

Street mobility and network accessibility: towards tools for overcoming barriers to walking amongst older people

Initiating dialogue between stakeholders and establishing a common language for community severance through cross- disciplinary workshops

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Abstract

The concept of community severance has slowly been making its way into transport planning but it still lacks a consensual definition. This is because the issue has been approached by researchers from a range of disciplines, which have specific and diverse ways of constructing scientific knowledge. The objective of this paper, the first in a series of working papers to be generated by the *Street Mobility and Network Accessibility* research project² is to build bridges between these different approaches and provide a base for the integration of community severance into public policy. The paper is the outcome of a series of workshops attended by a cross-disciplinary team of researchers and stakeholders, including policy-makers and local practitioners. On the basis of these discussions, a framework for cross-disciplinary research on community severance is developed, taking into consideration the chain of direct and indirect effects of transport infrastructure and motorised traffic and the range and complexity in the methodologies used for analysing and formulating solutions to the problem. In a second stage, we examine the consistency between this framework and the opinions and experiences of stakeholders.

Keywords

Community severance, cross-disciplinary, stakeholder engagement

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1. Introduction

Over the last decades, public policy in European countries has been informed by a number of new or revised concepts including equity [Wilkinson and Pickett 2010], sustainability [Roseland 2012], environmental justice [Walker 2012], community resilience [Wilson 2012], social determinants of health [WHO 2008] and promotion of healthy lifestyles [Clavier and Leeuw 2013]. Demographic and socio-economic trends such as population ageing, increased ethnic diversity and, in many countries, widening income inequality have also raised the profile of the vulnerability of population subgroups to the negative effects of public policies. Transport planning is one area where these questions are most pertinent, due to the numerous negative effects, such as local and global pollution, noise and injury risk, and the unequal distribution of both negative and positive consequences of transport plans and policies.

Community severance is a negative effect of transport. This concept is used when transport infrastructure or the speed or volume of motorised traffic act as a physical or psychological barrier to the movement of people. Despite growing social and political attention to this effect, integration of severance into public policy has been slow. Only a relatively small number of empirical studies and technical reports exist on how to include severance concerns in actual transport and urban plans [Clark *et al.* 1991, Read and Cramphorn 2001]. Where community severance has been included in planning, this is generally not on an equal footing with other positive or negative effects of those plans; only broad assessments are made, lacking either rigorous quantitative assessments or detailed qualitative input from the affected communities.

However, there is a growing pressure for policy-makers to direct their attention to community severance because of increased knowledge about their complex second-order effects on public health [Egan *et al.* 2003, Mindell and Karlsen 2012] and social cohesion [Leyden 2003, Sauter and Huettenmoser 2008]. The issue has also entered agendas of social and environmental groups of activists at regional and national level. At the same time grassroots movements have become more empowered by recent developments on access to open data and mapping technology. Online platforms, such as blogs and social networks, now enable such groups to disseminate their own analyses and views about issues affecting their communities.

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As a complex issue, with multiple direct and indirect effects, community severance has been approached by researchers in diverse fields, using different concepts and methods and aiming at different policy solutions. The differences start with the terms used to define the issue, including variants such as community severance [Clark *et al.* 1991], barrier effect [Litman 2012], social severance [Lee and Tagg 1976] and community effects [Smith and Gurney 1992]. Further debate occurs when related concepts, such as community cohesion [Quigley and Thornley 2011], are introduced.

The issue of community severance is relevant to a range of stakeholders, including local communities, road users (of all types, including motorists, cyclists and pedestrians), those who do not use the roads because of community severance effects, transport planners and local politicians. These stakeholders have different understandings of the problems and their solutions, and in some cases, even different opinions about whether this is a genuine problem that needs to be addressed.

The purpose of this paper is to establish a common approach for cross-disciplinary research in community severance, which can identify similarities and differences between the points of view of different disciplines and to look at how these points of view relate with those from policy-makers and other stakeholders, including the general public. It is hoped that this can also inform research in other urban health issues.

The paper is a part of an on-going cross-disciplinary research project (*Street Mobility and Network Accessibility*) at University College London (UCL), funded by three research councils (the EPSRC, ESRC, and AHRC), which is developing tools for identifying and assessing community severance. These tools include individual questionnaires, modelled indices of severance, monetised appraisal techniques, space syntax analysis, and participatory mapping methods. The project will increase understanding of people's perceptions about severance and suggest ways to mitigate its negative consequences.

As one of the first initiatives of the project, a series of three workshops was organized to collect information about the multiple understandings of community severance. The first two workshops were attended by members of the multi-disciplinary research team and had the objective of establishing a common language and developing understanding of other disciplines' methods. The third workshop included project partner organisations and expert external advisors (see Acknowledgements) and aimed at discussing opinions

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and experiences related with actual projects and policies dealing with community severance.

