Arguments and Contextual Preferences

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Abstract

The aim of this article is to propose a preference-based framework for reasoning from inconsistent beliefs considered from multiple contexts. Our proposal is to take into account several preference relations between beliefs. Each preference relation is issued from a particular context. We consider also an ordering over the different contexts in order to solve the problem of possible conflicts between preferences. These different relations enable us to define the set of acceptable arguments and consequently the set of admissible consequences.
We propose three inference relations showing beliefs with a qualitative degree: credulous consequence (an admissible consequence in a context), acceptable consequence (an admissible consequence according to the ordering over the contexts) and strong consequence (an admissible consequence sharing by all the contexts).

1 Introduction

Argumentation is one of the solutions for handling inconsistency in belief base. Beliefs are represented in terms of arguments and counter-arguments [EFK93, Dun95, Vre97]. Arguments support beliefs (i.e. conclusions) and may challenge other arguments (counter-arguments). In a preference-based argumentation framework, acceptable arguments are defined by conflicts between arguments and by a preference relation between arguments [AC00, Vre97].

As mentioned in [ARS95] preferences may also arise between from domains themselves. In other words, we have to handle several preordering on the beliefs. These different preorderings can be considered as contextual preferences [Rya93]. In this paper, we limit the contextual aspect to the preference relations. In that framework, beliefs and, thus, arguments and counterarguments, are sharing by all the contexts and the contextual preference relations represent the preferences about inconsistent beliefs for each context. Contexts have to be considered without any particular meaning: a context can be a time point, an agent, a place [MB94, BBM95, Per98]... In computational dialectics, this problem is crucial: agents contruct agreements and judgements in order to solve inter-agent inconsistency: they exhibit their arguments which represent their own viewpoint on inconsistent beliefs. In other words, agents compute/negociate the best arguments among the whole set of contextual arguments.
In [Bre96, PS97], frameworks for reasoning about priorities have been defined. They propose to encode the preferences and to use them as beliefs. This solution seems interesting when handling conditional preferences, i.e. when a preference depends of beliefs. However it is quiet complicated when handling contextual preferences which are given as preorderings. The aim of this paper is to propose i simple way for handling contextual preferences and we propose a preference-based framework for reasoning from inconsistent beliefs considered from multiple contexts.
In order to define acceptable arguments, as [Rya93], we introduce an ordering relation between the contexts. For instance, if we consider contexts as differents agents in a company, the order represents the hierarchichal level of the agents in the organization of the company. Using this order, we compute the set of the most acceptable arguments. For instance, preferences of the managing director take precedence over those of its assistants. We consider here the two kinds of acceptability: individual acceptability [EFK93] and joint acceptability [Dun95] where reinstatement is considered.
According to the ordering over the contexts and the contextual preferences, we extract qualitative information. We define different degrees of admissibility for the consequence of the inconsistent belief base: credulous consequence (an admissible consequence in a context), acceptable consequence (an admissible consequence according to the ordering over the contexts) and strong consequence(an admissible consequence sharing by all the contexts).

The plan of the paper is as follows: next section introduces preference-based argumentation framework. We then provide in section 3 the definition of the contextual preference-based argumentation framework. Section 4 presents the new acceptability inference relation and some properties. Section 5 presents the qualitative reasoning model. In section 6, we give an example illustrating our framework. In section 7, we outline some perspectives.

2 Preferences-based Argumentation framework

In this section, we present the argumentation systems based on preferences [Amg99]. We assume that beliefs are formulas expressed in propositional logic. Let K be a belief base. $\vdash$ denotes the standard deductive inference relation and $\perp \equiv p \wedge p$. An argument is a couple unifying a support and a conclusion [EFK93]:

Definition 1 (Argument). Let h be a formula and $H \subseteq K$ a set of formulae. The couple (H, h) is an *argument* iff:

1. $H \nvdash \perp$;
2. $H \vdash h$;
3. H is minimal: $(\forall h_i \in H)(H - \{h_i\} \nvdash h)$

H is called the support of the argument and h its conclusion.

The defeat relation connects arguments between them in terms of arguments, counter-arguments. Among the different defeat relations [Ver96], let us mention the rebutting and undercutting defeat relations [EFK93]:

Definition 2 (Rebut). Let $a_1 = (H, h)$ and $a_2 = (H', h')$ be two arguments: a_1 *rebuts* a_2 iff $h \equiv \neg h'$.

