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ANALYSIS

Weak comparability of values as a foundation for ecological economics

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Abstract

The main argument of this paper is that weak comparability of values should be seen as one characteristic feature of ecological economics. The formal properties of the concepts of strong comparability (implying strong or weak commensurability) and weak comparability (implying incommensurability) will be clarified. Multicriteria evaluation offers the methodological and mathematical tools to operationalize the concept of incommensurability at both macro and micro levels of analysis. The concept of incommensurability of values already has a long tradition in economics; moreover, we will show that analytic philosophy, theories of complexity, post-normal science and the recent theories of rationality lead with different trajectories to a non-algorithmic approach which, in our view, could be implemented by some forms of multicriteria evaluation.

Keywords: Incommensurability; Values; Compensability; Sustainability; Multicriteria evaluation; Ecological economics

1. Introduction

The environment is a site of conflict between competing values and interests and different groups and communities that represent them. Biodiversity goals, landscape objectives, the direct services of different environments as resource and sink, the historical and cultural meanings that places have for communities, the recreational options environments provide are a source of conflict. The different dimensions of value can conflict with each other and within themselves, and any

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decision will distribute different goods and bads across different groups both spatially and temporally. How are such conflicts to be resolved? One approach that has its roots in utilitarianism is that which attempts resolution though the use of a common measure through which different values can be traded off one with another: monetary measures are the most commonly used measure invoked for this purpose. The approach assumes the existence of value commensurability. Is that assumption justified? In the following we argue that it is not.

From a philosophical perspective, it is possible to distinguish between the concepts of strong comparability (there exists a single comparative term by which all different actions can be ranked) implying strong commensurability (common measure of the different consequences of an action based on a cardinal scale of measurement) or weak commensurability (common measure based on an ordinal scale of measurement), and weak comparability (irreducible value conflict is unavoidable but compatible with rational choice employing practical judgement) (O'Neill, 1993). In our view, *ecological economics rests on a foundation of weak comparability only*.

2. A historical overview of the concept of incommensurability

The arguments about economic commensurability and its place in decision making about the environment are not new to economic debate. It was precisely the relation between rational decision-making and economic commensurability which was the main point in the opening stage of the famous debate of the 1920s and 1930s on economic calculus in a socialist economy. The debate, started in central Europe (Hayek, 1935), focused on disagreement of how an economy could work, when the means of production were socialized, and therefore were not in the market. The question seemed practically relevant in the aftermath of the War of 1914–18 because of the wave of revolutions in central and eastern Europe.

Both Max Weber (in *Economy and Society*, vol. 1) and Hayek (1935) credited Otto Neurath, the analytical philosopher co-founder of the Vienna Circle, with the seminal contribution to the debate, although there had been previous contributions to this debate on economic calculus in a socialist economy, in the form of exercises in economic theory (Barone, in Hayek, 1935). Neurath has been recently claimed with reason as one of the founders of ecological economics, not only for his part in this debate of the 1920s and 1930s, but also because of his work on the 'unity—or rather, the 'orchestration'—of the sciences' in the study of specific issues in social, economic, ecological history (Martinez-Alier, 1987, 1991; O'Neill, 1995a). Neurath's articles on the economics of socialism had a practical bent, since they were reports addressed to revolutionary groups. He himself was inspired by the work of authors such as Ballod-Atlanticus and Popper-Lynkeus, who had written what would be called now scenarios of an ecological economy, particularly Popper-Lynkeus (1912) who carefully counted the energy and material throughput in the German economy, suggesting the introduction of renewable energies and also of new social and economic institutions. Neurath thought of such scenarios as practical Utopias (Martinez-Alier, 1987, 1992).

