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Making OR practice visible: Using ethnomethodology to analyse facilitated modelling workshops

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Abstract: Empirical studies attempting to open the ‘black box’ of the practice of operational research (OR) are beginning to appear in the literature, particularly within the area known as *behavioural OR*. Many scholars within this community share a commitment to both empirically investigate what OR practitioners and users actually do when engaged in OR-supported processes, and evaluate what the effect of these ‘doings’ is. Despite these developments, we still know very little about the complexities and situated specifics of OR practice as it happens on the ground. This is mostly due to the methodological challenges involved in treating real-time OR practice as an analytical problem, which requires making OR practice ‘visible’ by bringing to the fore its material and interactional features for close examination. In this paper we adopt *ethnomethodology* as one way to address this challenge. Using an empirical vignette drawn from a facilitated modelling workshop in which causal mapping was used with a top management team, we illustrate how an ethnomethodologically-informed perspective can reveal the ways in which OR-supported activity is practically accomplished by those involved, *moment by moment*, and with what effects. We conclude the paper by summarising the contribution that these kinds of fine-grained studies of OR practice make to the behavioural OR agenda, and outline some potentially useful avenues for future research.

Keywords: Behavioural OR; practice of OR; ethnomethodology; facilitated modelling; workshops; causal mapping.

1. Introduction

In recent years there has been an increasing interest in unpacking the ‘black box’ of operational research (OR) practice. This interest is particularly salient in Europe, where OR academics and practitioners are beginning to promote *behavioural OR* (Hämäläinen, Luoma, & Saarinen, 2013; Kunc, Malpass, & White, 2016) as a new area of work within the field. Whilst the literature emerging in this area appears to be theoretically and methodologically diverse (see, for example, the special issue edited by Franco & Hämäläinen, 2016c), there is general agreement that in order to improve contemporary OR practice, we must first engage with what OR practitioners and users actually do when carrying out their work (Franco & Hämäläinen, 2016b).

Despite this recognition, most empirical studies of OR practice have mainly assessed the adoption rates of particular OR approaches by practitioners and organisations (e.g. Mingers & Taylor, 1992; O'Brien, 2011; Ranyard, Fildes, & Hu, 2015; Stenfors, Tanner, Syrjänen, Seppälä, & Haapalinna, 2007). These studies are mostly *about* OR practice rather than *of* OR practice and thus, arguably, the discipline appears to be surprisingly uninterested in empirically examining OR practice itself. This can be illustrated by the very large number of published case studies in which authors treat the conduct of OR-supported processes

descriptively and based on introspection and anecdotal evidence, or on empirical materials (e.g. post-hoc interviews) removed from the ebb and flow of OR practice as it actually happens. Indeed, empirical research on the details of how real-time OR is carried out has only started to attract academic attention (e.g. Velez-Castiblanco, Brocklesby, & Midgley, 2016; White, Burger, & Yearworth, 2016).

The scarcity of empirical research on the live conduct of OR practice is mostly due to the methodological challenges involved in treating the real-time doing of OR as an analytical problem. This requires making OR practice visible by bringing to the fore its material and interactional features for close empirical examination. To this end, and responding to renewed calls for engaging the discipline more explicitly with the social sciences (e.g. Brocklesby, 2016; Franco, 2013; Franco & Rouwette, 2011; Horlick-Jones & Rosenhead, 2007; White et al., 2016), we adopt *ethnomethodology* (Garfinkel, 1967) as an approach to empirically examine the complexities and situated specifics of OR practice *in situ*. Specifically, an ethnomethodological approach can help us to appreciate the ways in which those engaged in real-time OR practice orient their conduct to both the OR-supported activity at hand and each other. Furthermore, we contend that ethnomethodologically-informed studies of OR practice can highlight potential gaps between ‘textbook’ OR and what actually happens on the ground, producing a more nuanced understanding of the practice of OR. Such improved understandings can in turn contribute to design and deploy more effective OR-supported processes in the field, as well as inform and deliver more effective OR education and training in the classroom.

In what follows we start by positioning our intended contribution within the relevant OR literature, and then introduce ethnomethodology as a distinctive approach to the study of OR practice. Next, we present fragments from a video recording of a facilitated modelling workshop in which causal mapping was used with a top management team, and empirically interrogate these materials through detailed sequential and interactional analysis. Our analysis illustrates how an ethnomethodologically-informed perspective can help reveal the ways in which real-time OR-supported activity is actually accomplished, *moment by moment*, and with what effects. We conclude the paper by summarising the contribution that these kinds of fine-grained studies of OR practice make to behavioural OR agenda, and outline some potentially useful avenues for future research.

2. Zooming in on OR practice

Given the long standing concern with the need to understand and unpack the complex nature of OR interventions (e.g. Eden, 1989; Keys, 1989, 1998; Ormerod, 1996), it can be argued that the analysis of the ebb and flow of ‘live’ OR-supported activity is an important area of study within the discipline, particularly within the behavioural OR agenda (e.g. Franco & Hämmäläinen, 2016a). Yet fine-grained studies of OR practice *as it happens* on the ground remain rare. By contrast, earlier attempts to study the details of consulting practice (including that performed by operational researchers) can be found within the wider field of management research (e.g. Argyris, 1985; Argyris & Schön, 1974; Schon, 1987). However, these efforts had only a limited impact on the OR discipline (except perhaps for influencing scholars working in the facilitated modelling tradition), and did not lead to a specific research programme and associated approach to examine OR practice. In what follows we consider a number of recent attempts within the OR discipline to adopt a distinctive approach for the study of actual OR practice. Our purpose is not to review these attempts in full but to

highlight a key empirical issue as well as what is distinctive about the approach we propose here.

