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The futures of OR†

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This paper considers possible futures for OR by building on the views of earlier writers and considering several different images that OR presents of itself, each of which has advantages and disadvantages. Ackoff's 1978 critique of OR is reviewed, together with his proposals for reform and, with the benefit of hindsight, his prognosis is examined. OR has survived, but it has changed, certainly in the UK, in some of the ways that he suggested. In the 1980s, the OR Society investigated the then state of OR practice via a commission that also expressed its thoughts about possible futures. It too got some things right and missed the target on others. Finally Checkland's ideas of root definitions are used to consider possible futures for the OR Society. This is all done in the belief that the future is not out there waiting to happen, but is something that we can create and influence.

Keywords: OR practice; OR process; futures

Background: the paradox of success

Operational Research emerged[1,2] as Britain prepared for war with Germany in the late 1930s and early successes led to its spread across the UK war effort and from here, as operations research, to the USA. As a subject, discipline or activity OR has been around for over 60 years and could by no stretch of the imagination be called young. Since the pioneer days in wartime, OR has spread throughout much of the business and government sector in the UK, USA and elsewhere. I have been working in universities for over 25 years and I find it hard to think of any legitimate sectors of the UK economy into which students I have taught have not been recruited. Last year graduates from the MSc course in OR at Lancaster entered companies engaged in areas as diverse as air traffic control, air travel, banking and finance, defence, general consultancy, government, health, manufacturing, railways, retailing and telecommunications. Thus, in some terms, OR has been a success story. It has survived for over 60 years and has prospered as its tentacles have extended throughout modern economies.

The two largest OR societies in the world are the Operational Research Society and INFORMS. The first society was formed here in the UK as the OR Club in 1948, becoming, later, the OR Society. Its name betrays the common British attitude that we need not indicate, in our title, our country of origin. Thus we have The Football Association and, for wine buffs, The International Exhibition and Co-operative Wine Society. INFORMS, based primarily in the USA, was formed from a merger between the Operations Research Society of America and the Institute for Management Sciences, the former also beginning in the 1950s. So the societies, like the subject, have survived and produce highly regarded journals, employ a significant number of staff and run events to support and encourage their members and anyone else who wishes to join in. These two, like other OR societies around the world, are affiliated to IFORS, The International Federation of OR Societies, which holds large triennial conferences and supports the development of OR in new geographical areas.

Yet these success stories also lead us to a couple of paradoxes. OR is neither young nor old and, despite its widespread use, the visibility of OR in the public eye is very limited indeed. OR is middle-aged, possibly even beyond that stage. Writing about life in County Kerry's Blasket Island in the early parts of the 20th century, Maurice O'Sullivan titled his book[3] *Twenty years a growing*, which is a line from a short Irish saying:

> Twenty years a growing,
> Twenty years a blooming,
> Twenty years declining
> And twenty years a stooping.

More ominously, the final line sometimes reads:

> And twenty years a dying.

Or even:

> And twenty years when nobody much cares whether you're there or not!

Though OR graduates that are properly trained and educated are in great demand, few of the jobs that they enter are called OR or operational research. Instead the new entrants become business modellers, business analysts, marketing analysts, credit analysts, dynamic modellers, consultants and the like. The main exceptions to this, in

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the UK at least, are in government where the OR name is still used widely. Government apart, in the UK, the OR label, and with it an association with the OR societies, is now rather weak and ill defined. Why are our services, if not our name, in great demand? One reason is the ways in which organisations have altered over the last decade or so with greater decentralisation and an emphasis on quasi-independent business units. Organisations are slimmer than they were and rely on the analysis of data based models to assess their performance and to operate effectively. Another reason is the development of e-commerce, not so much as a consumer activity, but more as automated business-to-business links that also rely on models if they are to work. An illustration of the importance of OR applications in e-commerces can be found in a recent issue of *Interfaces*.[4] A further issue is that the rate of change is much faster, which means that organisations are even more reliant on models to understand what might happen if certain policies are pursued. They need rational approaches to help them cope with the ever-increasing complexity and inter-connectedness of the world.

But this increase in demand for OR skills, insights and approaches has not been matched by growth in the OR societies. The membership of the OR Society is typically about 3000 and that of INFORMS about 10 000. If we regard the ORS as UK-based and INFORMS as US-based, the ratios of membership to population are similar and low. Neither society has seen significant growth over the last 20 years, even though demand for OR skills, insights and approaches does seem to have grown.

My aim in this Presidential paper is to encourage readers to do some thinking about the future of OR and of the OR Societies. I am not attempting to present any nostrum that will guarantee a bright future for the subject or the societies. I do believe, though, that if we face up to some issues then we are more likely to find positive ways to respond.

