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Praxis in healthcare OR: An empirical behavioural OR study

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ABSTRACT

Operational researchers working in academia commonly struggle in attempts to influence practice and decision making in healthcare amid a growing recognition that behaviour is key to effective operational research (OR). To further our understanding of the behavioural factors that operational researchers working in healthcare consider influence their work's impact, we interviewed 24 OR practitioners working in academia and with experience of working with the UK National Health Service (NHS). The semi-structured interviews were consented, recorded, transcribed, and analysed thematically using a framework approach. Five dominant themes emerged that highlighted: behavioural challenges concerning flexibility, pivoting and the abandonment of projects; the influence of the evolving ambitions, maturity and behaviours of a practitioner's OR group; the hidden and changing motivations of host healthcare organisations; the reliance of practitioners on intuition and how their praxis is influenced by their agency within their group and its relationships with healthcare organisations; and how attributes of altruism, broader life experience and creative risk-taking influence an individuals' praxis. In summary, we identified numerous behavioural factors considered important to success that operate within and across individual projects.

1. Introduction

There has been a resurgence of interest in the role and impact of behaviour on the practice of operational research (OR), with Behavioural OR (BOR) emerging and gathering momentum as a sub-discipline within OR. BOR has been defined broadly as the study of "behavioral aspects related to the use of operational research (OR) methods in modeling, problem solving and decision support" (Hämäläinen et al., 2013). Franco and Hämäläinen split BOR into two distinct strands of study: how human behaviour can be modelled using OR methods (type 1), and how behavioural aspects impact on the effectiveness of OR in supporting problem solving and decision making (type 2) (Franco & Hämäläinen, 2016b).

Franco and Hämäläinen additionally introduce an organising framework for BOR studies that distinguishes between OR methods, OR actors, and OR praxis as analytical dimensions of BOR, which can be conceptualised as follows (Franco & Hämäläinen, 2016a):

- OR methods – The range of OR tools and techniques (including approaches to building, using, embedding, and communicating with and about

models) that guide behaviour in an OR-supported process;
- OR actors – The individuals who conduct or engage with OR-related activity and whose behaviour may influence the effectiveness of OR interventions and projects;
- OR praxis – The activity carried out by OR actors and how behaviour is enacted in the OR process.

An alternative BOR taxonomy introduced by Kunc et al. (2016) considers behaviour either in, with, or beyond models, referring, respectively, to incorporating behavioural factors within models of human activity systems, studying how behavioural factors influence the use of models for decision-making, and understanding how behaviour changes as a result of using models in a social context. This focus on models carries an implicit focus on individual interventions or projects, which have been the primary focus of study within BOR to date: the building of human behaviour into models naturally occurs at the level of an intervention, and projects are a (reasonably) well-defined unit for the empirical analysis of behavioural aspects of OR. The study of behaviour *beyond* models takes an expansive view of interventions, emphasising the socially situated nature of OR and recognising, for

example, the emergence of collective behaviour (White, 2016). Further, units of analysis other than individual projects can offer a different lens through which to gain insights that contribute to BOR's overarching promise of enabling "a move towards better OR methods, improved OR praxis, and increasingly competent OR actors" (Franco & Hämäläinen, 2016b). For example, Corbett et al. focus on OR practitioners as a unit of analysis and argue that "an OR practitioner's work cannot be understood by looking at the projects he performs as independent entities. Those projects are strongly interrelated, and the practitioner's approach and his success or failure in any one project can only be understood by looking at the series of projects that form that practitioner's prior experience" (Corbett et al., 1995). In further critiquing solely project-based analyses of OR, they reflect that OR practitioners develop "strands of practice" through a learning process that is influenced by the environment they work in (which in their case refers to OR consultancies). Focusing on a perceived lack of impact from OR conducted in business schools, Mingers (2015) identifies a number of contributing environmental factors including the emphasis on producing theoretical research so as to do well in research evaluation exercises that influence a School's income and individuals' career paths.

The social sciences have a rich tradition in the study of human behaviour that can usefully augment BOR. Indeed, Becker argues that OR cannot develop a "genuinely new perspective on behavioural phenomena on its own, i.e. a perspective that can do without existing social scientific expertise" (Becker, 2016). It is helpful to consider two ways in which the social sciences can be harnessed constructively to inform BOR. First, one can use established methods from the social sciences to study behavioural aspects of OR, e.g., ethnography (Atkinson, 2007) and thematic analysis (Silverman, 2016). Second, one can draw on social science theory and literature to make sense of and explain behavioural phenomena relating to OR. In their work, both Becker (2016) and Brocklesby (2016) emphasise the need for more theoretically informed accounts of the human and social aspects of OR interventions and suggest areas of social science theory that may prove fruitful in this endeavour. However, Becker cautions that learning about behavioural aspects of OR through social science theory and method "cannot be done casually" and yet operational researchers cannot hope to "wait for the social sciences to carry out this type of research on its behalf" (Becker, 2016).

