Human- & Building-Scale Interactions

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Abstract
This position paper follows up on earlier position papers at ar-CHI-tecture at CHI'12, and GeoHCI at CHI'13, and outlines a number of themes on the intersection of location-based services, robots and autonomous systems. I'll look at the interaction between people and buildings from a variety of distances and then drive off to a slightly alternate reality. In the end, I'll have to arrive at the conclusion that considering the human-scale is crucial, especially in the large-scale data context that modern buildings already are. Just as crucial: our meeting with those disciplines that have a much more longstanding relationship with the built environment and its design.

Author Keywords
ArCHItecture, building technology, location, place, transport, reactive environments

Human-Building Interaction
Physical environments have a profound influence on people. Our surroundings and physical comfort affect our health, our behavior, how we perform, what we buy, our moods and general satisfaction [3, 8, 17]. Beyond our basic need for shelter, buildings are a crucial part of our interactions with the environment. We interact with buildings on a multitude of levels and distances.

Buildings from the abstracted afar
Buildings determine the distant view of cities, and can be crucial salient marks in the mental maps we build for ourselves – especially for the cities that we do not necessarily know well [2]. At the same time, the potential of cities lies not in their physical buildings, but rather in the meetings between people [9]. As the influential architect Jan Gehl points out, there is 'life between buildings' [8], and as Doersch et al. put it [7] pose how the 'look and feel' of a city does not depend on a few famous landmarks, but on 'the visual minutiae of daily urban life'.

Such human-scale experiences can get lost in the large. We can collect and process large-scale data, but when abstracting into a summary of local data, it's important to identify what is indeed locally characteristic rather than simply occurring [10]. However, we've seen that social norms and service design influence data collected [18], and that we may miss out on those in-place experiences most important to people [5].

Building-scale adaptation to human-scale optimums
A similar issue arises when figuring out the 'optimal experience' inside of a building. Robotic, smart or adaptive buildings have been around for quite a while [6]. Most modern buildings are equipped with a multitude of sensors, generating data for a variety of purposes [12], including adaptation to human occupants. Adaptive environments provide the opportunity for visceral experiences, that influence people's moods, behavior and use of space.

However, let's take automatic thermal regulation as a down-to-earth example of a technology meant to increase the comfort of human occupants of a building (and save energy and money). While perhaps not necessarily the most exciting topic, it does illustrate challenges that even the seemingly mundane can pose. Kingma [13] for example shows that standard comfort models used in buildings' thermal regulation are based on average male metabolic rates; leaving female occupants - and other 'non-male-averages' - cold. In addition, Parkinson and De Dear [17] point out that while most regulation systems are focused on maintaining a stasis, humans' experience of pleasure actually depends on perceived state changes, such as warming up when cold. Understanding the needs of *all, individual* human occupants of such buildings is of the utmost importance, as is the choice of the *specific* optimization target that functions as the proxy for 'the optimal' human experience (as is the case in any user-focused Machine Learning context). However, understanding the changing needs of individual occupants would require additional (intrusive?) data collection and adaptation. Plus, the smarter a system becomes, the more problems can arise – as illustrated by the recent Nest outage[1] – and the more crucial it is that human overrides are possible [1].

Similar issues arise in aesthetics. We can for example predict how visual building facades and street characteristics influence the perceptions of beauty and 'happiness' [19]. However, if we simply would blindly follow the goal of 'average happiest' design, our urban surroundings would potentially devolve into a bland mean; offensive to none, exciting to none. A human perspective, a point of view, should remain.

[1] http://www.engadget.com/2015/09/07/nest-outage/

There is enormous potential in adaptive architecture, but even enthusiasts for changing apartments and optimizing spatial usage such as Gary Chang, whose Hong Kong apartment's flexible walls create a 24-in-1 transformer house[2], points out he still wants the ability to control the home on his own, and the importance of enjoying the city outside.

ROBOTIC BUILDINGS' BODY LANGUAGE

An intriguing aspect of automated housing is the perspective of human occupants of robotic surroundings. Automated buildings have moving parts, and the momentum and aesthetics of those movements matter. Bakker [1] for example finds that 'less frequent but discrete transitions in facade configuration are significantly better appreciated than smooth transitions at a higher frequency'. As we've seen in human-robot interaction [e.g. 14], robotic body language has a large influence on people's perceptions and behavior. Perhaps the subtle movements of a flexible apartment's wall could be the difference between the experience of being locked down, or being hugged in a safe cocoon. Trust in autonomous agents is a fundamental challenge. If home technologies and home assistants start surrounding us, and affect not only the information we receive, but also our direct physical comfort, we need to still be able to trust our own homes.

In conclusion

While Human-Building Interaction may be positioned as an emerging field, the interaction between humans and buildings is a rather traditional, fundamental human affair. As a HCI researcher, I am woefully behind on millennia of architectural trends and practices – whether it's the effects of cultural shifts on Pompeian wall paintings [15]; the history of computational perspectives in architecture and discussions of AI assistants for architectural design in the 70's and 80's [11] to current practices in, let's say, automatically generating building layouts for games and VR [16].

Even if, in some distant optional future, alternate realities would be dominant, and our main experiences with buildings would be virtual ones, the principles that underlie the experience of buildings' physical design by humans remain relevant. Anecdotally, in a workshop in 2014[3] I attended where CCA graduates designed new car concepts, one group decided to position a car as a 'moving room' – illustrating that perhaps the principles of human-building interaction will have even wider applicability as the role of other technologies changes.

In any case, rather than reinvent the wheel, we need to meet – and be schooled by - our colleagues in those disciplines that have engaged with the built environment for ages, and I hope this workshop provides us with a possibility to do so.

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[3] 'future of the connected car' by CCA (SF, CA) & Audi.

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Bio

I'm a research scientist at Yahoo in California. My user data & design research revolves around people's interaction with systems that learn and adapt, and the resulting feedback loop. This has involved human-agent/robot interaction, and mobile location-based interactions focused on perceptions of cities and place, in both research and applied product settings.

I'm particularly interested in the ecosystems that surround individual users' interactions, the effects that different design strategies have on people's perceptions, and the (mis)match between human and machine models of the world around them.