DECODING SPACE SYNTAX ON TRANSLATION OF SITE CLUSTER PERMEABILITY INTO BUILDING COURTYARD

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INTRODUCTION & LITERATURE REVIEW

► RECENT URBAN ISSUE:
1. The complexity problem of thermal, noise, and optimization of eco-friendly energy use
2. The wider considered aspect of social factors

► DENSE ENVIRONMENT OF THE CITY, URBAN, OR SUB-URBAN TERRAIN ROUGHNESS:
1. Requiring wind acceleration for generating physiological cooling → considering the space continuity in real estate
2. Converting the site mass permeability into building arrangement

► HUMAN INTERACTION AS AN INTERFACE OF SOCIAL LIVING | syntax of spatial integration [1]:
1. The problem of distinctions between inner-city and socio-spatial understanding and dilemmas to be solved in its future housing planning
2. Dependent social activities on the degree of the site cluster permeability [2]
3. The conflict between promoting air for the requirement of the high permeability site cluster and social interaction → The better increased social interaction and activities

► THE SPATIAL ORDER OF URBAN HOUSING ESTATE:
1. Using transparent and combined opaque materials → Building the different degrees of privacy
2. Manifested in a diverse combination of levels of visibility and permeability in different areas of the building [3]
INTRODUCTION & LITERATURE REVIEW

► THERMAL AND NOISE SIMULTANEOUS PROBLEM:
1. Extending wind speed requirement review and Proposing the updating standard of physiological cooling in the tropics in restoring thermal comfort [4]
2. The strategy for predicting the spatial system and potential environmental intervention

► THE SPECIFIC AND CUMULATIVE IMPACTS OF ALL THE URBAN TRANSFORMATIONS:
1. Assessed by the spatial model on local and global dimensions [5]
2. The analysis for urban scale: Effective for building or environment courtyard
3. The environmental concerns: Embedded in physical urban transformation [6]

► HOWEVER:
For analyzing the critical factor to review the housing estate related to the site cluster and its environment, all previous findings have not proposed the decoding of the spatial language related to the site analysis on environmental issues

► THEREFORE:
This research conducts the translation of space syntax for site cluster permeability into the building courtyard
“Three types of site cluster prototypes as the basis of evaluation, such as grid, cul-de-sac, and loop, taken from East Surabaya typical real estate planning.”

“Separated by 6 m street width as the representative unit, the models are related to wind speed in various wind direction and Mean Radiant Temperature (MRT).”

**INVESTIGATION:**
Ecotect Analysis as MRT tool and Ansys Fluent simulations for computational fluid dynamics of air movement prediction

**THE PATTERN TRANSFORMATION AND OPTIMUM COURTYARD AND ATRIUM DESIGN:**
accomplish the standard or requirement as optimized by the preceding study [8]

**THE POTENTIAL ACTIVITIES:**
the DepthmapX simulation is used for the analysis of spatial programming recommendations

**SIMPLIFYING THE RELATION:**
The additional program, Pajek will estimate the network prediction
1. Visibility analysis

- The high MRT arises in the pedestrian path evenly: the wind speed has a role as a medium of heat transfer
- The high MRT in the opened area: coded as a windy path to reach the building courtyard
- The quality of syntax on-site space: the site junction as the warmest area of visibility → accumulation of accelerating wind, potential consideration of space programming

- The longer distance: reducing the potential of physiological cooling from similar MRT is not referred to as strategical space or lower visibility → effective space and the wind will be quite different in all parts of the site
- The visibility space: the cross line as the highest social space and outdoor comfort area the most
- The event distribution of wind contour and temperature will be special for specific social interaction: a flat response from the occupants because there is no sufficient shading even supported by adequate wind speed for outdoor activities
- Decomposing the inspection of intimacy: implication into two systems such as the mean directional distances connected with the grid patterns as a single system, and the mean directional gaps from injected roads to the nearest section [10]

- The technical characteristics: general and specific -oriented aspects such as courtyard sizes and area, specification of street and hardscape, housing type, and several units
- The social characteristic: the larger population factor and instant user implications such as compactness, affordability, social interaction, privacy, accessibility, site permeability, pedestrian, and vehicle way pattern
- The typical intersection connectivity: a link-node ratio as well as street segment analysis, and assimilation of techniques used in the recent Western method as recognized as specific cul-de-sac syntax [12]
- Providing surroundings shadow and capturing wind: Blocking and localizing the wind event the velocity lower and discontinue to all part of the site

Environmental Condition and Space Syntax Analysis

- Translating in high MRT and low wind speed → permeability cluster has a lack of visibility when the grid results in the warmest space in the cross street
- Supporting building courtyard layout: surrounded by a limited number of housing estate units, with a single vehicular entrance [11] → tabulated and calculated in detail by dividing the items into two main categories of technical and social characteristics

- The open space: a method of an extended sample of housing estates in resilient urban design [13] → enhanced performance of high prospective wind speed but high-level MRT all at once

- The open space, lack intimate: developing high visibility that interacts with social activities
- Different from the prior statement [14], the open space in loop arrangement: accelerating 50% or more transformed air movement from the larger context of site to the smaller one of building an indoor environment when the planning results in the warmest connectivity of open space.
- The influence of energy efficiency: revealed by 25% by having the largest permeability and opened area and obtaining the highest exposed area and the most distributed visibility space
2. Network analysis

► The spaces which have high “connectivity values” and “integration values” in space syntax analysis: Providing more natural ventilation which is important to increase the thermal comfort sensation in the tropic condition without using active cooling for energy efficiency

► The occupants prefer to move to an open space [15]: Improving building thermal performance in the architectural early design stages through spatial configuration → a tendency, which relates high integration, as well as connectivity, to low costs on active cooling [16]; identified between low closing index, high compactness, and best thermal performance

► The more spread out site clusters pattern: Presenting an even higher closing index to control the air changes rate spreading through the definite zones as cul-de-sac strategy has

► The spatial network arrangement: Simple and clean as possible and lower the appearance of by-passes [17]

► The spatial activities: Attaching to the principle of relative regularity, support the subject of every space and try to avoid people losing which have an excessive attraction to occupant should be located around it to scatter people streams

► Further, additional argumentation by convex decomposition [18]: Viable basis for comparative evaluation of a variety of significant urban ambiance properties, with prospective to notify the design intervention

3. Visual Integration and Connectivity

► The irregular pattern in cul-de-sac and loop site clusters: Potential on finding wind speed more → Providing vertical ventilation is the best solution for urban density [19]

► The regression analysis showing the cul-de-sac cluster has the lowest relationships: The irregular model may lead to having spread out a pattern and having high required air movement

► The better trend line as a grid cluster: The close relationships between connectivity with visual integration indicates the regular pattern, evenly potential activities, and performance of the environment control

► A similar result for loop design: enriching the quantitative for both variables → Delivering the open space on site planning stimulates both environment and social aspects
► **THE CRITICAL FACTOR FOR URBAN DEVELOPMENT:**
How to arrange the site of real estate indicating compactness and regularity of the pattern

► **SOCIAL AND ENVIRONMENT ISSUES:**
“Contradictive” based on previous similar discussion [2]: Obtaining the large area as a loop cluster **having** potential on all issues

► **AIR MOVES FREELY FROM THE SITE TO THE LOWER SCALE AS THE BUILDING:**
The capability of reaching at least 50% → The optimum on reducing the active system and a high probability of the energy efficiency for the commercial estate

► **SPACE DEPTHLESS:**
Providing by the **cul-de-sac cluster**: The decode of irregular building height and capturing high air movement even in a lack of connectivity


Thank You