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Pre-Filled Maps for Proactive e-Participation: A New Paradigm for PPGIS Methodologies

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Abstract:

Over the last decades, Public Participatory Geographic Information Systems (PPGIS) have gained increasing traction in urban and landscape e-planning, where it is often adopted to collect citizens' local knowledge. This approach is widely described as inclusive, aiming at empowering non-experts and marginalized populations, ideally leading to more democratic and well-informed policy outcomes (Marondedze et al., 2024). However, practical applications demonstrate mixed efficiency due to several barriers rooted in three categories: the tool itself, the participants, and institutional settings (Aranda et al., 2023). One persistent barrier to the success of PPGIS initiatives is low participatory engagement (Salminen et al., 2025). When participants are asked to locate their opinions on an empty digital map (a common method in many PPGIS projects), individuals may feel hesitant about sharing their local knowledge on the map. We argue that confronting a default basemap with no visible inputs from peers or pre-filled elements can amplify this feeling, as the absence of contextual prompts, examples, or social cues leaves participants wondering whether their feedback is on topic, correct, or even welcome. As a result, both the quantity and quality of contributions could suffer, limiting the potential impact of PPGIS.

We suggest that providing a pre-filled, thematically enriched map can significantly improve both the rate and depth of citizens' engagement, leading to meaningful citizen-government dialogue. Our central hypothesis is that the presence of a thematic basemap allows participants to "react" instead of having to "act", drawing upon spatial features that are visible on the pre-filled map. This aligns with widely described human tendencies to respond more easily to recognizable information, a behavior frequently exploited in Human-Computer Interaction and user experience (UX) research through the use of affordances (Davis & Chouinard, 2016). To demonstrate the potential of such an approach, a two-step process is needed: (1) designing data layers that are meaningful for participatory sessions, and (2) evaluating the participatory effectiveness of the pre-filled layer. In this study, we address the first step, introducing a modular urban vibrancy (UV) framework as a groundwork for the thematic basemap. UV was selected because it highlights existing urban spatial patterns, blending human activity and built environment characteristics. These patterns provide a good use case to support participants in identifying locations where they "like" or "dislike" spending time, a prompt that is often adopted in PPGIS to collect critical feedback about public space usage.

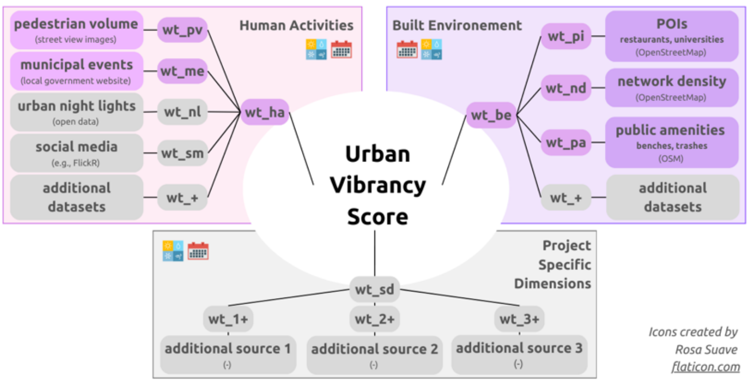

Figure 1. Urban vibrancy framework illustrating key dimensions (human activities and built environment), modular data sources, and weighting schemes. Each element contributes to an overall vibrancy score that can be adapted to project-specific requirements.

Figure 1 portrays the urban vibrancy (UV) framework, which derives UV scores from two primary dimensions, namely human activities and the built environment. Additional data sources can be integrated with optional project-specific

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dimensions to enhance flexibility. Each dimension is subdivided into customizable subcategories that can be freely adapted (added, weighted, or substituted) to fit the specific requirements of any project (in terms of scale, temporal scope, geographic setting, cultural context, and data availability). Each subcategory is based on commonly accessible, cost-effective data sources such as OpenStreetMap (network density, points of interest, and public amenities like benches and trash bins), municipal event calendars (cultural events and festivals), and publicly available weather datasets. UV scores also integrate Google Street View imagery (restricted to its free tier usage) to estimate pedestrian volumes via image segmentation. Each source can be dynamically adjusted to reflect temporal variations (time of day), changes in human mobility (social events, road maintenance), or weather conditions (see icons and weights in Figure 1). Future extensions should incorporate additional datasets, such as nightlight imagery, aggregated and anonymized social media data, and newly released open data from platforms like Meta's Data for Good. Each of these data sources can seamlessly be integrated into our framework, resulting in a robust, generic UV composite indicator.

The UV framework was transcribed into a modular Python workflow. The code-based implementation accepts parameters including city name, date, and time, and generates a pre-filled map tailored to the specified temporal and geographic context. The output aggregates UV dimensions into a hexagonal grid, encoded in GeoJSON to facilitate web integration. Figure 2 illustrates an example of the calculated UV scores in Graz, Austria. Our approach additionally offers scalability and flexibility: hex cells can be resized depending on the level of detail desired, and the underlying data sources can be expanded and edited to meet the needs of different projects or data formats.

With the next step, we plan to compare participation rates, response quality, and spatial distribution of participatory inputs across mapping exercises employing either a blank canvas or a pre-filled UV map. If empirical outcomes suggest that pre-filled data enhances engagement and produces more actionable insights, such findings could impact how government agencies, non-profit organizations, and community groups gather feedback in e-participatory approaches. Ultimately, we envision an open and replicable system that can be adapted to various urban scales, differing data availability, and diverse policy objectives. Each dimension or subcategory of our framework can be reimagined based on context-specific data relevance, ethical considerations, and local needs. Moreover, reliance on free or low-cost data tiers further ensures that the methodology remains accessible to a broader range of practitioners. This urban vibrancy framework is fully open-source (available on GitHub) and welcomes contributions from the community.

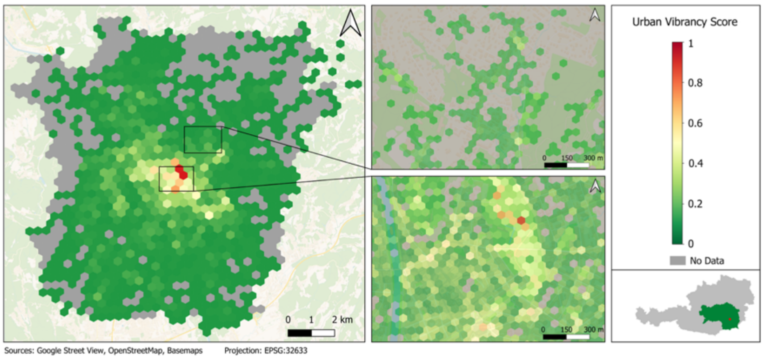

Figure 2. Pre-filled urban vibrancy map of Graz, Austria, with higher scores shown in warm colors (red/orange) and lower scores in cooler tones (green). The left map provides a citywide overview, highlighting an expected concentration of higher scores in the central district. The right panels offer zoomed-in perspectives of selected areas, highlighting local activity patterns.

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