Argument Schemes and Critical Questions for Decision Aiding Process

Wassila OUERDANE [a;1], Nicolas MAUDET [a] and Alexis TSOUKIAS [a]
[a] *LAMSADE, Uni. Paris-Dauphine, Paris 75775*

Abstract. Our ambition in this paper is to begin to specify in argumentative terms (some of) the steps involved in a decision-aiding process. To do that, we make use of the popular notion of argument schemes, and specify the related critical questions. A hierarchical structure of argument schemes allows to decompose the process into several distinct steps—and for each of them the underlying premises are made explicit, which allows in turn to identify how these steps can be dialectically defeated *via* critical questions. This work initiates a systematic study which aims at constituting a significant step forward for forthcoming decision-aiding tools. The kind of system that we foresee and sketch here would allow: (i) to present a recommendation that can be explicitly justified; (ii) to revise any piece of reasoning involved in this process, and be informed of the consequences of such moves; and possibly (iii) to stimulate the client by generating contradictory arguments.

Keywords. Decision aiding, argument schemes, critical questions

Introduction

Decision theory and multiple criteria decision analysis have established the theoretical foundations upon which many decision-support systems have blossomed. However, such systems have focussed more on how a "best solution" should be established, and less on how a decision maker should be convinced about that (for exceptions on that see [9,5]). In addition, the decision-support process is often constructive, in the sense that the client refines its formulation of the problem when confronted to potential solutions. This requires the system to cater for revision: it should be possible, for the client, to refine, or even contradict, a given recommendation. These aspects are usually handled by the decision analyst, but if we are to automate (some part of) the process (as is the case in recommender systems, for instance), it is important to understand more clearly how they can be integrated in a tool.

In AI, a different tradition to decision making had identified these problematic issues. One of the key distinctive ingredient is that many AI-based approaches are prone to represent decision making in terms of "cognitive attitudes" (as exemplified in the famous Belief-Desire-Intention paradigm) [11,12], instead of crude utilities (as already elicited by the analyst). This change of perspective paved the way for more flexible decision-making models: goals may change with circumstances, and understanding these under-

[1] Corresponding Author.

lying goals offers the opportunity to propose alternative actions, for example. But then a reasoning machinery has to be proposed to handle these complex notions. Regarding the issues of expressiveness and ability to deal with contradiction that we emphasized here, argumentation seemed a good candidate. Indeed, recently, following some early works [13,8], several models have been put forward in the artificial intelligence community that make use of argumentation techniques [16] to attack decision problems. These approaches have contributed to greatly extend our understanding of the subject, in particular they clarify what makes argumentation about actions crucially different from mere epistemic argumentation (when the object under discussion is a belief).

On the one hand, our contribution is much more modest in its current state than the aforementioned approaches. We will not, in the present paper, base our model on cognitive attitudes and try to represent the underlying motivations and informations of agents. We take, instead, a different perspective which results from the following observation: there exist many decision-support tools that clients understand well, find valuable, and would be reluctant to drop for a completely new tool. Hence the following question: is it possible (and to what extent) to integrate some flavour of argumentation within these tools. On the other hand, having to deal with complex aggregation procedures proposed in these approaches, we will also have to make explicit and discuss some aspects that are often left aside by argumentation-based approaches (although it is known that some aggregation procedures can be captured by an argumentative approach [1]). The main one being that the aggregation procedure itself may be the subject of potential exchange of arguments.

The remainder of this paper is as follows. Section 1 offers a brief reminder on decision aiding theory. In particular we identify the different steps that compose the process, and the nature of the involved objects. Section 2 then presents the different argument schemes that are involved in such processes. The section that follows exploits this representation and defines the critical questions that can be attached to the argument schemes. In Section 4, we present the nature of the resulting dialectical process, pointing out the added-value of this argumentation-based approach when compared to classical multicriteria decision-aiding tools. We conclude by discussing perspectives of this work.

