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People-Place Interactions: From Pictures and Stories to Places and Sense of Place

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The emergence of a networked society generates transformations in the dynamic interactions of people impacting cultural and service systems. A location can provide different individual and collective meanings, perceptions, and experiences to different people. However, it is unclear how urban actors can collect, measure, and operationalise such place-based knowledge. Thus, this work addresses the Social-Design Modes theme from the IASDR community, rethinking how urban actors can interpret place-based knowledge from a given community. This research evaluates the potential of an exploratory method involving photo-based storytelling to unpack key factors associated with a place. Geographic Information Systems support the approach in order to transfer complex subjective experiences into simple and unique geographical representations. We provide empirical evidence of how this method operationalises individual and collective place-based knowledge through two study cases. This method merges design with the 'social' to respond to pressing social questions by urban actors. The methodological implications encountered through this process may act as guidelines to inform practitioners in related fields and other areas of knowledge.

Keywords: place; storytelling; geographic information systems

1 Introduction

Cities are complex and evolving environments in which citizens carry out their daily lives. The locations that citizens often visit define their network of familiar places and social relationships. Likewise, each citizen has a unique perception of a city shaped by different experiences and the possibilities that the place offers (Gieryn, 2000). For example, while a soccer stadium could be a special place for a player who won a tournament there, it could also be a meaningful place for a couple who got engaged during a match. However, this unique, dynamic, and time-dependent place-based knowledge is still not fully articulated by urban stakeholders, and opportunities to add

citizens' place-based knowledge into city processes such as planning, participatory history, and decision-making initiatives have been missed. City governments rely heavily on census data, sensors, and quantitative information to observe, analyse, and mitigate urban challenges. Such a focus reduces the characterization of the urban environment to quantitative attributes, leaving aside the qualitative nature of individuals' interactions with their environment. The motivations are multiflued.

Firstly, practitioners lack of a unified process to combine multiple singular perceptions towards a geographical area or object to create a common knowledge (Goodchild & Janelle, 2010). Secondly, the storage of dynamic and complex place-based information presents difficulties in what and how to preserve their primitive forms and dependencies (Purves et al., 2019). Thirdly, governments are still lacking in analysing the potentialities of the urban environment from a place-based perspective (Acedo, Painho, et al., 2018). For example, we have plenty of available information about the locations of lamp posts, listed buildings, or bars with good reviews in a given city. However, it is unclear how to gather, measure, and validate data about which places or urban amenities foster positive or negative sentiments and perceptions among people. Finally, despite the disciplines of Human-Computer Interaction (HCI) and urban informatics research have often addressed how to gather, operationalize, and understand the notion of place and "placemaking" (Akpan et al., 2013; Cranshaw et al., 2016; Crivellaro et al., 2015), there is a lack of common frameworks and methodologies to effectively gather place-based knowledge in a practicable way for other related disciplines and stakeholders (Brown et al., 2015; Huck et al., 2014).

This research provides new methodological contributions about leveraging the knowledge and experiences of city residents for researchers and practical implications for communities, municipalities, and policy-makers. It describes and analyses the results and implications from a novel method designed for the collection, mapping, and operationalization of place-based knowledge through two communities case studies. Drawing from the fields of HCI, storytelling, and Geographic Information Systems (GIS) literature, we develop an exploratory method which unfolded into two parts: (i) to unpack the key themes from complex narratives, elucidated by pictures of meaningful places, and (ii) to mobilize the collected themes geographically through the notion of sense of place. The geographical acquisition of such place-based knowledge allows us to look at cities as not merely physical spaces but as meaningful intersections of people, places, stories, and experiences (Bonacini, 2019; Crivellaro et al., 2015; Taylor et al., 2015). Although city solutions are mainly decided upon from a top-down approach and supported by governmental information, this contribution highlights and provides evidence about the importance of new methods and methodologies for leveraging the knowledge and experiences of city residents to complement, for instance, current official data, planning decisions, and cultural heritage assets.

This paper starts with a presentation of the state-of-the-art of place studies in HCI and a review of methods that have been applied to collect place-based knowledge from narratives elucidated by pictures and GIS. The article then presents our exploratory method and the results obtained from two communities, followed by a discussion about the opportunities and limitations of our approach. Lastly, we conclude reflecting on the opportunities to combine storytelling, HCI, and GIS for the collection, mapping, and mobilization of place-based knowledge.

2 Related Work

In this section, we first review the notions of place and sense of place in HCI. We then provide an overview of storytelling methods elucidated by pictures, which have focused on highlighting place meanings and socio-cultural contexts. Finally, we review methods and tools within the participatory GIS domain that attempt the mapping of place-based concepts and knowledge.

2.1 Place-based knowledge and HCI

In the field of geography, place is referred to as a space endowed with context and meaning (Tuan, 1978) and perceived by individuals' experiences. However, these subjective meanings are difficult to quantify and justify in empirical terms (Cross, 2001). The processes involved in forming this connection are seen by many as broad and complex and it has been said that we can "sense" places in many subtle and subjective ways. Perhaps this is why we sometimes use the catch-all term "Sense of Place" to describe our relationships with specific locations, as this helps to congregate these varying notions under one banner. While *place* is a complex and multi-faceted concept, *sense of place* is focused on the singularity of a particular view towards a geographical area. In other words, place is the unique experiences and perceptions that a human being might encounter within a particular surrounding (Steele, 1981). Thus, in this study, sense of place refers to the feelings, beliefs, and behaviours that humans associate towards a specific place (Jorgensen & Stedman, 2001). In this way, sense of place is transactional because we take feelings, beliefs, and behaviours from our experiences regarding a location and then react in a specific way towards that experience.

