First Steps Towards RAT

A Protocol for Documenting Data Use in the Agent-Based Modelling Process

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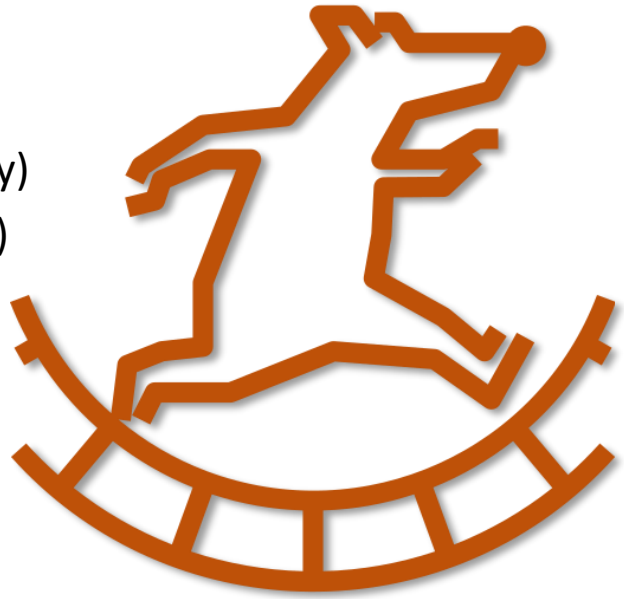

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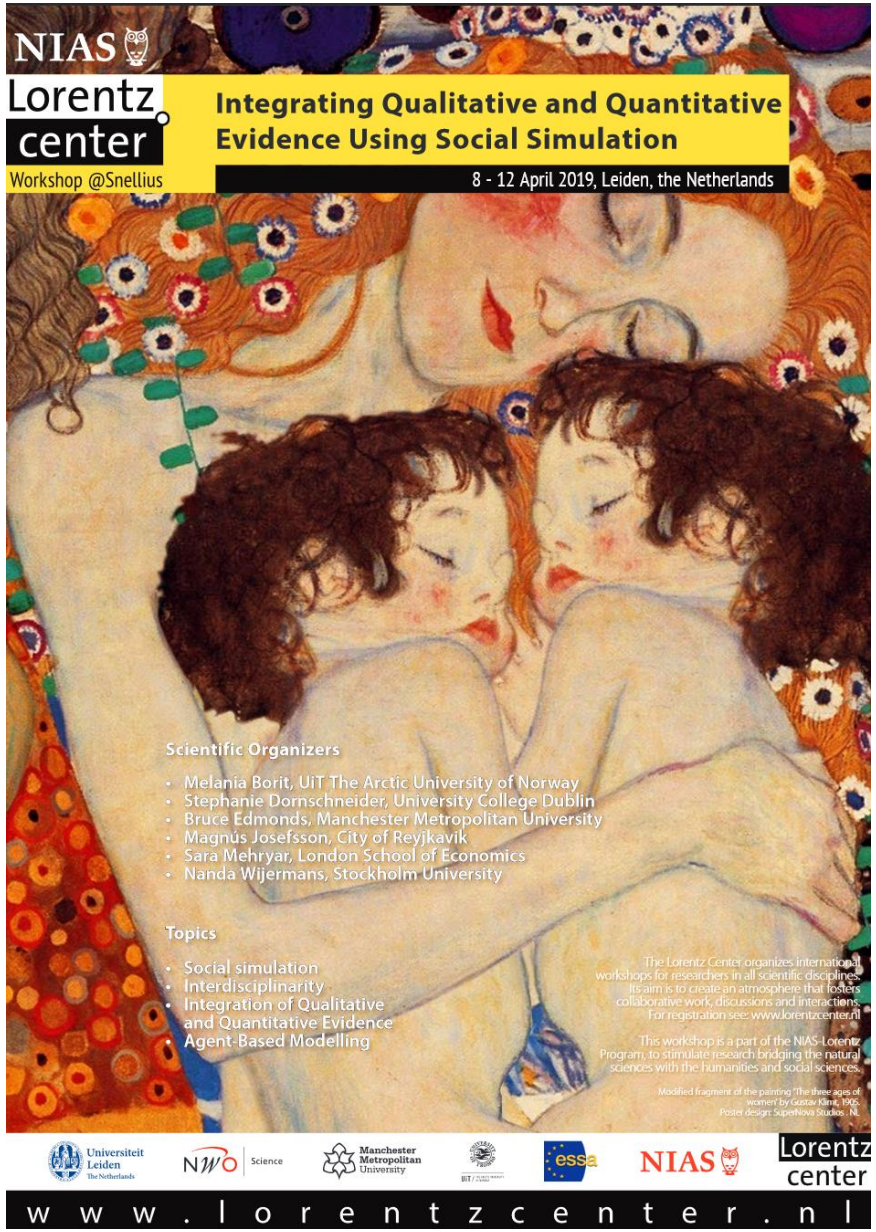