Some views of the future

What do we mean by the future? Perhaps many people would regard this as a stupid question, since they might respond that the future is what has yet to happen—and that's that. Historians, physicists and theologians might respond rather more thoughtfully, for they may regard the concepts of past, present and future as rather more problematic. Here are some views about the future, taken from sources outside the world of OR.

Alan Kay,[5] developer of SmallTalk, a pioneer of Xerox PARC and other future-oriented technological ventures, is quoted as saying, 'The best way to predict the future is to invent it.'

The science fiction writer John Sladek,[6] writing with tongue firmly in cheek, opined that 'The future, according to some scientists, will be exactly like the past, only far more expensive.'

Ambrose Bierce,[7] writing his Devil's Dictionary, produced the following definition: 'Future, n. That period of time in which our affairs prosper, our friends are true, and our happiness is assured.'

Charles F Kettering, who had much to say about the future and was perhaps the most realistic, was content to say why the subject interested him, rather than attempting to define it. 'My interest is in the future because I am going to spend the rest of my life there.'

As will become clear later in this paper, the future is a major topic for OR people and is one on which there has been frequent disagreement between those who regard it as essentially determined and those who regard it as something that we create or can, at least, influence. The questions that we need to consider in this paper are: what futures do we think are likely for OR and what futures do we regard as desirable? To address these questions will require a roundabout look at several issues. First, without getting tied up in semantic knots, what do we mean by OR? Second, what has been said before about the future of OR? Third, what has been said before about the future of the OR Society? Finally we consider some possible futures.

Some images of OR

I have written elsewhere[8,9] at much greater length about different images of OR, but it will be helpful to briefly consider them here, for it helps to know where we are before deciding where we wish to go. In 1980, a previous OR Society President, George Mitchell, produced his own set of images[10] which overlap with mine, so my list is certainly incomplete. It is important to realise that the images considered here have two further characteristics. Firstly they are, in effect, metaphors and, as such, have much the same status as those suggested by Gareth Morgan in his standard text[11] on organisations; that is, each one sheds some light, but also obscures other views. Secondly, and in the same vein, these are almost parodies rather than paradigms, in the sense that they do not really exist but are useful devices for debate.

Images 1 and 2: mathematical approaches unconcerned about implementation

A common way in which many people encounter OR for the first time as students, especially if they are mathematics students, is that OR is a form of *decision mathematics*. The essence of this image is shown in Figure 1, which depicts a decision maker *D*, sitting in a defined and enclosed environment E and facing a choice in which there are at least 2 courses of action C_1 and C_2, each of which can have at least two possible outcomes O_{11}, O_{12}, O_{21} and O_{22}. The links between the courses of action and the outcomes can be modelled by some efficiency functions E_{11}, E_{12}, E_{21} and E_{22}. Clearly this model can be scaled up to cover large numbers of options and outcomes. It is perhaps easiest to

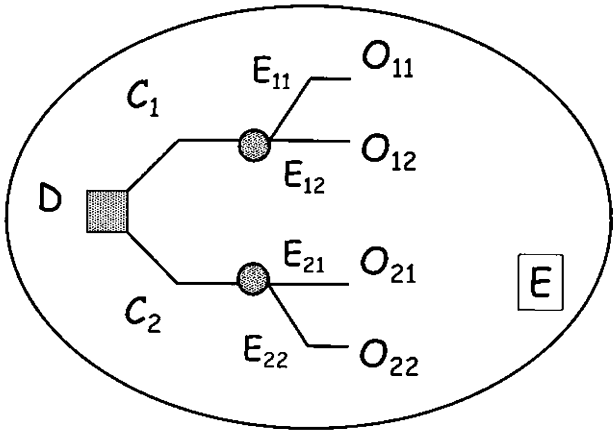

Figure 1 OR as decision mathematics.

see in statistical decision analysis, in which the efficiency functions become probability statements (possibly subjective). The same underlying model also fits mathematical programming, with its emphasis on programmed choice amongst options.

If OR is viewed as *decision mathematics*, the tasks facing the would-be OR analyst are as follows.

(i) Identify the decision maker.
(ii) Draw a boundary around the decision space.
(iii) Identify the possible courses of action.
(iv) Identify the potential outcomes.
(v) Link all this together in a decision model that employs a utility function to enable choice to be made on some rational basis.
(vi) Feed the model with data, perform the calculations and come up with the best course of action.

Of course, the use of decision mathematics may be more subtle than this, but the essence applies.