Although geographers have been dealing with the qualitative study of place for more than 50 years (Tuan, 1978), the evolution of smart and connected cities is offering new opportunities and methods to empirically re-examine the notions of place and sense of place within HCI (Akpan et al., 2013; Cranshaw et al., 2016; Crivellaro et al., 2015; Dourish, 2006; Freeman et al., 2019). For example, researchers have captured and recorded emerging cognitive maps through human behaviours in specific environments (Dearman et al., 2011), investigated the possibilities of quantitative and qualitative data in a street's community to extract rich and heterogeneous human and nonhuman assemblages (Taylor et al., 2015), and generated online heritage initiatives by creating and sharing written text, images, video footage and audio about places of interest (Bonacini, 2019; Szabo et al., 2017). These approaches underline the interplay between the things we encounter, both physically and emotionally, and how are they associated with a place and its meaning. Hence, the understanding of the personal and public meaning of places requires an assemblage of various data to convey the different nuances and aspects of place and sense of place in cities at large. Methods used to form such an assemblage include, but are not limited to, semi-structured interviews, discourse analysis, cognitive and morphological mapping, sustained visual observation, spatial syntax analysis, digital storytelling, and photo-elicitation (Dearman et al., 2011; Taylor et al., 2015). Such approaches are now often used in HCI studies as means to understand place.

In this way, place-based HCI innovations can offer valuable evidence in support of the uniqueness of geographical spaces, while illuminating ways in which they might change or benefit from preservation (Freeman et al., 2019). From the range of methods that help us process place and place-based knowledge, this research focuses on the combination of storytelling and GIS methods as tools to help foster the acquisition of place-based knowledge. While the process of storytelling

facilitated by pictures responds to the complexity of place discourse through words and the recollection of meaningful information conveyed by an image, GIS offers geographical tools to pursue the spatial definition and operationalization of sense of place.

2.2 Place-based photo-elicitation and storytelling

Photo-elicitation has been used among social science disciplines as a method to gather insights emerging from participants' memories and personal experiences of place (Loeffler, 2004; Nisi et al., 2021). Photo-elicitation provides individuals with cognitive links needed to access memories of experiences within space (Blinn & Harrist, 1991) and is a key tool for social and historical research (Tinkler, 2014). In contrast to traditional interview approaches, photo-elicitation methods incorporate a picture that aid participants to engage with meaningful personal experiences in greater emotional depth alongside the interview (Jacobsen, 2007). Photos act as a mediator to relieve the focus of the interview from participants and enable participants to feel valued in a non-evaluative way (Dennis et al., 2009), and can also act as "visual inventories" of individuals, conveying the collective and institutional experiences of people and the personal dimensions of their social experience (Clark-IbáÑez, 2004). For example, Gil-Glazer (2019) analysed the value of photo-elicitation when exploring family photo-albums to inspire discussion and associations to specific places among Arab and Jewish students in Israel. Likewise, Ortega-Alcázar et al. (2011) used photo-elicitation to construct stories with Nigerian and Indian immigrants, living in deprived areas of London, through the exploration of objects, locations, people, and memories.

The process of photo-elicitation has also come under criticism for two main reasons: the challenges of finding questions that are relevant and powerful for participants and the sometimes superficial responses that they can elicit (Samuels, 2004). The importance of context was also a major factor in Hanson and colleagues' study (2016) of socioeconomically deprived communities in Great Yarmouth, England. The combination of photographs and semi-structured photo-elicitation and interviews allowed the researchers to understand the meaning and "insider" experience of place. Some researchers have also experienced difficulties in elucidating how the deeper knowledge that is embedded in a picture can be revealed through narrative. For example, Buckley (2014) noted that participant responses in their study mainly focused on aesthetic and stylistic aspects to the images and that little reference to the deeper societal themes embedded within the photographs emerged.

We might deduce from these varying global examples that photo-elicitation is often most successful when approached in an empathic manner that offers agency to participants. Concurrently, digital initiatives over the past twenty years have reflected upon the uses of photos and locative media to capture, preserve, and share personal experiences in a geographical context. Wireless applications have allowed users to remotely author location-specific content through the inclusion of digital media, such as pictures, creative writing, short movies, and sounds (Lane, 2003). Applications provide users with ubiquitous toolkits to allow the authoring, sharing, and annotation of media in order to tell stories about physical spaces and places (Tonge et al., 2013). Such tools enable users to offer in-depth information elicited by image. As such, they can act as instruments to extract rich social and emotional information from an individual's daily interactions within a given location, and thus provide new ways to capture place-based knowledge.

2.3 Place-based participatory tools in Geographic Information Systems

The inherent dynamism and geographical vagueness of place-based concepts make their mapping and incorporation into other disciplines difficult (Brown et al., 2015; Huck et al., 2014). Adding boundaries to place or place-based knowledge is always accompanied by inherent problems (see (Massey, 1994)). The process can sometimes over-simplify complex multi-faceted concepts such as place and sense of place to plain coordinates, objects can also lose precious information, spatial accuracy, and geographical context (Huck et al., 2014). For example, when measuring place-based concepts, the level of granularity at spatial scales can change the extent of responses, particularly in data derived from transnational or regional surveys (Brown et al., 2020).

However, some studies have developed participatory GIS tools, under specific and controlled conditions, to be able to discern place-based concepts and spatial behaviour and patterns (see (Brown et al., 2020)). Brown and his colleagues have largely contributed to research on map-based methods for measuring landscape values from citizens and tourists' point of view (Brown et al., 2015; Brown & Raymond, 2007; Raymond et al., 2010). Alto University developed the Maptionnaire software, a tool to create map-based surveys to get ideas and insights from residents based on Soft-GIS methodology (Carver et al., 2009). Jorgensen (2010) conceptualized the empirical model "attitude-based evaluative mapping" that attempted to study the spatial dimension of sense of place and social capital (Jorgensen & Stedman, 2011). Huck and colleagues (2014) advanced on capturing imprecise notions of place through a public participatory geographic information system platform called Spraycan. More recently, Acedo and his colleagues built a web-application (Acedo, Mendoza, et al., 2017) to study the topological association and implications of place-based concepts in Lisbon (Acedo et al., 2019; Acedo, Painho, et al., 2017, 2018; Acedo, Santa, et al., 2018; Acedo & Johnson, 2020).

