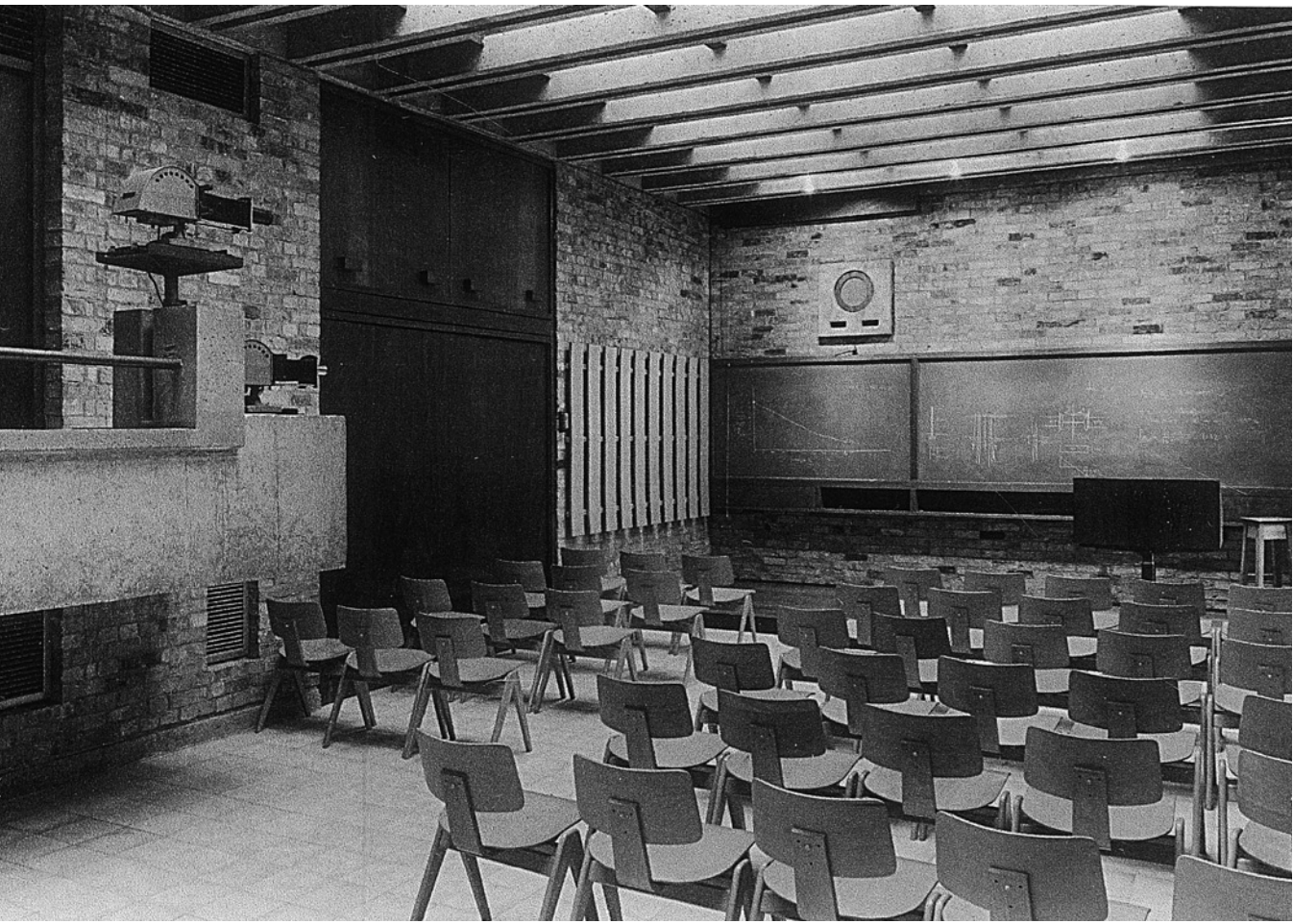

ONGOING RESEARCH PROJECTS

(Information about some of the current research projects at the Martin Centre)

