

The University of Salford

Professor Rachel Cooper
Principal Investigator (Consortium)
Co-investigator Work Package 1
and Work Package 8

Dr Caroline Davey
Co-investigator Work Package 3

Andrew Wootton
Co-investigator Work Package 1

Professor Trevor Cox
Co-investigator Work Package 4

Professor Ghassan Aouad
Co-investigator Work Package 8

Professor Terrence Fernando
Co-investigator Work Package 8

University College London

Professor Julienne Hanson
Co-investigator Work Package 6
and Work Package 7

Professor Alan Penn
Co-investigator Work Package 2
and Work Package 5

Professor Bill Hillier
Co-investigator Work Package 3

Dr Ben Croxford
Co-investigator Work Package 4

London Metropolitan University

Professor Graeme Evans
Co-investigator Work Package 2

The University of Sheffield

Professor Steve Sharples
Co-investigator Work Package 4

For More Information Contact:

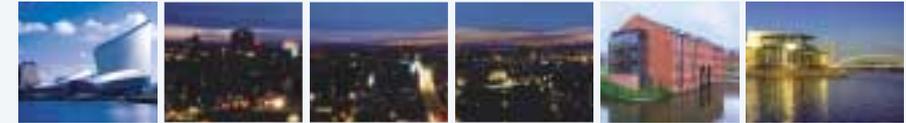
Joanne Leach
Project Manager

Tel: +44 (0)161 2952690
Fax: +44 (0)161 2956174
Email: j.leach@salford.ac.uk

www.vivacity2020.org



The University of Sheffield



VivaCity2020

Urban Sustainability for the Twenty-four Hour City

Development of design decision-making tools & resources

VivaCity2020

Contents	
Project Overview	4
Introduction to the Research	6
Process Mapping	8
Evolution of Land Use Diversity	10
Secure Urban Environments by Design	14
Designing Environmental Quality into City Centre Living	18
Generation of Diversity	22
Community Pattern Book for Housing	24
Public Conveniences	26
ICT Support Solutions	28
Conclusion	30

Delivering Design

Britain is not short of design ideas to improve the quality of life in its cities. What it lacks is the resolve to implement them.

For designers and architects, sustainability issues are familiar territory. Since the 1970s, architects and product designers have been increasingly encouraged to consider the environmental and social implications of their decisions, and adopt a more holistic approach than one solely driven by the need to generate profit for the customer.

Today's designers of buildings and products are able to address sustainability and quality of life issues while still creating competitive advantage for their client. The difficulty designers often face, however, especially in the context of urban environments, is in winning the client's full support to tackle those issues innovatively.

The issues themselves have become so complex, so interwoven and interdependent, that clients, planners, policy-makers and developers need more advanced means of evaluating different design solutions and the long-term consequences of their decisions. Quality of life, after all, cannot easily be expressed in pounds or euros. What VivaCity2020 seeks are new tools that will enable designers to gain an 'aerial view' of this labyrinth of issues; a new viewpoint that will help them lead their clients and other stakeholders towards the most appropriate choices for sustainability.

VivaCity2020 is an ambitious, five-year research project developed by a Sustainable Urban Environments consortium. This EPSRC-funded research initiative is delivering practical tools and resources to support sustainable and socially responsible urban design decision-making.

By enabling designers, planners and developers to create innovative and sustainable solutions, these tools and resources address issues of crime, economic vitality, the environment, social exclusion, and aim to improve the quality of urban life.



Project Overview

The Vision

VivaCity2020 is a £2.75M, five-year programme of research, funded by the Engineering and Physical Sciences Research Council (EPSRC), which envisions the design and delivery of sustainable urban environments. The aim is to develop an in-depth understanding of human behaviour in urban environments, and to create new, inclusive, practical tools and resources that will support sustainable design decision-making. By enabling designers, planners and developers to create innovative and sustainable solutions, these tools and resources will address issues of crime, economic vitality, social exclusion, the environment and the quality of urban life.

The Project

The research that will lead to these tools is divided into 'work packages' themed around issues of urban sustainability. These include:

Process Mapping: Understanding how urban design decisions are currently made, and identifying a process best suited to promoting urban sustainability in the future.

Diversity Generation: Analysing how to promote economic growth and social vitality in an urban setting by the diverse use of land and space.

Secure Urban Environments: Documenting how urban design can prevent crime, reduce the fear of crime and raise the quality of the urban experience.

Social Inclusion: Identifying how to meet the needs of communities and increase inclusivity through the design of housing, urban spaces and public amenities.

Environmental Quality: Understanding the impact of the urban ecology, such as noise and traffic pollution, on user perceptions of the city environment and their quality of life.

The findings of these work packages will yield standards, guidance, case studies, databases and techniques. Integrating these into a co-ordinated body of knowledge will support the further development of practical, issue-specific tools and resources. By the time they have been validated and refined on live development projects in London, Sheffield and Manchester, these tools will offer designers and decision-makers what they need to raise the quality of life in our cities.

The Consortium

By bringing together acknowledged experts in a range of fields, VivaCity2020 has assembled a team with the scope and track record to turn high quality research into practical, effective tools. The VivaCity consortium comprises specialists in design, engineering, urban planning, requirements capture and process mapping from four British institutions: The University of Salford; University College London; London Metropolitan University and The University of Sheffield.

The consortium also includes more than 30 non-academic partner organisations. Among them are: The Centre for Accessible Environments; Metropolitan Police; Greater Manchester Police; the Greater London Authority; London Borough Islington; Sheffield City Council; Manchester City Council; the Commission for Architecture in the Built Environment (CABE); the Environment Agency; The Housing Corporation; Northwest Development Agency and leading practitioners in urban design, development, construction and social housing. In addition, as part of the EPSRC's Sustainable Urban Environments programme, the VivaCity consortium is networked with 3 other consortia working on aspects of sustainable environments.

VivaCity2020



Introduction to Research

Core Research

Three core areas of research underpin VivaCity: identifying and mapping the design decision-making process, identifying the generation of land use diversity and designing secure urban environments.

Process Mapping

The focus of VivaCity is to develop design decision-making tools and resources that will enable urban planners, designers and developers to manage conflicting opportunities and constraints in a sustainable manner. Development of these tools is inextricably linked with an ICT element, both understanding the technology already in use and developing ways to improve it. But, before any tools can be developed, ICT or otherwise, we must gain an in-depth understanding of the processes, systems and tools currently in use.

Evolution of Land Use Diversity

Urban environments function socially and economically through the way they create space. The spatial infrastructure of a city defines pedestrian and vehicle flow and impacts on environmental factors such as airflow, air quality and noise. Urban configurations also shape human interaction, community formation, service and utility structures and economic transactions. By understanding land use in urban environments, and the relationship between diversity and social and economic vitality, an understanding of these human-environment interactions will emerge.

