

Issues in conducting process studies

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What are the goals of Behavioural OR?

- To provide a **more accurate description** of *how people work, perform tasks, make decisions, or otherwise behave* **in OR-supported settings**.
- To **design, deploy and evaluate (behavioural) theory-informed interventions** that can *help people make better decisions and improve performance* **in OR-supported settings**.

OR-supported settings



Desk-based modelling & model use



Individual elicitation



Meetings



Modelling & model use



Group elicitation



Presentations

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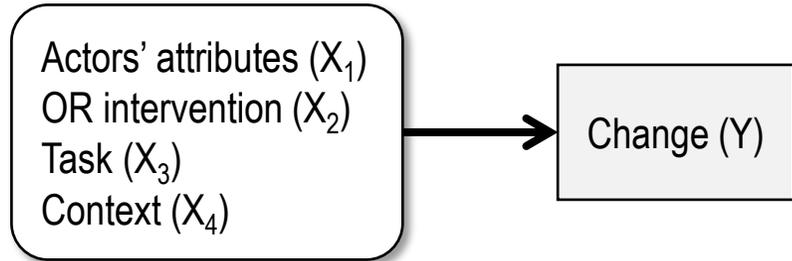
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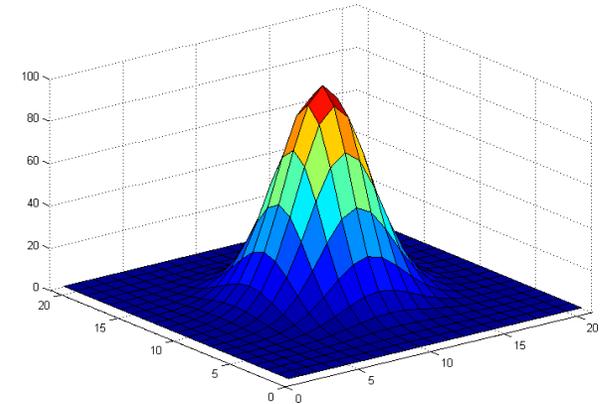
Research approaches to study behaviour *in OR-supported settings*

