From **Narratives** to **Formal Representations** and Back Again
– a preliminary analysis concerning how they might be related

Bruce Edmonds

Part 0:

Introduction: **Qual.** vs **Quant.**

The Quantitative Conceit

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- That the qualitative is OK for vague discussion but objective science should keep to what can be precisely represented

- In particular, conclusions can only be **justified** by the quantitative & formal – "*measurement enables us to transcend our subjectivity*" (Bradley and Schaefer 1998:108)

- …because human narratives are inherently unreliable and systematically misleading.

The Qualitative Conceit

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- That, ultimately, we understand everything using human narrative

- Formal representation of the social is reductive and eliminates meaning – "*qualitative methods are more faithful to the social world*" (Gergen and Gergen 2000:1027)

- In particular, quantitative methods ignore, and then hide, human diversity (e.g. by averaging) and meaning (it can't deal with)

My Position

- All kinds of evidence have their own pros&cons and these need to be taken into account, but…

- It is a fundamental principle of science that evidence (of whatever kind) is not ignored without a very, ***very***, **VERY** good reason.

- We are good at deceiving ourselves with our (biased and simplistic) ideas about the world – *evidence disrupts these ideas*.

- If our evidence and ideas clash then, *ultimately*, the evidence should win

Focusing on *narrative* **and the** *formal*

- Both "*qualitative*" and "*quantitative*" have many different meanings in social science
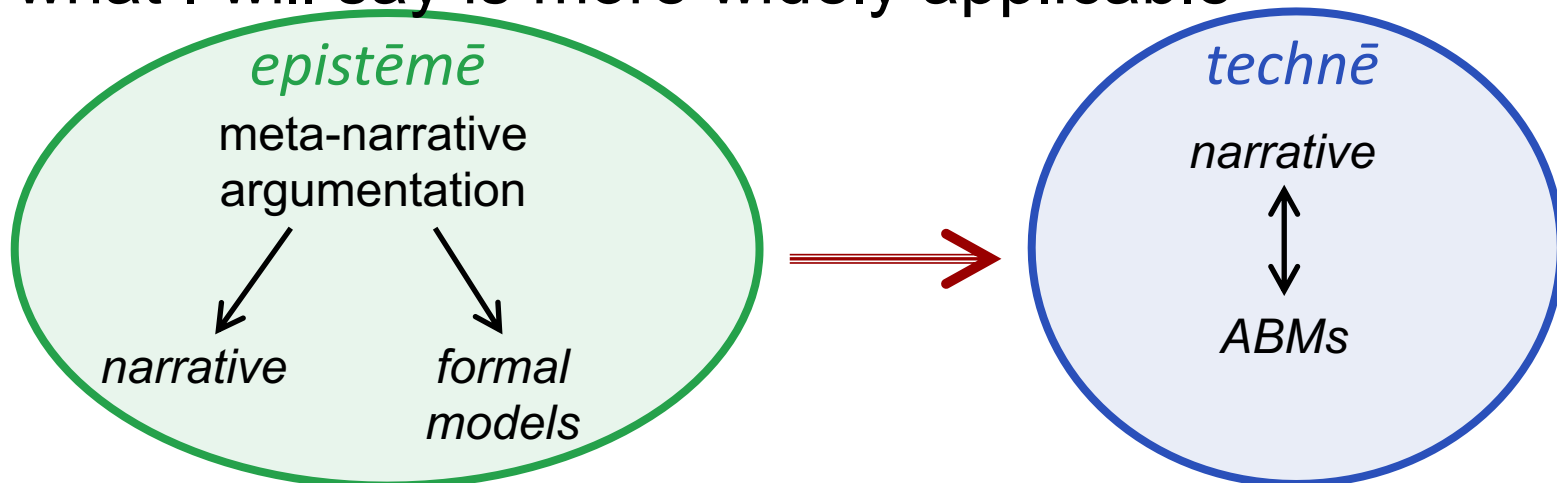- Both tend to be more in the line of labels for paradigms rather than be well-defined

Thus, I will focus on:

- narrative – the stories and explanations that people use discursively in natural language
- formal representations – models, data, equations, etc. that have precise definitions, (we focus on agent-based simulations)

