Multimethodology: Towards a Framework for Mixing Methodologies

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In recent years the predilection for Systems/OR practice to be underpinned by a single methodology has been called into question, and reports on multimethodology projects are now filtering through into the literature. This paper takes a closer look at multimethodology. It outlines a number of different possibilities for combining methodologies, and considers why such a development might be desirable for more effective practice, in particular by focusing upon how it can deal more effectively with the richness of the real world and better assist through the various intervention stages. The paper outlines some of the philosophical, cultural and cognitive feasibility issues that multimethodology raises. It then describes a framework that can attend to the relative strengths of different methodologies and provide a basis for constructing multimethodology designs. Finally it presents a systematic way of decomposing methodologies to identify detachable elements, and the paper concludes by outlining aspects of an agenda for further research that emerges out of the discussion. © 1997 Elsevier Science Ltd

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1. INTRODUCTION

In recent years, the number of methods, techniques and methodologies within the broad field of Management Science (to include both OR and Systems) has burgeoned. There is now an enormous variety of approaches all having very diverse characteristics and stemming from various paradigms based on differing philosophical assumptions. Whilst this plenitude can enhance practice [1], it also poses problems for practitioners who often tend to restrict themselves to one paradigm or even one methodology.

Both Bennett [2] and Eden [3] have addressed this problem, but the main attempt at imposing some order is that of Jackson and Keys [4] through the vehicle of the system of systems methodology (SOSM) and, subsequently, Flood and Jackson [5, 6] through total systems intervention (TSI). The main emphasis (but see notes 2, 3) of the latter two has been that different methodologies are complementary, making different assumptions about the problem situation, and that it is therefore necessary to make a choice as to which methodology(ies) is(are) appropriate for a particular intervention.

It is the contention of this paper that in order to make the most effective contribution in dealing with the richness of the real world, it is desirable to go beyond using a single (or, on occasions, more than one) methodology to generally combining several methodologies, in whole or in part, and possibly from different
paradigms. We argue for this use of multimethodology both on theoretical/philosophical grounds, and on the practical grounds that practitioners are increasingly doing this already. However, mixing methodologies, particularly from different paradigms, does present serious problems—philosophically in terms of paradigm incommensurability, theoretically in terms of effectively fitting methodologies together, and practically in terms of the wide range of knowledge, skills and flexibility required of practitioners.

It is encouraging to note that similar attempts to move away from paradigmatic isolation and conflict are occurring in other disciplines. In organizational studies there are strong attacks on the paradigm incommensurability advocated by Burrell and Morgan [7–10]; in sociology a mixture of research methods—triangulation—is advocated [11–13]; and in philosophy there is debate about theoretical and methodological pluralism [14–16].

This paper is organized into four main sections. The next, Section 2, discusses definitions of terms such as 'paradigm', 'methodology' and 'technique', and the different possible interpretations of 'multimethodology' are given. In Section 3 the main arguments for the desirability of multimethodology are put forward, followed by Section 4 which considers the problems and feasibility of (particularly) multi-paradigm work. Finally, in Section 5, a more substantive contribution to multimethodology research is presented with two frameworks that may be helpful in combining methodologies and parts of these together.

2. TERMINOLOGY

Many terms, such as 'paradigm', 'methodology', 'method' and 'technique', are open to various interpretations, as is the concept of multimethodology itself. This section will specify a set of terms that will be used consistently, although it must be recognized that these are not claimed to be 'correct' in some sense, and that inevitably some latitude will be required in applying them across a variety of domains. Section 2.1 defines terms such as 'methodology', while the Section 2.2 distinguishes a number of possible way of interpreting the idea of multimethodology.

2.1. Paradigm, methodology, technique, tool

The first set of distinctions is between paradigm, methodology, technique and tool. Similar categorizations have been made by Eden [3] and Rosenhead [1].

A paradigm is a very general set of philosophical assumptions that define the nature of possible research and intervention. There can only be a relatively small number of paradigms extant at one time although the actual number, and their characterization in terms of underlying dimensions, differs. See, for example, [13, 7, 17–19]. We shall distinguish between paradigms in terms of three philosophical dimensions: ontology, that is, the types of entities assumed to exist and the nature of that existence; epistemology, that is, the possibilities of, and limitations on, our knowledge of the world; and praxiology, that is, how we should act in an informed and reflective manner. This latter category is of particular importance for management science which is primarily concerned with intervention and action. It can be further sub-divided, drawing on Habermas [20], into three aspects: effectiveness, questions about the extent to which desired ends are achieved; ethics, questions about the value and desirability of courses of action for individuals and communities; and morals, questions about the effects of an individual's actions on other people.

Clearly paradigms differ on some or all of these dimensions and an important question that must be addressed in multimethodology research is the extent to which paradigms are incommensurable, that is, mutually exclusive, unable to be combined or linked. We shall distinguish three main paradigms each of which has been referred to by a variety of names: empirical–analytic (positivist, objectivist, functionalist, hard), interpretive (subjectivist, constructivist, soft), and critical (critical systems).

A methodology is a structured set of guidelines or activities to assist people in undertaking research or intervention. Generally, a methodology will develop, either implicitly or explicitly, within a particular paradigm and will embody the philosophical assumptions and principles of the paradigm.1 Usually there is more than

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1The question about the extent to which methodologies are tied to paradigms is addressed in Section 5.
one methodology within a paradigm. Methodologies may be developed self-consciously as methodologies (for example, Soft Systems Methodology), or they may emerge as broad prescriptions for good practice in using particular techniques within a paradigm (as is the case with the traditional OR methodology of model building).

A technique is a specific activity that has a clear and well-defined purpose within the context of a methodology. Examples of techniques are: developing a discrete-event simulation model; undertaking statistical analysis; producing root definitions and conceptual models in SSM; drawing a cognitive map; identifying systems 1–5 in Beer’s [21] VSM. Techniques may be complementary, that is they combine together within a methodology, for example statistical analysis, building a simulation, and sensitivity analysis; or they may be substitutes, for example, using queuing theory instead of a simulation. Techniques can themselves be decomposed to different levels of detail.

