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From individuals to collective spatial truth: data characteristics in digital participatory mapping

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Abstract: The collection of individual spatial insights through participatory mapping using structured digital sketch maps through self-administrated geo-questionnaires has gained increased visibility as an effective method for capturing subjective data, including people's perceptions, opinions, experiences, and knowledge. This approach gathers individual contributions and aggregates them into a unified dataset, enabling the identification of collective insights derived from diverse inputs. This aggregation process facilitates the generation of knowledge from a collective perspective.

The aim of this paper is to describe five key characteristics of this data: unique inputs that transform into collective narratives, varying levels of bias, data assessment, multiscale data, and spatial representation uncertainty. These characteristics highlight the strengths of this technique, including its proven potential and widespread acceptance across a wide range of applications. However, they also reveal weaknesses and opportunities for improvement, such as the uncertainty that permeates the entire data lifecycle—from participant recruitment and technical proficiency to task understanding and data representation. The outlined characteristics are intended to be enunciative rather than exhaustive and serve as a starting point for more in-depth exploration of the methodological, technical, and conceptual aspects of collecting and analyzing subjective spatial data through digital participatory mapping.

Keywords: participatory mapping, geo-questionnaires, structured digital sketch maps, SoftGIS, collective truth

1. Introduction

The integration of collective insights and individual experiences into the study of geographic space has grown significantly over the years. Incorporating people's perceptions and knowledge has become essential to understanding the complex relationships that shape social-spatial phenomena. This approach acknowledges that human experiences, emotions, and interpretations play a crucial role in shaping geographic space.

The SoftGIS methodology emerged as an approach to bridge the gap between the "soft" knowledge contributed by individuals and the "hard" analytical capabilities of Geographic Information Systems (GIS) (Kyttä, 2012). SoftGIS is an internet-based methodological framework designed to collect, analyze, and deliver localized, subjective knowledge contributed by people. This methodology emphasizes understanding how people interact with, perceive, and relate to their environment. The data collected often includes a range of elements such as emotions, opinions, preferences, perceptions, and knowledge, providing insights that are both spatially and socially grounded. Czepkiewicz et al. (2018) identified four interrelated categories for classifying subjective data: patterns of spatial behavior, values and valuable places, experiences and subjective evaluations, and development preferences. Data collection in SoftGIS often employs structured digital sketch maps (Sloan et al., 2016), in which participants locate and mark spatial objects and features directly onto a digital basemap.

Structured digital sketch mapping is usually integrated into geo-questionnaires (Jankowski et al., 2016), which combine spatial and survey-based data collection. Geo-questionnaires typically consist of two main components: a mapping activity, where participants identify locations or areas on a map using points, lines, or polygons, and a follow-up questionnaire, which collects additional information about the mapped features through open-ended or multiple-choice questions.

Once collected, the data is analyzed to explore, explain, and model spatial phenomena (Fagerholm et al., 2021). The primary objective of this analysis is to capture individual responses and integrate them into a dataset that reflects a diversity of contributions. This process enables the identification of spatial patterns and areas of convergence, revealing shared perceptions while maintaining the uniqueness of each individual input. This approach has been applied to study the physical and social dimensions of space (Denis, 2018), including perceptions of landscape values, ecosystem services, and urban environments (Vallejo-Velázquez & Kounadi, 2025). By doing so, it addresses the concerns, needs, and priorities of residents, providing insights for urban planning and environmental management.

Given the widespread use of digital participatory mapping for gathering subjective data, the purpose of this study is

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to highlight five key characteristics of this type of data. These characteristics aim to contribute to the ongoing development of a theoretical framework for subjective participatory mapping data. While not exhaustive, they provide foundational elements to guide future considerations and the development of guidelines for applying this framework. As it has been observed that there is a significant gap in the literature regarding the detailed reporting of methodologies used for data treatment and assessment (Denwood et. al., 2022). Addressing this gap can help improving transparency, replicability, and the overall reliability of subjective spatial data in participatory mapping studies.