Approaches of this type have been widely criticised and perhaps the most damning criticism comes from the economist Herbert Simon[12,13] who pointed out that such a model assumes that perfect knowledge is available at zero cost and that preferences remain stable over time. Neither is true. I think it unlikely that, in OR, we would be seduced by such assumptions and 'used sensibly' such approaches do at least provide a rational ideal against which deviations can be assessed. However, applied uncritically, this image of OR has another fault—which it shares with the second image of OR covered here.

OR as *optimisation and improvement* is the second image, which is an extension of the first. It is a little more subtle, since it perhaps takes a different statement from Simon as its starting point. One of his justifications of bounded rationality[12] was that 'We prefer the postulate that men are reasonable to the postulate that they are supremely rational . . .'. Thus, there is no need to assume that information is free nor that it is complete. Instead there is a view that people pursue improvement and that the role of OR is to support this with rational methods and means. As a variant of *decision mathematics*, this is intuitively appealing, since most people would like to see the world become a better place and few of us would argue against improvement. But it does beg an important question—improvement for whom? It is sometimes true that negotiations can end in a win: win situation, but it is all too often the case that there are winners and losers, at least in the short term. If a decision that increases shareholder value also leads to large-scale job losses, then there are winners and losers and it does not result in improvement for all. As in so many walks of life, he who pays the piper calls the tune.

In addition, there is the other common thread that links these first two images of OR. They enable rationality to be used as a weapon against those who disagree. If a wholly rational approach has been taken and if all the possible data and information has been considered, and if no mistakes have been made in the analysis, then the decision that falls out from the analysis must be correct. Thus, implementation becomes a process of selling or of explaining a solution to people who would see that it is correct—if they could understand it. Disagreement is thereby labelled as irrational and frequent implementation failures are the result. In essence, if such views are taken to their extreme, implementation is not regarded as an issue other than as a challenge to convince people that the analysis was done properly.

Images 3 and 4: OR as engineering or as management science

Though I have never attempted to research this properly, I suspect that most UK OR practitioners would, if asked, describe themselves as problem solvers in some way or another. It is important to realise that such a view does not regard problems as worrisome, but rather as challenges that, if faced, can lead to improvement of some kind (though see my earlier caveats about the notion of improvement). In this sense, OR is seen as a technical activity in which skilled people use whatever tools are appropriate in an attempt to tackle an important problem. This is a very appealing view of OR, since it is unhampered by some of the restrictive assumptions that underpin the first two images. In a sense, this is OR as engineering and is similar to the notion of OR as management engineering, suggested by Corbett and van Wassenhove.[14] Mathematics is seen as the servant and not the master of the OR/MS, and is used as and when necessary.

Sometimes this image of OR can be presented as if OR people are skilled Jacks and Jills of all trades able, without blinking an eyelid, to work in marketing, human resources, finance, logistics and government. But no such extreme assumption is necessary, since problem solving can be restricted to a particular domain of expertise.

The main question is whether problems actually get solved in OR. Though it is true that mathematical models can be solved, it may not be true that organisational problems are solved in any permanent way. A feature of organisational life is its constant flux and change, and some have argued that the rate of change has increased markedly in the last decade. A result is that problems often do not stay solved for long and an apparent solution to one problem may cause further difficulties elsewhere. Based on ideas of Russ Ackoff[15] I have argued elsewhere[9] that OR people often use the word 'problem' in confusing ways and that most organisational OR involves working with 'messes' that are not solved, but from which issues emerge that can be handled with our tools and approaches.

A fourth image sharing the same lineage is that of OR as *management science*. The term perhaps stems from the early days of OR when distinguished physical scientists took their expertise into the analysis of war[16] and refused to be relegated to a role as designers of better gadgets. Instead they focused on tactics and methods that would lead to better defence or more successful attack. As well as the distinctive insights of their disciplines, they took with them a mind-set, the scientific method, which was very successful when allied to sympathetic military leadership. This early emphasis continued as OR staff moved into industry. It is clear, for example, in the early name given to one of the largest civilian groups, the Field Investigation Group of the UK National Coal Board. A name which suggests that scientific investigations will be carried out in the coalfields; science in management.

I am a Professor of Management Science and a member of a Department of Management Science, but I well remember an articulate student suggesting that the title 'oxymoronic studies' would be more appropriate. As an undergraduate I took a course in what, in the UK, was called industrial engineering and which many texts referred to as 'scientific management' or 'Taylorism'. The latter being named after FW Taylor who popularised and developed work study as 'scientific management'. This paper is not the place to develop a proper critique or defence of Taylorism, which has certainly had its benefits (such as mass produced goods that have raised living standards for many people). However, a major criticism of scientific management is that it dehumanises, de-skills and demeans. It dehumanises because it treat peoples as if interchangeable parts on a production line. It de-skills, for the aim is to reduce any task to fundamental elements that can be simplified and, possibly, mechanised. It demeans because it creates a distinction between those who plan and control (managers) and those who do exactly what they are told (workers). Such a division might fit the mass production of standardised items at minimum cost, but is inappropriate in a knowledge-based organisation that sells expertise.