We can see the relation between methodology and technique as that between a what and a how. The methodology specifies what type of activities should be undertaken, and the techniques are particular ways of performing these activities. Generally each what has a number of possible hows. We can also see the philosophical dimensions of a paradigm as providing the why for the methodology, i.e. providing the grounds for the types of activity that the methodology generates.

Finally, a tool is an artefact, often computer software, that can be used in performing a particular technique (e.g. an LP optimizer, a systems dynamics package, or COPE for cognitive mapping [22]) or a whole methodology (e.g. STRAD for strategic choice [23]).

We should also note that interventions are always undertaken by particular people at particular points in time. There are various possible terms—analyst, actor, agent, practitioner, problem-solver, intervenor, facilitator—although each has its own particular overtones. We shall generally use the term agent as the most general to apply to someone actively engaged in dealing with a particular problem situation. We recognize that often groups of people will work on an intervention but we do not explore this possibility. Also, we do not use the term ‘method’ as this is most confusing, sometimes being used to mean a particular technique and sometimes to refer to whole methodologies.

2.2. Varieties of multimethodology

The essence of multimethodology is to utilize more than one methodology, or part thereof, possibly from different paradigms, within a single intervention. There are several ways in which such combinations can occur, each having different problems and possibilities. Table 1 provides some examples that can be

<table>
<thead>
<tr>
<th>Methodological Isolationism</th>
<th>Using only one methodology, or techniques from only one paradigm</th>
<th>Single</th>
<th>SSM only; hard OR techniques only</th>
<th>Checkland and Scholes [24]</th>
</tr>
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<tbody>
<tr>
<td>Methodology Enhancement</td>
<td>Enhancing a methodology with techniques from another</td>
<td>Single</td>
<td>Cognitive Mapping used in SSM</td>
<td>Mingers and Taylor [25]</td>
</tr>
<tr>
<td>Methodology Selection</td>
<td>Selecting whole methodologies as appropriate to particular situation</td>
<td>Multiple</td>
<td>Using Simulation in one intervention, SSM in another</td>
<td>Jackson and Keys [27–29]</td>
</tr>
<tr>
<td>Methodology Combination</td>
<td>Combining whole methodologies in an intervention</td>
<td>Single</td>
<td>Using Interactive Planning and VSM</td>
<td>Flood and Jackson [6], Flood [5]</td>
</tr>
<tr>
<td>Multimethodology</td>
<td>Partitioning methodologies and combining parts</td>
<td>Multiple</td>
<td>Using Cognitive Mapping, Root Definitions, Commitment Packages</td>
<td>Ormerod [30], Holt [31], Taket [32], Benneri [2], Ormerod [33]</td>
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<td></td>
<td>Using Cognitive Mapping and Systems Dynamics</td>
<td>Eden [34], Lehaney and Paul [35], Hocking and Lee [36], Midgley [37–40], Mingers [41], Ormerod [42, 43], Flood [5]</td>
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seen either as a set of logical possibilities, or as the preferred way of operating of particular agents. Note that the term 'intervention' covers a variety of situations from the classic consultancy case of external agents entering an unknown situation and leaving at the completion of the project; through multiple projects with the same organization over time; to someone using methodology in their own workplace.

The main distinctions between the different possibilities are (Table 1): whether more than one methodology is used or not; whether the methodologies used come from the same or from different paradigms; whether or not they are used within the same intervention; whether whole methodologies are used or parts are taken out and combined (Midgley [38] calls this methodological partitioning); and, in the latter case, whether a single methodology is given overall control or whether the parts are linked to form a multimethodology particular to that situation. The last columns give examples and selected literature references to either theory or cases.

There are three combinations of most interest as examples of multimethodology. First, methodology selection is essentially the situation assumed by Jackson and Keys' [4] System of Systems Methodologies (SOSM). This is based on the idea that methodologies from different paradigms make particular assumptions about the contexts within which they will be used, so that a methodology is most appropriate for a context matching its assumptions. This implies that, generally, only one methodology will be used in a particular intervention. Second, methodology combination is similar to Flood and Jackson's [6] total systems intervention (TSI) in which different whole methodologies may be used within the same intervention to deal with different issues, or to provide different viewpoints.

Third, the most complex form of multimethodology is where methodologies are split or partitioned into components and these are combined together to construct an ad hoc multimethodology suitable for a particular problematic situation. The parts may come from methodologies in different paradigms. An example would be combining cognitive mapping with developing a systems dynamics model. This type of multimethodology has been least explored theoretically, hence it is the main focus of discussion in this paper.

3. DESIRABILITY OF MULTIMETHODOLOGY

Having clarified what is meant by multimethodology, this section considers why such a development might be desirable for more effective practice. Four arguments in favour of (multi-paradigm) multimethodology are put forward. First, that real-world problem situations are inevitably highly complex and multi-dimensional. Different paradigms each focus attention on different aspects of the situation and so multimethodology is necessary to deal effectively with the full richness of the real world. Second, an intervention is not usually a single, discrete event but a process that typically proceeds through a number of phases. These phases pose different tasks and problems for the agent. However, methodologies tend to be more useful in relation to some phases than others, so the prospect of combining them has immediate appeal. Even where methodologies do perform similar functions, combining a range of approaches may well yield a better result. Third, further consideration of the philosophical and theoretical aspects of multimethodology is timely since many people are already combining methodologies in practice. Finally, arguments from a postmodern perspective also support pluralism in methodology.

3.1. The multi-dimensional world

Adopting a particular paradigm is like viewing the world through a particular instrument such as a telescope, an X-ray machine or an electron microscope. Each reveals certain aspects but is completely blind to others. Although they may be pointing at the same place, each instrument produces a totally different, and seemingly incompatible, representation. Thus, in adopting only one paradigm one is inevitably gaining only a limited view of
the problem situation, for example, attending only to that which may be measured or quantified, or only to individual subjective meanings and understandings. This argument is a strong one in support of multimethodology, suggesting that it is always wise to utilize a variety of paradigms.