Neurath explained the essence of economic incommensurability by means of the following example (Neurath, 1919). Let us consider two capitalist factories, achieving the same production level of the same type of product, one with 200 workers and 100 ton of coal, the second one with 300 workers and only 40 ton of coal. Both would compete in the market, and the one using a more 'economic' process would achieve an advantage. However, in a socialist economy (where the means of production are socialized), in order to compare two economic plans, both of them achieving the same result, a present value should be given to future needs for coal (and, we would now add, a present value should be given also to the future impact of carbon dioxide emissions). We must not only decide, therefore, a rate of discount and a time horizon, but also guess the changes in technology: use of solar energy, use of water power, use of nuclear power. In Neurath's own words (Neurath, 1928, p. 263; Neurath, 1973), the answer to whether coal-intensive or labour-intensive methods should be used, "depends for example on whether one thinks that hydraulic power may be sufficiently developed or that solar heat might come to be better used. If, however, one is afraid that when one generation uses too much coal thousands will freeze to death in the future, one might use more human power and save coal. Such and many other non-technical matters determine the choice of a technically calculable plan… we can see no possibility of reducing the production plan to some kind of unit and then to compare the various plans in terms of such units…". Elements in the economy were not commensurable, hence the need for a Naturalrechnung.

Summarizing Neurath's ideas, Hayek wrote that Neurath tried to show "that it was possible to dispense with any considerations of value in the administration of the supply of commodities and that all calculations of the central planning authorities should and could be carried out in natura, i.e. that the calculations need not be carried out in terms of a common unit of value but that they could be made in kind". Hayek added (Hayek, 1935, p. 31), "Neurath was quite oblivious of the insuperable difficulties which the absence of value calculations would put in the way of any rational economic use of the resources…" Rationality was thus conditioned to commensurability of values. Or, as Von Mises had put it (Von Mises, 1920; in Hayek, 1935, p. 111), "Where there is no free market, there is no pricing mechanism; without a pricing mechanism, there is no economic calculation".

Certainly, the market would sometimes fail to give economic value to environmental amenities, thus, the calculation of the profitability of a hydroelectric scheme would not include "the beauty of the waterfall which the scheme might impair", except that attention could be paid "to the diminution of tourist traffic or similar changes, which may be valued in terms of money" (Von Mises, in Hayek, 1935, p. 99). Through what is now called the 'travel-cost method', or similar methods, the market mechanism could be extended in a capitalist economy to positive or negative externalities. But in a socialist economy, the issue was not whether the externalities produced by a tractor could be internalized into the price system, but rather that the tractor itself had no price. Socialism, Von Mises concluded, was "the abolition of rational economy".

As it is well known, the debate on economic calculus in a socialist economy took a new turn with the proposals from both Lange and Taylor (1938), according to which the decisions by socialist managers would be guided by a tentative vector of prices which would fulfil a parametric function. Such prices would be periodically adjusted by the planning commission, by trial and error. The Lange and Taylor position assumed with Mises that rational choices required commensurability (O'Neill, 1996a,b). The debate continues to this day (Brus, 1991; Roemer and Silvestre, 1994; Roemer, 1994), in the direction of a market socialism able to cope (theoretically) with the problems of missing markets, and also of a lack of incentives and the dispersal of information, i.e. recent contributions wish to demonstrate how a socialist economy could be as efficient as a capitalist economy (by the use of actual markets for most goods and services, and of surrogate markets only for externalities), and at the same time more egalitarian.

In this paper, our intention is not to make our own contribution to the economics of socialism, but rather to remind the readers that the question of incommensurability of values (which we take to be a foundation stone for ecological economics) was already analyzed in such a famous occasion as the debate on economic calculus in a socialist economy. Moreover, one should note that the issue of value incommensurability has also been tackled by institutional economists.