There is a growing corpus of *field* studies within the discipline that uses theory to inform systematic analyses of OR-supported processes and outcomes (e.g. Brocklesby, 2009; Franco, 2013; Rouwette, Korzilius, Vennix, & Jacobs, 2011). Here we briefly review three recent exemplars of these kinds of studies as an illustration. The study by Ormerod (2013) draws on Pickering's (1992; 1995) 'sociology of science as practice and culture' to reassess an OR intervention undertaken for the UK National Coal Board during the late 1970s and early 1980s (Ormerod & McLeod, 1984; Plackett, Ormerod, & Toft, 1982). Specifically, he uses the vocabulary and grammar of the 'mangle of practice' to describe how the complex intertwining of material and social factors affected the design, deployment and outcomes of this particular OR intervention. Similarly, but within the context of soft OR, White (2009) uses actor-network theory (Callon, 1986a, b; Latour, 1987, 2005) and narrative analysis (Abell, 1993; White & Taket, 2000) to examine how problem structuring interventions are socially constructed through a bundle of sociotechnical interactions. More recently, Thompson, Howick and Belton (2016) review the role of mental models in constructivist learning theories (e.g. Doolittle, 2014; Fox, 2001; Steffe & Gale, 1995; Von Glasersfeld, 1995) to investigate how mental model form links with the timing of learning incidents and the role of social mediation and negotiation in the learning process. Their systematic examination of ten system dynamics projects led them to conclude that changes in the mental models of project participants were associated with the occurrence of critical learning incidents. Furthermore, the timing of these incidents appears to be connected to a range of factors including the type of system dynamics tool used, its intended purpose, and the project stage in which it was used.

These kinds of studies offer interesting and valuable insights into actual OR practice and its impact. The main issue, however, is that while these studies are explicitly about OR practice, the actual treatment of OR practice remains elusive. In particular, their chosen materials for analysis constrain the possibility to understand the intricacies of OR use during interactions between those involved, and how these shape the outcomes of episodes of OR practice such as meetings, workshops and presentations. In Ormerod's case, the description of the intervention is in the form of a rich narrative guided by theory, but analysis relies heavily on post hoc self-reflections rather than data generated from the intervention itself. Even when observational notes taken during the intervention are recorded and analysed to supplement theoretically-informed introspection, as in White's case, the analysis steers clear of analysing live OR intervention conduct. In the case of Thompson *et al*'s study, the chosen theory guides data collection but, again, analysis tends to rely on materials that are removed from the ebb-and-flow of real-time OR-supported processes. Furthermore, what this third study presents are interesting accounts of OR interventions elicited during post hoc interviews with practitioners and clients, which are then organised into researcher-generated codes and categories. However, this approach to analysis does not make apparent the complex dynamics of mental model change that it is trying to portrait.

A few empirical studies have attempted to reconstruct the flow of real-time OR activity not from post hoc sources but from the analysis of participants' logged contributions in computer-supported problem structuring sessions. Two studies in particular are noteworthy. Ackermann and Eden (2011) trace the patterns of participant contributions over time, and link these patterns to modes of making sense and styles of negotiation. Similarly, Shaw, Ackermann and Eden (2003) analyse computer logs to show how participants develop

knowledge about issues with different degree of complexity, which affects their ability to develop in-depth understanding about those issues. These studies are important because they begin to unpack the temporal dimension of OR-supported activity more explicitly. However, like the other studies introduced earlier, they draw heavily on the researcher's own interpretations of what goes on within an OR intervention. Overall, all these studies share a key methodological issue. If the interest is in opening up the complexities and situated specifics of the practice of OR as it happens, then this is not apparent in the empirical materials presented or in the interpretations offered by those conducting these studies. A different approach is thus needed.

The use of live recordings of actual OR-supported work can address this issue. With such empirical materials at hand, it becomes possible to develop novel understandings into the intricacies of the ebb and flow of OR-supported activity and its outcomes. The use of live recordings remains rare within the OR discipline, but three recent studies that adopt this approach are worth considering further here. First, in their study of an OR workshop in which the viable system model (VSM) is used, Tavella and Franco (2015) conduct sequential analyses of audio recordings of participants' interactions to identify links between behaviours and knowledge outcomes. They show that new or shared knowledge is associated with collaborative behaviours and related model-supported interactions that enable contributions to be expanded, combined or reframed. By contrast, the display of calculative behaviours together with related model-supported interactions support boundary setting and the fixing of meanings associated with 'old' (rather than new) knowledge and the status quo. In a similar vein, Velez-Castiblanco, Brocklesby, and Midgley (2016) present a fine-grained study of how a team of OR practitioners design an OR intervention. They demonstrate how the configuration of an OR workshop to support a regional council in New Zealand is shaped by communications about boundary judgements. Team members 'set', 'follow', 'enhance', 'wander outside', 'challenge' and 'probe' boundaries during a discussion about the context and the methods to be used in the workshop. These two studies are noteworthy because they examine OR practice up close through detailed analyses of permanent audio records of live OR-supported work. Furthermore, these studies show an explicit concern with OR-supported interactions as effectuated through talk. However, the material aspects of OR-supported activity –namely, the 'models' used, talked about, and oriented to in interactions, as well as the technologies used to support their creation– are kept in the background. To bring the materiality of OR practice to the fore we thus need to capture not only talk, but also gesture, movement and the OR models and supporting technology in and through which OR-supported activity is accomplished in practice.

The interaction between people (such as OR practitioners, clients, users) within OR-supported practices is not just influenced by what people say, but also by the various OR technologies used (such as models and software). People do not just react and orient to what others are saying, but also towards the OR technologies at hand during their conversation. Take, for example, the case of facilitated modelling workshops (Franco & Montibeller, 2010). Those who have experienced such workshops either as facilitators or participants will be aware that when browsing the model displayed in front of them the conversation becomes less fluid. The embodied activities of the facilitator/participant in browsing the model content are intertwined with the ways in which the conversation unfolds. In that sense, the model both shapes, and is oriented to, in facilitated modelling workshops. The only way to capture such details is through the analysis of video recordings of live OR-supported interactions. This takes us to the third study that uses live recordings. White, Burger and Yearworth (2016) adopt activity theory (Engeström, 1987, 2000; Miettinen, 2005)

to guide their analysis of an intervention focused on energy efficient planning in a UK city. Using video-recorded material and a comprehensive micro-level coding scheme, the authors show how participants in a problem structuring workshop use mediating artefacts to wrestle with the object of a “zero carbon zone”, and demonstrate how a shared activity system is developed to accommodate contradictions between workshop participants’ activity objects (motives). What makes White *et al*’s (2016) study stand out from the other studies briefly reviewed above, is their use of video analysis to close examine what participants in OR-supported interventions do with each other and the OR technologies at hand, and what the effects of these doings are. In this sense their approach is arguably the closest to the one we adopt here. We too use video recordings to trace OR-supported practice in situ like White and his colleagues do. However, and this will become clearer in the paper later on, what distinguishes our approach from theirs is that we do not rely on predefined theoretically-informed coding schemes to guide our empirical analyses.