Secure Urban Environments by Design

Crime is a major issue for residents and users of urban environments; it is a key factor in social and economic decline as well as in people's perception of the environmental quality, their houses, neighbourhoods and public spaces. Design can play an important role in preventing crime and potential offending behaviours, reducing fear of crime and creating a positive experience of urban environments.

Peripheral Research

Four additional areas of research focus on advancing our understanding of sustainability issues, while research into ICT support solutions utilises innovative ICT to enable the development and delivery of practical decision-making tools and resources. These areas of foci represent a small sample of the many sustainability issues facing cities today. However, VivaCity's research framework has been designed to be able to incorporate additional issues in the future. Some of these issues are being researched concurrently under the research remit of the Sustainable Urban Environments (SUE) programme (please see pages 30-31 for more information).

Designing Environmental Quality into City-centre Living

The environment is a key pillar of sustainability. Effective decision-making tools and resources must integrate environmental issues with those relating to social inclusion to enable an effective understanding of environmental factors that impact on quality of life.

Generation of Diversity

A critical gap exists in knowledge concerning the achievement and sustainability of mixed use. Using simulations, this research is testing data gathered from a longitudinal study of the evolution of land use diversity to understand the dynamics of urban environmental change and development.

Community Pattern Book for Housing

Housing providers face many practical problems requiring identification of opportunities for improving the social sustainability and inclusivity of design of affordable housing and neighbourhoods within the context of contemporary, multicultural society.

The Inclusive Design of Away From Home (Public) Toilets in City Centres

The availability of key services is a significant issue for visitors to city centres, especially tourists, older people and parents with young children, yet has received limited attention due to its sensitive nature.

ICT Support Solutions

This research is supporting the development of effective tools and resources through the use of innovative ICT techniques such as VR, multi-media and 3D to nD scenario modelling.

The following pages provide an update on the progress of research underway.



Work Package 1: Process Mapping

To aid in the generation of tools and resources, we must first understand the complex relationship between design and sustainability and be able to map out the design decision-making process from start to finish. Work Package 1 tackles the problem of creating appropriate and useful tools and resources to support sustainable design decision-making in urban environments.

Case study research so far has involved meeting with, observing and surveying key stakeholders about the urban design decision-making process. Through case studies in Central Salford, Greater Manchester, Sheffield and Clerkenwell, London, we can begin to see who makes design decisions, what influences those decisions and where and when sustainability may be embedded within the process. Preliminary analysis of the case study research suggests that a number of factors are important to examine at the beginning stages of the design decision-making process. These factors include:

- *Forming the right kind of team for the project.* Members should include a diversity of individuals with different experiences and backgrounds that will complement each other in practice (e.g. urban designer, architect, planner, sustainability expert, sociologist, urban historian, community activist, residents, small business owners). The team should be assessed and re-assessed throughout the lifecycle of the design project to ensure that new expertise is brought on-board when needed and existing members have the opportunity to take a less active role if desired.
- *Making sure the team has a value system.* The value system of team members should complement the design project's aims, goals, mission statement and/or vision. If achieving a sustainable urban environment is an important goal for the team, then it would be advantageous for team cohesion if members possessed a value system in support of urban sustainability.
- *Making sure the team knows and shares that value system.* Communication between team members is fundamental. Knowing the project values from the start and recognising that these values are shared among team members may foster greater team cohesion and trust when tackling design project issues.
- *Finding someone to take the lead.* Having a leader who is visionary, creative, strong in conviction and who can take forward initial ideas and bring them to fruition is key. The leader should possess the experience and the necessary skills to work with others to realise a vision, yet also have the passion and the drive to see a design project through to the end.
- *Finding the best mechanism to carry through the project.* Team members should explore the different ways in which to carry out a design project that will not only complement the aims and goals of the design project, but also will maximise the benefits for the project and for sustainability. If a team believes that a joint partnership between the public and private sectors would result in the inclusion of more stakeholders, allow for greater understanding of sustainability and is the best way to carry out a design project, then the formation of an urban regeneration company or similar vehicle may be a good option.
- *Identifying the key stakeholders.* Knowing at the outset who should be consulted – and at what stage(s) they should be consulted – in the design decision-making process ultimately provides the team with a clearer picture of the design project and its impacts on the larger context and on sustainability.
- *Thinking about design and sustainability from a holistic perspective.* Team members should envision their design project within the larger context and engage in holistic thinking instead of 'fire-fighting'; that is, working on little projects that are not connected to a larger vision for an area.



These factors may act as triggers for further development, prompting decisions to be made before progressing to the next stage in the design decision-making process. Who monitors these triggers and what resources these stakeholders possess is therefore important.

This work is also developing new approaches to understanding the design decision making process. To date the model of such a process has been linear and mainly a descriptive list of tasks. Our work is attempting to visualise a process which will aid those involved understand the dynamics of the decisions and how they relate to sustainability.

Future work will be undertaken in Clerkenwell and Sheffield.





Work Package 2: Evolution of Land use Diversity

In recent years, governments here and abroad have put the weight of public policy solidly behind mixed-use development. Broadly, property schemes that contain a mixture of uses - residential, retail, leisure and office, for example - have come to be seen as a way of reviving the vitality and attractiveness of town centres, and have been promoted increasingly as a sustainable form of urban development.

To those looking in from the outside, districts with a lively blend of users and activities tend to seem more efficient, more interesting and more enjoyable places than those with only a single use. Most people would rather work - and would probably work better - in a mixed-use environment than in a monofunctional one such as a traditional business park.

But behind the happy facade, the accepted building blocks of mixed-use development sustainability - land-use diversity plus social mix and economic growth - present by no means a foolproof formula for success. Higher density living has long been unpopular in the UK, for instance, while shifts in trading hours demanded by the '24-hour economy' have impacted less than conveniently on the lives of those who live nearby to nightclubs and entertainment venues.

Debate continues as to the components of sustainable mixed-use development. How influential are the mix and compatibility of different uses, their location relative to one another, the street layout and patterns of comings-and-goings, for example? Mixed-use sustainability becomes even more complex and harder to analyse when the influence of social factors are considered, such as differences in class, lifestyle and tenure of users, and the effects of new encounters between residents, workers and visitors.

This research re-examines the relationships between people, buildings, businesses, land use and lifestyles, in an attempt to better understand the conditions for sustainability in mixed-use development.

The first case study centred on the district of Clerkenwell, in London's 'City Fringe' - an area selected as one of six 'Urban Village Precedents' in the UK.

A postal survey of households and businesses revealed a separation of land-use in the area. Single-use, residential zones (with a sprinkling of pubs and newsagents) dominate the north of the study area, while in the southern sector are mainly mixed-use zones containing a high concentration of offices and shops, with services, leisure, residential and community uses. This separation operates at a finer scale, too, with thoroughfares such as Exmouth Market, a semi-pedestrianised zone with shops, cafés and flats, neighbouring purely residential streets.