Variance

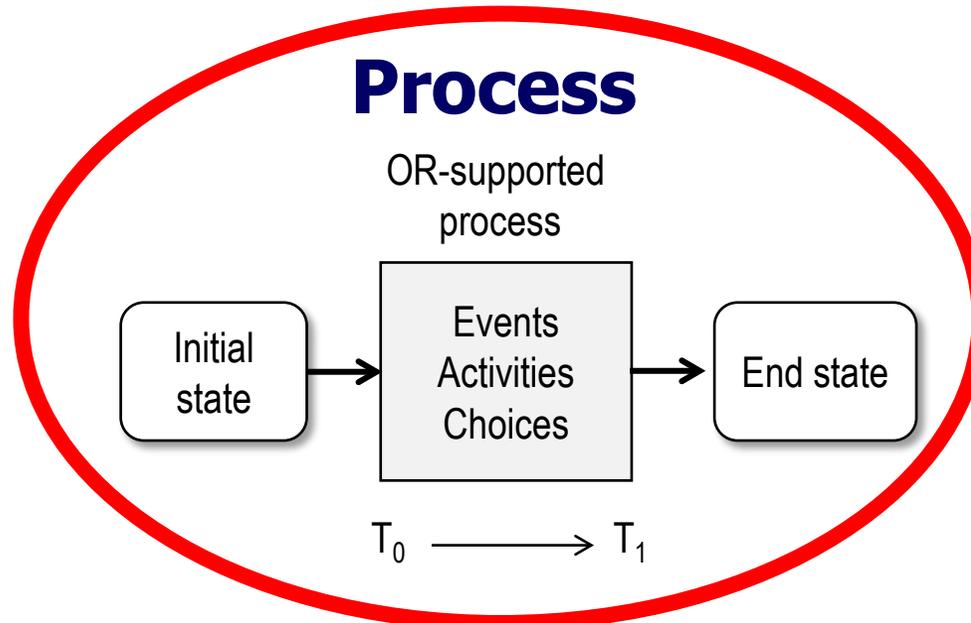


$$Y = f(X_1, X_2, X_3, X_4)$$

Modelling

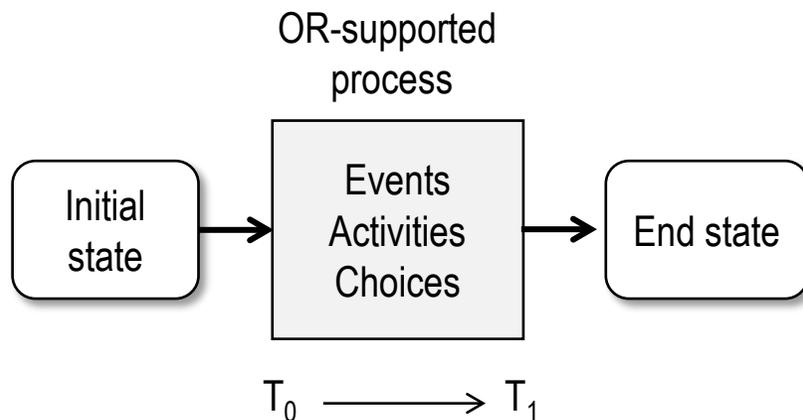


Process



Research approaches to study behaviour *in OR-supported settings*

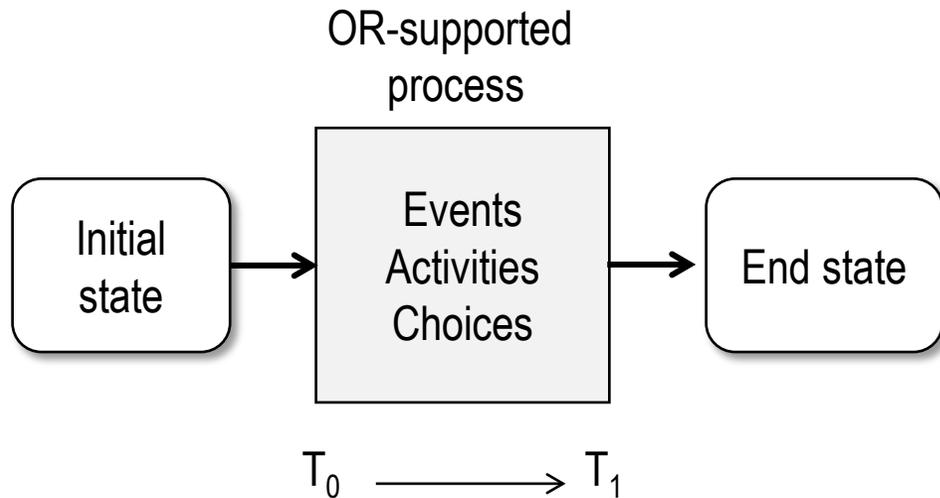
Process



- Unit of analysis is an evolving agent which makes events happen and to which events occur.
- Used in eclectic research designs, in observational studies in the lab or field.
- What counts as an 'event' and the temporal ordering of events are both critical.
- Data analysis methods can be quantitative or qualitative, or both.
- Produces *process explanations* (=narratives that account for the sequence of events observed) or further specification of process theories through deduction/induction/retroduction.
- Generality depends on the 'versatility' of the process explanation or further specified theory.

Research approaches to study behaviour *in OR-supported settings*

Process



- Examines questions such as:
 - *How* do experts and novices build models?
 - *How* do individuals and groups engage with OR methods, processes and tools?
 - *How* is OR-supported activity performed by those involved *in situ*?
 - *How* do actors' interactions with the material and conceptual elements of an OR intervention develop over time?

Sample of process studies in the lab and field

1. Quantitative model building.
2. Qualitative model building.
3. Model use.
4. OR-supported activity *in situ*.
5. OR intervention success.