Although there is an extensive variety of tools to gather place-based knowledge, a unified agenda to formalize this understanding among GIS scientists is still lacking (Goodchild & Janelle, 2010). There is still no unified process to normalize and include this information in governmental agendas and it is largely absent from planning and participatory studies as a result. We thus see an opportunity to complement storytelling and photo-elicitation methods with HCI and GIS tools in order to capture nuanced place-based knowledge and reinforce the impact of this knowledge in other disciplines such as urban and decision-making studies.

3 Research Questions

Experiences located in the same place produce stories that provide different subjective meanings and perceptions. However, understanding how to gather, normalize, create, and curate qualitative information from this place-based knowledge is an ongoing research challenge. Moreover, this knowledge is rarely accessible by citizens, communities, and municipalities, such that it can empower their needs and desires. There is a need to implement strategies and methodologies to better analyse human-environment interactions and human experiences in ways that consider the geographical and cultural context where those interactions occur. In response to these problems, this study combines place-based knowledge from individuals' locative photographic stories with GIS capabilities, to provide new methodological contributions for researchers and practical implications

for communities, municipalities, and policy-makers. With these motivations, we address the following high-level research questions:

- RQ1:How can we leverage storytelling and participatory GIS to unpack, examine, and operationalize place-based qualitative knowledge for citizens and communities?
- RQ2:What are the methodological implications and limitations that emerge out of combining storytelling and participatory GIS in studying place-based knowledge?

4 Methodology

This section describes the exploratory and qualitative approach we designed to collect and analyse community members' perceptions, attitudes, and experiences towards personally meaningful places, and the process of mapping this personal knowledge through the notion of sense of place. The method of this study articulated two distinct parts (acting as activities), in which the same participants contributed. Firstly, in Part #1, we asked participant to document places which were meaningful for them, through place-based photographic stories (pictures accompanied by one paragraph texts). Then, we conducted a thematic analysis of the textual content to extract common themes. Secondly, in Part #2, participants answered a map-based web survey, to map their unique experiences and perceptions about specific locations and their sense of these places. From the data of the study, we derived maps representing the communities' meaningful places and sense of place. Each of the participants also responded to a survey about the limitations and possibilities of the study. The sequence of steps followed in this study is depicted in Figure 1.

4.1 Contextualizing the case studies

The study was based on two communities, one located in Madeira Island (Portugal) and the other in La Garriga town (Barcelona, Spain). The selection of participants was limited by the current pandemic situation (Cesário & Nisi, 2021) and followed a convenience sampling of participants known to the researchers. However, some criteria were established before the sampling took place. Firstly, we aimed to have two communities formed by established social groups. Secondly, we intended to demonstrate the versatility of our method in embedding and managing different spatial scales. Finally, we also intended to represent a cross-cultural populations and study communities based in different spatial-social environments. Each participant conducted the activities individually. The Madeiran community is composed of ten participants, all working in the same institution, ITI/LARSyS (five males and five females) aged between 27-35 years old. La Garriga community is a group of ten participants, connected by childhood friendship ties, aged between 32-35 years old (five males and five females). Every participant signed a consent form that explains all the steps of the two parts of the procedure and the associated contingency measures to preserve their privacy.

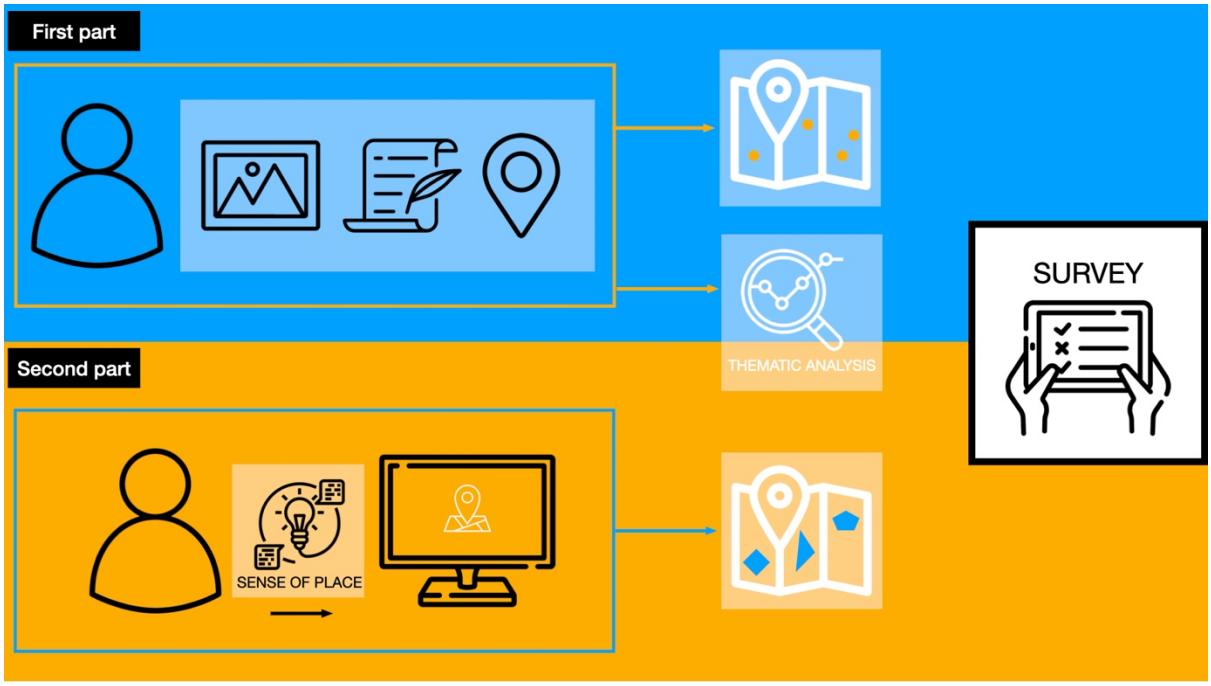

Figure 1. Schema of steps followed in the study.

4.2 Part #1: Place-based knowledge

The first part of the study consisted into two stages: (i) collecting individual's meaningful places, and then (ii) analysing stories through a thematic analysis. Both stages are reported in detail below.

