

For IFORS 1999 in Beijing

Complexity and Quality

Abstract

At a conference with the Management Science society of Ireland the following concepts were found to create some of a “grounded formal theory”¹ about operational analysis: 1. A complexity of situation influencing complexity of analytic approach, 2. Purposes and ambitions in the operational research activities and 3. Moods of appreciation in the relations between the different constituent acts of an operational research project.

A Map

"Overview before decision" is an advice often given to clients by our operational research profession. We do not always apply it ourselves however, when we are to decide about methods to apply. The screwdriver syndrome still appears, mainly because it is difficult to keep in shape a big toolbox. However, to choose without knowing a certain variety of options is risky. It is against Ashby's law of requisite variety. See for example Beer 1974, Ritchey 1991 and, explicitly for choice of methods, Flood 1997.

The present article aims at making a map for choice of methods in an operational research project. This map will serve as a checklist of facets not to forget in such a project as well as a basic pattern for design of an action plan of the project. Quality then becomes a matter of choosing, nesting and doing relevant methods.

Concepts Which Import

There are already many checklists and taxonomies about the methodological choice and its variety, many with a striking similarity. Brugha et al (1999) has made a nice and natural fusion of some of them. The basic categories are *what*, *where* and *how*. In practice this becomes similar to a categorisation according to purpose: *change system*, *change behaviour* and *change thinking*. This is a taxonomy for requirements specification for type of method and it is grounded theory, since the items of this taxonomy quite generally make a difference for performance and results. In a project we need also to be more specific about how to do it, in planning an OR project as well as in doing it.

Let us continue in this direction, finding more salient factors by again asking what matters for planning and doing the details of an OR project. We look for those, which have advantages of their application, those, which make a difference. First then we want to promote the difference between the *picture* and the *act*, the act of using pictures. This may seem an obvious difference, but it is not in management and OR. Some alerting examples: lots of non used descriptive model-building, all seminar discussions falling "down" from methodology into factualities like a new law

¹ Glaser & Strauss 1967

of gravity, and now, 1999, not least, the lacking precision of the NATO intelligence in Yugoslavia. The problem with the latter is not really a missing technical precision. It is the belief, that such would be possible! The picture was, and is, not enough. A wider concern for an action system is needed whatever mood of *what*, *where* and *how* we employ. Even if we find it necessary to reduce the importance of the picture, we still need it, and we need acts of observation. These acts however rarely stand by themselves. They are embedded in other acts.

THE ACT

The "act" is the basic element in the present theory making. Operational Research (OR) is to act. Especially, OR is not just to be realistic and to make pictures. It is not primarily a force and not a tendency. It is the act to find and manage information for a purpose, not just for academic learning. In the present taxonomy we shall see this management as a putting together of information. There is a certain complexity in this putting together, at the same time as a client present would enjoy a simplifying digestible guidance. This is in short our views of the OR work.

Parts of acts are also acts as far as you can distinguish them, but they may be distinguished in different ways; as phases or as facets.² With iterations phases no longer stay distinct in time and place. Instead facets are distinguished by a kind of logical cohesion in an action pattern. So, for example we may distinguish imagination from analysis, though the two acts are often intertwined.

The reason for making an explicit dimension describing acts of varying complexity comes primarily from the problems of implementation. The OR of the sixties with its limited tool perspective was insufficient. Implementation failed. Russ Ackoff (1979) gave a strong wake up. Donald de Raadt (1998) is nowadays the most eloquent author in the critique of the isolated tool. They are very severe in their critics of applying simple models to complex phenomena, especially social ones. In this paper however, paying respect to their critics, we see a way back for the small models by playing the concepts appreciation and purpose.

Let us now define a hierarchy of acts and their parts. We shall also argue for it by seeing how its concepts make a difference in the OR projects.

An *observation* of an object as a phenomenon³ is the simplest act to consider. That is to see phenomena, to indicate or measure them, in concrete or abstract, in the real or imagined. A use of *tools* then, brings observations together. Some tools are called data fusion, others, like simulation, optimisation and multi-criteria analyses do operate like a kind of data fusion without being called so in normal language. There are also tools of mental vitalisation (e.g. brainstorming), discovery, combination and design, which bring observations together in a practical sense rather than an analytical one. For the beauty and simplicity of the present taxonomy it is important that we are able to consider this heterogeneous set of tools as a kind of bringing together or data fusion. Earlier versions of the present taxonomy did not separate the concepts tool and method. See for example Agrell & Vallée (1985).

Fusion of tools brings us to a complexity level of *methods* or methodologies. We can make the distinction, if we wish. It is important now to convey to the reader a feeling for a complexity dimension in the operational research activity. Precisely which complexity levels to define is not

²See Dror 1971.

³ The observation of the observing subject himself, on the contrary, is the most complex activity. We shall return to this by the end of the paragraph.

a key issue. That may vary from project to project. Three early path-breaking events in order to make aware of the methods complexity level were Hildebrandt (1982), Boothroyd (1983) and Jonathan Rosenhead with his "Blue book" (1989). Here we have beautiful examples of successful combined methodology. The so-called implementation problems much spoken about at that time had a clear role to inspire these publications. The three texts gave a nice part of a solution.