In this talk…

- …I will relate narrative and formal representations
- …denying that they are totally incommensurable
- The majority of the talk will be done in terms of meta-narrative arguments and examples…
- …but the *purpose* is to develop practical ways of moving between narratives and the formal
- I will narrow down the formal to data and ABM since those are the kinds I know, though I suspect much of what I will say is more widely applicable

From Narratives to Formal Representations and back again, Bruce Edmonds, The culture of the artificial, Copenhagen, Oct. 2024, 7

Structure of talk

1. Aspects of human narrative

2. Aspects of agent-based modelling

3. Narrative → ABM

4. ABM → narrative

5. Conclusions

Sorry – lots of text and not many pictures!

Part 1:

Aspects of (human**) narrative**

About narrative

- The human brain seems to be 'engineered' to think in and communicate via stories

- This mechanism seems to evolved to facilitate our social organisation…

- …to pass down culture/knowledge/warnings etc. to others in their group

- …that allow groups to survive in their niche

- It must be communicable and memorable…

- …so they tend to simplify and dramatise.

What do we know about narratives?

- They occur within a (mutually understood) context that is usually implicit

- They delineate one possible string of events (they can imply others but not many)

- They assume lots of background knowledge (e.g. what is/is not possible in that context)

- They are usually sequenced in time

- They concern causation (this happened as a result of having chosen that etc.)

- They can include choice points

But (human) narrative is bound up with the ego viewpoint

- We can understand the actions and motivations of others through narrative

- …but we also employ narrative to make sense of ourselves

- …helping define our identity

- Thus narrative is more than just subjective, it is bound up with the ego

- However, we are the experts of ourselves and our accounts of what we do and why can be more accurate than those of theory

CSNE Analysis Framework

CSNE Aspect	Corresponding Property
Context	Relevance
Scope	Applicability
Narrative Element	Local: cause-effect pairs, decision points, sequences, alternatives etc.

1. Context: the kind of situation one is in that determines the 'bundle' of knowledge that is relevant to that kind of situation

2. Scope: what is and is not possible given the current situation and observations

3. Narrative Elements: the narrative elements that are mentioned assuming the context and scope

(Edmonds 2015)

Context

- The kind of situation is recognised in a rich, fuzzy, complex and unconscious manner

- Knowledge, habits, norms etc. are learnt *for* that kind of situation and are retrieved *for* it

- Context allows for the world to be dealt with by *type of situation*, and hence makes reasoning/learning etc. feasible (e.g. which norms, expectations, etc. are relevant)

- Context can be difficult to pin down – it is usually implicit

- However, encultured people have a natural ability to identify the relevant context (but not necessarily to name it)

About Scope

- By "scope" I mean *what is possible* if the present circumstances

- For example, if all the seats are taken in a lecture, then some of the norms, habits and patterns as to where one sits might not apply

- Reasoning about scope can be complex and is done consciously

- However once judgments about scope are made then they tend to be assumed (i.e. are fixed), *unless* the situation changes critically

Scope vs. Context

- Both scope and cognitive context determine which knowledge is useful for any particular situation that is encountered

- However, they play *different* roles:

  - Cognitive Context is learnt using pattern recognition over a long time, but then is largely a 'given', is almost impossible to change once learnt, is quick and automatic and is socially rooted

  - Scope is reasoned about, taking effort to do so, is possible to re-evaluate but only if needed, and is more individually oriented

Narrative Elements

A variety of narrative structure elements are possible, including:

- Causal stories: A … resulted in … B

- Sequences: A … then … B … then C

- Choices: had to choose between … A and B

- End points: which resulted in A which was a disaster/really good/…

- Parallelism: A … happens at the same time as ….B

Different Aspects Illustrated

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Universe of Knowledge

Knowledge indicated by current cognitive context

Knowledge that is possible to
apply given circumstances

Cause1 & Cause2… ➔
Result1 & Result2…

Event1, event2, etc.

