

## Interpreting Citizen Energy Perceptions through Bivariate Spatial Mapping: Linking Subjective Experience and Urban Context

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### INTRODUCTION

Citizen-generated spatial data offer new opportunities to understand **how residents perceive** the energy and socioeconomic conditions of **their living environments**.

However, translating **subjective perceptions into interpretable urban patterns** remains methodologically challenging. This study explores how bivariate spatial mapping can be used to reveal alignments and mismatches between perceived conditions and measurable characteristics of the **built and social** environment.

The analysis is based on **citizen-generated geodata** collected through a **neighbourhood crowd-mapping** platform developed within the oPEN Lab Pamplona (Spain) project, applied to the Rochapea neighbourhood.



### METHODOLOGY

The study area comprises 14 census sections, which led to a combined **cartographic and descriptive analytical approach**. Two independent bivariate maps were constructed:

(1) **perceived thermal comfort × energy consumption**

(good–neutral–poor) × (high–medium–low)

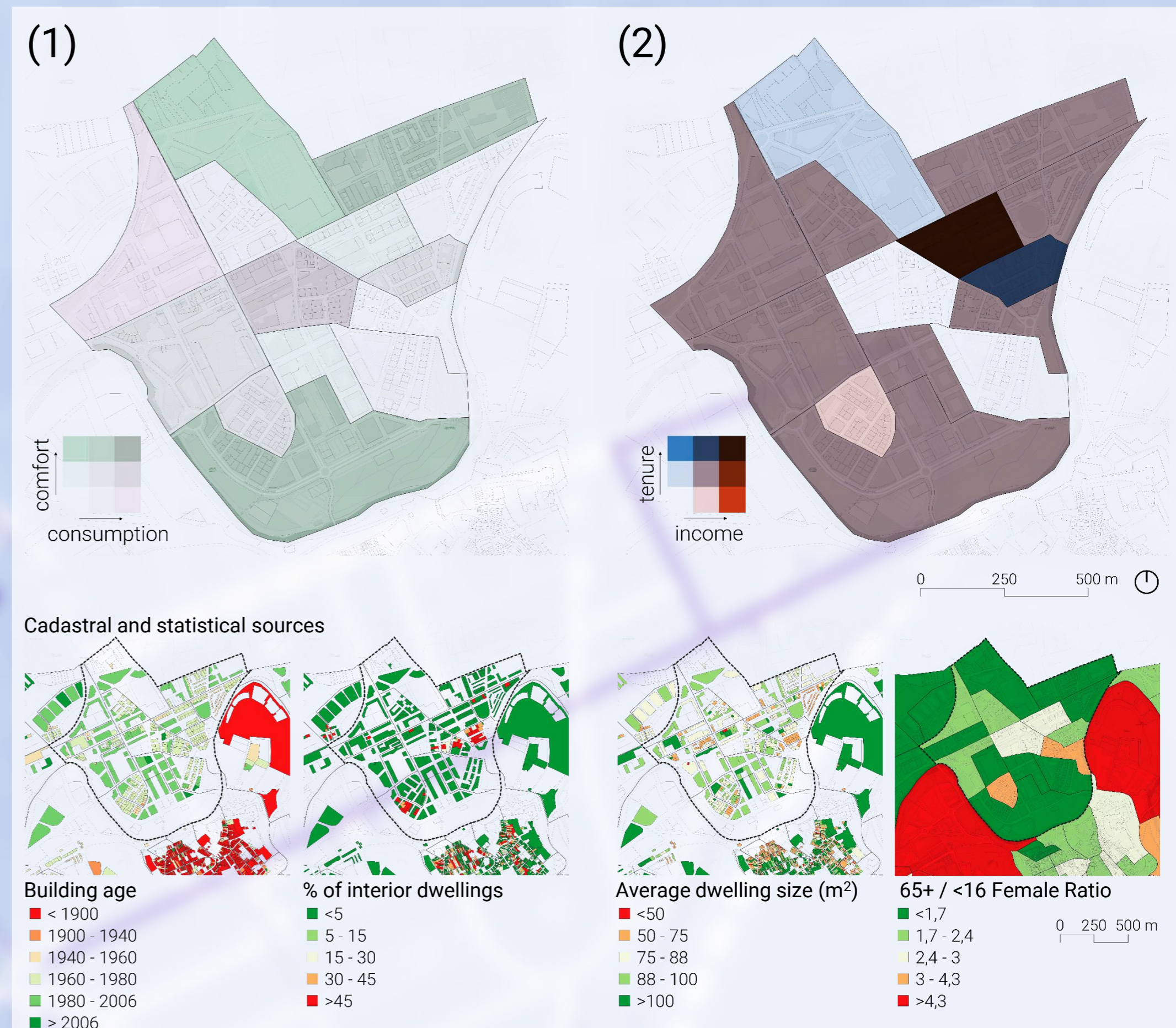
(2) **housing tenure × income level**

(owner–mortgage–renter) × (high–medium–low)

Each map followed a 3×3 classification matrix, producing **nine perception classes** arranged along a theoretical gradient. For each class, **mean values** of available demographic, socioeconomic, and residential indicators were aggregated **from cadastral and official statistical sources**.

The analysis focused on **internal comparisons** between classes to detect gradients, discontinuities, and inconsistencies **between perception-based categories and contextual indicators**.

### RESULTS



Energy perception patterns showed a clear association with post-regulatory housing stock and the absence of interior dwellings, **suggesting a link between construction standards and perceived comfort**.

Conversely, socioeconomic perception displayed **counterintuitive spatial configurations**, where favorable perceived classes did not consistently align with higher official income or newer housing.

These discontinuities highlight **complex socio-spatial dynamics** beyond conventional indicators.

### CONCLUSION

Despite a **reduced spatial sample** and the participatory nature of the data, including a **participation bias** (59% women and 53% minors due to school-based engagement activities), bivariate spatial mapping of citizen perceptions provides an **exploratory framework** to identify concordances and tensions between lived experience and urban structure.

The approach supports evidence-informed neighborhood diagnostics and demonstrates the analytical value of **participatory geodata for urban energy planning**.