

Professor Alan Penn – Curriculum Vitae October 2019

Present appointments

Professor of Architectural and Urban Computing
The Bartlett School of Architecture
University College London
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London
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Email: a.penn@ucl.ac.uk

Chief Scientific Advisor, Ministry of Housing Communities and Local Government, UK.
Director and Chair, Space Syntax Ltd.
Trustee, Shakespeare North Trust Ltd.

Degrees and Professional Qualifications

BSc (Hons) 2.1 University College London, in Architecture, 1975-78
Dip Arch University College London, 1979-80
MSc University College London, in Advanced Architectural Studies (Distinction), sponsored by NETRHA, 1981-83 (part time)
RIBA Part III 1982

Professional history

2019- Chief Scientific Advisor, Ministry of Housing Communities and Local Government, UK.
2009-2019 Dean, The Bartlett Faculty of the Built Environment
2011-2014 HEFCE REF 2014 Chair Sub-panel 16, Architecture, Built Environment & Planning, member Main Panel C
2005-2008 HEFCE RAE2008 Chair Sub-panel 31, Architecture & The Built Environment, member Main Panel H
2003- Professor of Architectural and Urban Computing, UCL
2001-2005 HEFCE Business Fellow
1999-2003 Reader in Architectural and Urban Computing, UCL
1997- Director of the Virtual Reality Centre for the Built Environment, UCL
1996-1999 Senior Lecturer, UCL
1989-1996 New initiative Lectureship in Urban Design and Regeneration at the Bartlett, UCL.
1985-1989 Independent consultant, including Research Manager for Unit for Architectural Studies, Department of Education and Science and t² Solutions Ltd.

Research grants

2015-2020 UK Regions Digital Research Facility (UK RDRF), Reference: EP/M023583/1, £4,000,602 PI: Prof Alan Penn; Co-Is: Prof Sir Alan Wilson, Prof M. Batty, Prof P. Longley, Prof P. Treleaven, Dr E. Arcaute
2013-2018 Centre for Nature Inspired Engineering (CNIE): Addressing Challenges in Sustainability and Scalable Manufacturing, Reference EP/K038656/1, £4,980,773
PI: Prof M.O. Coppens; Co-Is: Prof Alan Penn + 14 others
2009-2018 Industrial Doctorate Centre: Virtual Environments, Imaging and Visualisation EP/G037159/1, £5,648,706, PI: Prof Ant Steed; Co-Is: Prof Alan Penn, Julier, Prince, Turner; 30 project partner organisations.
2009-2014 Platform Grant: Space, Technologies and the Design of the Built Environment EP/G02619X/1, £1,180,902, PI: Prof Alan Penn; Co-Is: Hanna, Vaughan, Hillier
2011-2013 Exploring the potential of networked urban screens for communities and culture, Reference: EP/I031839/1 £233,915, PI: Ms A Fatah gen Schieck co-I: Prof Alan Penn
Project Partners: Design Council CABE, Horizon Digital Economy Research, E11bid, Waltham Forrest Education Services.

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- 2007-2013** SPACES Lo Spazio dei Diritti: L'effettivita del diritto alla salute nelle strutture ospedale, Reference: Regione Toscana sui fondi PAR-FAS; Investigators: A. Simoncini, M.C. Torricelli, L. Chiese, S. Surrenti
- 2007-2009** City History and Multi-Scale Spatial Masterplanning EPSRC: EP/F00222X/1 £536,371, PI: Prof Alan Penn; Co-I: Dr Ruth Conroy Dalton, Project Partners: Arup Group Ltd, Space Syntax Ltd
- 2005-2009** Cityware: urban design and pervasive systems funded by EPSRC Grant Reference: EP/C547691/1 £348,614, UCL PI: Prof Alan Penn, Co-I: Professor May Cassar; Bath PI, E. O'Neill, Imperial PI: Prof N. Dulay; Recognised Researchers: Ms Ava Fatah gen Schieck, Ms Irene Lopez de Vallejo), Project Partners: IBM United Kingdom Ltd, Vodafone, Bath and North East Somerset Council, HP Labs, Node, Nokia
- 2004-2009** Platform grant (continuation): space, time and interaction: integrating spatial and temporal domains in analysis of the function of the built environment funded by EPSRC Grant Reference: GR/S64561/01 £427,895, PI: Prof Aklan Penn, Co-Is: Prof J Hanson, Prof WRG Hillier, Mr PA Turner, Dr LS Vaughan; Recognised Researcher: Dr C Mottram.
- 2003-2008** Urban Sustainability for the Twenty-four Hour City: development of design decision making tools and resources funded by EPSRC £1.3m (Total £2.75m)
PI: Prof. R Cooper, Salford, Co-Is Prof Alan Penn, Profs J. Hanson, B. Hillier, et al
- 2002- 2005** NetVR Network funded by EPSRC, £50k, PI: Prof. N. Dawood, Teeside, Co-I Prof. A.Penn. In collaboration with Universities of Salford, Teeside, and UMIST. EPSRC funding for a network of VR Centre's specialising in the built environment field.
- 2001-2006** Engineering Doctorate Centre in Virtual Environments, Imaging and Visualisation
EPSRC ENGD/00/021 Total approx £4.3m, PI: Prof. B. Buxton, UCL, Co-I: Prof Alan Penn
- 2000-2004** Platform award: Configuration, Attraction and Emergence: Effects of Space Pattern on Emergent Behaviour funded by: EPSRC GR/N21376/01 £499k PI: Alan Penn Co-Is Profs Hillier & Hanson
- 2001-2004** ARTHUR - Augmented Round Table for Architecture and Urban Planning EC Framework 5: IST-2000-28559 £405k (Total Value £2.23m) PI: Prof Alan Penn; (coordinated by Fraunhofer FIT)
Collaborating organisations: Fraunhofer-FIT, Foster and Partners, Ericsson Saab Avionics, Linie 4, Aalborg Uni
- 2001-2003** RADICAL - Research Agendas Developed in Creative Arts Labs EC FPV £2000
PI: Prof Alan Penn, (coordinated by London Institute)
- 2000-2003** RACMIT - Minimising the Impact of Refurbishment on Customer Movement
funded by: EPSRC GR/N02917/01, 162k (Total value 422k), PI: Prof Alan Penn,
- 2000-2003** VIRCON -The Virtual Construction Site: a decision support system for construction planning
EPSRC GR/N00876/01 £137k (Total value £515k), PI: Prof G. Winch, UMIST, Co-I: Prof Alan Penn,
Collaborating organisations: AMEC, Bond Bryan Partnership, Carillion, SDA, Skanska, Stent Foundations, Turner & Townsend, WS Atkins, Uni of Wolverhampton, University of Teeside.
- 2001-2002** Strategic Equipment Initiative: Upgrading VR facilities for immersive stereo projection
funded by EPSRC SEI GR/R06878/01 80k, PI: Prof. D. Delpy, Co-I: Alan Penn
- 2000-2002** SIMSTORE II – A supermarket shopper simulation funded by: J Sainsbury PLC, Procter & Gamble (UK) Ltd.£80k; PI Alan Penn.
- 1999-2002** TOWER – Theatre of Work Enabling Relationships funded by: EC Framework 5: IST-1999-10846 £305k (Total value £2.94m) PI: Alan Penn (coordinated by Fraunhofer FIT)
Collaborating organisations: GMD - German National Research Centre Institute for Applied IT, blaxxun interactive, BTEexact, WS Atkins
- 1999-2002** An immersive VR 'cave' for manipulation, visualisation & auralisation for applications in design, medicine & computer science. funded by JREI £980k (Total value £1.8m)
PI: Prof. M. Slater, Co-I Alan Penn.
- 1997-2000** Virtual Reality Centre for the Built Environment funded by: OST/EPSRC Foresight Challenge Award, GR/L54950/01, L54943/01 £1.125m (Total Value £2.25m) UCL PI: Prof M. Batty; Imperial PI: Prof B Richards. Director and Co-I Alan Penn - a consortium of 16 industry firms. This was the single largest research investment made up to that time in the Built Environment field by the UK research councils..
- 1997-2000** Spatial, email and telecommunications media in work environments funded: BT laboratories £46,000, PI: Alan Penn.
- 1996-2000** Millennium Crowd Safety Project funded by: Westminster Public Safety Committee, in association with Risk Management Consultants, £45,000 PI: Alan Penn.
- 1997-98** Virtual meeting spaces: the Forum project funded by: BT laboratories £22,000, PI: Alan Penn