1. Decision Aiding Process

An instance of a decision process is characterized by the participating actors, their concerns, and the resources committed by each actors on each object. We are interested in decision aiding. Intuitively, in decision aiding we also make decisions (what, why and how to model and support). Decision aiding is also a decision process but of a particular nature [9,10]. A decision aiding context implies the existence of at least two distinct actors (the client and the analyst) both playing different roles; at least two objects, the client's concern and the analyst's (economic, scientific or other) interest to contribute; and a set of resources including the client's domain knowledge, the analyst's methodological knowledge, money, time... The ultimate objective of this process is to come up with a consensus between the client and the analyst [19]. Four cognitive artifacts constitute the overall process:

> *Problem situation*— the first deliverable consists in offering a representation of the problem situation for which the client has asked the analyst to intervene;

Problem formulation— given a representation of the problem situation, the analyst may provide the client with one or more problem formulation. The idea is that a problem formulation translates the client's concern, using the decision support language, into a "formal problem";

Evaluation Model—for a given problem formulation, the analyst may construct an evaluation model, that is to organise the available information in such a way that it will be possible to obtain a formal answer to a problem statement. An evaluation model can be viewed as a tuple comprising the set of alternatives on which the model applies (denoted $\mathcal{A}$); the set of dimensions (attributes) under which the elements of $\mathcal{A}$ are observed, described, measured, etc. (denoted $\mathcal{D}$); the set of scales $\mathcal{E}$ associated to each element of $\mathcal{D}$; the set of criteria $\mathcal{H}$ under which each element of $\mathcal{A}$ is evaluated in order to take in account the client's preference; and an aggregation procedure ($\mathcal{R}$). Formally, a criterion is a preference relation, that is a binary relation on $\mathcal{A}$ or a function representing the criterion. (A set of uncertainty structures may also be used. Depending on the language adopted, this set collects all uncertainty distributions or the beliefs expressed by the client. We shall not discuss it further here).

Final recommendation—the evaluation model will provide an output which is still expressed in terms of the decision support language. The final recommendation is the final deliverable which translate the output into the client's language.

The study of this process shows that it suffers from some limits. The first one is the lack of a formal justification or explanation of the final recommendation. Indeed, the process focuses more on how to reach the final decision and fails in some way to provide a justification for the decision-maker. Second, during the decision aiding process several different versions of the cognitive artifacts may be established. These different versions are due to the fact that client doesn't known how to express clearly, at the beginning of the process, what is his problem and what are his preferences. So, as the model is constructed, the decision maker revise and update his preferences and/or objectives. However, such different versions are strongly related to each other since they carry essentially the same information and only a small part of the model has to be revised [19,10]. The problem that arises here is that this revision (or update) is not taken into account by the model. In other words, there is no formal representation of how the evolution occurs between different versions. Finally, the last problem encountered in this process is the incomplete information. More specifically, the process does not support situations or problems decision where some fields of one or more of the different models are not completed.

In this paper we concentrate on the evaluation step. The approach based on argumentation that we sketch in the next few sections is particularly well suited to tackle these aspects: (i) by presenting the reasoning steps under the form of argument schemes, it makes justification possible, and offers the possibility to handle default reasoning with incomplete models; and (ii) by defining the set of attached critical questions, it establishes how the revision procedure can be handled.

2. Argument Schemes

Argument schemes are argument forms that represent inferential structures of arguments used in everyday discourse, and in special contexts like legal argumentation, or scientific argumentation. *disjunctive syllogism* are very familiar. But some of the most common and interesting argumentation schemes are neither deductive nor inductive, but *defeasible and presumptive* [22].

