

Abstract Book

# Multiculturism and Multimodality in Architecture

1<sup>st</sup> AKAN Symposium

24-25 August 2022

Hanyang Univ., Seoul, Korea

UNSW, Sydney, Australia



Australian Government




Australia-Korea FOUNDATION



*This symposium is part of a project, "Supporting Exports of International Creative Team's Services: Australia-Korea remote teamwork", which is supported by the Department of Foreign Affairs and Trade (DFAT)/Australia- Korea Foundation (AKF) & UNSW Sydney (Scientia Program)*

 **사단법인 대한건축학회**  
ARCHITECTURAL INSTITUTE OF KOREA



## **Supporting Exports of International Creative Team's Services: Australia-Korea remote teamwork**

In response to the COVID-19 pandemic, architecture and design practices have faced a significant challenge in the need for successful collaboration without any physical contact between 'creative industry' people in different cultural and linguistic backgrounds. Due to this rapid digital transformation of communication, remote Computer Supported Cooperative Work (CSCW) has become core to the cognitive and communicative operations of creative teams in Australia and South Korea.

This project seeks to understand and overcome the emerging challenges of working in remote, bilingual creative teams, leading to opportunities for Australian and Korean designers and industries. Through intensive cognitive experiments using cloud-based CSCW technologies, combining cognitive analytic methods with cross-linguistic approaches, this project advances knowledge about the challenges and opportunities of remote design collaboration.

Educational, professional and industrial partnerships developed in the project will support creative and strategic links across both countries. By developing a guide or recommendations for cross-national teamwork, this project will advance the skills of the creative workforce for effectively engaging with architectural and design industries across the Australia-Korea region. Through this work, this project seeks to support, promote and grow the creative industries, building their sustainable and creative capital and multi-national connections.

Australian partner: Ju Hyun Lee, Michael J. Ostwald, Lan Ding, Dijana Alic

Korea partner: Mi Jeong Kim, Jeong-Hwa Song, Jin-Kook Lee, MinJung Cho, Sung Jun Park

Advisory contributor: Mark Taylor, Willy Sher

Program coordinator: Samaneh Arasteh

January 2022 - December 2023

## ***“Multiculturalism and Multimodality in Architecture”***

Steering Chair: Dr Ju Hyun Lee

Local Chair: Prof Mi Jeong Kim

The COVID-19 pandemic challenged this globalised creative industry in unprecedented ways, forcing both large and small architectural design practices to change their operations in this rapid digital transformation of communication and collaboration. This symposium seeks to understand and overcome the emerging challenges, *“Multiculturalism and Multimodality in Architecture”*, of working in remote, bilingual creative teams, leading to opportunities for international designers and industries.

세계화된 크리에이티브 산업은 COVID-19 대유행에 의한 전례 없는 방식의 도전을 경험하고 있습니다. 크고 작은 디자인 건축 실무들도 커뮤니케이션 및 협업의 급속한 디지털 전환에 따라 운영방식을 변화하도록 강요되고 있습니다. 이 심포지움은, “건축의 다문화주의와 다중양식”의 주제아래, 이러한 도전들을 이해하고 극복하고, 원격, 이중언어 (두나라간) 크리에이티브 팀들이 함께 효과적으로 일함으로써, 국제적 디자이너들과 산업들의 기회를 선도하고자 합니다.

Specifically, this Symposium explores communication/collaboration challenges faced by architectural teams working remotely and support efficient and sustainable design collaboration between designers working in a diverse range of environments.

특히, 이 심포지움은 원격으로 작업하는 건축 팀이 직면한 커뮤니케이션/협업 과제를 탐구하고 다양한 (다문화적인) 환경에서 작업하는 디자이너 간의 효율적이고 지속 가능한 설계 협업을 논의하고자 합니다.

## AKAN 2022 Program

**25 August 2022** at Hanyang University

9:30 – 10:00 am (Seoul), 10:30 – 11:00 am (Sydney)

**Welcome Keynote address** – Prof. Michael J. Ostwald

10:00 – 10:50 am (Seoul), 11:00 – 11:50 am (Sydney)

**Digital Design Collaboration** (Chair: Prof. Mi Jeong Kim)

11:00 – 11:50 am (Seoul), 12:00 – 12:50 pm (Sydney)

**Building Information Modelling** (Chair: A/Prof Jin-Kook Lee and Dr Ju Hyun Lee)

Lunch time

1:00 – 1:50 pm (Seoul), 2:00 – 2:50 pm (Sydney)

**Computer Supported Collaborative Design (CSCD)** (Chair: A/Prof Lan Ding)

2:00 – 3:20 pm (Seoul), 3:00 – 4:20 pm (Sydney)

**Design and culture** (Chair: A/Prof Dijana Alic and Prof Mladen Jadric)

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**24 August 2022** at Hanyang University

2:00 – 3:00 pm (Seoul), 3:00 – 4:00 pm (Sydney)

**Pre-Symposium virtual workshop** (Chair: Dr Michael J. Dawes)



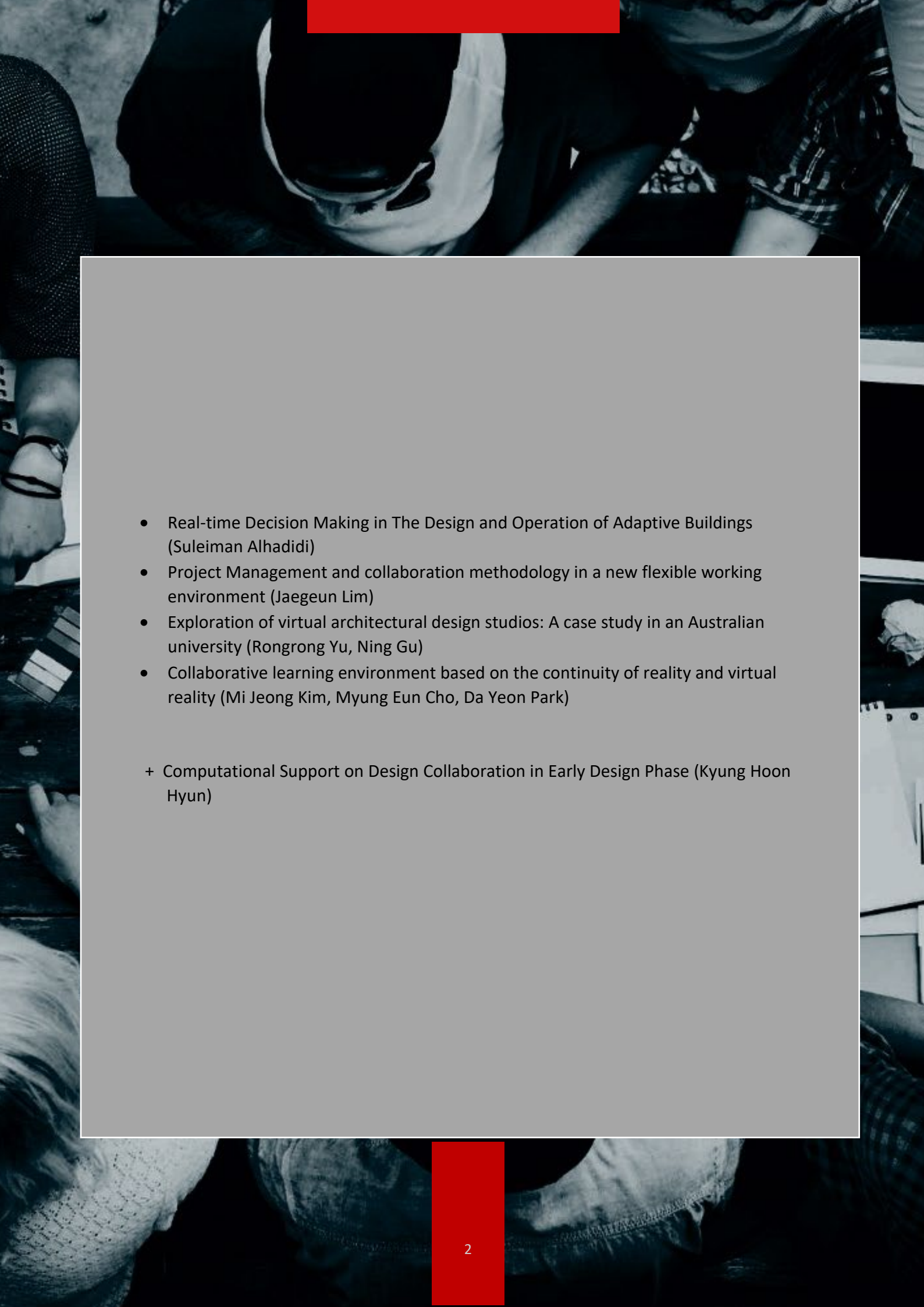
## Table of Contents

<b>Digital Design Collaboration .....</b>	<b>1</b>
Real-time Decision Making in The Design and Operation of Adaptive Buildings - Suleiman Alhadidi3	
Project Management and collaboration methodology in a new flexible working environment- Jaegeun Lim.....	5
Exploration of Virtual Architectural Design Studios - a case study in an Australian university – Rongrong Yu, Ning Gu.....	7
Collaborative learning environment based on the continuity of reality and virtual reality – Mi Jeong Kim, Myung Eun Cho, Da Yeon Park .....	9
Computational Support on Design Collaboration in Early Design Phase – Kyung Hoon Hyun .....	11
<b>Building Information Modelling.....</b>	<b>13</b>
BIM-enabled design collaboration in distributed environments (Samaneh Arasteh, Ju Hyun Lee, Michael J. Ostwald).....	15
AI-assisted BIM techs development project- Jin Kook Lee .....	17
Development of BIM-based building maintenance system for architectural heritages – Jong Jin Park, Kyeonghwan Kim, Seung Yeul Ji, Han Jong Jun.....	19
Dynamic evolution of collaboration network on BIM-based projects in Hong Kong (Xiaoying Li)...	21
<b>Computer Supported Collaborative Design (CSCD) .....</b>	<b>23</b>
Towards Mul-Sensory Design: Collaborative Placemaking through Immersive Environments- Rui Wang.....	25
Augmented Reality-based Historical Architecture Repair History Data Visualization and Management System – Mi Kyoung Kim, Jin Cheol Bae , Seung Yeul Ji, Han Jong Jun .....	27
Remote collaborative design processes between distributed designers and across cultures – Michael J. Ostwald, Ju Hyun Lee .....	29
Implementation of Smart Space Using Brain Wave and Game Engine in Digital Twin- Seung Yeul Ji, Jin Cheol Bae, Mi Kyoung Kim, Han Jong Jun.....	31