Definition 3 (Undercut). Let $a_1 = (H, h)$ and $a_2 = (H', h')$ be two arguments: a_1 *undercuts* a_2 iff there exists $h'_i \in H'$ such that $h \equiv \neg h'_i$.

Preference-based argumentation framework extends argumentation systems by introducing an ordering over the arguments. In other words, two arguments can contradict themselves but one of them can be more doubtful than the other one. Formally, we have [ACL96]:

Definition 4 (Preference-based argumentation framework). A *preference-based argumentation framework* (PAF) is a triplet $\langle \mathcal{A}, \Re, \geqslant \rangle$ s.t. $\mathcal{A}$ is a set of arguments, $\Re$ a defeat relation: $\Re \subseteq \mathcal{A} \times \mathcal{A}$ and $\geqslant$ is a preference relation on $\mathcal{A} \times \mathcal{A}$ ($\geqslant$ is a total or partial preordering).

The associated strict order associated with $\geqslant$ is denoted by $>$. $a_1 > a_2$ means that a_1 is strictly preferred to a_2. The preference relations between arguments are induced from preference relations between supports which are themselves induced from preorderings between the beliefs (the belief base may be layered for instance).

From the defeat and preference relations, we define the set of acceptable arguments. An argument is acceptable iff it defends itself against all its defeaters: an argument defends itself if it has no counterargument or if it is defeated by counterarguments then the argument is preferred, w.r.t. $>$ to each counterargument.

Definition 5 (acceptability class). Let $\langle \mathcal{A}, \Re, \geqslant \rangle$ be a PAF. The set $\mathsf{C}_{\Re,\geqslant}$ of the arguments defending themselves is:

$$\mathsf{C}_{\Re,\geqslant} = \{a \in \mathcal{A} | \forall a' \in \mathcal{A} \text{ if } (a', a) \in \Re \text{ then } a > a'\}$$

This class is extended by considering the arguments which have to be reinstate [Dun95]. This extension is obtained by using fixpoint. Let us consider the function F defined as follows:

$$\begin{aligned} \mathsf{F} &: 2^{\mathcal{A}} \longrightarrow 2^{\mathcal{A}} \\ &: S \longrightarrow \mathsf{F}(S) = \{a \in \mathcal{A} | a \text{ is defended by } S\} \end{aligned}$$

The new set of acceptable arguments $\mathsf{C}^{J}_{\Re,\geqslant}$ is obtained as the least fixpoint of the function F [Dun95, PS97, AC00].
The set of acceptable arguments enables to reason about the inconsistent belief base. Let $\mid\!\sim$ denotes the inference relation. Let K be an inconsistent belief base with an associated preference-based argumentation framework [EFK93]:

- $K \mid\!\sim_{\Re} \phi$ iff $\exists \Phi((\Phi, \phi) \in \mathsf{C}^{J}_{\Re,\geqslant})$. ϕ is a probable consequence of K.

An investigation about different kinds of inference relations is presented in [Cay95].

3 Multiple Preference Relations

The natural extension of preference-based argumentation frameworks is to consider a set of preference relations: each preference relation represents a context. For instance, an argument a_1 may be preferred to another argument a_2 in a first context c_1 and a_2 may be the preferred argument in a context c_2. As an example of application, let us consider the legal domain: the rules defined by the european community take precedence over those defined in France..
Work has already been done to analyse acceptable arguments in the context of multiple preference relations [Rya93, ARS95, Gro91]: these works show how to integrate the different relation into a new and unique resulting relation. They next consider properties of this relation. In contrast they do not consider the multiple context aspect for introducing different degrees of acceptability such as in [EFK93].
In this section we give the definitions of contextual preference-based framework (CPAF) and its associated class of acceptable arguments. In order to consider a set of preference relations, we stipulate a pre-order between contexts for comparing contexts (see also [Rya93]. This relation enables to represent facts such as: in the legal domain, the European context is more important than the French context. Let $\mathcal{C}$ be the set of contexts, $\geqslant_c$ the preference relation associated to the context c and $\succ$ be the ordering relation on $\mathcal{C} \times \mathcal{C}$. The set of acceptable arguments is defined as the sets of arguments which defend themselves in the "best" contexts, w.r.t. $\succ$. Since K is shared by all the contexts, the set of arguments is unique. Formally, we obtain the following definition:

Definition 6 (CPAF). A *contextual preference-based argumentation framework* (CPAF) is a tuple $\langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c \in \mathcal{C}} \geqslant_c, \succ \rangle$ where: $\mathcal{C}$ is a set of contexts, $\mathcal{A}$ is a set of arguments, $\Re$ is a defeat relation: $\Re \subseteq \mathcal{A} \times \mathcal{A}$, $\geqslant_c$ is the preference relation associated to the context c, $\succ$ is a total ordering: $\succ \subseteq \mathcal{C} \times \mathcal{C}$. Each relation $\geqslant_c$ is minimal for the inclusion.