Regional Visions of Integrated Sustainable Infrastructure Optimised for Neighbourhoods (ReVISIONS)

Supported by: EPSRC – Engineering and Physical Sciences Research Council

Cities have developed spatially to facilitate economic growth and lifestyle aspirations but with increasing rates of consumption of resources and production of waste and carbon emissions. The global population living in urban areas will double by 2050 according to UN projections. There is clearly an imperative to understand how to plan urban areas to be more sustainable. To gain a full understanding of urban areas they need to be researched within a regional context using an integrated multi disciplinary method. The research involves a number of in-depth regional case studies, carried out in partnership with government agencies and other stakeholders, for systematically testing the effectiveness of alternative design and development strategies for the year 2031, and beyond.

Principal Investigator: Prof. Marcial Echenique

Project Manager/Co-Investigator: Dr. Anthony Hargreaves

Co-Investigator: Prof. Koen Steemers

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Conflict in Cities and the Contested State

Supported by: ESRC – The Economic and Social Research Council

'Conflict in Cities and the Contested State' focuses on divided cities as key sites in territorial conflicts over state and national identities, cultures and borders. The research objectives are to analyse how divided cities in Europe and the Middle East have been shaped by ethnic, religious and national conflicts, and conversely, how such cities can absorb, resist and

potentially play a role in transforming the territorial conflicts, which pervade and surround them. The project seeks to understand divided cities as arenas of intensified ethno-national conflicts, particularly with respect to the role that architecture and the urban fabric play as a setting and background for everyday activities and events. Phenomena related to creating, maintaining, crossing, transcending, and possibly ignoring ethnic and territorial borders, both physical and symbolic, are central to the study. The main research sites are Belfast and Jerusalem, two very distinctive cities - one firmly embedded in the West and one central to the Middle East - and both at different stages of national conflict and peace building.

Principal Investigator: Dr. Wendy Pullan

Co-Investigators: Prof. James Anderson (Geography, Queen's Belfast), Prof. Liam O'Dowd (Sociology, Queen's Belfast), Prof. Mick Dumper (Politics, Exeter)

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Energy Efficient Cities Initiative (EECi)

Supported by: EPSRC – Engineering and Physical Sciences Research Council

The Energy Efficient Cities initiative (EECi) is a cross-disciplinary research project at the University of Cambridge. EECi aims to strengthen the UK's capacity to address energy demand reduction and environmental impact in cities, by researching building and transport technologies, district power systems, and urban planning. This research will facilitate deployment of energy efficient buildings, transport, and energy supply technologies in city design, by developing quantifiable, system-level models that assess their feasibility and implementation in the wider context of socio-economic, physical, and regulatory characteristics of the city. The system-level model will not only enable a more robust scaling-up of the impact of technological innovations up to the city level, but also allow trade-offs between their environment, societal, and economic impacts to inform regulations and policy scenarios.

Co-Investigators: Prof. Marcial Echenique (Architecture), Prof. Koen Steemers (Architecture), Prof. Ann Dowling (Engineering), Prof. Robert Mair (Engineering)

Innovation and Knowledge Centre (IKC) for Smart Infrastructure and Construction

Supported by: EPSRC – Engineering and Physical Sciences Research Council

Much of our infrastructure is more than 100 years old. Resilience against systemic failure of UK infrastructure is significantly weakening through ageing. Infrastructure owners therefore have a strong interest in emerging technologies in sensors and data management, to quantify and define the extent of ageing and the consequent remaining design life of their infrastructure. The application of emerging technologies to advanced health monitoring of existing critical infrastructure assets will address these needs, improve the management of infrastructure and reduce the risk of failure. By providing cradle-to-grave health monitoring, combined with innovative manufacturing processes, these technologies will also lead to more efficient and economic construction of new infrastructure. The IKC will focus on smarter construction and production processes, employing the latest research developments in intelligent sensing and information processing, decision support, manufacturing strategy and reconfigurable building blocks.

