Modelling everyday pro-environmental behaviour

Scenario studies using agent-based models

Gary Polhill and Tony Craig
The James Hutton Institute, Craigiebuckler, Aberdeen, AB15 8QH, Scotland UK
Email: gary.polhill@hutton.ac.uk

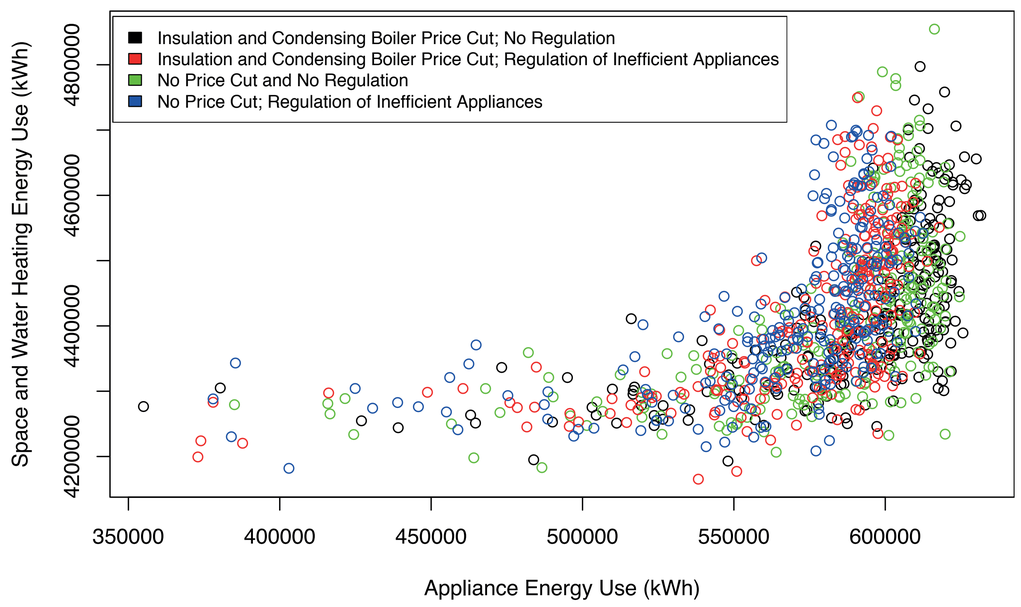
The James Hutton Institute

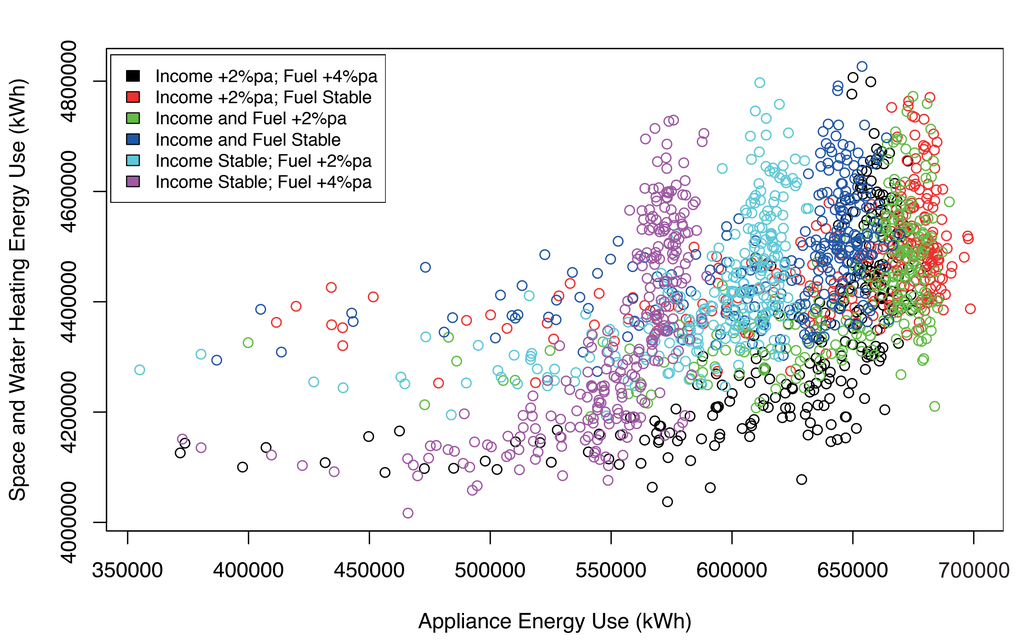
Agent based modelling

Traditional approaches to computer simulation have been based on finding solutions to equations with variables operating at the population level. Recent thinking has recognised that societies are complex systems: observations of population-level variables are emergent outcomes of the interactions of heterogeneous individuals. Agent-based models inherit from complex systems thinking. They are computer simulations in which different individuals (humans, households, firms, animals) and their interactions are explicitly represented. They can be used to explore scenarios.

