CEJOR (2007) 15:253–269
DOI 10.1007/s10100-007-0029-8

ORIGINAL PAPER

The importance of systems thinking in ethical and sustainable decision-making

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Accepted: 2 July 2007 / Published online: 25 July 2007

Abstract Ethical values beyond the satisfaction of basic human needs are specific to each society at a given time. Modern societies are confronted to the challenges of disappearing natural resources, fierce competition on global markets, and climate change. In this paper we define 'good', and at the same time 'ethical' decisions in the 21st century as being in accordance with the principles of Sustainable Development. Operations Research can assist sustainable decision-making in two ways: (1) through the tools of systems thinking, in particular system dynamics and soft system modelling, to provide insight into the way complex non-linear living systems and human societies function, and help making sustainable decisions, and (2) through educating and training young people in systems thinking. The paper presents examples of simple models that could serve in classrooms.

Keywords OR in Ethics · Sustainable development · Systems thinking · Education

1 Introduction

There has been a feeling for quite some time within the operations research (OR) community that social and ethical issues must be addressed within this discipline. The

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authors' purpose is not to present a review paper on this topic, so that we only briefly mention the existing literature. It did start with the founding fathers of OR during the war who were very much conscious of the social issues addressed by OR (Rosenhead 1989; Horner 2002). Later on, there were significant debates about the social and ethical role of OR (see for example Ackoff 1974; Mingers 1980; Jackson 1982), also as part of the agenda of the Critical Systems Thinking movement (see Jackson 1985, 1991; Mingers 1984, 1997, 2000). Brans and Gallo (2004) give a recent review on contributions of OR to Ethics and discuss recent attempts to revive the ethical debate within EURO from 2000 on.

When talking over 'Ethics and OR', it is usually assumed that a well-defined or universal ethical framework is available. Then comes a discussion over deontological aspects, or over the prescriptive role of OR within this established framework. As an example for this line of thought, contributions in Wallace (ed.) (1994) discuss Ethics in modelling practice. Discoursive Ethics as introduced by Habermas (1990), and Apel (1990) can be considered in this line of thought. In this paper we follow a different approach. Our main message is that a main ethical issue has to do with the current situation and particular difficulties faced by today's societies in a broad sense, from commercial organisations, human communities of any kind to supranational entities, what may be called 'human ecosystems'. 'Bad' or 'Good' decisions within these complex ecosystems may well depend on the time and context. Regarding today's conditions, it seems obvious that two major sustainability challenges of human societies are identified:

– Increasing competition on globalised market, creating structural violence and unfair wealth distribution all around the world;
– The rapid decay of the environment in terms of biodiversity, availability of non-renewable resources and the pending threat of climate change, today widely recognised.

It is why the main challenge of the beginning 21st century is to succeed in including Sustainable Development principles in 'ecosystems' in a broad sense, not only in the natural environment, but also in all human ecosystems, which are part of it.

Sustainable Development. SD has many different definitions, but the most frequently quoted one is from the Brundtland Report (WCED, World Commission on Environment and Development 1987):

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

This definition looks suitable for considering present problems, in terms of distributional justice and long-term human interests in a preserved natural environment.

In Sect. 2 we attempt an explanation on the origin of the present violence in modern human ecosystems, evidencing herewith the existing strong links with systems thinking in the way it can be understood and addressed. It is argued there that today's problems are just a specific expression of generic violence characterising human societies everywhere and at all times. To that aim we briefly introduce the concept of 'mimetic violence' developed by René Girard (1977). The well-known mechanism of the 'Tragedy of the Commons' (TOC) is central to this approach. The TOC is illustrated by

examples in ancient and modern societies, which failed to survive. This brings us to the idea elaborated in Sect. 3 that a 'good' decision must necessarily be at the same time a 'sustainable' decision for the society, contributing to the enhanced long-term viability and sustainability.

We further elaborate in Sect. 4 how, according to this view, OR helps with the instruments of systems thinking to get insight into the functioning rules of human 'ecosystems', and into ways to improve their sustainability. Systems thinking is outside the more conventional and hard stream of optimisation, so that it has all too often been ignored by practitioners and decision-makers; moreover the Club of Rome in the first report of Meadows et al. (1972) announced rather unpopular 'Limits to Growth', shortly before the 1973 oil crisis. We illustrate how simple classroom SD models are able to reveal essential mechanisms important for making 'good', i.e., in our opinion 'ethical' decisions. We insist in this section on the need to develop systems thinking (Haines 2000) in the 21st century and to promote it in the education of young people, perhaps not only at universities, but early in life. Considering the present sustainable challenges this is an extremely urgent task for all modern societies. A short conclusion is given in Sect. 5.

2 Mimesis and the role of ethics in ancient societies

'Morale' (Latin origin) and 'Ethics' (Greek origin) are in fact synonymous words as pointed out by Schweitzer (1996). They refer to what is complying with established customs. In the usual use of these words morale includes the set of rules required for a 'moral' behaviour, while 'Ethics' refers to the science of morale, the search of 'good' and 'fair' attitudes in human conducts. These adjectives may have different meanings in space and time, as we will discuss in this paper.