So we might be reluctant to hoist the management science flag too high, but there is another related factor that might give us pause for thought. Again I have no hard analysis to support this claim, but I suspect that most newspapers and TV programmes nowadays carry more items that are critical of science than those that speak of its benefits. Current examples include genetically modified crops, renewed interest in nuclear power generation and vaccination programmes for young children. Whether we like it or not, people in the developed world may not hold scientists and scientific endeavour in particularly high regard. Thus, hoisting the flag of scientific problem solving may not attract many salutes from those watching.

Images 5 and 6: OR as design and synthesis, OR as intervention and change

The final two images to be discussed here have a quite different orientation in common. The previous four focus on analysis, that is on a rigorous approach in which things are decomposed so as to understand how they function and how they might be improved. The first of the two, image five, is that of OR as a *systems approach*. OR was defined as such in one of the very first texts[17] on OR that appeared in the 1950s, where we read that OR takes '... an overall, or systems, approach...'. The notion of holism that this implies was later extended by Checkand[18] and others into soft systems approaches such as his soft systems methodology (SSM), which stresses that a process of enquiry could be systemic.

Systems approaches, whether hard or soft, have a number of things in common. The first is a stress on holism rather than reductionism. That is, a realisation that systems are composed not just of elements but that these elements are organised and are inter-related. Thus changing one element may well affect others and may have consequences that are somewhat different from those intended. Thus, to understand a system we must identify not only those elements but must be sure that we understand how the system is composed in terms of the relationships between those elements. Hence systems are changed by modifying the elements and by modifying their relationships. A second feature of systems approaches is that they emphasise the need not just to analyse but to design. That is, to consider how existing and new elements might be better organised and linked. This requires an ability to synthesise and to idealise, rather than an ability to solve problems through analysis.

This same stress on synthesis finds its way into the final image of OR to be considered here. This is the image of OR as *intervention and change*. In a sense this is a hybrid between the images of OR and systems and as problem solving. Here the problems to be tackled are not well defined but are, in Ackoff's terms, messes. The idea of this type of OR is that it should embody what Simon[13] called procedural rationality. Elsewhere[9] I have written of this as follows: '... procedural rationality is concerned not so much with

the outcome of a deliberation but with the nature of the deliberation process. Behaviour is said to be procedurally rational when it results from some appropriate deliberation. Thus the focus is the process of decision making, on how it is done or on how it should be done. Hence, in these terms, irrational behaviour is impulsive behaviour that occurs without adequate consideration and thought. Procedural rationality is thus closer to the common sense view of reason than might be the case with substantive rationality. In these terms, the focus is on developing procedures that may enable people to make better decisions.'

These attempts to apply procedural rationality are often called 'soft OR'. Checkland's soft systems methodology applies a procedural systems approach in which systems ideas are applied to the process of enquiry. Others who have developed procedurally rational approaches to intervention and change include Eden[19] and his collaborators, Friend[20] and his co-workers, and others.[21] Taken to extremes, some might argue that these soft approaches simply codify what intelligent practitioners do anyway. However, I think that things are not that simple.

Which image is correct?

It should be clear that none of these images gives a full and accurate picture of what OR is or of what many people intend it to be. However, they do illustrate the multi-faceted nature of OR that needs to be borne in mind when reading the rest of this paper.

Ackoff on the future of OR

Russ Ackoff, one of the pioneers of civil OR and one of its most intelligent commentators, delivered two papers at the 1978 OR Society's Annual Conference in York, later published in this journal.[22,23] The first paper was a critique of what he saw as the failings of the, then, contemporary OR and its trends. The second was his suggestion of the changes that were needed. It is important to realise that, in his spoken addresses, Ackoff made it clear that much of his barrage was aimed at academic operations research, particularly mathematical operations research, in the USA. In his view, the future for this OR was bleak unless some major changes were made and he was concerned that UK OR was headed in the same direction.

The first paper,[22] 'The future of OR is past', was a resounding critique of what he argued were the paradigm and resulting practice of OR. He characterised the paradigm as one of 'predict and prepare'. This was not a criticism of one of the main characteristics and values of OR—that it offers a way for people to think through the consequences of possible actions before taking any. There is always a risk of paralysis by analysis, but that was not his main concern. Rather he argued that successful organisations were ones that actively interact with their environments as open systems, and that they do not just respond to whatever their environment throws at them. Instead, they actively try to change that environment by taking at least some control over their own destinies. He argued elsewhere[24] that only extreme bureaucracies, isolated from their environments, could survive without this interaction.