Considering this new kind of argumentation systems, we re-define the set of acceptable arguments:

$$\mathfrak{C}_{\Re,\succ} = \{a \in \mathcal{A} | \forall a' \in \mathcal{A} \text{ if } (a', a) \in \Re \text{ then } (\exists c \in \mathcal{C})((a >_c a' \text{ and } (\forall c' \in \mathcal{C})((a' >_{c'} a \Rightarrow c \succ c')))\}$$

Our definition of acceptable arguments differ with the definition proposed in [Rya93]. In his approach, contextual preferences are integrated with a consensus viewpoint, i.e. in a more cautious way. In our work, the prefereces about a particular conclusion stated in the most important context are the "relevant ones". Based on the set of acceptable arguments where arguments are considered in the individual aspect, we consider reinstatements of defeated arguments, i.e. joint acceptability. Let $\mathfrak{C}^J_{\Re,\succ}$ denotes this new class of acceptable arguments [Dun95, PS97, AC00].

Proposition 1 ($\mathfrak{C}^J_{\Re,\succ}$). *The set of acceptable arguments is the least fixpoint of* F *and the the least fixpoint of* F *is:*

$$\mathfrak{C}^J_{\Re,\succ} = \cup \mathsf{F}^{i \geqslant 0} = \mathfrak{C}_{\Re,\succ} \cup [\cup \mathsf{F}^{i \geqslant 1}(\mathfrak{C}_{\Re,\succ})]$$

Our motivation is to "decompose" beliefs hierarchically, where each level represents a qualitative degree of confidence. This "slicing" process is based on the rebutting and undercutting defeats. Before introducing acceptable inferences and qualitative reasoning, we detail some properties. Let $\mathfrak{C}_{\mathsf{Reb},\succ}$ (respectively $\mathfrak{C}_{\mathsf{Und},\succ}$) denotes the acceptability class associated to a rebutting defeat (respectively undercutting defeat). Let $\mathsf{Supp}(\mathfrak{C}_{\Re,\succ})$ be the union of the supports of all the acceptable arguments.

Property 1. $\mathsf{Supp}(\mathfrak{C}_{\mathsf{Reb},\succ})$ *can be inconsistent.*

Property 2. *Let* $(H, h) \in \mathfrak{C}_{\mathsf{Und},\succ}$*. For any* (H', h') *s.t.* $H' \subseteq H$*,* $(H', h') \in \mathfrak{C}_{\mathsf{Und},\succ}$*.*

Thus, every sub-argument of an acceptable argument is also acceptable.

Property 3. *The set* $\{H | (H, h) \in \mathfrak{C}_{\mathsf{Und},\succ}\}$ *may be inconsistent. Consequently the set* $\{h | (H, h) \in \mathfrak{C}_{\mathsf{Und},\succ}\}$ *can also be inconsistent.*

4 Acceptable inferences

After defining the set of acceptable arguments, the next stage consists of building a new inference relation, named acceptable inference, which enables to represent acceptable consequence induced by an acceptability class.

Definition 7 (Acceptable Inference). Let K be a belief base and σ its associated CPAF: $\sigma = \langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c\in\mathcal{C}} \geqslant_c, \succ \rangle$. ϕ is an acceptable consequence if and only there exists a set of formulae Φ such that $(\Phi, \phi) \in \mathfrak{C}^J_{\Re,\succ}$. This inference is noted: $K \mid\!\sim_{\Re} \phi$.

We can show that when the different preference relations $\geqslant_c$ satisfy a *Cut* rule, there is a link between the acceptability classes of the two frameworks $\langle \mathcal{C}, \mathcal{A}, \mathsf{Reb}, \bigcup_{c\in\mathcal{C}} \geqslant_c, \succ \rangle$ and $\langle \mathcal{C}, \mathcal{A}, \mathsf{Und}, \bigcup_{c\in\mathcal{C}} \geqslant_c, \succ \rangle$ and consequently between the corresponding sets of acceptable conclusions.