Simulating energy demand in the home to 2050

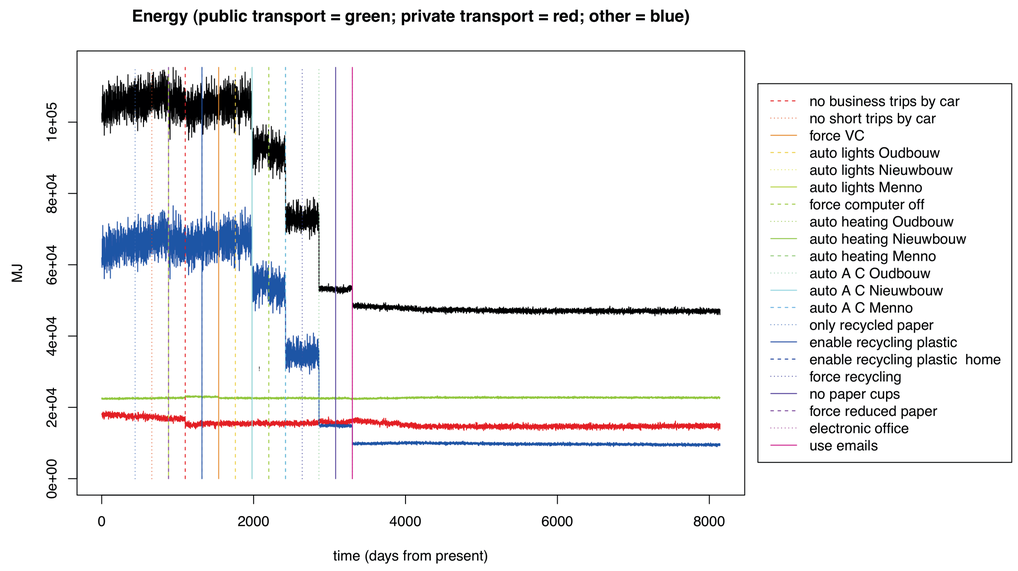
We simulated changes to energy demand in the home through to 2050. Stakeholder input, a survey of households, and publicly available data sources were used to design and calibrate the model. In the model, households visit each other and this influences both how they will decide to buy appliances, and which appliances they will buy. We combined six scenarios of income and fuel price increase with four policy interventions to incentivize home energy efficiency. Policy interventions have an effect on energy use in 2050 (top graph), but fuel and income price change are bigger drivers (bottom graph).





