Participatory system dynamics modelling to support integrated transport decisions
Critical reflections and lessons

ALEX MACMILLAN
Senior Research Fellow
The Bartlett School of Graduate Studies, UCL
School of Population Health, University of Auckland
Theory and practice

Theory is when you know everything but nothing works.
Practice is when everything works but no one knows why.
In our lab, theory and practice are combined: nothing works and no one knows why.
Alistair Woodward, School of Population Health, UoA
Jennie Connor, Preventive & Social Medicine, Otago
Karen Witten, SHORE, Massey
Robin Kearns, School of Environment, UoA
David Rees, Synergia Ltd, Auckland
Decision-making for healthy, fair sustainable transport

1. Policy, community and academic knowledge
2. Participatory action research – collective learning
3. System understanding (complexity, uncertainty)
4. Quantifiable and non-quantifiable outcomes
5. Environmental sustainability and social equity

Participation in transport planning

- Too complex *Booth & Richardson 2001*
- Lack of skills *Sanchez & Wolf 2005*
- Sustainable transport “lacks publics” *Burby 2003*
- Focus on neighbourhood level change *Innes & Booher 2004*
- OR limited to post hoc consultation *Booth & Richardson 2001*
- Limited success with innovative methods *Lowry 2010*
Leaping off Arnstein’s ladder

1. Provision of information
2. Offering options, listening to feedback
3. Deciding together
4. Acting together
5. Supporting independent community initiatives

Intervening in the trip to work project
System dynamics (SD) modelling

1. Many interacting variables
2. Behaviour governed by structure
3. Feedbacks
4. Accumulation (stocks)
5. Time important
6. Endogeneity

Richardson 2011
Reflection v prediction

SD modelling as relativist, constructivist and holistic

Usefully reflective models rather than point prediction

Barlas 1996, Sterman 2000, Charmaz 2005
Places to intervene in a system

5. Numbers, constants and rates of flow

4. Feedback loops, time and information delays

3. The system rules

2. Capacity of actors to change and evolve

1. Paradigms and ideological constraints

Adapted from Donella Meadows 1997
Process

- Desired outcomes
- Problem identification
- Representation of system structure and behaviour
- Dynamic model
- Scenario experimentation
- Policy design

Adapted from Saeed 1992 System Dynamics Review
Participatory SD process

- Define communities of interest
- Identify and recruit the “right” stakeholders
- Elicit collective understanding of the “system”
- Triangulate collective theory with data and literature
- Simulation modelling
- Policy levers
- More simulation modelling
- Policy insights

Andersen 1997; Van den Belt 2004; Beall & Ford 2010
## Participants

<table>
<thead>
<tr>
<th>Groups represented</th>
<th>Participants representing each group</th>
</tr>
</thead>
<tbody>
<tr>
<td>People with disabilities</td>
<td>1</td>
</tr>
<tr>
<td>Māori communities</td>
<td>5</td>
</tr>
<tr>
<td>Pacific communities</td>
<td>3</td>
</tr>
<tr>
<td>Low income families</td>
<td>3</td>
</tr>
<tr>
<td>Young people</td>
<td>2</td>
</tr>
<tr>
<td>Regional transport policy makers</td>
<td>2</td>
</tr>
<tr>
<td>National transport agency</td>
<td>1</td>
</tr>
<tr>
<td>Public health</td>
<td>2</td>
</tr>
<tr>
<td>Local business association</td>
<td>1</td>
</tr>
<tr>
<td>Local tertiary institution</td>
<td>2</td>
</tr>
<tr>
<td>Local government</td>
<td>2</td>
</tr>
<tr>
<td>Regional government</td>
<td>2</td>
</tr>
<tr>
<td>Academics</td>
<td>3</td>
</tr>
</tbody>
</table>
Raerino K, Macmillan AK and Jones RG. Indigenous Māori perspectives on urban transport patterns linked to health and wellbeing. *Health & Place.* 2013; 23: 54-62
Then what happened when we tried to...

- Move from qualitative to simulation
- Shift from local to regional focus

In the context of...

- Significant governance upheaval
Cycle commuting simulation model
What did participation achieve in this project?

- Shaped included outcomes
- Germinated and governed new research
- Developed agreed collective causal theory linking transport, energy and wellbeing
- Divergent issues of interest: policy/academy/community
- Shared policy levers to increase cycling
SDM – how participatory?

- Developed in particular citizenship contexts
- Time consuming!
- Language and symbols OK
- Able to incorporate different knowledge
- Flexible to shifts in focus and participation
- Meaningfulness of regional transport policy
- Community familiarity with computer simulation
- Tensions of timing
- Assumptions of spatial homogeneity
Ingredients for success?

1. Policy champions/embedded in government
2. Active participation of policy makers
3. Stable governance (huh!)
4. 2 steps forward, 1 back
5. Flexibility of process and involvement
6. Facilitated practice sessions for participants ++
7. Being prepared to listen to and fund new questions
8. Introducing small simulations early