The identified characteristics aim to define the nature of data collected through structured digital sketch maps, offering a general perspective that acknowledges potential variations depending on the survey method—whether administered (with the help of a facilitator) or self-administered (without interviewer assistance). While these characteristics are broadly framed, the focus is mainly on self-administered geo-questionnaires. Following this discussion, a SWOT analysis is conducted to support reflection and identify starting points for future research, contributing to the ongoing refinement and application of participatory mapping practices.

2. Methodology

The characteristics identified in this paper are the result of a reflective process based on prior work, including a literature review, processing and analysis of data gathered through structured digital sketch maps, and a usability test of sketch-mapping tools.

To illustrate these characteristics, we use data collected from a survey conducted in 2023 as part of a research project on crime perception in Budapest, Hungary, and Vienna, Austria (http://cpg.amk.uni-obuda.hu/index.php). The data were gathered through a custom-developed, self-administered online geo-questionnaire (http://cpg.amk.uni-obuda.hu/survey1.php), where participants were asked to draw polygons on an OpenStreetMap basemap to indicate areas where they felt insecure or unsafe, as well as areas where they felt secure or safe.

3. Subjective spatial data characteristics

3.1 From individual inputs to collective narratives

Each input is valued for the uniqueness of its content, but its true value lies in the aggregation of all responses. The goal of this type of participatory mapping is to provide a general perspective through the analysis of aggregated results. The concept of the "collective truth" (Brown & Pullar, 2012) underscores the power of participatory mapping by blending individual insights into a shared spatial narrative. This is particularly valuable for urban planning, resource management, and decision-making, where a participatory approach ensures that diverse perspectives can be represented and that outcomes are more inclusive.

By synthesizing diverse responses, participatory mapping captures the plurality of perspectives, showcasing how people perceive, and interpret their environment. Through this process, it allows the identification of patterns and areas of consensus but also highlights variations and outliers. Figure 1A displays the individual polygons sketched by participants to indicate areas they perceive as unsafe in Budapest. Figure 1B illustrates the overlapping of these polygons, where darker blue shades represent higher levels of overlap, showing greater agreement among participants. The use of transparency emphasizes the intensity of this overlap—darker tones reflect a higher concentration of responses. Together, these maps visualize the collective perception of unsafe spaces in the city, with a notable clustering of perceived unsafe areas on Pest, the eastern side of the Danube River.