Healthcare is one important activity worldwide that is ripe for the attention of BOR for several reasons. First, healthcare faces numerous challenges that are potentially amenable to OR-supported approaches. Second, human behaviours are central to healthcare yet many research articles fail to acknowledge behavioural aspects and make explicit the assumptions used to represent behaviour in OR models, as shown by Kunc et al. in their recent systematic review of the healthcare OR literature (Kunc et al., 2020). Third, levels of successful implementation of healthcare OR are low (Brailsford et al., 2009) and so there is a pressing need, and opportunity, for type 2 BOR research to address this.

To this end, we conducted an empirical type 2 BOR study of non-technical factors perceived to influence the uptake of academic OR (i.e., OR conducted by academics) in healthcare, drawing on research methods from the social sciences. Rather than use OR projects as our sampling frame, we interviewed OR practitioners working in academia regarding their experiences working to have impact in healthcare OR over their careers to date. Our findings provide a rich view from practice, with insights into the 'hidden motivations' of OR researchers and groups, and their perceptions of hidden motivations on the part of client organisations. The research contributes to the BOR literature in two key ways. First, we generate valuable insights regarding the OR actor and OR praxis dimensions of BOR, and the interaction between them. Secondly, we highlight the importance of considering praxis across individual projects or interventions.

The remainder of the article is in four parts. In the next section, we describe in greater detail the context of academic OR in healthcare in relation to BOR, with a particular focus on the United Kingdom (UK). In Section 3, we set out the methods used in this empirical study, which draw on social science approaches to data collection and analysis. In Section 4, we present our findings, organised around five key themes. In Section 5, we discuss the findings in relation to current discourses in BOR and social science theory, and suggest directions for future research and for broadening the education and training of OR.

2. Healthcare OR conducted by academics

Systems delivering healthcare are often complex, challenging to organise, and subject to resource constraints making them ripe for the beneficial application and, where necessary, development of OR approaches. However, in the UK's National Health Service (NHS) OR is not habitually performed inhouse as part of the business of designing, redesigning, and improving services. Attempts at introducing more OR thinking, knowledge, models and findings to healthcare thus often come in the form of projects, which are commissioned either by health service organisations or research funders and

undertaken by consultancy firms or academic groups (Brailsford & Vissers, 2011). From the perspective of healthcare organisations, these projects often have a dual purpose of solving a specified problem and trying out, or demonstrating the value of, OR as an approach for solving such a problem. Those OR academics focused on their work being impactful within healthcare therefore often engage in distinct projects that have this dual purpose and elements of consultancy practice (with objectives and time-scales influenced strongly by the healthcare organisation and the relationship being a hybrid of a client-provider relationship and a relationship between research collaborators). The distinct projects may have little or no continuity of stakeholders or thematic focus between them.

OR in healthcare has been an academic field of interest for many years and there are some well-established journals (e.g., Health Systems, Health Care Management Science, and Operations Research for Health Care) and groups (e.g., the Society for Medical Decision Making, the EURO Working Group on Operational Research Applied to Health Services). There are many academic articles focusing on the theory or practice of healthcare OR, with several examples of successful applications. However, the general failure of academic OR projects to influence decisions in healthcare is well documented (Brailsford et al., 2009; Fone et al., 2003), and findings from individual OR projects are not widely taken up and adopted elsewhere by other health organisations (Brailsford & Vissers, 2011). Given its unfulfilled potential, healthcare OR is fertile ground for the attention of type 2 BOR. There has been little such research to date, apart from review articles on project-level barriers to, and facilitators of, successful implementation. For example, as early as 1981, Wilson surveyed the healthcare simulation literature and, for the low proportion of papers that reported successful implementation of project findings, evaluated possible reasons for their success and developed criteria for prospectively selecting projects likely to influence decisions in practice (Wilson, 1981). More recently, van Lent et al. (2012) reviewed the literature to identify factors contributing to the implementation of findings from simulation projects, whilst Brailsford and Vissers (2011) also used the project life-cycle as a framework for analysing papers presented during meetings of the EURO Working Group on Operational Research Applied to Health Services. While these authors are no doubt aware that these issues apply beyond single projects and that other issues originate and act outwith the conceptual boundaries of the isolated project, they write about projects.

It has been recognised for decades that, as noted by Wilson (1981) and by Rosenhead (1978), there are several reasons why healthcare is a particularly difficult field in which to implement OR studies, including: a lack of clear decision-making hierarchy, with managers often unable to take direct actions towards goals and many decisions made by committees; significant weight being given to political considerations in decision-making; an inter-dependency of decisions with external actors (e.g., in local and national government, industrial and commercial organisations), and; the "wicked" nature of the problems and potential for conflicting judgements on "what good looks like." Results from a survey conducted by Tako and Robinson (2015) show that simulation experts generally perceive modelling to be different, and more challenging, in health compared to other sectors, and suggest that the key sources of perceived difference are human factors (relating to clinical staff and patients), the fragmented nature of health services, absence of good quality data and the politically charged environment.