A framework developed from Habermas [56] and also drawing on Searle [57] is shown in Fig. 1. It suggests that it is useful to distinguish three worlds—the material world, the social world and the personal world. The distinction is, of course, purely analytic. Real-world situations of human activity will involve all three. For instance, a simple conversation has physical dimensions such as body posture/gesture and spacing; personal dimensions such as emotions and beliefs; and social dimensions such as linguistic and social practices and power relations.

Each domain has different modes of existence, and different means of accessibility. The material world is outside of and independent of human beings. It existed before us and would exist whether or not we did. We can shape it through our actions, but are subject to its constraints. Our epistemological relationship to this world is one of observation (rather than participation as in a social activity, or experience as of a personal feeling), but such observations are always theory- and subject-dependent. We can characterize this world as objective in the sense that it is independent of the observer, although clearly our observations and descriptions of it are not.

From this material world, through processes of evolution, linguistically-endowed humans have developed, capable of communication and self-reflection. This has led to the social and personal worlds. The personal world is the world of our own individual thoughts, emotions, experiences and beliefs. We do not observe it, but experience it. This world is subjective in that it is generated by, and only accessible to, the individual subject. We can aim to express our subjectivity to others and, in turn, appreciate theirs.

Finally there is the social world that we (as members of particular social systems) share.

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Fig. 1. Three dimensions of problem situations.

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^Habermas's three worlds are developed from, but different from, Popper's three worlds. See [[56], pp 75–80].
Our epistemological relation to it is one of intersubjectivity since it is, on the one hand, a human construction, and yet, on the other, it goes beyond and pre-exists any particular individual. It consists of a complex multilayering of language, meaning, social practices, rules and resources that both enables and constrains our actions and is reproduced through them. One of its primary dimensions is that of power [48].

3.2. Intervention as a process

The second argument is that interventions go through several phases and have different task requirements at each stage. A number of categorizations already exist in the literature. In TSI there are three stages in the selection of a methodology: (i) Creativity—initial exploration of the situation; (ii) Choice—the selection of a particular methodology; and (iii) Implementation—putting the methodology into practice. This approach, however, provides no structure for the ongoing process of the intervention—leaving that entirely up to the selected methodology. But, taking an intervention to be concerned with bringing about some form of desired change, there are logically several types of activity that must occur, from finding out about the situation through to taking action. It is not the case that all methodologies address all these activities, or, even if they do, that they are equally effective. Thus, a strong argument for multimethodology is that by combining methodologies, or parts thereof, we can construct a more effective combination that deals comprehensively with a particular intervention.

To help do this in practice some categorization of the phases of an intervention would be useful, against which could be mapped various ‘methodologies’ strengths and weaknesses. There are two schemas in the literature—Mapleston and Lane’s [58], and Ormerod’s [33], based on Boothroyd’s [59] work. However, these were both found to be insufficiently generic to apply to all situations. An SSM analysis of the general process of intervention led to the following activities:

**Appreciation** of the problem situation as experienced by the agents involved.

**Analysis** of the underlying structure/ constraints generating the situation as experienced.

**Assessment** of the ways in which the situation could be other than it is; of the extent to which the constraints could be altered.

**Action** to bring about desirable changes.

At the beginning of an intervention, especially for an outside agent, the primary concern is to gain as rich an appreciation of the situation as possible. Note that this cannot be an ‘observer-independent’ view of the situation ‘as it really is’. It will be conditioned by the agent’s previous experience and their access to the situation. The next activity is to begin to analyse why the situation is as it appears, to understand the history that has generated it, and the particular structure of relations and constraints that maintain it. Next, consideration must be given to ways in which the situation could be changed. This means focusing attention away from how things are, and considering the extent to which the structures and constraints can be changed within the general limitations of the intervention. Finally, action must be undertaken that will effectively bring about agreed changes.

We should emphasize immediately that these activities are not seen as discrete stages that are enacted one by one. Rather, they are aspects of the intervention that need to be considered throughout, although their relative importance will differ as the project progresses. Thus, in the early stages appreciation of the problem situation will be the primary concern, but analysis and assessment will still occur, if only implicitly, and, even then, attention will be directed towards action. Equally, towards the end implementation and action will be the focus, but appreciation and analysis will still be going on. See Fig. 2.

3.3. Practice ahead of theory

The management science literature contains sufficient examples of multimethodology practice to suggest that while the latter is not yet in a position to challenge the dominance of the single method orthodoxy, it is, nevertheless, becoming increasingly popular. Although some of the published reports of multimethodology do attempt to broaden the perspective and delve into the theory behind multimethodology, most of the work done to date is descriptive, the primary concern being to show how particular
methodological combinations can help to meet various objectives.

Ormerod [30], provides an illustration of how one methodology can be used as a framework to incorporate others. He uses Ackoff’s Interactive Planning as a framework to incorporate other soft OR and soft systems methods in information systems strategy development. SSM has been used in a similar way in information systems development [60]. Traditional IS methodologies are ‘embedded’ within the SSM process as a means of better understanding the information needs of users. Alternatively SSM can ‘front-end’ information systems design methodologies.

The idea of ‘front-ending’ exploits the relative strength of SSM in relation to the different stages in the intervention process. Bennett [61], and Bennett and Cropper [62] combine conflict analysis, SODA and strategic choice to demonstrate further the value of employing different methodologies at various stages in interventions. In a similar vein, Lane and Oliva [63] illustrate how SODA can help in the problem formulation stage of systems dynamics modelling. The objective of combining methods to sustain a particular purpose is pursued by Gains and Rosenhead [64], who combine cognitive mapping with SSM in medical quality assurance. Likewise Ackermann and Belton [65] combine SODA and multiple criteria analysis to acquire, organize and make use of corporate knowledge.

3.4. The postmodern world

Another possible reason why multimethodology may be thought desirable is that one could see it as an appropriate response to postmodern beliefs and values. Conceivably one could even see multimethodology as the definitive form of postmodern management science practice. Postmodernism has infiltrated virtually all intellectual fields including management science [66, 67, 44, 68], and we should not ignore the contribution that it might make to the multimethodology debate.

