Keynotes

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Zooming in on Problem Structuring Interventions: An Affordance Perspective

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Abstract

Empirical studies examining the complex dynamics between the social and material aspects of OR interventions are beginning to appear in the literature. Despite these advancements, we know very little about these dynamics at the micro-level of analysis. This is partly because of a lack of theories that can inform an empirically grounded understanding of the interplay between the social and the material as they become interwoven in micro-level practices. To address this gap, I adopt an affordance perspective to examine how the materiality of an OR technology can shape, but not fully determine, social actors’ behaviours during interaction with that technology. I illustrate the potential usefulness of the affordance perspective for the case of problem structuring interventions that use Group Explorer as a group causal mapping technology. I then show, via an empirical case vignette, how perceptions of affordances called forth by the technology affect social actors’ behaviours within a strategy workshop. I conclude with a discussion of the implications of adopting an affordance perspective for the conduct of OR intervention research and practice.

Keywords: Affordances; Behavioural OR; Interaction; Materiality; Intervention; Problem structuring.

1. Introduction

Although it has long been recognised that OR interventions involve complex dynamics between the social and the technical (e.g. Eden, 1989; Keys, 1989, 1998; Ormerod, 1996), empirical studies examining these dynamics are just beginning to appear in the literature. For example, White (2009) draws on 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, Ormerod (2013) uses the concept of ‘mangle of practice’ (Pickering, 1992, 1995) to reassess an intervention undertaken for the UK National Coal Board during the late 1970s and early 1980s (Ormerod & McLeod, 1984; Plackett, Ormerod, & Toft, 1982). He shows how the complex intertwining of material and social factors affected the intervention’s design, deployment and outcomes. These studies pay close attention to macro-level interactions between the social agency of intervention actors and the material agency of the OR technology deployed within an intervention. Despite these advancements, however, the study of micro-level interactions between the social and the technical elements of OR interventions remains relatively underexplored in the literature (Franco & Montibeller, 2010; Franco & Rouwette, 2011), with some exceptions (e.g. Ackermann & Eden, 2011b; Franco, 2013; Horlick-Jones & Rosenhead, 2007).
The relative neglect of micro-level studies is in part due to a lack of theories that can inform an empirically grounded understanding of the interplay between the social and the technical as these aspects become ‘entangled’ (Orlikowski, 2007) in interaction. In this paper, I address this gap by drawing upon the theory of affordances (Gibson, 1986; Hutchby, 2001; Norman, 1999) to examine how the materiality of an OR technology can shape, but not fully determine, social actors’ behaviours during interactions with that technology. Affordances are aspects of the materiality of an object that offer action possibilities for those who come into contact with that object. In the context of OR technology, the principal objects comprise the models, concepts and physical infrastructures within which these models and concepts are developed and used; affordances are what these models, concepts and infrastructures enable or constrain social actors to do within an intervention. I contend that an examination of how these affordances are realised in practice is likely to produce a more nuanced understanding of why and how OR technology affects social actors’ behaviours, and with what effects. This improved understanding can in turn help design and deploy more effective OR interventions.

The rest of the paper is structured as follows. I begin by introducing the theory of affordances, highlighting its potential usefulness for the study of OR interventions. I then illustrate this conceptualisation for the case of problem structuring interventions that use Group Explorer, a computer-supported group causal mapping technology. Next, I show via an empirical case vignette how perceptions of affordances called forth by the Group Explorer technology affect social actors’ behaviours within a strategy workshop. I conclude with a discussion of the implications of adopting an affordance perspective for the conduct of OR intervention research and practice.

2. The Concept of Affordance

The term ‘affordance’ was first coined by ecological psychologist James Gibson (1986) following his research on visual perception. His theory of affordances aims to explain how an individual perceives the behavioural possibilities of an object, noting that the same object can call for different possibilities for action. Thus, for example, a rock can be used as a weapon or as a paper weight. Similarly, an apple tree can be used as a shelter or as a source of food. Gibson claims that what we perceive is not what an object is but rather what kinds of uses it affords. Obviously we would still be able to discriminate an object’s material features (e.g. colour, shape) if prompted to do so. However, the empirical evidence suggests that what we normally pay attention to is what the object affords us (Grezes & Decety, 2002; Symes, Ellis, & Tucker, 2007; Tucker & Ellis, 2004). Beyond the individual, the theory of affordances is also taken to be relevant to social behaviour (Gaver, 1996; Hutchby, 2001). In this context, because an object can be perceived to afford multiple uses, it is possible that the same object can produce multiple behavioural outcomes.