<b>Design and culture .....</b>	<b>33</b>
Exploring the complexities of cross-cultural collaborations through the dialogue of two international practices- A/Prof. Mladen Jadric and Prof. Yoon Geun .....	35
Collaborative design: cross cultures and diversity- David Holm.....	37
Hassell’s International collaborations- David Tickle .....	39
Culture and environment in open spaces within large dense urban living blocks- Minjung Maing.	41
Pattern languages as means of cultural exchange- Michael J. Dawes.....	43
ENCLAVE : TESTING CITY FOR KOREAN REUNIFICATION - Joohui Son.....	45
<b>Pre-Symposium virtual workshop .....</b>	<b>48</b>
Developing a Balanced Smart Urban Context focusing on Human Experience – Min Jee Nikki Han, Mi Jeong Kim.....	50
Cultural diversity in the built environment: the importance of diverse, inclusive and sustainability- Ling Zhou.....	52
The changing syntactic patterns of public housing in Sydney over time- Rui Wu.....	54
Machine Learning and Optimisation Approaches to Automated Design Generation: A Case Study of Residential Building Layouts in Saudi Arabia - Esraa Aljawi, Ju Hyun Lee and Michael J. Ostwald .....	56



# Digital Design Collaboration

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- Real-time Decision Making in The Design and Operation of Adaptive Buildings (Suleiman Alhadidi)
  - Project Management and collaboration methodology in a new flexible working environment (Jaegeun Lim)
  - Exploration of virtual architectural design studios: A case study in an Australian university (Rongrong Yu, Ning Gu)
  - Collaborative learning environment based on the continuity of reality and virtual reality (Mi Jeong Kim, Myung Eun Cho, Da Yeon Park)
- + Computational Support on Design Collaboration in Early Design Phase (Kyung Hoon Hyun)





## Digital Design Collaboration

### Real-time Decision Making in The Design and Operation of Adaptive Buildings - Suleiman Alhadidi

The recent socioeconomic changes in the way we work and live are forcing the design and construction industries to re-evaluate their methods of designing and operating buildings. As buildings are becoming more flexible and adaptive, we need to rethink how we quantify spaces' needs to change in shorter timeframes. This talk describes a novel way in decision-making based on real-time data during the design and operation phases of the buildings. Suleiman will discuss the emerging trends and the opportunities for adaptive buildings based on his current practice and research work at Harvard and MIT universities.



**Suleiman** is an award-winning architect (NSW ARB Australia #9827), researcher, engineer, and investor in adaptive buildings and building automation through real-time technologies. In his work, he uses advanced technologies to create efficient buildings and cities. Alhadidi practiced architecture in Australia, the USA, Europe, and the Middle East. He took several in academic positions in Australia and USA with leading institutions such as the MIT, Harvard University, UNSW, and the University of Melbourne.

## Project Management and collaboration methodology in a new flexible working environment- Jaegeun Lim

The purpose of this paper is to share the work in progress of our project management and collaboration methodology in a new working environment of a post pandemic situation.

A project architect, in general, manages and communicates with team members by email, and has project coordination meetings in regular working hours. In the pandemic period the office was enforced by the government to close, and all employees were situated to be working from home. Therefore, the traditional project managing methodology was limited to operate in a flexible and remote working environment. To provide architectural services, projects had to be managed and collaborated through online video communication platforms such as Zoom and MS Teams. Now, employees are allowed to work back in the office, however COX continuously offers flexible working hours and working spaces to prepare for future situations. Application COX's national design and technology group (DT group) initiated a research program with COX R&D group to apply software that is comparable to our current office management system, and to improve team communication and work efficiency of projects in a new working environment...Working from home diminishes the moment to be interactive with other colleagues or the project team. Currently, 90 percent of employees are willing to continue to take the opportunity of flexible working hours and work from home in this situation. To retain the office culture and expand collaborative opportunity, the management team applies a new work desk policy which allocates shared desks and reduces dedicated desk spaces. This increases the opportunity to collaborate and communicate with other colleagues.

The applied new managing and collaborating system motivates members to participate in the overall project process and delegates the authority to accomplish this. It reduces time spent on incidental matters in the office and expands members' understanding of the project process. It alleviates the office culture, the opportunity for interaction and knowledge sharing in between team members. The new office fit out also escalates interactivities.



**Jaegeun** joined Cox Architecture in 2016, initially providing parametric design and solutions for documenting complicated geometries in the construction phase of the National Maritime Museum in China. Jaegeun has worked and studied in various cities across Australia, South Korea, and the United States. He brings experience from his international design work on specialised form-making, master planning, public spaces, art installations, office, education, and sporting facilities.

Jaegeun emphasises collaboration throughout his work by bringing artists, designers, contractors, engineers as well as clients and key stakeholders to the forefront of the process, and ensuring the essential ideas are captured in the results.

## Exploration of Virtual Architectural Design Studios - a case study in an Australian university – Rongrong Yu, Ning Gu

Architectural design and learning heavily relies on visual representation and interaction and precedent narratives. In architectural design studios, students learn and trial design strategies and procedures, and develop their proficiency through a regular iterative process of consultation, feedback and reflection (Logan, 2008). Traditionally, architecture students learn to design within a physical studio environment, in which a qualified tutor (e.g., a practicing architect) periodically reviews their work and progress (Schön, 1983). The potential value of a virtual architectural design studio (VADS) concept was first identified in the 1990s (Mitchell, 1995), and since then the concept has been extensively discussed and developed with each new generation of technological advancement. VADS can have the capability to support complex interactions in intricate social learning scenarios (Jones et al., 2020), as well as to promote virtual collaboration between universities globally.

We are at a key juncture, where architectural education and its dominant studio culture have reached the point of fully embracing these technologies and entering the virtual learning. Yet to date there remains a lack of clear understanding, in relation to the learning and teaching experiences in various emerging virtual studios and the perceptions of students and teachers alike, as well as the obstacles and limitations associated with different technologies adopted in such studios. This study investigated seven VADSs at an Australian university, incorporating survey results returned from 47 students enrolled in those studios and one in-depth interview with the course coordinator. Preliminary results from this study suggest that architectural students have a generally positive experience within VADS, especially in relation to the flexibility offered by VADS. These results also identify a need for further development and enhancement of related technologies, such as a need for enhanced drawing and collaborative shared modelling environments, in order to better support the future of architectural design and learning in these new contexts. Results of the study provide us with understandings about the students' and staff's teaching and learning experiences of the current VADS, which can set a foundation for better planning and designing virtual learning for architectural education.



**Rongrong Yu** is an Enterprise Fellow and Senior Lecturer in Architecture at the University of South Australia. Her research interests cover broad areas of architectural computing, computational analysis and design cognition. She was awarded her PhD from the University of Newcastle in Australia, and she's had multiple visiting and research positions in Australia, China, and the United States. She recently co-authored the book "Computational Design: Technology, Cognition and Environments" (Taylor and Francis CRC Press, 2021) with Prof. Ning Gu and Prof. Michael Ostwald.



**Ning Gu** is a Professor in Architecture at the University of South Australia. He is a Deputy Director of Australian Research Centre for Interactive and Virtual Environments (IVE). He has researched in the broad areas of Architectural Computing and Design Cognition, including topics such as Computational Design Analysis; Computer-supported Collaborative Design; Interactive and Virtual Environments; Building Information Modelling (BIM); Generative and Parametric Design Systems; Intercultural Design and Communication; and Protocol Studies on designers' behaviour and cognition.



## Digital Design Collaboration

### Collaborative learning environment based on the continuity of reality and virtual reality – Mi Jeong Kim, Myung Eun Cho, Da Yeon Park

Various collaborative technologies have supported design communication among members of design teams and the understanding of affordances in technologies is critical to design collaboration. Recently, many fields have begun discussing the potential of virtual spaces for design collaboration and communication in education along with the surge of interest in the metaverse. However, empirical research on the space and content utilizing the continuity of reality and virtual reality is lacking. To improve the quality of education in the design field delivered through the virtual space such as online classes, this research focuses on the educational environment in the design field to be supported by various technologies. Compared to other majors, the design majors have not reached a high level of participation in online classes due to their learning centred on practical skills. However, due to the COVID-19 pandemic, design classes conducted online were unavoidable, and it is expected that online courses will continue in some subjects due to the flexibility of the online method. This study aims to provide empirical data for developing the digital education environment using virtual space centred on students and instructors in the design major. To this end, as a first step, this study examines what kind of educational experience that students and professors in the Architecture departments had gone through, during the COVID-19 pandemic. In addition, this study introduces the explorative research for the potential of social networking as a collective medium, encouraging design communication among students. The status of the online education environment and the demands for digital technologies in design education are presented, focusing on the experiences of architecture students' learning and professors' lecture.



**Mi Jeong Kim** is a professor of the School of Architecture at Hanyang University in Korea. She received her Ph.D. in the Key Centre of Design Computing and Cognition at the University of Sydney and worked as a postdoc fellow at UC Berkeley before joining Kyung Hee University. She was previously a visiting fellow at NYU, MIT, and Curtin University. She is an Editor-in-Chief of the Journal of the Korean Institute of Interior Design and on the editorial boards of the International Journal of Architectural Research. Her research interest includes sensing architecture, human-building interaction, design education & strategies for creativity, smart homes, and communities.



