Visualising Option landscapes

External Client & Supervisor: Lorraine Dodd, Centre for Applied Systems Studies, Director of Research, Defence Academy of UK, Shrivenham.

Warwick Supervisor :   Yasmin Merali, Warwick Business School

Agent-based simulation models have been developed over the years to address dynamics of agent behaviours, actions and interactions. The dynamic displays for these simulations tend to be based on geographical landscapes showing agents' movements in physical settings. However, there is currently a shift in focus onto simulation and visualisation of the underlying, complex inter-relationships between causes and perceptual (even emotional) effects of agent behaviours. More importantly, this includes explicitly modelling the conditions that might be shaping the perceptions, actions and the nature of the choices open to the decision-takers.

The project aims to design prototype visualisations that will allow analysts to see option-based landscapes, which will have contours and spot heights to represent effects of beliefs, perceptions and preferences. The visualisations will show when, for example, agents may be being behaviourally 'backed into a corner' or when agents may be being presented with new lines of perspective that could encourage adoption of extreme options for action.

The project would involve the following:

- Review agent-based simulation literature to ascertain if there are any existing visualisations of option-based landscapes.
- Research and assess available visualisation tools and software and recommend useful tools for visualisation of agent options.
- Design and outline initial prototype landscapes. (These could be simple
- Populate the set of landscapes with stakeholder positions relating to their perceptions and their beliefs; also show how to plot possible pathways relating to their values, desires, needs or assumed intents.
- Work with research staff to establish candidate set of visualisations for options landscapes showing potential for regulatory measures; useful for example for addressing questions of financial regulation.

This work will build on existing research on decision-agent option-spaces [1], [2] and also research in collaboration with Prof J Q Smith of Warwick Statistics Dept [3]. This work has recently been set against scenarios of financial regulation and high frequency algorithmic trading, but the options landscapes could be based on any set of agent-based decision options for action.

[1] L Dodd, *Neuro-physiological analogies for military Command and Control: an insight into the processes of situation assessment and course of action selection.* ICCRTS Stockholm. September 1998.

[2] L Dodd, J Moffat and S B Richardson**,** *Defining New Landscapes for Control and Influence to Determine the Value of Information*, 19 ISMOR, Eynsham Hall, Oxford, UK, August 2002.

[3] L Dodd, J Moffat, J Q Smith, *Discontinuity in decision-making when objectives conflict,* Journal of Operational Research Society **57** pp 643-654, 2006.