

Enhancing community participation in metropolitan strategic transport planning through shared analysis

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Abstract

This paper assesses and explores the existing potential for new approaches to software and data, such as the open source movement, to contribute to more open and contestable strategic land-use and transport planning processes. Issues with the current state of practice of modelling and analysis in such processes have been reviewed; developments for addressing them have been profiled; and practical efforts exemplified by the use of modelling in recent large-scale processes, such as Chicago Go To 2040, have been assessed. We then specifically developed a proposal for how the open source approach to software development and management can be an important part of this process, and illustrate and profile the progress thus far of two of the largest urban modelling projects that have embraced at least aspects of this approach – UrbanSim and MATSim. Finally, we assess the key open governance and technical issues involved in moving such efforts from an academic research context, to an operational application in group decision-making for urban and transport planning.

INTRODUCTION

The perception of modelling urban systems by the larger body of urban planning practitioners and academics has a complex history that strongly influences current thinking and approaches. Lee's (1973) 'Requiem for large-scale models' paper, although almost 40 years old, is still widely cited in this context – often in discussions concerning the rise of post-modern theory and its application to urban planning, and in critiques of scientific rationalism. Guhathakurta (1999) provides a nuanced historical review, arguing that modelling has never been a 'mainstream' part of urban planning as a discipline, however much it has informed and assisted the management of major rural and urban infrastructure projects. From an urban planner's stance, modelling has always needed to adapt to

new contingent concepts and situations, and its practitioners must engage in an ongoing process to address these broader movements to prove its relevance and applicability.

The use of the results of earlier generations of large-scale models as supporting evidence for controversial urban freeway building projects in the 1960s to 1970s is also likely to have had a lasting impact in this respect. This history is interlinked with the broader critique of 'scientific planning' by an archetypal isolated expert, and a concomitant demand for greater accountability and public participation in such decision-making. Indeed, advocates of new approaches to urban transport planning can still point to historical examples where key unstated assumptions in such models, such as the concept of minimum population densities to make public transport viable, constrained the outcomes of such processes (Mees 2009). Evans, Burke & Dodson (2007) offer a recent critique from this perspective, of the problems of the practice of transport modelling in Australia. It is also arguable that much of the modelling undertaken has not drawn upon more recent global developments, and as a result has become standardised and even inflexible to some degree.

As summarised by Waddell and Ulfarsson (2004):

The tradition that has emerged within planning agencies of having technical staff run models to support planning processes, without clear and open access to the models, their assumptions, their theoretical foundation and their practical application, has become very inconsistent with the current context demanding more democratic analysis and decision processes.

A general concern to be considered up front is squaring any move towards openness with the practice of governments or public institutions outsourcing the majority of their modelling to consultant companies using proprietary software tools. A survey by Hatzopoulou and Miller (2009) showed that this was often the case in Canada, a country with considerable institutional support and academic expertise in modelling, and is likely to be even more of an issue in Australia (Evans, Burke & Dodson 2007).

A further challenge to be addressed in re-engaging with modelling is education of the broader planning community, beginning with tertiary studies. Transport planning and modelling are now often taught as a specialist engineering profession, distinct from the much more generalist education provided to urban planners. Further, the basis of

much of this teaching¹ is framed on the existing small set of commercial modelling tools. These are generally a global standard set of (typically, but not exclusively) VISSIM, VISUM, TransCAD, TRIPS, Paramics, Aimsun, Emme, and CUBE. Some of them have extensive customisation options (e.g. Paramics) adding a further range of variations, which engender additional intellectual property issues if they are to be audited or used by other parties.

These educational barriers can be further exacerbated by the exclusive use of commercial proprietary modelling systems. Commercial purchase requirements can limit the ability of stakeholders to 'play' in this space at all, thus limiting the ability of other parties to assess, understand, use, examine and apply variations to published studies. We contend that, in practice, this can lead to an increasingly serious fundamental failure in governance, as some level of contestability and transparency is needed to secure this.

Accountability is not the only driver towards more open, interoperable models. Another trend is the steady expansion of the issues to which transport and planning analysis is required to contribute. This is addressed to some extent in the review by Hunt et al. (2005). Of central concern is the recognition that environmental, social and technical concerns are generally interlinked. Waddell and Ulfarsson (2004) and Wegener (1995) both provide examples where legal requirements to consider these relationships, such as the Clean Air Act Amendments (CAAA) and Intermodal Surface Transportation Efficiency Act (ISTEA), spurred developments of the modelling process. (See Garrett and Wachs (1996) for an in-depth analysis based around a San Francisco regional planning process). Furthermore, developments of regional and urban systems over time are now becoming necessary, and require extensions beyond the more traditional models still frequently employed.

