
Games, Computational Simulations, and Philosophy of Science

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Outline

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- Motivation**
- Computational Modelling and Game Theory**
- Representation**
- Standard View**
- Should Game Theorists care about Representation?**
- Credible Worlds?**
- Social Mechanisms**
- Idealisation**
- Similarity I**
- Similarity II**
- For Simplicity**
- References**

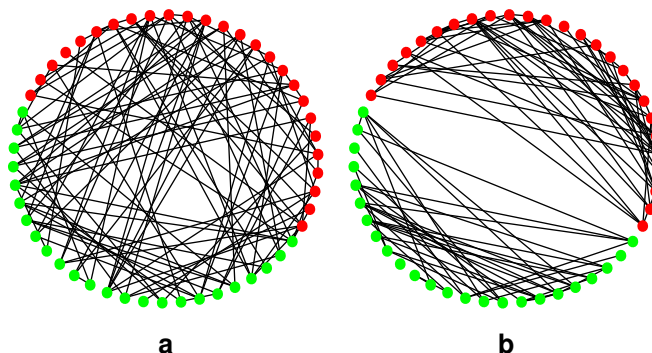
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Motivation

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- I use computational models (in particular agent-based) to model social phenomena
- Example: Cooperation on dynamic networks



- Building computational models is fun (computers! graphics!! colour!!!), but is it useful?
- What are the philosophy of science foundations for computational models in the social sciences?

Computational Modelling and Game Theory

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... game theory is not simply a matter of abstract mathematics but concerns *the real world*.

[Rubinstein(1991)]

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... game theory is not simply a matter of abstract mathematics but concerns *the real world*.

[Rubinstein(1991)]

- Game theory provides components and language to build models in the social sciences
- Computational simulations to analyse *complex* interactions between several agents — where purely analytical approaches fail
- Complex: Repeated, distributed information, diversity of roles, multiple levels, non-random mixing, spatial restrictions, stochastic elements, path dependencies, ...
- Computational modelling and (arguably) game theory face the problem of representation

Representation

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But in virtue of what is a model a representation of something else?

[Frigg(2006)]

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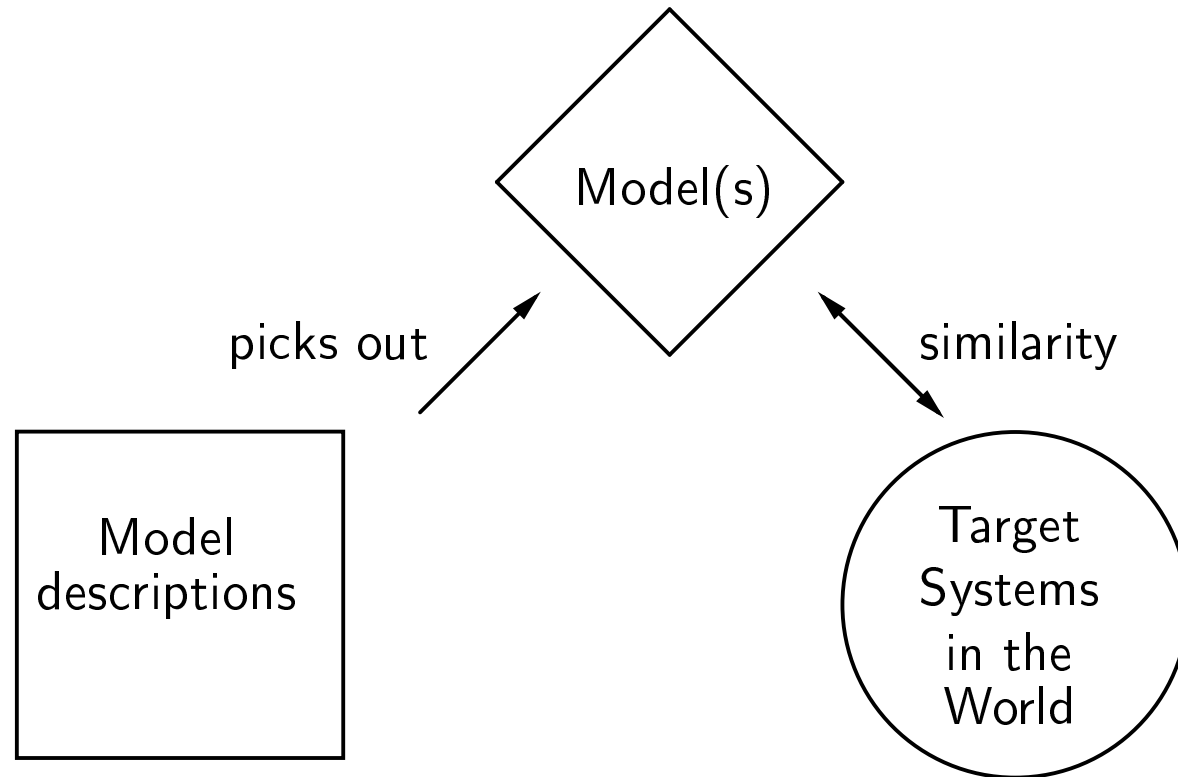
[Frigg(2006)]