The challenging nature of the landscape and the poor uptake of academic healthcare OR in practice have led some to propose frameworks for conducting more successful OR projects. For example, Harper and Pitt (2004) draw on their personal experiences as OR academics in proposing a project life-cycle for successful implementation of healthcare models. In addition to considerations relating directly to model development, their framework includes: forming a project steering group; engaging with actors in the client organisation to build credibility and to understand any political sub-agendas, and; promoting the results to a healthcare audience. Focusing more specifically on improving facilitative simulation projects in healthcare, Tako and Kotiadis (2015) present a framework that combines soft systems methodology with simulation in order to incorporate stakeholder involvement in the project life-cycle. In contrast, and in a rare example in which the OR practitioner is the analytical unit rather than the OR project, Brandeau (2016) draws on her experience as an academic operational researcher to propose a blueprint for junior academics seeking to inform and influence decisions in health.

Whilst the question of how to make academic health OR more impactful on practice is often discussed on conference panels, workshops, and informally amongst peers, there are very few empirical type 2 BOR studies in healthcare to the best of our knowledge. Notable exceptions are the qualitative study of factors influencing the successful adoption of simulation tools by Brailsford et al. (2013) and

Table 1. Interview participants.

Seniority/job role	Number of interviewees
PhD student	1
Research Associate/Fellow	6
Lecturer/Senior Lecturer/Senior Fellow/Associate Prof	9[a]
Professor	6
Performance Analysis Manager/Mathematical Modeller	2
University department/school	
Business/management	9
Health Sciences/medical	7
Mathematics	5
Engineering	1
Other	2

Interviewees ranged from junior to senior operational researchers, all working in healthcare and predominantly through their academic posts (which were spread across business/management, mathematics, health sciences/medical, or engineering departments or schools).
[a]One participant identified as a consultant with academic positions.

Crowe et al. (2017)'s qualitative study of OR praxis in the generation of actionable knowledge for improving healthcare. Both studies drew on social science methods (interviews, participant and non-participant observation, thematic analysis) and literature (e.g., on technology/innovation adoption and knowledge management). Other applied health research makes significant use of relevant social science literature and theory that could usefully inform the beneficial adoption of OR approaches and findings within healthcare, for example in the fields of research utilisation and knowledge mobilisation (Crilly et al., 2010), the diffusion of innovations (Greenhalgh et al., 2004), and managing organisational change (Davies et al., 2000).

3. Methods

3.1. Study context

In 2013, the first author (SC) began a research fellowship focusing on enhancing the effectiveness of OR in healthcare by drawing on methods and learning from the social sciences. This included undertaking training in qualitative research under the mentorship of a senior academic organisational ethnographer and conducting an ethnographic study of an OR project (Crowe et al., 2017). The component of the fellowship described in this article was concerned with using social science methods to examine how operational researchers could be better supported to understand the context in which they undertake projects in order to enhance the beneficial impact of their work.

3.2. Study design

Our study involved semi-structured interviews with operational researchers, focusing on participants' experiences in relation to OR in healthcare (e.g., their interactions with stakeholders, the challenges they encounter, and strategies they use to overcome

challenges). The study received approval from UCL Research Ethics Committee.

3.3. Data collection

Semi-structured interviews (total $n = 24$) were conducted using a topic guide (i.e., pre-defined open questions employed with flexibility to probe, expand on, and deviate depending on interviewee responses: see Supplemental online material A). Interviewees were a mixture of junior and senior operational researchers working in healthcare and with posts within Universities, spread across business/management, mathematics, health sciences/medical, or engineering departments (see Table 1). As is common in social science we used a purposive sampling strategy, which focused on UK academic OR practitioners motivated to, and with some experience of, applying OR with healthcare organisations with a view to changing practice or informing decisions. Sample adequacy was ensured using the principle of "data saturation" (Given, 2008), i.e., we reached a point in our analysis where no new themes or relationships were emerging and considered that sampling more data would not have led to further insights. Participants were identified through existing professional networks and contacts, including members of the EURO Working group on Operational Research Applied to Health Services and the UK Operational Research Society. About 58% of participants were male. SC conducted all interviews, some face-to-face ($n = 11$) and some by telephone ($n = 13$), which lasted between 41 and 94 minutes (mean 73 min), and were recorded and transcribed verbatim. Participants were provided with a study information sheet and written consent was obtained.

3.4. Data analysis

Interview data were analysed thematically using a framework approach (Gale et al., 2013). Both

authors independently open coded four interviews, focusing on the emergent factors that participants perceived to influence the effectiveness of OR in healthcare. In this process, descriptive or conceptual labels ("codes") were assigned to excerpts of raw interview data (e.g., "the problem has to come from the health care organisation" was assigned to "project origins" and "sometimes they want things in a matter of time that we can't actually do" was assigned to "timeliness"). The authors then reviewed the open coding and agreed an analytical coding framework. All interviews were then coded by SC based on the agreed framework, and the data charted into a framework matrix using QSR NVIVO software. The framework was tested and refined through seeking negative cases and divergent data across all transcripts, reorganising, and collapsing the data into overarching themes which were then finalised through discussion between authors. The final codes within each theme are shown, along with descriptions for each code, in Supplemental online material B. The number of interview segments for each analytical code is presented in Supplemental online material C.