Quantitative model building

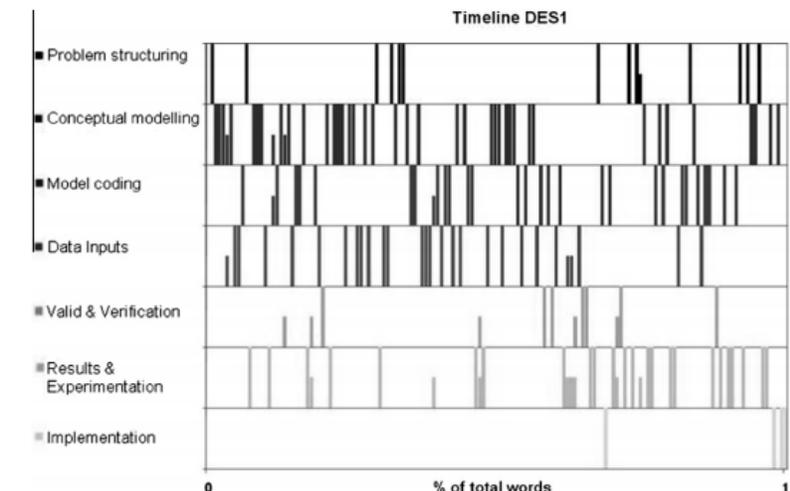
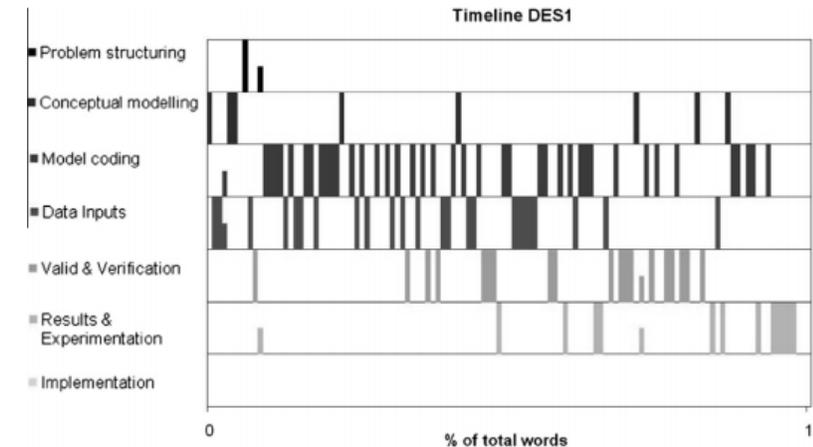


Quantitative model building seems to follow a complex non-linear sequence of stages.

There are clear differences between **experts' and novices' model building paths** and attentional behaviour.

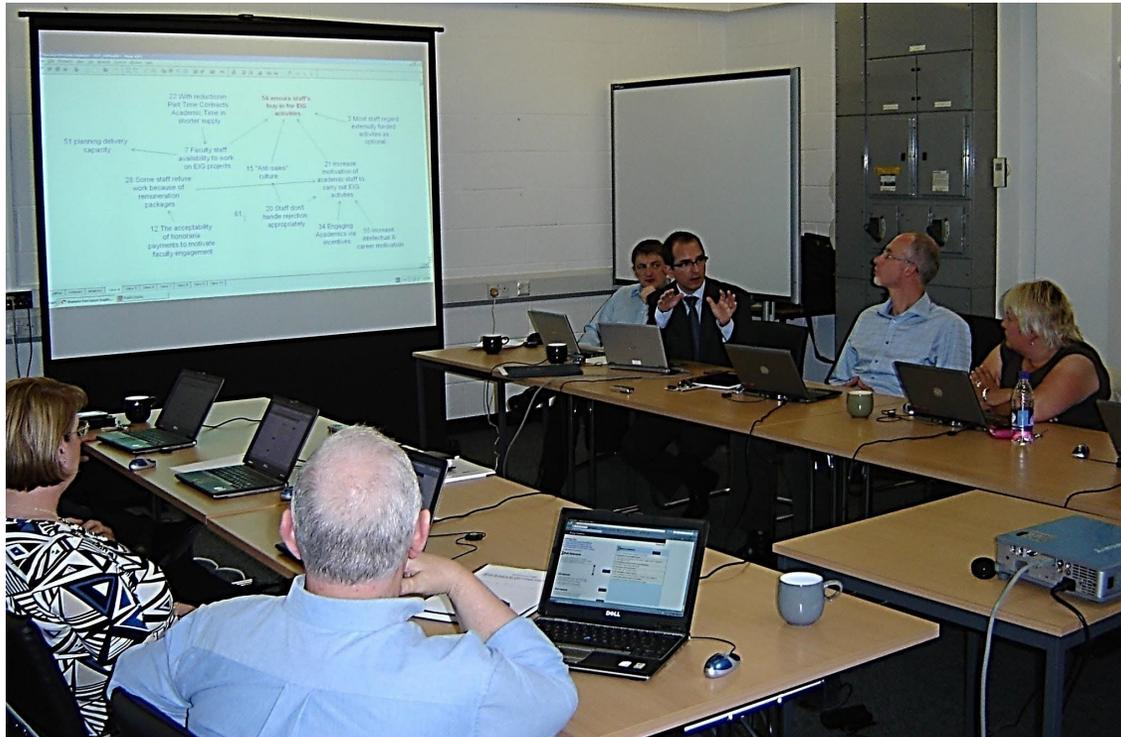
Tako & Robinson (EJOR 2010)

- Study of expert DES and SD modellers:
 - Seven modelling stages identified.
 - All modellers switch between stages, BUT...
 - DES modellers follow a more linear progression.
 - SD modellers focus more on conceptual modelling
 - DES modellers focus more on model coding and V&V.