His critique of the underlying paradigm was that analysis was used to predict likely futures and then to prepare possible strategies for coping with it. Thus, the future was seen as in some sense 'out there', just waiting to arrive and the best that we could hope for was to have the right coloured flags to wave when it did so. He argued that, thus conceived, OR would not have anything much to offer in the fast changing world of the future in which large bureaucracies would disappear. It is important to note that he was not denying the value of what we might think of as tactical OR in, say, scheduling, but was decrying a situation in which OR might have nothing to offer in tackling the messes that confront us. Messes, being complex, ill-defined and with many stakeholders who may have conflicting objectives are, unlike problems, not solved, they are handled and progress may be made in their resolution.

He criticised the outcome of this predict and prepare paradigm and the academics whose over-emphasis on mathematics supported it as a form of pseudo-science. He insisted that '... practitioners decreasingly took problem situations as they came, but increasingly sought, selected and distorted them so that favoured techniques could be applied...' and that 'OR has been interpreted by managers as mathematical masturbation'—a fruitless, if briefly pleasurable, pastime.

His proposals were contained in the second paper,[23] 'Resurrecting the future of OR', in which he suggested that OR should move to a new paradigm and a new practice. The paradigm should be one of 'design and invent', rather than predict and prepare, and should be based on a view that, for most organisations, it is always possible to have some influence over the future. In a way, this mirrors Alan Kay's statement, that 'The best way to predict the future is to invent it.' But how to invent the future and what approaches would be needed? Ackoff made two proposals in particular, one aimed at practitioners and the other at academics.

He suggested that the core activity of OR should be to engage in proactive or interactive planning, which would have three features. First it should be participative and based on planning with people, not for them. As far as the organisational world is concerned, this is a similar argument to one made later by Mintzberg,[25] who catalogues the early infatuation and later disillusion of many organisations with bureaucratic corporate planning departments that produced large and impressive sounding plans which were rarely implemented. It also mirrors one of the major critiques of Taylorism, the separation of planning from action. Though those who act may need support with their planning, it is best if they plan for themselves. Its second feature was to be

its continuity: that is, planning was more important than the documented plans that were produced. Again, this mirrors, though over a decade before them, the criticisms of Mintzberg and others at much of what passed for strategic management in many large organisations. Finally, though less clearly, he argued that planning should be holistic in the sense that all levels of an organisation should be planning simultaneously and interdependently. The role of OR in this was to support and facilitate this process in a form of procedural rationality.

Inevitably, the adoption of this paradigm would require a shift in OR education programmes from an emphasis on learning mathematical techniques in a disembodied fashion to one in which understanding how people worked in organisations was fundamental. Thus, mathematics becomes the servant rather than the master. Mathematics may be the queen of the sciences but sometimes a different monarch is better.

Without such changes, Ackoff argued that OR would die, though probably slowly like the mythical frog gradually boiled in a beaker. With the benefit of 20 years hindsight, was he right? The answer, as so often, has to be yes—no. He was right in the sense to argue that the only way to make progress on new, important and strategic messes was to adopt a new paradigm based on design and invent. This is what underlies much of what we now regard as soft OR, with its ideals of synthesis and procedural rationality. Was he right that highly mathematical approaches would, by implication, have little or no role to play in strategic OR? Probably not, as the large scale optimisation models used in dynamic pricing models testify. Was he right to argue that OR education based on the disembodied teaching of mathematical techniques must be changed? Yes, he was, but in the UK that was always a hard accusation to press, since most graduate programmes saw it as their prime responsibility to produce new practitioners and so already worked closely with existing practitioners to do so and included practical, organisation-based project work.[26] Also, it was in the UK that the pioneering conferences on OR and the social sciences were held[27,28] in a determined attempt to find ways to develop different paradigms for OR. The first of these conferences led to the establishment of the Institute for OR, as an initiative of the OR Society and the Tavistock Institute for Human Relations.[29] These developments and Ackoff's proposals perhaps cleared the way for 'soft OR', developed by people such as Eden, Friend and Checkland in the UK.[21] Informal reports suggest that soft OR methods and ideas have been taken up by academics and practitioners, whereas we hear little use of interactive planning—at least under that label.

The OR Society's Commission on the Future Practice of OR

Concern about OR practice is not new. Almost 20 years ago, in 1983, the OR Society launched its Commission on the Future Practice of OR, its main remit being to 'To investigate for Council the changing state of OR in practice . . .' with a view to ensuring that the Society's services and activities were organised so as to help OR practice to prosper. As is so often the case, the Commission recognised the need to draw a boundary around its investigations, which meant that it needed some suitable definition of OR and OR practice. Rather than produce its own definition, it chose to allow a definition to emerge under its own steam by allowing the name 'OR' to include anything so defined by OR practitioners. That is, in essence, OR was whatever members of the Society felt it to be in practice—their own practice or that of others. The work done by the Commission, which produced its report in 1986,[30] included a survey, structured discussions and larger meetings. Nowadays, some of the structured discussions might be described as focus groups.