As is standard within framework analyses, research findings are presented through descriptions of the empirical themes, with a selection of quotes from participants that highlight key points but that do not, of themselves, constitute the whole data supporting that theme. The relationships we see between themes and our broader interpretation of findings are then presented in the discussion.

4. Results

Participants often described their experiences of working in healthcare OR through examples of projects they had undertaken. This included describing many of the barriers (e.g., lack of data availability) and enablers (e.g., strong clinical "champions") they had encountered in projects, highlighting many, if not all, of those previously described in the literature (Brailsford et al., 2013; Eldabi et al., 2007; Mohiuddin et al., 2017; van Lent et al., 2012). Rather than focus on these well-recognised project-level barriers and enablers, which are the primary focus of the extant literature, we present our findings on broader emergent features of healthcare OR that participants with experience working in the field perceive to influence its effectiveness. Specifically, five dominant themes emerged from our analysis: the dynamic project; the OR group; the project's place in the host organisation; the personal in the project, and; the disposition of individual OR practitioners. In this section, we describe each theme using illustrative quotes, indicating how the

data sits within the BOR framework of OR methods, OR actors and OR praxis. We interpret and highlight the novel insights of these themes with respect to the literature in the discussion section.

4.1. The dynamic project

The iterative, incremental refinement of models in collaboration with decision makers and/or end users and in response to data availability is generally accepted to be standard and necessary within OR projects, and can be categorised as a feature of OR methods within Franco and Hämäläinen's scheme of analytical dimensions in BOR (Franco & Hämäläinen, 2016b). However, participants reported that OR projects in healthcare are highly dynamic in a sense beyond this, in that their very purpose and nature can change abruptly due to a process of genuine discovery for the operational researchers and people within the client organisation (the "OR actors"). This feature of projects demands flexibility from the actors, including the operational researcher(s) and stakeholders, who need to be responsive to the project as it develops. For example, operational researchers described pivoting to entirely different project formulations in response to a growing shared understanding of the underlying, and potentially evolving, problem being addressed:

> you may find that a problem that your clients had thought they had turns out, on closer inspection, perhaps not to be the real problem at all so you may find yourself doing something completely different from what you had expected to do […]. (OR20)

Sometimes this was clearly identified with a distinct pivot point. For example, one of our participants recalled a project meeting in which it suddenly became apparent that the envisaged modelling strategy that had been developed with input from some of the stakeholders was not going to address the problem as seen by other stakeholders:

> so at that point, you know, twenty minutes in, I'm just, like, 'Not going to work.' […] So, we reformulated that project completely. (OR9)

Both for individuals and a group of stakeholders, the need for flexibility can be challenging to accept and responsiveness within projects hard to deliver, although as one participant noted, it can help to set expectations:

> provided you can make it clear to everyone concerned, to not only your clients but your colleagues as well, that you may end up doing something rather different from what you had anticipated at the beginning, and provided you've got buy in to that, kind of, overall concept, then yes, I think people are prepared to be flexible. I think, though, flexibility is something

that you have to grow into. I think it's quite hard to suddenly realise that you're lacking flexibility and you need it. (OR20)

Participants also reported that the nature and circumstances of projects could change over time to the extent that they no longer seemed viable or of sufficient value to continue:

I think if there is a loss of key sponsor, then I think it's a good point to say-, I mean, depending on the contractual situation and all that, it's a good point to say, 'Well, is this [...] something that we really want to continue?', because it may well be a good reason for exit. (OR23)

However, there appeared to be no formal or explicit processes in place to reflect on the dynamic and potentially diminishing returns of OR work and decide whether a project should continue. Indeed, there was a sense from some that, if funded, a project should continue despite considerable time being invested for scant benefit and with little envisaged prospect for improvement:

I suppose I'm still plugging on. I said I would … and I've had a bit of funding to do so, so I'll do what I've said I'd do. (OR11)

In summary, the dynamic nature of projects in healthcare seems to present particular behavioural challenges concerning whether and how appropriate flexibility, pivoting, and abandonment of work are enacted.

4.2. The OR group

The OR practitioners we spoke to were all affiliated with an OR group, by which we mean a team or institution comprising actors, at least some of whom undertake OR projects with healthcare organisations, either together or on their own. This OR group may include actors with a range of experience (e.g., junior OR analysts and senior group leaders), varying degrees of autonomy about which projects the group and individual actors undertake, and different levels of responsibility for managing and sustaining the group as a whole. It emerged from our analysis that considering OR projects as isolated interventions by independent OR practitioners gives an incomplete picture, and several aspects of the OR group involved are important.

