Liu et al. (2022) regarding the existence of numerous shortcomings in the incorporation of social perception and behaviour into planning for historic cities. This research is therefore a step forward in evidence-based planning, as held by Jiang et al. (2021).

Despite the differences in techniques, the groups involved, and the geographical areas, this study and previous research share similar findings. The consistent results strengthen the argument for the credibility and accuracy of a theoretical framework to address future challenges for historic cities.

5. Conclusion

The results of this research can be useful for heritage policy-makers and planners worldwide. In the case of Spain, examining and cross-referencing data to assess structural deficiencies in World Heritage areas has proved effective. The combination of three data sources, one quantitative and two qualitative, has shown extensive similarities, albeit with some nuances. Future studies should focus on the limitations in the geolocation of the qualitative data. A more focused data collection on specific aspects of the districts may well offer more conclusive specific responses for both hotspots and coldspots.

In line with the objective and hypotheses of the study, results show three noticeable management challenges to consider for the future of World Heritage areas. Firstly, although all protected areas are socially active, some social and cultural imbalances can be identified in the different districts, particularly those with dysfunctional areas. Secondly, when observing structural polarization it is practical to resort to the study of the dynamics of districts. A look at online and onsite data provides an understanding of how stakeholders in World Heritage areas adapt to this social, economic, and mobility-related polarization based on their perception of life in certain areas considered dysfunctional. Thirdly, the study reflects the changing state of the consumption of culture where, although several forms of cultural representation are widely accepted, there is still work to be done in order to provide a space for alternative or countercultural movements.

Thanks to data verification it was possible to demonstrate the validity of online data and quantitative digital models, but models need regular observation to prevent long-term bias at local management level. In addition, further use of online data may benefit from artificial intelligence monitorization of visitors' and residents' passes and cards. These can contribute to a more accurate analysis of the routes taken, means of transport used and places visited by both groups. However, these data need to be open, explained and ethically verified through forms of citizen-led participation. Open and ethically tested AI helps the implementation of data analysis to avoid or reduce inequalities between districts and improve the quality of life, which in turn helps manage services, upgrade accesses and attract new residents to decaying districts.

The study highlights areas for improvement to prevent urban polarization, especially strengthening policies that have an impact on the quality of life in historic cities. Data analysis reveals that the disparities could be countered through participatory methods in the process of maintaining the outstanding universal value while also prioritizing the adjustment to social factors as the key to achieving social sustainability. Finally, future research could incorporate a longitudinal comparative analysis to enhance comprehension of challenges over time. This could be achieved by implementing international charters and recommendations in a broader study, involving multiple historic cities in Europe and other regions worldwide. Such an approach could bolster the results of this study and provide more detailed insights.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.habitatint.2023.102900.

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