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1993-96 Intelligent Architecture funded by: DTI/SERC, GR/J 33609 Advanced Technology Programme £638,938 (Total Value £1.48m) PI: Alan Penn Co-Is: Prof. Treleavan, Dept. of CS, & Prof Hillier

1993-95 Effects of street grid configuration on pedestrian exposure to vehicular pollution: civilising urban traffic funded by: SERC/CTU GR/J 50613 £148,000 PI: Alan Penn Co-Is: Prof.D Banister, Prof P. O’Sullivan

1993-95 Automated data gathering and incident detection in crowded situations using image processing funded by: SERC/ITE GR/J 49327 £122,000 PI: Prof. Allsop and Profs Velastin (PI) Davies, KCL); Co-I Alan Penn

1992-94 The relationship between urban structure and movement at the neighbourhood level: civilising urban traffic SERC/Clean Technology £63,787

PI: Alan Penn, Co-Is: Dr D. Banister & Prof B. Hillier, collaborations with Ove Arup & Partners, Steer Davies & Gleave Ltd, & Dr Margaret Bell at the Transport Studies Group, Nottingham University;

1992-3 Pilot study on automatic data-capture and analysis of crowds in confined areas using image processing SERC ITE initiative £30,290

PI: Prof R. Allsop, CTS, UCL Co-Is: Alan Penn, Dr S. Velastin, KCL, PI, Prof. AC Davies,

1991-93 Graphical Knowledge Interfaces: configurational models and precedent databases for built environment design teams funded by: SERC GR/H18647 £130,557 PI: Prof. Bill Hillier, Co-Is Alan Penn, Dr R. Winder, Dept Comp Sci, UCL, D. Chapman, Dept of Photogrammetry and Surveying, UCL,

1990-92 Massive databases for highway and transport engineering research funded by: SERC GR/G 19596 £105,920 PI: Dr C. Small, Birkbeck, Co-Is Alan Penn, Dr A. Poulavasillis, KCL, Department of Computing, Dr B. Heydecker, TSG, UCL, D. Chapman, Department of Photogram and Surveying, UCL,

4. Other appointments and affiliations

Research Council panels etc.

Universities Research Group (Built Environment), 2003

EPSRC Review Panel for IMRC, 2002

Chair EPSRC Responsive mode Panel B, 2001, 2002, 2003

Portuguese National Science Review Panel for Built Environment, 2001.

Foresight Built Environment IT Panel, 2000

EPSRC Engineering Programme Review Panel, 1998

UK Research Councils’ SOFT Science & Technology working party. A follow up panel to the Anglo-Japanese initiative, 1995

ESRC Cognitive Engineering Programme Commissioning Panel, 1995

Joint Research Council delegation to Prime Minister’s Anglo-Japanese n+n workshop on SOFT Science & Technology, Osaka, Japan, 1994. Session Coordinator: Environment & Innovation.

EPSRC Innovative Manufacturing Initiative: Construction as a Manufacturing Process ‘tiger team’, final definition of the programme prior to launch 1994.

EPSRC Clean Technology Programme Sustainable Cities Commissioning Panel, 1994

Regular reviewer of research grant proposals and final reports for the EPSRC and ESRC

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External examining, Appointments Boards, College Committees etc.

External Examiner Architectural Association, Design Research Laboratory 2008-2013

University of London Subject Panel in Human Factors and Ergonomics 1997-

External Examiner, for PhD's at Newcastle University (2007); KTH Stockholm Licentiate (2007); Open University (2001); Cranfield University, (2000); Georgia Tech (1997); Queen Mary and Westfield, (1995); Internal Examiner UCL, (1994, 1995)

Special advisor to University of North London, Department of Architecture on Doctoral Research Programme 1997-

External Examiner, University of East London, MSc in Architecture: Computing and Design, 1994 -98

Working Group for appointment of Chair in Spatial Analysis and Planning, UCL, 1995

Working Group for appointment of Chair in Planning, Environment and Public Policy, UCL, 1997

Chair, College Day Nursery Committee, UCL 1999-2003

5. Prizes/awards

2007-9 UrbanBuzz

2008 Inaugural 'Spirit of Enterprise' Award 2008, UCL Advances

2001 HEFCE Business Fellowship

2000 EPSRC Platform Funding Award for research of international standing.

1996 Technology Foresight Challenge Award – for the establishment of the Virtual Reality Centre for the Built Environment at UCL and ICSTM.

1995 Elsevier Design Studies Award for a paper with Hillier 'Virtuous Circles, Building Sciences and the Science of Buildings: using computers to integrate product and process in the built environment', Elsevier, 1995.

Space Syntax Ltd. studies (those with my input 1999-2002)

2002 **C-Plex**, West Bromwich: evaluation of design proposals by Allsop & Stormer for a major new cultural building in the heart of West Bromwich, looking at patterns of staff and visitor use, interaction and public space design, for Jubilee Arts.

2002 **Royal Festival Hall**, assessment for the South Bank Board of the implications of pedestrian movement patterns in the area for the Allies and Morrison restoration proposals and retailing strategy in the RFH.

2002 **Designs for Democracy**, Final stage design competition with Buschow Henley Architects, for a new Town Hall in Letchworth Garden City.

2002 **Patient Dignity: Ward Design Study**, UK: evaluation of patient, staff and visitor interaction patterns in a range of hospital ward layout configurations, for National Health Service Estates.

2002 **South Bank Centre**, London: review of the South Bank Masterplan Urban Design Strategy prepared by Rick Mather Architects, for the South Bank Centre.

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- 2002** **Town Centre Development Strategy**, West Bromwich, analysis of major development projects for the town centre of West Bromwich, including the CPLEX cultural centre and two large retail proposals, for Sandwell Borough Council.
- 2001** **Long Acre**, London: pedestrian movement analysis, spatial network study and design development advice, with HOK Architects for the Mercers' Company.
- 2001** **North Lambeth**, London: pedestrian capacity study, first stage study of current pedestrian movement patterns, for the London Borough of Lambeth.
- 2001** **Sainsbury's Vauxhall**, London: strategic design advice, for Robert Turley Associates, planning lawyers and Sainsbury's.
- 2001** **Swiss RE**, London: pedestrian movement and staff questionnaire analysis to assist in selecting the number and location of entrances to the building, for Foster and Partners.
- 2001** **Trafalgar Square**, London: pedestrian movement modelling and 'pedestrian impact assessment' study, for Foster and Partners, WS Atkins and TfL.
- 2000** **Broadgate Development**, London: refinement of a new signing strategy with CDT consultants and SOM architects, for the British Land Company PLC.
- 2000** **Broadgate Development**, London: analysis of public space reconstruction phasing strategy in terms of the likely impact of construction works (e.g. hoarding lines) on existing pedestrian movement flows, for British Land Company PLC.
- 2000** **Greets Green**, Sandwell: pedestrian movement, crime and urban form study leading to a spatial masterplan design, for Sandwell MBC.
- 2000** **Kwangju Veterans Hospital**, South Korea: competition design analysis with Daewoo.
- 1999** **Chiswick Park Development**, London: public space study, with Richard Rogers Partnership and Stanhope PLC.
- 1999** **Frankfurt Urban Entertainment Centre**: pedestrian movement, urban form and design evaluation study for EisenbahnImmobilien Management GmbH.
- 1999** **Frankfurt Hauptbahnhof Railway Lands**: masterplan evaluation for EisenbahnImmobilien Management GmbH.
- 1999** **Greets Green**, Sandwell: pedestrian movement, crime and urban form study leading to a spatial masterplan design for Sandwell MBC.
- 1999** **Kensington Gardens**, London: Diana, Princess of Wales Memorial pedestrian movement study for the Royal Borough of Kensington and Chelsea, L&R Consulting and MORI.
- 1999** **Princes Circus**, London: pedestrian movement study and urban space redesign proposals for London Borough of Camden as part of its Clear Zones strategy.
- 1999** **Salford**, Crescent Area: international ideas competition special mention with Buschow Henley Architects.