Verbal Protocol Analysis of experts' in situ modelling activity

Qualitative model building



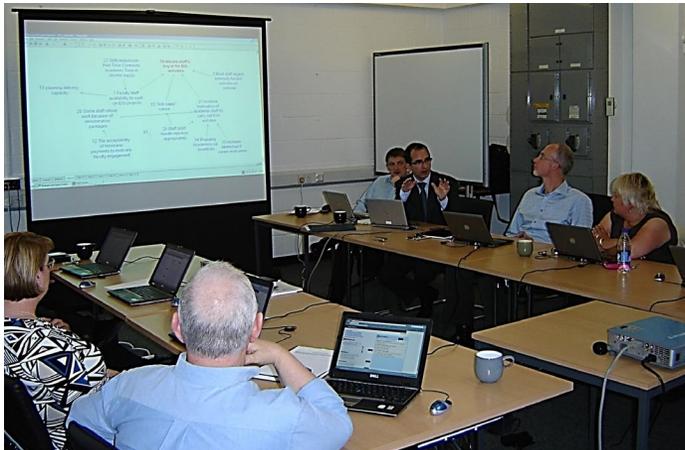
Effective qualitative model building in a facilitated group setting ***resembles the normative linear problem solving sequence.***

Expert and novice facilitators ***show some common patterns of behaviour*** regarding process management and the use of domain knowledge.

Model use



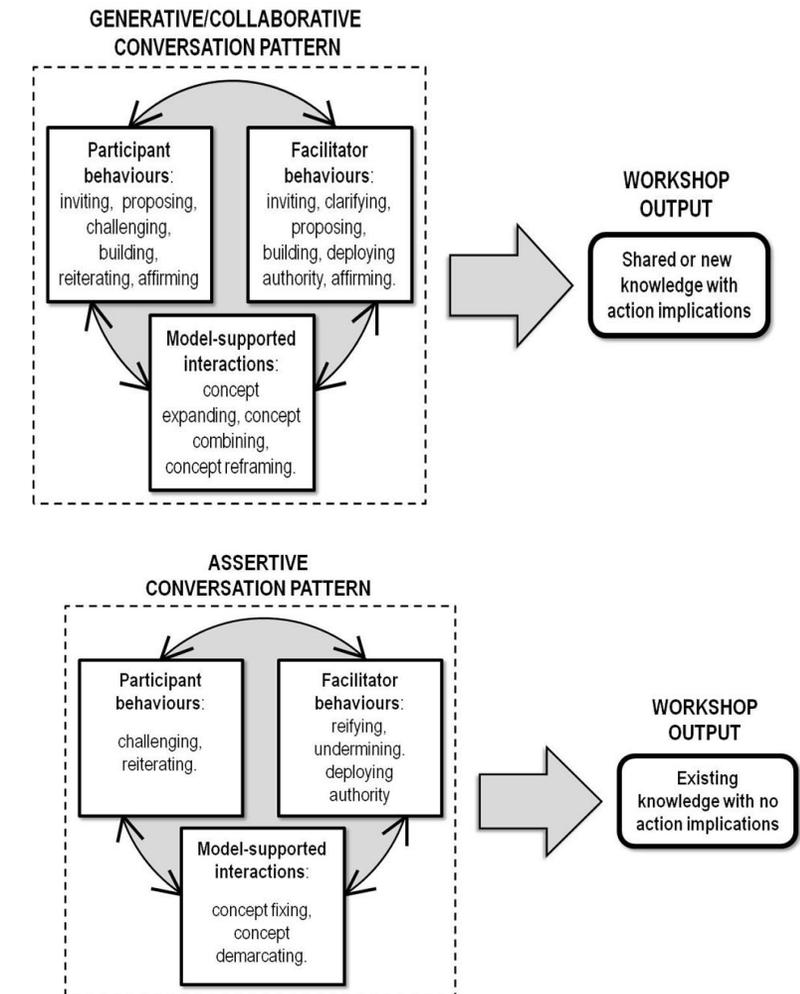
Individuals adopt distinct problem solving strategies when using quantitative models.



Groups adopt distinct knowledge sharing/production strategies when using qualitative models.