One aspect of OR praxis is how projects are brokered and there may be multiple, dynamic reasons for an OR group getting involved and staying involved in a project beyond a wish to address the client's problematic situation. For example, participants reported motivations ranging from research interests and the need to bring in funding to support staff members:

As an academic practitioner, a lot of the time, you're looking for the research element. So, you know, is this something which can be written up as a paper, or [...] could this provide some sort of sustainable funding stream for people. (OR23);

to the strategic use of projects to build relationships with stakeholders and to create illustrative case studies that could attract further projects and collaborations:

going back to the history, and certainly I was grateful that we could do projects for free, effectively, to start with. That enables you to build up your portfolio, your evidence. (OR16)

At times, the incentives for the OR group may be in tension with what it considers the best interests of the client organisation:

I think for the master's [student] projects, if the client tells us it will feed into their decision making process in some way, we don't push it any further. Maybe part of it, because if you really forced them to decide here and now, how valuable this is going to be, they might think it's not going to be all that valuable. (OR2)

The motivations for an OR group engaging in a project were found to relate to the maturity of the group and its portfolio of past and present projects. One aspect of this was the ability of an OR group to take on projects as they arise, which was considered to depend on the size and responsiveness of their staffing:

It would be lovely to have a sufficiently large critical mass of people and projects that you could actually do it, where you have work coming in and you always have the pipeline going. (OR15)

Motivations for engaging in a project were also reported to depend on how the project related to the incentive structures and identity of the OR group, which for academic groups can vary in different jurisdictions. For example, in many parts of the world, academic OR groups often sit within engineering schools, whereas in the UK, they typically reside either in mathematics or management departments, and this will impact on the OR group's research incentives (e.g., publications in certain journals) and requirements (e.g., attracting research overheads). For example, within a UK mathematics department, the case studies of research impact that OR can generate can be highly valued and potentially afford academic OR groups lee-way on research funding requirements:

So, we're in favour, if you like, because people don't mind taking a hit on overheads, etc., in the university, if it can lead to some good impact case studies. (OR16)

However, some participants felt that UK business or management schools currently strongly incentivise the publication of articles within a set of journals that, predominantly, publish theoretical OR contributions, and their perception was that failure to publish in these journals could negatively impact individual career progression and the sustainability of OR research groups:

> I think also the system drives people in that direction [away from practical work], particularly business schools, because they have a fictional list of journals that are the best ones to publish in, and they require a certain type of research. That, sort of, shapes OR groups, and shapes the sort of research that they do. (OR9)

> the performance management [in academia] becomes very relevant, and this is definitely a hindrance [...] A lot of management school academics are evaluated, basically, on publications and particular journals, and very little in terms of funding, or impact. (OR4)

These examples illustrate how the perceived success of OR projects can be influenced by the ambitions, nature, position, and indeed behaviour of the OR group involved, which may change over time.

4.3. The project's place in the host organisation

OR projects are carried out with OR actors within a host organisation (or, less commonly, across multiple organisations), which in healthcare might be a hospital or a community healthcare provider, for example. Typically, the organisation, or certain individual actors within the organisation, engage in a project with an OR practitioner for the espoused reason of tackling a problem they are facing, e.g., poor patient flow through the hospital. However, participants reflected that sometimes host organisations (or actors within them) appeared to have additional motivations for projects that they did not make explicit. For example, participants described occasions when they felt that an OR project was being used as a delay tactic:

> sometimes, I think we get asked because of that little bit of breathing space for them, and not to say, 'We're not doing anything about this problem, because we thought, well, we've had x to look into this. We're waiting for their recommendations before we even do anything' (OR7)

Interviewees also reported situations in which organisations they had worked with seemed to have undertaken the project as a means for backing up their existing thinking and supporting their predetermined plans:

> I remember being asked to produce a model that showed they were going to run out of [...] beds

by August [...] I said that's not actually the way it works. (OR5)

> the decision was made to drop it, that was a surprise, because, as I said, 'Why would they commission it?' Perhaps that was just done to strengthen their own case, I don't know. (OR16)

Motivations for undertaking an OR project were also reported to vary, and potentially clash, between stakeholders within a host organisation, such as between different professional or departmental groups. Why the project is undertaken is therefore intimately linked to which actor or actors instigated it. For example, the next quote refers to a regional network that initiated a project for motivations that were different, or opaque, to the local health professionals who were likely to be impacted most, and whose engagement was important to the OR project:

> the tertiary centre which did all the [clinical] work hadn't asked us to do the [modelling] work [...] The network had brought us in to try and collaborate with these people to make it work, but they were very suspicious of why we were in. (OR9)

Our analysis found that it was not always clear to operational researchers at the start of a project how, or under which circumstances, the organisation intended to use the OR findings. For example, operational researchers were not necessarily aware of previous or parallel work or thinking by the organisation on the same issue, nor cognisant of the relevant decision processes and external pressures:

> I actually found out later that there was a whole load of other things that played into their detachment. There were politics around them wanting to create a single point of access [...]and, particularly in relation to the STPs [Sustainability and Transformation Partnerships], there was pressure from there. It was just the communication was essentially cut [...] You're left out in the dark. (OR24)

In summary, the role that a project plays within a host organisation was considered by our participants to be crucial to its outcome, with potentially multiple motivations at play within the host organisation and complex internal and external politics to be alert to and to navigate.