Any modern critiques and proposed improvements of urban modelling now need to consider issues related to engaging with the broader governance and group decision-making processes within which they operate. The centralised mechanism now widely (but not exclusively) used in Australia is one of government study commissioning, followed by consultant execution under direction for the scope, reporting and alternatives to be fully assessed. This is a very difficult system to make contestable, and a restructure of the overall processes of governance

¹ Not all by any means, but certainly most of that aimed at vocational work in applied engineering consulting.

would inevitably follow any major changes and opening up of this closed loop (Wigan 2010). Contestability is steadily becoming an essential component in constructive engagement (Wigan 2008b).

Subsequent sections of this paper develop the case that these concerns with urban modelling can be addressed – that urban modelling as an activity is certainly not incommensurable with openness and broader engagement if the appropriate technical and governance approaches are applied. That is, those genuinely critical of the status quo in the analysis of urban transport systems should engage with these new potentials to reform and improve the practice of modelling, rather than ‘abandon the field’. Modelling can be recast as an ‘essential infrastructure for contestable evidence-based planning’ (Wigan 2008b) – contributing to raising the level and legitimacy of debate about future scenarios (Naess 2001), and aiding in collectively thinking through and deliberating on the spatial implications of policy, with elements of adaptability more widely accessible both technically and as part of the planning process. Part of this process involves democratising access to key information and modelling capacity, which is an educational as well as technical challenge, but one aided by current trends in rapid technological change. In the following section we profile some of the necessary concepts to draw upon in this process, before elucidating these through examples.

RELEVANT CONCEPTS TO DRAW UPON IN DEVELOPING OPEN ACCESS MODELLING

While this paper focuses on the potential of open source software to improve urban transport modelling, its credibility and its utility, it is useful to briefly introduce some other important aspects of why the field has a renewed potential to contribute to planning for urban sustainability and social justice. At the broad theoretical level, these include new approaches to combine the insights of post-modernism with the rigour of scientific research, such as ‘reflexive modernisation’ (Gleeson 2000; see also Guhathakurta 1999). One influential formulation in this field, attempting to codify appropriate policies and governance approaches to provide people with relevant information and a role in decision-making using an ‘environmental justice’ framework is the Aarhus Convention (UNECE 1998). This sits well with an emerging recognition that as well as impacting locally, almost all environmental issues, such as climate change, have technological aspects that are regional, temporal and systemic.

Given that the field of metropolitan transport and land-use planning is one which involves entrenched interest groups and institutionalised barriers to meaningful engagement, the temptation for either governments or interest groups to use ‘strategic communication’ to mask a lack of genuine participation is significant (c.f. Mees 2003; Low et al. 2005). Modelling can play different roles here: both the technology itself and the way it is interfaced with the larger process determines whether it supports wider participation and analysis, or else actually reinforces such strategic communication. Fischer (2003) discusses these issues in the context of the structured Strategic Environmental Assessment (SEA) approach to decision-making, arguing that while processes such as SEA may have issues in terms of full participation, they nevertheless can have a beneficial effect in the public interest by formalising the consideration of impacts at different levels. For transport planning decision processes in particular, Wigan (2008b) outlines several key governance concerns and ways to address them, focusing on the issue of making state-managed transport decision-making accountable and contestable.

Analytical techniques and technology can be applied to structured decision-making of land-use and transport at different scales. For example, on the scale of a community developing and agreeing on an updated long-term regional and land-use plan, tools can be used for formal scenario analysis of defined policy packages. On the scale of evaluating more specific projects (e.g. considering a new roadway or rail infrastructure project), models can be similarly used to forecast possible results of the different options. It would be beneficial to link the use of models (and indeed decision-making processes) at these different scales in a coherent manner, and the SEA approach would seem to be appropriate in this respect and could overcome some of the shortcomings of unlinked Environmental Impact Assessment (EIA) processes for individual projects (see, for example, Fischer (2002)).

