Unicriterion Model: A Qualitative Decision Making Method That Promotes Ethics

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Management decision making methods frequently adopt quantitative models of several criteria that bypass the question of why some criteria are considered more important than others, which makes more difficult the task of delivering a transparent view of preference structure priorities that might promote ethics and learning and serve as a basis for future decisions. To tackle this particular shortcoming of usual methods, an alternative qualitative methodology of aggregating preferences based on the ranking of criteria is proposed. Such an approach delivers a simple and transparent model for the solution of each preference conflict faced during the management decision making process. The method proceeds by breaking the decision problem into 'two criteria – two alternatives' scenarios, and translating the problem of choice between alternatives to a problem of choice between criteria whenever appropriate. The unicriterion model method is illustrated by its application in a car purchase and a house purchase decision problem.

Key words: decision making, ethics in management, multicriteria

Introduction

Whether as a profession or a survival tool kit, decision making is part of our lives and most of the times there is not much to wonder about it: we just do what we have to do. Sometimes, however, the path to follow is not so clear for some reason. Maybe because the decisions are more complex, with us having several goals at the same time and not knowing which of them to give up on, since there is no alternative that satisfies them fully. Or maybe the decision is not so complex (with so many factors) but we simply lack a gut feeling that enlightens our spirit to go in a certain direction.

One way or the other, a little more rationale is often of much use, not only to help finding out which way to go, but also to make it possible that in the future, one knows why a certain decision has been made, and replaces eventual regret with learning.

Decision analysis has been finding ways to make clear and complete to us what is at stake (gather all objectives or criteria), valuate each decision alternative according to these criteria, decide which criteria are more important (since probably they won't all have the same importance) and decide upon a course of action based on the judgement of how ready we are to give up on some objectives – criteria – to reach others to a greater extent.

To help managers and decision makers in general identify the best course of action between several alternatives, Multicriteria Decision Making methods are used when multiple criteria are necessary to evaluate each alternative across different value dimensions.

As a fundamental piece of theory in classical multicriteria analysis, Multiattribute Utility Theory (MUT) is based on the assumption that in any decision problem there exists a real valued function U that aggregates a set of criteria, and which the decision maker wishes to maximize (Roy and Vincke 1981, 209). This kind of approach is essentially numerical and puts forward a weighted sum for the aggregation of scaled utility functions (Dubois et al. 2001, 1).

For the purpose of illustrating our views, the classical approach of Multiattribute Value Theory (MVT) – as the particular case of MUT without uncertainty – will be considered as representative of the typical quantitative multicriteria approach.

Several methods are available, but multicriteria applications frequently might be described as sharing a value tree of criteria obeying certain characteristics (Goodwin and Wright 1991, 12) and comprehending the following three step sequence (Bana e Costa and Thore 2002, 30–38):

- *Structuring* – when one identifies the points of view that determine the preference structure of the decision-maker;
- *Evaluation* – when a value measure is associated with each alternative through the definition and application of criteria that measure each alternative's impact according to each point of view;
- *Criteria weights determination and aggregation* – when one solves the problem through the application of a quantitative preference aggregation model (typically additive) across the criteria.

The most common elaboration of the previous approach 3rd step – Criteria weights determination and aggregation – usually consists of two activities: First assign quantitative weights to each of the decision criteria, which can be decided according to several different procedures (Bana e Costa and Thore 2002, 38) and leads each criterion to hold a weight described (for example) by a percentage of a magnitude proportional to its importance, such that the sum of all the weights totals 100%; Second, to obtain the overall value of each alternative, multiply its value according to each criterion (also expressed on a scale from 0 to 100) by the respective criterion weight and add the procedure and its result across all the criterion. The final value of alternative A will therefore be something like:

$$V(A) = \sum_i w_i V_i(A), \tag{1}$$

where i stands for each decision criterion, w_i stands for the weight of criteria i (between 0 and 1) and $V_i(A)$ stands for the value of alternative A according to criterion i (from 0 to 100).

Naturally we also have that

$$\sum_i w_i = 1. \tag{2}$$

Scope and Basis for an Alternative Approach

In spite of its solid establishment and widespread use, criteria weights determination and aggregation quantitative approaches (like the one previously presented as an example) have some modelling limitations that an alternative way of tackling the problem might help overcome, finding its place in the wide range of decision making methods. That is the scope of this paper.

The first and major aspect to note is that multicriteria preference aggregation models like the one exemplified are not keen on clarifying what was in the basis of the decision. The decision maker ends up with a formula rather than a model. Despite being operational and giving an answer, quantitative additive preference aggregation models can not be fully understood, as they do not observe one major characteristic of models – the fact that they should exhibit explicit explanations, if possible identifying relations that resemble cause-effect relations. This limitation is of major importance if one considers that when a decision maker needs help to overcome complexity and reach a decision, his/her problem might not be to discover which alternative is best – they should already be quite equivalent in value to the decision maker, otherwise there wouldn't be a decision problem – but instead, to discover a reason, a conceptual view of why one alternative should be selected, something resembling a theory that one can learn from and improve in future decisions, that can not be manipulated as criteria weights can, and that, without loss of explanatory coherence, observes one of the characteristics a model necessarily obeys – to be simpler than the subject domain it represents (Jacobson 1995, 8).