Reasons why models in the social sciences are unlikely to be close representations of reality:

- unobservables
- lack of available data
- experiments difficult or impossible
- human decision making not well understood
- complexity of social systems
- hard to identify specific processes and treat them separately

The Standard View of Representation

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[Weisberg(2003)]

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- Does game theory produce models, i. e. representations of target systems?
 - Yes: Games are supposed to capture properties of real world interactions
 - No: Game theory proper aims for theorems, not models

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- Does game theory produce models, i. e. representations of target systems?
 - Yes: Games are supposed to capture properties of real world interactions
 - No: Game theory proper aims for theorems, not models
- A difference between theoretical and applied game theory?
- A game *can* be used to represent target systems, but a game theorist may take the stance that similarity does not matter for analytical theory
- Would game theory be interesting without an argument that its notion of rationality is similar to the concept of rationality in the real world?

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What is the similarity relation between an abstract model and a concrete social process?

- Models describe credible worlds [Sugden(2000)]
- Researchers want their model to be credible in the same way as «literary fiction» is credible [Godfrey-Smith(2006)]

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What is the similarity relation between an abstract model and a concrete social process?

- Models describe credible worlds [Sugden(2000)]
- Researchers want their model to be credible in the same way as «literary fiction» is credible [Godfrey-Smith(2006)]
- Fiction: Credible because of details
- Computational or game theoretical model: Credible because of the *lack of details*
- Wanted: A better account of representation!

Social Mechanisms

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- Computational models to analyse *social mechanisms*
- A social mechanism gives a plausible account for a causal story between inputs and an output
- The causal story usually refers to a lower level of aggregation
- “Open the Black Box”
- Social mechanisms as *ceteris paribus* explanations
- Models allow for counterfactual control of environment

- To identify social mechanisms:
 - **Isolation:** The modeller picks out specific kinds of entities and their causal relations, and omits all other aspects of reality, to analyse the uninterfered and uninhibited effects of the hypothesised social mechanisms at interest.
 - **Generalisation:** The modeller assigns simplified quantitative and structural properties to the components of the model in order to represent a larger class of specific entities in the target system.

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All models are false but some models are useful.
(George Box, statistician)

- Idealisations lie: Omission, misrepresentation, etc.
- Lies are useful to isolate social mechanisms
- How are highly idealised models similar to their target system?
- They *instantiate similar properties* with regard to a specific domain of interest
- Example: Schelling's segregation model: We do not live in checkerboard cities, but Schelling's checkerboard cities have some structural properties similar to real cities.

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Example: Brian Skyrms's [Skyrms(2004)] stag hunt:

“Once you have formed this abstract representation of the stag hunt game, you can see stag hunts in many places.”
(p. 2)

- The stag hunt is a model of real interactions
- The stag hunt is a highly idealised model
- How do we recognise stag hunts in reality? (We hardly see game forms in real life...)
- We see instantiations of structural properties similar to the stag hunt game

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- Temptation to add details to models
- More details — more similarity to target system?
- Trade-off: Given a set of data, adding details can increase the model fit
- Costs:
 - Informational cost of model validation grows
 - It is often easier to show similarity of simple structural properties
 - loss of generality for social mechanism
- Better fit does not imply higher explanatory power
- Aim for limited but well-understood models of social mechanisms

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