The significant work over recent decades in developing processes for enabling public participation in decision-making that involves a spatial aspect using GIS technology, known as Public Participation GIS (PPGIS), must be considered when evaluating the potential role of urban modelling (Carver et al. 2001). Gonzalez et al. (2008) provided a wide-ranging summary of the international state of practice in this area, focused on public participation in EIA/SEA processes and informed by a survey of experienced practitioners. While this study found that many subjects agreed

that GIS tools can enhance public participation, analysis of responses suggested that it was often at the lower rungs of Arnstein's (1969) 'ladder of citizen participation'. Nevertheless, they concluded that there is significant further potential for technology to enhance public participation, and provided a list of recommended actions necessary for achieving this. One of these conclusions is that appropriate use of technology combined with more conventional methods 'enhanced the transparency and integration of public perceptions within environmental assessment procedures' (Gonzalez et al. 2008). Related to the concept of contestable processes discussed above is the 'advocacy GIS' concept (Klosterman 1999), drawing on the advocacy planner model (Davidoff 1965).

And finally, from a technical point of view, it needs to be realised that any lingering perception of a transport model as being solely a 'four step network analysis' restricted to transport movements in a mechanistic manner, is now far from accurate in modern models. The latest generation uses a time-dependent, disequilibrium approach, and multi-agent simulation of decision-making to better capture some of the complexities of urban systems (Wegener 2004). Theoretical developments in fields such as urban ecology and complexity theory have begun to be incorporated into urban models themselves (Alberti & Waddell 2000; Deal 2001). Another good example built on an open source foundation (MATSim), and thus potentially widely available with fewer barriers to uptake, is Hackney and Marchal's (2009) extension of agent-based representations to include social networks and their impact on travel.

RECENT PROJECTS WHERE NEW APPROACHES TO MODELLING PLAYED A SIGNIFICANT ROLE: 'PROPOLIS' AND 'CHICAGO GO TO 2040'

Two real-world major spatial planning processes that show some of these potentials in action were the PROPOLIS (Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability) project carried out on behalf of the European Commission in the early 2000s (Lautso et al. 2004), and the use of technology in the current CHICAGO GO TO 2040 regional plan making process. PROPOLIS used a suite of leading European models, such as TRANUS (De la Barra 1989) and IRPUD (Wegener 1996), to evaluate a range of scenarios involving different sets of land-use, transport and other policies, according to a set of sustainability criteria. The models allowed exploration where a combination of policies would

help lead to desired outcomes, and included a well-developed system for viewing the results using GIS packages. It was also notable for the thorough development of the key indicators used, covering aspects such as CO₂ emissions and also accessibility to urban centres and services, and for the fact that these indicators were one of the drivers of the process rather than an afterthought. This reflected a process where a commitment was made to use modelling for assessing policy alternatives given an up-front and quantitatively defined goal of moving to a more sustainable urban development pattern, rather than to justify pre-existing investment decisions taken for other (e.g. political and/or economic) reasons.

The PROPOLIS example is indicative of recent modelling-based assessment processes initiated in an effort to bring together and coherently analyse the necessary urban and regional processes and systems, as sustainability became a more important and recognised goal. The *Land Use and Travel Demand Forecasting Models* report commissioned by the Puget Sound Regional Council is typical of the second stage of this trend in the USA, as the issues broadened to require a rethink of analytical support for wider scoped and more demanding policies (University of Washington et al. 2001).

The CHICAGO GO TO 2040 initiative had similar goals, embedded within the metropolitan planning update process of the city of Chicago and its surrounding region. It used modelling both for an organised scenario assessment process (CMAP 2008), as well as hosting an online interactive tool for the public to explore scenarios directly using the MetroQuest software package. This is notable for using models in both a public education/engagement role, and for formalised decision support. While available reports do not state exactly how the public participation element was used in the decision-making process (CMAP 2009) and whether the underlying modelling process itself was open to public critique, these represent positive directions.

These examples are introduced to show the potential of urban modelling to contribute to urban sustainability. Significant barriers remain of course (Wigan 2008a; Lee 1994), and regions without a developed modelling research or operational capability will not easily take on projects on the scale of PROPOLIS. The next section addresses why open source software, when properly utilised, can be a key component in reducing these barriers.