It is now well established that argument schemes can play two roles: (i) when constructing arguments, they provide a repertory of forms of argument to be considered, and a template prompting for the pieces that are needed; (ii) when attacking, arguments provide a set of critical question that can identify potential weaknesses in the opponents case. Then, as Walton puts it, " we have two devices, *schemes* and *critical questions*, which work together. The first device is used to identify the premises and conclusion. The second one is used to evaluate the argument by probing into its potentially weak points" [22]. The set of critical questions have to be answered, when assessing whether their application in a specific case is warranted. Prakken and Bench-capon [6] specify that argument schemes are not classified according to their logical form but according to their content. Some argument schemes express epistemological principles or principles of practical reasoning: different domains may have different sets of such principles. Our aim in this paper to identify those schemes that are involved in multicriteria decision-aiding processes.

We need different classes of argument schemes to construct the whole evaluation model. Argument schemes can very broadly be distinguished depending on (i) whether they aggregate several criteria, or are concerned with a single criteria (multicriteria vs. unicriteria); (ii) whether they follow a pairwise comparison principle or whether they use an intrinsic evaluation, the action being compared to a separation profile (intrinsic vs. pairwise); and (iii) whether they are concerned with the evaluation of the action or its mere acceptability (evaluation vs. acceptability). In theory, all combinations seem possible, even though some are much more natural than others.

In this paper, we shall focus our attention on the following schemes:

- argument schemes for *Unicriteria Pairwise Evaluation* (UC-PW-EV), which establishes that an objet is at least prefered to another object from the single viewpoint of the considered criteria (note that there may be an intrinsic version of this scheme, for instance for classification, but also to cater for all the argumentation-based aggregation techniques);
- argument schemes for *Unicriteria Intrinsic Acceptability* (UC-IN-AC), which establishes that the action can be considered in the evaluation process (here also, it may be possible to have a similar scheme for relative "pairwise" acceptability);
- argument scheme for *Multicriteria Pairwise Evaluation* (MC-PW-EV), which basically concludes that an object is at least as good as another object on the basis of several criteria taken together. It is constituted of two sub-argument schemes:
  - argument schemes for *Positive Reasons Aggregation Process* (PR-AP), which concludes that there are enough positive reasons to support the claim of MC-PW-EV, and that can be of many types depending on the aggregation technique used (ex. simple majority, weighted sum, and so on);
  - argument schemes for *Negative Reasons Aggregation Process* (NR-AP) which concludes that the negative reasons should block the conclusion of MC-PW-EV (again, this really constitute a family of argument scheme);

argument schemes for *Global Recommendation* (GR) which provides the output of the process (of different type depending on the decision problem considered). We shall not discuss this level in this paper.

In the rest of this paper we limit the discussion to the case involving only two actions. This is a basic building block that will be required if we are to construct more general decision-aiding.

Now we turn our attention to argument schemes. In fact, as must be clear from the discussion above, there is an underlying hierarchical structure that ties the different argument schemes. In short, we can distinguish three levels of argument schemes that will be embedded. At the highest level the multicriteria pairwise evaluation, which is based on the aggregation of positive and negative reasons, which in turn is based on unicriteria evaluation of actions versus other actions (or special profiles).

2.1. Argument Schemes for Unicriteria Action Evaluation

The first way to perform an action evaluation is to compare two actions from the point of view of the chosen criterion: this is modeled by the scheme for Unicriteria Pairwise Evaluation (UC-PW-EV), see Tab. 1. This argument scheme is the basic piece of reasoning that is required in our decision-aiding context. It concludes that an action a is at least as good as an action b from the point of view of a given criterion h_i, based on some preference relation $_i$ [17].

Premises	a criteria	h_i
	an action	a
	whose performance is	$g_i.a/$
	an action	b
	whose performance is	$g_i.b/$
	a preference relation	$_i$
Conclusion	a is at least as good as b	$a \;_i\; b$

Table 1. Scheme for Unicriteria Pairwise evaluation (UC-PW-EV)

When an action needs to be intrinsically evaluated, there is a need to define the categories and *separation profiles*. Such a separation profile defines on each criterion a sort of neutral point: this is by not necessarily an existing action, but it allows to define to which category to affect the action. A particular case is when we only consider “pro” and “con” categories. The scheme for Unicriteria Intrinsic Action Evaluation, as given in Tab. 2, details such a scheme.