Kapp (1983, p. 49), probably the first institutional economist with environmental interests, wrote: "To place a monetary value on and apply a discount rate (which?) to future utilities or disutilities in order to express their present capitalised value may give us a precise monetary calculation, but it does not get us out of the dilemma of a choice and the fact that we take a risk with human health and survival. For this reason, I am inclined to consider the attempt at measuring social costs and social benefits simply in terms of monetary or market values as doomed to failure. Social costs and social benefits have to be considered as extra-market phenomena; they are borne and accrue to society as a whole; they are heterogeneous and cannot be compared quantitatively among themselves and with each other, not even in principle''. For readers who have wide philosophical interests, this article could have started with a reference to Aristotle's distinction in *Politics* between oikonomia and chrematistics (Daly and Cobb, 1989; Martinez-Alier, 1987; Meikle, 1995; O'Neill, 1995b; Polanyi, 1957; Soddy, 1922).

3. Incommensurability of values and multicriteria evaluation

In this section, we will discuss the concepts of weak comparability, incommensurability and compensability. Since we believe that these topics are often tackled in a somewhat confusing way (Lockwood, 1997), we will try to define them in an axiomatically correct framework.

''There is great pressure for research into techniques to make larger ranges of social value commensurable. Some of the effort should rather be devoted to learning—or learning again, perhaps—how to think intelligently about conflicts of value which are incommensurable'' (Williams, 1972, p. 103). Incommensurability, i.e. the absence of a common unit of measurement across plural values, entails the rejection not just of monetary reductionism but also any physical reductionism (e.g. eco-energetic valuation). However it does not imply incomparability. It allows that different options are weakly comparable, that is comparable without recourse to a single type of value.

In terms of formal logic, the difference between strong and weak comparability, and one defence of weak comparability, can be expressed in terms of Geach's distinction between attributive and predicative adjectives (Geach, 1967). An adjective A is predicative if it passes the following logical tests:

1. if x is AY, then x is A and x is Y;
2. if x is AY and all Y's are Z's then x is AZ.

Adjectives that fail such tests are attributive. Geach claims that 'good' is an attributive adjective. In many of its uses it clearly fails (2): 'X is a good economist, all economists are persons, therefore X is a good person' is an invalid argument. Correspondingly, statements of the form 'X is good' need to be understood as elliptical. They invite the response 'X is good' what? If 'good' is attributive, then its comparative form will have its scope limited by the particular noun it qualifies. 'X is a better economist than Y, all economists are persons, therefore X is a better person than Y' is an invalid argument.

That a comparative holds in one range of objects does not entail that it holds in the wider range. Given a claim that 'X is better than Y' a proper response is 'X is better what than Y?'. Similar points can be made about the adjective 'valuable' and 'is more valuable than'. If evaluative adjectives like 'good' and 'valuable' are attributive in standard uses, it follows that their comparative forms have a limited range. That does not however preclude the possibility of rational choices between objects that do not fall under the range of a single comparative. Weak comparability is compatible with the existence of such limited ranges.

It is under such descriptions that evaluation takes place. A location is not evaluated as good or bad as such, but rather, as good, bad, beautiful or ugly under different descriptions. It can be at one and the same time a 'good W' and a 'bad X', a 'beautiful Y' and an 'ugly Z'. The use of these value terms in such contexts is attributive, not predicative. Evaluation of objects under different descriptions invokes not just different practices and perspectives, but also different criteria and standards for evaluation associated with these. It presupposes value-pluralism. Appeal to different standards often results in conflicting appraisal of an object: as noted above, an object can have considerable worth as an U, V, and W, but little as a X, Y and Z.

A typical multicriteria problem (with a discrete number of alternatives) may be described in the following way: A is a finite set of n feasible actions (or alternatives); m is the number of different points of view or evaluation criteria g_i $i=1,2,\ldots,m$ considered relevant in a decision problem, where the action a is evaluated to be better than action b (both belonging to the set A) according to the i-th point of view if $g_i(a) > g_i(b)$. In this way a decision problem may be represented in a tabular or matrix form. Given the sets A (of alternatives) and G (of evaluation criteria) and assuming the existence of n alternatives and m criteria, it is possible to build an $n \times m$ matrix **P** called evaluation or impact matrix whose typical element pij (see Table 1) ($i = 1, 2,\dots, m$; $j = 1, 2,\dots, n$) represents the evaluation of the j-th alternative by means of the i-th criterion. The impact matrix may include quantitative, qualitative or both types of information (Munda et al., 1994; Munda, 1995).