As a starting point for this paper we will therefore state the following empirical claim:

CLAIM 1 *Decision making problems are problems where the global value of the different alternatives (considering the value dimensions relevant to the decision maker) is quite similar between them.*

Given this claim, it is easy to advocate that a methodology focused on the quantification of the value measures of each alternative might not always be what the decision makers are looking for. The linear combination of criteria coming out of that method quantitatively expresses one unexplained ranking of criteria – there is no explanation for why some criteria are considered more important than others – as well as it expresses a ranking impossible to distinguish from several other similar rankings (with small differences in the weights) therefore not obeying the expected character of uniqueness of a model.

Some approaches have been put forward in trying to devise qualitative multicriteria decision methods: the voting system of multiagent decision making (Dubois et al. 2001, 1) or the Electre method (Roy and Vincke 1981, 210), which somehow resembles a voting system with criteria as voters. However, both of them assume a quantitative model of criteria aggregation assigning weights to each criterion.

The opportunity emerges for an alternative approach to deal with conflicting decision making preferences and that is the case for this paper: to come up with a qualitative solution for resolving the conflicts between preference judgements across different criteria and aggregate them towards a final decision based on a model alternative to the quantitative additive one.

Multicriteria applications, previously described as having the 3 step sequence, could be approached by transferring the focus from a problem of choice between alternatives to a problem of choice between criteria. In fact, if a certain level of indifference between alternatives is verified (as happens, for example, with incomplete preferences – Hansson 2005, 16) then the two-alternative and two-criteria simplified problem is one of deciding between one alternative performing better according to one criterion, and one alternative performing better according to the other. These scenarios should be common, since the alternatives are eventually chosen for their matching competitiveness.

In such a context, whenever one decides to prefer one alternative it is because the criterion it performs best in was found more important than the other (the value difference between alternatives in that criterion means more to the decision maker). This problem can thus be alternatively formulated as a problem of choice between the two criteria. In fact, if a priority is found for one of the criteria, one reaches a solution (an increase in the criterion's weight moves the balance towards the alternative that excels in that criterion). Therefore, the search is for a 'reason' for one criterion to be considered more important than the other. Such a reason is another criterion, or more generally a point of view, and that is the model we are looking for – the unicriterion model. The guarantee that such a point of view exists comes from the fact that if it did not, the priority between criterion could not have been established. If one criteria is (or becomes) more important to the decision maker than other, there is always a reason for that, somewhere in the decision maker's preference structure of values.

Therefore we state claim 2:

CLAIM 2 *Whenever the decision maker finds that one criterion is more important than another, behind that preference there is always a higher (abstraction) level criterion (which we call the unicriterion model) such that the corresponding point of view ranks the other two criteria accordingly.*

This approach can be generalized to problems of several alternatives and criteria, where the focus of the analysis is no longer the quantification of value preferences, but the modelling of criteria in order to organize them and, whenever necessary, rank them. Priorities between criteria are possible to reach, since for each pair of criteria weights comparison in the criteria aggregation procedures of MVT we might find the point of view according to which one criterion proves to be more important than the other. One of the advantages of this approach is not having to quantify such a judgement. To distinguish both approaches the following hypothesis is stated:

HYPOTHESIS 1 *The human mind is able to say it prefers one criterion or alternative over another, but not how many times it does.*

By this hypothesis (in terms of criteria) we mean that if a criterion's importance is equivalent to the difference in attractiveness between the best and the worst alternative according to that criterions solely, then the human mind can say that it prefers criterion A to criterion B (criterion A is found more important because one prefers changing from the worst to the best alternative in that criterion than making the same change in criterion B), but the human mind can not say how many times it finds criterion A more important than criterion B – if it is two or three times (for example) more important. In other words, we mean that the quantification of the difference in attractiveness between changing from the worst to the best alternative in each criterion is not a natural thing to do.

To test Hypothesis 1 we suggest the realization of an experiment to establish whether the relative importance of criteria perceived by the mind is solely an ordering procedure or whether it has a cardinal (quantifiable) intrinsic nature. Taking a pool of respondents, some alternatives and a few criteria (at least five), and taking a criterion's importance to be equivalent to the difference in attractiveness between the best and the worst alternative according to that criterion, each respondent would first be asked to order the criteria in terms of their relative importance. Next, each respondent would express the importance of all the criteria as a percentage (in multiples of 10) of the major criteria importance (valued as 100%). Later on, the respondents would be asked to refer to the second most important criterion (provided that it had an importance smaller than 100% in the previous step, otherwise choose the third, and so on) and, without having access to their previous ratings, rate again the importance of all the criteria (except for the most important) now as a percentage (in multiples of 10) of the second best criteria importance (now valued as 100%). This should be repeated progressively taking the third most important criteria as a reference and so on until one reached the less important criteria. If once converted to the same common scale of the importance relative to the major criteria, the criteria weights quantitatively agree (considering a maximum error margin of 5%) between the different reference rating procedures, that means that the same (quantitative) perception was reached in the several evaluations and its quantitative character can be captured. Otherwise, Hypothesis 1 would be true, as we expect.