**Myung Eun Cho** is a research professor in the Institute of Engineering and Architecture at Hanyang University. She graduated from Yonsei University, majoring in Housing & Interior Design, and received her master's and a Ph.D. from the same graduate school. She worked at LG Electronics Design Research Centre and was a research professor in the Centre for Sustainable Health Architecture and the Department of Housing & Interior Design at Kyung Hee University. Her research interest includes planning the residential environment, user experience, space design from an emotional and cognitive perspective, and housing related to intelligent technology.



**Da Yeon Park** received her bachelor's and master's degree from the University of Sydney, Australia, and a Ph.D. in Building and City Energy from Korea University. She researched sustainable building and renewable energy at the Korea Institute of Civil Engineering and Building Technology (KICT) and planned energy efficiency R&D at the Korea Institute of Energy Technology Evaluation and Planning (KETEP). Currently, she is a researcher at Hanyang University's Sensing Space Lab and works as a freelancer at Samoo Architects & Engineers. Da Yeon's area of interest is green transition in cities and building planning for a sustainable society.



## Computational Support on Design Collaboration in Early Design Phase – Kyung Hoon Hyun

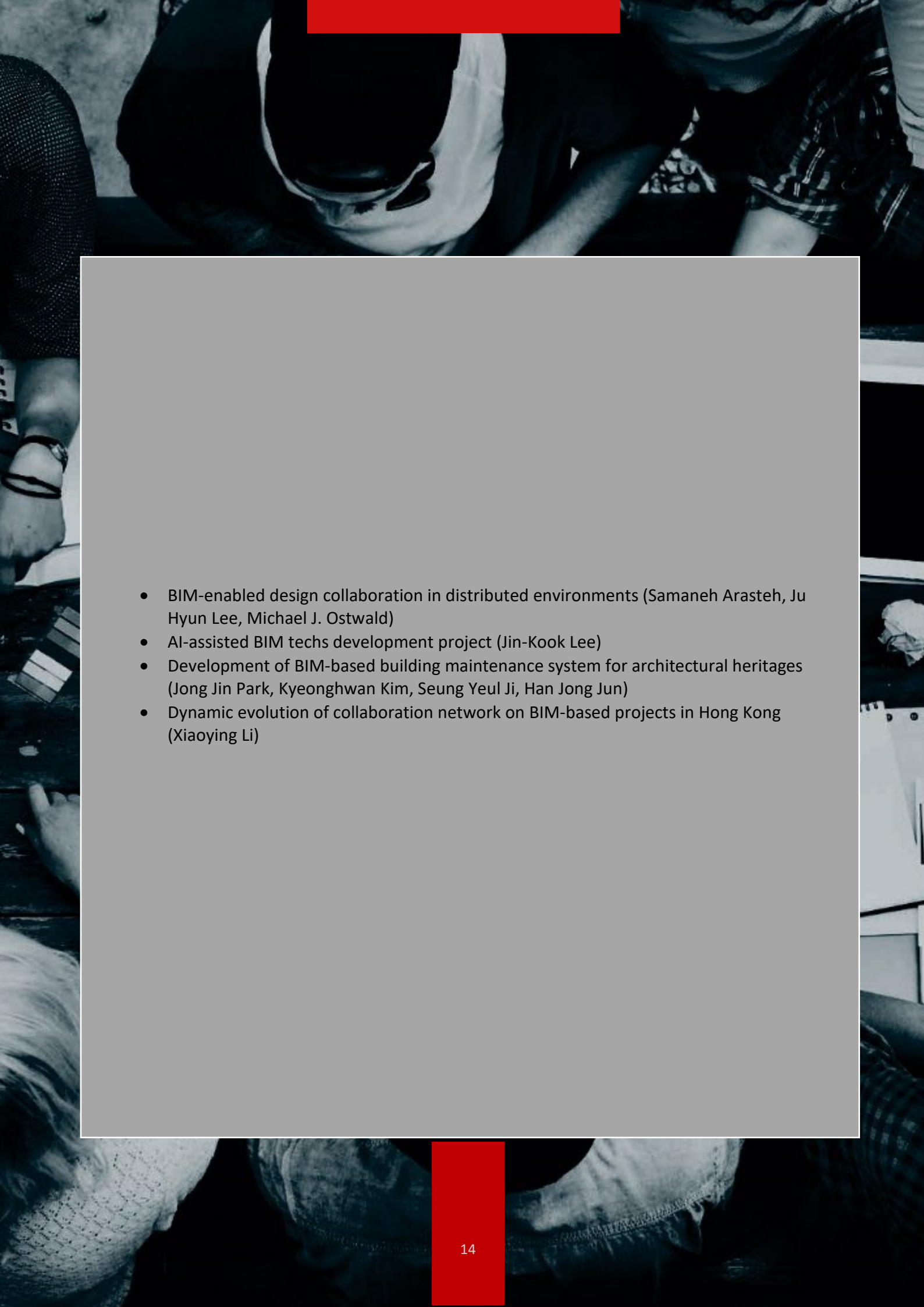
The range of problems that designers have to solve is expanding. Designers not only deal with aesthetics and functions but create design outcomes by considering various information such as user behavior, technology, usability, productivity, and financial factors. Therefore, effective design collaboration becomes essential as the time to solve complex design problems increases. Design collaboration is crucial because information can be shared with team members to handle complex design problems better. In particular, it is vital to support design collaboration as quickly and effectively as possible since the overall concept and direction of design are defined in the early design phase. This study intends to introduce research cases that support collaboration in the early stages of design. Also, this study discusses the implications of computational support on future design collaboration.



**Kyung Hoon Hyun** is a computational designer with an interest in human-computer interaction, design automation and intelligent design system; he is an Assistant Professor in the Department of Interior Architecture Design of Hanyang University, and director of the Design Informatics Lab.



## **Building Information Modelling**

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- BIM-enabled design collaboration in distributed environments (Samaneh Arasteh, Ju Hyun Lee, Michael J. Ostwald)
  - AI-assisted BIM techs development project (Jin-Kook Lee)
  - Development of BIM-based building maintenance system for architectural heritages (Jong Jin Park, Kyeonghwan Kim, Seung Yeul Ji, Han Jong Jun)
  - Dynamic evolution of collaboration network on BIM-based projects in Hong Kong (Xiaoying Li)



## Building Information Modelling

### BIM-enabled design collaboration in distributed environments (Samaneh Arasteh, Ju Hyun Lee, Michael J. Ostwald)

Remote design collaboration has become critical to architectural practice and education in Australia. BIM as computer supported collaborative design (CSCD) is core to both sharing and producing architectural designs, consequently evolving in response. This research aims to examine and identify ways to improve BIM-enabled design collaboration processes in architectural practice and education. Using data from semi-structured open-ended interviews (n = 25) undertaken during the COVID-19 pandemic, we identify six thematic categories of BIM-enabled design and collaboration processes: (i) representation, (ii) communication, (iii) coordination, (iv) collaboration, (v) technical operation, and (vi) non-technical operation. These themes, along with 48 codes developed from the interviews, are then presented as an integrated BIM process model. This model contributes to a collective understanding of recent BIM processes and areas where improvements are needed to support BIM adoption and implementation in the new era of remote design collaboration.



**Samaneh Arasteh** received her Ph.D. in Architecture and urban planning from UNSW, Sydney, in the School of Built Environment. She is project coordinator for AKAN project. Currently, she works as post-doctoral fellow in the field of sustainability with high performance team in UNSW. She is also a part-time post-doctoral fellow at the University of Sydney in the field of circular economy. She is interested in multidisciplinary collaboration in the fields of: Building information modeling, environmentally sustainable design, circular economy and sustainable society.



**Ju Hyun Lee** is a Scientia Senior Lecturer at UNSW, Sydney, in the School of Built Environment. He has made significant contributions towards research in architectural computing and cognition. As a senior lecturer he completed a five-year post-doctoral fellowship at Newcastle and has held multiple academic roles in Australia and South Korea since 2003. He was a senior research fellow at UNISA in 2018. He is co-author with Michael J. Oswald of *Grammatical and Syntactical Approaches in Architecture* (IGI Global 2020) and co-author with Michael J. Oswald and Ning Gu of *Design Thinking: Creativity, Collaboration and Culture* (Springer 2020).



**Michael J. Oswald** is Professor of Architecture and Associate Dean of Research at UNSW, Sydney. He has previously been a Professorial Research Fellow at Victoria University Wellington, a visiting Professor and Research Fellow at RMIT University, an ARC Future Fellow at Newcastle and a visiting fellow at ANU, MIT, HKU and UCLA. He completed postdoctoral research on geometry at the CCA (Montreal) and Harvard (Mass.). Michael is Co-Editor-in-Chief of the *Nexus Network Journal: Architecture and Mathematics* (Springer) and on the editorial boards of *ARQ* (Cambridge) and *Architectural Theory Review* (Taylor and Francis).



## Building Information Modelling

### AI-assisted BIM techs development project- Jin Kook Lee

As the more people use BIM (building information modelling/management), the more BIM applications have been developed for better built environments. Evolving techs are always the subject of BIM applications in order to synergize with them, and one of contemporary popular techs is AI (artificial intelligence). In this research, we present a direction of research and development of Korea government and industry to the so-called AI-BIM. There is a Korean government initiative to enhance the productivity, performance, and overall quality of building design by using BIM. However, in reality, there are still a lot of time-consuming and error-prone tasks especially to hinder enhancing productivity. Not only to explore AI-BIM as an extended version of BIM, but also to alleviate such unnecessary problems is the main objective of the project. We initially focus on the 'good data' from AEC-FM domain. This includes the way of creating good data by using BIM models, and to train those using deep learning algorithms so that we can test the possibilities and reliabilities for actual use cases of architecturally various trained models. In this Australia-Korea architecture network symposium, shared ideas will help to broaden the direction to better built environment.