Outwardly multimethodology sits comfortably with much of what postmodernism stands for. For example the postmodernist idea that foundational theories are a form of grand narrative and should not be given too much credence, is consistent with the idea that methods or parts of methods may be removed from their theoretical/philosophical base and pressed into the service of different, even competing, logics. Multimethodology’s anti-foundationalist antipathy towards orthodoxy is evidenced by its predilection to combine methods from supposedly incommensurable paradigms. Combining hard and soft methodologies in a single intervention may be seen as a form of de-differentiation where the boundaries of what were formerly clear-cut entities become blurred, and ‘playfully’ constructing creative combinations of methods may be seen as a form of the postmodernist’s pastiche.

We do not have the space here to explore further the postmodern perspective on multimethodology. However we do accept that further exploration of this line of thought is worthwhile.

4. FEASIBILITY OF MULTIMETHODOLOGY

Having put forward arguments for the desirability of multimethodology, it is now time to address the inherent problems and assess its overall feasibility. We should remember that we are concerned primarily with links across different paradigms. We will discuss three different levels of problems: (i) philosophical—paradigm incommensurability; (ii) cultural—the extent to which organizational and academic cultures militate against multi-paradigm work; and (iii) cognitive—the problems of an individual agent moving easily from one paradigm to another. Each of these is a major research area in its own right and in this paper all we hope to do is to outline the main debates and provide at least prima facie evidence that the problems are not insurmountable. A fourth problem area,
the theoretical issue concerning the extent to which different methodologies can be linked together, will be covered in the Section 5 of the paper.

4.1. Philosophical feasibility–paradigm incommensurability

The paradigm incommensurability thesis asserts that because paradigms differ in terms of the fundamental assumptions that they bring to organizational inquiry, agents must choose the rules under which they practise from among the various alternatives on offer. They must then commit themselves to a single paradigm, although sequential movement over time from one paradigm to another is permissible. The main reason why multi-paradigm research is proscribed is because of the supposed irreconcilable objectivist/subjectivist ontological and epistemological dichotomies that exist between the empirical-analytic and interpretive paradigms respectively. But, as Burrell and Morgan [7] and Astley and Van der Ven [69] have shown, there are other related dichotomies such as structure versus agency, determinism versus voluntarism, and causation versus meaning. The opposing positions in each dichotomy represent alternative competing ‘truths’ about the world, and, as such, they resist reconciliation or synthesis.

Clearly, the paradigm incommensurability thesis bears heavily upon the debate about multimethodology, and this has been acknowledged by a number of authors: Jackson [44], Flood and Jackson [6], and Midgley [39, 40], for example. In these debates, the response to the apparent tension between multimethodology and incommensurability has tended to converge around the social theory of Habermas. Thus, in seeking a possible solution to the problem, Jackson [44] appeals to Habermas’ theory of knowledge constitutive interests. All knowledge, according to Habermas, is geared towards serving particular human interests—our technical interest in prediction and control, our practical interest in developing inter-subjective meaning, and our emancipatory interest in helping people to free themselves from the constraints imposed through power relations. The three major systems paradigms are arranged in support of these interests. Accordingly, Jackson maintains that hard systems methods support the technical interest, soft methods support the practical interest, and critical systems methods support the emancipatory interest. Appealing to a higher level of reasoning, or meta-theory, allows methods to be combined without destroying the integrity of the paradigms from which they originate.

Like Jackson, Midgley [39] also appeals to Habermas, in this case to provide the basis for a new ‘critical systems’ paradigm sustaining what he calls methodological pluralism. Midgley attends to Habermas’ assertion that inherent in any utterance intended for communication there are four claims relating to intelligibility, truthfulness, justification and sincerity. Intelligibility, it is argued, is merely a prerequisite for effective communication. The other three claims, however, refer to the three ‘worlds’ discussed earlier—the objective external world, the normative social world and individual’s subjective internal world. Hard methods, Midgley claims, pursue truth statements through modelling the external world, soft systems methods pursue ‘rightness statements’, i.e. manage debate to identify a ‘right’ way forward, and subjective (soft OR) methods pursue ‘sincerity’ statements, i.e. produce a picture of an individual’s unique perspective. Through the process of rational argumentation these ‘worlds’ come to be viewed as separate. Individuals make and challenge validity claims ‘one world at a time’. In practice however, they are not separate from one another. Combining methods therefore becomes possible when carried out according to this logic.

Although Jackson and Midgley differ in terms of the theoretical rationale that they use to advance their case for multimethodology, they both accept the incommensurability thesis itself, neither questioning its overall veracity. They view incommensurability as an obstacle to be overcome. Although this is an understandable reaction, recent debates in the social sciences suggest that while the incommensurability idea is institutionally entrenched, we do not necessarily have to be beholden to it.

Both Morgan [70, 71] and Hassard [72], for example, argue that because of the ontological and epistemological uncertainties associated with any single paradigm, there is a need
for conscious pluralism in research practice. Hassard believes that moving between paradigms in a single piece of research—paradigm mediation—is difficult but eminently possible, that individuals can be trained into new paradigms. Elsewhere, and drawing heavily upon Wittgenstein, Hassard [73] suggests that the technical language games that are characteristic of the original Kuhnian idea of paradigm are merely refinements of the language game of everyday life that everyone assimilates during his or her first years of life. Paradigmatic knowledge, according to Hassard, cannot stand beyond or outside general knowledge. Moving between the opposing dichotomies of competing paradigms is therefore desirable and eminently possible.

Gioia and Pitre [74] argue that the characterization of paradigms as separate and mutually exclusive domains may have been overstated. Although the central prototypical characteristics are incommensurable, paradigms are permeable at the edges in their so called ‘transition zones’. It is possible, these authors argue, to ‘construct bridges’ across paradigm boundaries that are ostensibly impenetrable. Weaver and Gioia [75] develop an argument that echoes an earlier discussion about paradigms in systems (see [76]). They claim that the whole idea of paradigm incommensurability, based upon the objective–subjective duality, is fundamentally flawed. Giddens’ [101] structuration theory is used to demonstrate that it is not possible to separate out objective and subjective dimensions. Reality, according to structuration theory, emerges out of the dialectic interplay of forces of structure and meaning—structural regularities are created out of subjective meanings, and through socialization processes, structures then ‘act back’ upon individual’s meanings. Individuals, of course, may choose to emphasize one viewpoint over the other. In structuration this is done by selectively ‘bracketing’ the alternative view, not by ignoring it completely. However, complete understanding needs to consider both structures and meanings simultaneously since the two are so intimately intertwined.