In general, in a multicriteria problem, there is no solution optimising all the criteria at the same time and therefore the decision-maker has to find compromise solutions (here the concept of a 'compromise solution' is used in a technical sense, i.e. a solution as a balance among different conflicting criteria).

As a tool for the understanding of conflicts, and possibly for conflict management multicriteria evaluation has demonstrated its usefulness in many environmental management problems (for a review of applications in environmental problems see Faucheux and O'Connor, 1997; Janssen, 1992; Munda, 1995; Nijkamp et al., 1990; Paruccini, 1994; Rietveld, 1980). From an operational point of view, the major strength of multicriteria methods is their ability to address problems marked by various conflicting evaluations. Multicriteria evaluation techniques cannot solve all conflicts, but they can help to provide more insight into the nature of conflicts and into ways to arrive at political compromises in case of divergent preferences so increasing the transparency of the choice process. If we take a view of externalities, not so much as 'market failures' but as 'cost-shifting success', then conflict might help sustainability. Thus, the movement for environmental justice can be seen as a force for sustainability. In the present paper, therefore, we do not emphasize multicriteria evaluation as a technique for conflict resolution. Rather, we use the multicriteria framework as a paradigm for the whole field of ecological economics (both macro, micro and in project evaluation).

Table 1
Example of an impact matrix

Criteria	Units	Alternatives			
		a_1	a_2	a_3	a_4
g_1		$g_1(a_1)$	$g_1(a_2)$	·	$g_1(a_4)$
g_2		·	·	·	·
g_3		·	·	·	·
g_4		·	·	·	·
g_5		·	·	·	·
g_6		$g_6(a_1)$	$g_6(a_2)$	·	$g_6(a_4)$

The main advantage of multicriteria models is that they make it possible to consider a large number of data, relations and objectives which are generally present in a specific real-world decision problem, so that the decision problem at hand can be studied in a multidimensional fashion. On the other side, an action a may be better than an action b according to one criterion and worse according to another. Thus when different conflicting evaluation criteria are taken into consideration, a multicriteria problem is mathematically ill-defined. The consequence is that a complete axiomatization of multicriteria decision theory is quite difficult (Arrow and Raynaud, 1986). Acknowledging that the problem is mathematically ill-structured, two simple 'ways out' immediately present themselves (Munda, 1993):

1. leave the decision-maker entire liberty for the decision,
2. introduce, consciously or not, restrictive hypotheses, so that the problem can be solved by a classical method.

As a general rule, *we do not believe in algorithmic solutions of multicriteria problems*. In our view, multicriteria methods useful for environmental policy must offer a consistent framework aimed at helping the structuring of the problem and the evolution of the 'decision process', so that 'soft' approaches such as for example, discursive ethics (O'Hara, 1996) can more easily be implemented.

The importance of the decision process has recently been emphasised by different authors. According to Simon (1983), a distinction must be made between the general notion of rationality as an adaptation of available means to ends, and the various theories and models based on a rationality which is either substantive or procedural. This terminology can be used to distinguish between the rationality of a decision considered independently of the manner in which it is made (in the case of substantive rationality, the rationality of evaluation refers exclusively to the results of the choice) and the rationality of a decision in terms of the manner in which it is made (in the case of procedural rationality, the rationality of evaluation refers to the decision-making process itself) (Faucheux et al., 1994; Froger and Munda, 1997).