**Jin-Kook Lee** is an associate professor of dept. of Interior Architecture and Built Environment, Yonsei University, and a researcher/developer in the field of Design Computing, the intersection between design and computation where the challenging issues arise while we design and build our surroundings. His recent focus is on the applications of BIM and advanced techs including AI for the analysis and design of built environment in computational manner. He pursues 'way better environment' as his long-term goal in academia, to take advantage of his interdisciplinary studies in architecture, computer science, digital design media, and housing & interior design.



## Development of BIM-based building maintenance system for architectural heritages – Jong Jin Park, Kyeonghwan Kim, Seung Yeul Ji, Han Jong Jun

Traditional wooden architectural heritage has managed the problem of deterioration of durability due to aging through continuous repair. However, a small displacement occurs in the building during each repair process, making it difficult to identify the original member, and if the damage is serious, a secondary problem may occur within a short period of time after repair, resulting in a decrease in cultural value and economic loss. In the case of the wooden architectural heritage, the information necessary to analyse the cause of damage or determine the repair method is basically collected through written reports such as repair or survey reports from the past. However, such information is difficult to collect because it is often fragmented over time and distributed and managed by different remote institutions.

To compensate for these limitations, it is necessary to introduce Building Information Modeling (BIM) system, an integrated tool that can produce and manage life cycle information of buildings by linking geometric shape information and attribute information. In particular, in the case of wooden architectural heritage, where thorough maintenance and systematic management are of paramount importance due to the nature of materials, the introduction of BIM systems enables efficient spatial information construction and management while ensuring information consistency and continuity. Therefore, this study aims to develop a BIM-based building maintenance system for architectural heritage using non-formal information, which is one of the advantages of the BIM system. This BIM-based maintenance system allows users to not only integrated and manage the repair record data of building heritages directly through the system, but also to analyse information for building management through various data visualisations based on the repair history, thereby increasing the usability of the BIM system.

To develop the BIM-based building maintenance system for architectural heritages that can integrate and manage preservation and repair data, this research (i) analyses the BIM-based facility maintenance work procedure in order to link the functions and elements necessary for the maintenance of architectural heritages with the proposed BIM system, (ii) develops a Revit plug-in that can automatically input preservation and repair information using Revit API and Dynamo, (iii) visualizes the database of the repair history of building elements based on the BIM model of Daeungjeon Hall of Sudeoksa Tempmle, Yesan, Korea, and (iv) proposes a system utilisation scenario for the maintenance of cultural properties using the proposed system.



**Jong Jin Park** is currently working as a Research Professor in the School of Architecture at Hanyang University, Seoul, Korea. He completed his B.S. and M.Phil in Architectural Design Studies from Hanyang University in 2006 and 2010, respectively. Thereafter in 2016 he completed his Ph.D in Architecture, Building and Planning from the University of Melbourne, Australia in bio-inspired architectural design. Dr. Park is serving as a principal researcher in the Architectural Design Computing Centre (ADCC) and lecturer at Hanyang University since July 2017. His current areas of research interest are digital heritage restoration, HBIM, ontology, semantic web and data sciences.



Kyeonghwan Kim is currently working toward the master's degree in Architectural Design Studies in the School of Architecture at Hanyang University, Seoul, Korea. His research interests are BIM/HBIM, design collaboration and facility management for architectural heritages.



**Seung Yeul Ji** is a Research Professor at Hanyang University. He has been conducting research on the application of brain waves and artificial intelligence to architectural spaces for 10 years. He participated in the production of three documentaries on the topic of EEG-based architectural space research through a domestic broadcasting company. While he was also a research professor, he worked on four government projects related to brain waves. He previously worked on several BIM projects and founded a company to conduct overseas BIM construction projects.



**Han Jong Jun** is Professor in the School of Architecture at Hanyang University, Seoul, Korea since 1998. He completed his Ph.D in 1997 in design computing from University of Sydney, Australia. He has been a principal investigator on numerous research grants and contracts in the field of BIM/HBIM, IoT, VR/AR and knowledge-based design methodology funded by private sectors and national research foundations. He is the leader of the ADCC and is currently working on research projects on electroencephalogram (EGG)-based emotional architecture, HBIM and digital archiving.

## Dynamic evolution of collaboration network on BIM-based projects in Hong Kong (Xiaoying Li)

As an innovative technology to parametrically create, share, and utilize project life-cycle data, Building Information Modeling (BIM) is recognized as a promising technology to streamline traditional design and construction. Realizing the tremendous potential benefits of BIM, as pioneered by some public client organizations, the diffusion of BIM in the Hong Kong construction industry could date back about a decade ago. However, compared with leading countries, the development of BIM in Hong Kong is still at a preliminary stage and has driven the market itself.

This research aims to empirically investigate the structural characteristics of industry-level collaborative networks for BIM implementation and quantitatively characterize the dynamics of the networks. In order to achieve the research aims, longitudinal data on 192 BIM-based construction projects conducted in Hong Kong from 2002 to 2017 was first collected through a questionnaire survey and semi-structured interviews. Using the method of social network analysis (SNA) and stochastic actor-oriented models (SAOM), this research firstly categorized and compared the evolution of BIM collaboration networks in terms of different types of construction projects, and secondly characterized the evolution of the macro-structure of the project-based collaborative network and explored the underlying driving factors.

This research has generated several significant research findings which have provided a systematic understanding of the adoption practices of innovative technology and could help facilitate the diffusion and advancement of BIM in the regional construction industry. (1) Descriptive analyses of the project-based collaborative network for BIM implementation among the 204 investigated organizations reveal that the network becomes increasingly dense over time but persistently exhibits the core-periphery structure and expands around a small number of “super-connected” nodes. This result suggests that some prominent organizations have played relatively essential roles in facilitating the diffusion of BIM-related knowledge in the Hong Kong construction industry. The result also reveals significant differences in the structure of project-based collaborative networks for BIM implementation in the regional construction industry. (2) With regard to the micro-mechanisms underlying the dynamics of the project-based collaborative network, the results of SAOM analysis provide evidence that the evolution of the macro-level network significantly relates to the structure-based preferential attachment effect and the experience-based similarity effect operating at the

micro-level. It is also revealed that the individual covariate effects associated with organizational ownership type and organizational BIM experience also significantly influence the dynamics of the project-based collaborative network.

The present study not only models the dynamic evolution of project-based collaboration networks but also quantitatively examines the roles of the similarity effect and the individual covariate effects related to organizational ownership type underlying the dynamics of project-based collaborative networks for BIM implementation. The research contributes to a deepened understanding of the BIM adoption in the Hong Kong construction industry and provides several managerial and policy implications.




**Xiaoying Li** is now a Postdoctoral Fellow in the Department of Building and Real Estate (BRE) at The Hong Kong Polytechnic University (PolyU). She received her doctoral degree and master's degree in construction informatics from BRE at PolyU in 2022 and 2018, respectively. During this period, she has published several journal papers in major journals in her field. Her research interest focuses on Building Information Modeling (BIM) and Management, Project Networks, and Inter-organizational Collaboration. Meanwhile, she has participated in two Public Policy Research projects in Hong Kong, which enables her to acquire the leading practice and lay the foundation of deep research in the regional construction industry.



## **Computer Supported Collaborative Design (CSCD)**

- Towards Multi-Sensory Design: Collaborative Placemaking through Immersive Environments (Rui Wang)
- Augmented Reality-based Historical Architecture Repair History Data Visualization and Management System (Mi Kyoung Kim, Jin Cheol Bae , Seung Yeul Ji, Han Jong Jun)
- Remote collaborative design processes between distributed designers and across cultures (Ju Hyun Lee, Michael J. Ostwald)

+ Implementation of Smart Space Using Brain Wave and Game Engine in Digital Twin (Seung Yeul Ji, Jin Cheol Bae, Mi Kyoung Kim, Han Jong Jun)



## Computer Supported Collaborative Design (CSCD)

### Towards Mul-Sensory Design: Collaborative Placemaking through Immersive Environments- Rui Wang

Mul-Sensory Design is an experimental project that explores the potential and limitations of immersive environments as a means to support the incorporation of intangible sensory aspects of place integrated into the collaborative design process. The study investigates how sensory exploration of collaborative designs in VR can be integrated into decision making and design concept assessment. An interactive mixed-media approach adopted for this project, allowed users to tap into visual, aural and kinetic human senses; and provided an additional level of engagement by adding a temporal dimension to the shared virtual space. Results of the evaluation study are presented, assessing key features of the proposed sensory design approach and reports on the identified limitations and opportunities for future studies.


#### Highlights

- New and accessible approach for immersive multi-sensory collaborative design in architecture.
- Mul-sensory environments have advantages over traditional communication approaches.
- Weather features and smells are top priorities to incorporate in future prototypes.
- The use of photographs was reported to be redundant for VR environments.
- Placemaking in VR can benefit from Incorporating multi-sensory experiences.



**Rui Wang** is a senior research scientist in the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, in the emerging research direction of digital twin (DT) and Industry 4.0. She has an interdisciplinary research background with degrees experiences in both computer science and built environment. Before she joined CSIRO, she was a senior lecturer of emerging technology in the School of IT, Deakin University. Her expertise and research interests include virtual reality (VR), augmented reality (AR), mixed reality (MR), Human-Computer Interaction (HCI) and their applications in the AECO (Architecture, Engineering, Construction, Operation) sector.





## Computer Supported Collaborative Design (CSCD)

### Augmented Reality-based Historical Architecture Repair History Data Visualization and Management System – Mi Kyoung Kim, Jin Cheol Bae , Seung Yeul Ji, Han Jong Jun

Historical architectural information has been produced from the past to the present as a variety of historical information such as drawings, photos, and documents. This fragmented information is comprehensively considered by field workers in the field, and decisions are made for maintenance. It is difficult to repair, maintain, and restore each component under limited conditions considering the complex and diverse situation.