However, street level seems to be as mixed as mixed-use gets. The survey suggests that activities mix much less within buildings than within neighbourhoods. While 80% of residents claimed to live in a mixed-use neighbourhood, only 36% said they lived in mixed-use buildings. The instances of buildings with a mix of businesses and residents were particularly scarce.

Studies of traffic and pedestrian flows reinforce the spatial split between residential and more mixed-use environments. A high proportion of people and vehicles move along retail streets, with residential streets remaining relatively quiet. Movement patterns are highly time-dependent, though, changing from weekday to weekend, and between different times of the day, which adds a temporal dimension to the area's land-use split.

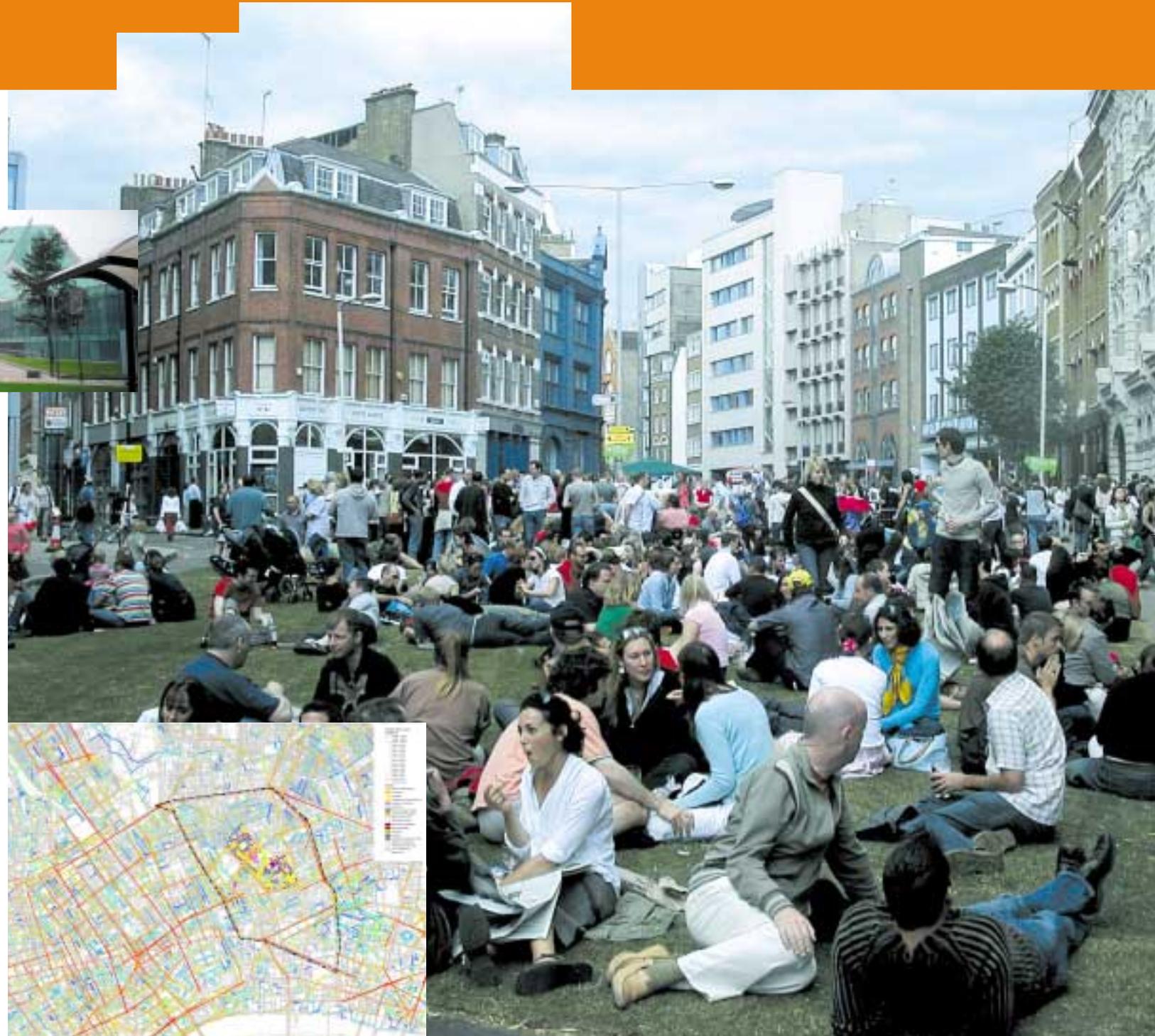


In gauging the attractiveness of the mixed-use zone, residents and businesses were found to trade negative factors such as noise, litter and parking problems against positive factors such as good transport connections. Respondents expressing a preference for mixed-use neighbourhoods identified the level of amenity as the main reason (with shops, for example, being valued more highly than pubs). Generally, though, the diversity of the area was a less significant factor in decisions to locate in a mixed-use neighbourhood than its proximity to city centre.

The research so far suggests that gathering knowledge about the range of interactions in mixed-use neighbourhoods can help to map and address the concerns of different stakeholders. It has raised questions about the degree of integration between uses across designated mixed-use zones, and has begun to highlight the extent to which different negative and positive factors affect stakeholders' experiences. The integration of mapping and survey data is providing a richer basis for debating mixed-use sustainability, and promises to improve the development of practical tools for policy-making and design.

The next phase of the work will see the spatial and survey analysis and methodology developed in the City Fringe area of London, applied to case studies in Sheffield and then Manchester city centres. Both cities have undergone city centre revitalisation, with conflicts of land-use arising from night-time activities and higher density development. Here, mixed-use areas designated as production and regeneration zones will be investigated in collaboration with city councils, residents and business owners.

The study will thus provide a valuable comparative of compact city living and urban design, between cities at differing stages of development, but which face similar quality of life challenges.





Work Package 3: Secure Urban Environments by Design

This work package focuses on two important questions facing planners, designers and developers that previous research has failed to adequately address:

- How can the open and permeable residential environments required for sustainability be achieved without incurring actual or perceived increases in crime?
- How can facilities in city centres be designed to attract legitimate users, whilst also minimising crime?

This work package is unique in bringing together two innovative quantitative and qualitative methodologies to support the development of evidenced-based tools and resources.

- From a quantitative perspective, UCL is undertaking a rigorous analysis of crime patterns in selected areas of London (Brent) and Manchester (city centre and Hulme).
- From a qualitative perspective, Salford is undertaking case studies in Manchester (city centre and Hulme), Sheffield (city centre) and London (Brent, Clerkenwell).