The French philosopher René Girard (born in 1923) almost spent his entire career teaching in the United States where he still lives today after his retirement from Stanford University in 1995. His main research topics are the myths in the literature, the origins of human culture, and the links between violence and religion. These main themes are already present in the seminal books 'The Violence and the Sacred' (1977). Girard developed the impressive sociological theory of 'Mimesis', i.e., desire imitation, thought to play a considerable role in human development. The 'desire' appears from the very beginning of any human life. A small child will be rewarded (pat on cheeks, tenderness, good school results, etc.) for first imitating his parents, and later his teachers and masters, indicating to him the very objects he shall desire. In this way synaptic links in the brain get created and reinforced through positive feedback loops. Later on, the pupil becomes autonomous and the possession of the desired object creates its own satisfaction. At maturity the master model is no longer needed, and the former pupil becomes himself a model for others to imitate. The human desire is only weakly inspired by the animal instincts, because it is mainly cultural. Therefore, although it is not singular, i.e., attached to a specific individual, human desire is not universal either. It is strongly attached to a specific culture in a given geographical space, becoming increasingly global in modern times, and at a given moment in

history. Given this cultural process, the mimesis at the basis of human behavior can be either "co-operative" or "violent":

(a) The 'co-operative mimesis' or 'good reciprocity' makes human associations rewarding by developing their own cultures and creating welfare surplus. This is particularly true when the objects of desire are common goods of symbolic nature, which are shared, and further developed by co-operation and creative minds in the group: knowledge, art, crafts, technical and agricultural progress, etc. Also recreational activities can be shared without rivalry by the group and contribute to its social cohesion. Progress is actually the process, almost absent in animal societies, by which humans transmit to the next generations the past experience and culture and permitting herewith its future development to more well being. The good reciprocity is thus associated to a virtuous growth loop (positive feedback loop); according to Girard it explains the creation of human civilisations and cultures. This type of mimesis induces a founding and growing progress of 'All for One & One for All'.

(b) The violent mimesis is also present in each human group; it often appears in a second stage after the human association has started to thrive, thanks to co-operative mimesis. This is due to an identity in the appropriation desire of objects. When humans live together they tend to desire the same things. Everyone (the 'imitator') desires what the other one (the 'model') desires: a vicious feedback loop between model, object, and imitator starts to spin, in which the imitator becomes the model and vice-versa. Through this mechanism of reciprocal imitation and jalousie a fierce rivalry appears between two contenders. In addition, mimesis conflicts are very contagious: there will soon be three, four, five, etc. contenders for the same goods. This mechanism of escalating violence is confirmed by recent comparative research on big-ape behaviours in which competition violence is very much present, as in human associations (de Waal 2005). Everyone is aware of such escalating competition in every day's life.

Ancient societies have soon recognised the risks upon their very survival caused by violent mimesis. According to Girard it is why ancient societies invented the 'Sacred', which took the form of myths, rites, and eventually religions, from very simple ones (animism) to the today existing much more sophisticated 'world religions'. It is noticeable in this respect that indeed human societies have at all times developed a sense of the Sacred in a way or another, and this is indeed a fundamental difference to animal societies. Religions, the final achievements of myths and rites, are first no attempts to forbid desires, but they establish good-conduct codes to counteract violent mimetic desires. For example in the Old Testament one the Ten Commandments forbid desiring the neighbours belongings or wife, limiting herewith the risks of violent mimetic appropriation. Religions also often operate transfers of earthen desires to promises of later unearthed happiness.

By setting rules for regulating mimetic violence religions are originally moral codes averting or curing mimetic crises. In summary, according to Girard's anthropological model, Ethics is, at least at the origins, a manifestation of religion regulating the mimetic violence in the interest of the group long-term survival.

In our opinion Girard's model of mimetic violence has much in common with systemic models based on causal-loop diagrams and feedback loops, as also noted in Vinolo (2005). Mimetic escalation to a crisis corresponds to a positive snowball feedback loop between rivals competing for some common goods. Religious rites

damping the mimetic violence or avoiding its occurrence are negative feedback loops setting in for regulation.

Violent and cyclic bursts of 'mimetic crisis', endanger the very survival of human groups. Moreover a mimetic crisis is considerably enhanced in violence when the seed for competition are goods in limited supply, partly or non-sharable: non-renewable resources, food, sex, or search for power, prestige, etc. Then violent mimesis leads to the violence of all against all, in which rivals try to eliminate each other physically. Disasters due to the systemic mechanism of the 'Tragedy of the Commons' (TOC) are then to be expected (Hardin 1968; Stevenson 1991).

The TOC is a caricature of the 'All for One & One for All' principle becoming 'All for One & None for All' (Senge 1990; Kim 1992; Richardson 1996). There are many more annoying than harmful TOC manifestations in every day's life: use of a crowded swimming pool on a hot summer day, congestion on the highway, etc. Unfortunately TOC's have brought many much more dangerous crises in ancient or modern human societies: they often ended up with complete collapse.

The basic causal-loop diagram of the TOC system is illustrated for a simple example of population dynamics in Fig. 1:

A population growth rate exceeds the renewal rate of its food resource (Pearce and Turner 1990; Roberts et al. 1994). The characteristic pattern of 'overshoot and collapse' (Sterman 2000) is well observed in the time diagram. Only two competitors for the common good A, B are represented in the symmetrical diagram for the sake of simplification, while they are in reality many of them. To be more explicit observe three loops for each sub-diagram A, B:

1. The unique positive loop P1 generates growth thanks to the resource usage;
2. A first negative loop N1 limits the 'gain' of each individual due to the limits in the shared resource, represented by the carrying capacity of the common good. The pair (P1, N1) would bring the system to the well-known stable logistic trajectory described by the Verhulst equation (Kunsch 2005);
3. A second negative loop N2 is the erosion loop that brings the progressive disappearance of the resource and its eventual collapse because of its use beyond the carrying capacity.

