

# **The Social Complexity of Immigration and Diversity (SCID)**

## ***Partners***

SCID is composed of three teams, two from the University of Manchester – the Institute for Social Change (ISC) and the Theoretical Physics Group (TPG) – and one from the Manchester Metropolitan University – the Centre for Policy Modelling (CPM).

### ***The Institute for Social Change (ISC), University of Manchester***

Part of the group ranked joint first for sociological research in the 2008 RAE, the ISC is an interdisciplinary social science research centre that conducts empirical research into the causes and consequences of social change in the areas of inequality, immigration, religion, the workplace and political and civic engagement. Recent ISC work has shown the influence of ethnic diversity on electoral participation (Fieldhouse & Cutts, 2008), the extent of ethnic inequalities in education, employment and earnings (Li, Devine & Heath 2008), and the socio-economic position and political support of Black and Minority Ethnic populations in Britain between 1971 and 2004 (Li & Heath, 2008). PI Nick Crossley is a Professor of Sociology in the school of social sciences and is affiliated with ISC. He conducts work on the use of complexity science in sociology (Crossley, 2008). ISC also develops methods for the use and analysis of social science data (Fieldhouse, Shryane & Pickles, 2007). ISC researchers have expertise spanning sociology, political science, human geography and psychology. ISC research has had substantial exposure in government and policy circles, for example the National Employment Panel, the Cabinet Office and the Department of Communities and Local Government.

PI Professor Fieldhouse has considerable experience of management of large scale university and grant funded research projects. He is director of the ISC, which currently employs 11 professorial and full-time research staff, and was previously director of the Centre for Census and Survey Research, leading 25 research staff. He is executive director of 'Social Change, a Harvard-Manchester Initiative', a five year, high profile collaboration with Harvard University and Professor Robert Putnam, arguably the world's most influential social scientist. ISC and SCHMI represent a combined expenditure of more than £8 million over 5 years. He is also director and PI of the ESRC Census program-funded support team for the Samples of Anonymised Records (SARs), worth approximately £1 million over 5 years and employing 5 staff, and has held dozens of research grants and consultancy projects over the last fifteen years. The researcher co-investigator (Shryane) is assistant director of ISC and was one of the lead authors of the bid. He has significant interdisciplinary experience (see CV) and, through his active participation in the weekly Manchester Complexity Group meetings since 2008, represents a crucial link between the social and complexity science parts of the collaboration.

### ***The Centre for Policy Modelling (CPM), Manchester Metropolitan University***

The CPM (cfpm.org) is a research-only unit of the MMU Business School that has focussed on complexity science and social simulation since 1992. The CPM has recently been partners in the following relevant projects. NANIA (Novel Approaches to Networks of Interacting Autonomes) an EPSRC project funded under its "Novel Computation" initiative, 2005-2009, during which the collaboration between the TPG, the CPM and ISC was developed. This explored the techniques and methods of agent- and individual-based simulation modelling across a number of sciences. EMIL (Emergence In the Loop: simulating the two way dynamics of norm innovation) an EU FP6 project, under its Future Emergent Technologies initiative, five EU partners, 2006-2009, is using agent-based simulation to understand how new social conventions and norms emerge and spread in these systems. Previous CPM projects have included the EU CAVES (Complexity, Agents, Volatility, Evidence and Scale) project (which the CPM led) which developed the use of descriptive simulation to capture aspects of social networks and social change in three different detailed case studies; the EU FIRMA project which used agent-based simulations to model social issues around the management of common water resources; and the EPSRC-funded IMIS (Intelligent Management Integrated System) project.

Bruce Edmonds, a Col of SCID, is the Director of the Centre for Policy Modelling (CPM), Scientific Chair of the 6th European Social Simulation Association Conference to be held in 2009, and currently editing a 1000-page Handbook on "Simulating Social Complexity" for Springer. He is led the modelling work package of FIRMA and is leading the final summative theory workpackage of EMIL. He has developed many new social simulation techniques (e.g. Edmonds, Norling & Hales, 2009), championed the descriptive modelling approach (Edmonds & Moss, 2005) and the methodology of social simulation, included the method of cross-validation (Moss & Edmonds, 2005). The named CPM RA, Ruth Meyer, was the key modeller in CAVES (Alam, Meyer, Ziervogel & Moss, 2007) and her previous modelling the geographical routes of couriers (Hilty, Meyer, & Ruddy, 2001).

Together they have unique expertise in social simulation, in particular in the building of the descriptive simulations that will link the models of complexity science to the issues and evidence from the social sciences.

