Exploring pedestrian thermal comfort in hot climates

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Designing cities for thermal comfort should be a priority in the warming and urbanizing world. As cities continue to break extreme heat records, it is necessary to develop new sensing approaches capable of tracking thermal sensations of actual users of urban spaces. The influence of built infrastructure on the microclimate at a human scale and residents' thermal sensations is not well explored, but combining sensing techniques with simultaneous collection of user experiences is a promising research direction to shorten the gap.

We explored the relationships between the built environment, heat perception, and behavioral coping mechanisms in one of the most heat vulnerable Phoenix neighborhoods. Using Phoenix as an example, where extreme summer temperatures are a norm, can help to address heat challenges of other cities that have started facing temperature extremes in the recent years.

This study is an experimental citizen science project in which participants helped to create a "heat map" of the neighborhood. Participants were engaged in a 1-hour walk around the neighborhood and recorded their experience in a field guide. A smaller group participated in walking interviews and wore GPS devices and UV meters to gain deeper insights on subjective heat perception and physical body heat accumulation during the walk. Results revealed the differences in heat perception across a variety of urban landscapes. Participants identified preferred and most challenging locations, and gave ideas on what could improve their experience. Combined heart rate, UV exposure and microclimate data mapped in GIS visualized dependencies between the streetscape and physiological conditions of the study participants.

This project is one of the first to examine the impact of urban environment on dynamic psychological and physiological responses to heat. Using sensing techniques and qualitative research instruments, this research will inform the design changes in the neighborhood that will undergo redevelopment. It can serve as an example for other cities striving to adapt urban microclimates to new extremes.