The emphasis of our approach is therefore placed on the modelling of the pertinent reality in analysis, which is the mental structure of preferences between criteria rather than a set of quantitative trade-offs between them. One outcome of the methodology is the reduction of all the decision criteria to one single dimension of value, or point of view, which approximately represents the decision model. It is noticeable that such a procedure of dimension reduction is already adopted in multiattribute utility theory, however without clearly making explicit whatever dimension that is – what particular value or point of view lies behind the overall greatest attractiveness of a certain course of action as the one that solves the conflict between fundamental objectives.

Besides its simplicity advantages, the idea of reducing the decision criteria to one single point of view on the top of a pyramid-like structure seems to follow the biological trace of decision making mechanisms in human beings. As we know by now, when facing a decision, the individual's emotions play an important role in the operational search for preference structures in the memory. According to Damásio's somatic marker hypothesis (Dunn, Dalgleish, and Lawrence 2006, 241), the scenarios that the mind selects as candidates for a decision are filtered with the help of emotions into a single one as the result of a biological optimization process that predicts and evaluates on the common dimension of 'biasing body signals' the different scenarios impact, in a way that might be considered equivalent to an ordering of decision making criteria or value dimension preferences. These scenarios must be tied to the neural machinery underlying emotions, resembling criteria rather than just alternatives, otherwise their abstraction level would not be enough to serve in multiple decision situations, and they should also resemble the kind of points of view on the top of the pyramid-like structure we are trying to achieve in our approach's applications, making us confident in that the proposed methodology elaborates on the same potential of preference structure search mechanisms that nature provided us with. If these natural mechanisms sometimes cannot be applied straightforward, in complex scenarios or scenarios (criteria) with which we have had no experience, we can still go to an upper level of values and apply for our experience with points of view that order them.

Unicriterion Model Method

In figure 1 we define the new method proposed as an alternative to the preference determination and criteria aggregation procedures usually applied in MVT.

Application and Results

HYPOTHETICAL DECISION PROBLEM

i) To illustrate the method, with all variables and values having been defined previously to the methodology application, a typical decision situation was considered, a car purchase choice between three alternatives: A, B and C. As a result of the structuring phase the following decision criteria were defined as the ones relevant to the decision maker:

- Technical performance (motor, speed, etc.)
- Environmental impact

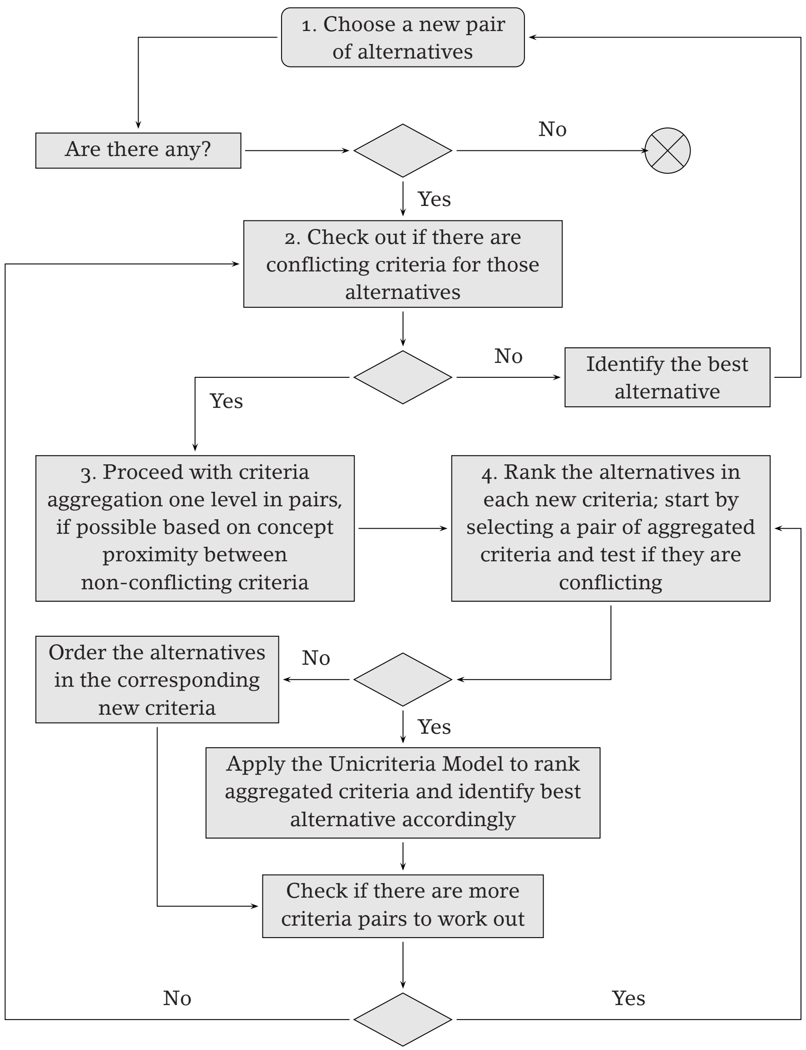

FIGURE 1 Steps of the Unicriteria Model procedure

- Costs (considering both acquisition, fuel and maintenance costs for the expected lifetime of the car)
- Safety
- Comfort
- Space

