Review of: "Study of environment-behavior in three types of the urban context of Tehran — Comparative analysis of the Chizar, Narmak, and Khazane neighborhoods' context using survey and space syntax methods"

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Potential competing interests: No potential competing interests to declare.

Space syntax theory by Hillier & Hanson in early 1980s is presented as a synthesis between two approaches, benefiting from both micro and macro domains. Space syntax is applied to investigate common physical attributes shaping human behaviours in three residential contexts in Tehran, Iran. Examples of space syntax methods are presented. The authors highlight that i. spatial configuration, ii. spatial cognition, and iii. observation methods are key in all these reported examples. In their Section 2. Research method, authors employ a 14-day survey using space syntax, including a questionnaire with sections on general descriptive features and various aspects related to sociality, territory, activities, behavioural settings, and affordances. "Affordances" refer to *possible actions that an actor can readily perceive in space*, a term coined in James J. Gibson 1966's Theory of perceptual learning (TPL). Space syntax is done using UCL Depthmap 10 software, through axial analysis and visibility graphs methods performed in the studied area of Teheran.

In **Section 3. The studied contexts**, three residential neighbourhoods in Tehran (Chizar, Narmak, and Khazane) are described, each a combination of single-unit homes and multi-unit apartments. On the details authors shared in Table 2 and Figure 1 (Google shots), we can summarize the following configurational properties of each neighbourhood:

- **Chizar**:
  - Geometry of Passages: Organic with curved alleys.
  - Age of Context: Old village.
  - Total Area: 120 hectares.
  - Approximate Total Population: 20,000.
  - Studied Area: 2 hectares.
- **Narmak**:
  - Geometry of Passages: Orthogonal network and urban squares.
  - Age of Context: 1952-1958.
  - Total Area: 540 hectares.
  - Approximate Total Population: 150,000.
  - Studied Area: 6 hectares.
- **Khazane**:
  - Geometry of Passages: Orthogonal network and hierarchical passage (dead-ends).
  - Age of Context: Qajar - 1950s.
  - Total Area: 150 hectares.
  - Approximate Total Population: 45,000.
  - Studied Area: 6 hectares.

These characteristics highlight the diversity in the geometry of passages, the historical background, and the structural elements of the three neighborhoods, as they are “unique” in the sense stressed by K. Karimi “these parts, if studied carefully, create a defined pattern of relationships, namely, configuration, which is unique to any system.” **[1 Karimi, 2012]** The combination of single-unit homes and multi-unit apartments in all three contexts suggests a mix of residential structures. The mentioned hazards, such as **increasing population density and building density**, can impact the properties of these contexts, and understanding these aspects is crucial for urban planning and development.

In **Section 4. Results**, the authors present some of their findings, among which correlations in the three neighbors with the axial attributes. The Likert scale scores from the questionnaire responses provide subjective assessments of “Behavioral settings” (nine items) and “Affordances” (twenty items). Each item is rated on a scale from 0 to 4.5. Visibility and Axial Analysis: The visibility and axial analysis results generate quantitative measures related to the spatial configuration and attributes of the studied areas. Table 4 shows the authors’ visibility graph coefficients and Table 5 the axial coefficients. The values under each attribute provide information about the variation and characteristics of these features within each residential context with the target to understand how spatial configurations influence human behaviors and interactions in different urban or residential environments. Correlation coefficients (such as Pearson’s correlation coefficient) indicate the strength and direction of the linear relationship between two variables.

Positive correlations suggest that as one variable increases, the other tends to increase as well. Negative correlations suggest an inverse relationship. From these coefficients the authors set up in **Figure 2** a bar graph comparison in the three neighbors about “Behavioral settings,” and “Affordances.” The authors visually analysed the spatial relationships between different elements in their study, using techniques like ‘isovist analysis.’ Isovist analysis involves understanding the visual field from a particular vantage point in a space. It is a method commonly used in architectural and urban design studies to evaluate visibility and spatial connectivity. The ‘Isovist areas’ in this context represent regions visible from

specific locations. The term “connectivity” in this case refer to the visual or spatial connections between different points in the studied environment, and the authors have used isovist analysis to illustrate these connections.

While the main body of text might not explicitly discuss network connectivity in terms of graphs and clustering coefficients as in reference **[2 Jiang & Claramunt, 2004]**. Topological analysis of urban street networks. *Environment and Planning B: Planning and Design*, vol. 31, pp. 151–62; doi: 10.1068/b306]. The visual representation in Table 3 could provide insights into how the visibility and axial properties contribute to the perceived connectivity within the space. Another significant contribution on the representations of street networks in space syntax is in reference **[3 Stavroulaki et al., 2017]**. Outstanding contributions to the topic include reference **[4 van Nes & Yamu, 2021]**.