Gibson’s formulation has been further elaborated by numerous studies in psychology, sociology, and information management. Recent developments of the notion of affordance emphasize its relational character (e.g. Chemero, 2003; Faraj & Azad, 2012; Hutchby, 2001; Leonardi, 2011). In this view, affordances are constituted in relationships between social actors and the materiality of the objects with which they interact. The term ‘materiality’ here refers to the features of an object, including physical or digital features (Leonardi, 2012; Leonardi, Nardi, &
Kallinikos, 2012). In this formulation, materiality exists independent of social actors, but affordances do not. Because social actors come to the materiality of an object with diverse goals, they perceive that object as affording distinct possibilities for action. Furthermore, affordances of an object can change across different contexts of use even though its materiality does not. Similarly, people may perceive that an object offers no affordances for action, perceiving instead that it constrains their ability to carry out their goals.

I argue that to gain a deeper understanding of the complex nature of OR interventions at the micro-level, then it is important to focus research attention on how OR technology’s materiality and its perceived affordances affect social actors’ behaviour. Take the models created and used within the so called ‘facilitated modelling interventions’ (Franco & Montibeller, 2010; Robinson, Worthington, Burgess, & Radnor, 2013; Rouwette, 2011) as an example. In this type of intervention a model is developed with a group of participants working in a workshop environment, and assisted by an OR facilitator. The materiality of the models created by facilitated modelling interventions enables ‘on-the-spot’ editability because participants’ contributions can be changed almost instantaneously by either the OR facilitator or the participants themselves. However, the degree of editability enabled by the models depends on whether they are created with or without computer support (Ackermann & Eden, 1994, 2001). That is, computer-supported models afford higher levels of editability than models created with manual technology (e.g. pens, flipcharts) because the former allows for many changes to be made in lesser time than the latter. Perhaps more importantly, participants will construct individual perceptions of whether editability affords them the possibility to achieve their goals or not, and take action. Thus materiality and affordance may have direct consequences for how participants interact in the workshop. To understand what these consequences are and the conditions under which they are likely, we must first recognize that a model’s materiality makes certain actions possible and others impossible, or at least more difficult to achieve. This insight has been used to show how variations in the level of affordances called forth by the same model, can lead social actors to engage in similar or disparate dynamics (e.g Franco, 2013)

3. The Materiality of Group Explorer
In this section I will briefly outline the material features of a particular problem structuring technology: Group Explorer. 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 (Ackermann & Eden, 2010, 2011a; Bryson, Ackermann, Eden, & Finn, 2004; Eden & Ackermann, 2010). The technology is designed to be used in a workshop room, and in this sense it can be seen as a particular operationalization of the facilitated modelling intervention approach discussed earlier. 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 OR 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 screen, or shouted out loud and entered and displayed on the screen via the facilitator. Contributions are
jointly structured between the team members and the facilitator using causal mapping coding guidelines (Eden, 1988, 2004), which results in a map that is continuously in transition as team discussions develop.

Figure 1 shows a typical Group Explorer workshop setting, and Table 1 summarises Group Explorer’s key materiality dimensions: tangibility, associability, traceability, and editability. In the next section, I present an empirical case vignette to help ground and illustrate how Group Explorer’s materiality and its perceived affordances interact to shape behaviour.

Figure 1: Typical Group Explorer workshop setting
Table 1: Materiality of *Group Explorer*

<table>
<thead>
<tr>
<th>Materiality</th>
<th>Description</th>
<th><em>Group Explorer</em> illustrative features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tangibility</strong></td>
<td>Ability to make its contents visible and concrete</td>
<td>• Anonymous gathering (i.e. ‘brainwriting’).</td>
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<td></td>
<td></td>
<td>• Multiple ‘map’ and ‘text’ views.</td>
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<td><strong>Associability</strong></td>
<td>Ability to relate its contents based on shared attributes</td>
<td>• Linking (via console or public machine)</td>
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<td>• Set analysis</td>
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<td></td>
<td></td>
<td>• Preferencing and ranking</td>
</tr>
<tr>
<td><strong>Traceability</strong></td>
<td>Ability to relate its contents temporally and structurally</td>
<td>• Verbal tag and style search</td>
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<tr>
<td></td>
<td></td>
<td>• Consequences analysis</td>
</tr>
<tr>
<td><strong>Editability</strong></td>
<td>Ability to modify its contents instantaneously</td>
<td>• Concept editing and deleting (via console and public machine)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Style editing (via public machine)</td>
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4. Empirical Case Vignette

In this section I draw on the use of *Group Explorer* in a workshop held as part of a strategic review process at Back2work (a pseudonym), a small 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 management team at Back2work gain a shared understanding of the key strategic issues they were facing in 2007. I was invited to act as the facilitator of the workshop by the consultancy team conducting the strategy review for Back2work, and was able to obtain permission to video and audio record the workshop. These audiovisual data provided the main source for the analysis presented in this section.