To proceed to the evaluation phase, an ordinal scale was considered for each criterion, such that the value of each alternative ac-

TABLE 1 Evaluation of three car acquisition alternatives according to six criteria

Criteria/ Alternatives	Technical performance	Environmental impact	Costs	Safety*	Comfort	Space
Car A	Holds 100 km per hour in the Monsanto Hill	165 g/km of CO_2 emissions	50,000 €	Excellent Safety – Highly recommended	Equivalent to a 4 star Hotel	Car
Car B	Holds 120 km per hour in the Monsanto Hill	180 g/km of CO_2 emissions	40,000 €	Good Safety with a Minus – Recommended together with other choices	Equivalent to a 3 star Hotel	Car
Car C	Holds 90 km per hour in the Monsanto Hill	130 g/km of CO_2 emissions	52,000 €	Good Safety – Recommended	Equivalent to a 3 star Hotel	Wagon

* Based on the Overall Ratings Safety Scale used by SafeCarGuide.com

cording to that criterion was made as meaningful and explicit as possible. As a result, table 1 resumes the evaluation of the alternatives.

Provided the decision maker still cannot establish a preference between pairs of alternatives or eliminate any of them – which is the case (each alternative excels in two criteria and satisfies minimum levels in the others) – the assumption of facing a decision making problem holds and one proceeds to the step of the MCDM methodology that this paper focuses on in particular – preference determination and aggregation between criteria.

ii) According to figure 1 the process starts with the selection of alternatives A and B (1.), for which there are conflicting criteria (2.), and therefore one proceeds with criteria aggregation (3.).

Through criteria aggregation one builds the pyramid like structure from bottom-up, using the unicriterion approach whenever necessary to rank alternatives in the new criteria.

The most convenient way to aggregate criteria would be to include in the same group all those criteria that share a certain alternative as their best one. However, that sometimes conflicts with a 'concept proximity' rule, which should be prevalent given the importance of making correct aggregations. For this reason, comfort and safety, for example, went to separate groups of criteria in spite of sharing car A as their best alternative.

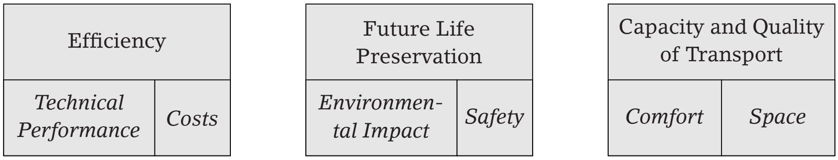

FIGURE 2 First step of criteria aggregation

Once aggregated as described in figure 2, the new criteria require an ordering of the alternatives on its own scale and a re-evaluation of the alternatives' comparative value in the new conceptual reference level.

In the next step of the methodology (4.) alternatives A and B are immediately ranked in the new criteria since none of the three pairs of aggregated criteria is conflicting. In each of all the three cases there is always one alternative that dominates over the other one in both of the original criteria – see figure 3.

Since the information associated with the alternatives is still the same – for example the efficiency of car A consists of Holding 100 km per hour in the Monsanto Hill and costing 50,000 € – one assumes that the condition of preferential indifference between alternatives remains. Therefore the process goes on after returning to step 2 of the methodology (2.), since the alternatives have been ranked for all pairs of aggregated criteria.

Having only three criteria in step 3 (3.), since there seem to be no more obvious aggregatable concepts for non-conflicting criteria, one can now choose one pair of conflicting ones and try to order the alternatives in a new virtual criterion that would aggregate them. By choosing the criteria 'Efficiency' and 'Future Life Preservation', one proceeds to step 4 (4.) without any need to identify the virtual criterion for now, and one asks the decision maker whether he/she prefers changing from car A to car B or vice-versa considering only these two criteria. The question could be formulated in these terms:

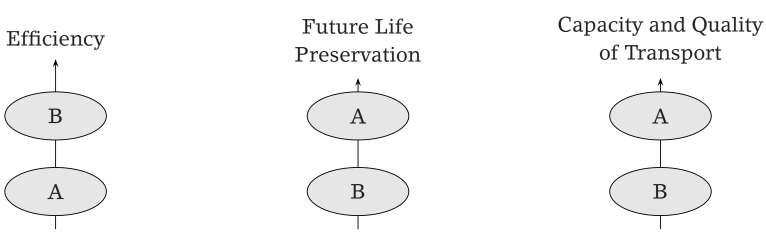

FIGURE 3 Ranking alternatives A and B with the new criteria

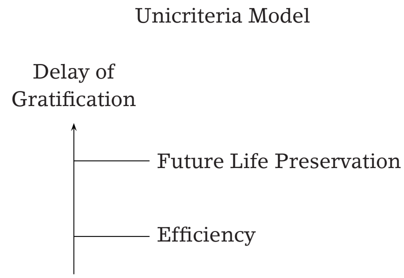

FIGURE 4
Unicriterion model that ranks criteria 'Future Life Preservation' and 'Efficiency'

'Would you prefer changing from an efficiency of "Holding 100 km per hour in the Monsanto Hill and costing 50,000 €" to an efficiency of "Holding 120 km per hour in the Monsanto Hill and costing 40,000 €", knowing that in terms of future life preservation it would cost you an increase from 165 g/km to 180 g/km of CO_2 emissions and a decrease from excellent to good in terms of safety? Or would you prefer not to make such a change?'

Considering the answer to be no for both hypotheses, the decision maker cannot distinguish between them, which means that the value difference of the alternatives in one criterion is quantitatively indistinguishable from the value difference of the alternatives in the other, maybe because it is difficult to compare value differences across different dimensions.

To tackle such a difficulty, and since the criteria are conflicting (there is a decision problem) as represented in figure 1 scheme, it is time for the application of the unicriterion model between these two criteria. Once searched and found, a new point of view – a perspective that orders the criteria in relative importance and that one consents to be the right perspective to adopt – the ranking of the criteria leads to a ranking of the alternatives, since the quantitatively indistinguishable value difference of both alternatives from one criterion to the other is replaced by a sensed qualitative difference between the same value differences or criteria (the value difference between alternatives are considered equivalent to the criterion itself since that is what defines it – reality gives meaning to the concept and not the opposite way around (Wittgenstein 1995, 5)).

The new criterion chosen to order 'Efficiency' and 'Future Life Preservation' is a behavioural point of view called 'Delay of Gratification' – see figure 4.

Since the criterion 'Future Life Preservation' becomes more important, the value difference between alternatives A and B in this criterion becomes also more important than the same difference in the criterion 'Efficiency.' The conclusion is that in light of the new point of view the decision maker prefers to change from B to A in

TABLE 2 Value of alternatives A and B across the criteria 'Efficiency' and 'Future Life Preservation'

Criteria /Alternatives	Efficiency	Future Life Preservation
Car A	0	100
Car B	100	0

'Future Life Preservation' in spite of the cost of changing from B to A in 'Efficiency.' Therefore the decision maker prefers A to B in terms of Future Life Preservation and Efficiency.

Another way to reach the same conclusion from the quantitative perspective would be to consider the initial ranking situation between the two criteria. In a typical Multiattribute Value Theory application, like the Simple Multi-attribute Rating Technique – SMART (Edwards 1971), one would have the situation described in table 2, adopting for each criterion the same scale from 0 (minimum) to 100 (maximum) for convenience reasons in order to calculate the criteria weights.

Following the 'swing weights' attributes weights determination technique used in SMART, since the decision maker was unable to decide between changing from A to B in 'efficiency' or changing from B to A in 'future life preservation', this meant that the weight of each criterion was 50%, and through the application of the additive model one would obtain the same value of 50 for each alternative.

Returning to our qualitative approach, through the application of the unicriterion model the situation changes. One can now valuate Future Life Preservation's weight above Efficiency's weight (though one cannot say how much). Since the value of each alternative maintains, alternative A becomes preferable and we have eliminated step 4 (4.)

Returning to step 2 (2.), there is no conflict between criteria. Since both 'capacity and quality of transport' and the virtual criterion that aggregates 'efficiency' and the 'future life preservation' value alternative A over alternative B, A is globally preferable.

iii) To proceed with the decision making process one would now compare alternatives A and C (1.).

Since there are conflicting criteria one proceeds to step 3 (3.), and taking advantage of the previous aggregation of criteria, step 4 (4.) comes next.

In terms of Efficiency, A dominates C in both of the original criteria, so there are no conflicting criteria.

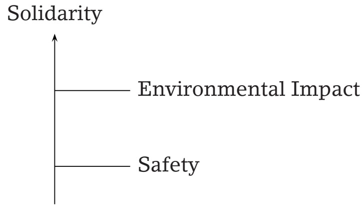

FIGURE 5
Unicriterion model that ranks criteria 'Environmental Impact' and 'Safety'

In terms of Future Life Preservation, A dominated in Safety and C dominated in Environmental Impact. To resolve such a conflict, the unicriterion model was applied, and it became clear to the decision maker that there was a qualitative difference between the criteria which he used to rank them. The safety criterion contributed to the future life preservation of one family in particular – the decision maker's family – while the Environmental Impact criterion contributed to the future life preservation of all the families. This led to the unicriterion ordering represented in figure 5, and as a consequence, to the preference of C over A in terms of 'Future Life Preservation.'