Then, Table 6 (Visibility Coefficients) and Table 7 (Axial Coefficients), present correlation coefficients between questionnaire results and various visibility and axial analysis metrics. These coefficients indicate the strength and direction of the relationship between the variables. The correlation coefficients range from -1 to 1, where -1 indicates a perfect negative correlation, 0 indicates no correlation, and 1 indicates a perfect positive correlation. In Table 6, the visibility coefficients represent correlations between questionnaire results related to social relations, physical territory, behavioural settings, affordances, and other factors, and visibility analysis metrics such as Integration, Connectivity, Controllability, Entropy, etc. In Table 7, the axial coefficients represent correlations between questionnaire results and axial analysis metrics, including Integration, Connectivity, Choice, Control, Entropy, and others. The authors discuss the classification of human behavior at different scales and its implications for neighbourhoods' design. A comparison is made between orthogonal and grid-organic contexts in terms of urban safety. Higher correlations in axial analysis are noted concerning integration among choice attributes, social relations, and physical territories. The authors discuss the relationship between micro and macro scales, emphasizing that space syntax is not always applicable when switching between them.

Finally in **Section 5. Discussion**, the authors highlight how they have presented a “classification of human behavior at different scales” as performed among others by Eslami Mojaveri at al. in 2021, which can help to address the design of neighbors. This approach shows that a specific combination of i. spatial configuration, ii. spatial cognition, and iii. observation methods are useful not only to inquire into connectivity and integration of people in urban spaces, but also to detect change in affordances are read both in stationary (e.g., sitting) and mobility (e.g., walking) mode. In their local context at the three neighbors the authors notice higher correlations in axial analysis concerning an integration among choice attributes, social relations, and physical territories. **Figure 5** at the end of research shows the flow of entropy in social relations, behavioural settings, and affordances in the axial visibility/accessibility towards the city level. Inverse relations are detected in relation to ‘walkability’ and ‘drivability’ in the three neighbors, confirming that space syntax is not always applicable when switching from micro- to macro-scales.

Optional amendments:

- Please define the acronym E.-B. (“Environment-behavior”) also at the start of your paragraph Introduction. Acronyms should be resolved at the first appearance in each section, e.g., abstract, main body, tables, figures, appendices, etc.,
- Please in your enlisting of space syntax methods by Kim, Esra, Alper, Morales, Ottenby, etc. I do not see the

mentioning of ‘locations.’ Please add this essential element to your list,

- Please add the fourth section of your own questionnaire: 4. Activities,
- Please write in words the numbers when they are related to your study items: 32 houses > thirty-two houses.

Required amendments:

- Please explain the main objectives of your research. Are you aiming to establish correlations between the environment’s configurations and urban behaviours?
- How do attitudes, subjective norms, intentions, and the respect of local policies play a role in your study? Could you elaborate on the relationship between these factors and urban behaviours in the context of your research?
- Could you provide a more accessible explanation of the term ‘Isovist area’ for a non-expert audience?
- Could you explain the methodology used to establish the scale of values in Figure 2? Is it derived from respondent ratings on a Likert scale or mean values of answers?
- In the concluding part of the paper, the authors present a nuanced discussion on the correlations among location configurations, social interaction behaviours, and urban safety. The intricate relationships between ‘choice attributes’ in the questionnaire results and the space attributes in space syntax are highlighted, revealing potential contradictions. Could the authors elaborate further on how these contradictions might influence the interpretation of their results and the practical implications for urban planning or design strategies in the studied contexts?
- What would it be a concrete example of how “population density” and “building density,” can impact the properties of your three inquired contexts in Teheran, because as you pointed up understanding these aspects is crucial for urban planning and development?

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Appendix:

Suppose in one of the neighbourhoods inquired by the authors, there is high population density but low building density. This might mean that there are many people living in the area, but the buildings are scattered or not as tightly packed. In such a scenario, it could lead to a few observations:

Social Interaction: High population density might lead to increased social interactions among residents. However, the low building density could mean that these interactions occur more in open spaces or communal areas rather than within confined, built environments.

Mobility Patterns: High population density might suggest more people moving through the area, but if the building density is low, it might result in more dispersed and less organized mobility patterns. This could impact the walkability and overall flow within the neighbourhood.

Urban Safety: The combination of high population density and low building density might have implications for safety. While the presence of more people can enhance the collective vigilance, the dispersed building layout might create areas with less oversight, potentially impacting safety perceptions.

Understanding these dynamics is crucial for urban planning. Planners might consider strategies to optimize building layouts, increase communal spaces, or enhance connectivity between buildings to create a more cohesive and safer urban environment. This example illustrates how the interplay between population density and building density can significantly influence the urban experience in a given context.