The interaction segment below shows team members’ discussion about the cross impacts between issues of succession planning and company ownership. The segment illustrates how team members’ behaviours and Groups Explorer’s materiality (tangibility, associability, traceability, editability) become interwoven during interaction. Initially the map is changed
because some team members perceive that it constrains their ability to articulate their individual thinking and knowledge about the strategic issues of concern. Later on, however, the use of the map produces gradual changes in the way team members interact with one another, as they perceive that the map affords them the possibility of changing the way they understand and think about the strategic issues of concern.

F: Is that [looks and points at map] related to the previous one somehow? Or is it an independent…?

S: I think it will be impacted. The thing for me is what we want to do is develop our people which I think that [points at map] said, but we know that the component is something that needs to be developed in the next three to five years, it will be magnified with succession.

B: [looks at S] Yes.

K: [looks at model, then at S, then at model, then nods].

S: [looks at C, then points at map] So, they…they’re interrelated you could take them as separate components but they are interrelated..

F: Sure, can we explore that a little bit… I mean can I bring that material into the previous screen? Aahm just ah…[locates and brings contributions into map display].

S: [looks at F, then nods].

In the segment above S begins to articulate his particular understanding and knowledge about how succession planning and ownership issues may be related (lines 3-6). Team members use Group Explorer’s tangibility to highlight certain parts of the map by orienting to and pointing at the map throughout their discussion. In addition, F uses Group Explorer’s traceability and tangibility to locate particular contents of the map and make them visually available to team members, respectively (lines 11-12).

S continues to articulate his perspective until this is challenged by C, who starts surveying the different (number-tagged) issues displayed on the map (lines 14-17, and evaluates the domain-specific knowledge collated and displayed in the map at that point (lines 21-24, 26-35).

C: [looks at map] 39, 15 and 9 I say are different from that, [points at map] I can see what 43…43 is different from 39, 15 and 9 [looks at S then points at map]. 39, 15 and 9 are do we sell, do we float, do we stay as we are, and that decision will be made at that time. It is separate from developing people or whatever else [looks at S and uses hands to indicate separation].

S: [looks at C, then at map] Do you not think that if 39 occurred that that would affect that?

So you wouldn’t change your succession planning in the knowledge that in twelve months time you sell it.

C: [looks at map] But you would…The way we are structured at the moment if you were to put a sell pack together, [looks at S] one of the strengths would be the stability of the business, the growth of individuals within the business, that would be [extends hands and claps them
once] one of the facets to sell that...

S:  [nods] absolutely agree.

C:  ..and that sits there [looks at S while pointing at map]. However, [looks at S, puts fists together] new ownership of the business would determine its direction. No matter what we as operating people thought [looks at F], if I just bought your business [looks at S] I am actually gonna tell you [points at map] and I’m gonna give you the point of direction that you’re gonna go in [looks at S]. And that’s what … the difference we have to get away from here is [places hands together to his left] what can we impact upon and what is beyond our influence [places hands together to his right]. And [points at model, then looks at S] when you get down to ownership and desire of, whether it’s [looks at S, counting with fingers] a market that’s directing you, whether it’s a civil owner that’s directing you or whatever, a combination, I think that those three things [points at map] have to be dealt with separately to…

It can be inferred from the above exchange that at this point the map is constraining C’s ability to express his current understanding of and knowledge about the strategic issues under discussion. A debate between S and C will ensue, during which F will make changes to the map to capture the debate while ensuring that S, C and the rest of the team keep their focus on the map. In the segment below, as C continues to elaborate on his views (lines 40-42, 44-46), S suddenly uses the map to surface the conditions upon which an accommodation may be possible (lines 39, 47-48), which in turn causes a shift away from the original contrasting positions (49-50).

S:  [looks at map]

C:  …so [points at map] dependent upon the decision [uses hands] whether it’s float, whether it’s sale, whether it is management buyout, will depend on [points at map] how it can impact, it can impact in different ways [looks at F].

F:  [looks at C] Yes.

C:  [looks at team, counts using fingers] One could be getting rid of you, one could be developing you further, and one could be taking over, [looks at S] management buyout, you become the shareholders [opens hands].

S:  So those things [points at map, then looks at C] becoming in your way will be impacted on that.