Definition 8. A preference relation $\geqslant$ satisfies a *Cut* rule iff: if $a \geqslant a \cup b$ then $a \geqslant b$.

Property 4. *Let $\langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c\in\mathcal{C}} \geqslant_c, \succ \rangle$ be a CPAF such that each $\geqslant_c$ ($c \in \mathcal{C}$) satisfies the Cut rule.*

$$\mathfrak{C}_{\mathsf{Und},\succ} \subseteq \mathfrak{C}_{\mathsf{Reb},\succ}$$

Let us consider the set of acceptable consequences: $\mathsf{Csq}(\mathfrak{C}_{\Re,\succ}) = \{\phi | K \mid\!\sim_{\Re} \phi\}$. According to property 4, we get:

Property 5. *Let $\langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c\in\mathcal{C}} \geqslant_c, \succ \rangle$ be a CPAF such that each $\geqslant_c$ ($c \in \mathcal{C}$) satisfies the Cut rule.*

$$\mathsf{Csq}(\mathfrak{C}_{\mathsf{Und},\succ}) \subseteq \mathsf{Csq}(\mathfrak{C}_{\mathsf{Reb},\succ})$$

As usual, in the case of consistent belief bases K, the sets $\mathsf{Csq}(\mathfrak{C}_{\mathsf{Und},\succ})$ and $\mathsf{Csq}(\mathfrak{C}_{\mathsf{Reb},\succ})$ become equivalent:

Property 6.

$$\mathsf{Csq}(\mathfrak{C}_{\mathsf{Und},\succ}) = \mathsf{Csq}(\mathfrak{C}_{\mathsf{Reb},\succ}) = \{\phi | K \vdash \phi\}$$

5 Towards Qualitative Reasoning

The basic idea is that it should be possible to say more about the acceptability of consequences. Indeed, we show how contexts determine a qualitative status of consequences. For this, we consider three inference relations: the first one defines the notion of contextual acceptable consequence. This relation exhibits acceptable consequences in a specific context. This relation is introduced so as to define consequence notions as proposed in [Rei80]: credulous and strong (or skeptical) consequence. A formula ϕ is a credulous consequences if there is a context such that ϕ is a contextual acceptable consequence. Strong consequences describe acceptable consequences sharing by all the contexts.
First of all, we consider acceptable consequences in a specific contexts. The definition is similar to acceptable consequences definition in mono-context preference-based argumentation framework (PAF).

Definition 9 (Contextual acceptable consequence). A belief base K and its associated CPAF $\sigma = \langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c\in\mathcal{C}} \geqslant_c, \succ \rangle$ entail ϕ in a context $c \in \mathcal{C}$, iff there exists Φ s.t. $(\Phi, \phi) \in \mathsf{C}^J_{\Re,\geqslant_c}$ ($K \mid\!\sim_{\Re} c : \phi$).

The next stage is to consider contextual inferences in a credulous way: if a belief is an acceptable consequence in a context, then this belief is a credulous consequence of the CPAF.

Definition 10 (Credulous consequence). Let K be a belief base and σ its associated CPAF: $\sigma = \langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c \in \mathcal{C}} \geqslant_c, \succ \rangle$. ϕ is a credulous consequence of K iff there exists $c \in \mathcal{C}$ s.t. $K \mathrel{|\!\sim}_{\Re} c : \phi$ ($K \mathrel{|\!\sim}_{\Re} \Diamond\phi$).

It is obvious that for each context c if $K \mathrel{|\!\sim}_{\Re} c : \phi$ then $K \mathrel{|\!\sim}_{\Re} \Diamond\phi$. The last stage considers inferences in a skeptical way: if a belief is an acceptable context in every contexts then this belief as to be considered as a strong consequence.

Definition 11 (Strong consequence). Let K be a belief base and σ its associated CPAF: $\sigma = \langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c \in \mathcal{C}} \geqslant_c, \succ \rangle$. ϕ is a strong consequence of K iff for all $c \in \mathcal{C}$ there exists a set Φ s.t. $(\Phi, \phi) \in \mathsf{C}^{J}_{\Re, \geqslant_c}$ ($K \mathrel{|\!\sim}_{\Re} \Box\phi$).