OR practice in the mid-1980s: pragmatism rules

The main conclusions of the investigation of this investigation could be summarised as follows.

- OR practice was very varied and in a continuous state of flux. Though this rings true it may also be a case of self-fulfilling prophecy, in that allowing OR to be anything that OR people regard as OR seems likely to lead to such conclusions. It would have been a surprise were the Commission to conclude otherwise.
- That successful OR practice requires political skills was a thread woven through many of the views and comments of practitioners. By political skills they meant the organisational and business awareness that is needed to actually get things done in most organisations. Again, this should hardly have been a surprise, though it does make a contrast with the view that OR is a scientific and objective activity.
- The Commission also reported a frequently expressed concern to be 'scientific'. Again, given the origins of OR, that should be no surprise, but to some it may seem a contrast with the view that political skills are needed for successful practice.
- The practitioners surveyed reported little explicit use of traditional mathematical OR techniques, though the use of quantitative approaches and statistical methods was common. This was in marked distinction with the common perception that OR is the application of mathematical techniques—the image of OR as decision mathematics.

Running through these conclusions was a view that successful OR practice required continuous innovation because practitioners were continually coming to terms with new challenges and areas of work. This required creativity and an ability to learn quickly. Thus, a suitable, if slightly flippant summary of UK OR practice in the mid-1980s would be

pragmatism rules, OK? If anything, this is OR practice closest to the image of OR as problem solving, with a toolkit that includes some mathematical equipment but in which much more than lip-service is paid to the image of OR as intervention and change.

Some possible futures from the Commission

The Commission was not content just to report on current practice, but moved on to consider possible futures for OR practice. Its members were far too smart to think that the future was waiting out there, ready to happen. Instead they considered a range of possible futures and included three in the final report. These were named as *absorption, stability* and *continuing change*.

Absorption was a future in which OR type work would persist but might not be labelled as such and which might, therefore, be missed by future investigators wishing to ask people whether they are engaged in operational research. In essence, this was to be a future in which OR people carved out successful niches in marketing, finance, logistics or whatever and became absorbed into those areas as marketing, financial and logistics analysts. Thus people with the right skills would be recruited into those posts and many central OR groups would disappear. The OR would still be done, but would be hidden behind other labels. The remaining central groups would keep innovating and achieving new successes or they would disappear. However, in many cases, as they developed successful work in new areas, dedicated analysis groups for those areas would be spun off.

Stability was a future in which OR effectively grabs topics and approaches that it alone owns and is valued for its expertise in those areas. At the time that the Commission deliberated, many OR groups were at the forefront of decision support based on early personal computers and some people wondered whether this would be the unique proposition that OR would have to offer. If so, it would be in contra-distinction to the monolithic computer systems developed by many corporate IS departments. Appealing though some people found such a well-defined future, the Commission eventually decided that this was unlikely as far as OR was concerned.

The third future articulated by the Commission was that of *continuing change*, and this was what they thought most likely. This implied that, in some ways, the future would be like the past. That is, successful OR groups would continue to innovate and to develop new approaches to whatever issues were most important to their organisations. The Commission argued that this, in effect, defined the qualities that would be needed by successful OR groups and individual practitioners. These were adaptability, opportunism, innovation and responsiveness—presumably in addition to an analytical mindset. In this future of continuing change it was felt that the mix of in-house groups versus external consultants would remain stable.

With the benefit of hindsight, it is clear that this final point was a forecast too far. It was not many years later that the privatisation of nationalised organisations led to the dispersal and outsourcing of large OR groups in coal, steel and energy production. The trend towards networked organisations with slim, possibly anorexic, central services led to similar things in the commercial sector. The mix of in-house to external groups did indeed change, as discussed in Fildes and Ranyard[31] and, as I observed earlier, most graduates from education programmes in OR do not enter jobs that are labelled as OR. Perhaps, of the scenarios considered by the Commission, the one closest to what has happened in the UK is *absorption*?