4.2.1 Collecting individuals' meaningful places

During a one-week activity participants were asked to provide between three and five pictures of different meaningful places (from Madeira and La Garriga, respectively). Along with each picture, participants were required to provide a title, a short description explaining the specific location and the meaning the place has for them. The task of taking or providing a picture of a meaningful place just acted as the trigger to recall and reflect on the feelings, memories, and experiences related to it. Thus for each participants' meaningful place, we have a picture, a title, a location (i.e., point), and a story (see Fig. 2). It is also important to note that we explicitly asked the participants about the specific location of the picture to avoid any confusion in interpreting where the photograph was taken. Most of the participants provided a Google Maps location from which we extracted the coordinates. Participants provided all the information individually, sending the content via mail or WhatsApp directly to the researchers.

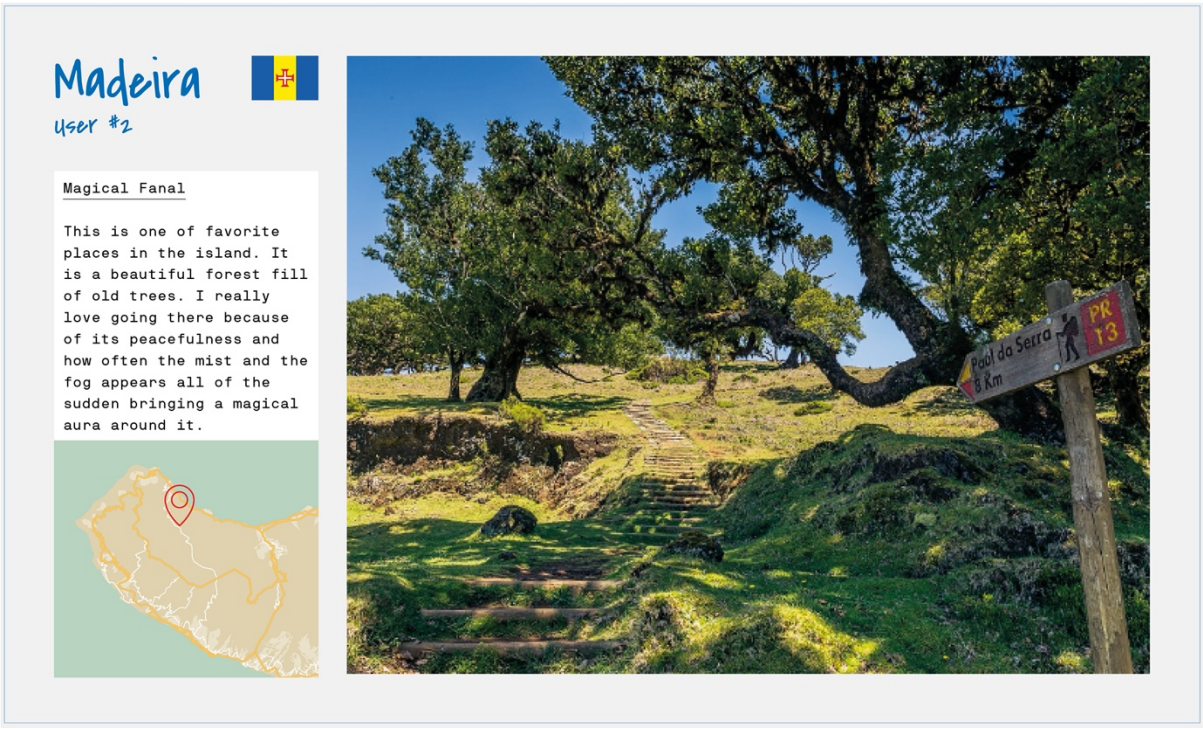

Figure 2. Example of picture and story associated with its location provided by a participant.

4.2.2 Analysing stories and creating place key characteristics through a thematic analysis

A detailed analysis of the textual story content was conducted to understand how and why specific locations are meaningful for the participants. We used thematic analysis to identify, analyze, and report patterns within the data (Braun & Clarke, 2006). Firstly, we started reading the 74 short textual narratives provided by the 20 participants and assigned codes (i.e., a brief description of what was said) to its content. These codes were sorted into eleven sub-themes (grouped by similar concepts), and finally, sorted according to four overreaching themes (*Activities, Physical attributes & features, Socio-cultural aspects, Personal experiences*), highlighting patterns and trends (see section 5.1 and figure 4). The relationship between codes and themes was double-checked by the authors of this study to guarantee consistency between the meanings across the two communities. These themes and sub-themes were given distinct names and definitions, based on participants' original stories, in order to capture the essence or key characteristics of place, for the two communities. Due to the complexity and richness of the stories, several sub-themes were covered in the same story and, thus, in the same location. Hence, a meaningful place for a participant can encompass more than one sub-theme and, consequently, themes.

4.3 Part #2: Geographical dimension of sense of place

The second part of the study consisted into two stages: (i) geographical definition of individual's sense of place, and then (ii) geographical analysis of individuals place-based knowledge. Both stages are reported in detail below.

4.3.1 The geographic definition of individual's sense of place

Participants of both communities answered a 10-minute-long map-based web survey, 5 days after finishing Part #1 of the study, so not to overload participants with tasks. This tool employed for Part #2 of the study is open source (www.placeandcity.com). We provided the participants with a link, to the first page of the survey. The steps that participants followed are detailed below (note that step 3 and 4 are repeated for each area defined):

- *Step 1: complete name and community*. The initial page of the application presented the activity and asked for the complete name of the participants and city or region in which their activity was focused (i.e., La Garriga or Madeira).
- *Step 2*: *name and number of sense of place areas defined*. The platform presents a geographical definition of sense of place based on the conceptualization by Jorgensen and Stedman (2001). First, we asked participants to think about an area or areas that they dentify the most with, and/or feel attached to, and/or depend on. Second, once the participants recalled these areas, they needed to name each area, as a place can arguably only exist once it is named (Gieryn, 2000).
- *Step 3*: *geographical representation (i.e., polygon) for each sense of place area.* Participants were asked to map all their meaningful areas. The platform guided participants in the mapping process and presented a base map centred on the location of the participant. Participants defined a polygon for each area that held a sense of place for them (see Fig.3).
- *Step 4*: *nature of the sense of place area.* For each sense of place area defined, participants had to specify their reason for considering the area a place, choosing from four options. These options were derived from the thematic analysis carried out in the first part of the method (i.e., physical attributes, personal experience, socio-cultural, and activities – see section 5.1) with the possibility to define a new one if necessary.