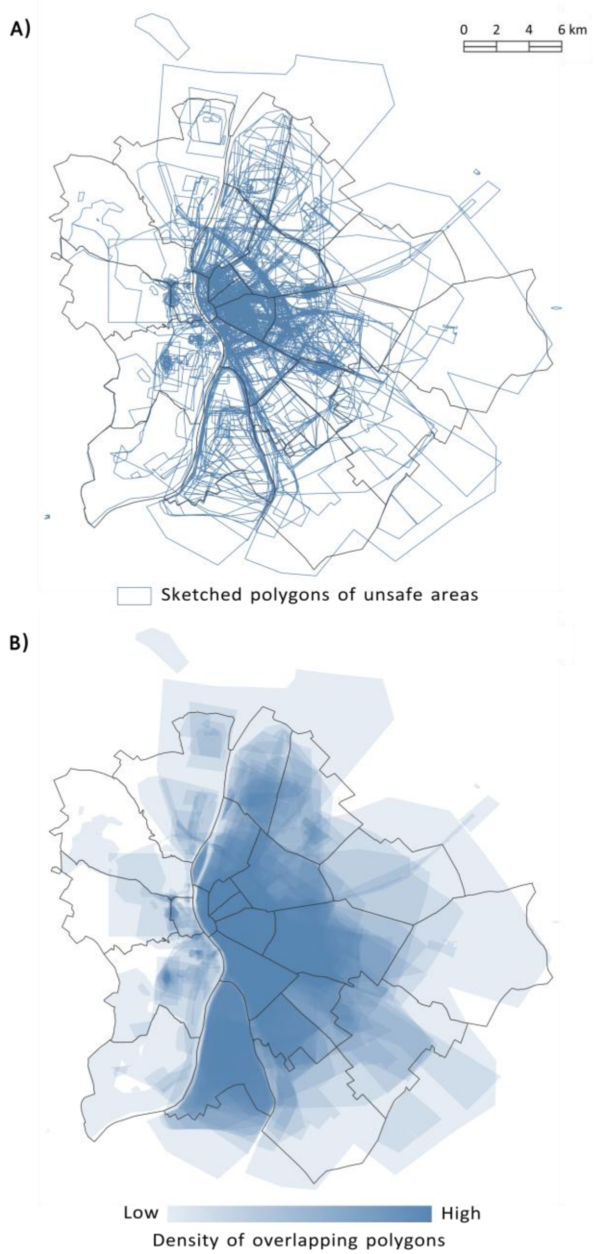

Figure 1. Sketched (A) and aggregated polygons (B) representing perceived unsafe areas in Budapest.

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Although this method can capture a form of collective spatial truth, it is not without limitations. As with other survey-based approaches—particularly digital self-administrated surveys—the samples tend to be non-probabilistic and often fail to accurately represent the broader population (Schonlau & Couper, 2017), partly because response rates tend to be low (Sammut et al., 2021). These limitations introduce potential biases that must be carefully considered when interpreting the aggregated spatial patterns of the data.

3.2 Participation-related biases

As with other forms of crowdsourced geographic information, data collected through digital participatory mapping can exhibit multiple types of bias (Zhang & Zhu, 2018). Different levels can be identified. The first level of bias stems from differential access to internet connectivity, which determines who is able to participate. Individuals or communities without reliable internet access are often excluded from the mapping process, resulting in the underrepresentation of certain groups.

The second level relates to technological proficiency and the digital divide. People who lack the knowledge or skills to navigate digital tools are effectively excluded, even if they have access to the internet, further narrowing the diversity of participants.

At the third level, the self-selection of participants introduces inherent bias. The responses reflect the input of individuals who choose to participate, often influenced by their personal interests, motivations, or familiarity with the survey topic (Basiri et al., 2019). Socio-demographic characteristics such as age, educational background, and familiarity with mapping tools can influence people's participation. This can skew the dataset toward the perspectives of more engaged or interested participants, leaving other viewpoints unrepresented.

The fourth level of bias concerns participant engagement during the mapping activity itself. Variations in the amount of effort, attention, and interaction invested by each participant directly affect the quality and completeness of the data collected. Some individuals may provide detailed and thoughtful sketches, while others contribute minimal or imprecise information. Engagement levels can be reflected in the number of features mapped; however, this must be interpreted cautiously, as the nature of the topic and the semantic framing of the task significantly influence how much participants contribute (Brown, 2017; Ducci et al., 2023; Baumeister et al., 2022).

Furthermore, notable differences emerge depending on whether participants are asked to map positive features (e.g., favorite places for spending free time, walkable streets, preferred green spaces) or negative features (e.g., traffic-congested areas, poorly lit streets, zones affected by littering). Studies have shown that mapping negative attributes often generates a higher number of contributions (Alvarado-Arias et al., 2023; Huang et al., 2023), possibly because negative experiences evoke stronger emotional responses. Therefore, both the emotional salience of the mapping topic and participants' spatial literacy levels can influence the resulting spatial data, impacting how collective spatial narratives are formed.

In the case of the data collected through our geo-questionnaire, although the same protocol and timeframe were applied equally in both cities, we received a total of 533 responses from Budapest and only 123 responses from Vienna. We attribute this discrepancy primarily to additional promotional efforts made by the Hungarian institution's general administration, which were not replicated at the Viennese institution. Moreover, the difference in participation may reflect cultural or interest-driven biases. Residents of Budapest may have perceived the survey topic—crime perception—as more personally relevant or pressing, thus leading to higher response rates. This introduces a self-selection bias, where individuals with stronger opinions or emotional reactions to the topic are more likely to contribute, limiting the generalizability of the data to a broader population.