A similar philosophical stance is adopted by Bhaskar [77, 78]. Bhaskar’s ‘critical realism’ depicts the co-existence of ‘intransitive objects of knowledge’—entities that exist independent of our experiences of them, and ‘transitive objects’—our experiences, theories and descriptions that are used in the production of knowledge. Like structuration, critical realism acknowledges the conjoint existence of the objective and subjective dimensions.

Aside from identifying possibilities for mediating between the boundaries of paradigms, or appealing to alternative forms of reasoning that dispel the objective/subjective duality, it is further possible to question Burrell and Morgan’s [7] claim that we should develop methods independently within the separate paradigms. This can be done by appealing to the postmodernist idea that the divisions between theory, method and data are unstable and eroded. But even within the dominant modernist tradition there is a body of literature (see [19], for example) which claims that the bonding between paradigm and research techniques is not inviolable, the relationship being nowhere near as straightforward as is often thought. Paradigms do not determine techniques. Techniques can be, and frequently are, detached from their original paradigms to sustain all sorts of different logics. Thus, “the empirical reality of a natural science’s practice and the practice of natural scientists is not one informed by such moral philosophy. It admits of very much more contingent, local and situational considerations, much less than the paradigm totalization that we might think.” [79].

Although the paradigm incommensurability issue has to be taken seriously in debates about multimethodology, the previous discussion gives us grounds for believing that multi-paradigm multimethodology is philosophically sustainable. To date the primarily vehicle for circumventing the incommensurability thesis, in management science, has been Habermas’ theory of knowledge constitutive interests. This falls short of the mark, primarily because it does not make any new ontological statement that is capable of subsuming the incommensurable ontological assumptions of the original paradigms. The work of Giddens [101] and Bhaskar [78], in contrast, is more promising, because these authors do present an ontological perspective that can subsume the objective–subjective dichotomy. This opens up plenty of philosophical space for the further development of multimethodology. It also holds out the promise that once an agent adopts this new
ontological position, methods and techniques from the original competing paradigms may be combined without the agent having to constantly adjust their philosophical position depending upon whichever method is being used at any time. Providing the agent understands the implications of using any method or technique in the employ of this new paradigm, then this would seem to be a big advantage.

4.2. Cultural feasibility

The question pursued in this section and Section 4.3 is whether agents can learn to operate effectively in two or more paradigms, and move easily between these. Some might claim that this is a redundant question because, ostensibly, there are plenty of people who are already doing it. Nonetheless the question is worth raising for two reasons. First, recall that adopting a plurality of methods and techniques which originate in different paradigms does not mean that an agent will employ them in the service of these paradigms. Methods can be combined without crossing paradigm boundaries and it is possible that this is what often happens. Second, while there are plenty of people who routinely combine methods, anecdotal evidence suggests that many management scientists largely operate within a single paradigm, often specializing in a single methodology or technique. Many of these specialists are academics. In general, we believe that practitioners are more eclectic, although some practitioners (e.g. Friend and Hickling [23] with their Strategic Choice approach) also specialize in a single methodology.

Broadly, the main issue concerns the extent to which adopting a paradigm is a simple matter of choice for the agent. Our position on this matter is that individuals do indeed have some freedom of choice. However, this may require that important obstacles be overcome, especially if the agent has been trained and socialized in one paradigm, and wishes to operate within another. Even if we accept that agents are able to work across different paradigms, the degree of comfort that they experience is likely to depend upon the compatibility between themselves—their beliefs/values, their personality, their preferred cognitive style, etc.—and the operational premises of the paradigm.

If we turn first to the question of cultural feasibility, the issue is the extent to which individuals' values, beliefs and basic assumptions about the world might stand in the way of moving from one paradigm to another. This is a cultural issue for two reasons. First, because these sorts of preferences are not randomly distributed. Instead they are often reinforced by institutional, physical and geographic boundaries in which communities of like-minded people tend to congregate. Management science contains a large number of such highly fragmented subcultural communities, and many of these converge around methodologies or techniques which embody particular sets of values and beliefs [80]. To all intents and purposes, such preferences are important cultural artefacts that are intricately bound up with individuals' competencies and their self-identities. While it is by no means impossible to extricate oneself from the constraints imposed by a particular culture, this can present difficulties. Ultimately, it is probably fair to say that the degree of difficulty depends upon the strength of one's attachment to a particular institutionalized 'way of doing things', combined with the strength of one's desire to 'do things differently'.

The second reason why this is a cultural issue, is because peoples' basic assumptions about the world, and their beliefs and values, arise out of lengthy socialization and acculturation processes. These may also present obstacles for someone attempting to move from one paradigm to another. As Lincoln [81] puts it, "fooling around with a new paradigm is an intensely personal process, evolving from not only intellectual but also personal, social, and possibly political transformation". This difficulty is manifest in shifting from one management science paradigm to another. Take, for example, the case of someone wishing to move from hard to soft systems. A key operational premise of hard systems is that it is geared towards designing new (ontologically) 'real' systems, or in making existing systems work 'better'. Success in this task domain is contingent upon the agent possessing high levels of technical expertise which he or she must apply according to prevailing standards of rigour. Soft systems embody markedly different operational premises. The stock-in-trade of soft systems is the construction of notional—not ontologically real—systems and technical rigour is secondary to relevance. The primary goal
of agents working within this paradigm is to 'connect' with people—to facilitate intersubjective understanding—and to help them reach accommodation and a commitment to action. So in moving from hard to soft systems, the agent has to make a not-insignificant adjustment. Moving from either hard or soft systems to the critical paradigm requires a further transformation. This has political overtones. The critical paradigm almost obliges the agent to have some degree of empathy for the underdog, and—at least in the traditional guise of critical theory—to harbour noble dreams about creating a more equitable society.