AR can be used as a technology that can be used as a decision-making tool for field workers by organizing, analyzing, and visualizing such components information. AR superimposes architectural information on the current appearance seen by the camera, so that each attribute information can be directly checked.

Therefore, the purpose of this study is to analyze the requirements for the maintenance of historic architecture, and to build a system that can be directly visualized and managed through overlapping with field data using AR technology. It is possible to realize an environment that enables digital collaboration with field workers by directly checking the data for maintenance through real-time interlocking of historical architectural information with the AR system.

This can be used as a decision-making tool for maintenance by segmenting and specializing historical architectural repair information in the future.



**Mi Kyong Kim** is a Research Professor at Hanyang University, Seoul, in the School of Architecture. She conducts research in BIM and architectural design computing. As the project manager, she carried out three government tasks and is currently working on the HBIM(Historic Building Information Modeling) project.



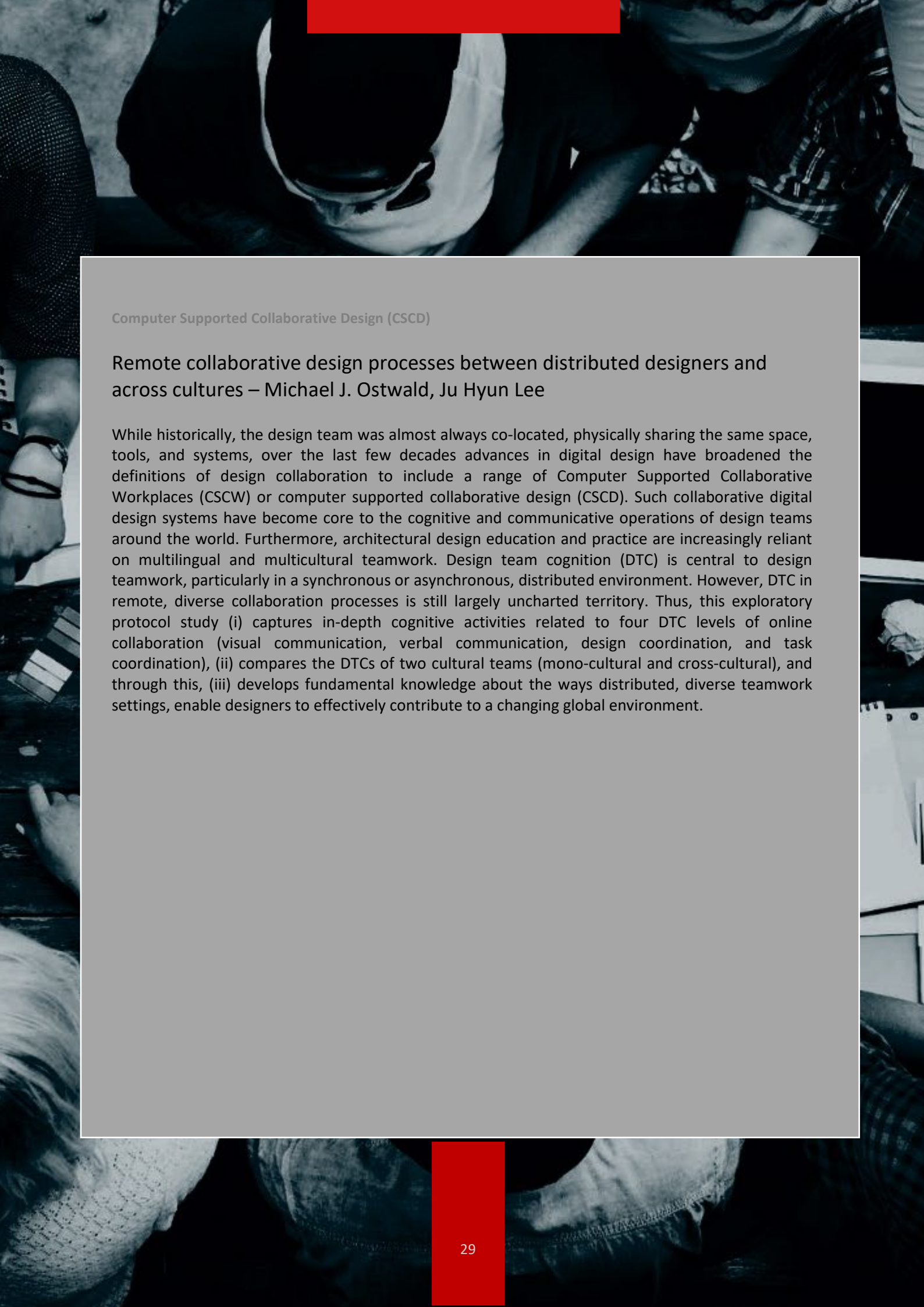
**Jin Cheol Bae** is a graduate student at Hanyang University. He is a member of the ADCC researcher. Currently, he has been working on a BIM project on cultural heritage with the Cultural Heritage Administration for the second year. In particular, he is working on high-resolution BIM modeling using old documents and laser scanning, and he is conducting research to increase the productivity of BIM by using parametric algorithms.



**Seung Yeul Ji** is a Research Professor at Hanyang University. He has been conducting research on the application of brain waves and artificial intelligence to architectural spaces for 10 years. He participated in the production of three documentaries on the topic of EEG-based architectural space research through a domestic broadcasting company. While he was also a research professor, he worked on four government projects related to brain waves. He previously worked on several BIM projects and founded a company to conduct overseas BIM construction projects.



**Han Jong Jun** is Professor in the School of Architecture at Hanyang University, Seoul, Korea since 1998. He completed his Ph.D in 1997 in design computing from University of Sydney, Australia. He has been a principal investigator on numerous research grants and contracts in the field of BIM/HBIM, IoT, VR/AR and knowledge-based design methodology funded by private sectors and national research foundations. He is the leader of the ADCC and is currently working on research projects on electroencephalogram (EGG)-based emotional architecture, HBIM and digital archiving.



## Computer Supported Collaborative Design (CSCD)

### Remote collaborative design processes between distributed designers and across cultures – Michael J. Ostwald, Ju Hyun Lee


While historically, the design team was almost always co-located, physically sharing the same space, tools, and systems, over the last few decades advances in digital design have broadened the definitions of design collaboration to include a range of Computer Supported Collaborative Workplaces (CSCW) or computer supported collaborative design (CSCD). Such collaborative digital design systems have become core to the cognitive and communicative operations of design teams around the world. Furthermore, architectural design education and practice are increasingly reliant on multilingual and multicultural teamwork. Design team cognition (DTC) is central to design teamwork, particularly in a synchronous or asynchronous, distributed environment. However, DTC in remote, diverse collaboration processes is still largely uncharted territory. Thus, this exploratory protocol study (i) captures in-depth cognitive activities related to four DTC levels of online collaboration (visual communication, verbal communication, design coordination, and task coordination), (ii) compares the DTCs of two cultural teams (mono-cultural and cross-cultural), and through this, (iii) develops fundamental knowledge about the ways distributed, diverse teamwork settings, enable designers to effectively contribute to a changing global environment.



**Ju Hyun Lee** is a Scientia Senior Lecturer at UNSW, Sydney, in the School of Built Environment. He has made significant contributions towards research in architectural computing and cognition. As a senior lecturer he completed a five-year post-doctoral fellowship at Newcastle and has held multiple academic roles in Australia and South Korea since 2003. He was a senior research fellow at UNISA in 2018. He is co-author with Michael J. Oswald of *Grammatical and Syntactical Approaches in Architecture* (IGI Global 2020) and co-author with Michael J. Oswald and Ning Gu of *Design Thinking: Creativity, Collaboration and Culture* (Springer 2020).



**Michael J. Oswald** is Professor of Architecture and Associate Dean of Research at UNSW, Sydney. He has previously been a Professorial Research Fellow at Victoria University Wellington, a visiting Professor and Research Fellow at RMIT University, an ARC Future Fellow at Newcastle and a visiting fellow at ANU, MIT, HKU and UCLA. He completed postdoctoral research on geometry at the CCA (Montreal) and Harvard (Mass.). Michael is Co-Editor-in-Chief of the *Nexus Network Journal: Architecture and Mathematics* (Springer) and on the editorial boards of *ARQ* (Cambridge) and *Architectural Theory Review* (Taylor and Francis).



## Computer Supported Collaborative Design (CSCD)

### Implementation of Smart Space Using Brain Wave and Game Engine in Digital Twin- Seung Yeul Ji, Jin Cheol Bae, Mi Kyoung Kim, Han Jong Jun

Recently, game engines have expanded beyond the purpose of game development to include movies, industries, and medical services. The game engine, which used the real-time expression of 3D computer graphics as its main function, has expanded the scope of use of the graphic card to artificial intelligence, and the range of use has also expanded. It is being attempted as a method to implement a digital twin using the computational power of 3D graphics and artificial intelligence in the environment of a game engine. In the field of architecture, research on using digital twins in a smart environment by monitoring the state of space users using sensors and analysing the user's situational characteristics is attracting attention. In this study, we focused on the connection between biometric data and space by wearing EEG equipment for monitoring the user's emotional information, utilizing the existing functions of the game engine and using artificial intelligence algorithms. We planned a smart space for single-person residence that responds to EEG-based biometric information and tried to implement an interactive space that can improve the user's current emotional state. The technical characteristics of the digital twin that can control the spatial transformation according to the user's emotional information and secure the safety of the actual building by utilizing the physics calculation function of the game engine were utilized. A process for sequentially controlling the virtual model of the game engine, the 1:100 model, and the real building was established while controlling the motor to change the size of the smart space for the purpose of improving the emotional state of a single user. Also, an artificial intelligence model that converts brain waves into emotional information and an algorithm that selects the amount of change in spatial size are discussed. The purpose of this study is to propose a smart space realization model using a game engine based on brain waves.