The paper is structured as follows: the following section, Section 2, provides a brief review of the issues commonly found in cross-disciplinary research. Section 3 develops a framework for a cross-disciplinary study of community severance. Section 4 discusses the compatibility of this framework with actual policy and practice, taking into account issues raised by stakeholders. A final section summarizes our findings and describes the future steps of the project.

2. The challenges of cross-disciplinary research

Cross-disciplinary research has the potential for analysing complex issues beyond the restrictions of individual disciplines, which are often affected by "generalising, decontextualising and reductionist tendencies" [Horlick-Jones and Sime 2004, p.442]. However, this approach also meets with several challenges regarding both the research projects and the engagement of researchers with the stakeholders on the issues studied.

A central aspect of research incorporating multiple disciplines is the contrasting, and sometimes conflicting ways for the production of knowledge [Johnson *et al.* 2007]. This concerns the ontological and epistemological framework through which specific disciplines operate. Ontology is the philosophical frame through which the world is viewed, using a specific system of classifications and encodings to construct a particular view of the world, and thus specific meanings that can be derived from them [Nickles *et al.* 2007]. Epistemology refers to the philosophical framework through which knowledge is considered to be valid, and the associated methods for obtaining that knowledge [Miller *et al.* 2008].

These ontologies and epistemologies vary between disciplines. Quantitative research is firmly rooted in the positivist approach that seeks to prove or refute a pre-existing theory through the scientific method. Qualitative research falls broadly within the interpretative approach that works in the opposite direction, seeking to firstly understand the phenomena in question, and then create a theory or narrative that explains the observed phenomena. Disciplines usually have a preference towards either quantitative or

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qualitative methods [Slatin *et al.* 2004], although there is increasing use of multimodal or mixed methods studies (combining qualitative and quantitative elements) to provide richer data.

The differences in ontologies and epistemologies are dealt with in different ways in the three types of research that brings together various disciplines: multidisciplinary, interdisciplinary, and transdisciplinary research [Miller *et al.* 2008]. Multidisciplinary research is carried out by people from separate disciplines, maintaining their own approaches to the acquisition and creation of knowledge throughout the research process. Interdisciplinary research brings together the approaches of different disciplines through shared problem definitions, exchange of methods and new question formulation [Eigenbrode *et al.* 2007]. Transdisciplinary work is the most integrated of all three cross-disciplinary working methods, and is brought about by creating new epistemologies to facilitate the research [Roux *et al.* 2006].

In all forms of cross-disciplinary research, an understanding of the differences in the ontological and epistemological approach is necessary [Petrie 1976]. Without those engaged in joint research understanding their respective philosophical approaches to research, developing a common understanding that enables anything beyond multidisciplinary research is not possible [Bracken and Oughton 2006].

Disciplines are also separated by the different concepts and jargon used to describe the same thing or, more confusingly, disciplines often have different meanings for the same word. Using jargon enables ownership of topics or concepts, but in cross-disciplinary research this can be at the expense of others' understanding and can restrict what contributions are made [Bracken and Oughton 2006, Monteiro and Keating 2009].

The issue of unequal power among disciplines has also been documented. It is often the case that some pairs of disciplines are accustomed to working alongside one another, while other pairs overlap less [Choi and Pak 2008]. Some disciplines like geography are more inclined to interdisciplinary work, as they themselves contain a diversity of distinct branches [Schoenberg 2001]. In addition, some disciplines are more likely than others to be invited at the outset to participate or to be funded to initiate the process.

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Projects on broad fields such as urban research [Ramadier 2004, Petts *et al.* 2008] and environmental sustainability are especially vulnerable to these issues [Stock and Burton 2011]. The development of tools for public policy in these fields can be problematic, as solutions common in some disciplines, such as cost-benefit analysis and economic valuation of intangible effects, are viewed with suspicion in other disciplines [Norgaard *et al.* 1998].

Cross-disciplinary projects have tried to overcome these problems by creating opportunities for researchers to become aware of the similarities and differences in approaches used. Solutions have included organisation of seminars and workshops to develop common understanding [Petts *et al.* 2008, Straatemeier and Bertolini 2008] and the construction of applications for the shared use of different disciplines [Jones *et al.* 2009]. The first stage of the *Street Mobility and Network Accessibility* project had the objective of adding to these efforts, by tracking the process by which a cross-disciplinary group comes together around the issue of community severance to better understand what insights may be derived by such an approach. The results of this process are described in the next sections.