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- 1999 **South Bank Centre**, London: masterplan study, with Rick Mather Architects for the South Bank Centre.
- 1999 **South Bank Centre**, London: masterplan briefing study, for the South Bank Centre.
- 1999 **Swiss RE Headquarters Building**, London: public space design, with Foster and Partners for Trafalgar House Property Limited and Swiss Re.
- 1999 **Trafalgar Square Millennium Crowd Safety Project**: with Risk Management Consultants for Westminster City Council, Royal Parks Agency, Metropolitan Police and the Department of Culture, Media and Sport.
- 1999 **Wales Millennium Centre**, Cardiff: visitor circulation study and design briefing, with Percy Thomas.

Previous Research grants and contracts (1989-98)

1998 Harrods Food Halls *funded by:* Harrods Stores Ltd. **£15,000**

Principal Investigator

This project investigated patterns of movement and shopping behaviour in Harrods Store Food Halls, in order to be able to advise the chairman on possible design changes to ease congestion, reduce stock shrinkage and optimise on turnover.

1997-98 South Bank regeneration masterplan

funded by: South Bank Board

£12,000

Principal Investigator

This project investigated patterns of space use and movement in and around the South Bank Centre to provide the masterplanning background for the proposed redevelopment of the centre and the area.

1997 Ogilvy & Mather Headquarters, London

funded by: Ogilvy & Mather

£15,000

Principal Investigator

This project investigated the patterns of space use and communication in O&M's offices at Canary Wharf in order to advise on possible remedial designs.

1997 Wolff Olins Headquarters, London *funded by:* Wolff Olins Ltd.

£8,000

Principal Investigator

This project investigated the patterns of space use and communication in Wolff Olins London HQ offices in order to advise on plans for refurbishment.

1997 Mars Headquarters, Slough *funded by:* Mars Foods Ltd.

£5,000

Principal Investigator

This project investigated the patterns of space use and communication in the Mars HQ building in order to advise on strategies for improving working atmosphere and quality of the environment.

1996 Zaanstad masterplan *funded by:* Battle McCarthy

£8,000

Principal Investigator

This project investigated possible urban masterplanning strategies for the development of an urban fringe site in Zaanstad, on the outskirts of Amsterdam.

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1994-5 London's South Bank Advisor to Sir Richard Rogers on his competition winning entry for the regeneration of the South Bank Centre, London.

1995 The Spatial Culture of Innovation, study of Howell Henry Chaldecot Lury & Partners London Office
funded by: HHCL **£7,500**

Principal Investigator

Study of innovation in the workplace as a contribution to strategic reengineering of this marketing consultancy's business. Including evaluation and computer simulation of the architects design strategies.

1995 Report on the refurbishment of the Neurosciences laboratory buildings, Harlow, for SmithKline Beecham *funded by:* SmithKline Beecham **£7,350**

Principal Investigator

Study of the effects of laboratory design on communications patterns and safe working practice and strategic assessment of the architects proposals for remodelling.

1993-94 Viability and vitality of town centres *funded by:* DOE/URBED, **£22,000**

Principal investigator

Research into town centre economic, social and environmental processes aimed at policy.

1993 Spandau Berlin Oberhavel Masterplan

funded by: Richard Rogers Partnership

£5,000

Principal investigator

Project for the regeneration of ex industrial brownfields site on the Oberhavel, Spandau for mixed residential and commercial usage.

1993 Security in hospitals: studies of Greenwich and Wonford Hospitals

funded by: NHSEstates

£22,000

Principal investigator

Research to extend the database of hospital types following the successful outcome of a previous study of Pinderfields. The project will provide the knowledge and database on which to develop policies for design to reduce crime vulnerability. Now published as design guidance in Health Facilities Note #5, Security in Hospitals, HMSO 1994.

1993 The campuses of the Universidad Catolica, Santiago de Chile

funded by: Universidad Catolica, Santiago de Chile,

£1,200

Principal investigator

A research collaboration with Margarita Green of the UCS in which we are providing technical assistance in research techniques to resolve campus planning problems.

1993 Day surgery units: an evaluation of spatial planning *funded by:* NHS Estates,

Principal investigator

£1,200

Study and contribution to the new operational policy document on Day Surgery Units. Now published as design guidance in Nucleus Study Pack: Day Surgery Unit, NHS Estates, Leeds, 1994.

1993 British Airways Prospect Park, People Movement Study *funded by:* British Airways

£4,900

Co-investigator (Prof B Hillier, PI)

Study of the design proposals for the new headquarters building for BA.

1993 Prague Railways Station Redevelopment Competition in association with Lusada & Pogy Architects

1993 Europian Competition, Sindlingen east, Frankfurt in association with SW Architects

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1993 Chalk Hill Estate, L B Brent, competition

funded by Avanti Architects:

£2,070

Co-investigator (Prof B Hillier, PI)

Project for the reintegration of the Chalk Hill Estate in its surrounding urban area.

1992-3 People's Republic of China, new financial capital at Shanghai East Bank *funded by:* Richard Rogers Partnership.

Principal Investigator

Study of the potential for integrating the new city with the existing city, and the implications of layout for energy sustainability in this competition winning scheme.

1992-3 Pinderfields hospital development, Wakefield: Security and space use issues *funded by:*

Department of Health, R&D 220/00/83B1

£2,816

Principal investigator

Project is to investigate the security and space use implications of design proposals for a major Nucleus hospital development at Pinderfields.

1992-3 Pinderfields hospital development, Wakefield: Nucleus Study Pack, Vol 1: Security *funded by:*

Department of Health, R&D 220/00/83B1

£7,638

Principal investigator

Project is to investigate the security implications of design proposals for a major hospital development at Pinderfields.

1992 The London Southbank urban space use appraisal. Consortium of South Bank land owners;
Phase 1:

£3,000

Co-investigator (Prof B Hillier, PI)

with Ove Arup & Partners

1992 Sagrerra Station development, Barcelona G. Ware Travelstead, Sir Norman Foster & Partners

£13,500

Co-investigator (Prof B Hillier, PI)

1992 Amsterdam Nieuw Oost development Dienst Ruimtelijke Ordening (Amsterdam City Planning Authority)

£4,800

Co-investigator (Prof B Hillier, PI)

1992 Berlin Oberhavel, Spandau Sir Richard Rogers Partnership

Co-investigator (Prof B Hillier, PI)

£7,200

1992 PowerGen Operational Headquarters communications study and design development PowerGen PLC, contract TCL00215

£17,484

Principal Investigator

1992 Kings Cross International Rail Terminal, Passenger behaviour study British Railways Board

£11,800

Co-investigator (Prof B Hillier, PI)

1992 Berlin, Spreebogen competition UAS with SW Architects

Principal investigator

Consultancy on the competition entry for the Spreebogen site in central Berlin.

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1992 Berlin, Reichstag competition UAS with SW Architects

Principal investigator

Consultancy on the competition entry for the new unified government buildings Berlin.

1992 Paris, Passerelle Solferino competition UAS with Masimilliano Fuchsas, Ove Arup & Partners.

Principal investigator

Consultancy on the winning competition entry for a new pedestrian bridge at the Louvre, Paris.

1990-91 The relationship between vehicular and pedestrian movement in the smaller scale urban grid

funded by: SERC GR/G23609

£53,281

Principal Investigator (Dr D. Banister, Prof B. Hillier, Co-I's)

plus collaborations with Ove Arup & Partners and Steer Davies & Gleave Ltd. Alpha 1 assessment.

1991 Retail property values and spatial configuration in Frankfurt: a pilot study *funded by:* Space

Syntax Ltd

£800

Principal Investigator

A study of the relationship between urban configuration and retail property values in Frankfurt.