Roy (1985) states that in general it is impossible to say that a decision is a good one or a bad one by referring only to a mathematical model: all aspects of the whole decision process which leads to a given decision also contribute to its quality and success. As a consequence, it becomes impossible to base the validity of a procedure either on a notion of approximation or on a mathematical property of convergence. This new way of looking at rationality implies a new concept of quality.

Environmental policy deals with 'reflexive' phenomena since an effective assessment, in order to be realistic, should consider not merely the measurable and contrastable dimensions of the simple part of the system, that even if complicated may be technically simulated (Funtowicz et al., 1997). It should deal as well with the higher dimensions of the system, those in which power relations, hidden interests, social participation, cultural constraints, and other 'soft' values, become relevant and unavoidable variables that heavily, but not deterministically, affect the possible outcomes of the strategies to be adopted.

A mathematical model of e.g. an ecosystem, although legitimate in its own terms, cannot be sufficient for a complete analysis of its reflexive properties, which include the human dimensions of ecological change and the transformations of human perceptions along the way. At the other end, institutional and cultural representations of the same system are on their own insufficient for specifying what should be done in practice in any particular case. The various dimensions are not totally disjoint; thus the institutional perspective can be a basis for the study of the social relations of the scientific processes. To take any particular dimension as the true, real or total picture, amounts to reductionism, whether physical or sociological.

To choose any particular operational definition for value involves making a decision about what is important and real; other definitions will reflect the commitments of other stakeholders. As a consequence, the validity of a given approach depends on the inclusion of the several legitimate perspectives as well as the non-omission of the reflexive properties of the system, even though these are not easy to deal with (O'Connor et al., 1996). This requires transparency in relation to two main factors:

1. mathematical and descriptive properties of the models used;
2. the way such models are used and integrated in a decision process.

Is it possible to improve the quality of a decision process? When science is used in policy, lay-persons (e.g. judges, journalists, scientists from another field, or just citizens) can often master enough of the methodology to become effective participants in the dialogue. This extension of the peer community is essential for maintaining the quality of the process of resolution of reflexive complex systems. Thus the appropriate management of quality is enriched to include this multiplicity of participants and perspectives. The criteria of quality in this new context will presuppose ethical principles. But in this case, the principles will be explicit and will become part of the dialogue. "The issue is not whether it is only the marketplace that can determine value, for economists have long debated other means of valuation; our concern is with the assumption that in any dialogue, all valuations or 'numeraires' should be reducible to a single one-dimension standard" (Funtowicz and Ravetz, 1994, p. 198).

We would like to stress that incommensurability of values does not imply a hierarchy of values. 'Intrinsic' value (or 'end value' (Lockwood, 1997) is sometimes considered 'superior' to economic value; this is not the issue here. Beckerman and Pasek (1997) (p. 65) note that: "While the frequent claim that the environment has some unique moral intrinsic value is unsustainable, its preservation often raises ethical and other motivations that are not commensurate with the values that people place on ordinary marketable goods''. We agree with Beckerman and Pasek on incommensurability. We go forward from here (and they do not) to a discussion of weak comparability and formal methods as multicriteria evaluation. We disagree with them on their total dismissal of hierarchies of values. For instance, the Uwa of Colombia recently declared that their land was sacred, trying to prevent oil exploration by foreign companies. In this way, sacredness cannot be traded-off for money or other values. However, all that non-compensability in a multicriteria framework requires is different types of values.[1]

Furthermore, we are not against giving economic value to natural resources, to environmental sinks, or to natural spaces. A location may be valuable for its biodiversity (measured in richness of species or genetic variety), and also as a landscape, and have also economic value (measured by differential rent, and also by the travel cost method, or contingent valuation). These are different types of value. It is misleading to take decisions based on only one type of value.

The 'fetishism of fictitious commodities' is common among conventional environmental economists. We understand and share their efforts to value environmental amenities, life-support systems, biodiversity, human lives by contingent valuation or other similar methods. Moreover, our contention is that the environment, as also human lives or non-human species, has other values which are not commensurable in money terms. Thus, in ecological economics, instead of focusing on 'missing markets' as causes of allocative disgraces, we focus on the creative power that missing markets have, because they push us away from economic commensurability, towards multicriteria evaluation of evolving realities.