3. Establishing a common language and understanding

The first two workshops were set up to establish the common ground that exists across the disciplines when approaching community severance. The 10 participants represented nine fields: epidemiology, statistics, public health, economics, transport planning, built environment, space syntax, anthropology and participatory action research. In the first workshop, each member of the project presented three key issues from their discipline that related to community severance [Table 1]. The presentations were followed by a discussion. In the second workshop, the team clarified and developed some of the methodological issues discussed in the first workshop.

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Table 1: Topics about community severance presented by participants from each discipline

Disciplines	Topic
<i>Epidemiology, statistics and public health</i>	<ul style="list-style-type: none"> ▪ Reduction in trips decrease independence, affecting daily life ▪ Reduced active travel leading to physical inactivity and its disease consequences ▪ Reduced social contacts (trips to family/friends, streets as social spaces)
	<ul style="list-style-type: none"> ▪ Collisions ▪ Socio-economic inequalities ▪ Gender inequalities
	<ul style="list-style-type: none"> ▪ Big issues for an ageing population: healthy ageing ▪ Well-being/quality of life ▪ Resilience
<i>Economics</i>	<ul style="list-style-type: none"> ▪ Efficiency in the use of resources ▪ Equity in distribution of road space to motorised vs. non-motorised mobility needs ▪ Stated or revealed preferences as means to monetise impacts
	<ul style="list-style-type: none"> ▪ Definition of attributes that are comparable across a variety of environments ▪ Presentation of attributes to individuals ▪ Elicitation of individuals' monetary valuations ("payment vehicle")
<i>Transport geography and planning</i>	<ul style="list-style-type: none"> ▪ Accessibility: ease of access (to goods, services or activities) ▪ Mobility: ease of movement ▪ Travel decisions: trade-off between walking time and pedestrian environment
<i>Built environment and space syntax</i>	<ul style="list-style-type: none"> ▪ Cities are complex urban systems, work at multiple scales ▪ Spatial configuration shapes movement flows and social encounters ▪ Social impact of interruptions and interventions in the urban fabric
	<ul style="list-style-type: none"> ▪ Local variations in spatial structure ▪ Differing spatial communities and personal geographies ▪ History and the experience of change over time on perception and sensitivity
<i>Anthropology</i>	<ul style="list-style-type: none"> ▪ Patterns of establishing and maintaining social networks over time ▪ Differences in usage patterns based on personal attributes (e.g. age, disability) ▪ Impact on an individual's 'sense of place'
<i>Participatory action research</i>	<ul style="list-style-type: none"> ▪ Who: Identification of stakeholders/impacted people ▪ Why: the role of information and action in CS ▪ How: what methods are appropriate for CS engagement and action

The discussion reached the conclusion that the presentations answered two broad questions: 1) what is affected by community severance and 2) what are the possible methods to identify and solve the problems presented by community severance. In addition, the answers to these questions can be integrated by considering that community severance is a chain of effects and that the methods to analyse the issue have different degrees of complexity. These two aspects are developed next.

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a) Community severance as a chain of effects

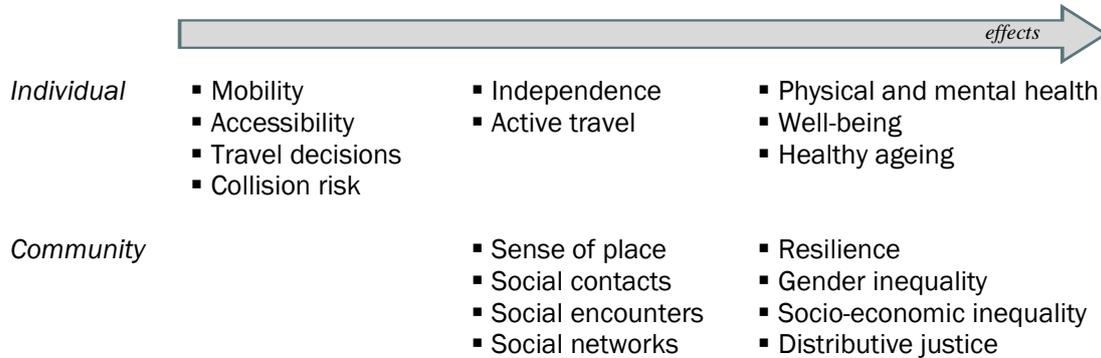
The effects mentioned in Table 1 can be classified as a continuum starting from the presence of transport infrastructure or motorised traffic and including a chain of effects at the individual or community level [Figure 1]. The challenge for a research project on severance is to track this chain of effects. A cross-disciplinary project brings added value because, as was obvious after the discussion in the first workshop, different disciplines tend to focus on different parts of the chain and so the results of the analysis of one discipline can inform the definition of the research problem by the discipline focusing on the next effect.