Property 7. *The set* $\{\phi | K \mathrel{|\!\sim}_{\Re} \Diamond\phi\}$ *can be inconsistent.*

Property 8. *The set* $\{\phi | K \mathrel{|\!\sim}_{\mathsf{Und}} \Box\phi\}$ *is consistent.*

Property 9.

$$\{\phi | K \mathrel{|\!\sim}_{\Re} \Box\phi\} \subseteq \mathsf{Csq}(\mathfrak{C}_{\Re,\succ}) \subseteq \{\phi | K \mathrel{|\!\sim}_{\Re} \Diamond\phi\}$$

As [EFK93], we suggest that these inference relations could be used to assign an ordering over the different set of consequences: strong conclusions are "better" than the credulous ones, for instance. We propose to define this ordering by also introducing the hierarchy induced by the different acceptability classes [EFK93, PS97], i.e. $\mathfrak{C}_{\mathsf{Reb},\succ}$ and $\mathfrak{C}_{\mathsf{Und},\succ}$. We regard an undercutting defeat as stronger than a rebutting defeat.

Definition 12 ($\gg$). Let K be a belief base and σ its associated CPAF: $\sigma = \langle \mathcal{C}, \mathcal{A}, \Re, \bigcup_{c \in \mathcal{C}} \geqslant_c, \succ \rangle$ such that each $\geqslant_c$ satisfies the *Cut* rule. Let us consider the following sets:

$$\begin{aligned}
\mathsf{S\text{-}Und\text{-}Conc} &= \{\phi | K \mathrel{|\!\sim}_{\mathsf{Und}} \Box\phi\} \\
\mathsf{A\text{-}Und\text{-}Conc} &= \mathsf{Csq}(\mathfrak{C}_{\mathsf{Und},\succ}) - \mathsf{S\text{-}Und\text{-}Conc} \\
\mathsf{C\text{-}Und\text{-}Conc} &= \{\phi | K \mathrel{|\!\sim}_{\mathsf{Und}} \Diamond\phi\} - \mathsf{A\text{-}Und\text{-}Conc} \\
\mathsf{S\text{-}Reb\text{-}Conc} &= \{\phi | K \mathrel{|\!\sim}_{\mathsf{Reb}} \Box\phi\} - \mathsf{S\text{-}Und\text{-}Conc} \\
\mathsf{A\text{-}Reb\text{-}Conc} &= \mathsf{Csq}(\mathfrak{C}_{\mathsf{Reb},\succ}) - \mathsf{Csq}(\mathfrak{C}_{\mathsf{Und},\succ}) - \mathsf{S\text{-}Reb\text{-}Conc} \\
\mathsf{C\text{-}Reb\text{-}Conc} &= \{\phi | K \mathrel{|\!\sim}_{\mathsf{Reb}} \Diamond\phi\} - \mathsf{C\text{-}Und\text{-}Conc} - \mathsf{A\text{-}Reb\text{-}Conc}
\end{aligned}$$

A strict ordering is enforced over these sets.

$$\mathsf{S\text{-}Und\text{-}Conc} \gg \mathsf{S\text{-}Reb\text{-}Conc} \gg \mathsf{A\text{-}Und\text{-}Conc} \gg \mathsf{A\text{-}Reb\text{-}Conc} \gg \mathsf{C\text{-}Und\text{-}Conc} \gg \mathsf{C\text{-}Reb\text{-}Conc}$$

From this hierarchy, we can discriminate between formulae of the belief base. This ordering provides a degree of confidence in a belief of K. For instance, beliefs in S-Und-Conc are consequences which are undercutting undefeated in every context and thus they have to be consider as the most acceptable beliefs of K.

6 Example

The example is inspired of the example presented in [Ver96]. Let us consider the following legal rules:

- A person driving a car after drinking too much alcohol should be fined.
- Minor persons should not be fined, except if there is an obvious risk of danger.