Sterman (2000) describes from a System-Dynamics (SD) point of view the overshoot-and-collapse evolution of the population on Eastern Island in the period 400–1700 (date of its discovery by Europeans), based on estimations from human-settlement data. There is a strong correlation to be found between the decay rate and the disappearance of tree and shrub cover on the island as established on the basis of pollen measurements. Note here that the construction of maoi (giant stone statues) accompanied in more and more extensive way the sharp decline after 1650. This may be an indication that this society has desperately tried to avert the eventual disaster by erecting huge monuments to their divinities, as a religious damping mechanism in the sense of Girard (1977). Although we do not know for sure what happened in the last stage of decay on the island, there are indications of bursts of violence, including cannibalism, which would also support the idea that a TOC mechanism associated to mimetic violence was the basic cause of the observed collapse. Many authors have considered the tragedy on Eastern Island as a metaphor for our own societies, isolated

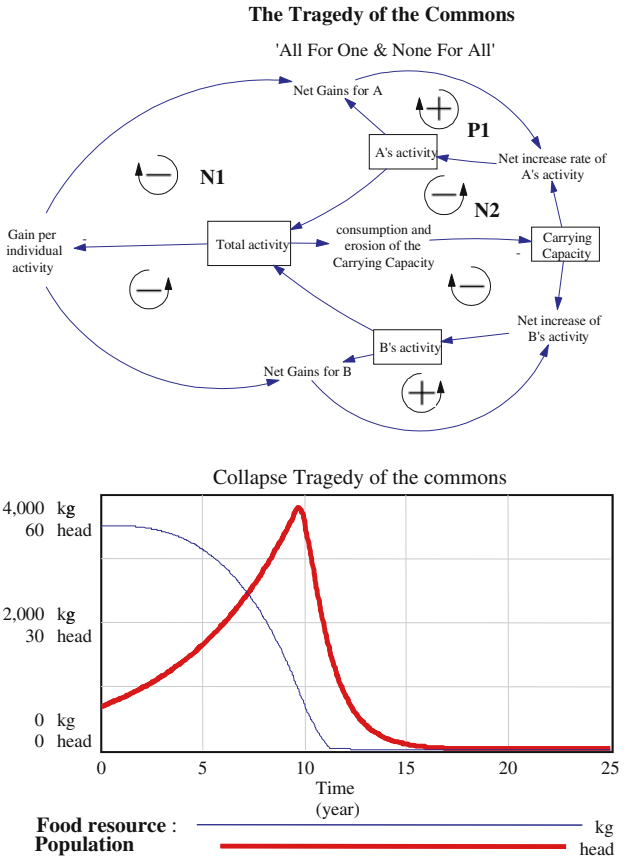

Fig. 1 The generic influence diagram of the Tragedy of the Commons (above). Only two competitors for a common resource are represented for simplification. This model has been applied to the collapse of a population with the destruction of its renewable food supply (below)

in space on spaceship earth, with nowhere else to go, after all resources will be used up. The disappearance of the brilliant Maya civilisation between the 9th and 10th century of our era is even as mysterious and could well have been caused by the same token. Coyle (1996) presents a possible influence diagram quoted from Hosler et al. (1977), which has been adapted by the authors with their students in Brussels, to produce a quantitative SD model: the resulting plausible stock-flow diagram is shown in Fig. 2. This model, although not first calibrated to real historical data, is able to generate the characteristic shape of overshoot and collapse already shown in Fig. 1.

The survival difficulties experienced by many ancient and modern societies have been recently tracked by Diamond (2005). Comparing so many decay mechanisms in so many different societies supports the suspicion of the frequent presence of systemic TOC-like mechanisms enhancing mimetic crises (although definite formal proofs of that conjecture will probably be impossible to provide in most cases). In many situations discussed by Diamond, it indeed appears that in those societies co-operative

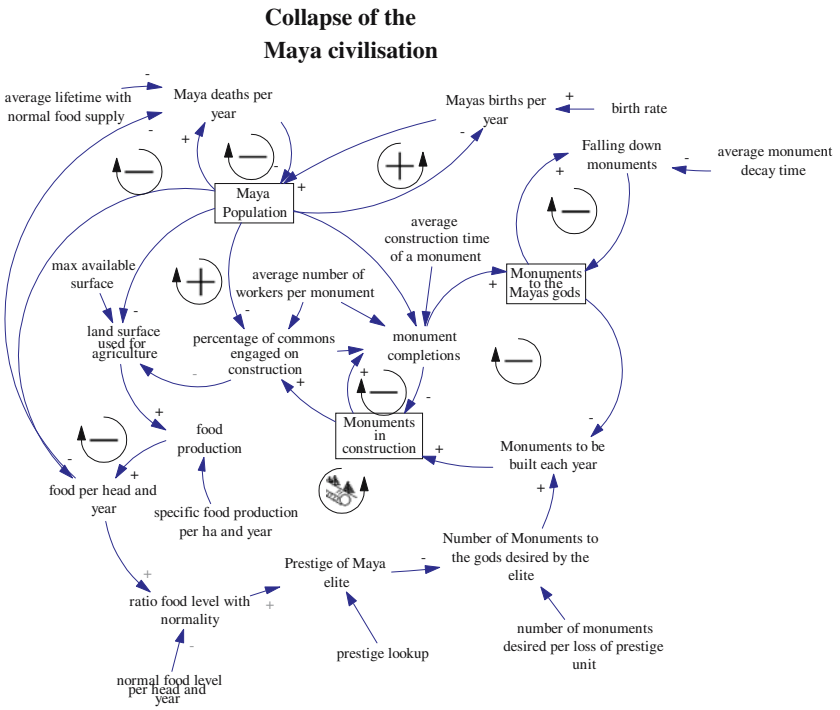

Fig. 2 The collapse of the Maya civilization. Quantitative modelling from an influence diagram according to Coyle (1996). Basically it is assumed that the Maya elite tried to recover their lost prestige after recurrent food crises, possibly due to local climate changes, by erecting huge monuments to their gods. The large percentage of commoners and the important space needed in the construction may have aggravated the crisis in a vicious circle causing a further reduction in the food production

growth had been replaced by competition for scarce resources before collapse occurred.

3 The modern need for ethics

Today at least two worrying violent manifestations evidencing potential mimetic crises are becoming more and more visible:

1. The rapid decay of the environment due to the immoderate *desire for consumption of rare material goods and resources*, mainly in developed countries. Modern forms of global TOC mechanisms are becoming possible.
2. The unregulated globalisation of markets resulting from the immoderate *desire for immediate profits*, which may bring the world economy on an unsustainable path. Moreover it reinforces the unlimited use of scarce non-renewable resources and aggravates the negative consequences of the unregulated markets by causing distributional inequalities and injustice between and within countries and by exacerbating economic competition, price wars, company delocalisations, etc.