Premises	an action	a
	whose performance is	$g_i.a/$
	along a criteria	h_i
	a separation profile	p
	whose performance is	$g_i.p/$
	a preference relation	$_i$
Conclusion	a is acceptable according to h_i	$a \;_i\; p$

Table 2. Scheme for Unicriteria Intrinsic Action Evaluation (UC-IN-EV)

2.2. *Argument Schemes for Acceptability*

The case of action acceptability is very similar to that of action evaluation: it can also be performed intrinsically or in pairwise manner. We start with the *Argument Scheme for Intrinsic Acceptability* (UC-IN-AC). The scheme is very similar to that of Unicriteria Intrinsic Evaluation. In fact, in this case the separation profile can play the role of a *veto threshold*: when the action does not reach that point, there are good reasons to exceptionally block the claim (disregarding the performance of the action on other criterion). For the sake of readability, we shall not repeat this very similar scheme here. A different kind of acceptability relies instead on the relative comparison of actions: it may be the case that an action is considered to be inacceptable because the difference in performance is so huge with another action. In this case, we talk about an *Argument Scheme for Pairwise Acceptability* (UC-PW-AC). We believe this is self-explanatory given the examples provided so far, and shall not give any further detail here.

2.3. *Arguments Scheme for Aggregating Positive Reasons*

At this level the piece of reasoning involved must make clear how we can conclude that enough positive reasons are provided. Perhaps the most obvious such scheme, at least one that is ubiquous in multicriteria making is the *principle of majority*. It only says that a is at least as good as b when there is a majority of criterion supporting this claim. Table 3 gives the detail of the corresponding argument scheme.

Premises	a set of criteria considered to be of equal importance	$\{h_1, h_2, \ldots, h_n\}$
	a set of pairwise evaluation of actions a and b	
	the majority support the claim	
Conclusion	there are good reasons to support a is at least as good as b	a b

Table 3. Scheme for Argument from the Majority Principle (PR-AG (maj))

Note that this scheme makes explicit that criteria are considered to be of equal importance. This is not necessarily the case, and more generally many other aggregation techniques may be used to instantiate $\mathcal{R}_P$. These other schemes will potentially require additional information, which justifies that we have many different scheme and not a single generic one. For instance, a possible scheme would conclude that a is at least as good as b when it is at least as good on (some of) the most important criteria (*argument from sufficient coalition of criteria*).

Here we only present a different one to illustrate the variety of argument schemes that may be used. This simple typical example is the lexicographic method that we detail below. The method works as follow: look at the first criterion, if a is strictly better than b on this, then a is declared globally preferred to b without even considering the following criteria. But if a and b are indifferent on the first criterion, you look at the second one, and so on.

Note that the basic input information that needs to be provided to these schemes is that of a pairwise comparison on a single criterion dimension (the output of UC-PW-EV). Indeed, this will be in most case the basic building block upon which the recommendation can be build. There is however a different type of scheme that would aggregate instead intrinsic valuations of both actions: that would be the case of argument-based

Premises	a set of criteria	$\{h_1, h_2, \ldots, h_n\}$
	a linear order on the set of criteria	$h_1 > h_2 > \ldots > h_n$
	a set of pairwise evaluation of actions a and b	
	a is strictly better than b on h_i	$a \succ_i b$
	a is indifferent to b on h_j for any $j < i$	$a \simeq_j b$ when $j < i$
Conclusion	there are good reasons to support a is at least as good as b	$a \succeq b$

Table 4. Scheme for Argument from the lexicographic method (PR-AG (lex))

aggregation procedures that take as input sets of arguments “pro" and “con". Clearly, the basic argument scheme required will be different here, for it needs to provide an intrinsic evaluation of the action.