3.3 Data attributes shaping spatial data assessment

Subjective spatial data is defined by its personal and unique nature, making it inherently distinct from objective data, which is tangible, measurable, and directly verifiable through methods like field validation or cross-referencing multiple sources. Subjective data, on the other hand, reflects individual perceptions, experiences, knowledge and interpretations, presenting significant challenges for traditional methods of quality assessment (Brown & Fagerholm, 2015). These characteristics need a different conventional validation framework, and an approach tailored to the nuances of subjective contributions.

The flexibility and individuality of subjective data demand methods of quality evaluation that respect its unique attributes while ensuring a baseline level of reliability. For instance, location consistency becomes a basic criterion, verifying that mapped features or objects fall within the defined study area. Similarly, thematic relevance must be assessed to confirm that participant inputs align with the study's intended focus. For example, when participants are asked to map green spaces, their contributions must correspond to actual green areas within the geographic region of interest.

Another characteristic of this type of data lies in the need for preprocessing techniques that balance refinement. Processes such as identifying outliers and resolving ambiguities in participant inputs are essential, but they must be designed to maintain the subjective essence of the data. Over-filtering risks excluding perspectives that, while unconventional, might hold valuable insights into local or context-specific phenomena.

In digital sketch maps, an important aspect of input assessment involves identifying elements that may indicate improper use of the mapping tools. While this is relatively straightforward to evaluate for data points—typically through location accuracy—it becomes more complex for polygons and lines. In these cases, the use of the mapping tools is often reflected in the geometric shape and properties of the sketched features.

Figure 2 shows two examples of complex geometries whose shapes, such as self-intersections or extremely acute angles, strongly suggest that participants struggled with the drawing interface. These objects not only introduce positional errors but can also render the features invalid under the Open Geospatial Consortium (OGC) Simple Features specification (OGC, 2011). Such invalid geometries may propagate errors during subsequent data processing and analysis. The critical challenge here is determining how to effectively assess such inputs and differentiate between unintentional errors and meaningful data. The goal is not to standardize or homogenize this data but to highlight its diversity while ensuring it remains reliable and useful for further analysis.

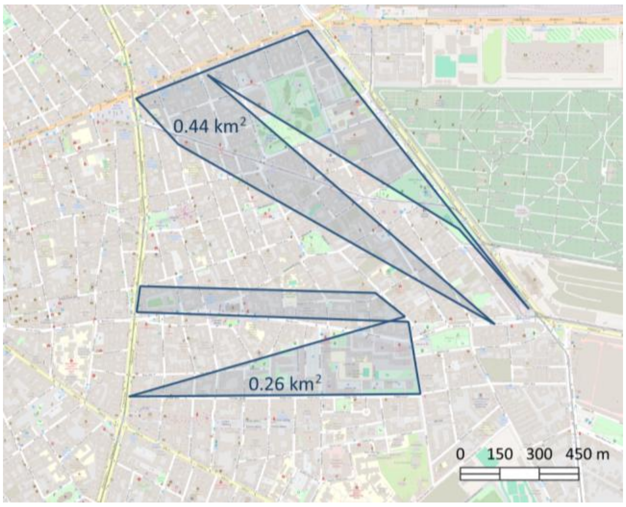

Figure 2. Sketched polygons with complex geometries indicating potential mapping difficulties.

3.4 Multiscale mapping

Unlike paper-based maps, where responses are constrained to a fixed cartographic scale, digital participatory mapping platforms provide the flexibility to navigate through various zoom levels and geographic scales. This capability allows participants to interact with the map dynamically, enabling them to provide inputs from diverse spatial perspectives while reserving the subjective definition of features to the respondent. This flexibility reflects the complexity of human spatial cognition, where scale influences how people perceive, interpret, and represent spatial phenomena (Vich et al., 2018). Each contribution becomes a unique realization of spatial understanding, crafted according to the participant's personal guidelines and context.