This theme and the previous one point towards a situation where, in addition to a description of a project that is shared between the OR group and the host organisation (the espoused project), there are parallel conceptions of the project held separately by actors within the OR group and the host organisation. These parallel projects may look similar at one level but can have different motivations, purposes, and success criteria. Enter the potentially unwitting OR practitioner.

4.4. The personal in the project

In addition to and distinct from the process of genuine "shared discovery" described in our theme on "the dynamic project," we found that academic OR practitioners often go through a process of discerning aspects of an organisation and its problems previously withheld or otherwise supressed, catching glimpses of parallel project motivations and success criteria. This brings the challenge of whether and how to alter their praxis in response:

> Partly to start with, people are a little bit cagey about giving too much away, if they think that you're there to evaluate them and to find problems. They don't like-, they try and hide what's wrong to start with, I think, which makes the problem harder rather than it being completely open. (OR7)

> something either changes or there's a bit of policy that you didn't actually know about, or a particular thing that you just don't know about and you couldn't have foreseen. (OR17)

OR practitioners appeared to lack the training or formal processes to help them probe and navigate the hidden, and potentially changing, motivations of an organisation or to gauge the likely success of their work and so they tended to rely on their intuition:

> The only sorts of ways that we can gauge whether there's going to be any potential for impact-, because you just never know. It's almost a bit of a dark art sometimes that you rely on, kind of, people's experience. (OR24)

For example, participants talked about sensing, even early on in a project, potential difficulties ahead:

> a few meetings into a project I can usually tell what sort of impact we'll have. So, the A&E work, yes, I thought quite early on, 'Actually, this is quite chaotic'. (OR9)

> I think, sometimes, if you've had an initial meeting, and you can, kind of, see that almost the room's divided in what it wants to happen, you're a bit more wary, because you don't necessarily want to side with one side or the other, but you're aware that your results are going to be divisive when you get to the end. (OR17)

Others had altered their praxis to attempt to surface, early in a project, problems they had experienced in past projects:

> I've learned a lot from that now, which is to upfront ask, 'Are you really going to use this? What happens if you don't like the result?' (OR17)

However, some participants felt that they were unable to act on their intuition, for example not being able to influence whether a project should go ahead despite strong reservations about the likely viability or benefit:

> I've done too many of these projects where I've, kind of, been forced to work with these people, and actually you know that it's not going to work …. (OR9)

This particular example appeared to be linked to the seniority of the OR practitioner, and the fact that the actors in the OR group making the decisions on whether projects go ahead were not necessarily the practitioners with first-hand experience engaging with the host organisation:

> So, we'd [junior analysts in the OR group] go out and structure the problem, and then they'd [senior members of the OR group] make decisions about which ones to take forward. I think what the problem was not having the analyst in the room who'd gone to that meeting and talked to them, and actually it was these factors that aren't in a specification document that you can talk to them about, actually these are the nightmare people, don't work with them. (OR9)

Our findings demonstrate how intuition and experience may influence an individual's praxis, which combined with the maturity of the relationships between the OR group and the host organisation, can impact on the praxis considered necessary for success.

4.5. The disposition of individual OR practitioners

Our analysis suggests that operational researchers working in the complex and challenging landscape of healthcare OR have, or require, a certain disposition. For example, many of the participants expressed a strong motivation for driving improvements within healthcare, which was bound up in a sense of personal identity and fulfilment:

> the financial engineering side [a previous career] wasn't really helping anyone, just helping some people get rich. Healthcare is different, although your project might be small, if it makes an impact, it makes you feel better about you. (OR10)

> I've got a real personal drive to want to see big changes in the NHS. (OR6)

Some OR practitioners described personally investing in certain projects in healthcare because they felt it was morally the right thing for them to do:

> other times I'm doing it more because I think it's the right thing to do, rather than it actually helping me in terms of my career. ["The right thing to do, in what sense?"] Well, sort of, morally [laughter]. No, but I think it's not just that. It's also from a sense of personal satisfaction. (OR21)

Participants also felt it was important for OR practitioners working in healthcare to want to understand and work with people:

> I suppose, kind of, understanding, or wanting to understand, people. I won't admit to always understanding them, but I want to understand and work with people, and to understand why they're making the decisions that they are, and how I can help better inform those. (OR24)

> Well, you have to be of that disposition as a person. You have to want not to spend your entire working life behind a computer screen. (OR4)

Some felt this was related to the maturity or wider experience of the practitioner beyond academic OR, suggesting that this meant they were better disposed to working with people and real-world problems.

> I could come to this job because I went out and worked in government for a year before coming back to academia. So I had to talk to other people, I had to get involved. (OR10)

> I think it is that experiential thing, maybe, that they've had to go out there and deal with really messy stuff. (OR9)

Our analysis also suggests that to be an effective OR practitioner in healthcare requires a willingness to take career risks and an ability to be creative in building a sustainable career, and that the nature and praxis of their OR group nurtures or hinders this:

> It takes a lot of creativity to do that, to get an academic publication out of something that was mainly a practical piece of work, but it can be done […] Being part of an experienced team is probably a bonus there. You know, people who said, 'Oh yes, you can do that. You could spin that'. (OR22)

> I can always publish stuff, figure out a way to publish it, in some way or another, I suppose, so, if by hook or by crook I'm surviving. Also, I've gone a different route, so, you know, I've no interest in working in a business school. I've managed to hook myself into a different type of organisation, but that might all go wrong. (OR9)

These personal attributes of motivation to do social good, an interest in other perspectives, broader life experience, and creative risk-taking inevitably influence the praxis of academic OR practitioners through their working life.