C:  [looks at map, then at S] In those ways [raises hands], in those three ways, dependent on the decision.
The preceding segment shows how the map affords S the possibility of reaching an agreement which signals the emergence of a new collective understanding and knowledge. When this happens F makes changes to the map to highlight the achievement by using Group Explorer’s editability and associability material features (lines 51-54, 58).

51 F: [looks at map] Yes, so maybe the issue is the nature between, [looks at S] I mean the impact between these two ‘reds’ [locates and points at the two issues on map –now coloured in red] will depend whether it is a buyout or [looks at C] it is a management sell-out decision.

52 S: [points and looks at map] It will change the shape of the things that you do within those comparisons.

53 F: [looks at S and nods]

54 C: [looks at S, then at map] that’s the link.

55 F: [draws link].

5. Discussion and conclusion

The argument advanced in this paper is that to gain a more nuanced understanding of the complex nature of OR interventions at the micro-level, we need to pay attention to how OR technology’s materiality and its perceived affordances affect social actors’ behaviours. As illustrated in the case vignette, to the extent that social actors have the ability to change their goals and the ability to change a model, their perceptions of affordances and constraints may produce behavioural changes that have important interactional consequences for those involved. This perspective provides a departure from current theorising about OR intervention impact in at least two ways, each of which has implications for research and practice.

One contribution is to suggest that the dynamic relationship between the social and the technical (or ‘material’ in the terminology used here) within OR interventions may be more usefully explained as one of affordance than one of causality. The affordance perspective enables us to build a theory of OR intervention that highlights the relation between its social and technical aspects without foregrounding one or the other. This move, from causality to affordance, offers a non-deterministic way to theorize the complex nature of OR intervention practice (Keys, 1989, 1998; White, 2009). One reason for the relative paucity of micro-level studies of OR interventions, and for the calls made by scholars such as Ormerod (2013) to provide more insightful accounts of OR practice in the literature, has been the lack of an integrative theoretical approach such as the affordance perspective. The case vignette shows how the concept of affordance can provide a useful lens to help us understand the specific material features of an OR technology that are relevant to social actors’ behaviours. More generally, the affordance perspective can help us understand how the goals of social actors and the materiality of OR
technology interact to shape social actors’ behaviours. For the OR practitioner community, adopting the language of affordance pushes practitioners to ask themselves many important questions about the impact of their interventions. For example, is the intended purpose of a particular intervention to afford behaviours and work practices in particular ways and, if so, how to embody these intentions in intervention design? Did the intervention design subsequently have the effects intended? If so, why? If not, why not?

A second contribution is to highlight that the effectiveness of an OR technology is likely to be dependent on the extent to which that technology is perceived to afford or constrain social actors’ ability to realise their goals during interaction. How can OR technologies be perceived by social actors to afford, rather than constrain, opportunities for goal-oriented action? For the case of models, one aspect that may significantly affect how social actors perceive a model’s affordances is the ability to sustain appropriate levels of ‘interpretive flexibility’ in the models created (Franco, 2013). Interpretive flexibility is derived from the level of ‘equivocality’ embedded in the model (Belton, Ackermann, & Shepherd, 1997; Eden & Ackermann, 2004; Eden & Ackermann, 2010) As the case vignette shows, the level of interpretive flexibility regarding how the issues of concern were related was initially sustained to enable social actors to reconcile initial understandings and positions and, consequently, change their thinking and knowledge about these issues. The implication for OR practice is that OR analysts need to ensure that the models they help create exhibit the required affordances for effective interaction.

Future work is needed to substantiate the generalizability of the argument I have presented here. A potentially useful direction for future study would be to implement research designs that compare the use of identical or similar OR technologies in different contexts, or compare radically different OR technologies in the same or similar contexts. An example of the former would be to compare a range of problem structuring methods in small– versus large–group settings; the latter would involve comparing the use of ‘hard’ versus ‘soft’ OR approaches within the same organisation. This type of research is likely to produce a taxonomy of affordances (and constraints) that would help to better predict the nature and extent of behavioural changes enabled (but not necessarily determined) by OR technologies.

Another potentially useful avenue for future research relates to the relational character of the affordance concept. The notion of affordance always presupposes a perceiving social actor, and different social actors may be afforded different behaviours by the same OR technology. Thus future research could consider different types of social actors. For example, familiarity with a particular OR technology or differences in cultural or professional background is likely to affect how social actors perceive the affordances (or constraints) called forth by the technology.

To implement this research agenda would require that empirical accounts of OR interventions include not just details of the models developed within the intervention but, equally important, the social interaction context in which the models are produced and used. This means being able to capture and examine how social actors’ behaviours and the materiality of OR technology become entangled during interaction, and with what effects.
**References**