These new forms of appropriation mimesis, and the associated violence, are obviously no longer adequately addressed by rites, myths, or by existing religions. One could nevertheless wonder if the rapid weakening of religious practice in the Western World is not creating a new threat in the absence of substituting damping mechanisms for counteracting mimetic violence. Religions are—admittedly at various degrees—quite rigid, with some tendencies to return to the fundamental tradition, and they are attached to a given geographical area and history, in which they arouse. Furthermore, they tend to be mainly repressive with respect to 'desires', at least in the present time, because of their approach based on transfer. Not all desires are bad, however: the sharable goods being the objects of co-operative mimesis are necessary for the growth of cultures and civilisations.

Humanity needs to find remedies counteracting new forms of mimetic violence. It is why in our opinion the coming-up of new movements with quasi-religious forms is observed in many industrialised countries, while the practice of traditional religions is weakening:

- Ecological thinking as an expression of sustainable development has been proposed to solve (1): this was originally an extremely promising development. Extreme forms observed in 'deep ecology' also appeared, however. The latter show characteristics of new religions based on coercive repression by authority of consumption desires (Ferry 1995);
- With respect to (2), tenants of the globalisation advocate the self-regulating forces of the market, while stern anti-globalisation movements develop.

These new movements have religious traits in fact, and rest on quite dogmatic thoughts.

We think that the needed regulation of such unfavourable trends should not be left to religion-like movements alone. Perhaps OR could play a beneficial role. The central point that we want to make visible in this paper is that making 'good' decisions is fundamentally linked to sustainable behaviour, and represents fundamental ethical values. Diamond (2005) asks in his already quoted book 'Collapse' what thought has got through the head of the citizen of Eastern Island who did cut the last tree? Transposing this question to our time, in the scary prospects of Business As Usual, we may ask what sort of thoughts may go, sometime in the possible future, through the head of the car driver consuming the last oil barrel? Although that may sound like a distasteful comparison, it does not miss the point, however. Unsustainable decisions, day after day, may bring a society, a country, a badly managed company, a family, or any human system in general, to the rim of collapse. Therefore the authors defend the opinion that such unsustainable decisions are 'bad', and thus non-ethical: they cause many times failures inducing much human suffering.

Our conjecture is thus that sustainable decisions are at the same time 'good', and thus ethical, because they are granting long-term survival to human systems and associations. The point is then to know why human beings often make—collectively—'bad' decisions, although many stakeholders may apparently behave like rational individuals. Diamond (2005) and Dörner (2004) extensively discuss this matter. Many bad decisions have proven to be disastrous in the past history, and have led to temporary, and sometimes definite collapse:

- Eastern Island collapse; Mayas collapse (both mentioned before); Greenland Norse disappearance; etc., as illustrative of collapses in ancient societies;
- French generals building the unused Maginot line before WWII started;
- The Bay of Pigs invasion leading later to the Cuban missile crisis;
- The plague of rabbits in Australia;
- The Chernobyl disaster;
- The Rwanda genocide;
- Environmental disasters in Haiti, China, and so many other places;
- Pending oil crisis all over the world;
- And many more.

Unfortunately many decisions still to come are expected to trigger new disasters. Although both Diamond (2005) and Dörner (2004) use different words or explanatory concepts, their basic understanding of those failures is similar. Using our own words to summarise their findings, we ended up with the following list of failures:

– The inability of thinking in terms of dynamics, systems, and networks;
– The myopic, static and linear way of apprehending complex natural and human environments proving to be completely inadequate or dangerous in the long term;
– The search for apparent short-term advantages, e.g., in competition of all against all on global markets, which dwindle in the course of the evolution because of many overlooked, not understood, or not accepted non-linear intertwined interactions and their resulting feedback mechanisms;
– The lack, and sometimes the refusal of suitable and timely actions, even when systemic interactions are at least partially identified or understood, etc.

Note here that any TOC rests on the gregarious behaviour of many, apparently rational individuals: collective thinking behaviour precisely shows those deficiencies. In our approach Ethics thus rests on adapted governance rules for human associations ('Gesellschaften'), with are 'ecosystems' in a broad sense embedded in the natural environment. It is why we think that techniques to be found in the systemic stream of OR can provide invaluable services. We discuss two important contributions of systemic OR in the next section.

4 OR helps promoting the modern-age needs for sustainability

4.1 Gaining insight into the sustainability rules of ecosystems

Brans (1994) argues that Multicriteria Decision Aid (MCDA) has an important contribution in moving away from the sole shareholder value to stakeholders' values, i.e., from exclusively economic aspects to all aspects that count for all members of a society. Nevertheless, the search for preferences—inclusive those of future generations, which are difficult to consider in a credible way—especially with respect to the choice of weights—does not guarantee an ethical foundation, as discussed by Rauschmayer (2001). Also we may argue that quite often some very contemporaneous decision-makers are indifferent to long-term consequences—which are moreover of-

ten ignored because not yet identified—and they have sufficient bargaining power in the decision process to impose their views.

We think that we ought to be quite ambitious for the ethical role of OR : OR can certainly provide facilitator tools for group MCDA- negotiations with pluralistic arguments, contributing herewith to Discourse Ethics (Habermas 1990; Apel 1990) but it can afford to be more than just that. All good managers know that coercion alone is not the adequate way for governing staffs, or citizens, if they are public managers. They have to discover the successful sustainability rules, in the given context, of highly complex, non-linear, adaptive, self-organising systems, and moreover capable of mutations in the relation between their members. Religious incantations won't help. Furthermore, intuition, or qualitative analysis, is often a miserable guide, because these complex systems are behaving in a counter-intuitive way (Forrester 1969). OR, a quantitative and operative technique for management can assist the managers' discovery process. It shall *'invent'* rules to be adopted and respected, in the meaning of the Latin word 'invenire', meaning 'to come upon'. The final purpose is to regulate the mimetic violence, which is taking unbearable proportions in the two indicated directions, as we discussed in Sect. 3.