[1] The concept of non-compensability was also discussed by Georgescu-Roegen (1954) in terms of 'irreducibility of wants' implying lexigographic preferences (i.e. a hierarchy (Gowdy, 1992; Spash and Hanley, 1995; Stern, 1997). On the contrary, by means of non-compensatory multicriteria evaluation, it is possible to consider the case where no hierarchy is necessarily implied.

4. Multicriteria evaluation, compensability and ecological macroeconomics

Is multicriteria evaluation a good tool for the assessment of (un)sustainability? Since multicriteria evaluation is multidimensional in nature, it allows us to take into account economy–environment interactions. According to the aggregation procedure chosen, weak or strong sustainability concepts can be operationalized. This depends on the degree of compensability allowed by the aggregation procedure.[2]

The aggregation of several dimensions implies taking a position on the problem of compensability. Intuitively, compensability refers to the existence of trade-offs, i.e. the possibility of offsetting a disadvantage on some attribute by a sufficiently large advantage on another attribute, whereas smaller advantages would not do the same. Thus a preference relation is noncompensatory if *no trade-off occurs* and is compensatory otherwise.

The way each aggregation procedure transforms information in order to arrive at a preference structure can be called its aggregation convention, which is generally well illustrated by the numerical transformation used. Clearly, the convention underlying, e.g. the additive utility model (and cost-benefit analysis) is completely compensatory (Munda, 1996). Let's start with the mathematical formal definition of the case of complete compensability.

An attribute i, $i \in \Omega$, consists of a set X_i of at least two elements expressing different levels of some underlying dimensions, and of a total strict order P_i on X_i Given any nonempty disjoint subsets of attributes I and J, I strongly compensates J if for all $x, y \in X$ such that $x \succ y$, $P(x, y) = J$, $P(y, x) = I$, there is a $z \in X$ such that $z \succ x$ or $z = x$ and $z_i = y_i$ for all $i \notin I$. Therefore, a notion of complete compensability is at hand if we ask for strong compensability to hold both ways between any two disjoint

[2] In the literature, one can find various aggregation procedures characterised by different philosophical and mathematical properties. The interested reader can refer to Munda et al. (1994) for a first introduction on this topic. However, here we would like to stress that assertions such as the ones contained in Lockwood (1997), pp. 91–92 about the lack of aggregation procedures in multicriteria evaluation are not well informed.

(nonempty) subsets of attributes (Bouyssou, 1986; Vansnick, 1986).

Some critics of multicriteria evaluation often say that to compute some kind of 'utility' requires making trade-offs and thus there is no real difference between these methods and conventional cost-benefit analysis. We share this opinion, but we would like to stress that this applies only to utility-based compensatory multicriteria methods.[3] For example, Gregory and Slovic (1997) (p. 178) clearly state that a fundamental step in applying a multiattribute utility theory approach is to make trade-offs across objectives. We think that this step is quite difficult on practical grounds (since trade-offs are very difficult to obtain and some consistency requirements are always necessary), and anyway not desirable, for environmental issues, on theoretical grounds (since a weak sustainability philosophy is always implied).[4]

An important consequence of noncompensability is that it is possible to operationalize the concept of strong sustainability (Munda, 1997a). Such a definition is based on the assumption that certain sorts of 'natural capital' are deemed critical, and not readily substitutable by man-made capital (Barbier and Markandya, 1990). In particular, the characterisation of sustainability in terms of the 'strong' criterion of non-negative change over time in stocks of specified 'natural capital' is based on direct physical measurement of important stocks and flows (Faucheux and Noël, 1995; O'Connor et al., 1996).