A decade later, the OR Society was still concerned about the continuing health of OR practice because of the closure of some prominent OR groups. Hence it commissioned some research, carried out from Lancaster by Fildes and Ranyard.[28,32] Their project, on the success and survival of OR groups, investigated the mixed state of OR practice in the UK. Its findings were that large groups, often working under the OR label, persisted and were thriving in UK government departments. Outside government many central OR groups were being closed, mainly because of competitive pressures or privatisation. The OR staff were dispersed to functional departments, to external consultancies under outsourcing deals, or lost their jobs. As a consequence, the number of OR staff employed in external consultancies increased, though not always under an OR label. The study found some evidence of basic management failing in some groups, most commonly ineffective internal marketing of the group's services. Also there may have been insufficient training of OR staff in social, political and consultancy skills.

Now it's my turn: some possible futures for the OR Society

So what can we conclude, anticipate and design for this third millennium as far as the OR Society is concerned? It should be clear, from what has been written earlier, that I regard the future as something that we can, at least in part, invent. It is not a fast approaching train that will squash us unless we run along the track in front of it. Nor is it a dream land in which a fairy godmother will make all our wishes come true. Somewhere in between is a position that says, unless we articulate what type of a future we would like to see, we are unlikely to see it. Writing of the future, Ackoff[23] argued that a process of idealised design is what OR can offer. This ties in well with Checkland's use of root definitions and conceptual models in his soft systems methodology.[18]

Root definitions

In helping people to understand how existing systems work or might be designed, Checkland suggests the use of root

definitions to articulate the core functionality and attributes of such systems. Root definitions are intended as devices for thinking through how things might be and there is no need to make tendentious assumptions about the real existence of the systems in question. They are tools for thinking. Most people follow Checkland[18] in using the mnemonic CATWOE to represent the root definition, though some prefer the mnemonic VOCATE instead (with the V replacing the W). The idea of a root definition is simple, it aims to be a concise description of a human activity system which captures a particular point of view. The notion of the point of view (represented by the W in CATWOE and V in VOCATE) is important for it embodies the notion that different people may quite legitimately view what is apparently the same human activity system in quite different ways. This notion of point of view (Weltanschauung in CATWOE and Viewpoint in VOCATE) is crucial to root definitions in SSM.

The CATWOE mnemonic is made up as follows:

Customer:	the immediate beneficiary or victim of whatever it is that the system does (the Transformation, see below)
Actors:	the agents who carry or cause to be carried out the main activity or transformation of the system
Transformation:	whatever the system does in transforming its inputs into outputs
Weltanschauung:	the outlook, frame of reference or set of core assumptions that makes this root definition meaningful
Ownership:	the agency or agents having the prime concern for the system and having the power to close it down
Environment:	the set of external constraints within which it must operate

It is important to consider multiple root definitions when trying to conceive of an idealised or concept design for it. Only in this way is it possible to cater for the likely participants and actors in its operation. Thus, to consider the possible future of the OR Society it should be helpful to consider several root definitions, each from a different point of view. Whilst these root definitions are not strictly scenarios in the sense that this term is used by the advocates of scenario planning, as with scenarios it can be helpful to give each definition a name to distinguish it from the others.

The exclusive sect

This is a root definition that is wholly inward looking, seeking to define and defend OR against the unorthodox.

C: the members
A: the members, officers and staff
T: use its resources to define and defend OR
W: OR needs to be defended and defined
O: members
E: charity law

Behind such a root definition is a worldview that might be interpreted positively or negatively. The positive interpretation is that any subject needs to be defined in some way or other and it would be better if this is done by OR people rather than by others who are not so knowledgeable or so involved. A negative interpretation would be that OR workers feel that OR is under threat if it is not defined and defended. Expressed in English, the OR Society is viewed as something that supports its members by using its resources to define and defend OR because this needs to be done. Thus the Society needs sanctions that it can impose on those who deviate from its definitions and statements about OR.

The service provider

This root definition also comes from a viewpoint that I regard as wholly internal. Its CATWOE might be as follows:

C: the members
A: the members, officers and staff
T: provide services in return for subscriptions
W: OR workers need and want the services that the Society can provide
O: Members
E: charity law and members' willingness to pay

Such a root definition implies that we should measure our success by the number of members that we claim and the degree to which they are satisfied by the services that we provide and the success of the activities that the Society provides. Expressed in a sentence, the OR Society is an exclusive group of OR workers that exists to support and encourage those workers by providing services and activities that are permissable within charity law. By withdrawing membership, its members can close it down. Thus the Society needs to be run efficiently and meet its members needs.

The co-operative

Remaining with an internal focus, it is possible to regard the Society as a co-operative with a CATWOE something like the following:

C: the members
A: the members, supported by officers and staff
T: take members' enthusiasm and channel this into activity
W: co-operative action is more fruitful than that of individuals
O: the members
E: charity law and resources—especially members' time

This is grass-roots OR in which the Society facilitates contacts amongst and between its members because such things are hard to organise on an informal and occasional basis and because some things are best done in concert with others. It is close to the idea of a learned society or intellectual community considered next, which allows anyone to participate in exchange and debate if they are interested enough.