The participants agreed that the transmission of knowledge would be facilitated by distinguishing direct effects (those of an independent variable on a dependent variable that do not operate through a mediating variable) from indirect effects (those of an independent variable on a dependent variable that operate through a mediating variable). However, the identification of causality may create problems in the dialogue between disciplines. For example, a fundamental aspect of space syntax research is not to attribute any causality between spatial and social changes. Epidemiology also emphasises the differences between association and causation [Hill 1965]. The direction of some of the effects presented can also be questioned. For example, severance impairs mobility but impaired mobility also means that the effects of severance are realised. Severance means fewer social contacts but social isolation also mean that a road is not used for socialising.

The type of relationships between variables is also important, as we cannot assume linearity in the impacts of severance across a multiplicity of aspects of individual and collective well-being. Disciplines relying on quantitative methods may be more alert to this aspect, but there is a risk that these disciplines will try to model relationships that are difficult to interpret or translate into actual recommendations for public policy.

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Figure 1: What is affected by community severance?



An important discussion point was the origin of this chain of effects. The term “busy roads” was mentioned in several presentations, but neither the words “road” nor “busy” were mutually agreed upon. Motorways, railways and other restricted-access transport infrastructure pose different types of barriers to mobility, which some felt should be addressed using different methods. Broader terms such as “problem streets” and “areas where access is difficult” were proposed as alternatives. Just how busy the road must be in order to start this chain of effects, and how to define “busy” were also discussed. This aspect is important because severance is related not only with physical characteristics of the road (such as measured motorised traffic volumes, speeds and compositions) but also with people's perceptions about such characteristics.

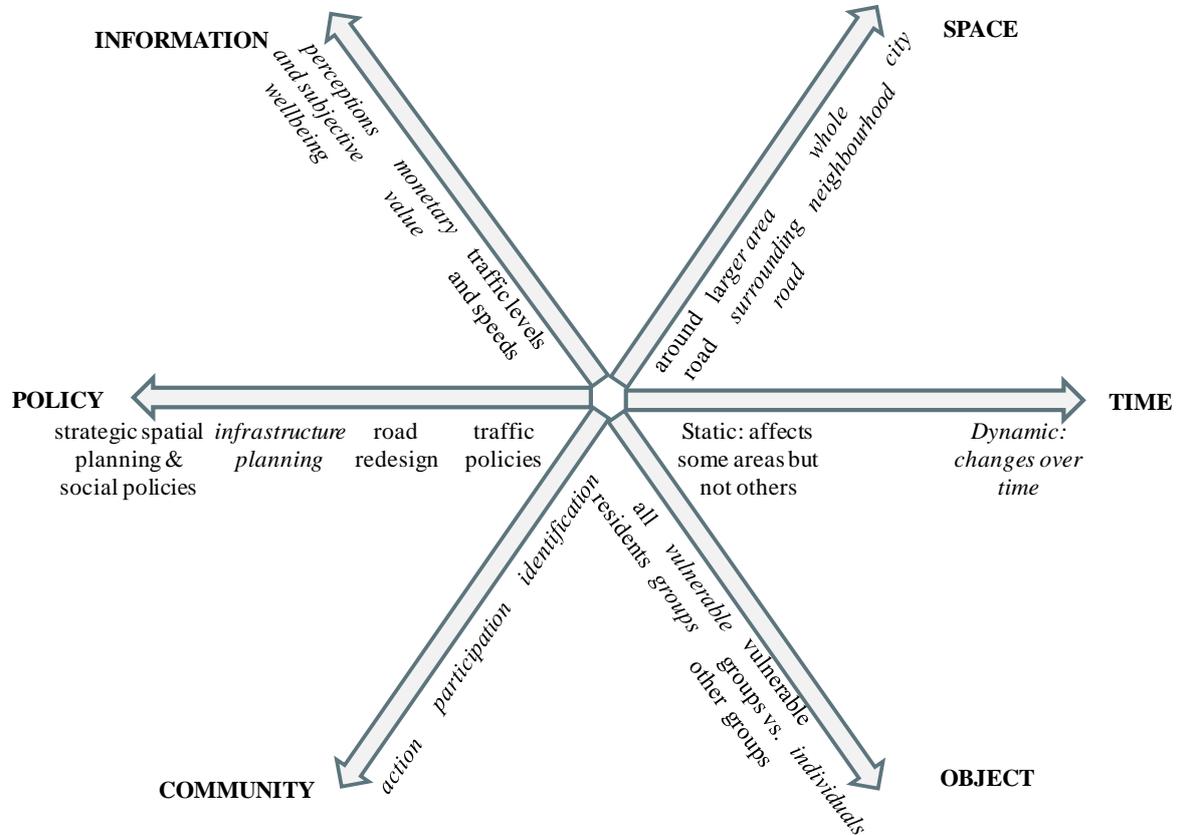
Another issue is whether severance may impact pedestrians' choice not only to cross roads, but to walk along them instead. This is particularly relevant for public health (as the unpleasant environment might discourage people from walking, even if crossing the road is not a problem) and the built environment, which has an interest in the role of active frontages enhancing opportunities for social contact.

