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Agent-Oriented Modelling and Simulation of Human Centric Systems

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There has been some debate about the place of Agent-Based Modelling and Simulation (ABM/S) in OR (Siebers et al 2010; Brailsford 2012). To date most simulation models are still Discrete Event Simulation (DES) or System Dynamics Simulation models. On reason for this is perhaps that the focus in OR simulation is still on processes rather than services - partly because our toolbox is limited. If we want to focus on individuals within a process we currently don't have the right modelling tools at hand as equation based modelling commonly used for individual based modelling in other fields (e.g. social simulation) does not mix well with the graphical flow chart notation we use for DES modelling.

In Software Engineering we have the Unified Modelling Language (UML) for analysing requirements and designing software. UML consists of 26 different types of diagrams which have the capacity of modelling process flows (e.g. activity diagrams) as well as individual object behaviour (e.g. state machine diagrams) and interactions between individual objects (e.g. sequence diagrams).

Using these kinds of diagrams allows us to model human centric service systems where processes are as important as the behaviour/interaction of individuals. We can use these tools to design "Agent-Oriented Discrete Event Simulation" models. At the core we have a DES framework (basically a queuing system). Then we use active objects instead of passive entities usually used in DES in order to represent the activities of individuals. These active entities (agents) are autonomous, make their own decisions, have a memory, and can interact with other agents.

In my talk I will introduce Agent-Based Modelling and Simulation and show how such agents can be integrated into a DES framework. I will provide some examples of ABM and hybrid ABM/DES models to demonstrate the applicability of such models to OR.

References
- Siebers PO, Macal CM, Garnett J, Buxton D and Pidd M (2010) 'Discrete-Event Simulation is Dead, Long Live Agent-Based Simulation!'. Journal of Simulation, 4(3) pp. 204-210.
- Brailsford S (2012) 'Discrete-Event Simulation is Alive and Kicking!' In: Proceedings of the UK OR Society Simulation Workshop 2012 (SW12), 26-28 Mar, Worcestershire, UK.