

# 2VT: Visions, Technologies, and Visions of Technologies for Understanding Human Scale Spaces

VILLE PAANANEN, University of Oulu, Finland

PIIA MARKKANEN, University of Oulu, Finland

JONAS OPPENLAENDER, University of Oulu, Finland

LIK HANG LEE, Korea Advanced Institute of Science and Technology, South Korea

HAIDER AKMAL, Lancaster University, United Kingdom

AVA FATAH GEN. SCHIECK, University College London, United Kingdom

NIELS VAN BERKEL, Aalborg University, Denmark

JORGE GONCALVES, University of Melbourne, Australia

SIMO HOSIO, University of Oulu, Finland

CCS Concepts: • **Human-centered computing**; • **Security and privacy** → *Human and societal aspects of security and privacy*;

Additional Key Words and Phrases: spatial experiences, speculative design, human-building interaction

## ACM Reference Format:

Ville Paananen, Piia Markkanen, Jonas Oppenlaender, Lik Hang Lee, Haider Akmal, Ava Fatah gen. Schieck, Niels van Berkel, Jorge Goncalves, and Simo Hosio. . 2VT: Visions, Technologies, and Visions of Technologies for Understanding Human Scale Spaces. In . ACM, New York, NY, USA, 7 pages.

## 1 INTRODUCTION

The subject of spatial experience is pivotal in HCI and relevant in other fields, such as architecture, urban design, geography, and philosophy. For the same reason, it can be approached through various different analytical lenses [5]. For instance, the traditional Cartesian understanding of spaces is beneficial for constructing buildings but does not account for the multitude of spatially formed behaviours that are critical in HCI, *e.g.* dwelling, interacting, or encountering [11, 15]. Spaces can also be understood through their attributes, such as structural properties, form and design, or other metrics such as personal meaning and functional affordances or lack thereof. As a result, explication of spaces also requires analysis of the subjective constituents [12]. This workshop advances the CHI community’s collective understanding of spatial experience in *human scale*. Human scale environments focus on eye level experiences in rooms, streets and homes – as opposed to motorways, skyscrapers, or apartment complexes [8]. Thus, they are also inherently important in HCI, as the *de facto* context of use for most applications and spaces where creative installations are deployed. In this context, in our built environments, the proliferation of embedded technologies necessitates new

---

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

© Association for Computing Machinery.

Manuscript submitted to ACM

methods of understanding the spaces, as their complexity is rapidly growing beyond what can be accounted for by contemporary HCI methods [1, 8, 15].

This interdisciplinary workshop brings together scientists and practitioners interested in spatiality from the fields of technology, design, architecture, and creative arts, to improve our collective understanding of human scale spaces. We start by finding common ground on what spatial features can best convey the holistic understanding of a human scale space. We then speculate on technologies that could be used to capture these features and seek to envision the potential implications of such added spatial understanding to different disruptive future technologies and creative undertakings.

We are confident this workshop will attract participants with a diverse background and will contribute to CHI 2021 a fascinating melting pot of different ideas on the notion of human scale spaces. Despite the narrow scope, the implications of increased understanding of how to model human scale spaces might be relevant to various different domains considered pivotal in HCI, including mobile applications, IoT, situated technologies, virtual and augmented reality, computational architecture, spatial arts, and boundary-crossing specialised applications that intersect these domains.

### 1.1 Prior Art

Most previous work has investigated methods for spatial understanding in the regional, city- and urban area scope [2, 14]. For instance, web-based crowdsourcing has been shown as efficient in characterizing neighborhoods by deriving spatial features from user-generated content online [14]. More related to the human scale, in the pair of seminal papers on spaces and places in HCI [5, 10] the researchers focused on the understanding of humans' spatial dimensions and how the concepts of space and place could be used in design. Since the publication of those works, technological innovations have grown in number and their effect, and spatiality is now an important consideration in e.g. virtual reality Pouke et al. [18] or even IoT Coulton et al. [3]. Thus, there there is a risk that the understanding of the embodied human existence cannot keep up.