LLMs and the limitations of pure narrative

- Large language models are encapsulations of linguistic embedding

- They get linguistic context and language←→language interaction

- They could be called "Wittgenstein Engines"

- But they are not embedded in the observable (non-linguistic) world

- …and are not designed for causal and inferential reasoning

Part 2:

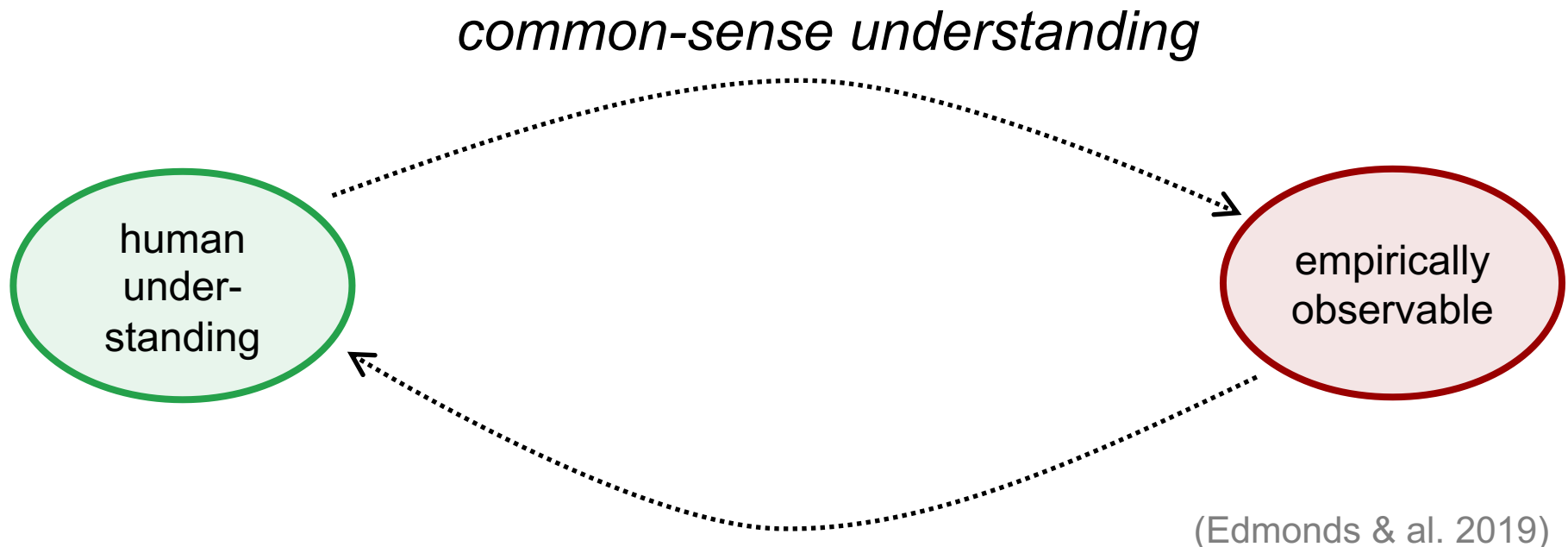**Aspects of (**agent-based**) modelling**

About (formal) modelling

- A model is not (just) a thing (e.g. simulation)

- …but it is a thing *plus* a relationship with what the model refers to (what it models)

- A *formal* model is one that it is defined precisely such as: logic, maths, computer code, data, etc.

- What it models can be a variety of things and for a variety of purposes

- The relationship to what is modelled can be vague reference or be a well-defined mapping
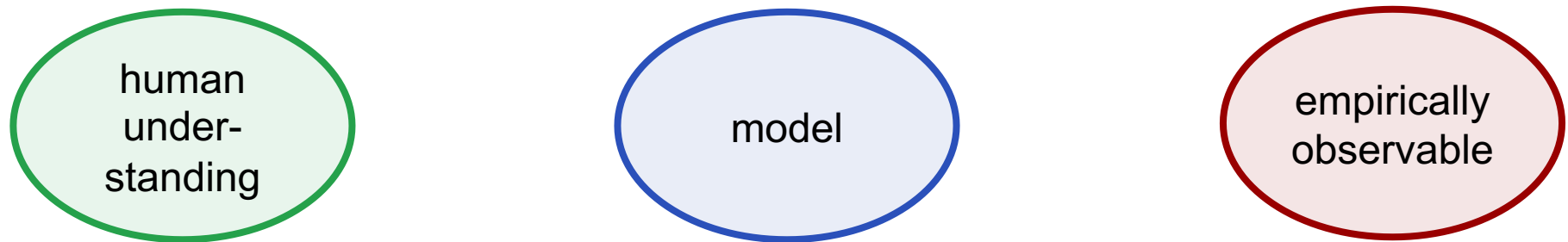
Models as kinds of mediator