1988-90 The design of research laboratories *funded by:* Department of Education and Science & Nuffield Foundation

£90,000

Co-investigator (Profs. Pat O'Sullivan and Bill Hillier, PI's)

A study of the Nuffield Report of the 1950's setting out new guidelines for the design and environmental control of research laboratories. Randomness is found to play a crucial role in morphogenetic models of many kinds, especially in spatial forms and in social networks. We argue here that it can also play a role in the advance of science.

1988-90 Second Generation Space Syntax *funded by:* SERC GR/78494 & t2 Solutions Ltd, Cooperative award with t2 Solutions Ltd. **£57,968(Total £102,000)**

Co-investigator (Prof. B. Hillier, PI)

Software development in the space syntax research programme. Developing new computerised methods for the analysis of built form and space, technology transfer of the existing Syntax knowledgebase to key markets in urban and facilities planning and retail management.

1991 Brindley Place, Birmingham: the UCL study of the potential of the site and the Farrell masterplan

funded by: Farrell & Co, Rosehaugh PLC

£18,595

Co-investigator (Prof B Hillier, PI)

A study of the spatial structure and space use patterns of central and western Birmingham, between the Bull Ring and Five Ways, including an evaluation of the likely distribution of pedestrian movement following the Brindley Place development and the strategic options for design fine tuning.

1991 Broadgate Exchange Square: east side of Liverpool station *funded by:* Rosehaugh Stanhope PLC

£10,094

Co-investigator (Prof B Hillier, PI)

A study of pedestrian movement and vehicle access to the station, with suggestions for fine-tuning the pedestrian walkways and taxi ramps giving onto the station concourse.

1991 Chiswick Park development Farrell & Co & Stanhope PLC

Co-investigator (Prof B Hillier, PI)

£3,149

1990 Liverpool Street Station redevelopment: pedestrian use patterns on the western side of the trainshed Rosehaugh Stanhope PLC

£5,000

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Co-investigator (Prof B Hillier, PI)

A detailed study of space use and movement in the vicinity of Liverpool Street Station with a view to advising on the fine-tuning of vehicular and pedestrian routes to and around the station concourse.

1990 Spitalfields development: an evaluation of pedestrian space use and the masterplan for the area

funded by: Spitalfields Development Group & Swanke Haden Connell

£5,260

Co-investigator (Prof B Hillier, PI)

A space analytic and use observation study of the open space of Spitalfields and a note on the strategic implications for the evaluation of candidate redesigns for the area for the Spitalfields Development Group and Swanke Haydon Connell.

1990 The public space of Paternoster Square *funded by:* Farrell & Co, Park Tower International,

Greycoates & Mitsubishi Consortium

£12,352

Co-investigator (Prof B Hillier, PI)

A use and movement study of the existing Paternoster Square development within its urban context coupled to a use and movement evaluation of a range of design proposals for the area, produced for Farrell Associates Architects in association with the Park Tower International, Greycoates and Mitsubishi Consortium.

1990 Ludgate Circus development *funded by:* Stanhope PLC & SOM

Co-investigator (Prof B Hillier, PI)

£4,497

A space analysis and use and movement study of the Ludgate area of the City of London together with an evaluation of design proposals for the reconstruction of Ludgate Circus produced for Stanhope /SOM

1990 Vienna Expo '95 competition entry Swanke Haden Connell & Gustav Pinkelmann in Association with the UAS

Co-investigator (Prof B Hillier, PI)

A strategy for the masterplan of the Expo '95 site in the centre of Vienna, together with a proposal for its integration within the wider urban area of the surrounding city neighbourhoods and outlying suburbs.

1990 Kanaal van Brussel urban regeneration study *funded by:* Ipage SA

Co-investigator (Prof B Hillier, PI, Van Dessel and de Maeseneer Co-I's) **£3,000**

An analysis and observation of an area of inner urban Brussels in preparation for a winning competition masterplan for the regeneration of the area.

1990 The Association for Consumer Research: observation of space use at the Harpenden Laboratories

funded by: Association for Consumer Research & John Outram Architects

£5,000

Principal Investigator

A study of space use and organisational variables to provide briefing for a proposed new consumer research centre for the Consumer Association at Milton Keynes.

1989 Kings Cross masterplan: consultancy on the masterplan design during 1989 *funded by:* Foster

Associates and London Regeneration Consortium

£16,578

Co-investigator (Prof B Hillier, PI)

1989 The spatial pattern of crime on the Studley estate *funded by:* Home Office Crime Prevention Unit

£9,000

Co-investigator (Prof B Hillier, PI)

Research commissioned by the Home Office Crime Prevention Unit into the spatial location of crime rates in a South London estate

1989 Space use and abuse on the Stockwell Park estate: the implications for design

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Co-investigator (Prof B Hillier, PI)

With Safe Neighbourhood Unit, for the community group. An investigation of space use and occupancy on a post-war housing estate in Southwark prepared for the Safe Neighbourhood Unit.

1989 Vancouver Bay foreshore development pilot study.

Principal Investigator

A pilot study in the analysis of context for a major land reclamation project in downtown Vancouver.

Projects as Unit for Architectural Studies (UAS) Research Manager (1984-88)

1988 Evaluation in use of the urban space in the Broadgate development in the City of London.

1988 Design consultancy on Kings Cross Railway Lands Masterplan.

1988 Crime Prevention Unit study of the Studley Estate in South London.

1988 A second opinion on the Maiden Lane Estate in Camden.

1988 The Greenwich Peninsula development

1988 Urban design and analysis of spatial context of the Kings Cross railway lands development

1987 Application of Space Syntax to work environments inside buildings - towards a predictive model, funded by SERC

1987 The Furnival housing development

1987 Problems in the design and management of housing estates in England and Germany

1986 Spatial Configuration and use density at the urban level

1986 The Camden Goods Yard site and its urban context

1986 A second opinion on proposed design changes to the Mozart Estate

1986 Appraisal of industrial research laboratory facilities

1986 Spatial Layout and Space Use patterns in the Charles Darwin Building, Bristol Polytechnic

1985 Space standards and layout in research laboratories

1985-87 Space Syntax as an interactive design tool SERC/GMW Computers Ltd

1985-87 The application of Space Syntax to work environments inside buildings (SERC)

1984 Mansion House Square - would it work?

1984 The Coin Street development in its urban context,

7. Invited talks

2003 Keynote Speaker, Pedestrian Dynamics Ped2003 Conference, London

2003 Keynote Speaker, BIAT Annual Conference, London.

2003 Invited speaker and session chair at the 4th International Space Syntax Symposium, London.

2003 Invited speaker and session chair at SmartGeometry '03, University of Cambridge.

2002 Invited speaker for Invest UK at CeBIT, 2002, Hanover, Germany.

2002 Invited speaker at the Ove Arup International workshop on design automation, London.

2001 Keynote speaker and session chair at the 3rd International Space Syntax Symposium, Georgia Tech, Atlanta, GA.

1999 Invited speaker and session chair at the 2nd International Space Syntax Symposium, University of Brasilia, Brazil.

1999 Invited speaker - RICS Centenary Conference, Nottingham.

1998 Keynote speaker - Photogrammetric Society 50th anniversary conference, paper: 'Virtual reality for the Built Environment'.

1998 Keynote speaker, Ordnance Survey review of Virtual Reality technologies, paper 'The Geometry of the Virtual Environment'.

1997 BAAS President's session lecture: 'Social Space and Spatial Societies'.

1997 PAWS Drama presentation of research for drama and television producers as a part of the Public Awareness of Science programme.