b) Complexity in the methods used

The discussion also produced a framework for identifying the relationships between the methods used in different disciplines to analyse and solve community severance. This framework classified procedures along six axes, each representing the degree of complexity regarding a methodological procedure [Figure 2].

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Figure 2: Complexity in the methods to study community severance



Note: Items in *italics* were included in the participants' presentations. The other items were implicit to some of the presentations or were mentioned in the discussion that followed

In Figure 2, the first axis represents the complexity in the spatial scale used to analyse the issue. Transport planners supported the idea that it is necessary to study roads with high motorised traffic levels to guarantee the applicability of the developed tools in new contexts. However, wider health and social effects can be felt at greater distance from the road. The built environment perspective was that severance can also refer to whole neighbourhoods, because residents may be deterred from walking in the entire road and street network through fear or dislike of the unpleasant environment. This may even limit city-wide access, as all neighbourhoods of the city are spatially inter-dependent: traffic in urban areas is complex and people's action spaces vary. A lesser degree of severance can occur on minor roads used by drivers as "rat-runs" to escape congestion in larger areas or on main (shopping) streets running through a neighbourhood. Spatial scale is also relevant when considering people's perceived "home territory", that is, the area they

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use often and are familiar with. In this perspective, scale would be defined without strict spatial boundaries.

The differences between approaches to study mobility and accessibility are better understood when we quantify their spatial scales. Transport planners are used to discuss sections of road that are about 2-5 km long, focusing on the roads themselves. Space syntax may consider a radius of 800m around a given point, while focusing on the road network. Participatory methods usually focus on areas of 1-4 km² which define a neighbourhood or area that people walk around within 20-30 minutes.

The second axis represents complexity in the time scale of the problem. Economics has sought to integrate community severance at the level of planning of individual projects, while recent geographic research has focused on community severance as spatial differences in accessibility levels at one point in time. Built environment and space syntax perspectives are broader, considering severance as a gradual process, changing over time and captured by changes in the street network structure and in the interactions between the character of the different neighbourhoods and the mobility of people living in each part of the city. The time scale in this case is measured in years. Aspects such as the length of residency of individuals are particularly relevant as such issues affect the perceptions of both the problem and the neighbourhood. In addition, a road may separate two communities that already define themselves separately for other reasons, such as differences in the characteristics of the population or housing.

Interest in the time dimension of environmental inequalities has increased in the past decade, with several studies investigating whether infrastructure linked to environmental risks was constructed before or after the location of low-income populations or racial minorities in the affected areas [Hipp and Lakon 2010, Mitchell and Norman 2012]. Similar approaches can be used to study the dynamic aspects of community severance.

The third axis represents the complexity in the object of analysis, that is, who is affected by the problem. The existence of particular groups of concern came up as a common theme in several presentations. Those groups were based on age, gender, socio-economic position, car ownership, ethnic group and disability. However, it was pointed out that the effects on one group can be assessed only if compared with the effects on other groups. Groups are also not homogeneous, for example, there are

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distinctions among people classified as "elderly". From an anthropological perspective, mobility needs are diverse and experiences are unique, and so the distinction between groups and individuals must also be considered. Within the same community, views differ regarding what is a barrier, and what is its relevance as a problem. This is similar to the existing distinction between "clusters" vs. "scatters" of social exclusion [Hine and Grieco 2003].

The fourth axis measures complexity in the type of information that is collected and analysed. Traffic levels and speeds are readily available from routine data sources. It is more complex to measure the value that affected people attach to the problem, and this may or may not be correlated with traffic levels and speeds. Surveys for this valuation must consider the ways to present the various attributes of the problem to individuals, with possible variations for different groups within each community and different communities.