Kirsh [15] discusses the notions of interaction and interfaces in relation to HCI and architecture. The differences run deep: *"People don't read buildings the way they do HCI interfaces"* [15]. However, Kirsh [15] gives a detailed description on how to approach spatiality in these fields; The limitations of traditional interaction patterns in terms of agency, intention, and control, serve as a strong argument that we need to frame our thinking in a new way when thinking about spatiality in HCI. To tackle this task of developing new understanding, the emerging notion of Human-Building Interaction, or HBI, is focusing on to connect the built environment closer to the field of HCI. The goal of HBI is to form new understanding for future technologies, and to *"provide a framework that can be used to understand, compare and relate the converging research efforts from the two fields of HCI and Architecture in envisioning and shaping the future of living."* [1]

Spatial experience is affected by characteristics of a person, such as current mood, cultural background, and physical abilities. The experience is further shaped by various objective features of the environment itself. The person and the space are in a complex interaction, which requires these phenomena are explicated using different viewpoints. Past research on spatial experience can be roughly divided into two camps: theoretical descriptions and empirical studies. Theoretical descriptions have been studied in architecture, for example by explaining spaces through their sensory aspects [17], structure for labor, power, or social meanings [16], and urban design for human scale cities [8]. The empirical research can be used to form quantified understanding of spaces. For instance, Sandstrom et al. [19] studied the effect of location on a person's mood and found out that "home" is correlated with a positive mood. Furthermore, personality traits were found to affect the mood in different situations and locations (ibid). Several methods have been

utilized to understand urban spaces such as neighbourhoods and buildings, including location-based data-mining from social media [4, 13, 14, 21], and crowdsourcing data on subjective experiences of places [2, 7, 12, 20]. While these examples provide an understanding of urban spaces, there is a need for the human scale spatial understanding, to clarify how spaces are experienced in the scale most relevant to ubiquitous computing solutions. This workshop sets to fill this identified gap in research: To envision the necessary approaches and technologies that are needed to make better sense of human scale spaces.

As the topic of our workshop is not an established facet of HCI, it is helpful to form an understanding of the design space in question. To tackle this, we will utilize the Speculative Design [6] to envision the possibilities of spatial experience in HCI. Speculative Design has been used to explore possible future scenarios, and to aid the development of new technologies. The use of Speculative Design has been criticized for the biased outcomes, due to the privileged positions of the designers [9]. In the case of this workshop, the subject matter of spatial experiences is universal and personal, which gives a lot of fuel to use a method like Speculative Design, without being critically biased.

## 1.2 Objectives of this Workshop

This workshop is organised as an agora for practitioners from various backgrounds to discuss together human scale spaces, with three overarching objectives:

- (1) Discussing in a multidisciplinary environment about the relevant spatial features that might matter in the respective fields, and how, in creating better human scale spatial understanding. This can range anywhere from attributes that might VR developers create more realistic environments for industrial use cases such as remote training, to creative artists attempting to capture the "digital soul" or supernatural facets of a human scale space.
- (2) Speculative design of future technologies, methods, approaches that could be used to capture, in a machine-storable format, some of these identified features. Such format is needed for the features to be better usable as a building block in the context of HCI and digital solutions.
- (3) Sketch out a road map for future research on spatial understanding in human scale by mapping out potential implications of such increased spatial experience to future disruptive technologies, such as XR, Digital Twins, Smartphone Applications, crowdsourcing solutions, etc.

At the end of the workshop we will plan how to document the findings, *e.g.* in a special issue submission in a journal that we will identify later.

## 2 ORGANIZERS

As this workshop is intended for a diverse audience of technology experts, architects, creative designers, and artists alike, we have gathered a an organizing committee that is well-suited to support as well as publicize the workshop to ensure participation. The committee is also experienced in organizing CHI workshops and, more recently, hybrid and virtual conferences.

**Ville Paananen** is a doctoral student at the Center for Ubiquitous Computing, University of Oulu, Finland. His research interests lie in the cross-section of HCI and architecture, the emergent notion of Human-Building Interaction, and how the future technologies can be more spatially aware.

**Piia Markkanen** is a doctoral student in Oulu School of Architecture, University of Oulu, Finland. Her current research focuses on evaluating situation-related spatial experiences in work environments. She uses user-centric design methods

and real-world intervention studies in her research to explore different spatial dimensions (e.g. functional, symbolic, aesthetic) and elements, such as lighting and acoustics, that holistically influence spatial experiences.