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- 1996** Invited guest speaker - International Communication on Residential Design 2000, Shanghai, PRC, paper: 'Intelligent City Design: bringing knowledge to bear in the design of future cities'.
- 1995** Invited guest speaker of the Korean National Housing Corporation - Second International Housing Symposium, Seoul, Korea, paper: 'Housing redevelopment to improve the quality of the urban environment'.
- 1995** Invited guest speaker - NATO Workshop on Virtual Reality and Training, Portsmouth, paper: 'Intelligent Architecture: desktop VR for complex strategic design in architecture and planning'
- 1995** Invited guest speaker - IEE Computing and Control Division Colloquium on "Knowledge Based Approaches to Automation in Construction", paper: 'Analysis of Configuration: knowledge of context and precedent in architectural design'.
- 1994** Joint Research Council delegation to Prime Minister's Anglo-Japanese n+n workshop on SOFT Science & Technology, Osaka, Japan. Session Coordinator: Environment & Innovation, paper: 'Space for innovation: effects of spatial configuration on social and knowledge generation'
- 1994** invited guest speaker, IBC Conference on Intelligent Computing for the Financial Sector, London, paper: 'Intelligent Urban and Building Planning'
- 1994** SET7 public lecture - Science and the City series.
- 1992** invited guest speaker, Corporate Space and Architecture Conference, Paris, paper: 'The social potential of buildings: space and the innovative milieu in scientific research laboratories'.

8. Academic supervision

Current Research Fellow Supervisions as Principal Investigator:

Chiron Mottram - ARTHUR
Ava Fatah - ARTHUR
Stefan Keuppers - LVRG
Irina Perdikogianni - Research generation
Rui Carvalho - Platform
John Kelsey – RACMIT
Corrinne Frazzoni - Administrator
Steve Coast - Platform System admin – Part time
Shinichi Iida - Platform and PhD – Part time

Previous Research Fellow Supervisions and current positions:

Edward Ho	2001 – 02	Further study
Jake Desyllas	1998 – 99	Set up consultancy - UK
Elsbeth Duxbery	1998 – 99	Set up consultancy - UK
Alasdair Turner	1997 – 2001	Lectureship, UCL
Simon Doyle	1997 – 98	Local Government - UK
Eleni Samara	1997 – 98	Private practice - UK
Mark Major	1996 – 98	Private practice - USA
Georgia Spiliopoulou	1997 – 98	Private practice - Greece
Ben Croxford	1993 – 95	Lectureship, UCL
Ruth Conroy	1993 – 94	Assistant Professor, Georgia Tech. USA
Laura Vaughan	1992 – 96	Lectureship, UCL
Tim Stonor	1991 – 92	MD Space Syntax Ltd. - UK
Xu Jianming	1990 – 93	Private practice - UK
Juan Alayo	1990 – 91	Consultancy – Ove Arup - UK
Nick Dalton	1988 – 96	Government agency - USA
Maria Kolokotroni	1988 – 90	Lectureship, Brunel University
Mark Rasmussen	1988 – 90	Research Fellow, UCL

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Tadj Grajewski 1987 – 92 Lectureship, UWIST

Doctoral supervisees, completed (main supervisor):

Roger Chouinard, a **Morphological analysis of Bloomsbury : an approach to the integration of new buildings into an existing urban context**, PhD awarded 1994,

Dongkuk Chang, **Integrated Multi-level Circulation Systems in Dense Urban Areas: the effect of complex spatial designs on multi-level pedestrian movement** - in receipt of ORS award, PhD awarded 1998, now in industry.

Laura Vaughan, **Clustering, segregation and the "ghetto": the spatialisation of Jewish settlement in Manchester and Leeds in the 19th Century**, EPSRC quota award winner – PhD awarded 1999, now Lecturer at UCL.

Young Ook Kim, **Spatial Configuration, Spatial Cognition and Spatial Behaviour: the role of architectural intelligibility in shaping spatial experience**, - PhD awarded 1999, now Professor at Seijong University, Seoul, Korea.

Jake Desyllas **The relationship between urban street configuration and office rent patterns in Berlin**, UCL Graduate School Scholarship awarded - PhD awarded 2000, has now set up a knowledge based consultancy.

Nasreen Hossain, **The sociological structure of spontaneous retail development in Dhaka City**, in receipt of an ACS scholarship - PhD awarded 2000, now Lecturer at University of Dhaka, Bangladesh.

Holger Schnadelbach **Mixed Reality Architecture** Part Time Started 2000.

Jamie O'Brian, EngD **ScreenZone: developing a mixed reality micro-environment to promote better working practices**, EngD awarded 2008, Sponsored by VOEDN.

Current Doctoral supervisions (main supervisor):

Theadora Antonokaki, PhD, **The effects of light and views on intelligibility of architectural space**, started 2003.

Sam Griffiths, PhD **Reading the 'city as a text' is not enough: mapping individual journeys and evaluating the effects of social change in the industrial city by developing a 'spatial syntax from below'**, started 2002, EPSRC quota award.

Sean Hanna, EngD, **Automated design of office space layouts using AI techniques**, started 2002, Sponsored by Foster and Partners.

Sarah Graham, EngD, **Integrated environmental analysis and visualisation for building design**, started 2001.

Francis Aish, EngD, **Design Optimisation Toolkit**, started 2001, Sponsored by Foster and Partners.

Nisrin Zerekli, **Implementing AR environments in the early stages of the design process and decision-making in Architecture**, started 2000, scholarship from Karim Rida Said Foundation.

Alasdair Turner, **An examination of the visual process of inhabitation in the built environment**, Part Time, started 2000, funded by EPSRC Platform award, now Lecturer at UCL.

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Sharon Carpenter, Physically realistic virtual materials, started 1998.

Shinichi Iida, Transport infrastructure and urban morphology in London and Tokyo, started 1998.

Georgia Spiliopoulou, Spatial, email and telecommunications media in work environments in receipt of a BT Scholarship, started 1998.

Andrew Matthews, Virtual architectural indices to textual databases - Part time started 1995

Irini Perdikogianni

Karen Martin

Katrin Jonas

Abel Junior

Francesco Olmos

Lesley Gavin

I am back-up supervisor to a further 17 MPhil/PhD students.

9. Teaching activity

I have taught in the Bartlett at both undergraduate and postgraduate levels, in the School of Planning (1989-93), the School of Architecture (1988-91) and in the School of Graduate Studies (1993 on). My teaching is now concentrated on the MSc Advanced Architectural Studies (for which I was Course Director from 1993-96) and the MSc in Virtual Environments, which I helped found in 1996, and which was at the time the first such course in the UK. Both of these courses consistently gain praise from external examiners as well as from student assessments, and students regularly receive commendations and distinctions. Most recently (2001) I have helped establish and won funding for an associated EngD programme in Virtual Environments, Imaging and Visualisation, which provides a fully funded 4 year Doctorate with a substantial taught element and very close links to industrial sponsorship and supervision. The EngD is run jointly with the Department of Computer Science and students share modules and carry out group projects together with the aim of helping to bring together science/engineering and design based cultures. I also supervise a large group of MPhil/PhD students (*see section 8*).

In the last three years I have introduced web based teaching support at both Masters and Doctoral level. The MScVE, the MScAAS and my own Doctoral supervisees now use the BSCW web based system to share information and documentation. (The same system is used to support my large collaborative research projects). The MScVE regularly uses virtual environment based cooperation spaces to work on group projects with remote partners (this year with colleagues at Georgia Tech). In 2002 I set up a new web based spatial analysis system (Webmap) to support both our own MScAAS students and the growing international constituency of researchers and research students using space syntax analysis techniques. I see all of these new methods of curriculum delivery as closely associated with my current research as well as with the taught content of the courses themselves.

2001-2006 Responsible, in collaboration with Prof. Buxton in Computer Science, for establishing the EngD programme in Virtual Environments, Imaging and Visualisation.