It was also agreed that the absence of data is as relevant as its existence, especially in cases where people do not travel (possibly because of community severance). It is as important to explore trips not made and destinations not visited as it is to collect data on existing travel patterns. To capture these factors, it is necessary to learn about people's perceptions of the issue. Perceptions also come into play when individuals define the community to which they belong and delineate the borders of their community. The greater the complexity of information required, the more likely that data collected are to become increasingly qualitative (and less quantitative). In the workshops, participants from some disciplines raised doubts regarding the degree to which in-depth qualitative information may be compatible with quantitative data in such research – although it was generally agreed that qualitative data can help define the research questions and can be used to validate and explain the conclusions from quantitative analyses.

The fifth and sixth axes represent the complexity of the solutions for the problem, involving public policies and community action. Policy interventions can be made at the level of traffic, redesign of existing infrastructure and planning of new infrastructure. Intervention can also occur in other domains, and have a social aspect aiming at a "compensation" for the physical aspects of severance or at a reduction of some of its

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second-order effects. The level of community participation also varies in the proposals of each discipline.

Academic research has traditionally used a 'top down' approach, involving the collection of data from participants, which is then analysed and disseminated without the involvement of feedback from the community. However, the use of alternative approaches is growing. For the *Street Mobility* project, participatory action research holds particular promise for providing additional insight as it adopts a bottom-up approach to researching community issues, learning from the participants in the case study areas and allowing emergent ideas and data to inform subsequent research.

c) Towards a common language

The two workshops identified community severance as a complex issue and used the input from different disciplines to break down the issue into a continuum of effects, which can be analysed by methods with different levels of complexity. This framework can help researchers to locate their own perspective in relation to those of other disciplines, and clarifies relevant issues when applying the research to actual problems affecting different stakeholders.

However, the different teams in the project need to work with a common operational definition of severance. One of the main challenges is to determine the language that should be used to describe the issue, as the use of common, jargon-free language allows freer exchange of ideas and concerns between researchers. This language should be compatible with that used by policy-makers as well as the language used by local residents when describing their neighbourhoods.

The use of a common language can avoid the problem that arises when 'jargon' or specialised terms diverts attention from the more important issues. For example, the term "social determinants of health" is common in public health research, but participants from other disciplines questioned how "determinant" are the factors studied and whether they are really "social". A consensus was found by clarifying the fact that the expression refers to a broad concept of the environment surrounding the individual, encompassing geographic, economic and social factors [Dahlgren and Whitehead 1991]. More importantly, the purpose of research is to investigate whether community

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severance does play a role in people's health, after isolating other factors, regardless of the particular academic concepts used to describe that role. This example shows the importance in distinguishing between relevant conceptual mismatches between disciplines and “red herring” issues which are of little consequence for applied research projects.

To help clear misunderstandings and to help select terms used when engaging with policy-makers and local communities around issues of community severance, the research team has developed a glossary with terms used by different disciplines and policy instruments and tools used. This is available at <https://www.ucl.ac.uk/street-mobility/docs/Community-severance-glossary>

4. Dialoguing with stakeholders

The third workshop in the series brought together the researchers in the *Street Mobility* project and 24 individuals with expertise in community severance and in the relationships between transport and health or wellbeing. These individuals represented local authorities, NGOs, universities and consultancy companies. The participants represented not just a cross section of the skills and expertise but also brought experience gained in a variety of urban areas in the United Kingdom.

The aim of the workshop was to assess the main differences between the views of each discipline and those of experts with different backgrounds. The members of the project first presented the objectives of the research, the first two case studies, and the proposed strategies for engaging with local communities. The participants were then split into groups to discuss topics related to the causes and effects of severance, and the methods to analyse and solve the problem.

Previous work has highlighted the role of local practitioners in the development of solutions to community severance [James *et al.* 2005]. The objective of the present work is to further this knowledge by assessing the views of a broad range of stakeholders about an academic research project which has the objective of developing tools that can be routinely applied as part of what good practice is in different contexts.

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Analysis of the transcripts from the discussion groups identified common themes signalling differences between the approaches of academics and stakeholders dealing with severance. The issues raised by the groups decomposed some of the concepts in the framework identified in the preceding two workshops into multiple levels. The consideration of these multiple levels is relevant, as it provides relevant detail for the teams working on the project, and highlights links between these teams. However, the multiplication of possible objects of analysis and methods can also lead to loss of focus for a project such as this.

a) Assumptions

A point raised by several participants is that severance is not necessarily perceived as a problem by the communities affected. It can be regarded as neutral, such as when local residents do not need to cross a road because there are no places on the other side where they want or need to go. This may be the case in many suburban regions where services and facilities are dispersed and roads separate residential areas from open space or from other residential areas. In these regions, walking trips across different residential areas are relatively infrequent because a large part of the population commutes daily to central areas.