The variability of scale in the data is evident in the range of zoom levels participants choose when sketching. Figure 3 presents examples of polygons sketched by different participants. The significant variation in the areas covered by these polygons reflects the diverse perspectives participants bring to the task. While some responses are more general, others are more detailed, with participants sketching at larger zoom levels or using finer cartographic scales.

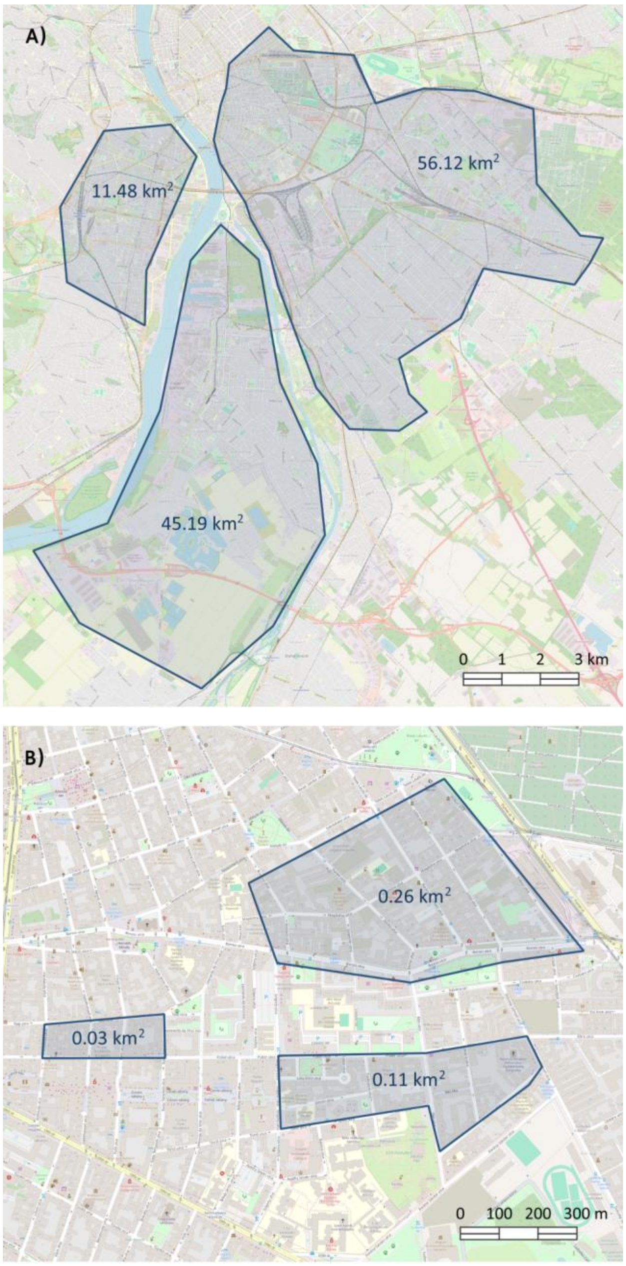

Figure 3. Variation in mapping scales, examples of large generalized sketched polygons (A) and small detailed polygons (B).

Although minimum zoom levels are sometimes set to enhance the accuracy of sketched features, participants generally retain freedom to determine the level of detail and scope of their responses. This freedom generates a dataset rich in diversity, capturing a range of spatial perspectives from broad, generalized depictions to highly localized and detailed delineations.

Geometric properties of the sketched features, particularly polygons, reveal the influence of scale. Larger polygons may encompass vast areas, reflecting broad spatial concepts or generalized understandings, while smaller, more precisely drawn polygons indicate localized perceptions and detailed cognitive maps. The range of polygon sizes underscores how participants express their

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spatial knowledge through their chosen level of spatial detail.

In addition to variability in scale, there is inherent uncertainty regarding what participants are truly representing. A large polygon, for example, might depict a homogeneous area or a collection of smaller, distinct spaces grouped together. A single large polygon can mean “everything inside is homogeneous” or alternatively, “this whole envelope contains scattered spots.” This ambiguity complicates the interpretation of spatial data, as the level of aggregation and cartographic detail directly influences the resolution and meaning of mapped features. Such uncertainty is not a limitation but rather an intrinsic characteristic of subjective mapping, which must be carefully considered during data analysis. One possible approach to address this ambiguity involves integrating auxiliary data layers—such as land use information—to assess the internal variability of sketched polygons.