**Jonas Oppenlaender** is a final-year doctoral student and a member of the Crowd Computing research group at the Center for Ubiquitous Computing, University of Oulu, Finland. His research interests include crowdsourcing, crowd feedback systems, and leveraging mixed-initiative systems for engaging, supporting, and empowering humans.

**Lik Hang Lee** is an Assistant Professor at the Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea. His research interests include augmented reality (AR) and virtual reality (VR). His recent research on AR/VR has investigated how to achieve city-wide user experience with such enriched contents and make the user-centric coexistence between digital entities and physical counterparts in an emerging form of spatiality.

**Haider Akmal** is a ...

**Ava Fatah gen Schieck** is...

**Niels van Berkel** is an Assistant Professor at the Human-Centered Computing Group at Aalborg University. His research interests lay in Human-Computer Interaction, Social Computing, and Ubiquitous Computing. On the topic of spatiality, he has studied the use of contextual data collection methods (e.g., crowdsourcing, citizen science) to support the creation of structured and unstructured local knowledge bases.

**Jorge Goncalves** is a Senior Lecturer in Human-Computer Interaction at the School of Computing and Information Systems in the University of Melbourne. His interests are in crowdsourcing, situated technologies, and Social Computing. Goncalves is a pioneer of situated crowdsourcing, including work on enabling situated technologies to self-learn about the surrounding space as a byproduct of offering gamified experiences to passersby.

**Simo Hosio** is an Associate Professor at the Center for Ubiquitous Computing, University of Oulu, Finland. He leads the Crowd Computing Research Group and is also associated with the Center for Life Course Health Research. His research interests include social computing, crowdsourcing, ubiquitous computing.

### 3 PRE-WORKSHOP PLANS

We will set up the workshop home page online, using the website of the Crowd Computing Research Group as the host site: <https://crowdcomputing.net/humanscale>. At first, the domain acts simply as a creative front for the workshop that contains the Call for Papers along with all the relevant dates and submission information.

Following the publication of the website, we will distribute the CfP via relevant mailing lists but also through the extensive colleague networks of the organizing committee, across several different organizations.

#### 3.1 Risk Management

This workshop will ideally be organized physically in Yokohama, but given the current situation with the COVID-19 pandemic, we are fully prepared to organize a hybrid or a virtual version of the workshop. To this end, the workshop submissions can all be presented remotely. The same applies for the design tasks and the urban exploration.

#### 4 WORKSHOP STRUCTURE

We aim for a maximum of 15 participants (excluding organizers), who will work in small groups during the workshop on themes that they self-identify to be most relevant to their interests. We will begin the day with a introduction to the topic of the workshop and organizers' presentation. Next, the workshop participants introduce themselves and present their submissions to the workshop. After the introduction of the organizers and participants, we will have a coffee break.

Next, as the first task of the workshop, the participants will be given a Speculative Design task to come up ways of gathering and applying spatial understanding. Afterwards each participant is given 3 minutes to present their ideas. During the workshop, we use shared Padlet board where all the photos and writings will be recorded, starting with the first design speculations.

After the coffee break, the participants will be divided into breakout groups (2–4 participants in each) to focus on different fields where the increased understanding of human experience in spaces will have implications; What and how exactly? The groups are free to bring their own expertise to the ideation process, but the organizers also provide inspiration through demonstrating Speculative Design and Design Fiction methods to support the group work. Like previously, groups will document their findings and designs on a shared collaboration tool online (e.g. Padlet, Miroboard). The morning session will conclude with a lunch (paid by the organizers, i.e. Center for Ubiquitous Computing) in a nearby restaurant.

The afternoon session will start after the lunch by organizing a urban exploration around the city, where the participants will gain further inspiration and are able to contrast their thinking by overlaying it to the physical surroundings under their respective themes. This approach allows the participants to refine and validate their ideas in a real-world context. The participants are encouraged to take photos, notes, and recordings from the exploration, to attach to their work. The route of the urban exploration will be arranged to cover different kinds of environments, and allow for various kinds of spatial experiences. The organizers plan the route during the day before the workshop with the help of our local contacts.

After the urban exploration we will continue working in the groups in the conference center and the participants will develop their ideas further. We will specifically ask them to consider the implications of their ideas in regards to the technology development. As the final task for the participants, they will present their groups' results. The workshop will conclude by reflecting on the outcomes of the day, led by the organizers.