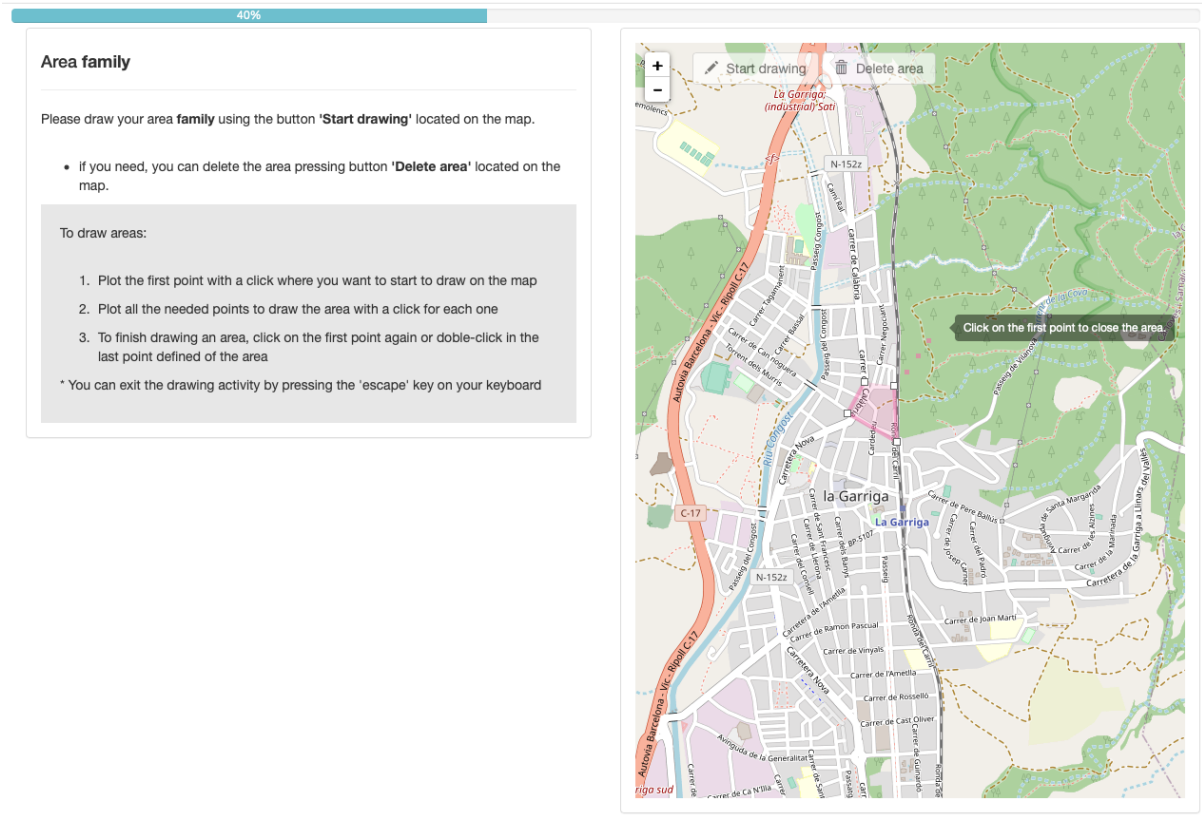

Figure 3. Platform interface to map the individuals' sense of place areas – on the left side it is displayed a pink polygon covering an area of interest in La Garriga.

4.3.2 A geographical analysis of individuals place-based knowledge

While the first stage of Part #2 stored geographic points that represented the exact location of participants' meaningful places, the second stage rendered the polygons mapped by the participants that define their sense of place. The thematic analysis presented in section 4.2 added one or more themes to each meaningful place location (point) depending on the complexity of the related story. For example, the following story from a Madeiran participant was classified with the themes: *Physical attributes & features* (sub-theme: built environment), *Personal experiences* (sub-theme: memories), *Social cultural aspects* (sub-theme: social relationships, home), and *Activities* (sub-theme: duties, sports).

***Title**: Home. **Story**: A top landscape view from my parish and my hometown. From this site, I can point every single place where I spent most of my childhood. My home, my grandparents' farm, my uncles' house, my primary school, the church, the university campus, the place where I currently work. . . It is the place where I grew up, and a share of the view I still wake up every morning. This hiking trail at Montado da Esperança was also a "shelter" during the last weeks of lockdown, the only place I was able to go for a walk and stretch, keeping social distance.*

In contrast, when participants were defining the areas corresponding to their sense of place in the map-based web survey, they could only pick one theme to characterize the polygon. Finally, we

mapped the different areas filtered by community to illustrate the spatial distribution of the themes along the local (i.e., La Garriga) and regional level (i.e., Madeira island).

4.4 Participants' evaluation of the method

Participants were required to fill out a survey – Google form – about their experience with the both parts of the method. participants were asked, on a 5-point Likert scale, how they felt about each activity, its length, and the level of difficulty. At the end of the survey, five questions compared pro and cons of the two parts of the method.

5 Findings

All 20 participants provided between three and five stories each (total of 74 stories gathered) and defined at least one sense of place area. While all the stories were located inside the geographical boundaries of Madeira island and La Garriga town, some polygons indicating sense of place touched more than one town in the La Garriga experiment. We limited the data analysis to those polygons that were entirely within the La Garriga town boundary. Consequently, for Madeira we obtained 39 meaningful places and 37 polygons delimiting sense of place areas while for La Garriga, we collected 35 meaningful places and 52 sense of place areas. We calculated the median for the sense of place areas for each theme, which ended up around 10 hectares each.