Whilst UCL's research is identifying crime patterns, case studies conducted by Salford are exploring specific issues in Brent identified by UCL. In addition to these crime-focused case studies, Salford is also researching human activities that take place in cities, including leisure, living and shopping.

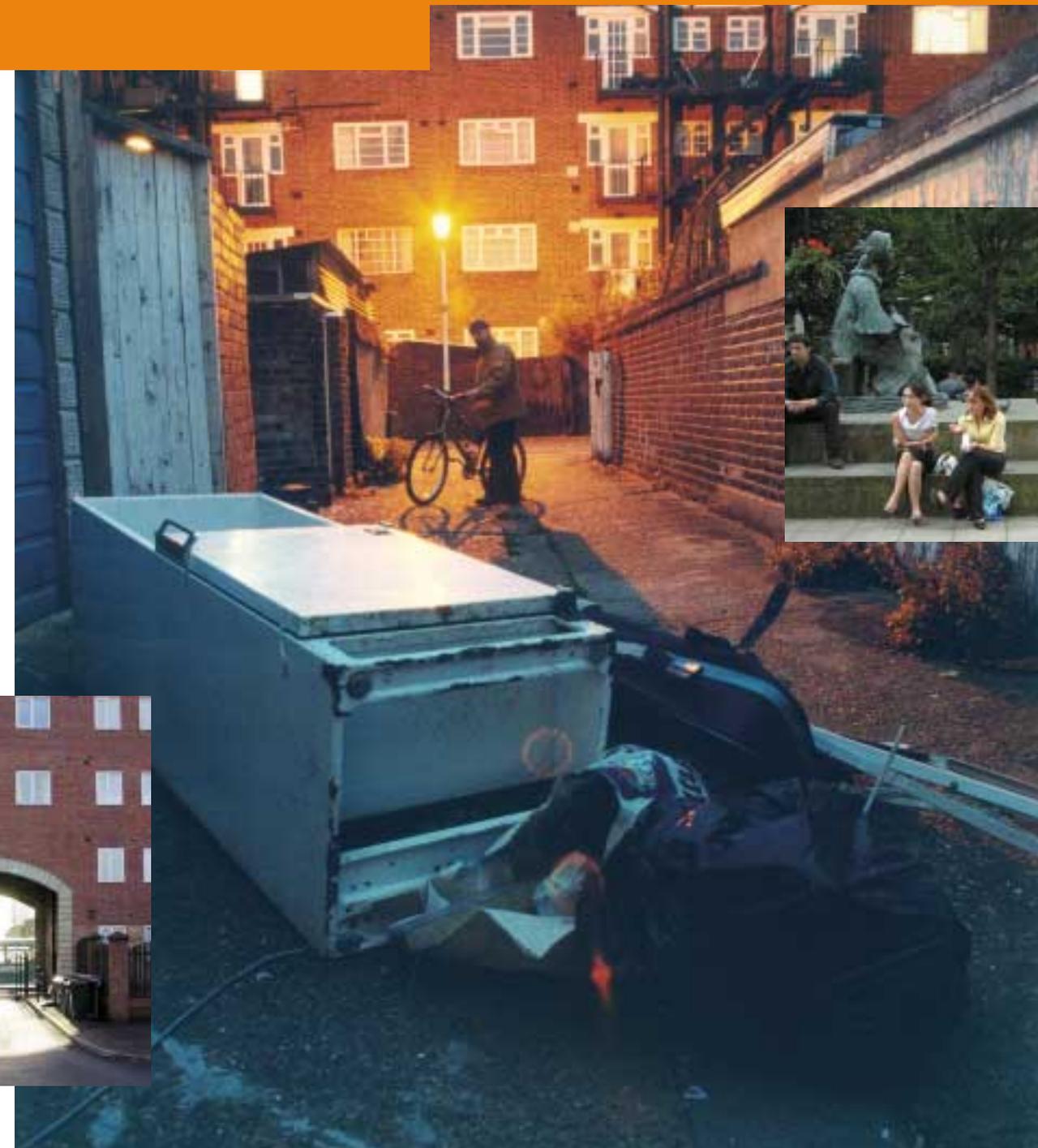
Crime Pattern Analysis

The UCL group have developed a new technique, which they call High Resolution Street Network Analysis, to provide a common basis for the analysis of crime patterns in urban street networks. The aim is to provide a simple and repeatable method for the comparative study of different kinds of street related crime, such as burglary and street robbery. High resolution studies are needed because patterns of urban crime have been shown to be affected by micro as well as macro scale features of the built environment, but in different ways from one crime to another, so that design features which inhibit one crime may facilitate another.

The main purpose of the technique is to allow the rigorous comparison of the operation of different crimes. The technique can be applied down to the level of the individual street segment, but can also be used at larger scales of aggregation such as small urban areas or larger administrative divisions.

A study of over 536 kilometres of urban streets in a large area of London, made up of over 7000 street segments is nearing completion. With over 60000 dwellings, nearly 13000 burglaries and over 6000 street robberies it is by far the largest database to which high resolution analysis has been applied. The study has been designed to address current controversial issues in the relation between urban design and crime: cul-de-sacs versus street layouts; mixing uses or mono-use; grid-like or tree-like networks; and the amount of high residential densities.

Spatial and functional factors in cities affect different kinds of crimes in different ways, so that factors which reduce one crime may increase others. High Resolution Street Network Analysis was used for comparing the types of streets that burglary and street robbery occur, and how the pattern is affected by spatial and functional factors. The differences in the temporal and spatial patterns of these two crime types have started to emerge in the analyses. Burglary and street robbery show different patterns depending on a combination of factors like the land use types, the configurational layout of space and time of day. Particulars of the spatial or temporal characteristics of these two crimes will be announced and disseminated after the control stages are completed.



Main photo © 2001 Brian Naseem

Shopping and Crime

The literature suggests that the presence of legitimate users can significantly reduce the risk of crime and anti-social behaviour in retail areas - with the exception of pick-pocketing, which thrives in crowded areas. Shoppers and other visitors also have an important role to play in reducing fear of crime - a priority for city centre managers looking to increase the success of a city centre.

It is also suggested that the usage and perceived safety of retail environments may be improved by placing housing over shops and employing 'street wardens' and security staff to support the police. These efforts may be supported by surveillance technologies like CCTV, Anti Social Behaviour Orders that restrict the movements of known offenders and schemes that improve the quality and safety of the built environment. Staff behaviour, interior design and security measures can also be used to reduce crimes that take place within retail premises, as long as interventions do not negatively impact on the shopping experience or reduce sales.