Exploring back-casting scenarios in the workplace

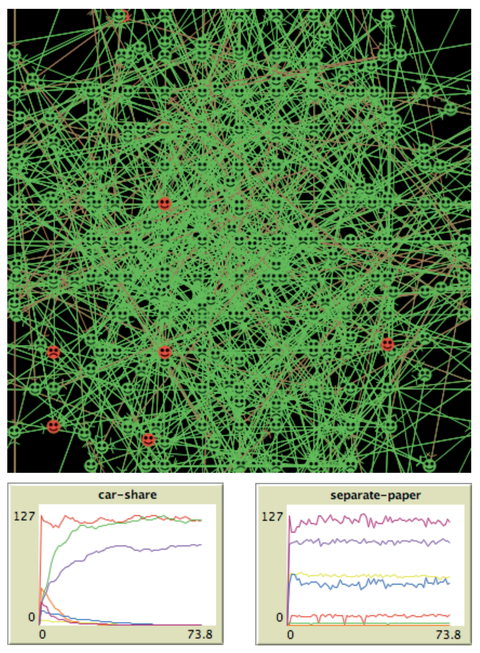
Back-casting starts with a desired vision for the long-term future, and then develops pathways to get there. Qualitative descriptions from back-casting scenarios can be interpreted into formal representations in a model, and these then used to evaluate the scenario using the simulation.



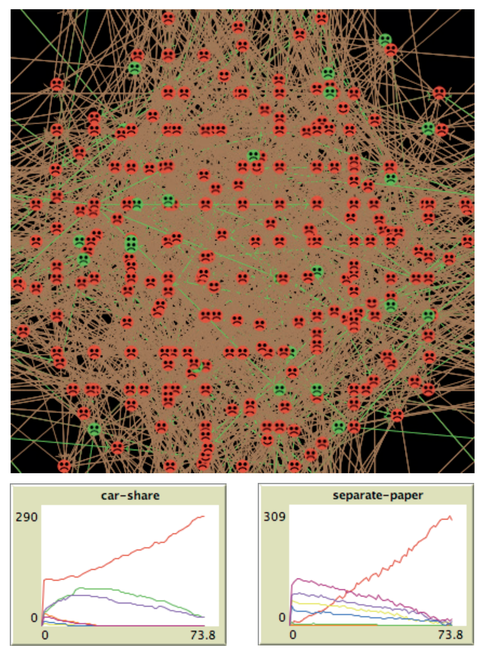
Year	Change
2	Only recycled paper is available in printing devices
3	Cars are not available for short business trips (<5km)
4	Automatic lighting is installed in the Menno building
4	Double-sided printing and other paper reduction methods are enforced
5	Cars are not available for any business trips
6	Automatic lighting is installed in the Nieuwbouw building
6	Recycling of plastics is enabled at home and work
7	Meetings must be conducted using video-conferencing
8	Automatic lighting is installed in the Oudbouw building
9	Climate control is installed in Nieuwbouw
10	Switching computers off when leaving work is enforced
11	Climate control is installed in Menno
12	Recycling of paper and plastics at work is enforced
13	Climate control is installed in Oudbouw
14	Paper cups are not available in vending machines and other drink-making facilities
15	Electronic office: no printing of emails; exclusive use of on-line procedures.

Modelling the socio-environmental dynamics of time pressure

There are known links between time pressure and behaviour. Besides the observation that individuals under stress are less likely to make rational decisions, a commonly-given reason for failing to perform everyday pro-environmental behaviours is a perception that the time cost cannot be afforded. Time pressure has social dynamics in its association with status, and in the interaction effects living or working with someone under time pressure can have on your own ability to manage time.



k = 5 (sparser connections): higher frequency of the most pro-environmental response (purple line)



k = 10 (denser connections): higher frequency of most non-environmental response (red line)

The James Hutton Institute SRUC

This research is part of a programme being undertaken by SRUC and the James Hutton Institute.
For further information please contact:
Gary Polhill: gary.polhill@hutton.ac.uk
Tony Craig: tony.craig@hutton.ac.uk

Strategic Programme

This research is funded by Scottish Government's Rural and Environment Science and Analytical Services Division (RESAS) under Theme 4 'Economic Adaptation' of the Environmental Change Programme (2011-2016), and by the European Commission FP7 grant agreement numbers 225383, 265155 and 613420.