If we accept that each paradigm does, indeed, have its own set of explicit and implicit operational premises of the sort just described, we are forced to admit that journeying between paradigms is by no means a simple matter. While we would not go so far as some who have likened it to an odyssey involving severe, even traumatic, philosophical and value dislocations [82], we do believe that moving between paradigms can present serious difficulties, especially to agents whose normal modus operandi is to employ a single methodology.

4.3. Cognitive feasibility

Whereas the cultural feasibility issue draws attention to obstacles that are socially constructed and which are often shared among a community of people, there are other difficulties that may be more unique to a particular individual. Cognitive processes are a case in point.

Because cognition is a vast area of study in its own right we cannot do justice to it here. All we can do is foreshadow some likely difficulties. Cognitivism—the dominant perspective—views cognition as a mentalistic data handling process, and, within this broad framework, there has emerged a body of literature which examines the relationship between personality type, data processing preferences, and research preferences. While the results of this research are by no means conclusive, there is prima facie evidence that there is a correspondence between certain 'personality types' and the sort of work that characterizes some of the key management science paradigms.

By way of illustration, consider the 'analytical scientist' personality type, which is one of four major groupings in the well-known schema of Karl Jung [83]. This type, it is claimed, prefers quantitative, aggregate data, and has a distaste for qualitative data [84-87]. He or she values precision, accuracy and reliability. Consider next, also from the Jungian schema, the so-called 'particular humanist'. This personality type prefers to conduct research via personal involvement with other humans. He or she prefers qualitative data and to report through personalized descriptive accounts. Such individuals tend to suggest consultative, group-process approaches to issues and zealously promote consensus and acceptance. They may be more interested in promoting discussions about premises than in exploring the premises in detail [87, 88, 98].

In comparing these two notional personality types, the analytical scientist and the particular humanist, it almost seems that we are, by default, attending to some of the key preferences that one could claim are required to operate effectively within the hard and soft management science paradigms. Obviously it is not as simple as that, and we should not read too much into these findings. The Jungian schema is only one of many in psychology, and real human beings rarely fit neatly into the categories that psychologists invent to make sense of their worlds. One suspects that most management scientists straddle two or more categories. Notwithstanding these caveats, there will be some agents whose data handling and data processing preferences do approximate these types. For such people, it may be surmised that they will experience some difficulties in moving from one paradigm to another, and/or experience a certain internal tension or discomfort if they are compelled to work in a paradigm that calls for actions and behaviours that do not 'fit' their cognitive processing preferences.

While the data-processing perspective on cognition has generally held sway, there are other cognitive perspectives that can also offer insights into the issue of the feasibility of multimethodology. One such perspective, emerging out of the work of Maturana and Varela [89]—and inspired by philosophers such as Husserl, Merleau-Ponty and Heidegger—challenges the idea that cognition is an exclusively mentalistic data-processing activity, claiming that this says little about what it means to be human and operate effectively in everyday lived situations. Cognition, it is argued, is not
detached cogitation, but situated practical action. Under this view, moving from one paradigm to another requires an agent to assimilate two basic types of knowledge. First, rule-based 'propositional' knowledge that applies to pre-defined bounded situations, and which can be acquired through instruction. Second, it requires 'commonsense' knowledge—or know-how—for situations that are more ambiguous. This latter capability is pre-conscious, or instinctive, and it arises out of the accumulated lived experience of certain kinds of activity.

Given that few, if any, of our 'lived worlds' in MS have completely pre-defined bounded environments, we may surmise that the possession of know-how is a critical success factor for performing effectively in any of the paradigms. Becoming 'expert' is even more demanding, it being almost exclusively instinctive [90]. Varela et al. [91], add another relevant piece to this jigsaw with their concept of enaction or embodied cognition [99]. This connotes the idea that as an individual confronts new situations various experiences are gained through thinking, sensing and moving. The emphasis on moving demonstrates how the way we experience the world is very much an active construction involving the whole body, rather than, as the cognitivists would have it, it being the passive receipt of sense data. Effective action in a task domain depends upon having a body with various sensorimotor and orienting capacities that allow an agent to act, perceive, and sense in distinctive ways. If the agent's body has not learned how to orient itself in such a way that the relevant cues are picked up, then he or she runs the risk of 'missing' that which others might pick up. Again, like commonsense knowledge, the problem is that these sorts of orienting credentials grow out of accumulated lived experience of certain kinds of activity. They are entrenched in the day-to-day experience of acting in the world, and they become entangled in various ways in expert practice.

The main implication of this is that learning how to operate effectively in a new paradigm requires an agent to do more than merely assimilate new propositional knowledge. While this is manifestly important, it represents only the very first tentative step in becoming proficient in a new paradigm. Really 'knowing' the paradigm—acting effectively in it—makes more substantial demands, and these can only be satisfied through active bodily involvement, experience and practice. So the opportunities for these must be available. And let us not underestimate the difficulty of taking even the first step, which can itself pose a formidable barrier. Not many management scientists, for example, who enter the discipline through the soft or critical paradigms and, lacking a background in mathematics or statistics, take up the challenge task of learning sophisticated quantitative techniques. Virtually all those who are known to be competent across the hard/soft divide graduated from the hard to the soft paradigm.

5. TOWARDS MULTIMETHODOLOGY

So far we have argued that multi-paradigm multimethodology is both desirable and feasible, although there are a number of difficulties and problems to be overcome. In this section we will offer some guidance on the theoretical difficulties of linking together different methodologies or parts of methodologies in a systematic way. That it is possible to do it, at least in an ad hoc way, has been demonstrated in Section 3.3 where several empirical examples of such links were presented. As for structures or frameworks to improve this process, it is again a matter for further research, but two possible ways forward will be presented.

5.1. A framework for mapping methodologies

In Section 3, on the desirability of multimethodology, two important features of interventions were described—their multidimensionality and the different types of activity that need to be undertaken.11 By combining these two factors, a grid is produced (see Fig. 3a) that can be used to map the characteristics of different methodologies to help in linking them together.