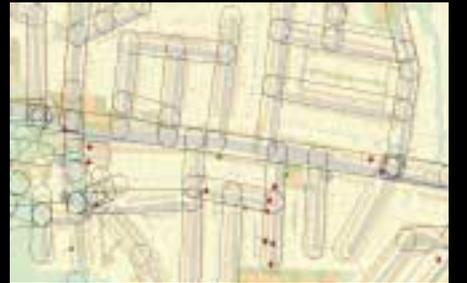
The study of Manchester city centre shows that a wide range of crime prevention measures are being used to address crime and anti-social behaviour, as well as reduce fear of crime, from graffiti reduction initiatives to Secured by Design and Safer Car Parking schemes. Improving the quality of the retail environment is perceived as being key to the city's economic success.

The media may be used to publicise crime prevention efforts, but there is always the risk that this will be perceived as 'negative' and damage the image of the city or generate fear of crime. Concerns about image may also deter local authorities from more openly addressing crime and related social issues.

There are instances where crime prevention measures potentially conflict with other sustainability issues. Of particular concern is the need to cater for groups such as the homeless and young people, without increasing fear and insecurity amongst other users, especially older people and those with young families.

We are also aware that people are increasingly living within city centres, and their safety may be compromised by efforts to increase the numbers of people in retail areas. For example, there is some evidence that the risk of burglary increases when residential areas are more open to the general public.

The University of Salford has also conducted a case study focusing on crime in residential areas. Hulme is a residential area in Manchester that is held up as an example of good practice in urban design, and is associated with the New Urbanist movement. However, its critics argue that the emphasis on permeability increases the risk of burglary and that courtyard parking leads to higher levels of car crime. This case study explores the development of Hulme, highlighting potential conflicts between safety and other urban design and sustainability issues. The relationship between openness, usage and safety will be further explored by UCL through Space Syntax analysis. By engaging with both quantitative and qualitative data, the VivaCity project will be able to contribute to this important debate.





Work Package 4: Designing Environmental Quality into City Centre Living

Pilot Fieldwork

A detailed micro-scale pilot study was undertaken in Clerkenwell, London, to explore and understand issues relating to urban environmental quality. Collection of data on outdoor air quality and noise levels formed an integral part of this study to understand 'external environmental quality', alongside collection of indoor air quality data for a representation of 'internal environmental quality'. Residents' views and attitudes on living in the area were also examined to gain an insight into 'perceived environmental quality'.

Air quality data (CO, NO₂, PM₁₀ and temperature) was collected at two sites within close proximity to each other in the Clerkenwell area. Noise levels (Leq) were also gathered at these sites, and at a number of other locations determined indirectly by the participants involved within the study. Four residents undertook a photo survey, a sound-walk and were subsequently interviewed about their local area. Indoor air quality data (CO, CO₂, temperature and relative humidity) was collected within four residential properties. The data was collected during a two-week period (28/6/04 - 12/7/04).

The study has enabled the development of a multi-method approach to explore urban environmental quality. The collection of data within this study not only provided detailed information on the quality of the environment in this city centre location, but has also helped develop ideas relating to the integrations and outcomes of this interdisciplinary project.

Emergent Findings

External Environmental Quality

Descriptive statistics on the external environmental quality parameters investigated within this study are presented in Tables 1 and 2. Concentrations of air pollutants measured over the monitoring period are shown in Table 1. Averages of the pollutant levels can be found alongside maximum and minimum data, and UK air quality objectives. Levels of PM₁₀ and CO recorded in this study were within guideline levels, however levels of NO₂ recorded were in excess of the air quality objective on a number of occasions.

Monitored noise levels are presented in Table 2. The World Health Organisation (WHO) recommend the environmental noise guideline of 55 dB(A); below this level people will be protected from becoming moderately or seriously annoyed (WHO 2001). This study indicates that people are exposed to levels above these guidelines within the area of Clerkenwell.

Analysis of external data also indicated spatial and temporal variations which will be examined further in our detailed case studies. Additionally, our measurements were compared against UK limit values for ambient air quality as well as against vehicle and pedestrian numbers using the two thoroughfares. Noise levels were also recorded during each participant's sound-walk. Different levels were experienced as the sound-walks covered a range of environments at various time of the day.



Internal Environmental Quality

The average indoor CO2 levels at the four homes ranged between 670 to 808 ppm which indicated the availability of proper ventilation during monitoring. Figure 1 indicates that the indoor CO2 level followed a pattern in the two family-oriented homes. Levels were seen to rise during lunchtime and drop afterwards, later rising and falling at dinner time and again at breakfast time. Analysis of internal data also considered whether people lived alone, whether they cooked with gas or electricity and whether members of the household smoked. Carbon Monoxide figures indicated that higher concentrations may correspond with periods of peak traffic flow directly outside the home. In addition, temperature and relative humidity were measured and compared with measurements taken externally.

Perceived Environmental Quality

Four individuals generated four sets of photos (96 individual photos), photo log sheets, sound-walk maps, recorded sound-walks and recorded interviews. Analysing the interview data involves a process of reading, coding, re-reading and re-coding the transcripts. On a first reading coding related directly to the content of the questions (eg pollution, noise, parking). A second reading enabled identification of generalisations and expressions of feelings being made by respondents. A further reading of the transcript was made in light of specific theoretical positions. For example, using some of the concepts from acoustic ecology, codes such as 'keynote sounds', 'soundmarks' and 'sound signals' were created to identify text where respondents have spoken about things that relate to these specific concepts. Photos were used both as a unit of data and as a visual elicitation at interview. This enabled a triangulation of interpretation of the content - the participant's description in their Log Sheet, the researchers' description of the content, and the participant's discussion of the photo at interview.

Quotes from interview:

CP3: *And this, this is a structure*

I: *What is that?*

CP3: *It's something for kids. It's in Spaielflds Park. You know the trees are magnificent and even the graffiti is, oh, I don't know, it's okay, I don't mind graffiti on a thing like that. I don't want it on a, I wouldn't want them to graffiti that building for example [a building on Abbott's Close], it would look horrible, or the pub it wouldn't look very nice with graffiti all over it. That might be an improvement with graffiti all over it [a high rise tower block], I'm not sure. Just across the road from here.*

In this instance the participant is discussing open green spaces and making judgements about the appropriateness of graffiti depending on what it is located upon. It highlights that the things of concern to residents about their local environmental quality are not necessarily those things that can be easily measured - so access to green spaces, proliferation of rubbish, types of graffiti, condition of pavements and buildings as well as noise, traffic fumes etc all impact on residents perceptions of their urban environment. These will all be investigated further in subsequent case studies.