ADDRESSING CORE CHALLENGES WITH OPEN ACCESS MODELLING

The open source software model as an enabler of open access modelling

All models are implemented in some form of software, and one of the most significant developments in the software domain over recent years has been the rapid rise to prominence of the open source concept. Open source involves more than an approach to managing computer code. Over several decades it has developed a fundamentally different approach to the economic and social aspects of developing, maintaining and distributing software (Bonaccorsi & Rossi 2003). Instead of a small group developing a proprietary tool and then selling this for economic benefit, it is based upon pooling the development effort for the mutual benefit of all involved. A key advantage of this approach is that while there is usually some sort of formal change control, any user of the software can find bugs or develop improvements, not just a core group.

This doesn't prevent commercial profit from the software in various ways – individuals and companies may sell support and development services for an open source tool, use it as part of consulting practices, or (depending on the licence forms used) develop and sell proprietary tools that leverage upon the capabilities of open source packages (Raymond 1999). Open source tools are not only common in the research world, but are also used by businesses and governments around the world, from back-end server software, such as the Apache web server², to user-focused tools, such as the Firefox web browser. This wide uptake is both a driver and demonstrator of the quality of software that can be developed using the open source paradigm.

The first key benefit of making urban models available under an open source licence³ is to encourage accountability and contestability. Since the source code of a model embodies the theoretical foundation and underlying assumptions used to model the future of an urban region in different scenarios, requiring this code to be publicly available explicitly enables at least a base level of transparency. Using open source software, the

model results do not appear from an opaque 'black box' whose internals are only known to the model developers, but are open to challenge and enquiry⁴. For example, issues of how the mode choice of simulated populations is determined would be open to inspection, challenge, and alternatives.

There is also a strong potential for open source to reduce the effort and cost of modelling, especially for smaller organisations and groups. The level of software and mathematical expertise to develop useful models is considerable and not widely available, and commercial packages are expensive, requiring frequent use to justify the expense, thereby often leading to 'outsourcing to consultants' as discussed above. Cooperation on shared open source models opens an alternative path forward for smaller organisations to significantly reduce this cost and raise the level of their modelling capability, particularly in neighbouring regions with shared characteristics and modelling needs.

A further essential feature of open source projects is that they can, and often do, generate a very high quality of software, openness and expertise sharing in a global community. The greater the usage, the better the contributors become recognised globally, and this has become one of the key drivers of quality in open source projects. In planning and transport, this mutual support community is analogous to the capture of skills, experience, and mutual training and support resources that are a major outcome of transport planning software user groups for commercial packages, and subliminally promote lock-ins to the tools on which they are focused.

It is a major (and quite proper) marketing goal of such vendors to take all steps possible to retain intellectual property on their tools, and to generalise all sorts of ways of ensuring non-contestable lock-ins to their tools. This can include carefully drafted apparently 'open' agreements and broad licensing agreements, especially when these guarantee a continuing stream from support and enhancements.

However, this model by its very nature militates against contestability, and limits and excludes the global community of quality assessment, enhancement, skills exchange and universal access, which is of course one of the reasons for its adoption by strategically competent commercial vendors. The appraisal of any such moves needs to be set against the losses of foregoing the now well-tested open source model.

2 Which at the time of writing maintained more than 50% 'market share' of global web server installations, according to an automated survey (Netcraft 2010).

3 There are many different forms of open source software licences. For a discussion of which are likely to be most appropriate to urban transport and other modelling projects, see Wigan and Drain (2002).

4 At least by people sufficiently versed in the relevant theory, software and mathematics. We realise there are significant issues here to be further explored in respect to this accessibility.

There are signs that some other major pieces of modelling and data-related software developed on a quasi-commercial basis are now moving to place a high priority on interoperability with a larger open source ecosystem. A good example is that of the data cube analyser NESSTAR, used as a core component of the Reorient Transport data repository (www.reorient.org.uk), which although developed on a proprietary basis itself, provides a distribution for the open source Linux operating system, and actively supports interoperability with open source databases (such as MySQL) and the GeoServer open source GIS server. At an industry-wide level in the GIS field, the Open Geospatial Consortium (OGC) has driven standards that allow both proprietary and open source software to interwork, and provided open source reference implementations of key components to ensure this.

Examples of open source urban modelling projects: UrbanSim and MATSim

Considerable progress has already been made towards open source options for transport and regional modelling, and two such examples, UrbanSim⁵ and MATSim⁶, have been selected to show that this is now beginning to be a reality. These are complemented by other initiatives in the GIS community (such as the OGC) and the open data movement (see www.openstreetmap.org) that are also needed for the full planning analysis and data sharing picture supporting improved contestability, but we will use just these two examples to illustrate what is now already under way.