The logic of this framework is that a fully comprehensive intervention needs to be concerned with the three different worlds—material, personal and social—and the four different phases. Thus each box generates questions about particular aspects of the

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11There are other important characteristics, especially the agent(s) undertaking the intervention, but these are not dealt with in this paper.
situation/intervention that need to be addressed.\textsuperscript{22} It is then possible to look at particular methodologies and see to what extent they address these questions and appraise their relative strength in each box. The point is not to pigeon-hole a methodology into a particular box, but to look across all the boxes and note all those that a particular methodology may help with. As shown in Fig. 3a, it appears the social and material dimensions are quite separate. This is not the intention but simply a result of displaying the framework in two-dimensions. It should really be thought of as a Toblerone bar as shown in Fig. 3b.

Figure 4 shows a tentative mapping for a number of well-known methodologies. For example, SSM mainly contributes to exploring the personal dimension and is particularly strong (darker shading) for Analysis and

\textsuperscript{22}These questions should not be interpreted objectivistically, that is capable of answers independent of the agents involved. Rather they will involve ongoing debate, construction and reflection amongst the agents and actors involved. The philosophical position underlying this framework is Bhaskar's critical realism. See [77, 78].
Fig. 4. A mapping of selected methodologies.
Assessment, although it does have some techniques for appreciating the social dimension (analysis 1, 2 and 3). Strategic Choice also covers the full range of intervention activities, and is strongest for Assessment and Action (its designing and choosing modes). But, we argue, it is not aimed so much at generating and exploring a diversity of individual viewpoints (i.e. the personal world), more at generating commitment to a particular viewpoint, hence its location across the personal/material line. VSM is seen as relating essentially to the material and social worlds, providing a model of viable organizational structure based on an analysis of biological organisms, and thus having the power to analyse weaknesses and suggest effective alternatives. There is nothing within the model for surfacing an individual’s beliefs and perceptions. Cognitive mapping and SODA has strengths in Appreciating and Analysing individuals’ patterns of belief, and in gaining commitment to Action (through merging maps), but is weak in Assessing possible alternatives.

We can use such mappings to design effective multimethodologies, one example of which is shown in Fig. 5. Here a range of complementary techniques is used in the appreciation phase—statistical analysis, SSM rich pictures and analyses 1, 2 and 3, and Critical Systems Heuristics. In the Analysis and Assessment phases cognitive mapping, and root definitions and conceptual models are used, with some help from VSM. Finally, a Strategic Choice type commitment package is used to facilitate agreement and implementation. Note that we are not advocating standardized multimethodologies (although some may emerge in practice), but designs specific to each intervention.

We should note two caveats. First, the mappings above are clearly debatable. Proponents of particular methodologies or techniques may disagree with our positioning, or it may be argued that the framework is deficient in some way. We would be quite happy for such debate to take place as we believe that it would lead to greater clarity about what different methodologies can and cannot do. Second, the mappings above reflect the standard, intended, use of particular methodologies. We have already introduced the idea of linking parts of methodologies, indeed this is a prime function of the framework, and this opens the possibility that techniques may be used in ways other than that intended. For example, instead of using the VSM prescriptively, it may be employed simply as part of an exploratory conversation to explore different peoples’ understandings [92]. When this happens the methodology or technique clearly belongs in a different section of the framework.

5.2. Linking parts of methodologies

The essence of multimethodology is linking together parts of methodologies, possibly from
different paradigms. This requires detailed study of the different methodologies to see where fruitful links can be created, but is in any case dependent on the idea that techniques can be detached from one methodology and used in another. Generally, such a transfer will conserve the original function, for example, using cognitive mapping within SSM to explore actors' viewpoints. However, it is possible to transfer a methodology or technique into a setting that makes different paradigm assumptions. For example, mathematical programming\textsuperscript{33} models are usually seen as empirical-analytic, being putative models of \textit{external reality}. However, they could be used as models of \textit{concepts}, i.e. as models of how things might be from a particular viewpoint \textsuperscript{[93]}, as part of an interpretivist debate within SSM. Equally, a systems dynamics model could be seen as a model of reality, or as a detailed and dynamic cognitive map \textsuperscript{[34]}. Moving in the opposite direction, a root definition and conceptual model that are usually assumed to refer to notional systems, could be used as the basis for the design of an actual, real-world, activity system. This approach is similar to Flood and Romm's \textsuperscript{[55]} 'oblique' use of methodology to help tackle coercive situations although it is more general.

This linking process requires that methodologies be decomposed in some systematic way to identify detachable elements and their functions or purposes. It is proposed this can be done in terms of the distinctions, outlined above in Section 2.1, between philosophical principles (\textit{why}), methodological stages (\textit{what}), and techniques (\textit{how}). The primary focus of a methodology is its stages—a conceptual account of what needs to be done. These are justified by the principles, and actualized by a set of activities or techniques. The techniques may be complementary to each other in that several must occur, or they may be substitutes, any one being potentially satisfactory. Potentially, it seems possible to detach either at the level of techniques or at the level of methodological stages. The former is more straightforward and is particularly useful in methodological enhancement. Whilst a technique does have a particular purpose or output, this needs to be interpreted within the context of the particular methodological stage that it realizes. Thus in moving a technique from one methodology (and possibly paradigm) to another, its context and interpretation may be changed. To take one of the examples above, if a systems dynamics model is built as part of a hard methodology its context will lead to the results being interpreted as a model of reality. If it is detached and used within a soft setting it will be interpreted as a model of a notional system. The model-building process will be essentially the same, although the previous stage of generating inputs to the model will be different.

Figure 6 shows a decomposition of SSM and concentrates on the stages concerned with expressing the real-world situation and modelling relevant conceptual systems. Each of these stages has particular techniques that help accomplish them, for example, rich pictures and analyses 1, 2 and 3 for expressing the situation. Some techniques may have tools such as CATWOE or a computerized CASE tool. It is these techniques (and their lower level tools) that can be disconnected from the methodology, as shown by the thick lines, and used in other contexts within other methodologies. The figure also shows how techniques can be imported into the methodology, for example, cognitive maps (and the associated computer tool COPE) instead of, or as well as, rich pictures; Ulrich's \textsuperscript{[94]} critical systems heuristics (CSH) as a complement to analysis 3; or a viable systems model (VSM) \textsuperscript{[21]} to aid development of a conceptual model.