5. Discussion

The themes that emerged from our interviews give us a fresh understanding of operational researchers' perceptions of what constitutes the non-technical factors that influence the adoption or otherwise of OR-supported solutions to problems in healthcare.

Our participants discussed their experiences of having to navigate very dynamic projects in partnerships characterised by multiple layers of volatile and at times hidden motivation. The prior experience of host healthcare organisations with OR work, the maturity of the OR group and of its relationship with the host organisation, and the disposition of the individual practitioner all came through as important in how academic practitioners in the UK account for success in their direct engagement with healthcare organisations. As an aside, we note that the definitions of success invoked by participants went beyond technical model performance and implementation to the development of beneficial relationships, trust and future opportunities. Some participants shared stories of failure, and of repeatedly being surprised by the behaviours of health service staff and organisations, showing signs of what Eden (1982) refers to as a "disillusionment with the power of analysis as a basis for changing things, with the power of 'science' in organisations." Others shared the ways in which they have learnt how to identify and navigate or obviate non-technical barriers to effective working in healthcare, with these strategies falling outside formal project scoping and definition protocols used in their organisations. In this way, our work reveals the messiness of practice and the motivations (hidden or otherwise) that help to maintain engagements in OR projects.

The findings set out in the previous section suggest to us that the praxis adopted by individual academics and, separately, by OR groups are crucial to the perceived success of their endeavours to frame and address a sequence of discrete problems within the logistically, socially, and politically complex settings of healthcare. This supports the view of Eden (1989) that "it is the way in which OR is practiced which makes for success or not." The fact that perceived success here is not constrained to the technical efficacy of mathematical or computational models in isolation has implications for OR practice, in particular for how the operational researcher needs to adapt and evolve their praxis in response to the praxis and incentive structures of their own organisations and those of host healthcare organisations in a sequence of projects.

Our work adds to the evidence base for taking a more complex view on what is often considered in the literature as a transactional client-consultant relationship built around a rational, Hard OR modelling process. The rich qualitative evidence we present highlights the messiness of practice and relationships, debunking any myth that OR projects performed by academics to directly inform decision

making within health care organisations are purely scientific endeavours.

In work that presages the current interest in type 2 Behavioural OR, Keys (2000) focuses on how the individual operational researcher chooses to position themselves in a framework defined by the distinction between "private and public methodologies" and the distinction between "role and analytical paradigms," emphasising the importance of the operational researcher's social actions, the role that they choose to adopt within a host organisation and the processes of interaction that they design. We found that these elements of praxis at the level of an individual operational researcher were influenced by contextual factors such as the healthcare organisation's previous experience of OR and the maturity of relationships between individual and organisation actors involved. However, while in Keys' description, the operational researcher acts as a "theatre director," "designing" interactions and strategically choosing the best role to embrace, our interviewees did not appear to have that sense of control, with the creativity they describe being in how they respond to unfolding situations, pivoting projects and relying on intuition to navigate their way through their professional life to, in the words of one of our participants "by hook or by crook" achieve their goals.

Another contribution from our analysis is that it is important to acknowledge that the OR group that an individual works in has its own praxis and, at a particular point in time, has a public methodology and a role paradigm that it espouses and favours. This can permit or constrain the praxis of the individual, whereas in the work of Keys the operational researcher is portrayed as an autonomous and free entity. This interaction between the praxis of individuals and their OR groups is one way of making sense of the notion of the "fit" between individuals and OR groups and how this may change if the praxis of the group and/or the individual changes. Keys writes of the difficulties faced by individuals when the gap between their public and private methodologies and role paradigms is too great. This is perhaps a greater risk for the individual when the OR group sets the public methodology and role. Our evidence that the praxis of the OR group and the culture of the host organisation can shape or constrain the evolving praxis of the individual supports Franco and Hämäläinen (2016a) in identifying the relevance of practice theory (Schatzki & Cetina, 2000) to the conduct of OR. The central tenet of practice theory is that, while individuals have a large degree of autonomy and agency in how they work, they do so within the structures and norms of the professions they belong to and the organisations they work for and within.

Practical challenges for academic practitioners working in healthcare include how to build acceptance that project proposals include necessary scope for flexibility in methodological approach and potential pivoting. This is a particular challenge when aiming to fund such work through grants from applied health research funders that predominantly support highly protocol-driven empirical approaches, and also given the dual purpose that many OR projects in healthcare have of convincing the host organisation of the value of OR as an approach. We consider that many of the challenges faced by the UK academic practitioners interviewed are intrinsic to them trying to be both academics and practitioners, aiming to work as "management engineers" in their dealings with host organisations but being judged by the criteria of "management scientists" by their employers and the academic community (Corbett et al., 1995), with a risk of falling between the cracks and doing neither well. If healthcare organisations had a strong internal OR function, academics would arguably be less likely to be drawn into this position. Those that are, based on our interviews, display a strong personal motivation to do work that contributes to genuine improvements in healthcare. We consider that this may partly explain the naivety towards the host organisation motivations and the blindness to diminishing returns from their efforts (in terms of influencing client actions regarding the espoused purpose of the project) that we identified in the data.