To conclude, studies based on audio and video recordings of actual OR activity are just beginning to appear within the emergent behavioural OR literature and, collectively, offer a response to calls for opening the black box of OR interventions at the micro-level (e.g. Franco, 2014; Franco & Rouwette, 2011; Tavella & Franco, 2015). It is against this background that we position our intended contribution. Our fundamental assumption is that unpacking the complexities and situated specifics of OR practice requires the adoption of an approach capable to study its material and interactional features as a ‘bundle’ rather than as separate dimensions. One such approach is ethnomethodology, which we discuss next.

3. Ethnomethodology and the analysis of naturally occurring interaction

Ethnomethodology was originally developed by Harold Garfinkel in the 1960s and was concerned, similar to Goffman (1959), with an exploration of the organisation of everyday conduct, in particular, how people do things: How do people greet each other? How do people portray themselves as male or female, as teachers or students, as managers or employees? How do people manage to talk without (much) gap and overlap? And, perhaps crucially, how people do all these things in such a way that they can be recognized by others? Thus, for example, when we want to greet someone we will extend our hand in such a way that the other can see that we want to ‘shake hands’ rather than, ‘hit’.

Garfinkel coined the term ‘ethnomethodology’ when he was analysing jury deliberations (cf. Garfinkel, 1974; Lynch, 2007). He noted that the jurors were being ‘methodological’ though not in any sense that “my colleagues would honour if they were attempting to staff the sociology department” (Garfinkel, 1974: 16). Garfinkel was reminded of the anthropological array of ethnosciences (e.g., ethnobotany) and conceived of ethnomethodology as “a study of local ‘native’ conceptions, terminologies, taxonomies, explanations, and practices in the domain of ‘methodology’ (Lynch, 2007: 491). In that sense, ethno-methodology refers to the study of people’s methods.

Ethnomethodology adopted a radical version of what is often referred to as the ‘actor’s point of view’. Rather than conducting investigations, typically based on ethnographic observation or audio-video recordings, of social activities to answer sociological questions, ethnomethodology tries to understand the work of everyday life in its own terms, ‘from the inside’ rather than ‘from the outside’ so to speak. Furthermore, rather than being interested primarily in what people think or believe (in particular, whether what they believe about social reality is ‘true’ or not), ethnomethodology was interested in what people do, i.e., how

they accomplish the various activities that they were engaged in, asking: How is it that people accomplish what they are trying to do? In that sense, ethnomethodology investigates ‘knowledge-how’ rather than ‘believing-that’ (Sharrock & Button, 2011: 39).

A fundamental resource for ethnomethodology, and its cognate approach of conversation analysis (Sacks, 1992; Sacks, Schegloff, & Jefferson, 1974; Sidnell & Stivers, 2012) has been the use of recordings of ‘naturally occurring’ interaction (in contrast with recordings of experimental situations). Initially, these were audio-recordings, but since the 1980s the use of video recordings has become widespread (Goodwin, 1981; Heath, 1986; Heath, Hindmarsh, & Luff, 2010). As Sacks (1984) remarked, such recordings provide a ‘good enough’ record of what happened and provide relatively direct access to the observed practices, in contrast to relying on accounts and recollections of those practices. Through repeated viewings and close examination of the data researchers have greatly expanded the range and precision of the observations that could be made. As Hindmarsh and Llewelyn (2016: 20) put it: “even a few seconds of video allows us to unearth a dense and rich social organization. It facilitates insights into the fleeting, yet fundamentally ordered and organized, nature of everyday work.”

In the 1970s, Garfinkel developed what has been referred to as ‘ethnomethodological studies of work’ (Garfinkel, 1986; see also Rouncefield & Tolmie, 2011). Garfinkel argued that most sociological studies of work did not actually study what people did as part of their work, but instead focussed on other issues, typically ‘sociological’ ones (e.g., power relations, gender differences, alienation, etc.). As Strauss et al. (1985: xi) put it: “[...] remarkably little writing in the sociology of work begins with the work itself (except descriptively, not analytically) but focuses on the division of labour, on work roles, role relationships, careers, and the like”. Again Garfinkel argued that one should study work from ‘within’, which means that researchers would have to engage in the practices they studied in order to become (at least) ‘vulgarly competent’ in them. Garfinkel’s students learned to play the piano (Sudnow, 2001 [1978]), conduct experiments in biology (Lynch, 1985), prove mathematical theorems (Livingston, 1986), or drive a truck (Baccus, 1986). More recently, there have been a number of studies exploring various aspects of organizations (Boden, 1994; Llewellyn & Hindmarsh, 2010; Rawls, 2008).

Both ethnomethodology and conversation analysis have been used for more *applied* research. Ethnomethodology has been used in system design, in particular computer-supported cooperative work and human-computer interaction to help with the design, improvement, and evaluations of new technologies (Button, Crabtree, Rouncefield, & Tolmie, 2015; Dourish & Button, 1998; Hughes, King, Rodden, & Andersen, 1994; Randall, Harper, & Rouncefield, 2007). In this context, Suchman’s (1987), *Plans and Situated Action: The Problem of Human-Machine Communication* was particularly influential, since it provided both a forceful critique of plan-based approach in both human-computer interaction and artificial intelligence, as well as a close analysis of a laboratory study of the use of a complex photocopier. Since the users in the study were famous scientists at Xerox PARC, Suchman aimed to show that initial problems in using a technology are not due to the incompetence of the user, but that there is an inherent (= unsolvable) difficulty in learning how to ‘read’ new artefacts (Suchman, 2011). Similarly, conversation analysts have used their methodologies and concepts to help with the changing, and improving, various institutional encounters, in particular service talk (Antaki, 2011; Stokoe, 2014).