To do the job, we may need more than the traditional OR-tools, which are generally static, to describe those complexities, and the often unexpectedly emerging properties. As said before in this article, the TOC, although it maybe a rather evident thought, only came to consciousness in the late 1960s: perhaps because economists often neglected so far to adopt a dynamic view at problems. We argue that OR models will have to evolve in order to remain adequate in today's organisations and societies. Several recent and partly unconventional techniques of OR must take a central part in this reforming process towards a more systemic and dynamic approach of the Real World using System Theory, with Soft System Modelling (Checkland 1993), or quantitative techniques like system dynamics (SD), Game Theory, Agent-Based Modelling, Evolutionary Algorithms, Small World Theory, etc.

In summary a first important contribution of systemic OR is to provide insight into the functioning rules of human ecosystems, and on how to keep them sustainable on a long-term track. Within this line of thought Brans et al. (1998) have developed the Adaptive Control Methodology (ACM), the purpose of which is to pilot in real time complex human systems by combining the techniques of SD, MCDA, and control.

4.2 Educating tomorrow's managers and decision-makers

Perhaps the main contribution of OR to the ethical attitude of making good decisions is in the education and training of young people in systems thinking, and its techniques (Haines 2000). While we do not defend the holistic Gaia assumption of deep ecology, considering the whole earth as a huge living organism, we think that it is important that coming generations better understand that so many things are interconnected in economy, social life and environment. At the occasion of a course on SD in Brussels in the Solvay Business School, students have to present their own SD models on contemporaneous problems in every possible field of life in society. They often start with the basic archetypes of the Fifth Discipline (Senge 1990; Kim 1992; Richardson

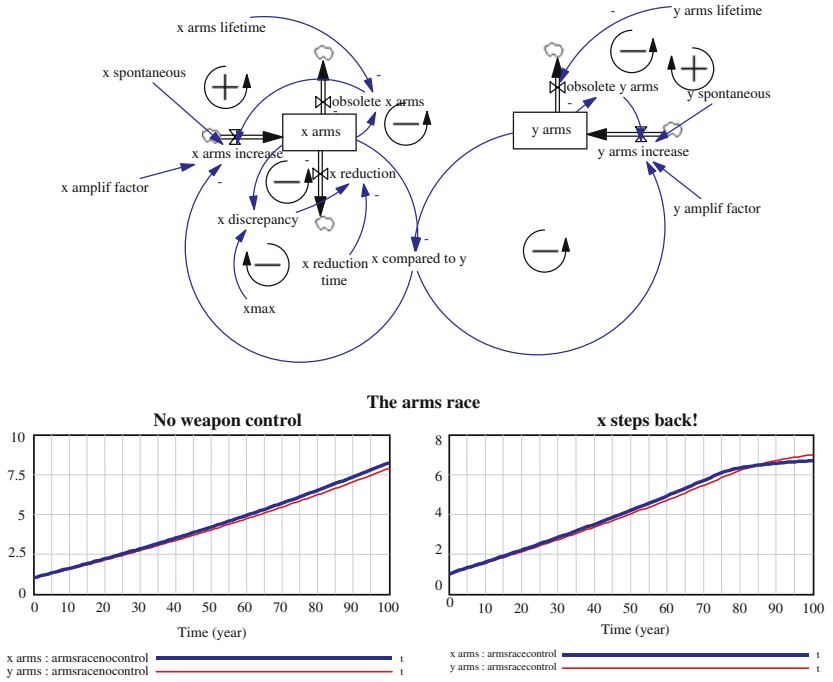

Fig. 3 Archetypes arms race—escalation

1996), as building blocks to those models, which, though simple, prove to be fantastically efficient for providing insights. System modelling brings to consciousness surprisingly evident results, which are however consistently ignored by most scholars, practitioners, private or public decision-makers. This is definitely a fantastic tool for politicians and other decision-makers in general. Because Senge's original archetypes were soft causal-lop diagrams, some original work has to be done to cast them into quantitative SD models, rivalling in imagination to find simple but important today's problems to model.

Four elementary quantitative models of this type have been prepared with the SD code VENSIM© (1998–2003) to illustrates archetypes; they are shown in Figs. 3–6. The dynamic patterns they produce are also shown. All four are related in a way or another to Girard's ideas according to our systemic interpretation presented in Sect. 2 (Vinolo 2005). All following figures are authors' originals.

- The archetype *'Arms race - Escalation'* (Fig. 3) provides an example of the escalation process, typical for the onset of mimetic crisis. A similar mathematical model has been built between the two World Wars (first published in 1960) by the British Mathematician L.F. Richardson (1993), as an early attempt to develop mathematical models of conflict situations. Note that the well-known Lotka-Volterra equations (predator-prey model, also a type of conflict in nature) were developed at about the same time with a similar intention of system modelling. In this model, each party involved—here for example the Soviet Union and the USA in the cold