Severance created by natural barriers, such as rivers and canals, can also be regarded positively, because these barriers, or the areas surrounding them, have amenity value. Nevertheless, bodies of water still separate two areas. One challenge is to assess how communities perceive and respond to the positive and negative aspects of such barriers.

In some cases a clear demarcation of boundary can also enhance community feeling. Inner city areas beset by gang warfare could fall into this description. Participants working in local authorities gave examples of cases when they encountered problems in convincing young people to attend events on the opposite side of the road from where they lived, not because of road or traffic barriers but because the area was perceived as a different territory. The lesson is that policy-makers and researchers should not assume that communities want to be connected. However, it was also pointed out that the desire not to be connected is not necessarily a positive thing. Just because a group wishes to be

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separated, it does not mean this is a good outcome for society overall or that this separation should be encouraged.

These reflections suggest that a research project on severance should question the assumptions that severance is a problem for the communities studied and for the society at large. In terms of the framework developed in the previous section, this means looking into the wider effects of severance on individual and social wellbeing (last columns in Figure 1). It also means that links should be made between the most complex methods represented in Figure 2. The research should consider the whole neighbourhood and how it has evolved through time, and collect information about the perceptions of different groups or individuals within the community. Possible policy interventions should consider social aspects, with the participation from the community.

b) Focus

The participants in the workshop also raised issues of scale and accessibility that were not contained in the framework developed by the researchers.

The spatial scale considered in the framework was the scale of the problem, that is, the differing severance that may occur for different types of mobility within the city. Participants in the workshop mentioned that severance might occur at the small scale, such as fear of crime within a block of flats or a housing estate. At the neighbourhood level, heavily trafficked roads and access to public transport were identified as factors. At the scale of movement across the city, economic barriers to certain forms of transport were identified as possible factors contributing to severance.

However, there are other types of scales. For example, the scale of the study was highlighted as an area that needed consideration in order to generate generalizable findings through a large enough sample of the population, whilst still capturing the specifics of how severance affects certain groups within the study population. The scale of the interventions to reduce the effects of severance is also important. This was specifically discussed in relation to the ability of the community to bring about local change. It was suggested that smaller and cheaper incremental changes would be easier for a community to achieve or campaign for, than large scale remodelling of the streetscape and transport infrastructure design. Easily achievable small-scale

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interventions such as lighting, signage and other minor urban design changes were suggested as avenues to explore, in relation to their potential impact versus large and costly infrastructure changes that would be hard to enact in short time frames or be led by the community.

The notion of accessibility was also seen as an important aspect to consider in all its facets when designing a study about community severance and evaluating the results. The discussion considered that accessibility needs to be understood in terms of all the barriers to movement and the use of space beyond purely physical conceptions. The participants in the workshop put forward dimensions such as the physical constraints on access that certain groups may experience, the physical services or destinations in specific locations and cultural and economic factors in accessibility.

Individuals with disabilities such as blindness, deafness or mobility impairments will also have different experiences of accessibility to those without such physical mobility constraints. Understanding these differences and how they change perceptions and experiences of severance will be necessary in order to develop a holistic study approach that takes this into account.

The locations of services highlight the need to understand what it is that people are potentially being severed from. It was suggested that the presence of a barrier to movement might not have severance effects if there is no desire or need to cross it to access specific locations. However, the conclusions from the discussion in the two first workshops showed that the significance of the barrier in limiting outcomes depends on how well served people are on their side of the barrier. If there are no shops on 'their' side and a barrier on the other side, they will be at a severe disadvantage, compared with people who do not need to cross the road as they have all they need locally. More complicated still, in some circumstances, having some services on the other side of the road will encourage people to roam further (and meet more people), but this must be balanced against people's ability and willingness to do so.

The description of severance as 'limiting access to services' overlooks the less easily quantifiable outcome of severance: severance may limit to access to society at large - the 'community'. People in different socio-economic and cultural groups within the population of the study areas will have different accessibility requirements, due to

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different destinations that they wish to access. Understanding these differences in accessibility requirements will be necessary to understand what severance means, and how it manifests to different sections of the population. Economic factors are also relevant, as the cost of services and the cost of transport influence the destinations accessed and the modes of transport used, and ultimately influence severance.