It is important to note here that we purposively sampled UK OR academics motivated to have direct impact through working with healthcare organisations. Other OR academics work on healthcare solely for the interesting and challenging problems it presents and, quite reasonably, do not see their role as supporting health care organisations to adopt OR methods. For these academics, issues of diminishing returns and building and maintaining trust with case-study organisations are likely to be less relevant.

The role of personal motivation outside the espoused objectives of a project could form one avenue of inquiry in future empirical research on the question of when operational researchers discontinue projects, and when they should. Operational researchers are accustomed to developing stopping rules for the algorithms that form part of our methods; our research suggests potential benefits from routinely and explicitly setting stopping rules for OR projects to guide OR practitioners as the prospects of a project's beneficial impact change over

time. The behavioural economics and sociology concept of "escalation of commitment" (whereby individuals or groups continue to align their behaviour to a previous decision, action or investment despite increasingly negative outcomes from it) may be a useful analytical lens to explore this, as might the related "sunk-cost fallacy" (which describes the justification of continued investment in a decision based on prior investment rather than future cost/benefit) (Staw, 1976).

Our focus in this work is the domain of healthcare, but we do not propose that our themes are unique to health, nor that they explain of themselves why OR in healthcare may be particularly challenging compared to other industries, as suggested by some in the literature (Rosenhead, 1978; Tako & Robinson, 2015; Wilson, 1981). Further empirical research on this would be valuable. It would be particularly interesting to explore possible areas of divergence, for example, whether the common practical challenges and personal motivations in healthcare discussed above differ from other industries, and if so whether differences in OR praxis arise as a result. Future research could also usefully explore how different industry contexts and, specifically, the maturity of in-house OR and commercial OR consultancies within those industries influence the praxis adopted by academic OR practitioners and their groups. Another future research avenue might be to compare the praxis of academic operational researchers and groups with the praxis adopted by commercial consultancies within healthcare.

There was some evidence in our data that the praxes adopted by individuals and by groups may change over time as the group or individual matures but also in response to the maturity of the individual or organisational relationships they have with the host healthcare organisation. This would be an interesting topic of future empirical research.

One consideration in such work should be whether, if there are identifiable patterns of change in praxis over time, an individual or group can simply adopt the praxis of another experienced practitioner or mature group or whether a trajectory of praxis is necessary.

This would echo the notion of "strands of practice" developed by Corbett, Overmeers, and others (Corbett et al., 1995; Overmeer et al., 1998) when analysing the development, convergence, and subsequent modes of failure of distinct business models for OR consultants. This previous work describes how a consultant (or a firm of consultants), in making successive choices of project, develops a "strand" of activity that constitutes, at least for a time, a commercially viable practice. However, the focus of these important papers is mainly on the nature of the work done (in terms of domain of application and techniques deployed) with less account taken of the behaviours of interaction adopted by the operational researchers and businesses studied in brokering and conducting work, and how these behaviours changed over time.

We note that we deliberately sought the perspectives of operational researchers and it would be interesting to compare and augment this with the perspective of other OR actors, notably those within host healthcare organisations. In future research focused on the impact of OR projects on changes to organisational practices, it may be useful to draw on the organisational behaviour literature, which explicitly studies the human behaviour of individuals or groups related to other elements of an organisation such as structure, technology, and social systems. Given that our findings are based on the perceptions of OR academics, it would also be useful to corroborate them through empirical evidence associating specific successes or failures with certain OR praxis, although this would be particularly challenging where complex combinations of individual and group behaviours come into play.

Eden (1989) argued that there ought to be a "focus on skills of bringing formal analysis into the arena of organisational and thus personal action." That so many of our participants stated that they relied on experience and instinct to identify and navigate the problems they encounter suggests that this need persists among operational researchers. It also raises the question of how our research and that of others in this space can usefully inform the education and continuing professional development of operational researchers and their development of individual creativity. In particular, our research suggests that such training initiatives look beyond projects to how careers can be shaped and renewed by concerted effort "to continually review and redefine the underlying paradigms of the practitioner" as "creativity takes place when practitioners see beyond the immediate intervention and place it in the broader context of a flow of activity and view it as contributing in various ways to their overall pattern of activity" (Keys, 2000). Theories of learning could be a useful lens through which to explore this, and other areas of OR practitioner professional development, further.

While educational resources to support individuals in their praxis certainly have a role, there is perhaps also scope for increased recognition within OR groups of the distinct praxes among their members, with this influencing project team composition, recruitment, and professional development activities in the way suggested by Ormerod (2014) for problem structuring competencies.

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