"*Just as physical tools and machines extend our physical abilities, models extend our mental abilities, enabling us to understand and control systems beyond our direct intellectual reach*" (Calder & al. 2018)

common-sense understanding

human under-standing

empirically observable

(Edmonds & al. 2019)

Models as kinds of mediator

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human under-standing

model

empirically observable

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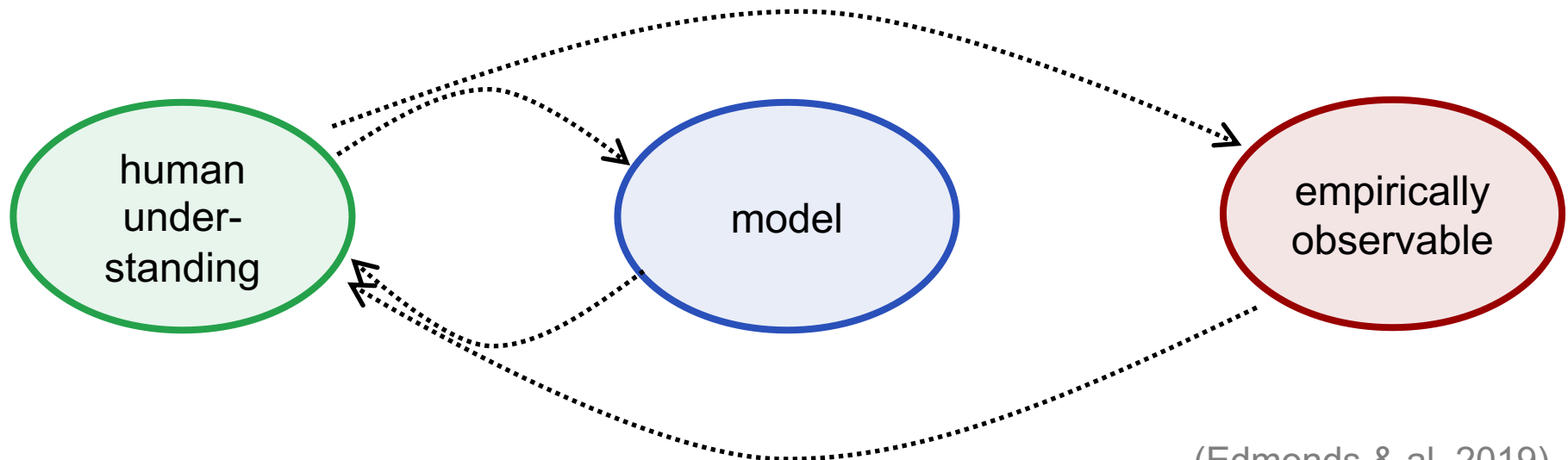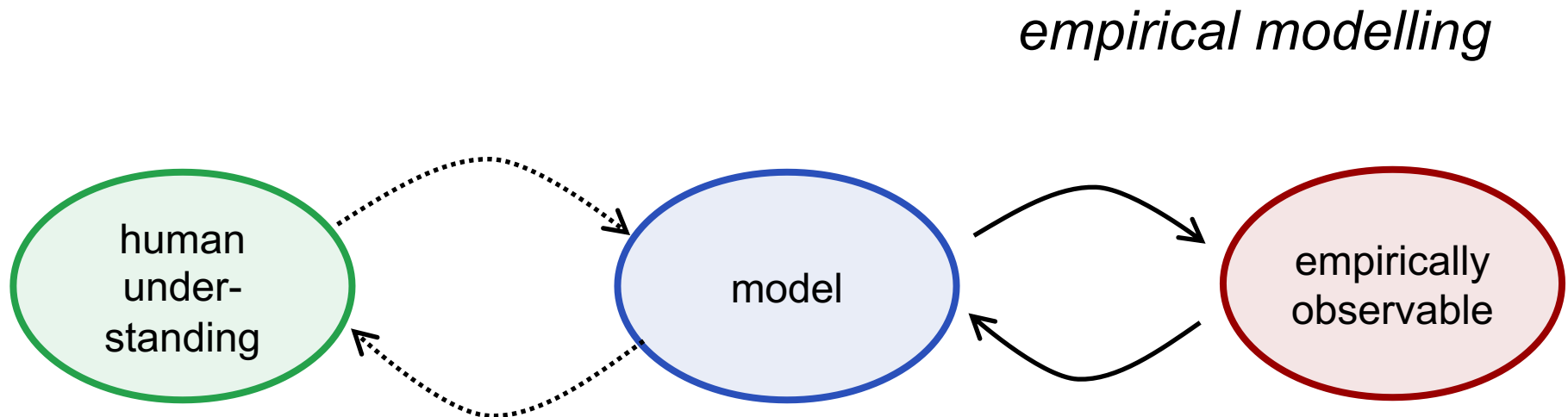
modelling ideas

