On the link between arguments and criteria

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Two traditions. Decision-support systems aims at helping the user to shape a problem situation, formulate a problem and possibly try to establish a viable solution to it. Under such a perspective decision support can be seen as the construction of the reasons for which an action is considered a "solution to a problem" rather than the solution itself (see [Tso]). Indeed the problem of *accountability* of decisions is almost as important as the decision itself. Decision support can therefore be seen as an activity aiming to construct arguments through which a decision maker will convince first herself and then other actors involved in a problem situation that "that action" is the best one (we are not going to discuss the rationality hypotheses about "best" here). Decision Theory and Multiple Criteria Decision Analysis have focussed on these issues for a long time, but more on how this "best solution" should be established and less on how a decision maker should be convinced about that (for exceptions on that see [BMP$^+$00], [BS02]).

More recently, in the field of artificial intelligence, argumentation has been put forward as a very general approach allowing to support different kinds of decision-making [BG96, PV02, Pol87, PJ98, AP06]. Typically, one will construct for each possible decision (alternative) a set of positive arguments (*e.g.* good consequences of the decision), and a set of negative arguments (*e.g.* bad consequences of the decision). However, decision-makers do not simply *list* pro and cons: they exchange arguments, some of them interacting with others, attacking or reinstalling previous arguments put forward (by the other party, or sometimes indeed by itself). Distinguishing what eventually should count as acceptable arguments has been the study of numerous studies, and necessitates to value the arguments. Cayrol and Lagasquie-Schiex [CLS05] distinguish *intrinsic* valuation of arguments (without any consideration for the other arguments –for instance it may be based on the credibility of the source), and *interaction-based valuation* of arguments (simply resulting of the interactions between arguments –for instance some may be better supported than others, etc.). In the seminal work of Dung [Dun95], different semantics are proposed, which interpret differently what (sets of, in this case) arguments should be considered acceptable, only based on their interaction-based valuation. More recently, some approaches propose to take both aspects into account, see *e.g.* [KP98]. Once the valuation has been made, it is then possible to select the acceptable arguments. Usually, only a crisp selection is allowed: arguments are acceptable or not; however a more gradual acceptability is also possible [CLS05].

To make things a little bit more concrete, we take the following illustrative example. Suppose a panel of debaters discussing the respective merits of different candidates (say 2 to make things simple) for a forthcoming election. You have agreed beforehand that the panel should concentrate on different criteria that will be used for the final decision, for instance: competence, fairness, and so on.

Multi-criteria approaches would take the problem from the following situation: a representative of the panel comes out from the room with a piece of paper ordering the two candidates, on each of the different chosen criteria. These orderings result from the discussion –but you have no further information as to the content of the discussion. Then you have to make your decision on the basis of these reported orderings. In the case of argumentation-based approaches, the representative simply gives you a transcription of the discussion that just occurred. These are the arguments that have been exchanged, and you should base your decision on those. It is attractive because you would certainly be in a better position to *explain* your decisions once it is made –but how to make this decision in the first place is definitely challenging.

In this presentation, we would like to investigate this problem, and discuss more precisely the connections between the notions of criteria and arguments. We shall present some existing approaches, and propose some preliminary ideas. An example will be used to illustrate the discussion.

Arguments and Criteria. Intuitively, an argument seem different from a criterion.

A criterion can be regarded as a point of view against which it is possible to compare different alternatives. For such a comparison you need the user's preferences either stated explicitly (through a binary ordering relation) or implicitly associating to "values" (how much it is?) "utilities" (measures or preferences). Therefore, criteria are models of preferences.

An argument, on the other hand, supports a given alternative. But it is perfectly possible that different arguments are exchanged about the same criterion. In fact, it is worse than that. Getting back to our example, the first thing that you may observe when inspecting the transcript of the political discussion, is that it possible that an argument related to a given criteria actually interacts with an argument related to a *different* criteria: in other words, arguments belonging to different "domains" of discussion, refering to different points of view, may well interact.

A further difference is that in argumentation, the pairwise comparison of alternatives only comes as a by-product of the construction of arguments pro/ con each alternative. In multiple criteria decision analysis on the other hand, the canonical case is the pairwise comparison of alternatives (explicitly or implicitly). One may argue that it is always possible to retrieve pairwise comparison on the basis of intrinsic valuations. But this is more than a simple technicality. The hypothesis done in almost all Multiple Criteria Decision Analysis methods (see [KR76], [Roy96]) is that criteria represent complete preferences (all alternatives being comparable to all the other ones). This is empirically falsifiable as well as other hypotheses (for instance transitivity of preferences). Moreover the process of inferring preferences from utilities or vice-versa is not trivial (see chapter 3 in [BMP$^+$06]).

Very broadly speaking, one can think of argumentation as a way to make explicit the reasons justifying each preference ranking among alternatives. (That is, if the decision-making were to ask the question "why did you say that you preferred a over b?", he may give those reasons). In the light of the previous remarks, it is then possible to conceive to two approaches:

- aggregate arguments separately on each different criteria, and then aggregate the obtained orderings to get the final recommendation;
- aggregate arguments and criteria all together, that is design an aggregation technique that will take into account some information related to the criteria.

Both approaches seem to have their own merits. The first one makes a clean distinction between both "levels" of aggregation, making it possible to use off-the-shelf techniques in both cases. This has, however, the drawback that it does not take seriously into account the possibility arguments belonging to different criteria may interact. On the other hand of course, it makes the aggregation process itself more challenging.

A brief review of some existing approaches. There has been some attempts in the literature to draw connections between arguments and criteria. We briefly discuss the most prominent here.

In [ABP05], Amgoud *et al.* regard an argument as a tuple corresponding to some knowledge justifying a decision, allowing in turn to fulfill a goal satisfying (to some extent) a criterion. Goals hence favour different criteria. Each decision (alternative) is then evaluated intrinsically, giving a score for the given alternative on the scale used for the criterion. In this context, it is argued that many of the classical aggregation operators can be retrieved. While the approach certainly shows how classical aggregation techniques can be applied to sets of positive and negative arguments, it does not, we believe, take into the possible interaction between arguments.

Another very interesting approach is the one proposed by Bench Capon [BC02]. *Value-based argumentation systems* assume that each argument refers to a given "value" (sometimes called criterion). Argument systems, in the sense of Dung, hence record interaction between arguments, possibly related to different values. *Audiences* are different ways to order those values. It is then possible to identify those arguments that will be accepted regardless of the chosen audience (*objectively* acceptable), while some others arguments can only be *subjectively* acceptable. In this case, the interaction between arguments pertaining to different criteria is fully recognized. The aggregation of values remains very limited though, for it is only possible to order the values.

Towards criteria-based semantics. One preliminary proposal that we make here, and that we would like to discuss further in the context of the workshop, is the possibility to define what we may call criteria-based semantics. In a nutshell, the idea is to *color* argumentation systems in order to record to which criteria they relate to (the color being exactly equivalent to the notion of value of [BC02], with the major difference that we do not assume any ordering on those values). Arguments would then be selected on the basis of their acceptability, which could be in turn related to some color-based properties of the extensions (sets of acceptable arguments). As an example, it would be possible to require that an argument is defended by a set of argument representing the majority of criteria at stake. Or that no single-colored extension supports a different alternative.

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