Assume that we have: John is minor and is driving after drinking too much alcohol. Let us suppose that the attorney believes that, since John was drunk, he was dangerous and thus should be fine. By contrast, John's lawyer mentions that John did not hurt somebody and thus there is no evidence of danger. This may be represented by the following formulas:

$$K = \{alcohol, minor, alcohol \rightarrow danger, \neg danger, alcohol \rightarrow fine, \\ minor \wedge danger \rightarrow fine, minor \wedge \neg danger \rightarrow \neg fine\}$$

and by the the contexts: $\{attorney, lawyer\}$. The preferences of the attorney are (al, fi, mi and da stand for $alcohol$, $fine$, $minor$ and $danger$):

$$\begin{array}{rl} (\{al, al \rightarrow da\}, da) & >_a (\{\neg da\}, \neg da) \\ (\{mi, al, al \rightarrow da, mi \wedge da \rightarrow fi\}, fi) & >_a (\{mi, \neg da, mi \wedge \neg da \rightarrow \neg fi\}, \neg fi) \\ (\{mi, al, al \rightarrow da, mi \wedge da \rightarrow fi\}, fi) & >_a (\{\neg da\}, \neg da) \\ (\{al, al \rightarrow fi\}, fi) & >_a (\{mi, \neg da, mi \wedge \neg da \rightarrow \neg fi\}, \neg fi) \end{array}$$

and the lawyer's preferences:

$$\begin{array}{rl} (\{\neg da\}, \neg da) & >_l (\{al, al \rightarrow da\}, da) \\ (\{mi, \neg da, mi \wedge \neg da \rightarrow \neg fi\}, \neg fi) & >_l (\{mi, al, al \rightarrow da, mi \wedge da \rightarrow fi\}, fi) \\ (\{mi, \neg da, mi \wedge \neg da \rightarrow \neg fi\}, \neg fi) & >_l (\{al, al \rightarrow fi\}, fi) \end{array}$$

Assume that the judge considers that the attorney is more convincing than the lawyer: $attorney \succ lawyer$. Let's consider a rebutting defeat. In this framework the only argument rebutting $(\{al, al \rightarrow da\}, da)$ is $(\{\neg da\}, \neg da)$. $(\{al, al \rightarrow da\}, da)$ belongs to the set $\mathfrak{C}_{\mathsf{Reb},\succ}$ since it is preferred to $(\{\neg da\}, \neg da)$ in the best context ($attorney$). We obtain the following consequences:

$$\begin{array}{lll} K \mid\!\sim_{\mathsf{Reb}} l : \neg danger & K \mid\!\sim_{\mathsf{Reb}} l : \neg fine & K \mid\!\sim_{\mathsf{Reb}} l : alcohol \\ K \mid\!\sim_{\mathsf{Reb}} a : danger & K \mid\!\sim_{\mathsf{Und}} a : fine & K \mid\!\sim_{\mathsf{Reb}} a : alcohol \\ K \mid\!\sim_{\mathsf{Reb}} \Diamond danger & K \mid\!\sim_{\mathsf{Reb}} \Diamond \neg danger & K \mid\!\sim_{\mathsf{Reb}} \Diamond alcohol \\ K \mid\!\sim_{\mathsf{Reb}} danger & K \mid\!\sim_{\mathsf{Und}} fine & K \mid\!\sim_{\mathsf{Reb}} \Box alcohol \end{array}$$

According to these inferences, we built the hierarchy ($alcohol \in$ S-Reb-Conc, $fine \in$ A-Und-Conc, $danger \in$ A-Reb-Conc, $\{\neg fine, \neg danger\} \subseteq$ C-Reb-Conc):

$$\{alcohol\} \gg \{fine\} \gg \{danger\} \gg \{\neg fine, \neg danger\}$$

7 Conclusion

The work presented here concerns the acceptability of arguments in contextual preference-based argumentation frameworks. Our first contribution is the definition of acceptability w.r.t multiple preference relations. We have investigated the acceptability notion in their individual and joint defense aspects and through the consideration of undercutting and rebutting defeats. Our second contribution concerns the introduction of a new ordering on acceptable beliefs. That is, this ordering extends the linguistics qualifiers presented in [EFK93] by taking into account the multiple contexts aspect. This is especially interesting in dialectical argumentation in order to represent group decision making or, to define status of beliefs.
An immediate extension of this work is to study the logical properties of the consequence relations [Dun95, AC00] and of the resulting preferences [ARS95, Gro91]. Another immediate extension is to consider other definitions of defeat relations such as those presented in [Ver96, Amg99].
Future work also includes taking into account several belief bases instead of one. In dialectical argumentation, the application is immediate: we may represent for instance agent-to-agent negotiation. In order to do so, we have to consider dialogue between agents [PS97, AC00].

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