UrbanSim and MATSim are both projects of a significant scale under active development, based on multi-institution collaborations. They are committed to developing an open source community of users and contributors, use best-practice open source software development approaches such as unit testing and continuous integration, and have been applied 'operationally' as part of planning decision-making. Further, they are good representative examples because they are from different but complementary and convergent domains (metropolitan land-use modelling vs agent-based transport network simulation), so can illustrate some of the integration challenges ahead so models such as these can be used interoperably.

From a software design perspective, while the projects use different but modern and popular programming languages (Java vs Python), they both use a modular object-oriented architecture, and

make use of configurable XML files. These reflect core design principles of aiming to provide for a high level of customisation and extension (CUSPA 2009). Both are closely integrated with popular GIS packages (such as ArcGIS) and commodity web spatial interfaces (e.g. MATSim can display results of simulations using Google Earth). MATSim's core modelling concept is based around networks and simulating the agents that use them (Balmer et al. 2008); whereas UrbanSim has developed around a concept of grids/parcels of land-use throughout an urban region, and how these evolve given different demographic, economic, policy and transport-related factors (Waddell 2002; Waddell, Wang & Liu 2008).

Both these projects show examples of the challenges of modifying open source software for different contexts, and the issues that need to be considered in this respect. In the case of UrbanSim, Nyugen-Luong (2009) pointed out that an effort to adapt it as part of a French transport and land-use decision process posed considerable challenges, among them adapting the code's ability to handle European regions with a denser rail network than the American cities to which it was first applied. To deal with these sorts of issues, Patterson and Bierlaire (2008) recommend an approach for developing prototype models as a precursor phase to evaluate whether UrbanSim is suitable for a full urban model and to get a better estimate of the time and resource investment necessary to achieve this – a useful approach in general for open source systems.

Regarding MATSim, it is evident from the design of the code, documentation and variables, that its primary application during development has been simulating multi-agent behaviour in a car traffic network (e.g. in the files logging the results of a simulation, agents must always be associated with 'vehicles', even for pedestrian phases where pseudo-vehicle data structures must be created⁷). The process of adapting the original design to better support simulation of travel mode-choice in relation to activity plans is still under development, with developments to include public transport in the network (Reiser, Grether & Nagel 2009) and mode-chain analysis drawing on the ideas of Miller, Roorda and Carrasco (2005)⁸. Thus, anyone wanting to use MATSim for mode-choice analysis needs to also carefully evaluate the development investment effort required.

5 <<http://www.urbansim.org>>.

6 <<http://www.matsim.org>>.

7 E.g. description at <<http://matsim.org/node/115>>.

8 See <<http://matsim.org/node/267>>.

While both these examples illustrate the issue that no open source model is likely to be perfect for any specific situation initially, they also show that with open source systems these issues can be identified by the modeller in a transparent manner. The person/group can then decide whether to use another package; or use the current package but find workarounds for their project and document these, or develop enhancements to fix the issues. When a modular software architecture used by the likes of UrbanSim and MATSim is employed, these contributions can be managed as either a custom add-on, or else contributed back to the main project. There is then a potential to share these enhancements and specialised modules throughout the community, as the projects discussed are beginning to do⁹. This is in contrast with a closed-source proprietary system, where shortfalls and workarounds can only be guessed at, and when they are found, it must be taken on trust that the vendor will modify the package appropriately. These differing licence and software strategies thus bear directly on the potential level of accountability and contestability of models as part of the public decision-making processes discussed earlier.

An appropriate e-research and governance framework for open source transport and land-use models

To make a contribution to real complex urban land-use and transport planning problems, and integrate the required knowledge and data from different fields, no single tool, open source or otherwise, will be sufficient. Frameworks and architectures will be needed, containing many different components that can be extended as required and modified to suit the problem at hand. Several major initiatives already exist along this line, such as the Oregon Department of Transport's regional modelling system TLUMIP (Wigan 2005).

While a wide variety of open source transport and urban modelling tools exist, none are appropriate for all situations. Each comes from a different institutional and theoretical background and is useful for certain aspects of urban modelling, but has quite clear limitations. In addition, while open source tools may be 'free', learning to use them effectively, and calibrating/customising them for a particular context and purpose is a non-trivial time investment that needs to be carefully weighed. This is especially true in the case of complex metropolitan-scale land-use and transport models

(Nyugen-Luong 2009). Thus, at the same time that technical infrastructure challenges required to run transport and land-use models need to 'disappear', the limitations of what each model can and can't do need to 'appear' (become explicit).