human under-standing → model → empirically observable
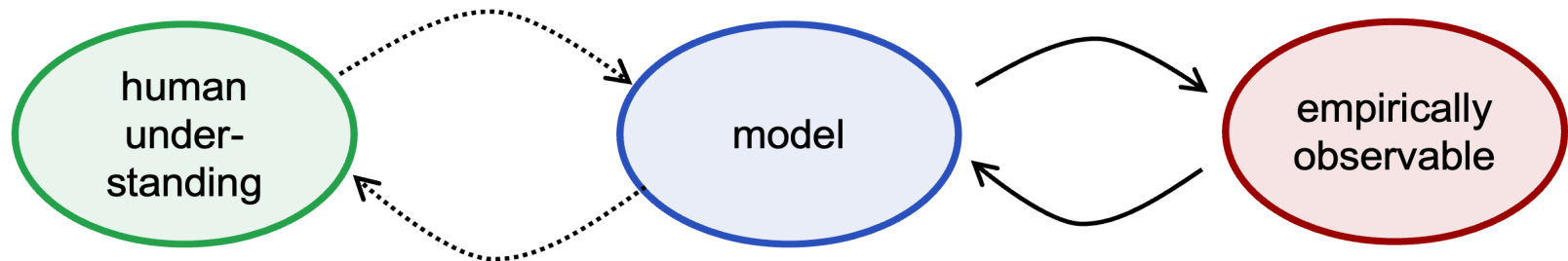
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Models as kinds of mediator

"*Just as physical tools and machines extend our physical abilities, models extend our mental abilities, enabling us to understand and control systems beyond our direct intellectual reach*" (Calder & al. 2018)

empirical modelling

(Edmonds & al. 2019)

Formal models can encode (non-human) knowledge about the world

- By repeatedly adapting a model in the light of empirical data, the model can encode knowledge about the world

- We can then confront our human understanding with the model by experimenting with it

- Even if the level of detail is beyond human capacity, we can still leverage indirect knowledge in this way

- E.g. Alphafold-2 encodes protein shape knowledge

Social Importance of Formal Models

- Formal models are not well suited, *per se*, for a semantic and complex world

- But they can be indefinitely elaborated to build structures that are a bit better at this

- And they can be passed around without reinterpretation (unlike narrative)

- They can thus support a social process of critique and improvement

- In physics the maths models of quantum processes have remained whilst our stories about the quantum world have changed

(Edmonds 2010)

Agent-based models…

…are significant because they:

- are the most flexible, theory-independent kind of formal model available…

- …entities are dynamic and interacting which we can understand/control at the micro level

- Can be related to a wide variety of kinds of evidence

- They facilitate the replacement of "high theory" with data and the "mundane theory" of stakeholder accounts