Principal Investigator: Prof. Koen Steemers

Co-Investigator: Dr. Ying Jin

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Design and Delivery of Robust Hospital Environments in a Changing Climate (DeDeRHECC)

Supported by: EPSRC – Engineering and Physical Sciences Research Council

The 'Design and Delivery of Robust Hospital Environments in a Changing Climate' (DeDeRHECC) project is investigating the design and delivery of economical and practical refurbishment strategies for the adaptation of NHS acute hospitals. The particular focus of the project is summertime overheating, already a concern and a problem that will potentially get worse as the climate changes. The NHS must maintain safe and comfortable internal temperatures for patients and staff, but the installation of air conditioning at the scale of the NHS estate – some 18 million square metres of patient-occupied space – would have

significant carbon implications at just the time when the NHS has been set onerous carbon reduction targets. Furthermore, in the present economic climate, wholesale replacement of the estate is unlikely. The project team is devising detailed refurbishment strategies for representative 'type' hospital buildings on its partner Trusts' estates. These strategies are developed in the light of monitored internal conditions, data having been collected over two years. The strategies are tested in the current climate and are modelled in the climates of the 2030's, 2050's and 2080's, using UKCIP projections. They are fully costed by Davis Langdon and interrogated for their infection control implications and buildability. Papers have been published and are forthcoming; a broadcast-quality film is being produced. Impact to date has included citation in the National Climate Change Risk Assessment. The team regularly meets policymakers, and those designing and delivering hospital construction projects in the UK and abroad.

Principal Investigator: Prof. Alan Short

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Designing Dynamic Environments for the Performing Arts

Supported by: AHRC – Arts and Humanities Research Council

This project, a collaboration with Salford University, stemmed from an observation that the process of designing for the Performing Arts had, in a number of prominent cases, been a difficult, even destructive process. The project team sought to understand why this had been the case, and to suggest ways in which the design and briefing process might be improved to better capture the initial sparks of creativity and to deliver buildings that preserved, intact, their creators' initial 'vision'. The team investigated the design and construction histories of six recent UK theatre-building projects. The selected theatres represented a variety of scales and approaches. For each, all key personnel were interviewed in detail; all project archives were interrogated. In addition to a number of conference and journal papers, the project has resulted in a major 300-page book, 'Geometry and Atmosphere: Theatre Buildings from Vision to Reality', published in late 2011 by Ashgate. The book presents an account of each case study theatre, as well as contextual chapters on the architectural history of twentieth-

century British theatre. The Foreword was kindly provided by the distinguished director Sir Richard Eyre. The book concludes with a suggested new approach to the funding and delivery of these buildings. It is accompanied by a broadcast-quality film, available via the University's Streaming Media Service. The project has been shortlisted for the RIBA President's Award for Outstanding University-Located Research 2012.

Principal Investigator: Prof. Alan Short

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Recovery of Natural Environments in Architecture

Supported by: The Leverhulme Trust and the Isaac Newton Trust

Dr. Alistair Fair has recently been awarded a three-year Leverhulme Early Career Fellowship for a project that will examine selected aspects of the environmental history of non-domestic buildings since the middle of the nineteenth century, considering how and why the art and science of often complex passively conditioned designs have been displaced by mechanical solutions. The project asks: how have framed structures, with mechanically controlled environments, come to be the dominant approach in the West? In answering this question, it will draw on the existing secondary literature plus primary archive sources to explore subjects including changing attitudes to the internal environment, the fierce competition between advocates of competing systems, and the extent to which designers considered environmental matters. In examining apparently sophisticated nineteenth-century passively controlled buildings, it is hypothesised that the research may well uncover strategies that might, perhaps with modification, be of value to contemporary designers. The project builds on Alistair's longstanding interest in the architectural history of modern public and institutional buildings, which has to date yielded a co-written book on theatres in addition to various published articles and other conference papers on theatres, hospitals and university architecture.