In terms of Capacity and Quality of Transport, A dominated in Comfort and C dominated in Space. In this situation, however, it was not necessary to apply the unicriterion model concept, since the decision maker directly stated prefering alternative A to C considering both criteria – he did not need the extra space that much – eliminating the apparent criteria conflict. Figure 6 resumes the ranking of both alternatives with the new criteria.

After returning to step 2 (2.), in step 3 (3.) for obvious reasons of convenience one aggregates the criteria Efficiency and Capacity and Quality of Transport in one new criterion entitled Transport Functionalities, that represents the direct transport advantages to the user. Steps 4 (4.), 2 (2.) and 3 (3.) come straightforward with the consideration of a new virtual criterion that aggregates Transport Functionalities and Future Life preservation.

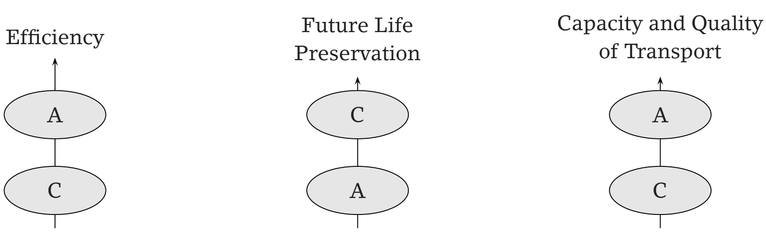

FIGURE 6 Ranking alternatives A and C with the new criterion

One proceeds to the ranking of alternatives in the new virtual criteria (4.). At this point the decision maker faces the problem of deciding between alternative A – that excels in 'Transport Functionalities' – and alternative C – that excels in 'Future Life Preservation.' Since the decision maker is unable to establish a preference between the value differences of the alternatives in each criterion, there is a decision problem and one proceeds to the application of the uni-criterion model. The task was facilitated by the previous value 'acquisition' process, which is typical of a constructivist approach and suggested the use of the already familiar point of view of 'Delay of Gratification.' According to this point of view, the criterion 'Future Life Preservation' was found more important than 'Transport Functionalities.'

Since there are no more criteria pairs to order or conflicting criteria for these alternatives, step 2 (2.) comes after step 4 (2.) and the process ends in step 1 leading to the selection of alternative C as the overall best one (assuming transitivity holds).

A REAL DECISION PROBLEM

To emphasize how the proposed method brings ethics into decision making by appealing to values more deeply rooted in every persons moral system of preferences and beliefs (whether we are talking of ethically sensitive problems or not) the methodology was applied in a real decision making situation: a house investment decision with three alternatives and six criteria described in table 3, as faced in real life by the author and his family at the time of this paper's writing. The appearance of this decision problem is due to the upcoming birth of this family's third child. The decision is somehow connected to the school enrolment decision for our oldest son's coming 5th year since only one of the house locations (Alto da Barra) gives access to a public school with a minimum of quality. The other two house locations determine the enrolment in a private school (better then the public one according to school rankings) and an increase in expenses.

Since the method has already been illustrated by the first decision problem, we will simply present a brief exposition of the decision conflicts undergone and solutions found.

Comparing alternatives A and B we, verify that A excels in 'Area inside', while B excels in all other criteria (except for the 'Best available and affordable school grade' that makes no difference). The following criteria aggregation has been made:

To have more than 100 square metres of area available inside the

TABLE 3 Evaluation of three house investment alternatives according to several criteria

(1)	(2)	(3)	(4)	(5)	(6)	(7)
A Buy 35 year old flat in Paço de Arcos	200 €	170	3.65	Good	Average	Average (balcony)
B Expand present house indoor area by closing porch	300 €	100	3.65	Excellent	Good	Very good (court and small garden)
C Buy used flat in Alto da Barra	400 €	117	3.22	Good	Average	Average (balcony)

Column headings are as follows: (1) alternatives/criteria, (2) monthly income leftover after expenses, (3) area inside (square metres), (4) best available and affordable school grade (0 to 5), localization (shops, surroundings and services proximity), (5) house investment (what will the investment be worth in a few years), (6) area outside the house.

house is seen as a need, while the other criteria (provided the alternative A level in them is guaranteed) measure the extent to which B provides more comfort.

Since according to the criterion 'Comfort', alternative B is better than A and according to 'Needs' it is the other way around, we applied a ranking of these two criteria in the new dimension of Human priorities, according to which Needs are more important to be guaranteed than Comfort.

Alternative A is therefore more attractive than alternative B.

Comparing now alternatives A and C, they are the same in half of the criteria. In the other half, A excels in 'Best available and affordable school grade' and 'Area Inside', while C is better in 'Monthly income leftover after expenses.'