The collection of inputs from diverse individual perspectives results in a unified dataset that incorporates multiscale information with varying levels of generalization and detail (Kajosaari, 2024). However, treating sketches of different scales equally during overlay analysis can artificially inflate the influence of larger polygons. If participants are not intended to be constrained to a specific mapping scale, the data can be normalized either by polygon area or by incorporating in the analysis the zoom level at which each polygon was sketched. Alternatively, if greater comparability is desired, the mapping task can be structured around fixed geographic units—such as city blocks or neighborhoods—by providing explicit instructions to participants (e.g., "mark the city block or neighborhood you perceive as unsafe").

3.5 Spatial representation uncertainty

Rather than adhering to strict spatial accuracy, the mapped features are shaped by the individual’s perception, understanding, and interpretation of space. These inputs are influenced by personal experiences, cultural contexts, and immediate interaction with the mapping interface. This dynamic, subjective nature of data collection underscores the stochastic nature of collaborative mapping, where each input represents a unique realization of the participant's spatial cognition.

For example, when a participant maps a point to represent a location they perceive as significant or sketches a polygon to outline an area, the geometry created is not a direct, precise measurement of objective reality. Instead, it reflects how they conceptualize and prioritize spatial relationships at that moment. This process introduces inherent variability in the data, as no two participants will represent the same feature in exactly the same way, even if they share a similar understanding of space. Moreover, even the same participant is unlikely to replicate the exact same geometry if asked to map the same feature again.

As Goodchild (2008) describes, “maps and geographic data can be regarded as the outcomes of stochastic processes: a map is a realization of a stochastic process.” Each input, therefore, represents a unique realization of the spatial phenomenon being mapped, filled with uncertainty and variability. This variability stems from factors such as differences in perception, precision in delineation, scale preferences, and the contextual framing of the mapping task (Bressan, 2021).

Thus, inputs in participatory mapping should be viewed as approximate representations of individual spatial understandings. Each contribution brings a distinct perspective, and the collective dataset embodies the richness—and the inherent uncertainty—of these varied representations. In this sense, each point, line, or polygon can be conceptualized as a random draw from an underlying distribution of spatial perceptions.

4. SWOT

4.1 Strengths

The use of structured digital sketch maps, typically embedded in geo-questionnaires, has become a widely adopted method for collecting subjective spatial data across various fields (Vallejo-Velázquez & Kounadi, 2025). This widespread adoption demonstrates both the method's capacity and its acceptance as a reliable approach for spatial data collection. One of its main strengths lies in the ability to produce datasets that are simultaneously spatial and complemented with attribute data as each sketched points, lines or polygons can be directly linked to follow-up questions capturing related opinions, ideas, emotions, or socio-demographic characteristics from the participants, all within the limits of informed consent and data-privacy regulations. These sketches are preferably stored in standard, open geospatial formats such as GeoPackage or GeoJSON, which allow for immediate integration into GIS workflows.

While technical barriers and gaps in digital literacy may present challenges, the sketch method is generally perceived as attractive. In many cases, once participants begin interacting with the mapping activity, they become more involved and motivated to contribute. However, this is not always the case—some participants may also feel frustrated when encountering difficulties using the mapping tools (Kotus & Rzeszewski 2023).

4.2 Weaknesses

One of the primary limitations of digital sketch mapping is the varying degree of participants' familiarity with digital mapping interfaces. Individuals with limited experience using interactive maps often struggle to navigate these platforms effectively, resulting in lower levels of engagement, higher drop-off rates (Poplin, 2015), and incomplete datasets. The requirement to interact with an online map can pose a barrier to participation, especially for users with lower digital literacy.