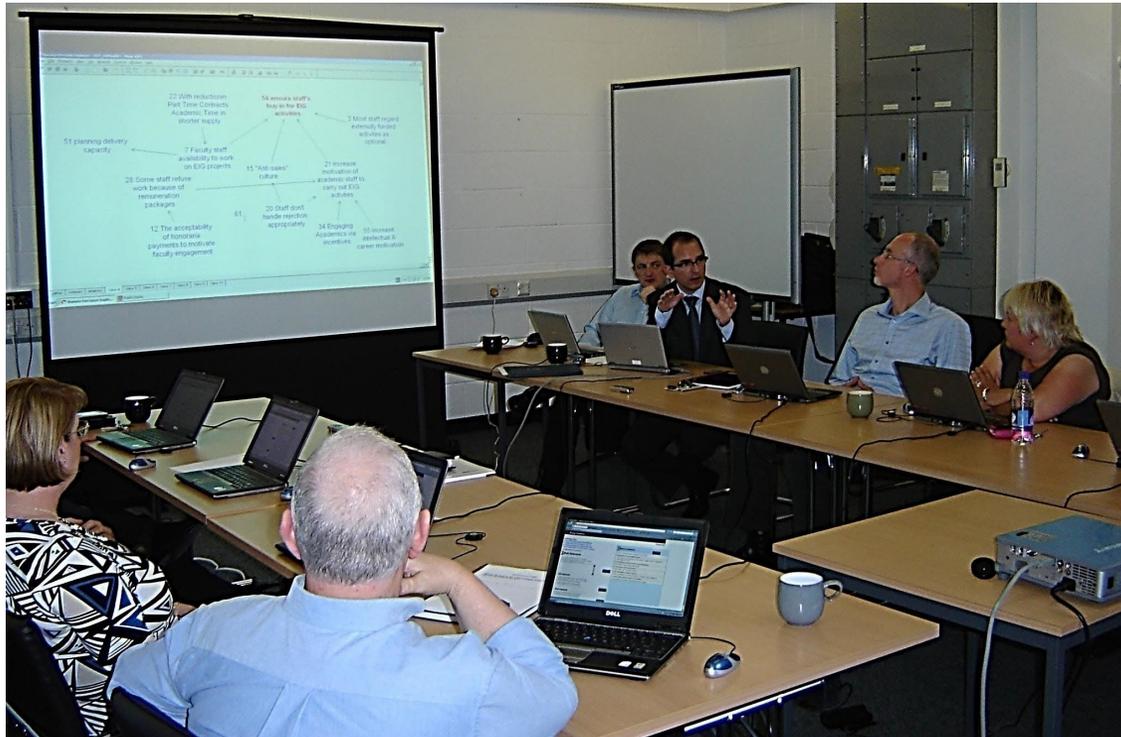
Tavella & Franco (GDN 2015)

- Study of knowledge production in facilitated modelling processes:
 - **Generative** model-supported conversations (e.g. *inviting, proposing, clarifying, building*) lead to new or shared knowledge.
 - **Assertive** model-supported conversations (e.g. *challenging, reiterating, undermining, deploying authority*) lead to recycling existing knowledge.



Qualitative analyses of audio data.
Mix of top down and bottom up coding.

Descriptive studies: OR-supported activity *in situ*



OR-supported activity *in situ* is rarely neutral and requires the **competent assembling of discursive** (e.g. talk, text) and **material** (e.g. body, models, software).

Franco & Nielsen (GDN 2018)

- Study of *formulations* used by facilitation modelling practitioners, and their interactional effects, e.g.:
 - formulations *encouraging reflection/action*;
 - formulations that are *collaborative produced*.
- It highlights difference between *textbook* and *actual* facilitated modelling *scripts*.

Qualitative analysis (Conversation Analysis) of video data.
Mix of top-down and bottom-up coding.

[4b]



[4c]