2.4. Argument Scheme for Multi-Criteria Pairwise Evaluation

The argument scheme that lies at the top of our hierarchy is inspired by outranking multi-criteria techniques [10], and indeed its argumentative flavour is obvious. The claim holds when enough supportive reasons can be provided, and when no exceptionally strong negative reason is known. This already suggests that there will be (at least) two ways to attack this argument: either on the basis on a lack of positive support, or on the basis of the presence of strong negative reasons (for instance, a “veto”). Typically, supportive reasons are provided by action evaluation, and negative reasons are provided by action (lack of) acceptability. We shall discuss this further when we turn our attention to critical questions.

Premises	an action	a
	an action	b
	a set of criteria	$\{h_1, h_2, \ldots, h_n\}$
	there are enough supportive reasons according to	$\mathcal{R}_P$
	there are no sufficiently strong reasons to oppose it	$\mathcal{R}_N$
Conclusion	a is at least as good as b	$a \succeq b$

Table 5. Scheme for pairwise evaluation multicriteria (MC-PW-EV)

Here, $\mathcal{R}_P$ stands for the aggregation process that should be used to aggregate the (positive) reasons supporting the claim, whereas $\mathcal{R}_N$ stand for the aggregation process concerned with the aggregation of *exceptionally* negative reasons (vetos). The conclusion of the scheme expresses that a is at least as good as b according to the preference relation $\succeq_{MCPWEV}$ induced by the scheme.

3. Critical Questions

Along with each different argument schemes comes a set of *critical questions* [22,21]. These questions as we said before, allow us to identify potential weaknesses in the scheme. Below we present the set of critical questions attached to the schemes MC-PW-EV, PR-AG (maj), and UC-PW-EV. We note that different types of critical questions can be identified [14], depending on whether they refer to standard assumptions of the scheme or to exceptional circumstances. This has in particular a significant difference on how the burden of proof is allocated. We now list some of the questions that can be attached to the different premises.

Argument Scheme for Multi-Criteria Pairwise Evaluation. In this context the different type of questions is clear. The burden of proof lies on the proponent when it must provide supportive evidence (positive reasons) for the main claim. On the other hand, the opponent should be the one providing negative reasons to block the conclusion.

1. *actions* (assumption): is the action possible?
2. *list of criteria* (assumption): (i) Is this criteria relevant?, (ii) Should we introduce a new criteria?, (iii) Are these two criteria are in fact the same?
3. *positive reasons* (assumption): (i) Are there enough positive reasons to support the claim? (ii) Is the aggregation technique relevant ?
4. *negative reasons* (exception): Are there not enough reasons to block the claim? Is the aggregation technique relevant?

Note also that while the use of a specific aggregation technique may be challenged at this level ("why are we using a majority principle here?"), the actual exchange of argument regarding this aspect will involve the sub-argument scheme concerned with this aggregation. We now turn our attention to the critical questions that may then be used.

Together with the *Scheme for Argument from the Majority Principle.* come two obvious questions are:

1. *list of criteria* (exception): Are the criteria of equal importance?
2. *majority aggregation* (exception): Is the simple majority threshold relevant for the current decision problem?

As for the *Argument Scheme for Unicriteria Pairwise Action Evaluation*, we can propose this tentative set of questions :

1. *actions* (assumption): Is the action possible?
2. *criterion* (assumption): Is the criteria relevant?
3. *action's performance* (assumption): Is the performance correct?
4. *preference relation* (assumption): Is the preference relation appropriate?

It should be noted that a negative answer to some of these questions leads to a conflict whose resolution requires sometimes the transition to a different stage of the negotiation process. For instance, when you challenge whether the action is possible to start with, you are dealing with the problem formulation (cf. section 1), where the set of alternatives is defined. It is out of the scope of this paper to discuss this problem. We will just mention that through the different critical questions, we have the opportunity to review and correct not only the evaluation model, but also other stages of the process.