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- 2000 -** Supervising and assessing Diploma in Architecture students on Technical Dissertations in subjects related to computing.
- 1997-2000** Responsible for setting up and managing the ‘training’ deliverables from the Virtual Reality Centre for the Built Environment through PhD and MSc modes.
- 1996 -** Mentor to Nick Dalton in setting up and Lesley Gavin in running the MSc in Virtual Environments. Teaching modules on theory of virtual environments and supervision of MSc projects.
- 1996 -** Teaching modules associated with health buildings, research laboratory and work environments, as well as on the methodology and theory of research and supervision of MSc projects for the MSc Advanced Architectural Studies.
- 1993-1996** Course Director MSc in Architecture, Advanced Architectural Studies option. Coordination of whole course, teaching 6 (of 16) modules in Complex Buildings and Principles of Spatial Morphology.
- 1990-1991** Unit 6 coordinator with Ram Ahronov in the Bartlett BSc in Architecture.
- 1989-1993** New initiative Lectureship in Urban Design and Regeneration at the Bartlett School of Planning, Lecturing in Research Methods and Urban Design to Planning MPhil, and Research methods to Planning BSc courses.
- 1987-1989** Lecturing and drafting examinations for MSc AAS in the Complex Buildings course.
- 1986-1988** Design tutor (part time) to the second year BSc in Architecture course at the Bartlett with specific input on urban design projects and the design of complex buildings. Lectures given on specific topics relating research to design projects.
- 1985-1989** Part time academic/research tutor to MSc students, supervising computing aspects of research, and in particular research techniques for the analysis of Urban design problems, large complex buildings, and housing. Tutorial and technical support to MPhil/PhD students in the UAS PhD programme. Particular responsibility for computing support on PhD research projects.

10. Research activity

There is no single neat chronology with which to explain the development of my research at UCL, rather, there is an overall direction and a series of strategic research aims that I have pursued. First, I have been interested in what it is about architecture that makes it a single discipline and field of knowledge despite the apparent diversity of scale and building type that it has to address: in what sense is designing a house, a hospital and a city the same? Second, I want to understand how architecture matters to people: what is it responsible for, how can it go wrong and what functional effects does it have? Third, I am interested in the way that architecture performs across domains: socially, economically, environmentally, and the interactions between these aspects of function. Finally, I want to find ways to turn that knowledge to use to create better environments: how is it that knowledge of the functional performance of the *product* can be brought to bear in the design, construction and management *processes* through which our industry operates? Computing is integral to both the research task and to the delivery mechanism, and so has formed a central component in my research.

In order to begin to answer these questions I have had to develop both methodology and carry out empirical studies, and these have been constrained by available funding and access to case material to focus either on live application projects where clients have questions that they want answered, or to areas such as urban

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sustainability where Research Council funding is available. What has emerged from these two is a body of theory coupled to case data which forms the main content of my teaching material. I am firmly of the mind that in my field, research, teaching and implementation must be pursued together, since a combination is needed of real world problems and data which come from live projects, with fundamental research funded through research council grants, staffed as often as not by ex-students who have been trained in the research methods and theories we have generated on our own courses. My main contributions have therefore been both intellectual - in the development of fundamental new methodology and empirical studies - and organisational, in putting together the structures (including a company to manage relations to live projects and provide careers for young researchers, and more recently the VR Centre for the Built Environment), and the research funding packages that have allowed the field to grow and flourish. However, none of this would have been achieved if the research itself had not also been fruitful, and headway made in a highly complex field.

Whilst at UCL my research has contributed to the following areas of knowledge:

- The development of methods of representation and analysis of space patterns within buildings and in urban areas. Patterns of space are what people use and move through, and so the way that they are patterned affects the way people navigate and are brought into contact with each other, and thus the effect of building design on communication and social function;
- The development of computing to make this analysis tractable. The techniques I have personally developed include overlapping convex space partitions and visibility graph analysis;
- The application of these ‘space syntax’ analysis methods to a series of well-defined urban research questions. Specifically: understanding the way that urban design affects both pedestrian and vehicular traffic patterns at the same time; how this can lead to or ameliorate conflicts between the two (Penn et al, 1998); and, the way that air pollution (largely vehicular in origin) is distributed in urban space and so how the public are brought into contact with it (Penn & Croxford, 1998);
- The application of these methods of analysis to understanding the social performance of complex work environments such as science research laboratories and large offices. Here spatial layout has been found to affect communication that people find ‘useful’ in their work (Penn et al. 1999);
- The development of methods for bringing this kind of knowledge to bear in the design process. Specifically, the development of computer based design decision support tools (Pangea, Candel, ARTHUR), and the development of Space Syntax Ltd. an organisational structure within the University to allow knowledge and research to be disseminated through application in live implementation projects with industry leading practitioners;
- The development of information and communication technologies (ICT) as an architectural material (or a part of buildings systems) to help overcome spatial dispersion in modern project teams (TOWER). Making use of virtual environments as an integral part of real environments to give awareness of the activities and current status of distant team members;
- Understanding the implications for theories of human cognition of findings about the way that people navigate and use urban and building space (Penn, 2003);
- The development of autonomous agent simulation techniques as a means for investigating issues of perception and cognition (Penn & Turner, 2001, 2002; Turner & Penn 2002).

11. Enabling activity

My contributions to management and administration have most recently been as Dean of the Bartlett Faculty of the Built Environment and member of UCL's Senior Management Team from 2009-2019. During that period, I have grown the faculty and increased its subject coverage. I established the Bartlett School of Environment, Energy and Resources, the Institute of Global Prosperity, the Institute of Innovation and Public Purpose and the Bartlett Real Estate Institute. I oversaw the acquisition and refurbishment of Central House, the reconstruction of 22 Gordon Street building, including temporary space in the Royal Ear Hospital and 150 Hampstead Road, and the acquisition and construction of the facilities at HereEast. During this period the volume of activity in the Faculty increased from £15m per annum to £95m.

12. Publications

A3. Chapters in Books

1. **Evolving Direct Perception Models of Human Behavior in Building Systems**, (Penn, A., & Turner, A.) In: Waldau, N., Gattermann, P., Knoflacher, H., & Schreckenberg, M., (Eds.) Pedestrian and Evacuation Dynamics 2005, Springer, Berlin, 2007, pp 411-422. ISBN 978-3-540-47062-5
2. **Instrumenting the City: Developing Methods for Observing and Understanding the Digital Cityscape**, (Penn, A., O'Neill, E., Kostakos, V., Kindberg, T., Fatah gen. Schiek, A., Stanton Fraser, D., & Jones, T.) In: Lecture Notes in Computer Science, 4206/2006. pp. 315-332. ISSN 03029743
3. **Augmented reality meeting table: a novel multi-user interface for architectural design**, (Penn, A., Mottram, C., Fatah gen. Schiek, A., Wittkämper, M., Störing, M., Romell, O., Strothmann, A., & Aish, F.) In: van Leeuwen, J.P. and Timmermans, H.J.P. (Eds). 7th International Conference on Design & Decision Support Systems in Architecture and Urban Planning 2004. Kluwer Academic Publishers, Eindhoven, 2004, pp. 213-220.
4. **Space syntax based agent simulation**, (Penn, A & Turner, A.) p99-114, in Schreckenberg, M., Sharma, S.D., (Eds.) Pedestrian and Evacuation Dynamics, Springer-Verlag, 2002. ISBN 3-540-42690-6
5. **Configurational Modelling of Urban Movement Networks** (Penn, A., Hillier, B., Banister, D. & Xu, J.) in Travel Behaviour Research: updating the state of play, Juan de Dios Ortuzar, David Henshar and Sergio Jara-Diaz (eds), Pergamon press, Elsevier, Amsterdam, 1998, Ch19, 339-362. ISBN 0-08-043360-x
6. **Intelligent Architecture: Desktop VR for Complex Strategic Design in Architecture and Planning**, (Penn, A., Dalton, N., Dekker, L., Mottram, C. & Nigri, M.) in Seidel R.J. & Chatelier, P.R. (eds) Virtual Reality, Training's Future?, Perspectives on Virtual Reality and Related Emerging Technologies, Defense Research Series, Vol 6, Plenum Press, New York, 1997, ISBN 0-306-45486, pp121-132.
7. **Intelligent Architecture: Pangea, an Intelligent Workbench for Architectural Sketch Design**, (Penn, A., Treleavan, P., Hillier, B., Bull, L., Conroy, R., Dalton, N., Dekker, L., Mottram, C., Turner, A.) in the Intelligent Systems Integration Programme ES96 Papers, (Watson, I. & Morgan, A. eds), SGES Publications, Oxford, 1996, 127-139. ISBN 1 899621 14 8.
8. **Intelligent Architecture: User interface design to elicit knowledge models**, (Penn, A., Conroy, R., Dalton, N., Dekker, L., Mottram, C., Turner, A.) in Applications and Innovations in Expert Systems III, (Macintosh, A. & Cooper, C. eds), SGES Publications, Oxford, 1995, 335-348. ISBN 1 899621 03 2.
9. **Graphical Knowledge Interfaces: the extensive and intensive use of precedent databases in architecture and urban design** (Hillier, B., Penn, A., Dalton, N., Chapman, D. & Redfern, F.), in Koutamanis, Timmermans and Vermeulen, Visual Databases in Architecture: recent advances in design decision making, Avebury, Aldershot, 1995, p197-227. ISBN 1 85628 994 X.
10. **Pedestrian exposure to urban pollution: Exploratory results**, (Croxford, B., Penn, A.) in Air Pollution III, Vol2, pp439-446, Computational Mechanics Publications, Southampton, UK, 1995. ISBN 1-85312-442-7
11. **Structure spatiale et innovation dans les laboratoires de recherche scientifique: le potentiel social des bâtiments**, (Penn, A., Hillier B.), in Evette, T. et Lautier, F. (eds) De l'atelier au territoire: le travail an