Current Status

The pilot study evaluation showed, in particular, the benefit of the photo survey in helping elicit information during interviewing of residents. It also helped sharpen up the monitoring methodology for this work package, and identified methods of collaborating with other work packages, in particular Work Package 2. The first full monitoring campaign of the winter was carried out during winter 2004/2005 in Clerkenwell, all data has now been collected. First stage, basic analysis of the data is nearly complete and the more complicated multivariate analysis, investigating for instance which factors are most important in determining how well perceived a particular micro environment is, is now underway. The analysis will investigate, amongst other issues, the spatial dimension of environmental quality and hopes to start to produce quantitative assessments of the largely qualitative concept of environmental perception. Summer monitoring in Sheffield will be carried out during the summer of 2005.

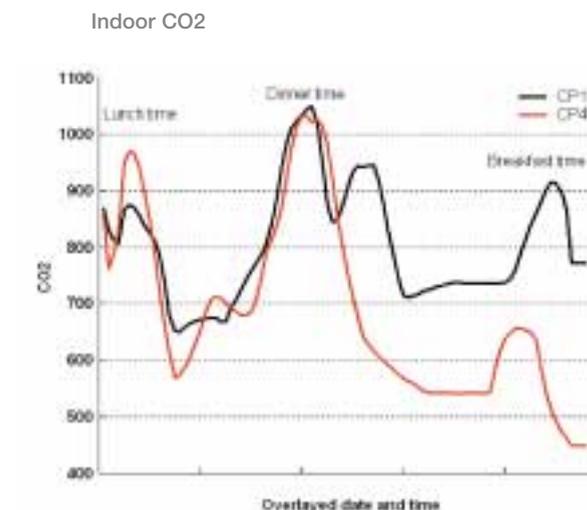


Table 1: Air Quality Data

Pollutant	Measurement	Location of Monitoring	Interval of Data Collection	Monitoring Period	Average	Min	Max	StDEV	Air Quality Objective exceeded	Number of Times exceeded
CO	ppm	Site 2	15 minute	28/6/2004- 12/7/2004	0.6	0	3.2	0.4	8.6 ppm (running 8 hour mean)	0
PM10	mg/m3	Site 1	1 hour	28/6/2004-10/7/2004	17	0	40	6.6	50 mg/m3 (24 hour mean not to be exceeded more than 35 times per year)	0
NO2	Ppb	Site 1	1 hour	28/6/2004-10/7/2004	65.4	0	146.9	22.1	105 ppb (1 hr mean not to be exceeded more than 18 times per year)	4
NO2	ppb	Site 2	15 minute	28/6/2004- 12/7/2004	77.3	-60	331	40.9		68

Table 2: Noise Levels

Site	Date	Time Period	Period of Monitoring	Leq Noise Level (dB(A))	Notes
1	29/6/04	12.00-13.00	5 minutes	61.9	People, background traffic noise
2	29/6/04	12.00-13.00	5 minutes	74.5	Road traffic, construction noise

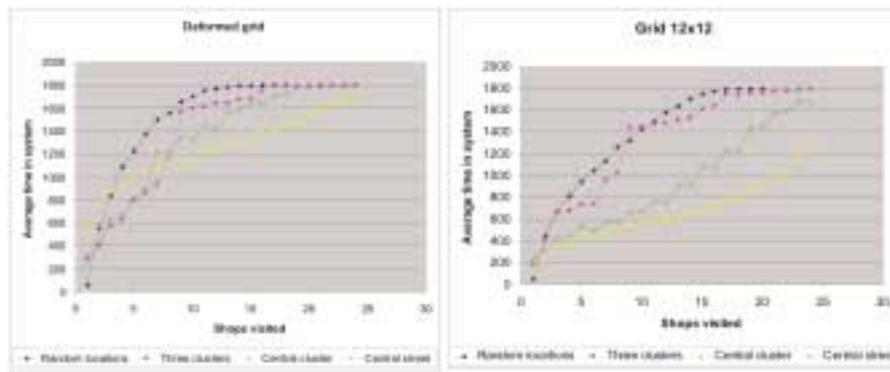


Work Package 5: Generation of Diversity

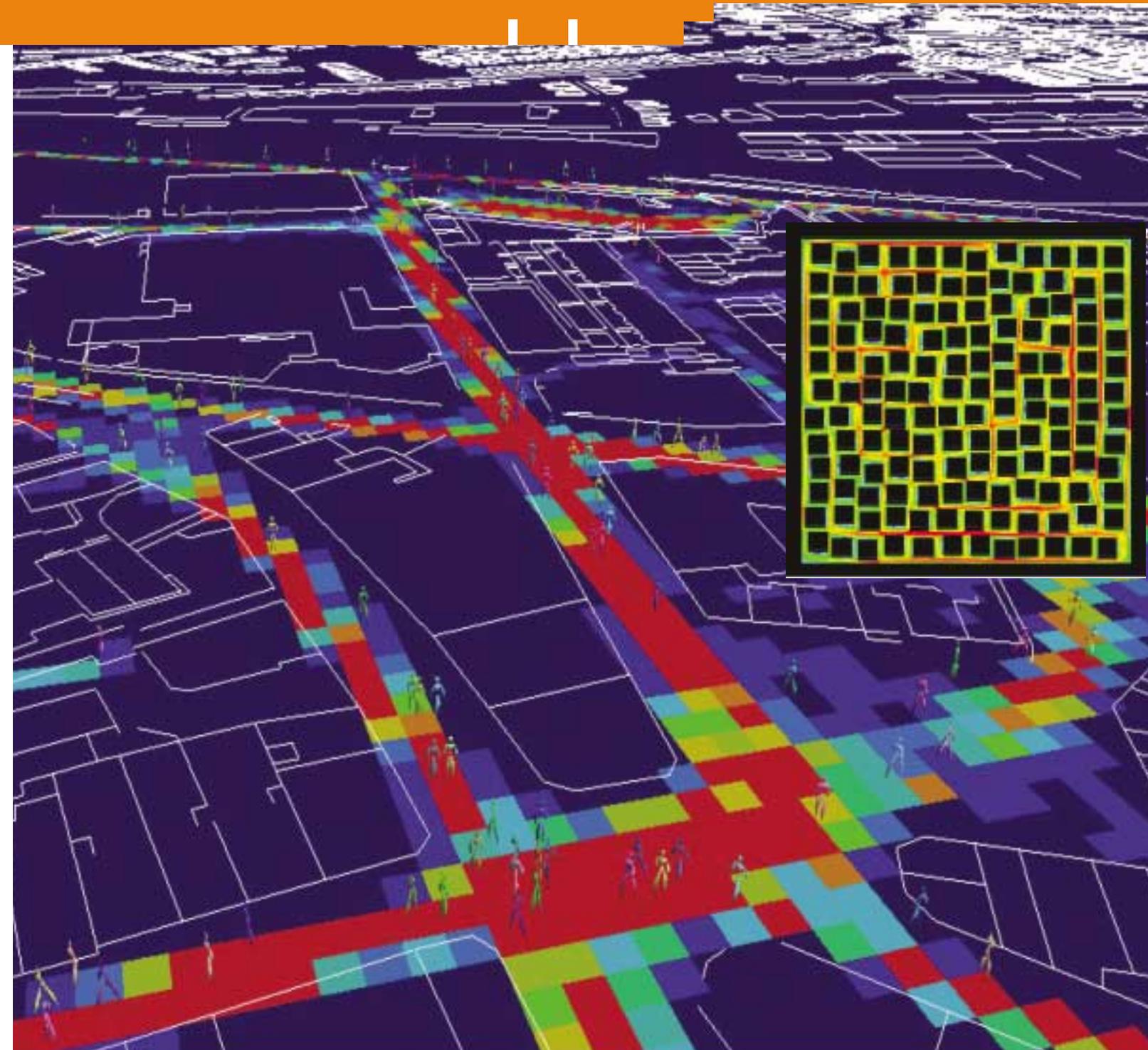
'Understanding the evolution of land use distributions and development densities and their interaction with pedestrian movement in urban areas'