4. The Dialectical Process

In this section we give a glimpse of the dialectical process that will exploit the argument schemes and critical questions that we have put forward so far. It is based on the popular model of dialogue games, and more precisely it is based on recent extensions that incorporate argument schemes within such models [18]. The full specification of the dialogue game is the subject of ongoing work. The process initiates with the client specifying the basic elements of the evaluation model[2] (see Sect. 1): it specifies a set of actions (in the context of this paper we limit ourselves to two actions though), a set of criteria, and the aggregation operators that shall be used. Contrary to classical decision tools, these sets will only be considered to be the *current* evaluation model, and it is taken for granted that it can be revised throughout the process. Now, as we see it, an argumentation-based decision-aiding process should:

1. *justify* its recommendation. Crucially, by presenting its justifications in the form of arguments, the system will make it possible for the user to pinpoint those steps that pose problems. The system builds up the current recommendation by embedding argument schemes of the three levels. The argument schemes are build on the basis of the information provided by the user, and in some cases by using default instantiation (when the scheme allows for it). If challenged by the user, the system provides the different steps of reasoning by revealing parsimoniously the lower level schemes that compose the recommendation. Each time a scheme is presented, the entire set of critical is at the disposal of the user to challenge the current conclusion. There are very different reasons to revise in such a process: in some case the user may simply want to correct/refine one of its previous statement, introduce new information. In other cases it will contradict one of the system's assumption;
2. *inform* the user of the consequences of its modifications. In many cases the user would not foresee the various consequences of a seemingly local modification: in these cases, the system helps the user by making explicit the hidden and critical consequences of its move;
3. potentially *propose* automatically generated arguments, in order to stimulate users (a technique that has proven very useful, for instance in the context of recommender systems [20]). The system holds a collection of argument schemes that can be readily used to generate counter-arguments that would stimulate the user in its decision-making process. In particular, the system may seek to generate counter-arguments based on the use of different argument schemes that would contradict the current recommendation, by relaxing some assumptions or informations provided by the user. The idea being here to emphasize for the user what are the assumptions in the evaluation model currently used.

The different cases mentioned above are illustrated by means of an example.
User: [specify its evaluation model: two actions a and b, five criteria $c_1; c_2; c_3; c_4; c_5$, *among which* c_1 *is considered to be of primary importance, followed by* c_2, *and so on. Acceptability is initially intrinsic: no action should have a score on a criterion lower than 1. The performance table is as follows:]*

	c_1	c_2	c_3	c_4	c_5
a	*7.5*	*6*	*2*	*3*	*5*
b	*7*	*4*	*8*	*4*	*7*

1. System: Given your informations, a is at least as good as b. [Recommendation]
2. User: Why? [Challenge]

[2] Of course a more ambitious dialectical system would have to consider the previous steps as well. This is beyond the scope of this paper.

3. System: The most important criteria according to you defend this claim, so by comparing actions on the basis of criteria of decreasing importance, a should be prefered to b [Justified Recommendation]
(although the majority of arguments defend the opposite claim [Gen. counter-arguments])
4. User: I still think that c_1 is the most important criteria so the majority makes little sense. [Reject counter-argument]
however, now I see that the difference between a and b is not significant enough...
5. System: My recommendation remains the same because a is prefered to b on the second most important criterion
6. User: I agree but still a cannot be acceptable.
7. System: Why? [Burden of proof shift]
8. User: b is way better than a on c_3, I could not justify this choice... [Argument Scheme for Relative acceptability]
9. System: Ok. [Revise the recommendation]
But beware that applying this scheme for acceptability may have the following consequences... [Inform of consequences of this revision]