By means of strong sustainability, we are left with bio-physical indicators, or 'satellite accounts' of variations in natural patrimony, not integrated in money terms. However, behind a list of indicators there would always be a history of scientific research and political controversy. Moreover, one should note that a list of indicators is far from being a list of targets and lower limits for those indicators. Then a question arises, how could such indicators be aggregated? Often, some indicators improve while others deteriorate. For instance, when incomes grow, SO_2 might go down while CO_2 increases, or at a different level of aggregation, MIPS might improve (this indicator compares the material input, measured in tons, with the services provided, sector by sector) (Schmidt-Bleek, 1994) while HANPP (measuring the human appropriation of net primary production) (Vitousek et al., 1986) deteriorates. It has to be noted that this is the classical conflictual situation studied in multicriteria evaluation theory. Of course, the possibility of limiting the compensability among indicators and to put lower bounds of acceptability (e.g. by the notion of a veto threshold) is of a fundamental importance to operationalize the strong sustainability concept. A first application of these ideas can be seen in the literature (Faucheux et al., 1994; Munda, 1995, 1997b).

5. Conclusions

Ecological economics does not resort to a unique type of value expressed in a single numeraire. On the contrary, it goes beyond neoclassical environmental and resource economics by including the physical appraisal of the environmental impacts of the human economy.

Ecological economists have often argued in favour of 'methodological pluralism' (Norgaard, 1989). The project of ecological economics as an 'orchestration of the sciences' for the study of (un)sustainability fits well with the idea of 'reflexive' or 'self-aware' complex systems. To see ecosystems in terms of 'reflexive complex systems' implies the study of the human dimensions of ecological

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[3] In Munda (1996) it has been shown that cost-benefit analysis can be considered a particular case of multi-attribute utility theory.

[4] In this framework, it is important to state formally the concept of non-compensability (Bouyssou and Vansnick, 1986). Let $P(x, y)$ be the set of attributes for which there is a partial preference for x on y. A preference structure $(X, \succ)$ is generalised noncompensatory iff $\forall\, x, y, z, w \subset \vee X$:

$$\{[P(x, y), P(y, x)] = [P(z, w), P(w, z)]\} \Rightarrow [x \succ y \Rightarrow z \succ \text{or} = w]$$

and

$$[P(x, y) \neq \varnothing \text{ and } P(y, x) = \varnothing] \Rightarrow x \succ y$$

This definition allows us to have at the same time $((P(x, y), P(y, x) = (P(z, w), P(w, z)), x \succ y$ and $z \approx w$. This possibility of an absence of preference between z and w aims to encompass the notion of discordance between evaluations, introduced whenever there is an attribute j in $P(x, y)$ for which $y_j \vee_j x_j$ which can be interpreted as 'y_j is far better than x_j'.

change and of the transformations of human environmental perceptions, i.e. to introduce historical human agency and human interpretation in ecology. The metaphor of the 'orchestration of the sciences' also fits well with the idea of 'post-normal science' and 'extended peer review' put forward by Funtowicz and Ravetz (1994). Such democratization of discourse arises from the nature of the problems at hand, from their urgency, their interdisciplinarity, their uncertainty, their irreversibility.

In the framework of ecological economics, the use of a multidimensional approach seems desirable. This implies that the strong comparability assumptions of neo-classical economics have to be abandoned. Since multicriteria evaluation techniques allow one to take into account conflictual, multidimensional, incommensurable and uncertain effects of decisions, they form a promising assessment framework for ecological economics both at micro and macro levels of analysis.

In this paper, we have shown that the debate on the concept of incommensurability of values already has a long tradition in economics. Moreover, it has been shown that incommensurability does not imply incomparability but weak comparability, which can be operationalized by means of multicriteria evaluation. It is interesting to note that analytic philosophy, theories of complexity, post-normal science and the recent theories of rationality lead with different trajectories to a non-algorithmic approach to decision problems that might be operationalized through a consistent multicriteria framework.

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