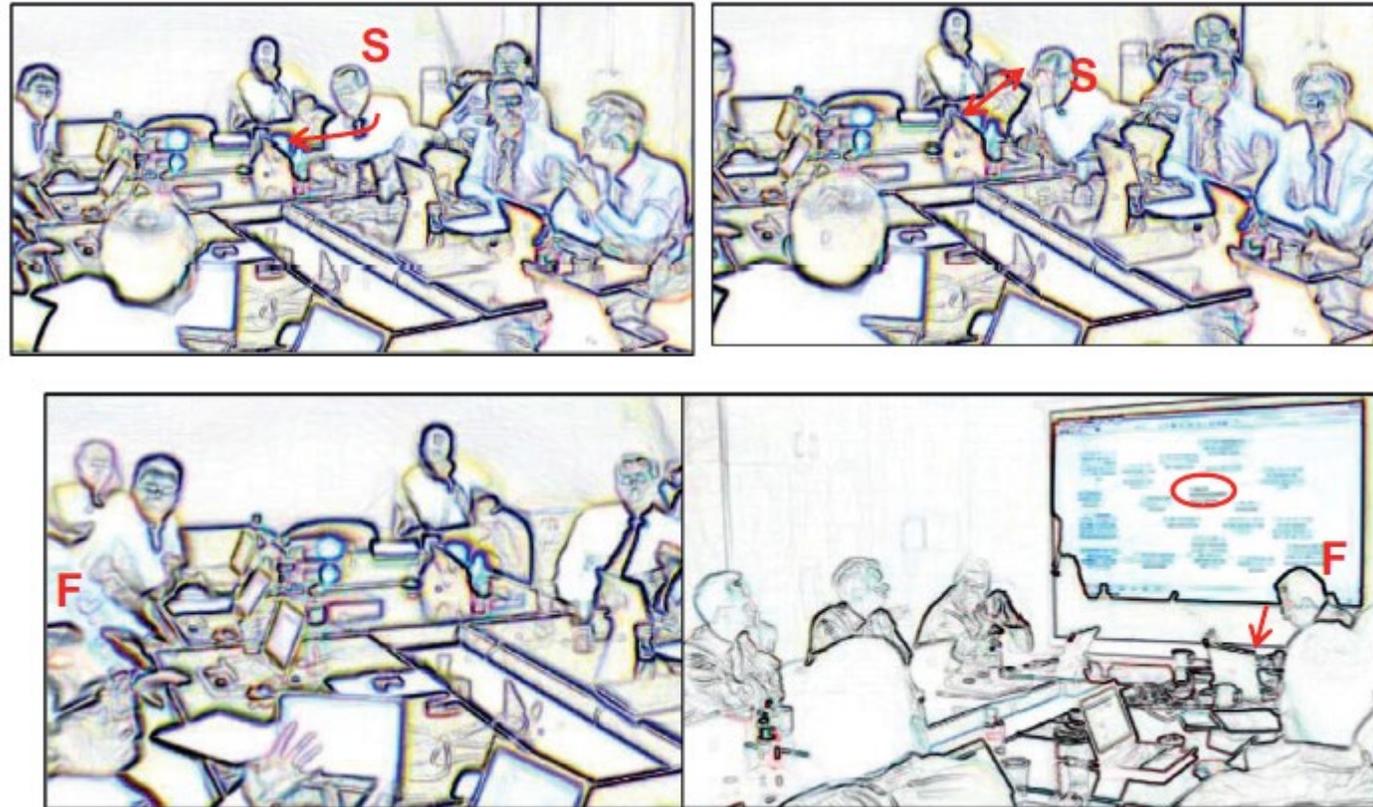
[4c]



16 F: it but it is an issue
17 ((points at his laptop screen) [4b]
18 that I want to capture
19 ((gazes quickly at J)) [4c]
20 F: **which i:s eh**
21 (0.3)
22 G: **We're not he:re for↓that**
23 F: ((types on his laptop)) [4d]
24 (.)
25 Ye:ah↓

Franco & Greiffenhagen (EJOR 2018)

- Claimed OR intervention *products* such as ‘shared understanding’ **must be continually accomplished** during modelling and are displayed through actors’ talk and gesture **turn by turn**.
- Intervention ‘*scripts*’ **do not determine or prescribe what actors actually do in practice...**
 - ...rather, like intervention products, they too **have to be interactionally accomplished moment by moment**.



Qualitative analysis (Ethnomethodology) of video data.
Bottom up coding.

Velez-Castiblanco (EJOR 2016)

- Study of a team meeting in which members were designing an intervention.
- Using a theory of boundary games, the process of intervention design is shown to be shaped by communications concerning boundary judgements about the intervention.