Although geo-questionnaires are typically open to a broad public, unless intentionally targeted at specific groups, disparities in access to technology and digital skills can exclude certain populations. This digital divide leads to the underrepresentation of less digitally literate populations and, consequently, to a narrowing of the diversity of perspectives captured. As Brown (2017) notes, the outcomes of participatory mapping—particularly the so-called "collective truth"—are ultimately shaped by who chooses to participate. The voluntary nature of participation introduces self-selection bias, where only those who are motivated or comfortable with the tools contribute, potentially skewing the data gathering.

Another significant weakness involves the multiple sources of uncertainty inherent in the method. Although uncertainty is common across many types of data, it poses particular challenges when dealing with participatory mapping data. Spatial geometries—points, lines, and polygons—raise questions about precision and accuracy. These concerns are influenced by factors such as the zoom level used during sketching, the participant's understanding and handling of the mapping tools, and their level of engagement, all of which affect the level of detail and quality in the contributions.

This uncertainty extends into the cognitive domain, as participants are asked to spatially represent abstract or subjective concepts. The act of translating personal perceptions into map features introduces variation and ambiguity, since everyone interprets spatial phenomena differently. This leads to inconsistencies that make it difficult to interpret the data uniformly. Moreover, the resulting datasets are inherently multiscale and vary in their degree of generalization and aggregation. This heterogeneity complicates data processing and challenges efforts to analyze or compare features systematically.

4.3 Opportunities

One of the key areas of opportunity in participatory mapping that could significantly enhance data assessment while simultaneously reducing uncertainty lies in the design of mapping platforms. Properly planning the scale of study, level of generalization, and data analysis requirements in advance can effectively guide the platform's design. This includes selecting appropriate mapping tools, determining the geometry types to be used (e.g., points, lines, or polygons), and providing clear instructions within geo-questionnaires. By adopting *ex-ante* approaches, which involve proactive measures to prevent errors and reduce uncertainty before the data-gathering activity (Bordogna et al., 2016), the usability and reliability of the data collection process can be greatly improved. Enhancing the usability of mapping tools can also increase participation rates and promote balanced representation across demographic groups.

Another significant gap that needs to be addressed is the lack of quality assessment methods for subjective data. Unlike objective collaborative geographic information, where well-established quality metrics and validation processes exist (Degrossi et al., 2018; Medeiros & Holanda, 2019), subjective data poses unique challenges due to its inherent variability and personal nature. Developing a framework for assessing the quality of subjective data would provide a more structured methodological approach, ensuring that the results derived from participatory mapping are more reliable and robust.

This gap is particularly important given the potential for digital participatory mapping platforms to be adopted in disciplines that may lack a strong spatial background. In these contexts, a taxonomy of quality assessment, similar to those created for objective spatial data, could serve as a valuable reference for researchers and consultants. Such a taxonomy would offer guidance on evaluating key dimensions of quality, including accuracy, internal consistency, and the contextual reliability of subjective spatial contributions.

4.4 Challenges

One of the main challenge lies in the fact that data collected through participatory mapping often remains static—confined to academic publications or consultative reports—rather than being actively integrated into decision-making frameworks. While such publications contribute to advancing scientific knowledge, they frequently fail to bridge the gap between research and practical application. This represents a missed opportunity, particularly considering that one of the core aims of the SoftGIS methodology is to translate subjective knowledge into actionable insights for planning and policy-making (Kahila-Tani et al., 2019). Although this methodology has been implemented at various stages of urban planning processes, the knowledge gathered is rarely fully leveraged, limiting its potential to foster genuinely bottom-up approaches.

In addition, concerns related to data privacy and ethical use persist. Digital participatory mapping tools collect both spatial and subjective information, making it essential to ensure the anonymity and security of participants' contributions. Without strong privacy safeguards, participants may hesitate to share sensitive information, potentially affecting the quality and authenticity of the data. This concern was evident in the data gathered from Budapest and Vienna, where approximately 29% of participants in both cities chose to sketch their daily routes. Given the sensitivity of this question, it was made optional, and fewer than half of the respondents opted to provide this information.