This time 'Area inside' is not considered to contribute to satisfying a need but to increasing house comfort since alternative C level

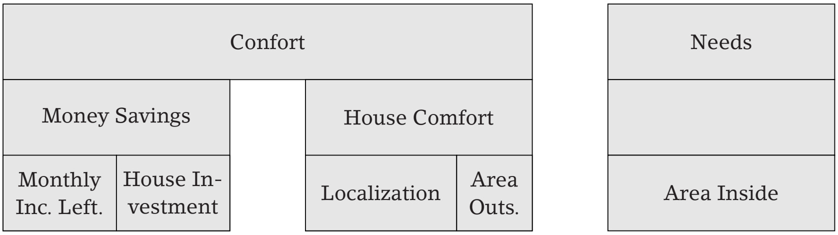

FIGURE 7 Criteria aggregation to compare alternatives A and B

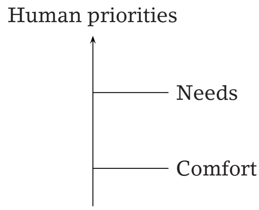

FIGURE 8
Unicriterion model that ranks criteria 'Needs' and 'Comfort'

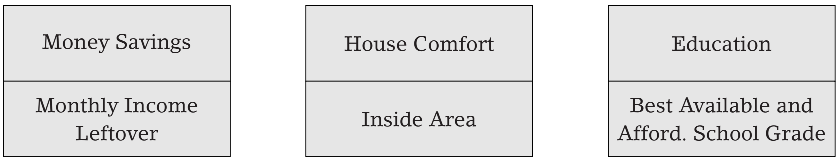

FIGURE 9 Criteria aggregation to compare alternatives A and C

in this criterion (117 square meters) is already considered to be the minimum to satisfy future needs (an extra room). Therefore, the aggregated criteria now become the ones presented in figure 9.

Figure 10 resumes the ranking of both alternatives with the new aggregated criteria.

Since the comparison between the criteria Money savings and Education in light of the new Unicriterion concern of 'Raising autonomous children' indicates that it is better to prepare (educate) someone to make a living on his (her) with own than to keep providing him (her) living expenses in the future (through present money savings), then alternative A is preferable to C even without having to account for the House Comfort criteria.

As a conclusion we therefore found that alternative A – 'Buy a 35 year old flat in Paço de Arcos' is the one we prefer.

Discussion

Figure 12 depicts the car purchase decision process, the one that illustrates the method in more detail. Unlike the normal decision

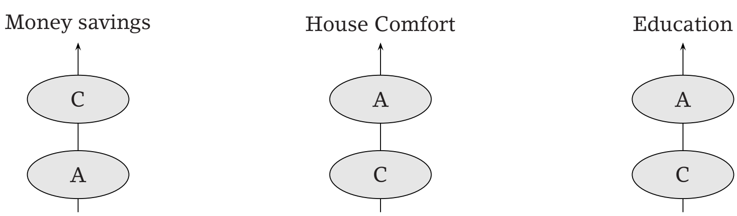

FIGURE 10 Ranking alternatives A and C with the new criteria

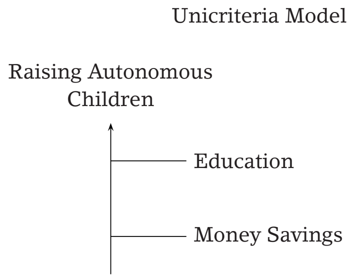

FIGURE 11
Unicriteria model that ranks criteria 'Education' and 'Money savings'

criteria, unicriterion models or points of view are represented between two arrows, one of them pointing out in the direction of the winning criteria. As expected, the decision model exhibits a pyramid like structure, and it is possible to enunciate a simple high-level reason for why alternative A was selected – a choice of gratification delay was made. Going down the value tree one can find the value structure adopted, which identifies the major decision conflicts undergone and solutions found. By doing this it is interesting to note that the environmental impact criterion turned out to be dominating in the decision, which can be attributed to the Solidarity point of view adopted.

Given the criteria modelling flavour of the method, Keeney's work (Keeney 1992, 29–152) might be considered a framework within which to compare this procedure. In a way, the Unicriterion model also follows a value – focused thinking approach, but where the fundamental objectives come out of a later step of the method application, from the alternatives comparison in a bottom – up procedure.

The low-level criteria are similar to Keeney's attributes that measure the extent to which a certain objective is reached. As we progressively aggregate these criteria in the method, the higher level ones become fundamental objectives. For simplicity and operational reasons we do not distinguish between these different level criteria/objectives by calling them all criteria. There is, however, a different kind of criteria that we distinguish from all the others: the criteria or points of view that solve the conflicts between criteria. These we call the Unicriterion, following the name of the model that they provide.

This approach lends a quite more active role to the analyst and the decision maker, since they are the ones to perceive the 'good' criteria aggregation and conflict solution opportunities. This means that the subjective part of the decision making process is entirely delivered to the human minds involved.