Finally, the multiple scales and concepts of accessibility increase the complexity of the object of analysis and methods identified in Figure 1 and Figure 2. While this helps the disciplines making connections between their different approaches, the project as a whole may also lose focus. The objective of the project is not trying to overcome all barriers to access, social equality, inclusion, participation and other social problems. The project will try to measure the transport issue called in the literature ‘community severance’, to determine its effects on health and health inequalities, and develop a set of tools so that practitioners can use the tools to identify problem areas, ameliorate them, or predict effects of proposals.

c) Applicability

The workshop attendees also highlighted the importance of recognising the local context and how this may influence the development and application of tools to address severance. Rural areas have problems with community severance that are different from those in urban and suburban areas. These problems often take place over a wider geographical area, as communities may be separated by several miles, rather than by one road that is difficult to cross, and may be more focused around car accessibility, because of distances and lack of provision for walking, cycling and public transport. The tools to address severance that are developed using case studies in urban and suburban locations do not address the issues unique to those living in rural areas, which means that further testing will be needed to adapt them to suit the rural context.

It also needs to be borne in mind how the tools can be applied in a local context where administrative and local authority boundaries complicate the implementation of solutions. These boundaries can complicate obtaining routine data and influencing local policy and facilitating change.

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The need to consider the spatial context increases the dimensions needed to represent the continuum of effects given in Figure 1, as the relationships between different effects are valid only in a particular context. It also presupposes the use of the more complex approaches represented by the different axes in Figure 2, as only these approaches can capture the specificities of the problem in each context.

d) Communication

The participants in the workshop were aware of community severance and related issues being discussed and worked on, both within and outside their organisations. Stakeholders mentioned tools that have been developed to identify the problems transport infrastructure can pose to pedestrians as well as case studies of how these problems have been alleviated. However, these tools have generally been developed at a local level with the specific context in mind, and therefore have neither been widely disseminated nor developed in order to be generalizable to other settings. There has been in some cases duplication of efforts by local teams, which may also not be well-resourced in order to review existing work. International evidence is also relevant and such tools should not be neglected as these could be adapted to use in a different country. The participants agreed that the existing tools cannot be used to routinely measure and model severance in different settings, but they can inform the development of new tools. To facilitate this process, the *Street Mobility and Accessibility* team will create an archive of relevant tools which will be publicly available on the project website.

The efforts to establish a common dialogue among the research team and identify a common conceptual framework through cross-disciplinary workshops are only the start of addressing the communication challenges ahead. The pool of advisors to the project and other stakeholders is diverse, with representatives interested in different aspects of the project, such as transport, planning, health and ageing and work at a variety of levels (from community organisations with practical experience, to local government, to national professional bodies which influence policy). These stakeholders bring an array of skills and experience but inevitably have different interests and backgrounds. It is important that the common dialogue and framework established makes sense to and

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satisfies these external stakeholders as well. To this end, the present paper is intended to begin such a conversation.

This also applies to the tools developed. Communities may want to evoke change, whereas local authorities may be more interested in measuring the extent of the problem. The tools that we intend to develop in the course of this project will need to be tailored to different user groups' specific requirements. On-going communication and consultation will be a fundamental part of enabling this.

5. Conclusions and further work

This paper analysed the process of construction of an overarching framework for research on community severance, based on reflections obtained in a series of workshops with a cross-disciplinary team of researchers and with a group of stakeholders.

Community severance is a complex issue defined by a continuum of effects stemming from the impact of transport infrastructure or motorised traffic on pedestrians. A cross-disciplinary project can bring added value because different disciplines focus on different parts of this continuum and analyse them with methods with different levels of complexity. However, the advantages of cross-disciplinary research will only be achieved if the research participants understand and communicate around issues relating to community severance.

The discussion with the project stakeholders also demonstrated the breadth of potential objects of analysis and of audiences for the research. The consideration of all these objects and audiences may help the project find the connections between the approaches of the different disciplines. However, there is also the risk of any project of this nature losing focus or diverting attention from its main objective, which is the development of tools to measure and overcome community severance, defined as the effects of busy roads on local mobility, and in older people's mobility in particular.

More generally, the series of workshops reviewed in this paper has shown that the efforts for the coordination of different disciplines involved in a common project must begin with the integration of epidemiological, economic and geographic approaches to

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understandings of, and methods employed to evaluate the issue. Research outputs need to be framed in such a way that they can be understood and used within policy contexts. This requires both awareness and understanding of the epistemological and ontological framework through which all involved actors operate. The value in doing so is the potential to create more nuanced and holistic knowledge of what community severance is, how it affects communities and how these issues can be effectively communicated to enable change to be brought about.

This is the first in a series of working papers that will be written and disseminated during the course of this study to document both the process and findings from the UCL *Street Mobility and Network Accessibility* project. The next steps of the project will be a set of workshops conducted with members of the case study communities to examine whether and how community severance affects them. This will produce a set of hypotheses to test using other methods, including GIS and space syntax analysis, video survey of motorised traffic and pedestrian behaviour, and interviews and questionnaires.

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