In the next section, we adopt an ethnomethodologically-informed lens to illustrate, through a fine-grained sequential analysis of audio and video recordings of actual OR practice, how a

particular *facilitated modelling approach* (Franco & Montibeller, 2010) is practically accomplished by those involved, and with what effects.

4. Empirical vignette

In this section we draw on data generated from a facilitated workshop held in 2007 as part of a strategic review process at Back2work (a pseudonym), a medium-sized company located in England. The company's mission is to help disadvantaged individuals get back into employment by offering skills training and placement services. The purpose of the workshop was to help the top seven-strong management team at Back2work gain a shared understanding of the key strategic issues they were facing at the time on the strategic review. The first author was invited to join a consultancy team in charge of conducting the strategy review, and act as the workshop facilitator. The consultancy team had a successful history of previous consulting engagements at Back2work, and this made it possible to obtain permission for videoing the workshop and interviewing participants for research purposes. It is these video recordings that provide the main source for the empirical vignette presented later in this section.

The modelling approach used in the workshop was the causal mapping technique (Bryson, Ackermann, Eden, & Finn, 2004) supported by the *Group Explorer* technology developed by Colin Eden and Fran Ackermann at the University of Strathclyde. *Group Explorer* is a computer system that enables the construction and use of causal maps to support the work of teams engaged in strategy making or problem solving tasks. To construct the map, team members typically sit at small tables arranged in a horseshoe-shaped layout, with a console laptop for each table. The consoles are connected to a master laptop operated by the facilitator, who uses it to control the consoles and assemble team member's contributions, which are then displayed on a large public screen located at the front of the workshop room. The screen is visible to all team members and provides the focal point around which discussions take place. Members' contributions can be either entered anonymously through the consoles and instantaneously displayed on the public screen, or shouted out loud and entered and displayed on the public screen via the facilitator. Contributions are jointly structured between the team members and the facilitator using specific causal mapping coding guidelines (Eden, 1988, 2004), which results in a map that is continuously in transition as team discussions develop. Figure 1 shows the *Group Explorer* setup during the Back2work workshop, which in many ways is a typical *Group Explorer* workshop setting.

Figure 1: Typical (computer-supported) group causal mapping workshop

In what follows, we adopt the ethnomethodologically-informed perspective discussed in the previous section to illustrate the extent to which this approach can contribute to improve our understanding of what ‘doing OR’ is within the context of a group causal mapping workshop. Although there are many different aspects of the group causal mapping workshop that could be interrogated from an ethnomethodological perspective, we concentrate here on those that seem typical of group causal mapping work. Perhaps unsurprisingly then, one aspect that immediately came to the foreground was the use of the ‘causal link’, and a variety of discussions on how the ‘causality’ of links could or should be interpreted. Linking is a core activity in group causal mapping that is intended to capture and examine how people frame issues of concern as chains of networked argumentation (Bryson et al., 2004; Eden, 1988, 2004).

The fragment below shows a discussion of causal links around the strategic issue of ‘growth’. Prior to the fragment, participants were first asked to come up with a list of ‘strategic issues’ that they thought were important, resulting in a variety of about seventy statements or ‘nodes’ which were subsequently grouped into thematic clusters. Participants were then asked to create links between nodes (representing the fact that one the issue captured in a node can lead to, impact on, or influence the issue captured in another node), before moving to examine (as a group) the links that had been created.

Figure 2: Map excerpt showing initial linking within growth management cluster

As can be seen in Figure 2, there is currently a link from the node 'growth management' (number tag 8) to the node 'coping with growth' (number tag 1). The fragment opens with Greg reacting to the link created between these nodes. (Details of the transcription symbols used in this and other fragments in the paper can be found in the appendix).

Fragment 1.1:

- 1 Greg: I think growth management is the issue here.
- 2 F: ((looks at Greg, then at map))
- 3 Greg: One is the- >one of the symptoms ((tilts head to left
- 4 shoulder to signal direction of the link))
- 5 F: ((looks at Greg, then at map)) Yesss, okay.
- 6 Greg: → The arrow is the other way round.
- 7 (3.0)
- 8 F: Wh- wh- ((looks at Greg)) which?
- 9 Greg: Eight to one should be one to eight.
- 10 (1.0)
- 11 F: So, it's actually, yeah okay, so the label is actually
- 12 'growth management' ((looks at Greg))
- 13 Greg: Yeah
- 14 F: ((looks at map)) 'coping with growth' is the issue. Let me
- 15 just uhm ((changes direction of link to 1 → 8, and also
- 16 font colour and style of item 8 to red italics))
- 17 (7.0)
- 18 °There you go° 'Coping with growth' is one of the issues.

Figure 3: Map excerpt showing changes to the direction of the link between nodes 1 and 8, and the font style of node 8.

This fragment is touched off by Greg in line 1, suggesting that “growth management” (item 8) is “the issue”; this initial suggestion doesn’t elicit a response (in other words, it seems that participants are unclear what Greg is actually suggesting: what does it mean that it is ‘the issue’?), so in line 3, Greg provides an elaboration by saying that node 1 is “one of the symptoms”. This gets a hesitant acknowledgement from the facilitator F in line 5, which prompts Greg to further elaborate on his proposal: “The arrow [between nodes 1 and 8] is the other way round”. F is still unsure about what Greg is trying to say (line 8), so Greg reformulates his proposal in line 9, which is finally acknowledged by F (lines 11-12), who goes on to change the direction of the arrow (lines 14-17) and the font colour and style of node 8, resulting in a new model displayed in Figure 3.