##### First Session

30 min	Workshop introduction and introductions
45 min	Spatial features
30 min	Coffee break
90 min	Technology speculation, working in groups
45 min	Lunch break

##### Second Session

60 min	Urban exploration, observing spaces to validate the groups' work
30 min	Coffee break
30 min	Implications, working in groups
30 min	Small group presentations
45 min	Reflection, closing the workshop

## 5 POST-WORKSHOP PLANS

After the workshop, we will publish a concise summary of the resulting design speculations on the workshop website. More importantly, we seek to publish a joint article with the workshop participants in a suitable special issue, optimally in a multidisciplinary journal that is welcoming to work that intersects HCI and architecture, such as *Architectural Science Review* (ISSN 0003-8628) and *Transactions on Computer-Human Interaction* (ISSN 1073-0516).

## 6 CALL FOR PARTICIPATION

Spatial understanding refers to the perceptions, measurements, and representation of our surroundings. How will the future technologies, applications, or creative installations leverage such spatial understanding? This one-day workshop calls for experts from all related fields to ideate and contribute to our collective understanding of spatial experience.

This workshop is interested in the human scale: eye-level environments that are the de facto operating environment for most end-user technologies. We are open to a broad audience to stimulate the workshop participants by exposure to new points of views from different disciplines.

We invite your submissions on how different future technologies might benefit from increased spatial understanding. There are two submission types that we encourage:

- (1) a “traditional” paper providing a scientific contribution with empirical results
- (2) a “reflection” to propose visions or concepts and to reflect on how human scale spatial experience affects technological or creative solutions

We encourage you to communicate your ideas using a variety of methods: text, images, photos, sketches, and more. The submissions should use the DIS2020 Pictorial Format with length of 2–6 pages. Further details can be found at <https://crowdcomputing.net/humanscale>. We accept your submissions as a pdf by February 19th, 2021. At least one author of each accepted submission paper must attend the workshop and all participants must register for both the workshop and for at least one day of the conference. Participants will be selected by a juried process, based on their experience, expressed interest, and the content of the submission. To gather a rich set of views, we will focus on the diversity of the group of participants.

### Important Workshop Dates

Call for papers: December 15, 2020

Submission Deadline: February 19, 2021

Notification of acceptance: February 28, 2021

Workshop Date: May 8 or 9, 2021

## REFERENCES

- [1] Hamed S. Alavi, Elizabeth F. Churchill, Mikael Wiberg, Denis Lalanne, Peter Dalsgaard, Ava Fatah Gen Schieck, and Yvonne Rogers. 2019. Introduction to human-building interaction (HBI): Interfacing HCI with architecture and urban design. *ACM Transactions on Computer-Human Interaction* 26, 2, Article 6 (mar 2019), 10 pages. <https://doi.org/10.1145/3309714>
- [2] Olga Chesnokova, Mario Nowak, and Ross S. Purves. 2017. A Crowdsourced Model of Landscape Preference. *Leibniz International Proceedings in Informatics, LIPIcs* 86, 19 (2017), 1–13. <https://doi.org/10.4230/LIPIcs.COSIT.2017.19>
- [3] Paul Coulton, Haider Ali Akmal, and Joseph Lindley. 2020. Design Research and Object-Oriented Ontology. *Open Philosophy* 3, 1 (2020), 11–41. <https://doi.org/10.1515/opphil-2020-0002>
- [4] Fernanda de Oliveira Capela and Jose Emmanuel Ramirez-Marquez. 2019. Detecting Urban Identity Perception via Newspaper Topic Modeling. *Cities* 93, April (2019), 72–83. <https://doi.org/10.1016/j.cities.2019.04.009>