The learned society

A learned society exists to promote high quality work and to facilitate learning, discussion and debate for anyone who is interested in the subject. Thus, a CATWOE of such an intellectual community might be as follows:

C: anyone who is interested in OR
A: anyone who is interested in OR, or has something relevant to say, supported by the staff of the Society
T: to use the Society's resources to provide opportunities for exchange and debate
W: free exchange and debate about OR is worthwhile for its own sake
O: the members
E: charity law, the Society's resources and interested people

The model of a learned society brings us to the next position that is much more outward looking and which, though it includes concerns for its members in its aims, goes rather further than that by actively encouraging the participation of anyone who is interested.

The evangelists

An evangelist is a person who announces the *evangel*, the (usually, good) news. Thus, this is an externally facing view of the Society, which might have a CATWOE something like the following:

C: the organisational world
A: the members, staff and officers of the Society
T: to use the Society's resources to encourage the development of OR and its further use in organisations
W: OR has much to offer to the external world and could be used more
O: the members
E: charity law, the Society's resources and interested people

Here we have a view of the Society as having, as its prime purpose, the increase and improvement in the use of OR around which it organises itself accordingly.

After the root definitions

Root definitions in SSM are not intended as ends in themselves, but rather as means to an end. The end is to consider idealised conceptual models that capture the activities that would need to be found in any viable human activity system that embodied the root definition. This could be done for the root definitions developed for the OR Society, but rather than devote space to such models here, there being several possible from each root definition, it is more important to consider what these root definitions tell us.

I suspect that each of the above definitions will have its supporters amongst the Society's members, even if they may bristle at the names that I have given to their favourite. Some will argue that the Society exists to further the development of OR as a subject, which is, in effect, the Learned Society definition. Others will regard it as a service provider that does its best to find out what its members wants and then endeavours to provide them. Others will regard the Society as gatekeepers and defenders of OR, the exclusive sect that is concerned with purity and tries to stop people using the name OR for work that is non-kosher.

My own view is that the Society may need to be all these things, with the emphasis changing through time as our environment changes and as new challenges appear. However it is not my views that matter (you'll recognise that I'm a co-operativist at heart) but rather that we reach an accommodation that leads to further developments in OR and OR people.

What about the future of OR?

To consider this, we need to return to the paradox of contemporary OR. We are successful and yet almost invisible. There is great demand for the skills and approaches that we offer, but much of this work is not labelled as OR. The scenario identified as *absorption* by the OR Society's Commission on the Future Practice of OR, but thought by it to be unlikely, has crept up on many of us by stealth. Of course there are exceptions, including those OR groups listed earlier that continue to thrive and are clearly identifiable as OR. Yet most jobs requiring our skills and insights are not labelled as OR. Does this matter?

As I write this, the OR Society is gearing up for a vote at its Annual General Meeting in September 2001. The proposal is for the addition of 3 new grades of membership, which will be open to any who are qualified. There will be no obligation for anyone to enter these grades and the criteria for membership of the society will be unchanged. Entry to the new grades will, if the proposal is accepted, depend on the experience and qualifications of the applicant. Members in these grades will have no extra voting rights and the criteria for entry to the grades are as broad as possible. Both points are important, for we have no wish to limit the

domain of OR and have no desire to become a solely professional society. People entering these grades would be able to add letters after their names, depending on their grade. The proposal provides a progression of grades that will, we hope, encourage people to continue as members of the Society as their careers develop. The grades will be some indication that a member has significant experience at an appropriate level and we hope that, over time, they will raise the external standing of OR.

These membership proposals are another instance of OR people attempting to combine two worlds. As should be clear from the earlier parts of this paper, it seems that successful OR requires a mindset that combines a scientific and rational outlook with political awareness and a willingness to work closely with other people. In intellectual terms, this is an attempt to combine two worlds. If the OR Society retains open membership as an intellectual community, and yet allows people to gain recognition for their experience, this is another attempt to live in two worlds. If we are able to live in two intellectual worlds, there seems no reason why the Society cannot inhabit two worlds as well.

My own view is that the future of OR as a discernable activity is inextricably bound up with the future of the OR societies themselves. Without the societies it seems likely that OR-type work would continue, but any sense of common purpose and of wider agendas would be lost. That is, the societies would have to be invented if they did not exist and, like OR itself, the societies have to be continually re-invented—hence the membership proposals. Thus, the future of OR rests on the creativity, energy and ingenuity of the OR community in creating a future that it desires. As is clear from this paper, there are many possible futures and we need to act and interact so as to produce one, otherwise it will arrive and take us by surprise.

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