While building on a qualitative perspective, different from the one typically adopted in multicriteria applications, since the deci-

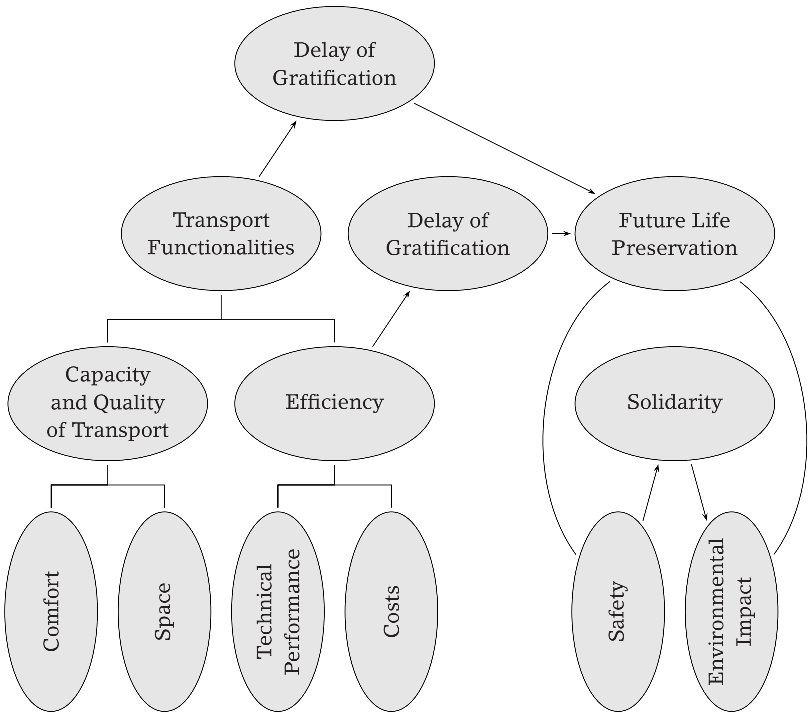

FIGURE 12 Car acquisition decision value structure

sion maker is asked to structure and eventually modify his preferences along the process, the Unicriterion Model hereby presented follows a rather constructivist approach, currently advocated among practitioners.

Given the unusual approach adopted towards the decision making problem, quite radical in its qualitative terms in comparison to other procedures, it seems appropriate to note that if the outstanding capabilities of humans indicate we are a product of intelligent 'decision making', and if we cannot say how many times we prefer one thing to another, maybe that is because when it comes to decisions we are made to think more in terms of values and less in terms of numbers.

Conclusions

This research attempted to find a way to go beyond some limits of the traditional models of criteria weights determination and aggregation used in multicriteria decision making methods, that have some shortcomings in developing and clarifying the rationale behind its results.

To accomplish this, the decision criteria were selected as the decision process items to be looked at from a different perspective, since the priorities established between them are the model – or the reason – that determines why some alternatives will be preferred.

Accordingly, the suggested approach was to put the emphasis on the criteria modelling part of the problem, through the application of a criteria aggregation and ordering qualitative procedure. Once applied in the algorithmic manner described in the method section such a procedure progressively orders pairs of alternatives.

The focus of the developed method was on solving every unavoidable conflict between criteria pairs, not through the quantification of a relative importance in the decision maker's mind but through the identification of a reason – a point of view – according to which he/she prefers one criterion to another.

The method was tested through its application to two different decision problems: one hypothetical (for illustration of the method) and the other a real one. The results of the experience showed that the method is viable and reaches its purpose of identifying the points of view behind preference conflict solutions found in the course of the decision analysis.

Given the amount of analyses it requires, the method is not recommended for application in decision problems with many alternatives or criteria. It could however be helpful as a reality check for the relative importance of the best performing ones in traditional quantitative multicriteria applications, considering only the most relevant criteria.

The fact that the method helps clarifying the values and the reasons for their relative importance on the basis of the decision, makes it particularly appealing to promote ethics in decision making. With this method one can not hide decisions behind numerical combinations of criteria weights. Instead, there is a simple and transparent solution to each preference conflict.

Given the qualitative nature of the procedure, it might be particularly appropriate to support personal decision making, which is less demanding from the point of view of quantitative rigor (let us recall that public evaluation of proposals sometimes requires a priori quantification of criteria weights) and is more likely prone to a personal value or subjective moral foundation of decisions. As a curiosity, we can mention that the author of this paper has already himself applied this method successfully some years ago to help decide whether to enrol his son in a public or private school.

We have identified two limitations of the study. One is that the verification of the ideas here presented through real case applications in a scale statistically relevant is still to be achieved. The other one is that since the author of the paper (together with his wife in the house purchase decision) played the role of both the decision maker and the analyst in the two decision problems considered, such coincidence made a successful application easier to attain, dismissing probable communication gaps between the decision process actors.

As future work, besides going beyond the study limitations, it could be meaningful to try to identify types or patterns of criteria pairs preference ordering and aggregation procedures, to facilitate and make these operations more reliable in the method.

Another interesting goal to purse would be to conduct the experiment proposed to test hypothesis 1 and draw some conclusions.

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