All the key underlying technology required for this kind of project exists and is readily available. Further, a lot of effort has already gone into developing processes and infrastructure for enhancing the productivity and capability of other (often multi-disciplinary) fields that make use of technology, with best-practice being shared under the banner of 'eScience' and 'eResearch'. Examples of this are: the world-wide computational infrastructure EGEE developed to support the Large Hadron Collider project in particle physics (Gagliardi et al. 2005), and the GeoFramework and later CIG (Computational Infrastructure for Geodynamics¹⁰) projects in earth sciences (CIG 2009). Thus, there is now a significant expertise base to draw upon for such efforts in urban transport and land-use modelling.

Drawing from the lessons of these other disciplines, the support of open urban modelling frameworks would be a multi-year process, and would likely best be conceived and carried out iteratively. Initial goals could be a documented, maintained list of current open source models participating in the process, their key modelling features, and the input and output formats they support. Medium-term goals could include being able to run different models and compare their results in a loosely-coupled manner, all through a single web-based portal, where the tools are pre-installed and accessible over a computing grid and results can be queried using direct manipulation through GIS-based maps and data processing techniques. Finally, long-term goals requiring active collaboration between the modelling projects involved would include working on standards of data exchange and metadata for key ontological concepts and models (most likely using the widespread XML approach), and even developing and utilising a common software framework for managing models and interactions between them. Both the aforementioned CIG, and the AuScope¹¹ projects, provide good examples of this iterative process in the field of Geodynamics.

The group behind UrbanSim have begun to address some of the long-term goals required on the software level by separating the UrbanSim-specific code from

9 See <http://www.urbansim.org/Community/WebHome#User_Contributions_to_the_OPUS_a> and <<http://www.matsim.org/node/377>>.

10 Project homepage at <<http://www.geodynamics.org>>.

11 AuScope website <<http://www.auscope.org>>; an NCRIS (National Collaborative Research Infrastructure Strategy) project containing simulation and modelling aspects, as well as a program for data transfer and interoperability.

a more general system for interacting urban models, named OPUS (Waddell et al. 2005). Wigan (2008a) outlines several other relevant efforts, including the REORIENT¹² tool, which made available an easy-to-use web-based form of tool to analyse rail freight networks in Europe (where the user is presented with a GIS interface to the networks and data, and also a wiki and database of publications necessary to understand this in more detail (Wigan et al. 2007)). These efforts, which each address different aspects of the larger picture, provide examples to build upon when designing and developing a larger system. Data management and presentation now need to play as important a role as the modelling components themselves.

Approaches to data for operational modelling systems

The issues are no longer those solely of modelling, but also of data and access to it. Models are of little use unless they incorporate sound and relevant data, and preferably data collected in a form consistent over time. A useful pattern in this respect is that adopted by the New South Wales (NSW) Government, which led to a standardised (and incrementally enhanced) modelling system backed by steadily updated and consistent data under the umbrella of the Transport Data Centre (Hensher et al. 1995). This places the modelling and the steady updating of data as dual aspects of the planning process, and the incremental updating of elements of the models used has provided a progressive pathway for consistent appraisals within this overall process. The system has allowed multi-year comparisons, trends and comparability in analyses undertaken by any party, as these provide a reference base against which changes or other choices can be assessed on a comparable, coherent basis¹³. The budget levelling, coherence and consistency are auspiced within a continuing body with defined responsibilities for the data's application. This approach avoids many of the difficult problems of deciding when to collect fresh data, which is always a slow and expensive exercise to do well.

The centralised solution has been largely followed in most Australia states, including Victoria, with access to the data steadily moving to approaches with lower fiscal and data handling barriers. This move is consistent with evidence-based contestability and transparent decision-making, as well as facilitating access by a broad range of people and groups. This

12 See <<http://www.reorient.org.uk>>.

13 However, good or specialised alternatives might have also been used for the analysis or data extension.

trend has recently accelerated all over the world for government data (see data.gov and data.gov.au as simply two recent examples).

While this has made major inroads into the barriers for wider use and access to the data to drive strategic models, this does not apply to many other types of traffic and Intelligent Transport Systems (ITS) data, where decisions still have to be made about refreshing data, often on a project-by-project basis (Wigan, Smith & Timmis 2007). The present paper specifically excludes detailed discussions of non-strategic (i.e. more locally focused or specialised) models and data, although the same overall arguments, and indeed data issues, apply to both the technical and the enhanced community participation and consultation made possible by wider and more open access to the tools of the analytical trade in this area.