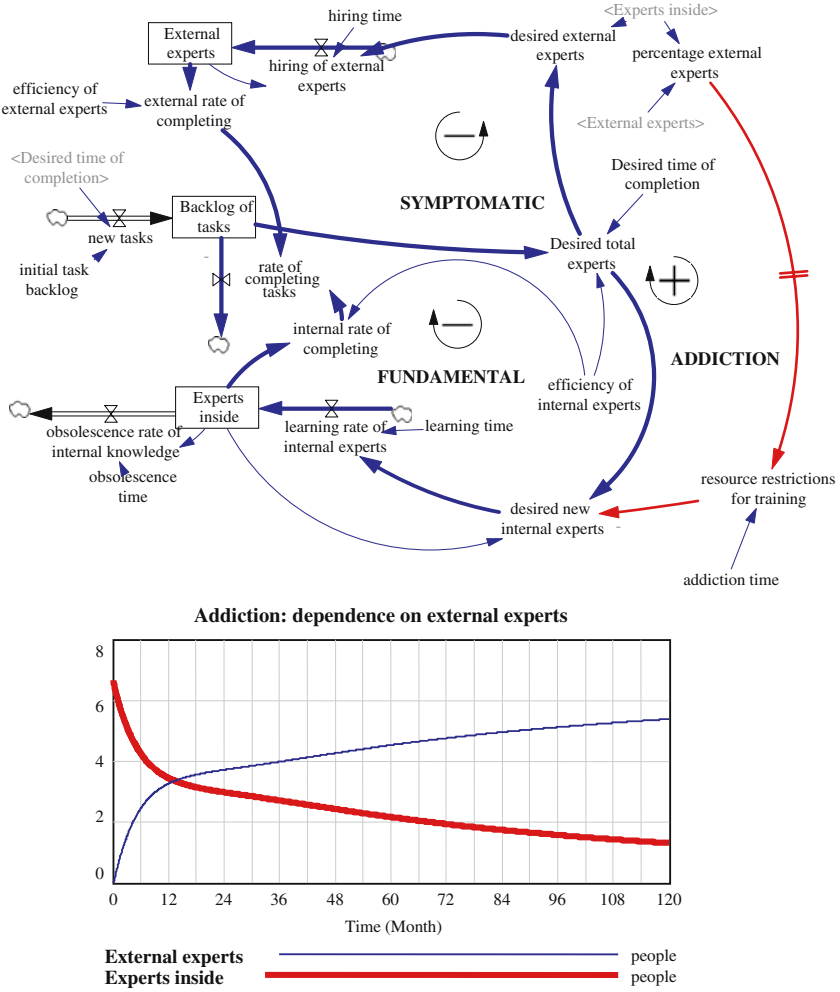

Fig. 4 Archetype shifting the burden—addiction

war at the time of the Cuban missile crisis—takes actions, which are perceived as threat by the other parties. The eight-shaped loop traced by the combination of the two central negative loop increases tension in an exponential way, like shown in the left time-diagram (no weapon control) underneath the influence diagram. De-escalation can only be obtained if one party accepts stepping back, diminishing the source of threat. To make the first step is more than often a courageous decision, because of the risk of loosing face. President Kennedy make this good and therefore definitely ethical decision, when he refused to follow the advice of the military hawks that had led to the Bay of Pigs disaster. The effect of stepping back of the x party on stopping the x-y escalation is made visible in the time-diagram on the right (x steps back!).

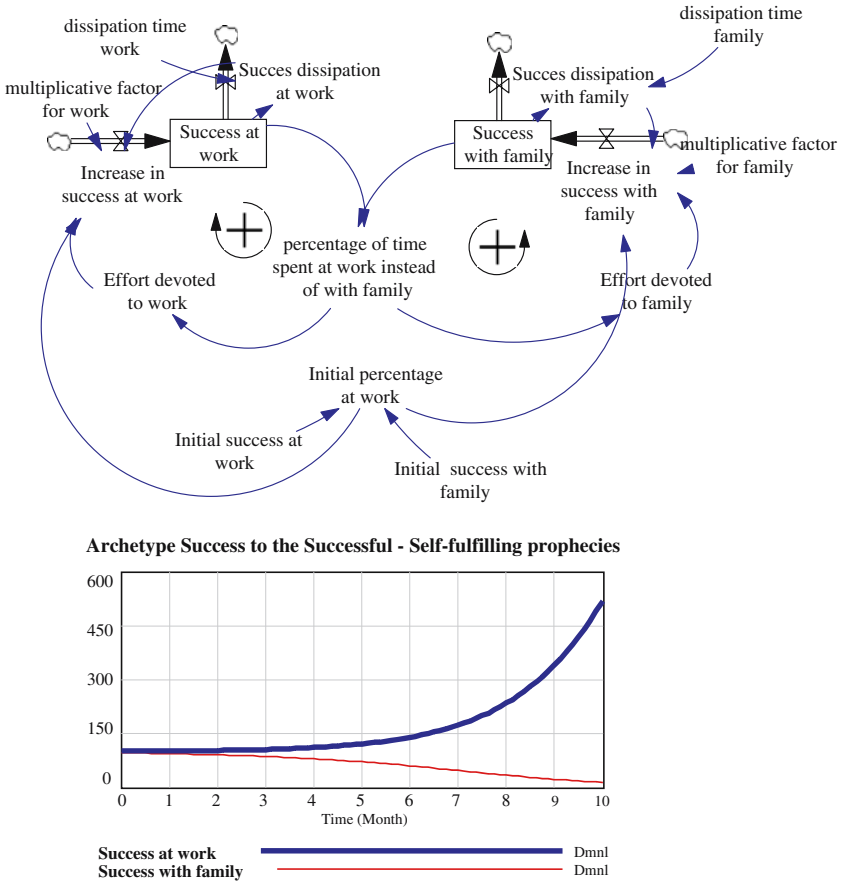

Fig. 5 Archetype success to the successful

- The archetype *'Shifting the Burden—Addiction'* (Fig. 4) is related to both 'Escalation' and 'TOC' in the sense that vicious strengthening loops create or enhance dependency and addiction to some resource or policy. Here a company is confronted to sophisticated commitments to its clients. A short-term fix, hiring outside experts, is shifting the problem away: it eliminates for sometime the symptoms, but at the same time it diverts attention away from fundamental and sustainable decisions. This policy results in a vicious addiction loop: as shown in the time-diagram underneath the influence diagram it increases the level of external dependency (thin line) while decreasing the available in-house competence (thick line). Educating internal experts would fortify the fundamental solution counteracting this evolution, and allowing the company to survive in the long term. This approach is thus the good, i.e., ethical decision supporting sustainability. Of course this example at microeconomic level could easily be adapted to macroeconomic decisions as well: dependency of a developing country on First World assistance; addiction of a government to persistent deficit spending, etc.