This is in many ways a very typical example of what can happen during the exploration of links within a causal mapping workshop: participants are looking at the model, thinking about whether the current links make sense to them, and if not suggesting ways of changing them. In this case, one of the participants formulates a proposal (Asmuß & Oshima, 2012; Davidson, 1984; Garcia, 1997; Kangasharju, 2002; Maynard, 1984), which is not directly challenged by other participants, and which is accepted by the facilitator who makes an actual change to the model. This move from a simple verbal proposal to an actual change in the model takes effort, as evidenced by how many tries it took Greg to make his point across (it took four tries –see lines 1, 3, 6 and 9). Presumably Greg thinks that the statement in line 1 is equivalent to the one in line 9. However, there are many nodes contained in the map that Greg could be talking about, which accounts for the initial problems encountered by F. Note also that Greg’s proposal is not just formulated ‘verbally’, but uses gesture (lines 3-4) and various material resources to highlight the direction of the link, namely the use of number tags attached to the statements displayed on model at the front.

Linking gives meaning to each node by setting it within a context that makes clear why the issue captured in the statement matters (consequences) and what needs to be done to address it (explanations) (Eden & Ackermann, 2010). This means that the actual wording of a node matters less than the causal context within which it sits, at least theoretically. In practice, however, interrogating the meaning of the wording of nodes happens often, which can lead to the re-examination of previously agreed links. This is illustrated in the following fragment that takes place moments after Greg’s suggested change. The fragment opens by participant B asking for the meaning of node 1, ‘coping with growth’.

Figure 4: Re-examining the direction of the link between nodes 1 and 8.

Fragment 1.2:

19 Bob: ((looking at display))

20 What does it mean to 'coping with growth'? [4a]
 21 (3.0)
 22 Sam: Depends on what you view to be the issue?
 23 (1.0)
 24 Bob: ((looks at Sam, then at display, then at Sam again))
 25 Sam: You see, I think management is a thing that
 26 you do in order to address a particular issue
 27 (4.0)
 28 Bob: Can't you say coping with growth for growth?=
 29 Kai: =Growth itself (.) is the issue, isn't it?
 30 (1.0)
 31 F: Is- Is 'coping with growth' the issue then?
 32 [
 33 Ali: (inaudible)
 34 F: ((looks at Sam))
 35 Sam: It is for me. [4b]
 36 F: ((scanning the room))
 37 (1.5)
 38 F: What do you think, huh?
 39 (1.5)
 40 Bob: ((gazing at Sam while looking at model))
 41 Growth management enables you to cope with
 42 growth
 43 Sam: >Absolutely!
 44 (0.7)
 45 So, it is something that comes out of it
 46 ((moves both hands in north-west direction))
 47 for- >in the way I see it

In this fragment, Bob starts by asking about the meaning of node 1, 'coping with growth' (line 20), as shown in Figure 4a. This is taken up by another participant, Sam, in line 22. Sam's utterance ("Depends on what you view to be the issue?") is clearly not a direct answer to Bob's question, but seems to divert the problem: the meaning of 'coping with growth' is dependent on what 'the issue' is (i.e. node 1 or node 8). Sam then elaborates on this, by voicing his understanding of "management" (lines 25-26), which can be heard as an elaboration of the *other* node, 'growth management' (in that sense, Sam is explaining the meaning of node 1 by explaining the meaning of node 8).

After a long pause (line 27), Bob makes a tentative but somewhat unclear suggestion of how to reformulate node 1 (line 28). Immediately afterwards, another participant, Kai, formulates another proposal, namely that 'growth' (in itself) is the issue (line 29). At this point, the facilitator F tries to reign in the interaction, by refocussing the participants' attention on which of the two nodes under discussion is 'the issue' (line 31). F asks whether 'coping with growth' is the issue and seeks a response from Sam (line 34), who confirms that this is the case (line 35) –see Figure 4b. F then seeks further confirmation from the rest of the participants but does not get a response (lines 36-39). Then Bob formulates the link between nodes 1 and 8 by stating that "growth management enables you to cope with growth" (lines 41-42), which gets a supportive reaction from Sam (line 43), who then confirms that "[coping with growth] is something that comes out of [growth management]" (line 45). Finally Sam gestures the suggested direction of the link by moving both of his hands in north-west direction (line 46), to indicate that the link should be re-drawn to from node 8 to node 1, as it was originally shown in Figure 1.

We can see here that the decision to reverse the direction of the arrow (in Fragment 1.1) prompts another participant to interrogate the meaning of one of the nodes. Various

participants make suggestions of how they understand the two nodes and the direction that the arrow should go. In this fragment participants' *individuality* (Kelly 1955) becomes salient in the ways they express their expertise, wisdom and experience of the world (e.g. "management is a thing that you do in order to address a particular issue"), a feature that is commonly claimed to be associated with group causal mapping interactions (Ackermann & Eden 2010). In contrast to the previous fragment, the whole discussion stays at the verbal level; the model is not modified. Thus, in a sense, the different understandings are left standing beside each other. These different understandings continue for a while until Sam invokes the 'prompt question' used at the start of the workshop to brainstorm the issues captured and displayed as nodes in the map. Figure 5, shows how the prompt question would have appeared on Sam's laptop screen (reconstructed using the Group Explorer systems and the recorded computer logs from the workshop) during the next fragment.

Figure 5: Pointing at and reading the prompt question

Fragment 1.3:

48 Sam: (We've talked-) ((points at prompt displayed on laptop screen) [5a]
 49 >You have to go back to the original statement.
 50 What's your original statement?
 51 (3.0)
 52 F: So basically
 53 ((looks at map, then highlights node 1 on map))
 54 Bob: ((looks at Sam))
 55 F: ((turns to Sam)) you are saying that *that's* basically the issue?
 56 Sam: That is for me, but- (((opens arms to rest of group))
 57 F: (((nods whilst looking at Sam))
 58 F: okay
 59 ((looks at participants to his left side))
 60 (5.0)
 61 ((looks at participants to his right side))
 62 Is *that* the issue then?
 63 Sam: ((reads prompt question on laptop)) [5b]
 64 >We are saying [if you were to be as successful
 65 F: (((looks at S and nodes))
 66 Sam: as you are being today, what are the key strategic
 67 challenges/issues that [Back2Work will be facing=
 68 F: (((turns to look at map))
 69 Sam: =over the next three to five years?

