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Prepared for Lorentz Center Workshop "Integrating Qualitative and Quantitative Evidence Using Social Simulation"

8-12 Apr 2019, Lorentz Center@Snellius, Leiden, The Netherlands

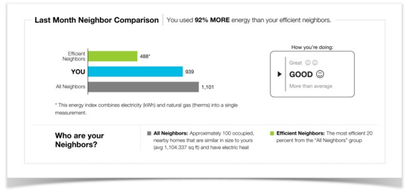
ima Intelligent Modelling & Analysis

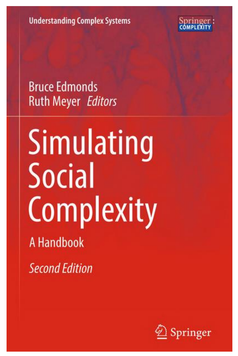
Knowledge Gathering

- Focus groups:
  - Facilitator from
    - Computer Science
  - Participants consisted of a mixture of academics and researchers from
    - Computer Science
    - Business Management
    - Psychology
  - We did not engage with business partners
  - Five core members that would participate regularly in the focus groups

Case Study

- Studying the impact of normative comparison amongst colleagues with regards to energy consumption in an office environment





For more information see: Siebers PO and Klügl F (2017) 'What Software Engineering has to offer to Agent-Based Social Simulation'. In: Edmonds B and Meyer R (Eds). Simulating Social Complexity: A Handbook - 2e

Analyse Problem

- Aim
  - Study normative comparison in an office environment
- Objectives
  - Answer the following questions:
    - What are the effects of having the community influencing the individual?
    - What is the extent of impact (significant or not)?
    - Can we optimise it using certain interventions?
- Hypotheses
  - Peer pressure leads to greener behaviour
  - Peer pressure has a positive effect on energy saving
- Experimental factors
  - Initial population composition (categorised by greenness of behaviour)
  - Level of peer pressure ("individual apportionment" vs. "group apportionment")
- Responses
  - Actual population composition (capturing changes in greenness of behaviour)
  - Energy consumption (of individuals and at average)

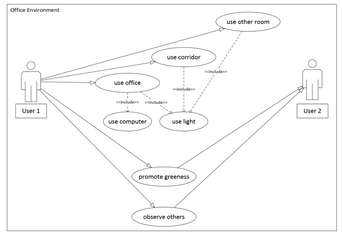
Define Scope

- Scope
  - After some discussions within the focus group we decided that "transparency" would be the key driver for our decision making and that we want to abstract/simplify as much as possible while still keeping a realistic model
  - In order to have easy access to data we decided to use our own offices as the data source

Category		Element	Decision	Justification
Actor		Staff	Include as group (User)	Regularly occupy the office building
		Research fellows		
		PhD students		
		UG+MSc students	Exclude	Do not have control over their work environment
		Visitors	Exclude	Insignificant energy use
Physical Environment	Appliance	HVAC (Heating + Ventilation + Aircon) system	Exclude	We only need one major energy consumer to test the theory; we decided to go for electricity
		Lighting	Include	Interacts with users on a daily basis; controlled by user
		Computer	Include	Interacts with users on a daily basis; controlled by user
		Monitor	Exclude	Modelled as part of the computer
		Continuously running appliances	Exclude	Constant consumption of electricity; not controllable by individuals
		Personal appliances	Exclude	No way to measure consumption
	Weather	Temperature	Exclude	Not necessary for proof-of-principle
		Natural light level	Exclude	Not necessary for proof-of-principle
	Room	Office	Include	Location where electronic appliances are installed
		Lab	Exclude	Mainly used by UG+MSc
		Kitchen	Include as group (Other Room)	Common areas frequently used by "users"
		Toilet		
		Corridor	Include	Commonly used when "users" move around
Social / Psychological Aspect		Comparative feedback	Include	Effective strategy to reduce energy consumption in residential building
		Informative feedback	Include	Effective strategy to remove barriers in performing specific behaviour
		Apportionment level	Include	Potential strategy to reduce energy consumption in office building
		Freeriding	Include	Behaviour that differentiate two apportionment strategy
		Sanction	Include	Factor to encounter freeriding behaviour
		Anonymity	Include	Factor to encounter freeriding behaviour