The main emphasis in Fig. 6 is on the disconnection of techniques. The second possibility mentioned above, of detaching stages, is possible and occurs in both methodological enhancement (adding a stage to another methodology that is deficient) and multi-methodology (combining various stages to construct a new, \textit{ad hoc}, methodology). It is, however, more problematic, particularly in the multi-paradigm case since the stages are strongly related to their philosophical paradigm. More consideration needs to be given to this situation.

To make the framework outlined above practically useful, decomposition diagrams such as Fig. 6 would need to be constructed for all possible methodologies, and the various

\textsuperscript{33}For example, linear programming, goal programming and data envelopment analysis (DEA).
Fig. 6. A Decomposition of SSM to show possible disconnection of techniques.
techniques and stages tabulated and cross-referenced.

5.3. The pivotal role of the agent

The discussion above of cultural and cognitive feasibility brings to the fore consideration of the particular agent(s) who will use multimethodology which is generally ignored in the methodology literature. This is somewhat ironic given the importance that soft methodologies place on the views of actors in problem situations. The point is that the choice of methodologies to combine must depend in part on the skills, knowledge, personal style and experience of the agent at a particular point in time. We cannot expect people to bring into play methodologies that are unfamiliar with, or that their cognitive style makes them uncomfortable with. Furthermore, if we consider the critical use of multimethodology then, as Mingers [95] argues, we cannot expect abstract methodologies or frameworks to force users to adopt a critical stance toward the status quo. Rather, it is the values, commitments and emotions of the agent that predispose them to adopt particular methodologies.

In practical terms, this aspect of multimethodology can be developed through a framework that considers three relationships within an intervention—that of the agent(s) to the theories and methodologies that are available; the agent to the problem situation; and the methodologies to the problem situation [95]. This is of particular relevance in the early stages of an intervention when the particular combination of methodologies or parts is being designed, but continues throughout as new aspects and events unfold. A series of questions covering each of the three relationships has been developed by Mingers [95] to assist in multimethodology design.

6. CONCLUSIONS

This paper began by identifying a number of alternative ways in which methodologies may be combined. We then argued the case for multimethodology on the grounds that it has the potential to provide a more complete way of dealing with the richness of the real world, and because individual methodologies differ in the degree to which they assist throughout the various stages through which interventions typically proceed. Combining these two dimensions into a framework has allowed us to assess the relative strengths of various methods and to foreshadow likely combinations that may be assembled to deal with the exigencies of any particular intervention. We have also examined some of the philosophical, cultural, theoretical and cognitive feasibility issues that multimethodology raises. We can now outline aspects of an agenda for further research that we believe emerges out of this discussion [100].

The first issue that requires further consideration is whether the particular framework for multimethodology presented here is underpinned by assumptions that are constitutive of a new paradigm, or whether it is, in fact, meta-paradigmatic. Our position is that in seeking to reject the idea that multimethodology must accede to the paradigm incommensurability thesis we have turned to Giddens and Bhasker, both of whom dispute the claim that we must choose between the competing realities offered by realist or nominalist thinking. These authors suggest that structure and meaning coexist in a dialectical relationship. Such a position contends the very basis upon which paradigms have traditionally been described, and obviates the need to reconcile hard and soft methods by appealing to higher levels of reasoning. However, this does not mean that such a position is in some sense free of all philosophical assumptions and thus extra- or meta-paradigmatic. Rather, our current view is that multimethodology research belongs to a new pluralist paradigm [96, 95] that accepts a plurality of theories and approaches currently but aims in the long run to integrate them together. Consideration now needs to be given to exploring the wider practical implications of multimethodology management science practice operating according to the logic of this paradigm.

Second, the nature of the relationship between multimethodology and critical systems thinking needs to be worked out. Multimethodology has much in common with other critical systems frameworks such as TSI which delivers its own set of commitments. Some of these we would wish to retain. Understanding the relative strengths and weaknesses of different methods, for example, is very important, as is the need to reflect upon the interests that are being pursued in interventions. However, in moving away
from a primary basis in Habermas’ theory of knowledge-constitutive interests, it appears as though multimethodology no longer has an inherent commitment to critique and emancipation. Although multimethodology does ask the user to consider the social and political context of any intervention it does not presuppose a particular stance on it. Perhaps this debate about multimethodology should ‘connect’ with wider debates—modernist and postmodernist—that are occurring within systems/OR regarding what constitutes an appropriate form of critique. As a minimum, because multimethodology ultimately seeks to provide the basis for intervening and interfering in the lives of others, consideration needs to be paid to the ethical aspects of such action.

Third, more research needs to be done on the cognitive and cultural obstacles that stand in the way of multimethodology. Are there other personality-related factors that impinge upon research preferences in addition to those identified here; can individuals operate effectively in non-preferred research modes; what are the preferences and ‘habits of mind’ of management science people; what scope is there, if any, for ‘paradigm shifting’; to what extent does the prevailing cultural constitution of the systems/OR community mitigate against multimethodology research; should there be changes in the curriculum in tertiary education and training to better develop multimethodology competences? All of these questions provide fertile avenues for further research.

Fourth, alternative theoretical frameworks to provide practical guidance for multimethodology design need to be investigated. The two-dimensional framework presented here only illustrates one possibility. Inevitably there will be others that provide a potentially valuable source of insight. Once frameworks are in place we can then set about the task of investigating logical possibilities for combining methods, putting them to work and then reflecting upon the results.

Last, it is already apparent that a good deal of multimethodology research is already being undertaken that has not yet filtered through into the literature. It would be useful to know more about this work. The answers to questions like who is doing it, for what reasons, and how they are combining methods would complement the insights that emerge out of more theoretically-driven concerns such as those expressed here.

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