This work package is using computer simulation experiments to investigate the dynamics underlying the urban land use diversity. It provides an experimental counterpart to the observation based Work Package 2 and brings added value to the empirical data and narratives about the emergence and sustainability of land use diversity. The approach is to look at the relationship between the visual access afforded to land parcels by the local morphology of urban space, the larger scale access afforded by the configuration of the urban street network and its effects on pedestrian movement, and the impact of daily, weekly and seasonal temporal cycles in driving aspects of the economy of land value. The results of the simulations will be evaluated using Space Syntax techniques and compared to empirical data on spatial configuration, use patterns and land uses. The phenomenon of particular interest is the emergence of fine scale density and land use patterns, such as the agglomeration of similar retail functions along streets, the interdependencies between land uses, property markets and the spatial configuration of the city, and the co-evolution of these patterns over time.

A critical gap in knowledge surrounds the processes by which urban mixed use development can be achieved and sustained. Until now a number of factors have hampered research into this at the very fine spatial scale which is of such importance to our experience of the city and its economic and social viability. First, there have been few useful methods for representing and quantifying the phenomena of urban growth and change in such a way that historical changes in urban morphology and function can be put on a comparative basis. This has constrained research either to deal with relatively low-resolution data across a range of examples, essentially ignoring the fine scale morphological variable, or to deal with single 'case study' examples at a higher resolution. Second, the complexity of the interactions involved has made it unclear what exactly to observe or measure, and in particular what factors might be considered to be prior to others. Since data gathering in real urban situations is very expensive, especially for longitudinal data, and existing datasets tend to be of relatively low spatial resolution or aggregated for data protection purposes, significant studies of these interactions are virtually nonexistent. Where detailed studies have been made they have tended to focus on single aspects of the domain rather than on the interactions between systems. Third, it has been difficult to convert this area of investigation into an experimental science since intervention is both expensive and long term. The result is that experiments are carried out on real design projects, and when they go wrong people suffer.



The time taken for sighted agents to find a number of shops varies with the degree of clustering as well as with the regularity of the street grid morphology.





Work Package 6: Community Pattern Book for Housing

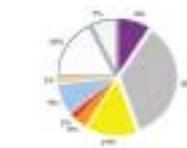
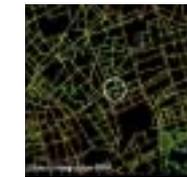
So far as the design of housing is concerned, one might be forgiven for assuming that the underpinning principles for sustainability are already well known, but there is compelling evidence that points to a need to incorporate culturally sensitive design principles into current housing stereotypes, in order to ensure that inner city housing is socially inclusive. This work package therefore examines the design issues that relate to housing for social diversity. These design issues are explored through a detailed configurational analysis of the housing stock, in conjunction with key quality of life parameters that affect city centre living within the 24-hour city and user-centred evaluations of the experience of living in a variety of housing settings.

Starting from an inclusive design perspective, the project seeks to understand what makes housing attractive to different sub-groups within contemporary, multi-cultural society. Much of the existing housing stock is occupied by people from a variety of cultural backgrounds, and this will continue to be the case for the foreseeable future. It is therefore important to establish the extent to which the design choices and housing preferences of ethnic minority communities are similar to or different from those of the majority community, as well as to show whether purpose-built housing schemes for ethnic minority communities incorporate novel design features that are not found within the mainstream stock.

The research is currently building a database of existing and newly-built housing that comprises both mainstream housing developments and purpose-built schemes for ethnic minority communities. The database contains a mixture of tenure types, including examples of housing built for owner-occupation, 'buy to let', the social rented sector and shared ownership schemes. Recently, the London pilot study has been completed, which is based in Clerkenwell, a historic city district that contains a rich mixture of traditional and innovative housing. The study comprises twenty typical residential districts and housing estates dating from the 1820s to 2005. The selected case studies also vary in terms of their morphological characteristics, age and type of housing, tenure and the ethnic diversity of their residents. The Clerkenwell study has been complemented with London-wide case studies that cater specifically for populations from ethnic minority backgrounds.

The methodology differs from other housing studies in that it extends beyond the site boundaries of the housing scheme itself, to study the relationship between the scheme and its wider urban context. To this end, a series of representations and quantitative measures of different properties of the urban residential environment have been developed and piloted including land uses, road types, public open space and the interface between dwellings and the public realm, that capture the main configurational features of each housing scheme and its layout. These representations and measures will be related to the variety and choice each scheme provides in terms of mixed use and social mix, and the effects of design on safety, security, anti-social behaviour and environmental comfort. A detailed study of the variety of housing units within each scheme has also been undertaken.

The next stage of this work will be to develop and pilot user-centred evaluation tools to investigate how different design principles relate to residents' perceptions of the design and layout of their housing scheme, and of its diversity, safety and environmental comfort. The objective of the project will be to show which design features of the housing stock, including both mainstream housing and purpose built housing for different ethnic communities, are most appreciated by residents and which are unacceptable.





Work Package 7: The Inclusive Design of Away From Home (Public) Toilets in City Centres

Historically, most public toilet provision was not intended to be accessible and so is not well designed. In consequence, ordinary mainstream toilets in the UK are far from inclusive and represent a key site of architectural disability within the built environment.

The introduction of Part III of the Disability Discrimination Act in October 2004 is destined to have an effect on public toilet provision, as access to and the design of such facilities will have to be reconsidered in line with current design guidelines. Already, the numbers of public toilets show a decrease in the available facilities, with an estimated 40% of on-street toilets having closed in the last decade.

Paradoxically, the implementation of Part III of the DDA may exacerbate public toilet closures. Many older facilities were originally located below or above ground level so as to minimise their prominence within the urban fabric. Other premises at ground level may be costly to convert to include an accessible toilet, yet not to do so could be interpreted as discriminatory. Faced with this dilemma, some public sector providers have already opted to close all their facilities, thereby not discriminating against anyone but disadvantaging everyone.