ENHANCING ENGAGED CONSULTATION

The open access frameworks described in the previous section would of themselves enhance many aspects of transport and land-use planning research, and increase the accountability of policy recommendations supported by models. But to address the broader concerns of how modelling and analysis is used as part of evidence-based policy and group decision-making, they need to be embedded in a suitable process that explicitly recognises contestability, differing value systems, and public participation.

As discussed earlier, much can be learnt from the use of GIS tools in public participation processes (Gonzalez et al. 2008), including PSS (Planning Support Systems) that involve tools to support the process as well as the substance of decision-making. Going beyond giving access to the community of the models used as part of evaluating transport plans in formal processes such as SEA, some of these systems also aim to enhance participation by giving the community input into defining what data is considered important and which aspects and indicators are to be modelled (Runhaar, Driessen & Soer 2009; Lieske, Mullen & Hamerlinck 2009; Guhathakurta 1999).

This will not be easy for systems as complex as land-use transport models, but Friedman et al. (2008) report significant developmental work here based around the UrbanSim tool. They draw on the concept of 'Value Sensitive Design' to acknowledge that different stakeholder groups will have different values about a given scenario, and propose to cater for these by developing different 'indicator frameworks' of what each group requires the model to be able

to report on. The requirement for these indicators is then fed back in to the design and development process of UrbanSim itself. The usage of a more freeform futures-exploration tool available online to the public (based on MetroQuest), as a parallel stream to more formal processes in the CHICAGO GO TO 2040 regional planning process discussed earlier, also provides an interesting approach of encouraging participation using modelling suitable for further analysis.

Currently, some agencies do make their strategic models available for others to use if they have the skills, and similarly the barriers to sharing at least a significant part of the data on which they are based are beginning to weaken. Processes have already been described as to how better data and modelling access can indeed be set up for the professional communities; the aforementioned Sydney Transport Data Centre-backed facility is only one example.

The limitations of the models used are now all too apparent when they are used outside their basic scope, and this places pressure on changing the models of governance within which such systems are used. Permitting wider participation and use requires both broader and better education and lower barriers to entry. Wider consultation and community engagement at a higher level requires both even lower barriers to entry (which open source developments can materially assist), and also changes in the mode of governance at the strategic planning stage at which they are used.

The changes in the consultation process that will follow as part of these developments will be constructive, and will permit a wider range of issues and emerging tools to be deployed earlier in their development, and more effectively in terms of working through the complex interrelated issues involved. Better understanding of the strengths and weaknesses of the tools can be achieved by making the basic data that drives them more widely and easily available, and in more readily understood forms. Actual use expands the range of options and the understanding of the implications, and open source lowers the barriers to access, use, and progressive development.

Together, these developments provide much room for opening up the modelling process in decision-making, but the issues raised require careful technical, systemic and field trial study, a program of work committed to by the authors of this paper.

CONCLUSION

Analytical models and data already have a basic role to play in planning. They are both necessary, and both need to be understood and appropriately employed to secure the assistance that they can offer in an increasingly complex planning environment. This potential applies to both improving the actual outcomes of planning policy through tapping into the analytic skills of the community, and improving the accountability of the strategic planning process. The trend towards modelling skills and understanding becoming a scarce commodity, and being narrowed down into skills for operating existing commercial packages, needs to be addressed. Unsurprisingly, with the current governance frameworks, the very real gains that models can offer are being undermined by this lack of transparency and understanding. Open source approaches have become very successful in breaking closed loops such as this and are now well trusted in many areas of IT, and it is time for a serious examination of how best to secure similar gains for all planning and transport stakeholders.

Software cannot do much on its own, but a global community that supports open source is a key feature for better, more responsive, as well as more widely understood analysis systems. Their integration into the governance of planning and transport offers a real opportunity to address some of the complexities of sustainability and overlapping specialist agendas by widening the potential for community engagement. This process would both support and be reinforced by changes to the governance processes for planning to support contestability, access and broader understanding.

It is time to design and test the forms of community engagement and consultation that this will enable. The present paper is the start of such a program of work, which will address trials of how the processes actually work, as well as the technical underpinnings to make the open source contributions more usable in various combinations – both are needed.

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