Define Key Activities

- System boundaries
  - Building boundaries of the office environment



Define Archetype Stencils

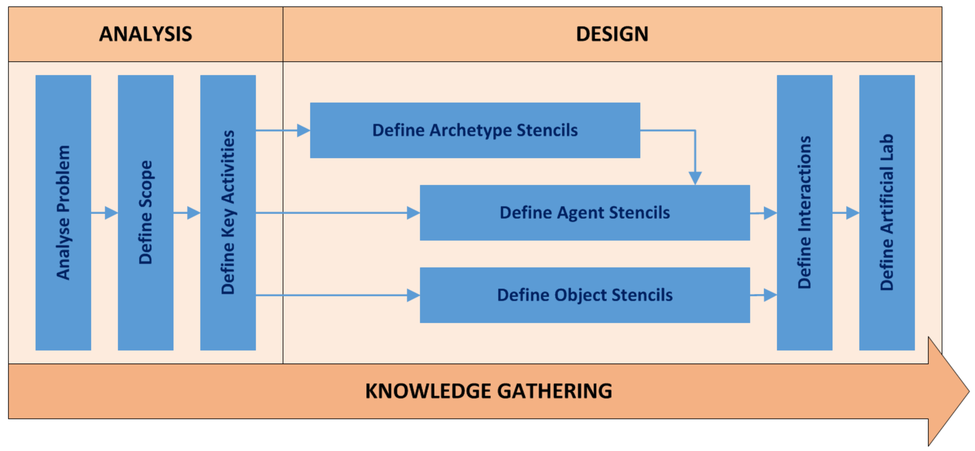
- We identified two categories
  - Habits for work time
    - Arrival time at office
    - Leaving time from office
  - Habits for Energy Saving Awareness
    - Energy saving awareness
    - Likelihood of switching off unused electric appliances
    - Likelihood of promoting greenness
- A survey was conducted asking our research group members

Archetype	Working days	Arrival time	Leave time
Early bird	Mon-Fri	5am-9am	4pm-7pm
Time table complier	Mon-Fri	9am-10am	5pm-6pm
Flexible worker	Mon-Fri	10am-1pm	5pm-11pm
Hardcore worker	Mon-Fri + Sat	8am-10am	5pm-11pm

Archetype	Energy saving awareness [0-100]	Probability of switching off unnecessary appliances	Probability of sending emails about energy issues to others
Environmental champion	95-100	0.95	0.9
Energy saver	70-94	0.7	0.6
Regular user	30-69	0.4	0.2
Big user	0-29	0.2	0.05

Agents to the Rescue: Creating Artificial Labs for Evaluating Human-Centric and Coupled Human-Natural Systems

Peer-Olaf Siebers : School of Computer Science : Nottingham University : peer-olaf.siebers@nottingham.ac.uk



Anecdotal evidence suggests that the Agent-Based Social Simulation community suffers from a lack of structured and standardised ways for model development. For multi-disciplinary projects with academic and non academic collaborators this issue becomes even more evident.

We have created a model development strategy that employs the Engineering Agent Based Social Simulation framework (or EABSS for short). It is grounded on the concept of co-creation and ideas from Software Engineering. We drive the qualitative information gathering process through focus groups, using predefined table templates and the Unified Modelling Language (UML) as main forms of stimulating and documenting the contributions of all participants.

The strategy has been used for two purposes: for collaborative model development and to stimulate and formally support discussions. We have tested the framework in several domains, including Architecture, Geography, Organisational Behavior, and Mental Health.

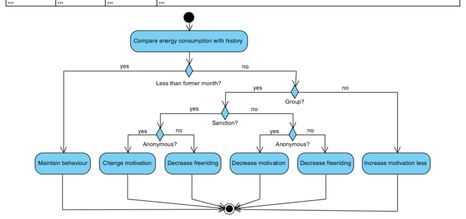
While we understand the model development process very well, we often struggle when it comes to working out how to embed relevant qualitative and quantitative evidence into our models. It is easy said on a high level what is relevant (e.g. by referring to a well-established theory), but how to add it practically, is often difficult to work out.

We would like to use the workshop to come up with a strategic extension that can guide the users of the framework with embedding qualitative and quantitative evidence into the models they develop.

How to embed qualitative and quantitative evidence?

Define Agent/Object Stencils

from state	To state	Triggered by	When?
outOfOffice	inCorridor	Condition	At typical arrival time during the working week for all
outOfOffice	inCorridor	Condition	At typical arrival time on Saturdays for hard-core workers only
inCorridor	outOfOffice	Condition	At typical leave time
inCorridor	inOffice	Timeout	At average after 5 minutes
inOffice	inCorridor	Condition	At random while at work or when leaving
inCorridor	otherRoom	Condition	At random while at work
otherRoom	inCorridor	Timeout	At average after 10 minutes
...	...	...	...

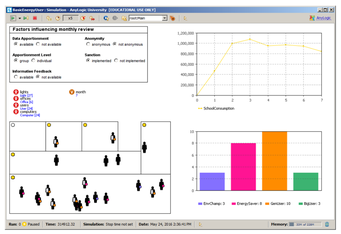


Define Interactions

Define Artificial Lab

- We need to consider things like:
  - Global variables
    - e.g. to collect statistics
  - Compound variables
    - e.g. to store a collection of agents and objects
  - Global functions
    - e.g. to read/write to a file

Implement the Model



Experiment with the Model