Mapping Spatial Analysis Methods to User Cognition and Behaviour



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Evidence-Based Design; Spatial Cognition; Spatial Analysis; Architectural Design

BACKGROUND & AIM

The cognitive and behavioural implications of design are essential to foster humancentric architectural and urban design. The design field is undergoing a transformative shift, from relying on subjective intuitions to more objective, data-driven decisionmaking. Emerging evaluation methodologies rely on a diverse range of tools with varied theoretical foundations. However, these tools are often employed by researchers only for post-occupancy evaluations, and their utilization by practitioners during design remains limited.

This research seeks to develop a comprehensive taxonomy to:

- Map widely used tools and methods available;
- Link users' cognition and behavioural aspects with scientific concepts and methods of spatial analysis;
- Enable effective use of tools for human-centric evidence-based design;
- Empower designers for data informed decisions, ensuring the integration of tools that align with specific user needs/design focus.

METHODS

Systematic Literature Search

- A comprehensive literature exploration;
- Identify scientific methods and tools for integrating user cognition in spatial design.

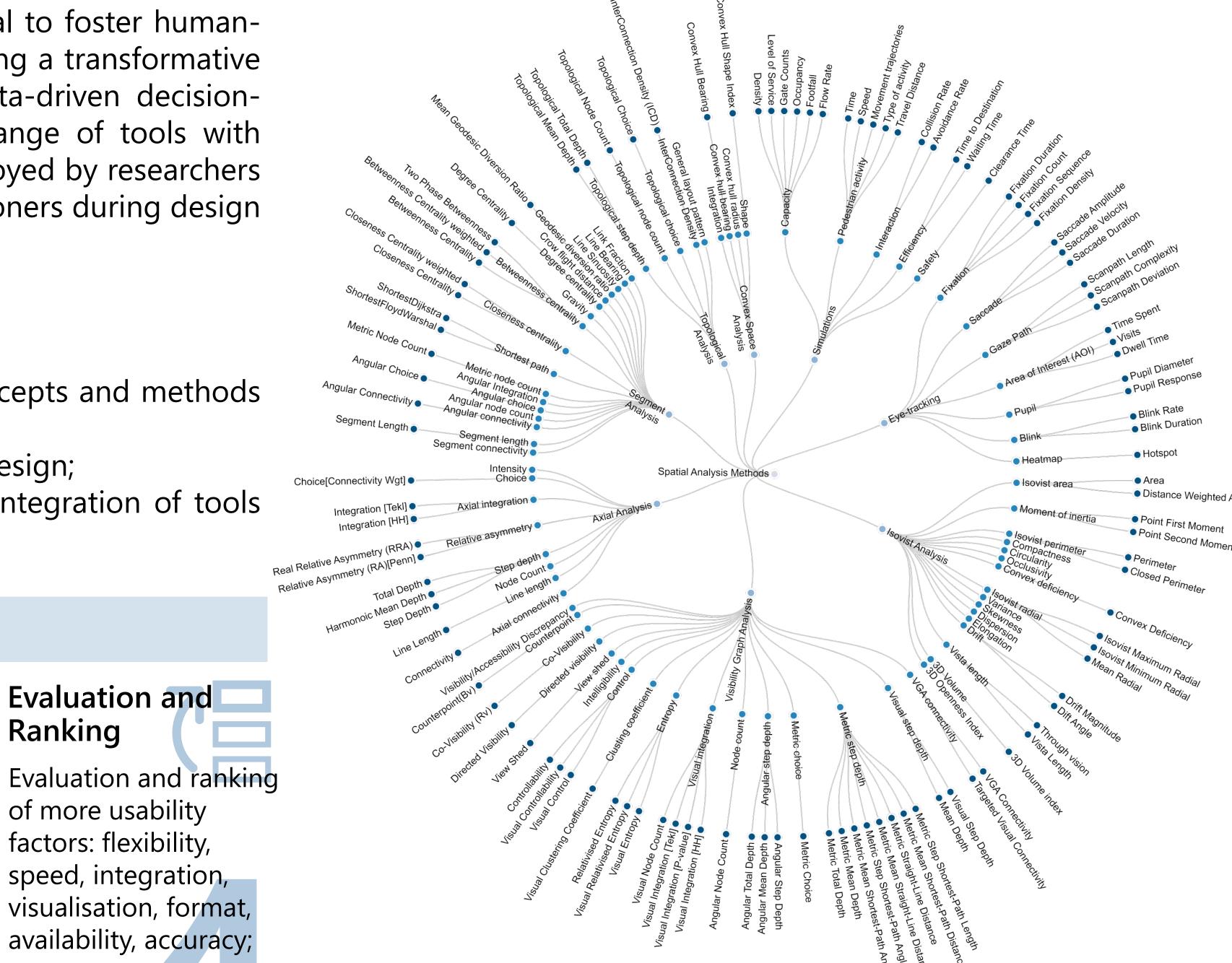
Comparative Analysis

- Evaluate tools against relevant criteria; Assessment of
- theoretical basis, coverage of concepts; Using common design
- scenarios for comparison

Industrial Surveys

- Inquiry on practitioners' use, knowledge, perceived effectiveness, preferences;
- Understand the challenges faced by practitioners.