- …but still are indefinitely inspectable and open to experiment

ABM vs Machine Learning Models

- Machine learning models are another very flexible kind of formal model

- In ABM we understand/specify the micro processes and get macro pictures back, good for explanations in terms of the micro

- In ML we specify macro examples and it infers micro-level details to match this, good for finding patterns in the macro that are too detailed for the human mind to "see"

Part 3:

Narrative → ABM

The process (version 0.0)

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Context: Use innate expertise to label relevant kinds of situation explicitly and which apply to which parts of this narrative

Scope: Map out the relevant set of possibilities and situate narrative within this

Narrative Elements: look for…

• Branch points/choices/alternatives

• Sequencing (necessary order of events)

• Causation (links with a past event)

• Underlying processes (assumed in account)

Consider…

- How what is mentioned in a narrative relates to those in other narratives

- Are there alternative accounts of the same processes

- What values/goals/power structures etc. are assumed in the narrative

- The contingency of the narrative – what are other trajectories if things were different

Example Analyses

using narrative examples from:
(Bhawani 2004)

Hypotheses about relevant contexts for the interviewed stakeholder

Different perspectives from which the narratives seem to be told:

- "survival" – things are continually getting worse and the primary goal is to keep in farming, battle against nature etc. to avoid bankrupcy

- "comfort" – conditions are comfortable with no immediate survival threat, one could stop worrying so much and take things a little easy

- "entrepreneur" – one is looking for big profit, taking risks if necessary

Quote 1 (p. 113) and CSNE Analysis

"The one conundrum here is that there are more people in the East who want to … upgrade to more wheat allied products, that may alter the value of the end product to us. You see the worst thing that has happened to us worldwide is the collapse of the Eastern economy... but it is coming back again now and that actually may help us again. It is a great shame because we were getting into the Eastern markets and it was beginning to grow and suddenly it collapsed."

Context	Scope	Narrative Elements
Survival	*No "killer" profit available*	• Prices for wheat may increase in near future • Price increases can be followed by a sudden collapse

Quote 3 (p. 112)

I… would imagine that if the summers were warmer and the autumns were wetter you would have an earlier harvest, and therefore all that would happen is that the harvest would come early and your drilling… would come early so that you would still be able to establish your winter crops before the rain really started. If the rains were really early then we would have to resort to spring sown varieties... The net effect would be that you would be drilling as soon as you possibly could which may be later than normal, but because the weather is warmer that would make up for lost time, so harvest would still be about the same time… If the autumn was continuously wet … and we were under water… If it was like this year every year, then yes there could be a problem.

CSNE Analysis of Quote 3

Context	Scope	Narrative Elements
Survival	*Summers warmer and autumns wetter*	• Harvest comes early • Therefore drilling needs to be early
	Summers warmer and autumns wetter + rains really early	• Need spring sown variety • Therefore drilling as soon as possible • Probably harvest at the same time due to warmer weather
	Summers warmer and autumns wetter + autumn was continuously wet and we were under water	• If wet like this every year then there is a serious problem

Quote 3 (p. 127) and CSNE Analysis

"…we have often had this conversation around this table. Some people don't want to maximize profit.... They are happier to take a slightly easier, lower level approach and have an easier life, and not make quite so much money.... And I can relate to that... But because I'm a tenant I don't own my own land... Everything we farm is rented and therefore we have an immediate cost, the first cost we meet is to our landlord and that tends to go up."

Context	Scope	Narrative Elements
Comfort	*Does not have to maximise profit to survive*	• Can take life easier • Does not make quite so much money
Survival	*Has immediate cost (rent) which tends to go up*	• Has to maximise profit to survive

Difficulties

- Context is implicit and not usually labelled
- People envisage one context when telling a story, if you want stories from others you need to set this up by prompting them
- Each story focusses on one of the possibilities, to get others one needs to explore the branch points and what could have happened differently
- People abstract to a level of personal significance and ignores the habitual
- Stories are always bound up with issues of personal status, power and identity

Part 4:

ABM → Narrative

Narratisation

- Unlike the art and science of "visualisation" there is no existing field of "narratisation"

- Simulation work is often going from informal→formal and micro→macro due to the social framing & history of modelling and so the output has tended to be macro-level graphs and other statistical projections

- But with the involvement of stakeholders, narrative outputs concerning individuals might well be desirable for consultation etc.