### ***The Theoretical Physics Group (TPG), University of Manchester***

Alan McKane leads the complexity science initiative of the TPG. He has been working on the theory of complex systems for over ten years, principally applying the ideas and techniques of statistical physics to problems in the physical, biological and social sciences. He was part of the EPSRC 'NANIA' project (see above), which developed ways of relating models at different levels of abstraction. He has also been the co-organiser of two EPSRC Summer Schools on Complexity as well as many shorter meetings and lecture courses on the subject. His research has involved many aspects of complexity theory. He suggested the use of co-evolving networks, which was used originally to model food webs (Drossel, Higgs & McKane, 2001) but is now being adopted by other researchers in other fields. An example of interdisciplinary work carried out in the social sciences is a collaboration that formalised a descriptive theory of the evolution of language (Baxter et al, 2006; Baxter et al, in press). Using both analytical techniques and numerical simulations the nature of the model was explored for a range of parameter values. This model also turns out to be a model of opinion dynamics: individuals in a social network are influenced by those with whom they interact to change or modify their opinions. McKane and co-workers have recently obtained a very general result about the time taken for a community to reach consensus in an arbitrary network. For an opinion dynamics which is neutral, that is, all individuals have the same degree of influence this time is essentially network independent (Baxter et al, 2008). He is now examining the effects of including individuals who have more influence than others.

### ***References***

- Alam, S.J., Meyer, R., Ziervogel, G. and Moss, S. (2007). The Impact of HIV/AIDS in the Context of Socioeconomic Stressors: an Evidence-Driven Approach. *J. of Artificial Societies and Social Simulation* 10(4):7.
- Baxter, G.J., R.A. Blythe and A.J. McKane, (2008) Fixation and consensus times on a network: a unified approach. *Phys. Rev. Lett.* 101, 258701:1-4.
- Baxter, G J., R.A. Blythe, W.Croft and A.J. McKane, (2006) Utterance selection model of language change. *Phys. Rev. E* 73, 046118:1-20.
- Baxter, G.J., R.A. Blythe, W. Croft and A.J. McKane, (in press) Modeling language change: An evaluation of Trudgill's theory of the emergence of New Zealand English. *Language Variation and Change*.
- Crossley, N. (2008). Small-world networks, complex systems and sociology. *Sociology*, 42(2), 261.
- Drossel, B., P.G. Higgs and A.J. McKane, (2001) The influence of predator-prey population dynamics on the long-term evolution of food web structure, *J. Theor. Biol.* 208, 91-107.
- Edmonds, B. (2001) The Use of Models - making MABS actually work. In: Moss, S. and Davidsson, P. (eds.), *Multi Agent Based Simulation*, Springer, 15-32
- Edmonds, B. and Hales, D. (2005) Computational Simulation as Theoretical Experiment, *Journal of Mathematical Sociology* 29(3):209-232.
- Edmonds, B. and Moss, S. (2005) From KISS to KIDS – an 'anti-simplistic' modelling approach. In P. Davidsson et al. (Eds.): *Multi Agent Based Simulation*. Springer, 130–144.
- Edmonds, B., Norling, E. and Hales, D. (2009) Towards the Emergence of Social Structure. *Computational and Mathematical Organization Theory*, 15(2):78–94.
- Fieldhouse, E., & Cutts, D. (2008). Diversity, density and turnout: The effect of neighbourhood ethno-religious composition on voter turnout in Britain. *Pol. Geog.*, 27(5), 530-548.
- Fieldhouse, E., Shryane, N., & Pickles, A. (2007). Strategic voting and constituency context: Modelling party preference and vote in multiparty elections. *Pol. Geog.*, 26(2), 159-178.
- Hilty, L.M., R. Meyer, T.F. Ruddy (2001): A General Modelling and Simulation System for Sustainability Impact Assessment in the Field of Traffic and Logistics. In: C. Rautenstrauch, S. Patig (eds.), *Environmental Information Systems in Industry and Public Administration*, Hershey, London.
- Li, Y., & Heath, A. (2008). Minority ethnic men in British labour market (1972-2005). *Int. J. Sociology and Social Pol.*, 28(5-6), 231-244.
- Li, Y., Devine, F. and Heath, A. (2008) Equality group inequalities in education, employment and earnings: A research review and analysis of trends over time. Report for The Equality and Human Rights Commission.
- Moss, S. and Edmonds, B. (2005) Sociology and Simulation: - Statistical and Qualitative Cross-Validation, *American Journal of Sociology*, 110(4) 1095-1131.