Let us briefly analyze this dialogue. Turn 1 provides the recommendation, which is challenged by the user on turn 2. Not being more explicit, the challenge can be assumed to ask the system to provide more explicit information regarding positive reasons supporting the claim. The system, on turn 3, explains that the claim is based on the use of the PR-AG(lex) scheme. Note that it also generates a possible counter-argument by relaxing some of the information provided by the user (here the fact that criteria have different importance). Observe that this is an indirect way for the system to use a critical question...) The user rejects this counter-argument on turn 4 (by re-affirming the fact that criteria have unequal importance), but attacks the basic UC-PW-EV argument upon which the recommendation is based. The critical question used here is that of the relevance of the preference relation. The system accepts the move (and modifies the user's information by specifying that actions should exhibit at least half a point of difference, otherwise they should be considered as indifferent). But the system restates that the recommendation remains unchanged: this is due to the fact on the second most important criterion, *a* is again better than *b*. (The attack is *unrelevant* in Prakken's sense). The user accepts this but now attacks on the ground of negative reasons, and explains that *a* can not be accepted on the basis of pairwise acceptability (UC-PW-AC). Finally, the system revises its recommendation but may at the same time make explicit the consequences of the proposed change.

5. Related work

One of the most convincing proposal recently put forward to account for argument-based decision-making is the one by Atkinson *et al.* [3,2]. They propose an extension of the "sufficient condition" argument scheme for practical reasoning [21], by distinguishing the goal into three elements: state, goal and value. This scheme serves as a basis for the construction of a protocol for a dialogue game, called Action Persuasion Protocol (PARMA) [4]. The authors show how their proposal can be made computational within the framework of agents based on the BDI model, and illustrate this proposal with an example debate within a multi-agent system. Prakken et al. [7] offer a logical formalisation of Atkinson's account within a logic for defeasible argumentation. They address the problem of practical syllogism by trying to answer questions such as: how can an action be justified? In particular, the aim is to take into account the abductive nature of the practical reasoning and the side effects of an action. A key element in this formalisation is the use of accrual mechanism for argument to deal with side effects (positive and negative effects).

The first approach attempting to introduce argumentation in the decision aiding process as a whole is the one of Moraitis et *al.* in [15]. The idea is to describe the outcomes of the decision aiding process through an operational model and to use argumentation in order to take into account the defeasible character of the outcomes. The authors tryu to provide a way allowing the revision and the update of the cognitive artifacts of the Decision Aiding Process.

In addition to these works, many other proposals have been put forward in the literature to use argumentation in a decision context, see [16] for a recent survey. From the point of *decision aiding* though, a couple of elements remain largely unexplored. Under that perspective, current argumentation models are not fully satisfying because for instance: (i) most of the approaches assume a decision problem where the aim is to select the "best" action for a given purpose, when in fact a variety of decision problems can be addressed (choice, ranking, sorting,...); and (ii) most models currently proposed in the literature rely on an underlying *intrinsic evaluation* (actions are evaluated against some absolute scale), whereas most decision aggregation procedure make use of *pairwise evaluation* techniques (actions are compared against each others).

6. Conclusion and Future Work

The purpose of this paper was to provide a first approach to represent the steps of a multicriteria decision aiding process by means of argument schemes and critical questions. We focused here on the evaluation model, and considered the restricting but basic case of the comparison of two actions. To represent the decision evaluation process, we identified a hierarchical structure of argument schemes. Each level refers to one step in the classical multicriteria evaluation. The highest level represents the pairwise evaluation, which is based on the aggregation level, which is in turn based on unicriteria evaluation (pairwise or intrinsic). To these schemes we associated a set of critical questions. One reviewer of this paper raised the following issue: does it make sense in the first place to consider argument schemes that cover the aggregation level? One of the main claim of this paper is that it does, precisely because the way basic argument schemes are collected and aggregated may also be disputed, and be based on assumptions that can be challenged and/or revised. The aim is (as usual with argument schemes and critical questions, as proposed here) to allow us to check the acceptability of each scheme by probing into its potentially weak points, and this from different point of views. We also give the very basic ingredients of the dialectical system currently under development. Future work should extend the model to take into account, in one hand a large set of alternatives, on other hand to handle different decision problems (ranking, sorting,...), in order to build a dialectical system-based decision aiding system for the whole process.

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