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quête d'espaces. L'Harmattan, Paris, 1994, Ch.24, p215-224. Chapter reporting research into the effect of spatial layout on communication networks potentially affecting scientific innovation. ISBN 2 7384 3159 3.

12. **The architecture of society: stochastic simulation of urban movement**, (Penn A. & Dalton N), in Gilbert & Doran (eds) Simulating Societies, UCL Press, London, 1994, pp85-126. Chapter describing research into the computer simulation of lifelike urban forms and lifelike population flows through restrictions on random processes.
13. **City Space and pollution dispersion: A modelling and monitoring exercise**, (Ni Riain, C., Croxford, B., Littler, J., Penn, A.) in The Compact City: A sustainable urban form?, edited by Mike Jenks, Elizabeth Burton, Katie Williams, E & FN Spon, London, UK. 1996, ISBN 419213007.

B. Refereed articles

1. **An algorithmic definition of the axial map**. (Turner, A. and Penn, A. and Hillier, B.) (2005) *Environment and Planning B: Planning and Design*, 32 (3). pp. 425-444. ISSN 02658135
2. **Exploring the effects of introducing real-time simulation on collaborative urban design in augmented reality**. (Attfield, S. and Blandford, A. and Mottram, C. and Penn, A. and Fatah Gen, A.) (2005) In: International Workshop on Understanding Designers '05, 17-18 October 2005, University of Provence, Aix-en-Provence, France.
3. **Linking the spatial syntax of cognitive maps to the spatial syntax of the environment**, (Kim, Y.O., & Penn, A.) *Environment and Behavior* (2004), **36**, 4, 483-504. ISSN 00139165
4. **Rejoinder to Carlo Ratti** (Hillier, B., & Penn, A.) *Environment and Planning B: Planning and Design*, (2004) **31**, 501-511
5. **Scaling and universality in the micro-structure of urban space** (Carvalho, R., & Penn, A.) *Physica A*, (2004) **332**, 539-547
6. **Movement-generated land-use agglomeration: simulation experiments on the drivers of fine-scale land-use patterning**. (Penn, A., & Turner, A.) *Urban Design International*, (2004) **9**, 81–96, Palgrave Macmillan Ltd. 1357-5317/04
7. **Interactive Space Generation through Play: Exploring Form Creation and the Role of Simulation on the Design Table**. (Fatah gen. Schieck, A., Penn, A., Mottram, C., Strothmann, A., Ohlenburg, J., Broll, W. & Aish, F.) In: *eCAADe 2004 22nd conference*, September 15-18 2004, Copenhagen, Denmark.
8. **Augmented reality meeting table: a novel multi-user interface for architectural design**. (Penn, A., Mottram, C., Fatah gen. Schieck, A., Wittkämper, M., Störring, M., Romell, O., Strothmann, A., & Aish F.) In: *proceedings of DDSS'04*, Eindhoven (2004).
9. **An ecological approach to generative design**. (Turner, A., Mottram, C. and Penn, A.), 2004, In *Design Cognition Computing '04* pp. (2004) 259–274.
10. **Space layout affects search efficiency for agents with vision**, (Penn, A. & Turner, A.) Proceedings of the 4th International Space Syntax Symposium, Vol. 1., UCL, London, 2003.

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11. **The shape of habitable space**, (Penn, A.,) Proceedings of the 4th International Space Syntax Symposium, Vol. 2., UCL, London, 2003.
12. **Kelsey J M, Winch G M and Penn A (2001) Understanding the Project Planning Process: Requirements Capture for the Virtual Construction Site, Bartlett Research Paper No 15**
13. **Space syntax and spatial cognition: or why the axial line?** (Penn, A.) Environment and Behaviour, (2003) 35 (1) 30-64, Sage Publications, ISSN:0013-9165. *Revised version of the paper given as keynote presentation to the 3rd International Space Syntax Symposium, Georgia Tech, Atlanta, GA, 2001.*
14. **Encoding natural movement as an agent-based system: an investigation into human pedestrian behaviour in the built environment**, (Turner, A. & Penn, A.), Env and Plan B: Planning and Design (2002) 29 (4) 473-490
15. **From isovists to visibility graphs: a methodology for the analysis of architectural space**, (Turner, A., Doxa, M., O'Sullivan, D. & Penn, A.), Environment and Planning B (2001) 28(1) 103–121
16. **The Grid is the Thing: space syntax for the Illinois Institute of Technology**, (Major, M.D. & Penn, A.), Urban Design Studies, (2001) 7 59-74.
17. **Space syntax and spatial cognition: or why the axial line?** (Penn, A.) Proceedings of the 3rd International Space Syntax Symposium, Georgia Tech, Atlanta, GA, (2001) pp11.1-11.17.
18. **Following the crowd: spatial layout and crowd behaviour**, (Major, M.D. & Penn, A.), Architectural Research Quarterly, (2000), Volume 4 Part 3, Edited by Peter Carolin, Thomas Fisher, CUP, Cambridge, ISBN: 0521794129
19. **The Space of Innovation: Interaction and Communication in the Work Environment**, (Penn, A., Desyllas, J. & Vaughan, L.), Environment and Planning B: Planning and Design, (1999), Vol. 26, 193-218, Pion, London.
20. **Virtual beings: emergence of population level movement behaviours from individual rulesets**, (Mottram, C., Penn, A. & Conroy, R.), in the Proceedings of the Second International Space Syntax Symposium, March 1999, Brasilia, Bartlett, UCL, London, 1999, Vol 1. 10.
21. **Making isovists syntactic: isovist integration analysis**, (Turner, P.A. & Penn, A.) , in the Proceedings of the Second International Space Syntax Symposium, March 1999, Brasilia, Bartlett, UCL, London, 1999, Vol 1. 08.
22. **Sketching a virtual environment: modeling using line-drawing interpretation**, (Turner, A., Chapman, D., & Penn, A.). VRST 1999: 155-161
23. **In with the right crowd: Crowd movement and space use in Trafalgar Square during the new year's eve celebrations** (Major, M.D., Penn, A., Spiliopoulou, G., Spende, N., Doxa, M., & Fong, P.), in the Proceedings of the Second International Space Syntax Symposium, March 1999, Brasilia, Bartlett, UCL, London, 1999, Vol 2. 27.
24. **A syntactic approach to the analysis of spatial patterns in sponaneous retail development in Dhaka** (Hosseini, N. & Penn, A.), in the Proceedings of the Second International Space Syntax Symposium, March 1999, Brasilia, Bartlett, UCL, London, 1999, Vol 2. 30.