The fragment starts with Sam proposing to go back to the original statement (the 'prompt question') they have been given as the workshop task (lines 48-50) –see Figure 6a. After a pause, F steps in and formulates a candidate solution by highlighting node 1 ('coping with growth') on the public screen (lines 52-53, 55). Sam agrees with this formulation, but indicates that other members of the group may have a different view ((line 56)). When nobody responds to this (note the long pause of 5 seconds in line 60), F restates the question

(line 62) but nobody responds. Instead, Sam reads out the prompt question (lines 4-69) –see Figure 5b.

We want to draw attention on how the ‘prompt question’ is brought into the discussion here. The whole sequence was started off, in Fragment 1.1, with a question about the direction of a particular *link*; this then led participants to interrogate the meaning of the two *nodes*; and as a result of them not being able to resolve their questions, a participant now brings back the original *prompt* that they were given. What is interesting is that all of this is ‘participant-driven’. These ‘moves’ are *not* initiated by the facilitator F, but by the participants themselves in response to what they see displayed in the map in front of them. In the next and final fragment, we show how F prompts the participants to reach a conclusion regarding the direction of the link between nodes 1 and 8.

Figure 6: Reaching closure

Fragment 1.4:

70 F: ((looks at map and opens hands)) [6a]
 71 So so (.) if if >if 1 is the issue then 8
 72 could become something like uhh (0.5)
 73 'ensure', you know?, (((looks at Sam)) 'successful growth
 74 management'?
 75 Sam: (((nodding)) °Yeah
 76 F: Something like that
 77 Cam: °Yeah
 78 F: So it's an enabler [on its own
 79 Bob: [°But (inaudible)
 80 Cam: [°Yeah
 81 F: ((starts changing the wording in the node)) [6b]
 82 Bob: For me, 1 could be 'growth', like you were
 83 saying (it). We don't have to be careful
 84 with growth, it's growth
 85 Sam: Yes, it could be (0.3) could be. And all the
 86 other things are (0.3) how do you cope with it?
 87 it's just- >it articulates the issue.
 88 [
 89 F: ((moves to changing font style and colour of node 8 to red
 90 italics))
 91 Bob: Yeah.
 92 F: ((has finished changing font colour))
 93 F: So::
 94 (4.0) ((selects the arrow from node 1 to 8, and deletes it))
 95 F: Is that? (one way the arrow goes?)
 96 (2.0)
 97 ((draws arrow from 8 to 1))

98 ((looks at Sam))
 99 F: Yeah?
 100 (0.5)
 101 F: Does that make more sense?
 102 (1.5)
 103 So basically- >yeah? ((looks at Greg, Bob, Cam, Kai and Ali))
 104 Bob: Yeah.
 105 F: Okay.

Figure 7: Map excerpt showing final version

In this fragment, the facilitator F tries to bring the discussion to a close. He proposes that node 1 ('coping with growth') really should be the issue, which then would mean that node 8 should be reformulated, perhaps into '*ensure successful growth management*' (lines 70-74). This proposal is accepted by at least one person in the room (lines 75 & 77) and F then moves on to implementing the changes into the model (line 81).

While the facilitator F is doing this, there is another exchange between Bob and Sam (lines 82-87, and 91), but the facilitator does not pick up on this as he appears already committed to changing the wording of node 8. F finishes re-wording node 8 and also changes the font style and colour of node 8 (lines 89-90, and 92). F formulates a conclusion while tentatively drawing an arrow from node 8 to node 1 (lines 94-97). Once that has been done, he looks into the room and tries to gauge whether everybody in the room accepts this new formulation (lines 98-103), which is shown in Figure 7.

We want to draw attention to the work of the facilitator F in this fragment. It is the facilitator who tries to bring the discussion to a (temporary) close, by making an explicit proposal (lines 70-74). Furthermore, when no one objects to this, the facilitator quickly moves on to implement his proposal into the model, thereby transforming the proposal from a purely verbal one to a permanent one that is now visible in the model. The sequential and interactional nature of the facilitated modelling process brings to the fore the ways F's turns were designed to select particular actions, such as participants' agreement on the wording of an issue (lines 70-74, 78) or the direction of a link (lines 93-103). What is also important to note is the fact that the work of *facilitating* is not just done verbally (by asking the right question; by trying to formulate 'compromises'), but also materially: only the facilitator can change the model on the display and thereby transform transient, verbal proposals into persistent, material ones. In other words, the facilitator is here 'solidifying' the proposal. It still could be challenged or changed – but at this point it stands 'there': not just as a verbal formulation in the room, but as a material representation on the display.

The fragments examined above show how agreement on model content is a temporal

interactional accomplishment: a situated process where ‘intersubjective alignment’ (Hindmarsh & Heath, 2000; Samra-Fredericks, 2010) is temporally gained and constantly worked upon by the facilitator. Let us quickly summarize how the model has changed in this fragment. Initially, the model is open for scrutiny by participants and, in particular, the arrow from node 8 (= ‘growth management’) to node 1 (= ‘coping with growth’). This arrow then gets changed in the other direction, from node 1 to node 8. At the end, the direction of the arrow is changed again, from node 8 to node 1, but now node 8 is *reformulated* (= “ensure successful growth management”). As already stated, a core aspect of group causal mapping involves linking nodes that capture issues of concern to those involved in the problem structuring activity. The direction of the links implies causality –i.e. issue to issue, means to ends, option to outcome. However, which direction is eventually captured in a map will depend on the value system of the individual (or group) involved in the mapping. Ackerman and Eden (2010) highlight this dilemma with their example of the relationship between ‘buying a new computer’ and the ‘backlog of processing is too big’: whilst some could see the latter as a good reason for realising the former, others could see the former is the only option to effectively address the latter. As a consequence, it is not uncommon for the direction of links to be re-evaluated as new perspectives on the issues are surfaced and explored. This might explain the apparent differences in the way Greg and Sam interpreted the direction of the link between nodes 1 and 8, as these represented their own beliefs about causality, which were not challenged by the facilitator during the discussion. These differences do get resolved in the end by the facilitator’s reformulation of node 8. This resolution will have interactional consequences for the participants’ subsequent discussions during, as the meaning and relationships of these nodes became (visually) permanent in the model.