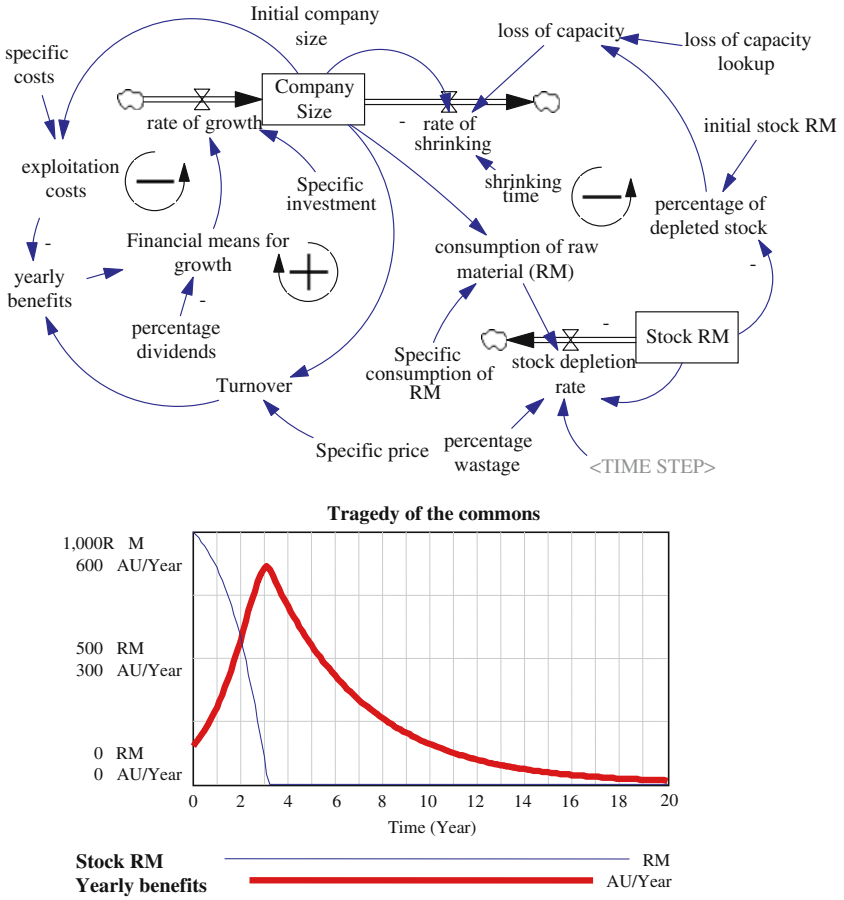

Fig. 6 Archetype the tragedy of the commons

- The archetype *'Success to the Successful'* (Fig. 5) is also called *'Self-fulfilling Prophecies'*, as the expectation that some evolution will follow some suspected path strengthens this expectation by taking away resources from equally possible—and perhaps more favourable or less dramatic—alternatives. This happens for example in the development of a mimetic crisis, as the violence of everyone against everyone is perceived as 'doomed to happen' (see also the 'Arms Race'). In the simple personal case of Fig. 5— easily extended to macro-level situations—a conflict exists between allocating the resources in time between work and family, leading to three reinforcing positive loops, including the combined eight-shaped loop, i.e., two more than escalation (Fig. 3). The time-diagram underneath the influence diagram shows how an initially fair allocation between both degrades—as predicted—to the benefit of work and career (thick line), as less and less time is left to harmonious and sustained family relationships (thin line). The good and ethical decision is here to think of co-operation rather than competition.

- The archetype 'The Tragedy of the Commons' (Fig. 6) has been extensively described before. Here a non-renewable raw material (RM represented by a thin line in the time diagram below) gets depleted while it is the driving source of growth for the company (thick line). Note again the typical overshoot-and-collapse patterns shown in the time-diagram underneath the influence diagram. Here the ethical solution might be looking for substitution materials in a timely way—terminating the addiction to the common resource causing the conflict (see also 'Shifting the Burden—Addiction'). Needless to insist again on the metaphoric character of the TOC for today's societies facing the end of the oil-era.

Students are thankful to realise how helpful such quantitative, but still very simple OR modelling is in gaining insight into serious problems of our time, and in providing another way of thinking and acting the systemic way.

5 Conclusion

Ethical rules for 'good' or 'bad' decision-making are dependent on spatial and temporal conditions, excepting of course universal rules necessary for any life in society, like you 'shall not kill', one of the Ten Commandments. In our modern global societies there are strong links between 'good behaviour' and 'sustainable behaviour'. Environmental and economic violence do or will arise from many actual or pending 'Tragedies of The Commons' due to exacerbated appropriation mimesis of unequally distributed and scarce resources, aggravated by economic and social competition of all against all on global markets. Mere intuition, incantations, religious rites and fundamentalist thoughts of any kind - including deep ecology—are not sufficient to stop the deleterious process, to master bad evolution paths, or to edict ethical and fair social rules necessary for a worthwhile life of all citizens in our world societies.

The authors argue, therefore, that while we, in these societies, face difficult global survival issues with respect to resources, environment and the market-globalisation challenges, Sustainable Development is a key reference from which to derive essential rules for the long-term functioning and common wealth of all human ecosystems (families, companies, regions, countries, nations, etc.).

The understanding of such complex human 'ecosystems', the way they function, and how to preserve them from failures and collapse require instruments to cope with inherent complexity. A first important contribution to Ethics of systemic OR is thus to provide analysis instruments to managers and decision-makers.

A second even more important contribution of OR to Ethics is to educate and train young people to systems thinking to prepare them to their future roles of citizens, practitioners, decision-makers and managers of our societies. This task has been in our opinion too much neglected in the past. OR teachers certainly have here a responsibility. But at least equally important is the frequent industrialists' attitude, when hiring young OR practitioners, to ignore the added value of a deeper education in systems techniques. Further work could be done on why so little importance is given to this discipline today. It certainly awakes the interest of young people with an OR education, may improve their job prospects, and help them better mastering OR techniques in general. Perhaps managers and decision-makers were—and still are—

too deeply involved in optimisation objectives imposed by the present competing, but perhaps unsustainable economic development?