About us

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Motivation

- A big problem in ABM is **rigorous** and **transparent** use of **data**
  - Qualitative and quantitative data

- We need help to **understand** and perhaps **replicate** models

- We need a **structured approach**
  - Needs to be "as straight forward as possible"
  - Needs to be "domain independent"
  - People need to see it as a useful asset, not a burden

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What is already out there

- ODD [Grimm et al 2006, 2010]
  - Provide a standard format for describing individual-based and agent-based models
  - Aims to improve reproducibility

Overview	Purpose
	Entities, state variables, and scales
	Process overview and scheduling
Design concepts	Design concepts
Details	Initialisation
	Input data
	Submodels

After Grimm et al (2010)

  - Some shortcomings (for our purposes)
    - Domain specific (originally developed for ecological modelling)
    - Does not support capturing the human decision making process very well
    - Does not consider the use of qualitative and quantitative data rigorously

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What is already out there

- ODD+D [Müller et al 2013]
  - Supporting documentation about human decision making processes by adapting "Implementation Details" block in ODD+D

- ODD+2D [Laatabi et al 2018]
  - Supports consideration of empirical data by extending "Input Data" block in ODD+D

- ODD+P [Reinhardt et al 2018]
  - Complements the ODD protocol with provenance information (i.e. how the model has been generated)

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What is already out there

- DOE Process Framework [Lorscheid et al 2012]
  - Increases transparency and effective communication through systematic design of experiments
- EABSS Framework [Siebers and Klügl 2017]
  - Co-creation ABSS framework that uses software engineering methods and tools to guide participants through the model development process
- …

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The Gap

- Non of the existing frameworks/protocols …
  - … does provoke a deeper confrontation why the data is used
  - … does provoke a deeper confrontation why certain data is not used
  - … is generally applicable but specific in the requested information
- Focus is on products and processes rather than on data!

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Our Methodology

- General questions of interest we started with
  - Can we learn from other protocols/domains how to report data use?
  - Is there a need to distinguish modelling types?
  - Are there specific reporting requirements at different stages?

- General research approach
  - Defining categories (modelling types / modelling stages)
  - Deriving and fine-tuning a protocol by working through examples for each of the modelling types identified
  - Stimulating debate and inviting the community to test the protocol

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Our Goal

- RAT Framework = f(RAT Roadmap, RAT Protocol)

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Road map draft

Types (Branches) / Stages (Modules)	Theory driven	Data driven - Qualitative - Quantitative	Participatory	Model driven	?
Start					
Conceptualisation					
Dataring					
Building model (physically)					
Experimental design					
Outputs					

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RAT Roadmap (Theory-Driven Branch)

1. Start

- 1.1 Formulate research question
- 1.2 Choose domain/topic area
- 1.3 Choose model type
  - …
  - 1.3.1 Theory driven

2. Conceptualisation

- 2.1 Mapping of theory elements to model elements
- 2.2 Include, exclude, change

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RAT Roadmap (Theory-Driven Branch)

3. Dataring*1

3.1 Support model elements with data

4. Building the model physically

Use subset of ODD with its extensions

*1 Comprehensive consideration of the use of qualitative and quantitative data in an ABM (subsuming conceptualisation, calibration, and validation); a systematic account of the relationship between model elements and data

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RAT Roadmap (Theory-Driven Branch)

5. Experimental design

Use subset of DOE protocol

6. Output

6.1 Data that can be captured as outputs

6.2 Which of these are going to be used

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RAT Protocol (Theory-Driven Branch)

Example: Shopping behaviour using rational choice

3. DATARING

Q3.1: What data type (qualitative or quantitative) have you considered to support each model element? Be explicit about data types that were left out. Information exchange (who talks to who) = qualitative. Information exchange (number of retweets) = quantitative > left out, as modeller does not know how to collect these data. Price = quantitative.

Q3.2: Have you used existing data? If no, why not? If yes, which data sources have you used? Specify sampling strategy and sample size or give source/reference. Prices > yes [UK consumer data]. Information exchange (who talks to who) > no [does not exist]

Q3.3: If data did not exist or you chose not to use existing data, how did you collect data? Specify sampling strategy and sampling size. Information exchange (who talks to who) = semi-structured interviews > volunteer sampling of participants > sample size = 20.

…

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Next steps

- Social Simulation Conference (SSC2019)
  - Working through information gathered at round table / poster exhibition
  - Inviting participants for testing the framework

- Lorentz Workshop follow-up meeting on 21+22 November in Manchester

- Test the RAT framework
- Publish the RAT framework

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