5. Discussion

The preceding fine-grained analysis of fragments drawn from an actual facilitated modelling workshop portrays the practice of OR as a skilled accomplishment: one that is based on the situated and concerted assembling of discursive and material resources. Furthermore, our analysis enables us to glimpse some of the complexities and distinctive features of real-time OR-supported activity. Specifically, the work presented here suggests that the actual practice of facilitated modelling may be more usefully understood as a contingent, interactional and sequential accomplishment involving the ‘collaborative viewing’ of models: a socio-material process where issues are ‘seen’ and understood through the interplay between a model open to scrutiny, and a set of discursive and embodied practices being deployed within the process. Thus, within a facilitated modelling workshop, these practices critically involve talking and looking, coding (e.g. ‘means’ vs. ‘ends’; ‘issues’ vs. ‘symptoms’), and highlighting (e.g. gestures such as pointing; changing the style of a node or link in a map). In and through these practices, participants display an orientation to both the model and the sequential character of the facilitated modelling activity. These interactional and situated aspects of facilitated modelling work are certainly well known to OR practitioners, but perhaps less so to those wishing to enter into this area for the first time.

Our ethnomethodologically-informed perspective provides a departure from current theorising about OR practice within both the general OR field and the specific behavioural OR sub-field in at least three ways, each of which has implications for research, practice, or both. The first one relates to the notion of ‘shared understanding’, a key product claimed to be associated with the use of OR approaches such as facilitated modelling. The literature on facilitated modelling (e.g. Eden, 1992; Franco & Montibeller, 2010; Phillips, 2007) tends to

highlight the cognitive and analytical aspects associated with the production of shared understanding –namely, how the analysis and manipulation of model structure and inputs by those involved in the process is conducive to a shared understanding of the situation of concern, and of potentially useful ways to address that situation. Consequently, one of the many purposes of conducting evaluation studies of facilitated modelling approaches is to assess the degree of shared understanding attained and experienced by those who used the approach (e.g. Rouwette, Vennix, & Van Mullekom, 2002). The task of the researcher in an evaluation study is thus to find the most robust and reliable way to conduct such assessment. However, the assessment of shared understanding is not just a task for the researcher/evaluator but, in the first place, it is a task for *participants*. A participant, in her or his reaction to another participant's prior turn, displays an understanding of *that* prior turn, which can, on occasion, be corrected, acknowledged, or challenged *in situ* (Sacks et al 1974).

Thus the question is: how shared understanding of issues such as 'growth' or 'management' is achieved turn by turn, moment by moment? In this respect, the empirical vignette presented here shows how the range of discursive and embodied practices displayed during interaction provided a framework within which the participants made judgements about their indexical understandings of the map. And whilst we cannot claim that shared understanding is really gained, the illustrative empirical evidence presented here suggests that at least a temporal 'intersubjective alignment' (Eden, Jones, Sims, & Smithin, 1981; Hindmarsh & Heath, 2000; Samra-Fredericks, 2010) towards that map is gained. For example, fragment 1.1 reveals how a participant who has pointed out a map feature (e.g. a link between two nodes) through talk and gesture can then assess whether the facilitator has seen or found that feature, that is, with reference to the facilitator's *publicly displayed* appreciation of the feature. The way in which the participant introduces the map feature provides for the potential range of actions that maybe be seen as appropriately and relevantly appreciating the feature. The appropriateness of those actions in the next turn reveals whether the relevant feature has been found by the facilitator. As fragment 1.1 shows, initially the facilitator has trouble in seeing the link and producing an answer, and the participant then has to provide further instruction in how to see the link (it took three turns for the facilitator to appreciate the link). By displaying an explicit orientation to both the map and sequential character of the facilitated modelling activity, participants make and produce sense of the map, and ensure that they are discussing the map in the same way, as it can have fundamental implications for any potential course of action that is projected.

As our empirical vignette makes evident, the sense and significance of the models produced in facilitated modelling workshops is thus continually accomplished. This leads to our second departure from current theorising about OR practice. Compare the representation of OR practice portrayed here with those embedded in the 'scripts' suggested as exemplars of effective OR practice, particularly those related to facilitated modelling (e.g. Ackermann, Andersen, Eden, & Richardson, 2011; Andersen & Richardson, 1997; Bryson et al., 2004). Scripts are a predefined and documented set of expected behaviours by those engaged in an OR-supported process. For example, step 4 of the script for 'building graphs over time' reported in Herrera *et al* (2016: 1307) states that the facilitator "asks participants to draw one variable over time per piece of paper", and that the participants "should be given the option of including *hoped for* behaviour, *expected* behaviour, and *feared* behaviour on the same graph" (our italics). It is not so much that such scripts are not close enough to practice: they are in fact developed by very experienced academic/practitioners, many of whom are the original developers of particular facilitated modelling approaches. The main difference resides in their inability to represent some of the practice's richness and complexity. In other

words, ‘scripts’ have to be *accomplished* and therefore do not *determine* or *prescribe* what the facilitator (or participants) actually do (cf. Schmidt, 1999). We are here reminded of Suchman’s (1987) discussion of ‘plans’, which in cognitive science had been seen as a prospective way of determining action, whereas Suchman argued that in most cases these are better seen as retrospective ways of formulating action, since *in the moment* we have to respond to conditions as they arise in an *ad hoc* fashion (even ‘planned’ actions are *situated* actions). The gap between ‘espoused’ practice and practice ‘in use’, to use Argyris & Schon’s (1974) terms, clearly has implications for OR education and training. To the extent that a theory of OR practice does not correspond to actual practice, students of OR are at a disadvantage, and thus may have to face a steep learning curve when starting their professional careers.