References

Ackoff R (1974) The social responsibility of operational research. Oper Res Q 25:361–371
Apel KO (1990) Is the ethics of the ideal communication community a Utopia? On the relationship between ethics, Utopia, and the critique of Utopia. In: Benhabib S, Dallmayr F (eds) The communicative ethics controversy. MIT Press, Cambridge
Brans JP, Macharis C, Kunsch PL, Chevalier A, Schwaninger M (1998) Combining multicriteria decision aid and system dynamics for the control of socioeconomic processes. An iterative real-time procedure. Eur J Oper Res 109:428–441
Brans JP (2004) The management of the future. Ethics in OR: respect, multicriteria analysis, happiness. Eur J Oper Res 153(2):466–467
Brans JP, Gallo G (2004) Ethics in OR/MS: Past, present and future. 4OR 2:95–110
Checkland P (1993) Systems thinking, systems practice. Wiley, Chichester
Coyle RG (1996) System dynamics modelling. A practical approach. Chapman and Hall, London
de Waal F (2005) Our inner ape. Riverhead Books, New York
Diamond J (2005) Collapse. How societies choose to fail or to survive. Penguin books, London
Dörner D (2004) Die Logik des Misslingens. Strategisches Denken in komplexen Situationen. (The logic of failure—strategic thinking in complex situations). Rowohlt Taschenbuch Verlag, Reinbek bei Hamburg, Germany
Ferry L (1995) The new ecological order, The University of Chicago Press, Chicago, originally published as: Le nouvel ordre écologique. L'arbre, l'animal et l'homme, Grasset, Paris
Forrester JW (1969) Urban dynamics. MIT Press, Cambridge
Girard R (1977) The violence and the sacred. Johns Hopkins University Press Girard, R. originally published as: La Violence et le Sacré, Grasset, Paris, 1972
Habermas J (1990) Discourse ethics: notes on a program of philosophical justification. In: Benhabib S, Dallmayr F (eds) The communicative ethics controversy. MIT Press, Cambridge
Haines SG (2000) Systems thinking and learning. HRD Press, Amherst
Hardin G (1968) The tragedy of the commons. Science 16:1243–1248
Horner P (2002) History in the making, OR/MS today, pp 30–39,
Hosler D, Sabloff JA, Runge D (1977) Simulation model development: a case study of classic Maya collapse. In: Hammond N (ed) Social process in Maya prehistory. Academic, London
Jackson M (1982) The nature of soft systems thinking: the work of Churchman, Ackoff, and Checkland. J Appl Syst Anal 9:17–27
Jackson M (1985) Social systems theory and practice: the need for a critical approach. Int J Gen Syst 10:135–151
Jackson M (1991) The origins and nature of critical systems thinking. Syst Practice 4:131–149
Kim DH (1992) Systems archetypes, diagnosing systemic issues and designing high-leverage interventions, toolbox reprint series: system archetypes. Pegasus Communications, Cambridge
Kunsch PL (2005) Limits to success. The iron law of Verhulst. In: Ausloos M, Dierickx M (eds.), The Logistic Map and the Route to Chaos, Springer Verlag, pp 29–51
Meadows DH, Meadows DL, Randers J, Behrens III WW (1972) The limits to growth. Universe Books, New York
Mingers J (1980) Towards an appropriate social theory for applied systems thinking: critical theory and soft systems methodology. J Appl Syst Anal 7:41–50
Mingers J (1984) Subjectivism and soft systems methodology—a critique. J Appl Syst Anal 11:85–103
Mingers J (1997) Towards critical pluralism. In: Mingers J, Gill A (eds) Multimethodology: theory and practice of combining management science methodologies. Wiley, Chichester, pp 407–440
Mingers J (2000) What is it to be critical? Teaching a critical approach to management undergraduates. Management Learning 31:219–237
Pearce DW, Turner RK (1990) Economics of natural resources and the Environment. Harvester Wheatsheaf, Hemel Hempstead
Rauschmayer F (2001) How to consider ethics in MCA? In: Colorni A, Parrucini M, Roy B (eds) A-MCD-A, European Commission, JRC, EUR-report 19808 EN, pp 273–279

Richardson GP (ed) (1996) Modelling for management, vol I. Dartmouth Publishing Company, Hants
Richardson LF (1993) The collected papers of Lewis Fry Richardson, vol 2. Quantitative psychology and studies of conflict. In: Sutherland I (ed) Press Syndicate of the University of Cambridge, Cambridge
Roberts N, Andersen D, Deal R, Garet M, Shaffer W (1994) Modeling the ecology of the Kaibab plateau. In: Introduction to computer modeling, chap 18. Productivity Press, Portland
Rosenhead J (1989) Operational research at the crossroads: Cecil Gordon and the development of post-war OR". J Oper Res Soc 40:3–28
Schweitzer A (1996) Kultur und Ethik, reprint of an original work published in 1923, Verlag C.H. Beck, München
Senge PM (1990) The fifth discipline. The art and practice of the learning organization. Doubleday & Co., New York
Sterman JD (2000) Business dynamics, systems thinking and modeling for a complex world. McGraw-Hill, Boston
Stevenson GG (1991) Common property economics. Cambridge University Press, Cambridge
VENSIM (1998–2003) Professional32 Version 5.4.a. The Ventana simulation environment. Ventana Systems, Inc.©
Vinolo S (2005) Du Mimetismeà l'homonisation. "La violence différante". L'Harmattan, Paris
Wallace WA (1994) Ethics in modeling. Pergamon, New York
World Commission on Environment and Development (WCED). Our common future. Oxford University Press, Oxford, p 43 (1987)