5.1 Investigating the nature of meaningful places

Both communities highlighted meaningful places through some similar aspects, such as the locations where they used to live during a defined period of time (childhood, adolescence) and the best and worst times spent in a given place (fun times, challenges, accidents, and deaths). Participants also remembered places they attended regularly in the past, such as childhood schools, universities, and previous workplaces. Moreover, several participants produced aesthetically striking images in picturing their meaningful places, evoking spectacular landscapes and memories of summers. However, as expected, the values that define those meaningful places are different due to cultural and community contexts. Both communities shared some themes, although they referred to them in terms of different values and aspects, the general motives can be coalesced to build a common conceptual framework for the two communities (see Fig. 4). The framework obtained is explained in details below. However, this study does not aim to compare the results and characteristics obtained from the two communities, but to create a process, and framework, that covers the different facets of place detected in participants' meaningful stories from the two communities. While we acknowledge the multifaceted nature of a place, an in-depth analysis or interpretations of the themes from the two communities is out of the contribution scope.

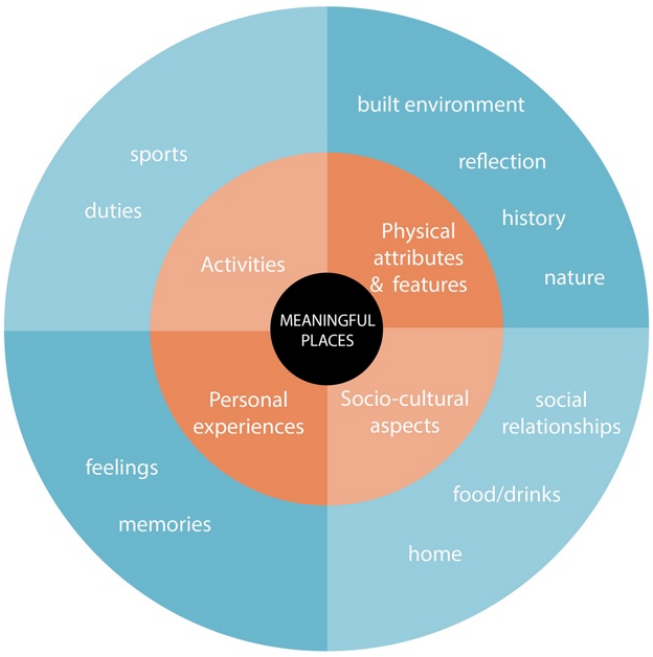

Figure 4. Meaningful places key factors from the two communities studied. Concepts in the orange circle are the key themes that define communities' meaningful places, and the blue circle cover the sub-themes extracted from the stories.

The following list describes the themes from the thematic analysis conducted and mapped in the conceptual framework (Fig. 4):

- *Physical attributes & features* is related to the location and nature of the place: citizens attach to a place its history, contrasts from past to present, activities, central points of the city, and also recall to the beauty of nature and relaxing views the place has to offer (forest, waterfalls, fountains, trees, ocean, mountains).
- *Socio-cultural aspects* related to social meeting points, places of gathering family and friends, meet people and chat, and the value citizens attach to being in their homes and keeping family traditions.
- *Personal experiences* is related to the feelings and memories citizens attach to sites. Citizens feel close to the spaces, feeling inner peace, energized, excited, and astonished with and by such places full of memories, associating both positive and negative memories to such areas (escape the intensity of the city and tragic events).
- *Activities* is related to places that recall a physical activity or duty from the citizens, such as learning new sports (bike, swim), play with others, school and working practices, or even taking public transportation.

5.2 The geographical representation

5.2.1 Community meaningful places

Although we obtained 74 meaningful places between the two communities, the allocation of themes to meaningful places can provide more than one theme for each location (see section 4.2), resulting in 172 themes distributed over the 74 locations. Moreover, the participants' stories related to this location range from personal experience to socio-cultural aspects. Figure 5 shows the spatial

distribution of meaningful places for the two communities. At the regional level (Madeiran community), the meaningful places are spread across the island but having clear clusters around the capital (Funchal) and a nearby city. The reminiscences of physical attributes and features (i.e., physical on the map) such as the built environment and nature are predominant together with the memories and feelings from personal experiences (i.e., personal on the map). At the municipal level (La Garriga community), meaningful places are generally gathered at the center of the town. The distribution of socio-cultural aspects and personal experiences follow a similar spatial distribution focused on the core of the town where recreational places and local social activities mainly take place. In the same way to the Madeiran community, La Garriga has a higher amount of occurrences in the theme of personal experiences.

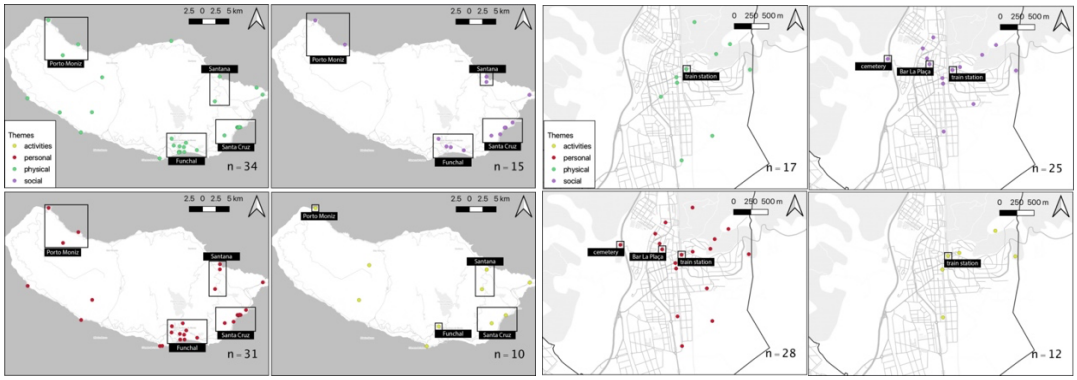

Figure 5. Meaningful places from Madeira (left) and La Garriga (right) communities.