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25. **Organisations as multi-layer networks: face to face, email and telephone interaction in the workplace**, (Spiliopoulou, G. & Penn, A), in the Proceedings of the Second International Space Syntax Symposium, March 1999, Brasilia, Bartlett, UCL, London, 1999, Vol 1. 13.
26. **Siting considerations for urban pollution monitors**, (Croxford, B. & Penn, A.) Atmospheric Environment, Vol 32, No 6., pp1049-1057, Elsevier Science Ltd, 1998
27. **Fingerprinting Urban Kerbside Carbon Monoxide Concentrations: interaction between street grid configuration, vehicle flows and local wind effects**, (Penn, A. & Croxford, B.), International Journal of Vehicle Design, Vol 20, Nos 1-4 (Special Issue), 60-70, Inderscience, Geneva, 1998, ISSN 0143-3369
28. **Integrated multilevel circulation in dense urban areas: the effect of multiple interacting constraints on the use of complex urban areas**, (Chang, D., & Penn, A.,) Environment and Planning B: Planning and Design, 1998, Vol. 25, 507-538, Pion.
29. **Configurational modelling of urban movement networks**, (Penn, A., Hillier, B., Banister, D., Xu, J.) Environment and Planning B: Planning and Design, Vol 25, pp 59-84, Pion, 1998.
30. **Socio-spatial analysis of four University Campuses in Santiago**, (Greene, M. & Penn, A.) in the Proceedings of the First International Space Syntax Symposium, April 1997, London, Bartlett, 1997.
31. **Effects of streetgrid configuration on kerbside concentrations of vehicular emissions**, (Penn, A., & Croxford, B.) in the Proceedings of the First International Space Syntax Symposium, April 1997, London, Bartlett, 1997.
32. **Spatial distribution of urban pollution: civilising urban traffic** (Croxford, B., Penn, A. & Hillier, B.), The science of the total Environment, 189/190 (1996) 3-9, Elsevier Science, BV.
33. **Virtuous Circles, Building Sciences and the Science of Buildings: Using Computers to Integrate Product and Process in the Built Environment**, (Hillier, B. & Penn, A.) Design Studies, (1995) 15, 332-365 (paper awarded Design Studies prize, 1996).
34. **Is Dense Civilisation Possible?: or the shape of cities in the 21st century** (Hillier B, Penn A.) paper given to the Watt Committee Conference on Energy, 25pp *inc. diagrams*, Applied Energy 43 (1992) 41-66, Elsevier; London.
35. **Natural movement; or, configuration and attraction in urban space use** (Hillier B, Penn A, Hanson J, Grajewski T & Xu J), Environment and Planning B: Planning and Design, 1993, Vol. 20, 29-66, Pion.
36. **Visible colleges: structure and randomness in the place of discovery** (Hillier B & Penn A): paper to conference in Jerusalem on 'The Place of Knowledge', May 1989, Science in Context. 4, 1 (1990) 29 pp.
37. **Creating life : or, does architecture determine anything ?** (Hillier,B., Hanson, J., Burdett, R. & Penn, A.) in Architecture & Behaviour, 1986-87,3(3).

C. Other publications and reports

38. **Scaling and universality in the microstructure of urban space**, (Carvalho, R. & Penn, A.), 2003, arXiv.org e-Print archive, Condensed Matter: <http://arxiv.org/abs/cond-mat/0305164>

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39. **Intelligent Modelling of Public Spaces.** (Penn, A. & Turner, A.), International Patent Application No. PCT/GB01/03763, (2001).
40. **Distributed simulation system for spatial design: parallel physical and virtual interactions between people and objects.** (Kueppers, S., Gage, S., Penn, A. & Mottram, C.) in the Proceedings of the Greenwich2000 Symposium on Digital Creativity, University of Greenwich, UK, January, 2000.
41. **The Virtual Tate,** (Batty, M., Conroy, R., Hillier, B., Jiang, B., Desyllas, J., Mottram, C., Penn, A., Smith, A., and Turner, A.) Centre for Advanced Spatial Analysis, Working Paper Series, (1998), Paper 5, UCL, London.
42. **Pangea V2.1b: Pangea user manual and interactive CD-ROM,** (Penn, A. et al.), University College London, 1996, ISBN 0902137-38-7
43. **Intelligent City Design: bringing knowledge to bear in the design of future cities,** (Penn, A., Bull, L., Conroy, R., Dalton, N., Dekker, L., Mottram, C. & Turner, A.), Proceedings of Shanghai Residential 2000, Shanghai PRC, 1996.
44. **The spatial culture of innovation: report on a study of Howel Henry Chaldecot Lury & Partners' Kent House offices, London.** (Penn, A. Vaughan, L., DeSyllas, J., Budgen, A., Campos, B. & Karimi, K.), Space Syntax Ltd, London, 1995.
45. **Housing redevelopment to improve the quality of the urban environment** (Penn, A., Hillier, B., Major, M.D.) Proceedings of the Second International Conference on Housing and Quality of Life, KNHC, Seoul, 1995.
46. **Refurbishment of SmithKline Beecham Pharmaceuticals: Report on spatial analysis, movement study, questionnaire analysis and analysis of design proposals,** (Penn, A. & Vaughan, L.) Space Syntax Ltd., London, 1995.
47. **Spatial distribution of Urban Pollution,** (Croxford B, Penn A., Hillier B.) Proceedings of the Fifth Symposium on Highway and Urban pollution, Copenhagen, May 1995.
48. **Pedestrian movement and spatial design** (Penn, A.& Vaughan, L.) Passenger Terminal '95, UK and International Press, Dorking, 1995, 122-125.
49. **Intelligent Architecture: desktop VR for complex strategic design in architecture and planning** (Penn, A., Dalton, N., Dekker, L., Mottram, C., Nigri, M.) Proceedings of the NATO Workshop on Virtual Reality and Training, Portsmouth, 1995.
50. **Analysis of Configuration: knowledge of context and precedent in architectural design** (Penn, A. & Hillier, B.) in IEE Computing and Control Division Colloquium on "Knowledge Based Approaches to Automation in Construction", June 1995, IEE Digest No: 1995/129, 7/1-9, IEE, London.
51. **Space for innovation: effects of spatial configuration on social and knowledge generation** (Penn, A.) Proceedings of the first Workshop for Cooperation between Japan and the United Kingdom on SOFT Science and Technology, 126-8 & 172-6, November 1994, STA, Osaka.
52. **Configurational modelling of urban movement networks** (Alan Penn, Bill Hillier, David Banister, Jianming Xu) paper given to the IATBR Conference, Santiago de Chile, 1994.

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53. **Intelligent Urban and Building Planning** (Penn A.), in proceedings of conference on intelligent computing for the financial sector, London, 1994.
54. **Automated Measurement of Crowd Density and Motion using Image Processing** (Velasin S.A., Yin J.H., Davies, A.C., Vicencio-Silva M.A., Allsop R., Penn A.) 7th IEE International Conference on Road Traffic Monitoring and Control, London 1994.
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93. Architecture of Innocence and Experience in Bartlett Forum, 1988, 1(1). Fashion versus theory in urban design and design education.
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102. The Spatial Culture of the City of London, Hillier, B., Burdett, R. & Penn, A., UAS, April 1984, Report of a research study into space organisation and use in the City of London in relation to the proposed Mansion House Square.

E. Lectures and media presentations

Today, BBC Radio 4, (10/3/2006) Interview on effects of architecture on psychological responses.

Arte programme (2001) 30 minute documentary on the TOWER project broadcast on ARTE programme in Germany France and Spain, and on Cable in UK.

BBC First Sight (21/1/1999) 30 minute documentary on the research into the new years eve crowd behaviour in order to plan the management for Trafalgar Square.

Millenium Dome (Mind Zone development) content development for exhibits 4 and 9 in the Mind Zone for NMEC and Zaha Hadid (1998-2000).

BAAS President's session, presentation on social space and spatial societies, 1997

Science Now, BBC Radio 4, February 1995, interview on spatial analysis and crowd movement;

The Acid Test, BBC Radio 5, January 1995, interview on crowd movement and image processing;

European Business News, (CATV) May 1995, short programme on visitor behaviour in art galleries.