Principal Investigator: Dr. Alistair Fair

Neighbouring and the Geopolitics of Ethnically "Mixed Cities" (NEGEOP)

Supported by: European Commission Marie Curie Actions

This research aims to fill the empirical and theoretical lacunae in the existing body of knowledge that deal with contested cities in Europe and elsewhere by offering a new interdisciplinary perspective about how people and communities use, appropriate, and claim the everyday space of their neighborhoods while advocating their own values and rights. Beyond the empirical input of this research, its intention is to contribute to the existing knowledge in urban studies and to the formulation of a theoretical basis concerning the relevance of geopolitics to the study of cities. Additionally, this project intends to add to the growing literature on cities such as Belfast, Berlin, and Brussels by contextualising the very specific and perhaps exceptional case of Israel within the existing experience, academic knowledge, and research on other cities.

Research Fellow: Dr. Haim Yacobi

Principal Investigator: Dr. Wendy Pullan

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The Interactive Vision Between Architecture and Photography (INVISA)

Supported by: European Commission; 7th Framework Programme for Research and Marie Curie Actions

In schools of architecture students often rely on images; rarely do they have hands-on experience with the actual building. We may say that our first idea of an architectural work comes from looking at a picture, normally a photograph. As trivial as this remark may sound, it helps us understand that our ideas of buildings are imposed upon us by the photographer's vision and cultural background. Yet photography invariably involves a mode of beholding which preconditions not only our perception of an object but also our conception of it and our idea of our relationship to it and with it. Photography is often presumed to serve as a substitute for personal familiarity, yet the choice of composition, lighting and framing of the view create an alternative reality that can be at least as influential as a direct visit. The research aims at studying architecture and photography during the

historically decisive period of the Modern Movement, the epoch that has so influenced and inspired contemporary architectural design. Photography not only helped the diffusion of new ideas in the early 20th century, but also encouraged architects to devise spaces that were flattered by the camera. The project went beyond the original aim, creating awareness of the photographic role in shaping public and professional perception of architectural space. The dissemination of outputs to a wider audience is an integral aim of the project, achieved by an international conference, 'Still Architecture: Photography, Vision, Cultural Transmission', and 'Cambridge in Concrete', an exhibition held in collaboration with the Royal Institute of British Architects. The research project and the events started the process of constructing an agenda for a new education to vision.

Principal Investigators: Dr. Marco Iuliano, Prof. François Penz

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Commercialisation of Satellite-Based Monitoring

Supported by: EPSRC – Engineering and Physical Sciences Research Council

This project utilises the outcomes of the EPSRC project 'Indicators for Measuring, Monitoring and Evaluating Post-Disaster Recovery', where a suite of twelve Performance Indicators spanning core recovery sectors were extracted from high-resolution satellite imagery. The prototype monitoring and evaluation (M&E) datasets resulted from pilot testing the recovery performance indicators in the cities of Ban Nam Khem, Thailand after the 2004 Indian Ocean tsunami, and Muzaffarabad, Pakistan after the 2005 earthquake. The Recovery Project Team delivered the following research outcomes: (1) a transferrable methodology for monitoring and evaluating post-disaster recovery using satellites; and (2) a range of data representations, e.g. GIS maps, graphs, bar charts, tables for displaying the recovery information. The main objectives of this follow on project are: (1) to identify and develop database structures and data packages that suit the needs of aid agencies with different geographic foci and scales of operation; and (2) to identify and develop delivery protocols that suit the workflow of aid agencies, taking into account the fact that different data in different forms are required at different operational stages. These aims will be achieved

by engaging the end user community to robustly test the prototype indicators within operational situations, and thereby fine-tune them into a commercial M&E data offering.

Principal Investigators: Michael Ramage, Dr. Keiko Saito
Industrial Partners: Cambridge Architectural Research and ImageCat, Inc.