FINDINGS



Designer-Accessible Spatial Evaluation Methods and Metrics

Human-centric Aspects Tools/Year Social interaction Collaboration Sense of privacy SimWalk Sense of pleasingness Sense of beauty SpaceChase Quality of activities IsovistApp Perceived size/distance DepthSpace3D Space Syntax Toolkit 2016 **UNAToolBox** Sense of place Sense of security Syntactic SpiderWeb Seating(private) occupancy DecodingSpaces Occupancy level Spatial usage pattern WebMapatHome Sense of complexity Sense of orientation 4 × × OmniVista Wayfinding strategies Cognitive map formation Axwoman **Analysis Measures** →

Axial Analysis

Evaluation and

of more usability

factors: flexibility,

speed, integration,

visualisation, format,

availability, accuracy;

Ranking matrix as a

guide for designers.

Ranking

This matrix acts as a dynamic capturing resource, connections between spatial evaluation measures, tools, human cognition & behaviour aspects. It outlines current research coverage, highlights areas of focus, and missing pinpoints as a roadmap for serving research deepen gaps understanding in this field for both communities.

Positive Both

Negative Non-binary

Scan for more information



() Covered

Relationship Between Spatial Evaluation Measures, Tools and Human-centric Aspects

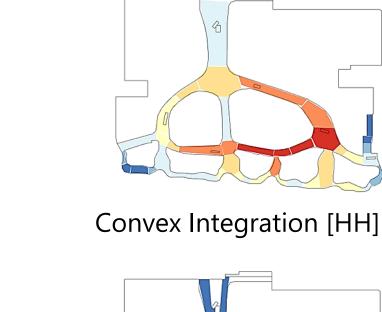
Visibility Graph Analysis

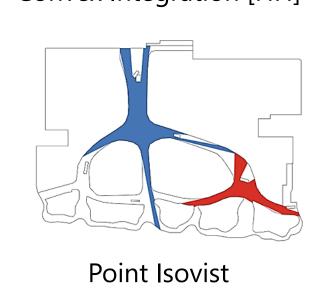


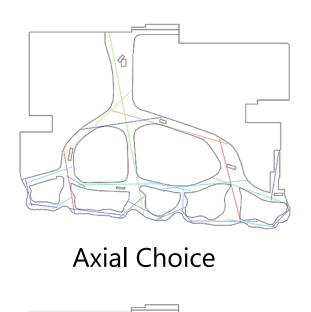
Visual Integration [HH]

Visual Entropy

Isovist Occlusivity





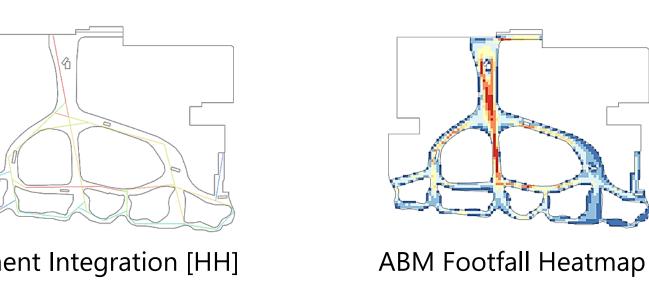


Segment Analysis

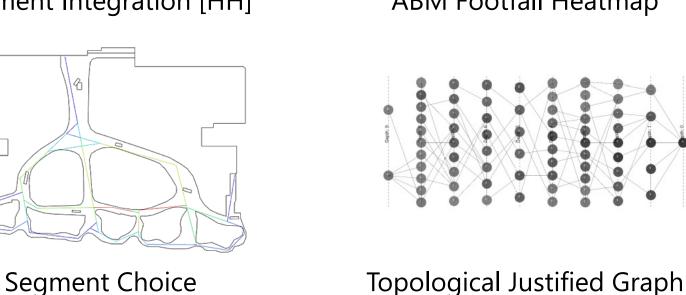
Axial Intensity

Example Spatial Evaluation Measures

Eye-tracking







High Low

Eye-tracking Gaze



Eye-tracking Fixation Heatmap

EXPECTED OUTCOMES

- Develop an inventory to evaluate tools for integrating cognition knowledge in spatial design, their efficacy, usability and theoretical basis.
- Offer recommendations to improve existing tools and develop new ones for better architect needs.
- Develop a framework for examine new tools and methods for integrating user cognition in spatial design.
- Create a guidebook or platform for architects to select suitable tools based on industry usage and needs, enabling knowledge sharing.

Acknowledgements





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