**Seung Yeul Ji** is a Research Professor at Hanyang University. He has been conducting research on the application of brain waves and artificial intelligence to architectural spaces for 10 years. He participated in the production of three documentaries on the topic of EEG-based architectural space research through a domestic broadcasting company. While he was also a research professor, he worked on four government projects related to brain waves. He previously worked on several BIM projects and founded a company to conduct overseas BIM construction projects.



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## Design and culture

### Professional talks

- Exploring the complexities of cross-cultural collaborations: Two international practices (Mladen Jadric, Geun Ju Yoon)
- Cross-cultural Architectural communication: Detail, sincerity and respect (Geun Ju Yoon) – *Video Abstract*
- Collaborative design: cross cultures and diversity (David Holm)
- Hassell's International collaborations (David Tickle)

### Academic talks

- Culture and environment in open spaces within large dense urban living blocks (Minjung Maing)
  - Pattern languages as means of cultural exchange (Michael J. Dawes, Michael J. Oswald)
- + ENCLAVE: TESTING CITY FOR KOREAN REUNIFICATION - Joohui Son





## Design and culture

### Exploring the complexities of cross-cultural collaborations through the dialogue of two international practices- A/Prof. Mladen Jadric and Prof. Yoon Geun

*This presentation explores the communication processes between the two architectural practices 'Jadric Arhitektura' based in Vienna, Austria and '1990uao' based in Seoul, Korea as presented by lead architects A/Prof. Mladen Jadric and Prof. Yoon Geun, and facilitated by A/Prof. Dijana Alic.*

Our discussion primarily focuses on the competition-winning project the 'Seoul Photographic Art Museum', but also extends to other design and academic collaborations between the two architectural practices. The multi-modal process of online and offline communication between the two practices demonstrates the complexities involved in the development and execution processes of design. Architectural drawings were produced using computer-aided design software including AutoCAD, SketchUp, Photoshop and Rhino, with the drawings shared via a common server. However, the offices' challenges laid not in their sharing and communication of designs through these softwares, but in their articulation and planning to overcome specific cultural and linguistic differences.

This innovative project highlights the diversity of contextual awareness that underpins all architectural collaboration, from specific construction requirements to cultural practices, holidays, and work disruptions. The dialogue between these two practices sheds a light on the exciting and challenging processes that the contemporary architectural field faces when operating in a multicultural and global context.



**Mladen Jadric** is a teaching and practicing architect in Vienna, Austria. He realized a wide range of architectural and urban development projects of various sizes in Europe, the USA and Asia. Since 1997 he has been teaching at the TU Wien, department of “Hochbau und Entwerfen 1” and has gained extensive experience as a visiting professor and guest lecturer in Europe, USA, Asia, Australia, and South America. His works were exhibited at the Royal Academy of Arts in London, UK; M.I.T., Cooper Union, and Roger Williams University, USA; Alvar Aalto University, Helsinki, Finland; the Architectural Biennale in Venice, Italy; the World Architectural Triennale in Tokyo, Japan; Museum of the 20<sup>th</sup> Century, Berlin, Germany; Seoul Biennale of Architecture and Urban Planning, Korea; NIT-Nagoya Institute of Technology in Japan, and many more.



**Yoon Geun ju** has been working architecture in Seoul (Korea) with Hwang jung hwan (partner) since 2010. He completed his architecture diploma studies in CBNU and SA (Seoul architecture School) and worked at architectural practice at KIOHUN and ONEOONE office. He participated in the Gwangju Design Biennale (2011) and Village Art Project (2013) and won the Kim Soo-geun Preview Award (2013), the Senzen MDI Award (2015. Hotel Part), and the Red Dot Award (2020, exhibition field). He teaches at Chungbuk National University, University of Seoul, and Vienna University of Technology and is working as a public architect in various local governments. Recently, he won competition Jeju Green-smart Future School, Seoul Station Line 4 Culture and Arts, Seoul Photo Art Museum (with Jadric Architekur), and Gyeonggi Museum renewal, etc. In the Cheongju City Hall international competition, he was nominated for the final list (union). He has also participated in various types of urban regeneration projects.



## Design and culture

### Collaborative design: cross cultures and diversity- David Holm

The majority of architectural conceptions and indeed realizations prior to and including the 20th century were based on regional design entities working and crafting solutions close to and with reference to their places of origin. The sense of genius loci the spirit of place was largely the default operating method of designers worldwide. As the computer age developed into the 21st century the broader community and in turn designers were able and wished to look towards solutions both lateral and diverse in content in order to develop the way of living and the quality of life. In order to successfully address this collaborative phenomenon designers may enlist a number of key albeit quite simple criteria influencing operations.

#### *Relationships*

You have to want to collaborate with design partners. Ideologies must be shared and agreed in order to allow smooth continuance of design thinking and workflows.

#### *Agreements*

Formalities whilst conservative in content must be established prior to the start of any design or collaborative activities. This forward preparation allows principles and procedures to be debated and agreed prior to the actualities often involving quality and quantity pressures to be commenced.

#### *Methods*

Protocols of engagement especially when working across differing time zones must be agreed and adhered to. This regime of discipline and recording of progress allows efficiencies in production to be enjoyed and clarity of information to be shared on a regular basis.

#### *Vision*

Built on relationship simpatico the sharing of visions both in design and on ideological grounds must be debated and shared. Once agreed these vision points become the key ingredient of successful collaborations. In truth the outcomes should be greater in concert than if each particular were operating alone. The strength of the union become expressed in the shared vision points.

These key points grounded in communication, clarity and honesty may form the cornerstones of successful design collaborations moving into the 21st century.



**David** is a Director of COX, leading transport and infrastructure projects in Australia and overseas. David's design focus is at the nexus of urban infrastructure, transport connections and public placemaking in the city. This is evident through key projects such as Western Sydney International Airport, Singapore's Changi Airport Terminal 3, University of Sydney Master Plan, New Delhi International Airport Terminal 3, Sydney International Airport "Forum" and "Marketplace", the Barangaroo Ferry Hub and the new West Metro in Sydney.

David is a recipient of the NSW Board of Architects Byera Hadley Travelling Scholarship and a Churchill Fellow. He is passionate about drawing and has published two books, 'Drawing Italy' and 'Drawing Paris,' and regularly runs drawing masterclasses.

He is a former NSW Chapter of the Australian Institute of Architects Councillor, a New South Wales Board of Architects Registration Examiner and an Adjunct Professor of the Faculty of Design Architecture & Building at the University of Technology Sydney.



## Design and culture

### Hassell's International collaborations- David Tickle

David will discuss his experience of working within a global urban design team, having been based in both Sydney and Shanghai, and working on projects across the world. A particular focus will be the Resilient by Design project, a year-long challenge that involved international and local teams working alongside communities and city governments to address the future impacts of climate change in the San Francisco Bay Area. David will reflect on how international collaborations can be supported by clear parameters of engagement and communication, technology and design methodologies.



**David** leads the urban design team at Hassell, with experience leading a range of city-shaping projects in Australia, Asia and North America. Key projects include the Newcastle City Centre regeneration strategy, master plans for the Summer Hill Flour Mill and Darwin Waterfront City, and a two-million tree urban forest proposal in the heart of Shanghai.

David established Urban Futures, Hassell's program of urban research, design speculation and discourse. Receiving extensive local and international media coverage, Urban Futures has produced the Little House (a pop-up space for kids to talk about the future of the city), a 6-city interactive exhibition on high-density housing, and SuperDensity, a multi-dimensional neighbourhood system for Hong Kong.



## Design and culture

### Culture and environment in open spaces within large dense urban living blocks- Minjung Maing

Culture is the fourth dimension, essential to planning for sustainable cities, and complements the three dimensions of environment, society and economy of sustainable development that was first introduced by UN in 2006. Large dense urban blocks are common in many rapidly urbanized Asian cities, primarily planned to meet the demands of rapid growth and mass urbanization. Focus is placed on large urban blocks as the scale of the communities within these blocks forces a diversity of programs, spaces and activities giving opportunity to cultural diversity within the built environment. The density of buildings in cities affect environment and open space is becoming a key critical element to alleviate extreme environmental conditions. In addition, open space in cities is well known to allow for culture to breed into urban lifestyles. This paper examines the cultural implications of planned and unplanned growth and development of large urban blocks in different cities. The role of open space as a design element to collectively address issues of culture and environment is to be discussed in context of compact urban block configurations.



**Minjung Maing** is Associate Professor of Architecture at Hanyang University, Seoul Korea. She has previously held faculty positions at University of Hong Kong, Chinese University of Hong Kong and Georgia Institute of Technology USA. Her research areas are environment and energy, sustainable cities, building performance and urban resilience. She is a licensed architect and engineer and holds degrees from University of Pennsylvania, MIT and Stanford. Her research unit – Platforms - focuses on integrating design and technology on issues of sustainability and livable cities publishing in journals of building science, urban planning, digital design and architectural research.





## Design and culture

### Pattern languages as means of cultural exchange- Michael J. Dawes

How do international design teams record and exchange architectural wisdom and the cultural norms forming it's basis? The answer might reside within the most widely read architectural treatise ever published - A Pattern Language.

In 1977 Christopher Alexander and his colleagues developed 'patterns', a new and unique way of codifying and distributing architectural knowledge. Each pattern follows a consistent format that first numbers, names, and describes a design problem that frequently occurs in the built environment. The pattern then provides a textual and graphic representation of a generic solution that can be adapted to a wide variety of different instances of the problem the pattern addresses. Each pattern also contains a series of connections to other patterns that make it more complete. These connections form an underlying structure that unifies the patterns into a cohesive architectural language. At the completion of their endeavours, Alexander et al had identified 253 patterns which they published as A Pattern Language.

