FOLDING STRUCTURES:A HUMAN-CENTERED APPROACH TOWARD REACTIVE ENVIRONMENTS

RESEARCH OBJECTIVES AND RATIONALE. This research will draw upon a range of cross-disciplinary methodologies to theorize a functional and ethical framework to guide architects designing kinetic solutions for public spaces. The potential advantages of kinetic architecture to resolve the increasingly complex requirements of modern cities have been discussed by Zuk and Clark. This research will examine a range of functional issues that traditional, static structures have difficulty resolving: space sharing, adaptive and secure access, ease of deployment, ease of mobility, responsiveness to environmental conditions, efficient off-site fabrication and safety during catastrophic events. Easily deployable and functionally flexible solutions could play a significant role in developing Arctic territories. On-demand adjustable structures would shift the traditional lifecycles of buildings from construct-and-demolish toward assembly-and-reconfigure approach thus offering ways to reduce the ecological footprint of built environments. Currently, construction industry is identified as the largest consumer of energy and materials as well as the largest source of waste. The second group of benefits centers on possibilities of influencing mood and perceptions of occupants through physical changes of the environment. Such possibilities offer designers the means to better manage user comfort under extreme occupancy scenarios like overcrowding or high transiency.

CONTEXT. For decades, scholars have been expecting kinetic structures to become a trend in building evolution. However, despite the rapid development construction technologies as well as the increasing maturity of digital design tools, kinetic architecture has not yet evolved significantly (A.., 2005). My earlier research discussed two reasons for the relatively slow evolution of folding structures: design challenges such as the modeling of folding shells and the need to understand the impact of kinetic environments on future users. In response to design challenges, I proposed a solution whereby architects can access the engineering domain of kinematics using a novel application involving fuzzy logic and a knowledge-based approach. I also outlined the complexity of social considerations related to planning built environments of the future. Though architectural objects form a ubiquitous stage for human activity, systematic research on the emotional effects of built environments on their occupants and on how such environments influence social interactions is lacking. Even recent research on kinetic architecture focuses on the ‘physical and tangible’. This relative lack of empathic consideration in architectural workflows is reflected in its governing codes and planning strategies. Regulations address details regarding size, materials and safety, while planning is usually aimed at maximizing the utilization of space. Often, simple measures, which could increase emotional comfort, are being ignored. Scholars point out the complex nature of public spaces as, far from being merely static architectural scenographies, they also project intentional programming and restrictions of owners or local authorities. Furthermore, ubiquitous wireless access intersects public spaces with a much larger virtual domain, a mediated space. This research asserts that understanding of such multifaceted and evolving character of public spaces is an essential part of the design process of the future built environments.

PROPOSED APPROACH. This research will adopt a human perspective, a subjective and emotion-centered point of view to explore the potential effects of kinetic environments on the perceptual experiences and emotional responses of future users. The proposal builds on the notion that ‘space is an essential component of sociocultural theory’ and it expands on my earlier research on environments that are capable of actively engaging occupants. The goal is to develop insights into how physical environments are being perceived by occupants in terms of spatial awareness, comfort, fatigue or confusion; how changing conditions like time of day, crowding, noise level and illumination further influence individual perceptions. These insights will be used to theorize architectural means of purposeful influencing individual perceptions and, consequently, the group dynamics within built environments. First, a reference, an understanding of a public space as a ‘behavioral setting’ will be

established through the review of current research. Second, examined will be factors influencing behavior, emotions and perceptions within physical settings: how cultural conditioning affects the perception of personal distances, how perceptions of environmental settings are affected by emotional states and ambient conditions like lighting or sound, and most importantly, how physical surroundings can influence behavior. Third, the collected information will be used to theorize links between physical aspects of built environments, emotions and behaviors. Such phenomenological approach toward built environments is novel and provides a promising alternative to the traditional view that has been criticized by many scholars for relying solely on quantitative aspects like spatial metrics and functional performance.

EXPECTED RESULTS AND SIGNIFICANCE. Progress in understanding the emotional perceptions of built environments will expand purely quantitative planning of architectural projects to include perceptual and behavioral considerations for the purpose of foreseeing and influencing human responses. This project proposes that including human perception-based criteria is a logical step in developing increasingly more comprehensive architectural planning programs that already include environmental and lifecycle concerns. In view of the constantly increasing demographic loading of existing urban resources, related crowding and high transiency, this new design approach offers means of emotional comfort management besides merely crowd management.

This research intends to identify physical attributes that affect perceptions and behaviors of occupants in built environments. Such attributes may be as obvious as illumination and shape or may involve more subtle properties like sound reverberation and olfactory effects. The goal is to conceptualize a methodology of manipulating these attributes to achieve the desired emotional responses. For example: what sequences of effects can decrease an anxiety in an overcrowded space or can mitigate aggressive behaviors? What sequences of effects can make a remote arctic station feel less confined? The important contribution of this project is a notion of a built environment as a space that can facilitate, control, and engage users. Such concepts provide future designers with new opportunities and new responsibilities. Designers would be able to transcend the stage of crafting merely static and passive backdrops to human activities. Instead, they would be able to script behavioral and emotional scenarios.