Comments

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- For specific, applied simulations, the context for events represented are clear

- For abstract, more theoretical, simulations a relevant context needs to be decided upon

- Unlike going from narrative to ABM, when going from ABM to narrative the simulation can be used to trace out possibilities

- Instead of removing detail the simulation can not cope with, we are adding this in – it can help here to use synthetic population data for more realism in terms of these details

The Process (version -0.000)

- Explore and understand the possible trajectories inherent within a simulation

- Choose one (at a time) and follow an agent through, noting the events that happen to it, including when it could have branched

- Add in (or decide) contextual information, e.g. using the same contexts as the evidence the ABM was specified using

- Add in specific, but arbitrary, names and details to make this less abstract

- Turn the events into a more fluid narrative

An example raw simulation output

(family 20)@0: is new family needing DA services ([female]) and characteristics: 56 "august" 1936 "female" "white" "white br" "dudley" "inapplic" "inapplic" "divorced" "gce o le" "3c:low s" "2a:middl" "employed" "junior n" "routine" "skilled" 4115

(family 20)@0: finds and rings help line

(family 20)@0: is provided with Contact Advice by (contact-agent 17)

(family 20)@1: is taken on by provider coordinator (family 20)

(family 20)@1: is moved to refuge provider: (provider 3) by (coordinator 13)

(family 20)@1: asks around for help on Counselling and Therapy

(family 20)@1: learns that (provider 4) provides Counselling and Therapy

(family 20)@1: (provider 3) tells (family 20) that (provider 4) provides service Counselling and Therapy

(family 20)@1: is provided with Counselling and Therapy by (provider 4)

...

(family 20)@7: asks around for help on Housing-related Support

(family 20)@7: learns that (provider 1) provides Housing-related Support

(family 20)@7: (provider 3) tells (family 20) that (provider 1) provides service Housing-related Support

(family 20)@7: is provided with Housing-related Support by (provider 1)

(family 20)@7: is moved to permanent accommodation with all their needs met

Reanimation process from raw output

- Context: a victim/survivor of domestic abuse
- Is 56, white British, divorced, no children, with basic education, in Calderdale, born Dudley
- Already knows about the domestic abuse help line and so quickly makes contact
- Is lucky that there is a place in the refuge
- Finds out about the services for her needs from her proactive case worker and accesses these rapidly
- Is also lucky to quickly find permanent accommodation to move into afterwards

Use cases for narratisation

- Very specific stories for presentation back to the stakeholders who provided input so they can give more input and comment on whether what is of value to them is there

- More generalised stories (encapsulating a particular range of possiblities) as input to discussions about a collective future

- Example stories for illustration of the complex processes for a wider public or for press releases

Part 5:

Conclusions: **Becoming Cyborgs**

Model-based and Human discursive understandings are complementary

Human Discursive	Model-based
Rich semantics	Thin formal semantics
Simplifies and abstracts	Can deal with indefinite levels of detail
Can be vague	Can be precise
Can be difficult to check	Rigorously checkable
Democratically accessible	Fairly impenetrable
Can be highly persuasive	Tends not to be except in technocracies
Covers one sequence of the possible	Can explore a space of possibilities
Narrative is widely applied (analogically)	Applying a model to new targets is hard
Historically embedded	Relatively new
Can relate to different values/cultures	Can be technocratic and closed
Can be reliable and useful but…	Can be reliable and useful but…
Limitations need to be heeded	Limitations need to be heeded

(Polhill & Edmonds 2023)

The Extended Mind

- Thinking is not limited to the brain but…

- ..extends out via the ways we perceive/act

These can include:

- Other parts of our body

- The social systems we inhabit

- Technical systems such as sensors and machines

- Computational systems

As we grow with these they become part of us

(Clarke & Chalmers 1998)

We are already Cyborgs

- As well as the many machines that extend our physical abilities, the system of writing extends our mental abilities – allowing mathematics, extensive literature, academia, large organisations etc.