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(Un)intended Consequences of Deep Low-carbon Retrofitting of UK Homes - Prebound Effect

Supported by: Cambridge Humanities Research Grant Scheme

Policy makers are recognising a "rebound effect" from programmes that promote household energy efficiency through better insulation and heating. This reflects people's tendency to increase consumption after their homes have been made more efficient – for example, by turning up the thermostat or buying new appliances. Recent research at the department has identified a companion phenomenon, the "prebound effect". It turns out that occupants of the least energy-efficient homes, where the potential savings are greatest, actually consume much less than national statistics suggest. In general, the worse a home is thermally, the more the occupants tend to control the amount of heating they use. For financial reasons, they have to. This challenges the prevailing view that large cuts in energy consumption can be achieved by focusing purely on technical solutions, such as retrofitting homes. In some cases, doing so may bring only half the expected savings, perhaps less. The research focused on German data, but similar patterns were found in other European countries, including the UK. The research suggests that if policy makers want substantial reductions in household energy consumption, they should rely less on technical measures and take greater account of people's behaviour – supplementing thermal efficiency programmes with other incentives to use less energy.

Principal Investigator: Dr. Minna Sunikka-Blank

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Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis (TEAM_play)

Supported by: European Commission, 7th Framework Programme for Research

TEAM_Play – Tool Suite for Environmental and Economic Aviation Modelling for Policy Analysis – is a collaborative project co-Supported by the European Commission. TEAM_Play will set up an effective and efficiently working Tool Suite to provide powerful tools for the performance of adequate policy assessment studies within the International Civil Aviation Organisation Council's Committee on Aviation Environmental Protection (ICAO-CAEP) and on European, national and local levels. Currently, there is no common approach by which models can collaborate to produce a consistent forecast for noise, local air quality and greenhouse gas emissions and impacts, and to assess the economic impacts of policy measures as well as the respective interdependencies. TEAM_Play aims to close this gap by creating a framework that allows existing and new models to be integrated for an assessment of the diverse effects of aviation policies. This will strengthen the European modeling capability and ensure the sustainable growth of air transportation with regard to environmental, social and economic issues.

Principal Investigator: Dr. Andreas Schäfer

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From East to West and Back Again: Mutual influence in Cistercian and Seljuk architecture in the late 12th and early 13th centuries

Supported by: The British Academy

The appearance of the pointed arch in Western architecture and its possible origin in the Middle East has been the subject of speculation since the 17th century and possibly before. The similarities in form and spatial arrangement between certain Cistercian churches in 12th century France/Switzerland and the Seljuk hans of 13th century Turkey have been commented on in secondary literature, but have not been seriously investigated. This groundbreaking new study will examine whether these buildings are merely close in morphology or if they were actually built in similar ways. The latter would suggest there

was significant exchange between two distinct and disparate cultures and religions. Understanding of the construction of medieval vaulting has improved due to recent research and new surveying techniques. The British Academy award will enable the team to apply these new insights and methods to a number of buildings from each region to see if the results suggest not just inspiration but also technical exchange.

Principal Investigators: Michael Ramage, Dr. James Campbell

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Structural Bamboo Products

Supported by: EPSRC – Engineering and Physical Sciences Research Council

This project develops green construction materials and building codes for bamboo. China, India and Brazil have rapidly expanding economies with increasing demand for building materials. The production of conventional construction materials such as steel and concrete is energy intensive and unsustainable: concrete alone accounts for 5% of global CO2 emissions. Bamboo is a fast growing, renewable building material widely cultivated in these countries but not utilised to its full potential in modern construction. Its mechanical properties are similar to wood but it produces up to six times as much mass per hectare as conventional timber plantations. Structural bamboo products (SBP), similar to plywood, oriented strand board, or glue-laminated wood products, therefore have enormous potential to partially replace the use of more energy intensive materials in rapidly developing countries. Widespread use of SBP is hampered by limited knowledge of their manufacture, structural and thermal behavior, and a lack of appropriate building codes. The goal of this project is to develop modern structural building materials from renewable bamboo in order to place growth in rapidly developing countries onto a more sustainable path.