5. Future research agenda

The reflection presented addresses a gap in the theoretical framework, particularly with the intention of laying the groundwork for future guidelines on data processing and quality assessment of subjective participatory data—an area that is often under-described or overlooked in current research. The five characteristics listed here are intended to serve as a foundation for future studies focused on preprocessing and analytical considerations. Identifying the specific attributes of a dataset is a necessary first step toward selecting appropriate techniques and ensuring meaningful analysis.

In this context, we propose the following directions for future research:

- **Improving tool usability to reduce uncertainty and dropout rates.** One of the main sources of uncertainty in participatory mapping arises from users' unfamiliarity with

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digital mapping tools. This can lead to errors when sketching and increased dropout rates. Therefore, greater attention should be given to the usability of mapping platforms. Usability testing focused on participants' interactions with sketching tools can help identify points of confusion and inform clearer instructions and more intuitive design. Usability and user experience remain among the major challenges for users of geospatial digital platforms (Atzmanstorfer et al., 2025).

Given that improving recruitment strategies alone has shown limited effectiveness in increasing participation in PPGIS platforms—particularly in fields such as natural resource management and biodiversity conservation (Salminen et al., 2025)—enhancing the usability of the tools themselves may be a more impactful strategy.

Solutions such as gamification techniques, interactive onboarding, and instructional videos have been proposed and should be evaluated further, as usability is a key factor in the success of digital participatory platforms (Babelon et al., 2017). In addition, we emphasize the need to explore alternative input methods beyond traditional points and polygons—such as freehand sketching or selecting from predefined shapes—especially given that many participants report difficulties when asked to draw polygon features.

- **Developing scale-aware analysis and visualization techniques.**

Another area for future research is the development of analytical approaches that account for the scale, granularity, and generalization present in sketched data. Typically, data collected through participatory mapping is analyzed as a single, undifferentiated dataset, despite the fact that features are drawn at different scales, with varying levels of detail. This can omit important patterns and lead to misinterpretation.

In the context of polygon sketches, the most common methods include visualizing overlap intensity, splitting overlapping polygons (Barros et al., 2022), or aggregating features into grid cells. Each approach has its strengths and limitations. Future research should aim to develop analysis techniques that explicitly consider the geometric and contextual attributes of the features—such as area, shape complexity, or zoom level at the time of sketching—in order to group, compare, or filter inputs based on how they were created. This could help differentiate between generalized spatial inputs and precise, localized insights.

- **Integrating real-time geomasking to address privacy concerns**. Data privacy remains a key concern in participatory mapping, especially when participants are asked to map sensitive places. Future research should explore the integration of on-the-fly geomasking: a process in which sketched features are automatically displaced after submission, and the participant sees the masked version on the map.

This approach could increase trust, as participants would know their exact input is not stored, potentially encouraging more honest responses. It may also reduce intentional misreporting, improving the reliability of the data. The degree of displacement (i.e. the masking radius) could be adapted depending on context, balancing privacy protection with spatial precision. Such methods would need to be tested and calibrated carefully to ensure that masked datasets remain analytically meaningful while respecting data privacy.

6. Final considerations

The aim of this paper has been to highlight key characteristics of subjective data collected through structured digital sketch maps, offering a foundation for ongoing reflection and a basis for guiding future research.

A defining feature of this type of data is its uniqueness, rooted in the individuality of each participant's input. At the same time, its strength lies in its collective aggregation, which captures a diverse range of spatial perceptions and interpretations. The interplay between personal contributions and their synthesis into collective patterns enables the identification of shared spatial narratives.

This reflection is intended to be enunciative rather than exhaustive, offering an initial framework for further exploration. The characteristics outlined here serve as a starting point for deeper inquiries into the methodological, technical, and conceptual dimensions of subjective spatial data collection.

By continuing to examine and refine these characteristics, researchers can contribute to strengthening both the theoretical and practical foundations of structured digital sketch mapping as a tool for participatory spatial inquiry—ensuring that the data's individual nuance and collective meaning are effectively harnessed to inform research, policy, and decision-making.

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