Despite it's popularity, Alexander's pattern language is the subject of significant criticisms. These criticisms range from confusing subjective and objective phenomena, excluding relevant data, through to being unclear, inexplicit, dogmatic, and failing to produce acceptable results. However, the vast majority of these problems could be traced to an Alexander's idiosyncratic world view, and he also clearly states that his language is just one of many, and encourages other people to develop additional patterns and languages. Therefore, through a rigorous approach it may be possible to create new pattern languages that exclude all the problems of the original. These new pattern languages have the potential to be powerful tools in the documentation and exchange of not just architectural wisdom but also the cultural norms that form its basis. For example, careful observations may reveal subtle, or even significant, differences in the way that the Korean and Australian public interact with the built environment. Codifying cultural norms and architectural responses as a Korean or Australian pattern language then presents a convenient way of sharing complex information which may contribute to deeper understanding of other cultures and result in superior architectural outcomes.



**Michael J. Dawes** is a Research Academic at UNSW focusing on work that combines architectural history and theory with mathematical analyses. Michael's research utilises space syntax and graph theory analyses to better understand architectural design ranging from Palladio through to Le Corbusier and Frank Lloyd Wright. Some of this work has been compiled in the book *The Mathematics of the Modernist Villa*. Michael earned a PhD in architecture for his critical re-examination of Christopher Alexander's second theory of beauty as defined in *A Pattern Language* and *The Timeless way of Building*.



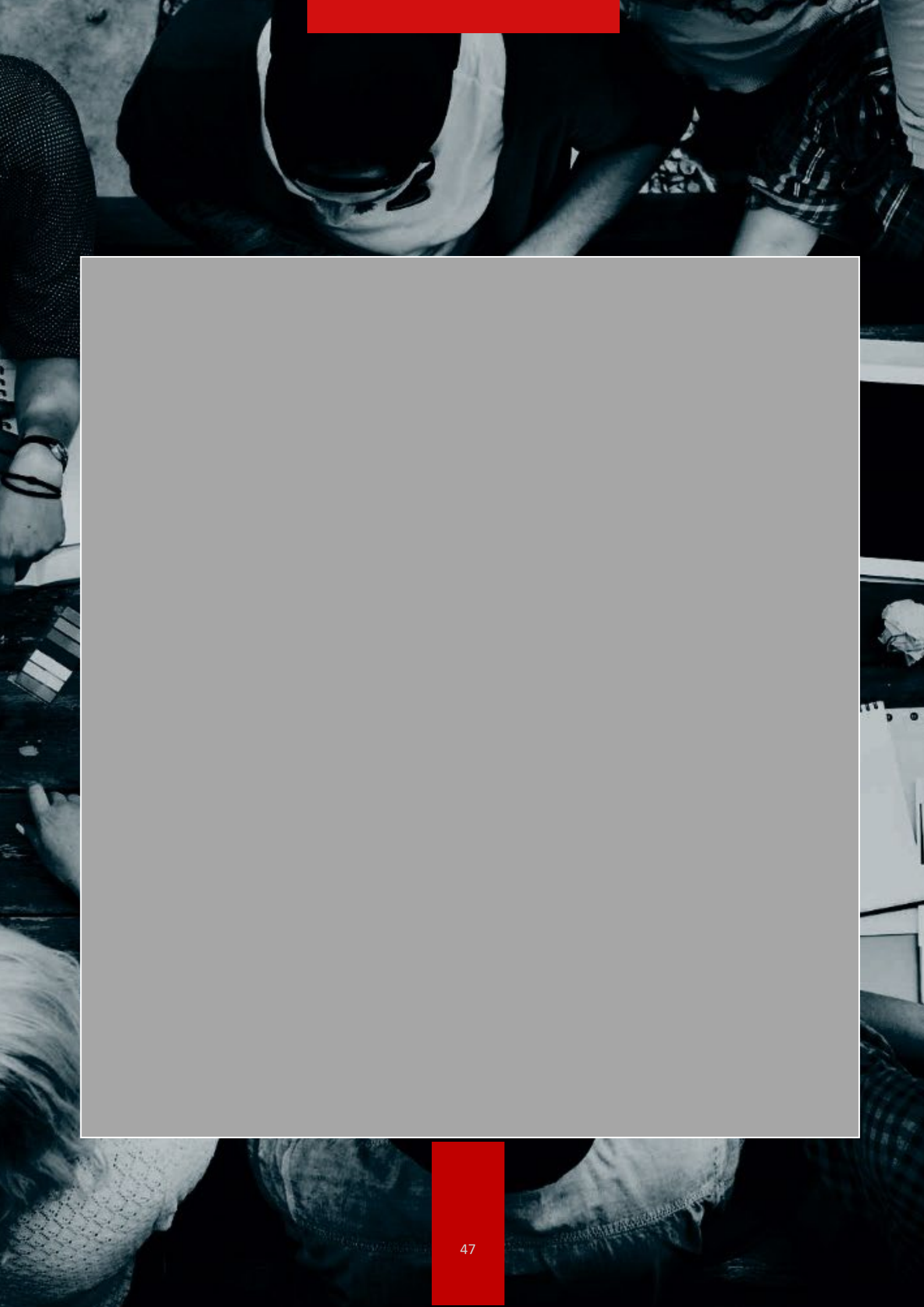
## Design and culture

### ENCLAVE : TESTING CITY FOR KOREAN REUNIFICATION - Joohui Son

The city is a form which not only reflects, but also builds social relations. The forms of the city and the types of architecture in the city have been used as tools to lead and stimulate societies toward certain utopias. Then, how can the form of the city and architecture be a tool through which heterogeneous groups of people can live together despite serious political conflict? This thesis explores strategies to establish social relations between two heterogeneous societies, North Korea and South Korea, in Kaesong, a jointly run small industrial city. The two countries joined together to build an industrial city near their border to take advantage of the technology and capital of South Korea and of the labor force in North Korea. This thesis asks: What is the ideal city form for Kaesong City? What kind of scenario will stimulate the polarized people to mingle in Kaesong? What type of architecture will allow the two societies to live together happily? Although Korea was a single country for over 5,000 years before the Korean division in 1948, the North Korean and South Korean social structures are now totally different. Also, the shapes of the cities are entirely different, reflecting the social structures. However, current Kaesong is a replication of a typical industrial city in South Korea. Despite the ruthless dictatorship of North Korea under the ideology of communism and socialism, the life of North Korean people is changing toward a free capitalist society. This thesis suggests Kaesong as the accelerator of that movement to reduce the economic and cultural gap between two countries. To do so, this thesis proposes a sequence of urban design strategy and architectural types that transform everyday life of South and North Korean people.

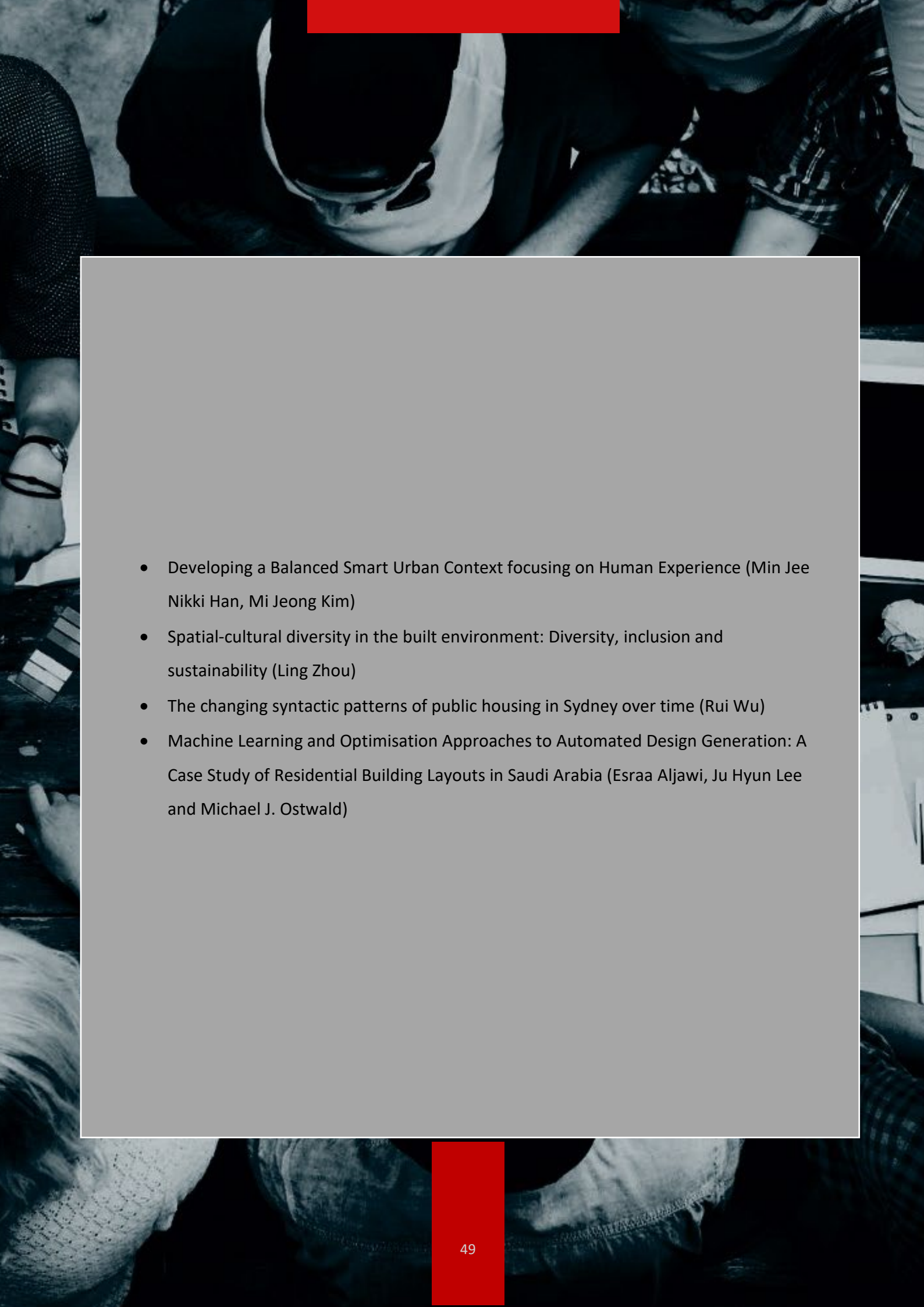


**Joohui Son** is an assistant professor at Hanyang University, and founder of the architecture firm SON-A. He is interested in regional and cultural projects as an integral part of the urban fabric as a registered architect in USA. He worked at Adjaye Associates NY, NADAAA, and OMA NY after he received a Master of Architecture from Massachusetts Institute of Technology (MIT) with Korean government scholarship. He received diverse international architecture and art competitions including the 1st prize for Centralglass shinkenchiku architecture competition in Japan and Bering-strait project competition by UIA. His work has been exhibited in National Asia Cultural Center in Gwangju Korea.