Finally, the ethnomethodologically-informed perspective adopted here both complements and broadens the approach and level of analysis typically used to evaluate the impact of OR in practice. With respect to the evaluation approach, the impact of OR is often determined by measuring changes in a system before and after the use of OR in that system, i.e. a variance approach. Although valuable, this approach ‘blackboxes’ how OR impacts come about as a *process*. Regarding the level of analysis, the impact of OR in practice is commonly highlighted at the organizational-level, as evidenced by the accounts reported in journals such as *Interfaces*. Again this is valuable but overlooks the impact of OR-supported activities at lower levels of analysis. In fact, behaviours that would perhaps negatively impact on an OR project will never be found in an *Interfaces* article because this journal requires documentation of successful implementation and impact, and thus these published accounts serve as quite a censored source of data for practice. By contrast, our adopted perspective suggests that the evaluation of OR impacts can be assessed with a process approach and at a fine-grained level of analysis. So for the case of the empirical vignette examined here, the developmental attainment of intersubjective-alignment about an issue or the direction of a link represents micro-level impacts that are consequential to the ensuing interactions within this specific workshop and its final products, which in turn are likely to be important for shaping the future direction of the Back2work’s top management team, and their organisation as a whole.

6. Conclusion

The argument advanced in this paper is that if the emergent behavioural OR movement is serious about improving the practice of OR, then we must first pay attention to *how* OR is used by those who engage with it *in situ*. This focus can help to avoid superficial understandings of what OR actors actually do on the ground, and of the critical role of these doings in generating OR-supported outcomes. The use of ethnomethodology to examine video recordings of actual OR practice allows us to show what seem at first unremarkable events (e.g. person A doing *x* led person B doing *y* as an example of *z*). However, what events are chosen for fine-grained analysis (and why they are important) is always driven by the theoretical and practical considerations of the researchers (e.g. how participants achieve intersubjective alignment and a shared mental model).

There is considerable potential for further research using the approach adopted here, and we would like to highlight two possible avenues in particular. First, if we are concerned about developing OR competences (Keys, 2006; Murphy, 2005a; 2005b; Ormerod, 2008, 2014) leading to successful ‘strands of practice’ (Corbett, Overmeer, & Van Wassenhove, 1995; Overmeer, Corbett, & Van Wassenhove, 1998), then we need to develop materials based on

real OR-supported interactions as a basis for training. To this end, the collection and analysis of video recordings of actual OR work provides an alternative way to develop and improve OR practice (for an approach that also uses video-based analysis for improving the practices of school teachers, see Kane & Staiger, 2012). Specifically, fine-grained analyses of multiple instances of observed OR practice can identify the organisation and trajectories of different micro-level OR-supported tasks (e.g. opening a task, explaining how carry out the task, doing the task, closing the task), with a view to distinguish successful from unsuccessful interactions. With the knowledge accrued from these analyses, it would be possible to develop ‘role-plays’ grounded in the actual activities of anonymised peers doing OR. The structure of such role-plays would be designed in a way that the trajectory of a given micro-level OR-supported task would only be revealed after the trainees do something at a particular point in interactional time. This type of role-plays are akin to those developed and used in the practice of Drama Theory (Bryant, 1997, 2002), although what we suggest here would be based on a corpus of empirical material comprised of multiple instances of actual OR work, rather than on the one-off situations that are typically the focus of Drama Theory. This approach to skills training has been pioneered by Stokoe (2013, 2014) in other professional fields, such as mediation services, and OR scholars wishing to develop this important avenue for future research are encouraged to consult her work.

A second potentially useful avenue relates to the design of new facilitated modelling approaches. Although some facilitated modelling approaches rely exclusively on paper-based technologies, several approaches use computer-support technology that is constantly evolving. For example, the *Group Explorer* technology described in this paper is an earlier version of the one currently on the market, and the laptops are sometimes replaced by tablets these days. Furthermore, the increasing use of audio-visual communication platforms where documents can be shared among participants who may be in remote locations is beginning to influence the way facilitated modelling workshops are run, i.e. ‘on-line’ rather than ‘face-to-face’. We posit that ethnomethodologically-inspired studies offer the potential to inform the design and development of new computer-supported technologies for supporting facilitated modelling in both face-to-face and virtual environments. Such studies can be based on designed experiments that can reveal any inadequacies of a particular technological development, and thus provide a means for their qualitative assessment and potential redesign.

Perhaps the most obvious limitation of our proposed approach is the time and effort needed to implement it: getting access; recording; watching listening, and transcribing; undertaking fine-grained analyses; and condensing all the materials and analyses into a meaningful written account. This is a big challenge for those new to this approach that perhaps not many would be willing to take on. However, if the interest is on revealing not what is said about OR practice, but on what is actually done as OR practice in order to assess and improve it, then undertaking this type of research is a needed and complementary addition to more conventional studies. This also suggests the need for operational researchers to acquire additional skills in this type of social science research. Alternatively, operational researchers can team up with social scientists, or perhaps social scientists can team up with operational researchers to consider OR practice as an important area worth investigating. It is our contention that proper attention to OR’s situated, interactional and material features will move the behavioural OR agenda closer to the reality experienced by those engaged in the world of OR practice.

Appendix: Transcription symbols

For the analysis presented in this paper, we followed the conversation analytic transcript conventions developed by Gail Jefferson (2004). The most important are the following:

- double parentheses [“(())”] are used to mark transcriber’s descriptions of events;
- single parentheses [“()”] indicate uncertainty on the transcriber’s part;
- underlined items [“item”] are hearably stressed;
- colons [“a:.”] indicate prolongation of the immediately prior sound;
- the degree sign [“°”] is used as a softener;
- a dash [“-”] indicates a cut-off;
- an inbreath is denoted by a preceding circle [“°h”];
- numbers in parentheses [e.g., “(0.3)”] denote a silence in tenth of seconds, while “(.)” denotes a micro pause of less than 0.2 seconds;
- the onset of overlap is indicated either through square brackets between lines [“[“], or in case of ‘latching’ through an equal sign [“=”].;
- an arrow is used to indicate particular lines of interest.

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