5.2.2 Community sense of place

The spatial dimension of the sense of place collected by this study is represented by the polygons that participants drew through the map-based web survey. Furthermore, participants classified the areas selected by the polygons according to the themes that emerged from the thematic analysis. Figure 6 shows the distribution of the four themes across the maps, for the two communities. The case of Madeira shows socio-cultural aspects located in urban areas mainly in Funchal, while in the case of La Garriga the same theme shows as a continuous area along the city center and extending to the next town. Polygons can span big areas or accurately define specific ones. For example, two participants from La Garriga community accurately drew a polygon around the same urban feature (i.e., a large promenade) but they characterized it according to different themes; one highlighting the physical attributes of the location while the other recalling personal memories linked to that place. The higher amount of sense of place areas defined are related to socio-cultural aspects and personal experiences.

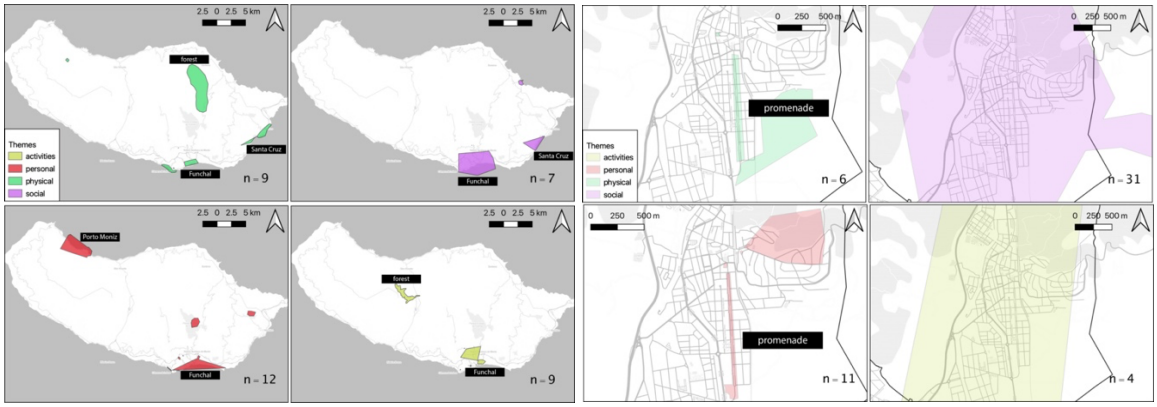

Figure 6. Sense of place areas from Madeira (right) and La Garriga (left) communities.

5.2.3 Participants' evaluation of the method

From the survey data, we can confidently say that they generally liked the activities, with the exception of three. In general, participants enjoyed more the first part (picture taking and storytelling) than the second part (answering the map-based web survey) as they reported that the first part had been explained better. Anyhow, both parts of the method were deemed quite easy. However, when we directly contrasted the two parts with specific questions half of the participants thought the first part was easier and 65% felt that it was more clearly explained. Likewise, 65% of participants noted that the first part of the method helped them to recall and cover their significant places better. When we asked the question*: Which part of the activity covers better your important places geographically, the first part (picture=point) or the second part (area=polygon)?*, 45% of participants preferred the second part, 35% the first part, and 20% both of them. Finally, to evaluate if participants understood both parts of the method, we asked if they thought that both parts of the method were asking the same thing. Three participants (15%) answered this question affirmative.

6 Discussion

Informed by the findings from our analysis, we discuss the research questions proposed earlier in the paper.

RQ1: How can we leverage storytelling and participatory GIS to unpack, examine, and operationalize the place-based qualitative knowledge for citizens and communities?

Together, but not mixed. While most of the photographic storytelling research methodologies in place studies gather insights from participants' memories and personal experiences of place (Blinn & Harrist, 1991; Loeffler, 2004), our exploratory method expands on previous efforts in several ways. Firstly, participants contribute with their own original photos to the study, instead of the facilitators presenting specific pictures of strategic locations for the purpose of a predefined research (Gil-Glazer, 2019; Iliana Ortega-Alcázar & Dyck, 2011). Secondly, the analysis of the place-based stories from our study are not limited to individual experiences (Samuels, 2004), but encompass stories from diverse communities enabling the possibility to extract themes across different cultures, geographies, and size of places (see section 5.1). Finally, the thematic analysis of the stories allows to uncover place-based drivers across different cultures and regions, a valuable resource that few studies have investigated (Blaschke et al., 2018). In addition, place-based themes and sub-themes

can be combined and articulated into a conceptual framework (see Fig. 4) that can be applied in planning, placemaking, and community studies. The main singularity of our method is that we applied the thematic knowledge gained from the the first part of the method, to characterize the participants' sense of place in the second part. Thus, this research provides results for the specific communities examined, the method can be replicated for other communities and governmental institutions interested in operationalizing the place-based knowledge of their citizenship.

From complexity to simplicity. This research highlight people's different ways to experience their everyday geographies and how the concept of place can be extracted from located stories. The latter is a complex narrative conveying information about the individual, context, place, and experiences. However, within this complexity, we found recurrent themes involved in the narrative's construction of the story. From the thematic analysis applied to all the textual descriptions of provided stories we extracted the subjective nature of places for the community, adding a new layer to the urban domain, based on individuals and community knowledge. However, each meaningful place can hold more than one associated theme, complicating possible readings and blurring the essence of our understanding of a place. In this line, our exploratory method simplifies place-based knowledge, by clarifying the notion of sense of place at the thematic level. While a place is a complex and multi-faceted concept, sense of place is the unique experiences and perceptions that a human being might encounter within a particular surrounding (Steele, 1981). The operationalization of sense of place through the creation of polygons by participants allows the defining of thematic entities that can be measured, observed, stored, and reused. Hence, the second part of our method works on accurately defining polygons about participants' sense of place associated with the themes that emerged from their own stories. That is, we moved from complex narratives to simpler geographical representation, that handles and operationalizes individuals' place-based knowledge. Although this process can simplify the concept of place loosing some facets, the reduction of places to polygons create a basic common place-based element to include in urban informatics databases, a social construct for debating in community studies and crucial information to incorporate in planning.