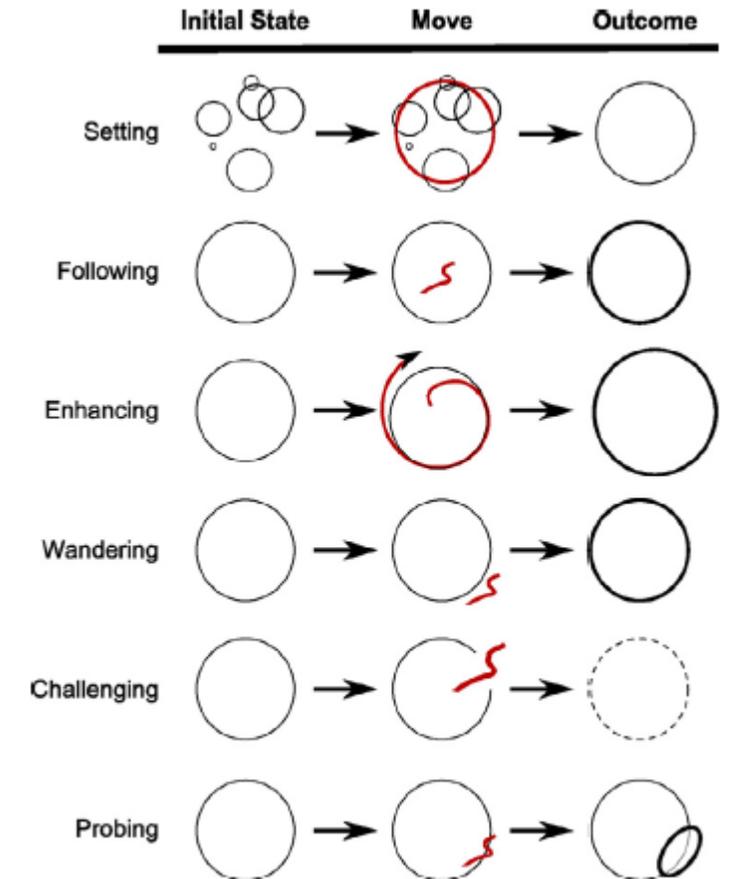
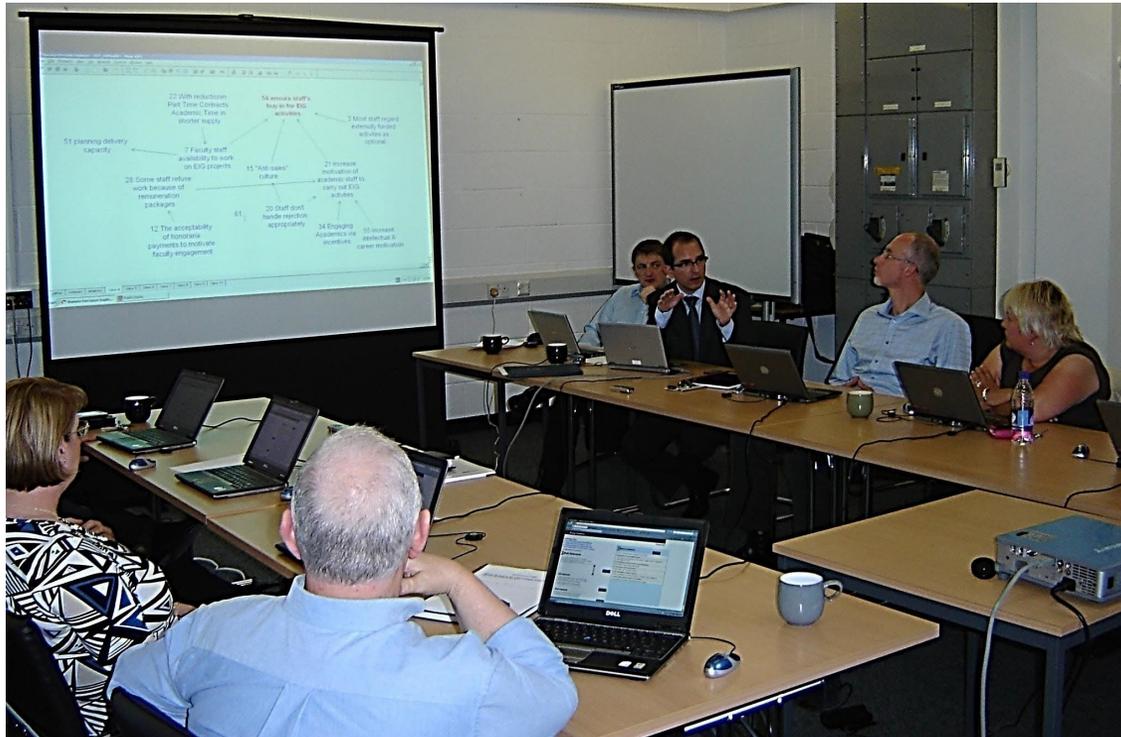


Fig. 1. Boundary games.