The early textbooks on this complexity level were not so taxonomic, rather with much redundancy. We think of the IIASA Handbook (Miser & Quade 1988) and Tomlinson & Kiss (1984). A nice exception is the taxonomy just mentioned by Steen Hildebrandt (1982) matching three problem types with three problem solving methodologies. Now, in the nineties much is getting written about combinations of tools, e.g. methods and processes. There are already plenty of methods archetypes. Flood & Jackson (1991 and 1992) identified six process archetypes by their "system of systems methodologies" in a conceptual context they called total systems intervention (TSI). Ken Bowen, Cathal Brugha and Markus Schwaninger (Brugha et al 1999) have each made their own process taxonomies in the eighties and nineties, and now they fuse into an eight field structure of approaches focusing the issues of "what", "where" and "which way".⁴

A next complexity level possible to define is the *process*, by which we mean the real proceeding of a project, e.g. the composition of methods, tools, observations, social interaction and everything else that hasn't got a name. Still it is not the reality of complex action itself.

Processes constitute *culture* in the sense that all kinds of process do not fit into all kinds of culture. Flood & Jackson (1991) make this very clear from cases of experience. Philosophy of science also backs this distinction. Fleck 1997 is very clear on this when he describes how cultural niches form their own local way of thinking with lots of references and examples. Thomas Kuhn, Imre Lakatos and Diana Crane give similar messages. So we have a reason to consider even this extreme complexity level of OR action, even if it is twisting the language a bit to say that culture is action. The original word of Fleck may be better than culture: "Soziale Verdichtung" (Social condensation).

Let us finally return to the issues of phenomena and observation! If we observe a culture, or some acts in it where we ourselves take part, then we can make still another complexity level, a cognitive reflecting dimension. A dimension of observation! This leads us into an infinite regress if we so wish. It would come by an infinite loop, where phenomena are observed at the same time as they make a context for our culture and for all our action.

Let us end the sketch of complexity levels here! Let us simplify again and summarise that, in some way, there are reasons to consider a complexity dimension in the design and practice of the OR-work.

APPRECIATION

The relation between OR-acts of differing complexity may be seen as a simple matter of inclusion, if we wish. This is what we have done in the preceding paragraph. However there are issues not solved this way. The power of the figure is a well-known issue. It may be taken for truth, even when it is only a made for a simplified representation or a hypothetical example. It

⁴From Methodological Dichotomy to Complementarity in Euro Decision Modelling Conference Dublin, January 1999. Also accepted for publication in Omega.

may be badly explained and misunderstood as well. The algorithms of simulation and multi-criteria analysis are typical of this. The professionals of the international working groups in these domains know very well, that the art of using such methods is something more than knowing the techniques of it. Discussions are frequent about how to interpret, imbed and use the quantitative results. (Roy 1985, Brewer & Shubik 1979) give a flavour of this.

At the Ecole des Mines de Paris the varied appreciation of an analytic act has been made an explicit reality. Making a client comply to a tool is a kind of appreciation, but there are others. Other, more realistic and viable moods of appreciation are the following: for organisational diagnosis, as a change agent, for an analysis of options (Moisdon et al 1997). More examples of appreciation are collected in Agrell (1997).

Making the techniques and the face value of a tool all of it in OR would be disastrous, which most real managers for example in defence, finance and logistics can certify.

There are many examples of the need to change the mood of appreciation during a project, for example when changing mood from brainstorming to critical analysis. (Popper's conjectures and refutation) In this case we would change mood of appreciation from "listening and listing" to "accepting".

Generally speaking "mood of appreciation" is an interesting parameter to play, since it is a stepping stone towards implementation. When a direct implementation is impossible, playing the mood of appreciation opens new options.

GOALS AND PURPOSES

Goals and values are traditionally a big issue in OR. They found assessment, quality reasoning and Business Process Re-engineering. That way goals and values are something to observe, so they belong *in* the observation level and *to* the categories of phenomena. However, there are also the analysts more immediate *purposes*, which belong *to* acts of all complexity levels, e g to the observations, the tools, the methods and the processes. This is a different perspective, and in this view we lean heavily on Ackoff & Emery (1972), their book *On Purposeful Systems*. They extend the idea of means-ends hierarchies into domains of thinking and analysis, even into issues of language and vocabulary.

More precisely observations have their purposes (to test, estimate or predict for example) and the more complex categories have others (for example optimisation, design, comparison, test or influence). The recent article by Brugha et al (1999) cited above gives a nice overview of options on the process level. It categorises process types of action according to their purposes (what, where and how?), it shows that these categories make a difference for the OR work, and it draws upon a broad empirical backing. This makes the concepts "process" and "purpose of process" strong candidates for being elements in "grounded theory". Let us lean on Ackoff&Emery plus Moisdon to claim the "grounded" interest in *purposes* at all our complexity levels.

QUALITY

It is modern (1999) to define quality with reference to a client satisfaction. We have this for example in the TQM and BPR methodologies. This has been considered a bad quality criterion

for OR however, since it is in the nature of OR to have a kind of scientific integrity and courage sometimes to oppose a client's prejudices. It is not reputable just to comply with the clients' already existing opinions, not even if we search for new argument to back their preconceived opinions.

The alternative now offered is to introduce the scientific community as a client to OR, in parallel with the formal paying client, who's satisfaction still counts as one quality dimension. Concretely, the idea in this paper is that for applications of a method, where you want to speak of quality you have to pinpoint one or several scientific niches, whose standards you fulfil. This also means, that in an OR project you may have to deal with several sets of quality criteria, even several sets of criteria on each complexity level. Some of them come from the client, some of them from a scientific world. No doubt criteria may contradict each other. For example an interview investigation may be psychologically excellent, where as a subsequent suggested allocation of funds may violate rules from both economy and business administration. So what! Action, life and not least multi-criteria analysis are full of contradictions. Quality here as everywhere is multidimensional and relativistic. It may be specified, that is a point of this article, but it is not absolute.

Conclusion

The conclusion is simple enough. We have shown a possibility, a possibility to view and organise OR with certain freedoms, with simplicity and with quality. This way we have a generally relevant and broad overview of the methodological options.

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