Principal Investigator: Michael Ramage

Academic Partners: Massachusetts Institute of Technology, University of British Columbia

Industrial Partner: Cambridge Architectural Research

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EcoHouse Research Initiative

Supported by: The AngloAmerican Group Foundation and the Newton Trust

Our primary research is work on developing transitional housing in developing countries into permanent low cost housing. This project explores the role of material efficiency for construction in low-income communities in the developing world. Through an understanding of architecture, engineering, and materials science we aim to research interventions that can make incremental and step-change improvements in transitional and permanent housing for the poorest of the poor. The project is an extension of ongoing research in the Departments of Architecture, Engineering, and Land Economy. While housing policy is widely researched in developing countries, little work has been done on improving the quality and energy efficiency of the homes themselves. Better materials and construction have the potential to make significant gains in the longevity and energy efficiency of housing. Nowhere is this need more pressing than in poor communities and informal settlements in low income countries, where migration to cities coupled with low-quality building materials and construction techniques mean that hundreds of thousands of houses built each year are environmentally unsustainable. Within the last five years the global population has shifted from a majority in rural areas to a majority in urban areas. The most rapid urbanisation is happening in developing countries where new inhabitants find housing predominantly in informal or slum communities. This project seeks to improve the energy efficiency associated with materials, construction and performance of housing in developing countries through design, engineering and materials research.

Principal Investigator: Michael Ramage

Co-Investigators: Prof. Peter Guthrie (Engineering), Allan McRobie (Engineering), Dr. Gemma Burgess (Land Economy)

Student Project Director: Jose Vallejo Bermeo

Post-Doctoral Researcher: Dr. Maximilian Bock

Development Partner: TECHO: Un Techo Para Mi Pais

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CURRENT GRADUATE STUDENTS

MPhil in Environmental Design in Architecture
2010-2011

Linda Nkatha Gichuyia, James Italu Kimanzi, Li Wan

–

MPhil in Environmental Design RIBA Part II
2011-2013

Thomas Bishop, Sahiba Chadha, Thomas Haworth, Dan Ladyman, Ting Li, Sophie Mitchell, James Purkiss

2010-2012

Emil Antlov, Edward Barsley, Iona Campbell, Matthew Cooper, Phillip Gibb, James Patterson-Waterston, Thomas Powell, David Sharpe, Afra Van 'T Land

–

MPhil in Architecture
2011-2012

Ji Hyun Kim, Miao Li, Joshua Mardell, Elizabeth Wagemann

–

Continued overleaf

Photograph by David Butler.

PhD

2010-2011

Fahad Allahaim, Aya Alphs, Peter Armitage, Gruia Badescu, Seung-Hyun Cha, Juls Chen, Bin Deng, Jesper Eriksen, Irit Katz Feigis, Patrick Fleming, Aaron Gillich, Carlos Gonzalez Guzman, Hsin-Tzu Ho, Andrew Hoolachan, Rose Head, Ranald Lawrence, Weifeng Victoria Lee, Wing Lam (Villian) Lo, Nicola Mingotti, Yiting Pan, Apurba Podder, Xiao Rong, Amir Soltani, Pawda Tjoa, José Vallejo

2009-2010

Jamie Anderson, Jill Bambury, Nicholas Bill, Simone Chung, Daniel Godoy-Shimizu, Magdalini Makrodimitri, Juan José Sarralde Tassara

2008-2009

Anita Bakshi, Gillean Denny, Konstantin Kastrissianakis, Micah Trippe, Ye Zhang

2007-2008

Daniel Brown, Alastair Donald, Pingping Dou, Heba Mostafa, Tao Sule

2006-2007

Gavin Hogben, Danny Rigby, Duan Wu, Jie Zhu

2005-2006 and earlier

Ross Anderson, Mark Brand, Emma David, José de Paiva, Alex Dougherty, Eduardo Mamede, Tim Mellor, Marylis Ramos, Eric Schuldenfrei, Lily Shirvanee