- [5] Paul Dourish. 2006. Re-Space-Ing Place: “Place” and “Space” Ten Years On. In *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work* (Banff, Alberta, Canada) (CSCW '06). ACM, New York, NY, USA, 299–308. <https://doi.org/10.1145/1180875.1180921>
- [6] Anthony Dunne and Fiona Raby. 2013. *Speculative everything: Design, fiction, and social dreaming*. The MIT Press, Cambridge, MA. <https://doi.org/10.1093/jdh/epv001>
- [7] Hinnerk Eißfeldt. 2019. Supporting Urban Air Mobility with Citizen Participatory Noise Sensing: A Concept. In *Companion Proceedings of The 2019 World Wide Web Conference* (San Francisco, USA) (WWW '19). Association for Computing Machinery, New York, NY, USA, 93–95. <https://doi.org/10.1145/3308560.3317059>
- [8] Jan Gehl. 2010. *Cities for people*. Island Press, Washington.
- [9] Alix Gerber. 2018. Participatory speculation: Futures of public safety. In *ACM International Conference Proceeding Series*, Vol. 2. Association for Computing Machinery, New York, New York, USA, 1–4. <https://doi.org/10.1145/3210604.3210640>
- [10] Steve Harrison and Paul Dourish. 1996. Re-Place-Ing Space: The Roles of Place and Space in Collaborative Systems. In *Proceedings of the 1996 ACM Conference on Computer Supported Cooperative Work* (Boston, Massachusetts, USA) (CSCW '96). ACM, New York, NY, USA, 67–76. <https://doi.org/10.1145/240080.240193>
- [11] B Hillier. 2007. *Space is the Machine. A configurational Theory*. Cambridge University Press, Cambridge University Press, University Printing House, Shaftesbury Road, Cambridge, CB2 8BS, United Kingdom. <http://discovery.ucl.ac.uk/49843/>
- [12] Yen-Chia Hsu, Jennifer Cross, Paul Dille, Michael Tasota, Beatrice Dias, Randy Sargent, Ting-Hao (Kenneth) Huang, and Illah Nourbakhsh. 2019. Smell Pittsburgh: Community-Empowered Mobile Smell Reporting System. In *Proceedings of the 24th International Conference on Intelligent User Interfaces* (Marina del Rey, California) (IUI '19). ACM, New York, NY, USA, 65–79. <https://doi.org/10.1145/3301275.3302293>
- [13] Kee Moon Jang and Youngchul Kim. 2019. Crowd-sourced Cognitive Mapping: A New Way of Displaying People’s Cognitive Perception of Urban Space. *PLoS ONE* 14, 6 (2019), 1–18. <https://doi.org/10.1371/journal.pone.0218590>
- [14] Andrew Jenkins, Arie Croitoru, Andrew T. Crooks, and Anthony Stefanidis. 2016. Crowdsourcing a Collective Sense of Place. *PLoS ONE* 11, 4 (apr 2016), 1–20. <https://doi.org/10.1371/journal.pone.0152932>
- [15] David Kirsh. 2019. Do architects and designers think about interactivity differently? *ACM Transactions on Computer-Human Interaction* 26, 2 (apr 2019), 1–43. <https://doi.org/10.1145/3301425>
- [16] Henri Lefebvre. 1991. *The production of space*. Blackwell Publishing, Oxford. 454 sivua pages. <https://doi.org/10.2307/490789>
- [17] Juhani Pallasmaa. 2006. *Eyes of the Skin: Architecture and the Senses*. Wiley-Academy, The Atrium, Southern Gate, Chichester, West Sussex P019 8SQ, England. [www.wiley-europe.com](http://www.wiley-europe.com)
- [18] Matti Pouke, Jorge Goncalves, Denzil Ferreira, and Vassilis Kostakos. 2016. Practical simulation of virtual crowds using points of interest. *Computers, Environment and Urban Systems* 57 (2016), 118–129.
- [19] Gillian M. Sandstrom, Neal Lathia, Cecilia Mascolo, and Peter J. Rentfrow. 2017. Putting Mood in Context: Using Smartphones to Examine how People Feel in Different Locations. *Journal of Research in Personality* 69 (2017), 96–101. <https://doi.org/10.1016/j.jrp.2016.06.004>
- [20] Jill Palzkill Woelfer, Amy Iverson, David G. Hendry, Batya Friedman, and Brian T. Gill. 2011. Improving the safety of homeless young people with mobile phones: Values, form and function. In *Conference on Human Factors in Computing Systems - Proceedings*. ACM Press, New York, New York, USA, 1707–1716. <https://doi.org/10.1145/1978942.1979191>
- [21] Xiaoyi Yuan and Andrew Crooks. 2019. Assessing the Placeness of Locations through User-Contributed Content. In *Proceedings of the 3rd ACM SIGSPATIAL International Workshop on AI for Geographic Knowledge Discovery* (Chicago, IL, USA) (GeoAI 2019). ACM, New York, NY, USA, 15–23. <https://doi.org/10.1145/3356471.3365231>