Qualitative analysis of audio data.
Theory-driven (top down) coding scheme

OR intervention success

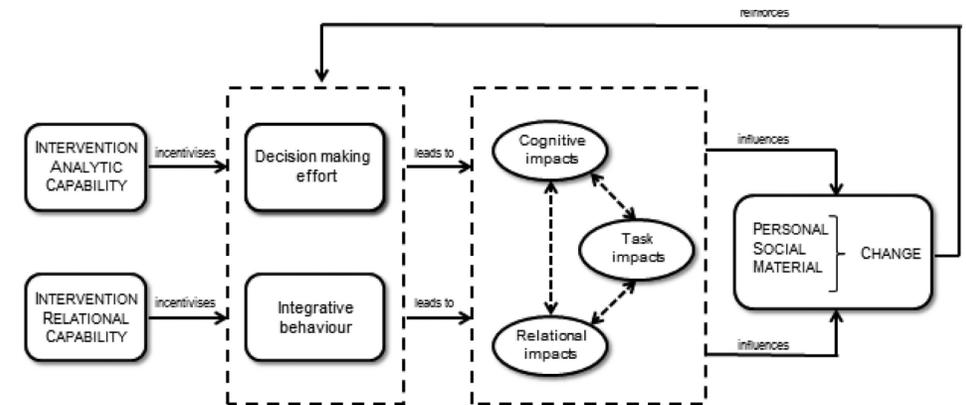


Some evidence that OR interventions are associated with ***improved communication, learning, consensus and commitment.***

OR intervention success is ***heavily dependent on the action possibilities afforded by the intervention, and the behaviour of stakeholders.***

Henao & Franco (EJOR 2016)

- Process impacts of OR intervention on business planning team:
 - **cognitive**: discovering, connection forming, detaching, valuing.
 - **task**: funnelling, case-building.
 - **relational**: minding, bonding.
- Process impacts driven by amount of:
 - effort incurred (motivated by analytic capability)
 - integrative behaviours (motivated by latent relational capability)
- Process impacts influenced tangible personal, social and material changes.

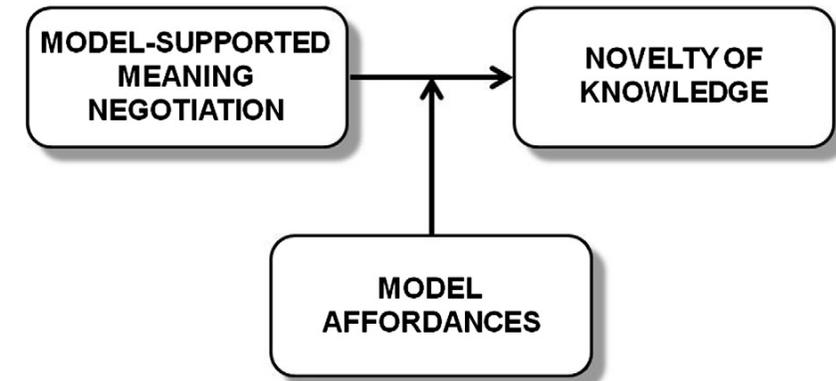


Qualitative analyses of interview data.
Bottom up coding.



Franco (EJOR 2013)

- Study of the role of OR models for knowledge creation within groups:
 - Transfer, translate, transform
- Only transfer & translate roles are warranted because models are 'transitional objects'.
- Transform role must be *accomplished*.
 - When this happens model is also a 'boundary object' (BO).
- Becoming a BO depends on the action possibilities afforded by the model:
 - E.g. can accommodations of interests be achieved?
- Some model affordances: tangibility, associability, mutability, traceability.



Qualitative analyses of interview data.
Bottom up coding

Some methodological considerations

- Design: Experiment or field study.
- Coding scheme:
 - Exhaustive (e.g. IPA)
 - Bespoke: theory-driven (e.g. DFCS) or emergent from data.
- Coding data:
 - Unit of analysis: speaking turn or time segment.
 - Reliability issues.
- Data analysis:
 - Quantitative (e.g. process tracing techniques, phasic analysis, optimal matching)
 - Qualitative (e.g. conversation analysis, verbal protocol analysis)

Process approach: Pros & cons

- Well suited for developing process theories in the form of:
 - Typologies of OR-supported processes.
 - Descriptions of the socio-technical interactions that are typical of OR-supported processes.
 - Identifies gap between ‘textbook’ and ‘actual’ OR.
- Disadvantages:
 - Needs lots of data (e.g. audio, video, observation/computer logs).
 - Intensive effort in coding and analysis.

Implications

- The three approaches should be seen as being *complementary* rather than as competing or opposite.
 - Each approach seeks to answer different questions.
 - Each approach provides a different, but partial, understanding of behavioural dimension of OR-supported processes.
- There is no one 'right' way to study behaviour in OR-supported settings:
 - combining the pluralistic insights from the three approaches can provide a richer understanding of behaviour in OR-supported setting than any one approach can provide by itself.

Thank you!

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