## Pre-Symposium virtual workshop

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- Developing a Balanced Smart Urban Context focusing on Human Experience (Min Jee Nikki Han, Mi Jeong Kim)
  - Spatial-cultural diversity in the built environment: Diversity, inclusion and sustainability (Ling Zhou)
  - The changing syntactic patterns of public housing in Sydney over time (Rui Wu)
  - Machine Learning and Optimisation Approaches to Automated Design Generation: A Case Study of Residential Building Layouts in Saudi Arabia (Esraa Aljawi, Ju Hyun Lee and Michael J. Ostwald)



Pre-Symposium virtual workshop

## Developing a Balanced Smart Urban Context focusing on Human Experience – Min Jee Nikki Han, Mi Jeong Kim

The notion of Smart City has surged worldwide with the rapid growth of population focused in the urban area. With ICT-driven, a sustainable management of the city becomes possible and has enhanced the quality of life, in terms of efficiency. Based on the massive Smart City infrastructure, the smart system and services become penetrated into human's daily life in-depth, almost impacting on every single activity of life. However, the current Smart City development is not adequately considering the aspect of forming a balanced urban context to create friendly urban livelihood for people. Such urban facets including environmental, social, and human, which are closely related to human experiences that critically influence human well-being and health, are still lacking in their insightful exploration. In this regard, the surge of digital transformation has distinctively increased social issues such as the urban digital divide, social isolation, and social stress, which negatively impact on human life. Therefore, this study aims to suggest the empirical structure for Smart City, focusing on human experience, in which a balanced urban context embraced to create a friendly and healthy urban livelihood for all inhabitants living in the Smart City. To do this, case studies of selected Smart City Development based on each City Strategic Planning will be undertaken. Then, a comparative analysis between these case studies will be undertaken to extract the critical factors that forming positive urban livelihood for inhabitants to sustain their lives amid the rapid surge of Smart City Development. This analysis will support organising a conceptual strategic framework for future Smart City development.





**Min Jee Nikki Han** received Bachelor of Design Architecture/ Digital Media & Master of Architecture at University of Sydney, Australia. She is currently pursuing PhD at Hanyang University in Korea and conducting her PhD thesis in the area of Smart Urbanism, under the supervision of Professor Mi Joeng Kim. Her interested field of research includes Smart City, Smart Urbanism, HBI (Human Building Interaction), Human focused design and Sustainable living environment. Prior to joining PhD at Hanyang University, she worked as an architect for a total of 7 years in both South Korea and Australia, participating in various international competition projects and BIM-based housing projects.



**Mi Jeong Kim** is a professor of the School of Architecture at Hanyang University in Korea. She received her Ph.D. in the Key Centre of Design Computing and Cognition at the University of Sydney and worked as a postdoc fellow at UC Berkeley before joining Kyung Hee University. She was previously a visiting fellow at NYU, MIT, and Curtin University. She is an Editor-in-Chief of the Journal of the Korean Institute of Interior Design and on the editorial boards of the International Journal of Architectural Research. Her research interest includes sensing architecture, human-building interaction, design education & strategies for creativity, smart homes, and communities.



Pre-Symposium virtual workshop

## Cultural diversity in the built environment: the importance of diverse, inclusive and sustainability- Ling Zhou

Today's global cities are characterised by cultural diversity. Different cultural contexts have a strong influence on the local spatial structure and architectural environment. When discussing multi-ethnic settlements or mixed settlements, diverse and inclusive spaces are often considered to be an essential component of a sustainable community. Diversity and inclusion in spatial forms are different from residential integration, and cultural differences cannot be mitigated by a simple mix of space uses. This paper discusses the relationship between the cultural significance of the built environment and the spatial patterns of residential communities. In light of research on cultural diversity and the cultural attributes of space, this paper examines the specific dimensions in which cultural attributes are expressed in space. It also proposes a conceptual framework for describing cultural spaces to enhance the understanding of cultural diversity.



**Ling Zhou** is currently a PhD candidate in the School of Built Environment, Faculty of Arts, Design and Architecture (ADA), UNSW Sydney. She is broadly interested in the relationship between cultural diversity and spatial environment, understanding how to assess spatial patterns that supports cultural identity and the inclusion of difference for minority cultural groups. Her research focuses on Cultural and Linguistic Diversity (CALD) communities, computational analysis methods, environment-behaviour interaction, and cultural-spatial interventions, which relates to the study between socio-spatial patterns and cultural-spatial experience in a broad context.



Pre-Symposium virtual workshop

## The changing syntactic patterns of public housing in Sydney over time- Rui Wu

As stated by Australian government in 2019, public housing—as a kind of social housing—is secure and affordable rental housing for people on low incomes with housing needs. Focusing on economically disadvantaged inhabitants, public housing also mirrors the correspondence between housing design strategy and cultural diversity within the process of social inclusion. As Hillier (1996) states, “socio-cultural function arises from the ways in which forms and spaces are elaborated into patterns”. This leads to one hypothesis that the changing syntactic patterns of public housing over the past century are identifiable and computable and they are deeply related to the socio-cultural background. That is, behind these socio-cultural factors: cultural background, spatial patterns and inhabitants' lifestyles, there might be syntactic rules that configure the topological order and to describe socio-spatial relationships in the system. Aim to reveal those syntactic rules among socio-cultural factors, this paper employs three methods, namely, space syntax, archival research and correlational analysis. First, through archival research—especially data provided by newspapers and on-site observation—the inhabitants' lifestyles and social activities in different time phases would be retrieved. Next, as one of the most comprehensive computational approaches in architecture and urban design, space syntax examines both social and cultural factors on space use and spatial configuration. Ostwald (2011) describes it as “one of the major analytical methods available for studying historic settlement patterns”. In this paper, the specific techniques from space syntax to test out the syntactic properties includes: the conventional techniques, justified plan graph (JPG), visibility graph analysis (VGA) and axial line analysis (ALA) and a new technique, road line analysis (RLA). Finally, for correlational analysis, it is applied to examine the relationships between archival and space syntax data in a holistic manner. Hence, from a diachronic perspective, the correspondence of inhabitant's behaviors and the socio-cultural effects on the spatial configuration of the housing layouts would be retrieved. In a similar way to Hillier and Hanson's (1984) research of the typical English cottage—test out those syntactic properties in domestic space, this paper explores the conceptual framework of syntactic rules within Sydney public housing and their relations with socio-cultural factors which are also related to each other. And that is, the changing socio-cultural background limited inhabitants' lifestyles over time, meanwhile those changes of lifestyles affected the housing spatial patterns. As a result, the changing spatial designs promoted the differences within cultural background from different time.



I am a PhD student in the School of Built Environment, Faculty of Arts, Design and Architecture (ADA), UNSW Sydney and currently working as an ADA Research assistant as well. After completed my masters in sustainable architecture and landscape design in Politecnico di Milano (2016-2019), I started a three-year professional career in the architecture and construction industries (2019-2021). My PhD research is now space syntax related which has used architectural computer science and a theological base of topology to test out and examine the syntactic properties of a certain of building type - public housings.



Pre-Symposium virtual workshop

## Machine Learning and Optimisation Approaches to Automated Design Generation: A Case Study of Residential Building Layouts in Saudi Arabia - Esraa Aljawi, Ju Hyun Lee and Michael J. Ostwald

Automated design generation has been a popular research topic for over fifty years, highlighting the optimisation of geometric and functional variables. However, the socio-cultural aspect of housing design, which is an essential factor that has a direct impact on residential architecture, has not yet been fully explored in the field of design automation. Can machines generate satisfactory designs relevant to a unique socio-cultural context? This thesis aims to develop an automated layout generation model (ALGeM) that reflects socio-cultural patterns, using a combined approach of a genetic algorithm (GA) and Space Syntax (SS) approaches. A GA that is a subset of evolutionary methods used to solve complex problems deals with multiple objects and multi-disciplinary issues and identifies the optimal solutions in this research. In contrast, SS techniques offer a large amount of socio-spatial information that is integrated into the algorithmic process to improve and control design alternatives. In this way, this thesis presents the socio-cultural approach involving the syntactic rules and cultural design vocabulary. Saudi housing design is selected as a case study to examine ALGeM. The research contributes to the new body of knowledge in design automation and machine learning.



**Esraa Aljawi** is a PhD student at the University of New South Wales, Australia. She earned her master's degree in Architecture in 2019 from the University of Illinois, USA. She worked at King Abdulaziz University as a Demonstrator from 2011 to 2015 and as a Lecturer from 2019 to 2021 in the Interior Design department. She is interested in the influence of human behavior and socio-cultural factors in the built environment, primarily residential buildings.



**Ju Hyun Lee** is a Scientia Senior Lecturer at UNSW, Sydney, in the School of Built Environment. He has made significant contributions towards research in architectural computing and cognition. As a senior lecturer he completed a five-year post-doctoral fellowship at Newcastle and has held multiple academic roles in Australia and South Korea since 2003. He was a senior research fellow at UNISA in 2018. He is co-author with Michael J. Ostwald of *Grammatical and Syntactical Approaches in Architecture* (IGI Global 2020) and co-author with Michael J. Ostwald and Ning Gu of *Design Thinking: Creativity, Collaboration and Culture* (Springer 2020).



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