Previous investigations into the toileting needs of disabled people have concentrated on the needs of people who use wheelchairs. This research seeks to extend this consultation to include people whose disability is hidden, but who may require the specialised fixtures and fittings of an accessible WC. In addition we are consulting older users, families with babies and young children, and people of minority ethnic and faith communities.

Preliminary findings have revealed a lack of understanding amongst providers regarding how certain fixtures and fittings are used. Often the toilet facility may look accessible, yet the incorrect placing of grab bars, the wrong choice in door lock and the flush on the wrong side of the toilet, and operated by an inappropriate flush handle, can make the toilet inaccessible to many users. The users of public toilets are rarely consulted about the design of these particular public spaces, yet user perceptions and social conventions would appear to play a large part in whether the facility is accepted or rejected. In considering all the issues, and those raised by participants in the research, this project aims to provide knowledge of current toilet facilities drawn from the users' perspective.

Adequate provision for all users at key locations would allow many people to access the city and its resources and amenities with the confidence to know that their toileting needs will be met. Current levels of provision are not sustainable for government policies that include accessible transport and creating opportunities for people with disabilities.

Achieving a sustainable accessible environment might be accomplished by specifying technical design solutions that meet the requirements of legislation such as the DDA, but embracing a more inclusive approach to design has the potential to achieve far more in terms of social justice, sustainability and inclusion. It can therefore be argued that the provision of accessible away from home toilets is a key aspect in planning and developing sustainable urban environments in the 24-hour city.





Work Package 8: ICT Support Solutions

The VivaCity2020 project is researching a number of different sustainability issues including the economy, land use diversity, crime and fear of crime, environmental quality, housing and inclusive design. Contained within these issues are numerous abstract concepts that increase the uncertainties of design decision-making.

This work package aims to apply a number of advanced ICT technologies, such as nD modelling, virtual reality visualisation, Analytic Hierarchy Process (AHP), weighting and scoring techniques for multi-criteria evaluation, and Geographic Information Systems (GIS) technology to establish a decision-support mechanism to assist urban design decision-makers. It does not intend to replace the decision-makers, but rather give assistance identifying the problems and uncertainties in the decision-making processes; reducing the uncertainties; predicting and analysing the consequences of different user-defined scenarios with various models; prioritizing different options; and finding optimal solutions to identified problems.

This work package started with a broad literature review of conceptual modelling, GIS, virtual reality visualisation, decision support systems, multi-criteria evaluation for urban planning and design, artificial intelligence and decision-making support tools. A conceptual model has been developed to illustrate generic objects in the urban environment and their topological relationships. The model aims to define all possible input data required for analysis and define an overall GIS database structure. An intelligent virtual reality model is also being developed based upon Ordnance Survey Mastermap data that will then be modified to incorporate sustainability issues and identify relationships, trade offs, best practice and optimal solutions.

At present, in collaboration with Work Package 1, the research is collecting data on the stakeholders involved in the design decision-making process through a series of interviews and is classifying them according to their different influences on the decision-making process. The research is also identifying the current decision-making tools used (and not used) by key decision-takers, what their decision-making needs are and how best to fulfil those needs through the development of a model that will assess existing and proposed scenarios, relationships and trade offs of various sustainability issues and integrate the knowledge developed by the other work packages into ICT solutions to mediate sustainable considerations between stakeholders.



We are grateful to Ordnance Survey for allowing us to reproduce these images.
Ordnance Survey ©Crown Copyright. All rights reserved.

Each work package is identifying critical aspects of the sustainable agenda. The unique nature of this project is the interaction between the findings; for instance, what is the relationship between crime, housing, policy, the provision of toilets and the 24-hour city? Where are the trade-offs between economic diversity and quality of life? These are the issues the Vivacity team is addressing.

VivaCity is reaping the benefits of working together across different research disciplines and with such passionate researchers and industry partners. By the year 2010 we hope to see our work supporting industry and the Government to make informed, sustainable design decisions. The UK is at the forefront in sustainable development research and it is rewarding to work with professionals at other universities and in industry on such an innovative and progressive project where our results will have a real impact.

Professor Rachel Cooper

Sustainable Urban Environments

VivaCity2020 is part of a much larger group of research consortia funded by the Engineering and Physical Sciences Research Council (EPSRC) under their Sustainable Urban Environments (SUE) umbrella. This initiative was created to improve quality of life, support sustainable development, and to meet the needs of industry, commerce and the service sector. In order to achieve these goals, SUE established four clusters of research consortia. Further information on each of these research groups can be found on the EPSRC's website www.epsrc.ac.uk.

Cluster 1. The Urban and Built Environment.

VivaCity2020, Urban Sustainability for the 24-hour City. Principal Investigator: Professor Rachel Cooper, the University of Salford.

CityForm, the Sustainable Urban Form consortium. Principal Investigator: Professor Mike Jenks, Oxford Brookes University.

Innovation and Design, Construction and Operation of Buildings for People. Principal Investigator: Professor Bakr Bahaj, the University of Southampton.

Cluster 2. Waste, Water and Land Management.

SUBR:IM, Sustainable Urban Brownfields: Integrated Management. Principal Investigator: Professor David Lerner, the University of Sheffield.

Waste Resource Management in Urban Environments. Principal Investigator: Professor William Powrie, the University of Southampton.

WAND, Water Cycle Management of New Developments. Principal Investigator: Professor David Butler, Imperial College London.

Cluster 3. Transport.

SOLUTIONS, Sustainability of Land Use and Transport in Outer Neighbourhoods. Principal Investigator: Professor Marciel Echenique, Cambridge University.

DISTILLATE, Design Implementation Support Tools for Integrated Local Land Use, Transport and the Environment. Principal Investigator: Professor Anthony May, the University of Leeds.

AUNT:SUE, Accessibility and User Needs in Transport. Principal Investigator: Mr Steve Shaw, London Metropolitan University.

FUTURES, Future Urban Technologies: Undertaking Research to Enhance Sustainability. Principal Investigator: Professor Mike McDonald, the University of Southampton.

Cluster 4. Metrics, Knowledge Management and Decision Making.

SUE: MoT, Metrics, Models and Toolkits for Whole Life Sustainable Urban Development. Principal Investigator: Professor RMW Horner, the University of Dundee.

CoDES, Consortium for Decision Support. Principal Investigator: Professor Dragan Savic, the University of Exeter.

PUR, Pollutants in the Urban Environment. Principal Investigator: Professor Stefan Jefferis, the University of Surrey.

Knowledge Mapping and Bringing About Change for the Sustainable Urban Environment. Principal Investigator: Professor Charles Egbu, Glasgow Caledonian University.