- Humans are natural cyborgs, we adapt so well to the systems (social, computational, mechanical) through which we perceive and act that quickly we do not have to think about it.

- Computer models (AI, complex simulations etc.) are next, enabling us to deal with the detail of data and complex inference in a way not possible before.

- Transitions take time and adaptation (think how long global literacy took) but it is not to be feared….

- *…we are **good** at this!*

An "EcoCyborg"
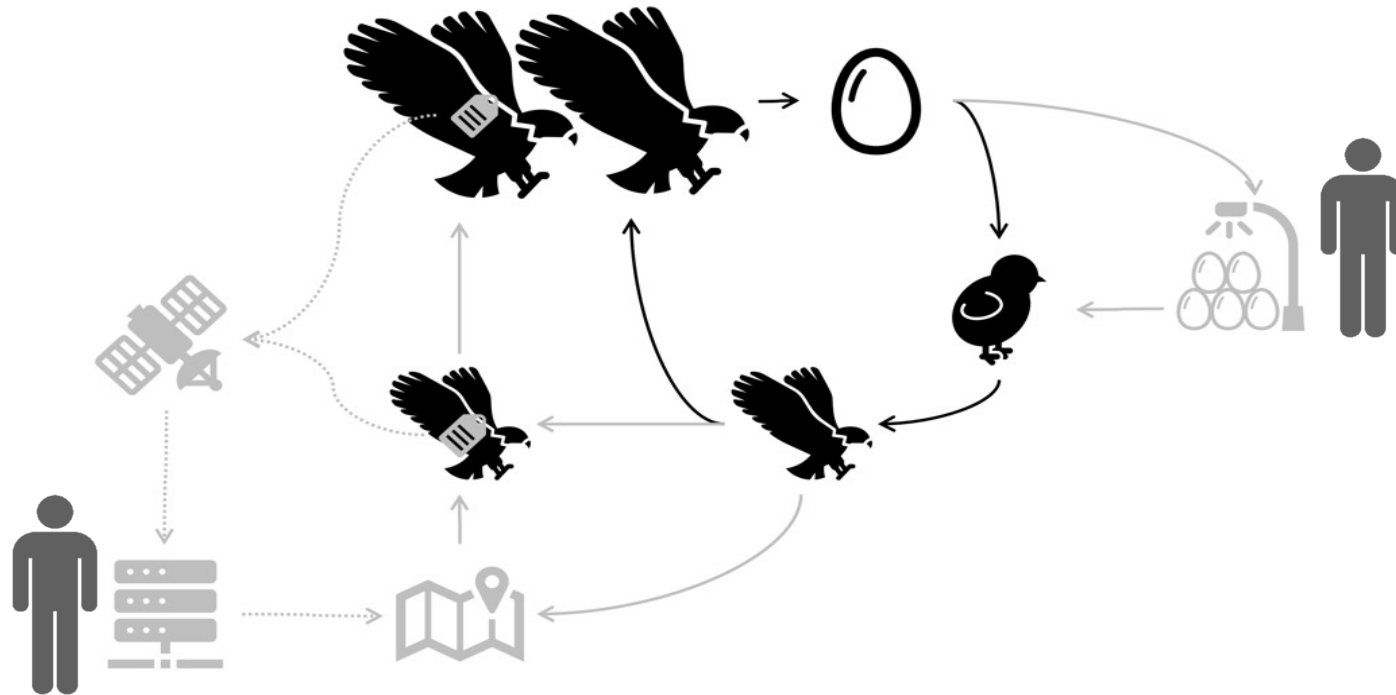
Here the cyborg is conceptualised to include the techosphere and ecosystem. Narratives in might come from those incubating eggs about nest health, narratives out might feed to press reports to the public who are funding it.

(Polhill & Edmonds 2023)

Conclusions

- We should reject both narrative and formalist chauvinisms that seek to insulate themselves against intrusion by the other

- We need a "simulation culture" – a conversation *using* models and not just conversations *about* models

- We need to become cyborgs, more closely integrating model-based and narrative encodings of knowledge about our world into our cognitive and social processes

References in slides

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Thanks!

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