HUMAN BEHAVIOR, URBAN MORPHOLOGY, AND OUTDOOR THERMAL COMFORT: MICROCLIMATIC STUDY OF PUBLIC SPACES IN TALL URBAN CONDITIONS

Abstract

Outdoor public spaces are a focal point of human interaction, creating livable communities. These spaces constitute urban morphologies and contribute to social, cultural, economic, and public health development of sustainable cities. The current scenario of the constant rise in world population has created tall urban morphologies, thus impacting outdoor microclimates through high thermal stresses. Studies have shown that such stresses result in poor comfort levels and low human attendance. The health benefits of using outdoor spaces through physical activities is thereby reduced. Additionally, many developed countries like the US are facing increased morbidity problems due to the existing sedentary indoor lifestyle. Thus, in order to ensure public health, it is inevitable to ensure good thermal comfort conditions in outdoor spaces. The study of the environmental impact on human behavior in public open spaces has recently gained momentum amongst many urbanists and researchers. It is found that there exists a strong inter-relationship between four factors of human interaction: physical, physiological, psychological, and behavioral. However, this inter-relationship is not clearly defined.

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This study aims to: 1) investigate the inter-relationships between urban morphology, outdoor thermal comfort, and human behavior in urban public spaces, found in unique microclimatic variations; 2) to propose an algorithm for a pedestrian behavior simulation model of a particular urban morphology and its thermal comfort data; and 3) to validate this algorithmic approach to field studies data for accuracy. Research methodology adopted for this research will include field surveys and computer simulation. A transverse method of samplings will be considered to collect data three times a day for a week for four seasons. The data types include climatic data obtained through an on-site weather station while clothing level and metabolic rate through observation. Human attendance will be captured through video camera. EnviMet will be used to compute UTCI (universal thermal comfort index). An Agent-Based Model will be used to simulate pedestrian thermal behavior.

The expected outcomes are: 1) determining thermal comfort sensation scale for outdoor public spaces of the tall built environment in Chicago for future projects, 2) algorithm to predict human thermal behavior for public open space assessment, and 3) outline the key performance metrics of a successful open public space for urban policies.