From individual to common knowledge. While the first part of the method is based on individuals' expressions about their meaningful places, the second part illustrates and represents geographically individuals' place-based knowledge. When participants plot place-based information on a map, they might also be locating feelings and memories of their community as stories are often co-experienced with community members. Our exploratory method allows the creation of participated and shared knowledge from a geographical point of view. While the meaningful places are represented by common points across several community participants, the definition of sense of place is pictured through polygons that can tolerate the overlapping of areas between community members. Figure 6 shows the union of all sense of place areas classified by themes for each community. These overlappings are partly happening because of the close ties among participants of each community, being work colleagues (Madeira) and long terms friends (La Garriga).

This study highlights the suitability of the method to advance HCI and other disciplines in the acquisition of place-based knowledge. We provided participants with tools and strategies to understand better, manage, and discover place-based knowledge. The methods sequence of steps allows complex mental perceptions about meaningful places to be mapped to geometrical representations of place-based concepts. This achievement is crucial to advance existent qualitative

knowledge on the notion of place to quantitative place-based data. By using our method is possible to unpack, collect, and operationalize complex place-based stories and concepts to transfer that knowledge between disciplines (e.g., information science, social science). Several HCI studies merge geographical resources, media content and narratives to create location-based knowledge. However, the novelty of our approach consists of the complementary use of storytelling and a participatory GIS tool to move forward in the acquisition and examination of human-environment interactions and human experiences.

RQ2: What are the methodological implications and limitations that emerge out of combining storytelling and participatory GIS in studying place-based knowledge?

When dealing with place-based concepts, geographic procedures and representations, there are several implications in the form of limitations, drawbacks, and benefits of our method. These are intrinsic to the process of asking participants about feelings, memories, experiences, plus adding a geographic dimension to those complex conceptualizations.

Questions and spatial scales. When asking participants about place-based knowledge there are three main factors to take into account: the concept, the spatial scale, and the explicit/implicit locations and map activity.

- *The concept*. To draw a polygon that represents participants' sense of place area on a map is not the same as, for example, locating a bar. Participants need to do an introspection exercise to first understand what they are being asked, then reflect on their experiences and memories to then decide which areas encompass their sense of place. In other words, there is a conscious or uncon- scious training process involved in answering questions or activities that relate to place-based concepts. Thus, for the second part of the method, the concept of sense of place needed to be clarified before participants could start to think about what areas of their context could be cover by their sense of place. Meaningful places and sense of place are concepts that can share values, locations, and even personas. Most participants understood the different nature of each part of the method, but better instructions and differentiation between the two parts could improve the findings.

- *The spatial scale*. Although we explicitly define the geographical context covered by the activities (Madeira island and La Garriga town), participants located meaningful places and sense of place areas outside the proposed boundaries. When participants are providing pictures and stories outside the field of research there is little that can be done afterward. However, the mapping activity can be improved to avoid these kind of issues. Some participants of La Garriga community draw sense of place areas outside La Garriga municipality borders. This confusion may respond to a lack of spatial literacy of participants, concerning the spatial limits of their hometown. However, this issue could be solved by adding a new layer showing the spatial extension of the town in the map layer, to help participants to focus.

Explicit/implicit locations and the mapping activity. Both parts of the method allow to geographically understand the concept of place from different angles. The first part implies recognising and pin pointing a location that participants identify through a third-party application (e.g., Google Maps). This location is the location of the picture and associated with the story. However, the second part of the method implies an exercise of mapping the sense of place using a map-based web survey. Half of the participants perceived that the first part of the method was easier to perform. 45% of participants reported that the map-based web survey helps them to define their important places in a more precise way. A clear example of this is the case of La Garriga's promenade. Two participants from this community marked it as meaningful and emanating a sense of place. While the point was located at the beginning of the promenade, the polygons perfectly defined its urban morphology (see Fig.6). However, prioritizing the definition of polygons and boundaries for the acquisition of place-based knowledge also implies several constraints connected to the inherent dynamism and boundary vagueness of that kind of concept and knowledge (see (Elwood, 2006; Massey, 1994)). Besides that, and based on the results of this study, the spatial definition of sense of place through polygons can derive either in precise definitions of a meaningful area or a generally meaningless area overlapping an entire town, city, or even a country. More research needs to be done on how to restrict the mapping activity to cover individuals' feelings, beliefs, and behaviors without limiting the freedom of participants' expression.

7 Conclusion

This study highlights the potential of unpacking storytelling facilitated by pictures for the study of place-based knowledge and the key role of GIS tools to inform the HCI field in the pragmatic acquisition of place-based knowledge. Our exploratory method shows the potential of HCI to move forward in the acquisition of (i) how places and urban environments foster, shape, and help people's cognitive perceptions, and (ii) how dwellers perceive their spatial surroundings to learn the multi-functional facet of the spatial organization of place. Bridging HCI scholarship within place theory through a participatory GIS method provides a range of opportunities to comprehend the continually shifting city environment. In line with Dourish's (2006) request to reconsider how we generate spatial forms and articulate spatial experiences, the current research provides and presents an exploratory method and it's implications in mapping and reading subjective place-based knowledge as a new resource for place practitioners to use, interpret, and, hopefully, extend.

All the results of this study are constrained and limited by the two communities studied; Spanish and Portuguese people in their 30's, most holding a background in higher education and a familiarity with using technological solutions in their daily life. For example, the framework obtained from the first part of the method (section 5.1 and Fig.4) represents just the two communities where the experiment was conducted. This means, that the findings are swayed by the place-based themes and facets of these targeted social groups. A wider and more heterogeneous sample would be useful to better evaluate the exploratory method presented and the implications defined. Moreover, the limited demographics of participants bias the areas highlighted and selected by the two communities. However, other social groups or unrelated participants with mixed demographics would reinforce and validate the effectiveness of the method followed. Future research can examine the overlapping areas of sense of place to reflect on the opportunity to trigger co-creation of stories, social innovation, and engagement strategies (Acedo & Johnson, 2020).

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