Acceptability Semantics and Contextual Defeat Relations in Extended Frameworks

Diego C. Martínez Alejandro J. García Guillermo R. Simari
Comisión de Investigaciones Científicas y Técnicas - CONICET
Artificial Intelligence Research and Development Laboratory
Department of Computer Science and Engineering
UNIVERSIDAD NACIONAL DEL SUR
Bahía Blanca - Buenos Aires - República Argentina
E-mail: {dcm,ajg,grs}@cs.uns.edu.ar

Abstract

In this work, contexts for extended argumentation frameworks (EAF) are defined. A context for an EAF is another framework where original arguments, conflicts and preferences are kept, while introducing new arguments leading to new defeat relations. Thus, the context may interfere with the original classification of arguments, inducing new set of extensions. These semantic change in the outcome of an extended framework in a particular context is characterized, and Dung's acceptability concept is analyzed on this basis.

1 Introduction

Argumentation has became an important subject of research in Artificial Intelligence and it is also of interest in several disciplines, such as Logic, Philosophy and Communication Theory. This wide range of attention is due to the constant presence of argumentation in many activities, most of them related to social interactions between humans, as in civil debates, legal reasoning or every day dialogues. Basically, an argument is a piece of reasoning that supports a claim from certain evidence. The tenability of this claim must be confirmed by analyzing other arguments for and against such a claim. In formal systems of defeasible argumentation, a claim will be accepted if there exists an argument that supports it, and this argument is acceptable according to an analysis between it and its counterarguments. After this dialectical analysis is performed over the set of arguments in the system, some of them will be *acceptable*, *justified* or *warranted* arguments, while others will be not. The study of the acceptability of arguments is the search for rationally based positions of acceptance in a given scenario of arguments and their relationships. It is one of the main concerns in Argumentation Theory.

Abstract argumentation systems [5, 12, 6, 1, 2] are formalisms for argumentation where some components remain unspecified, being the structure of an argument the main abstraction. In this kind of system, the emphasis is put on the semantic notion of finding the set of accepted arguments. Most of them are based on the single abstract concept of *attack* represented as an abstract relation, and extensions are defined as sets of possibly accepted arguments. For two arguments $\mathcal{A}$ and $\mathcal{B}$, if $(\mathcal{A}, \mathcal{B})$ is in the attack relation, then the acceptance of $\mathcal{B}$ is conditioned by the acceptance of $\mathcal{A}$, but not the other way around. It is said that argument $\mathcal{A}$ attacks $\mathcal{B}$, and it implies a priority between conflicting arguments. It is widely understood that this priority is related to the argument strengths. Several frameworks do include an argument order [1, 3, 4], although this order is used at another level, as the classic attack relation is kept.

In [8, 7] an extended abstract argumentation framework (EAF)is introduced, where two kinds of defeat relations are present. These relations are obtained by applying a preference criterion between conflictive arguments. The conflict relation is kept in its most basic, abstract form: two arguments are in conflict simply if both arguments cannot be accepted simultaneously. The preference criterion subsumes any evaluation on arguments and it is used to determine the direction of the attack. This argument comparison, however, is not always succesful and therefore attacks, as known in classic frameworks, are no longer valid.

An argumentation framework Φ is basically the modelization of a knowledge base conformed by arguments. These arguments interact each other and then several possible outcomes as sets of accepted arguments are obtained. However, it is possible for this outcome to be different when new arguments are taken into account. These new arguments are considered the *context* of the framework Φ. For example, when a person is judged in a regular trial, several arguments for and against its innocence are exposed by the district attorney and by the defender lawyer. This set of arguments, say $Case$, is about the assumptions and facts of the particular case. Another set of arguments, however, is taked into account: those produced by the juror and the judge. Thus, the set $Case$ is placed in a special *context*: the actual trial. If the person is declared guilty, its lawyers may appeal to an upper level of Justice Court. Basically, they want to expose its arguments in a *different context*, in order to plead the defended not guilty.

We think situations like above may be modeled using extended abstract frameworks. This paper is organized as follows. In Section 2 our extended argumentation framework is presented. In Section 3 the notion of *contexts* for EAF is introduced. In Section 4 the behaviour of contexts is analyzed according to Dung's acceptability semantics [5]. Finally, the conclusions and future work are presented in Section 5.

2 Extended Argumentation Framework

In our extended argumentation framework three relations are considered: *conflict*, *subargument* and *preference* between arguments. The definition follows:

Definition 1.
An extended abstract argumentation framework (EAF) is a quartet Φ=$\langle AR, \sqsubseteq, \mathbf{C}, \mathbf{R}\rangle$*, where* AR *is a finite set of arguments, and* $\sqsubseteq$*,* $\mathbf{C}$ *and* $\mathbf{R}$ *are binary relations over* AR *denoting respectivelly subarguments, conflicts and preferences between arguments.*

Arguments are abstract entities, as in [5], that will be denoted using calligraphic uppercase letters, possibly with indexes. In this work, the subargument relation is not relevant for the topic addressed. Basically, it is used to model the fact that arguments may include inner pieces of reasoning that can be considered arguments by itself, and it is of special interest in dialectical studies [9]. Hence, unless explicity specified, in the rest of the paper $\sqsubseteq = \emptyset$. The conflict relation $\mathbf{C}$ states the incompatibility of acceptance between arguments. Given a set of arguments S, an argument $\mathcal{A} \in S$ is said to be in conflict in S if there is an argument $\mathcal{B} \in S$ such that $\{\mathcal{A}, \mathcal{B}\} \in \mathbf{C}$. The relation $\mathbf{R}$ is introduced in the framework and it will be used to evaluate arguments, modelling a preference criterion based on a measure of strength.

Definition 2.
Given a set of arguments AR, an argument comparison criterion $\mathbf{R}$ *is a binary relation on AR. If $\mathcal{A}\mathbf{R}\mathcal{B}$ but not $\mathcal{B}\mathbf{R}\mathcal{A}$ then $\mathcal{A}$ is strictly preferred to $\mathcal{B}$, denoted $\mathcal{A} \succ \mathcal{B}$. If $\mathcal{A}\mathbf{R}\mathcal{B}$ and $\mathcal{B}\mathbf{R}\mathcal{A}$ then $\mathcal{A}$ and $\mathcal{B}$ are indifferent arguments with equal relative preference, denoted $\mathcal{A} \equiv \mathcal{B}$. If neither $\mathcal{A}\mathbf{R}\mathcal{B}$ or $\mathcal{B}\mathbf{R}\mathcal{A}$ then $\mathcal{A}$ and $\mathcal{B}$ are incomparable arguments, denoted $\mathcal{A} \bowtie \mathcal{B}$.*

For two arguments $\mathcal{A}$ and $\mathcal{B}$ in AR, such that the pair $\{\mathcal{A}, \mathcal{B}\}$ belongs to $\mathbf{C}$ the relation $\mathbf{R}$ is considered. In order to elucidate conflicts, the participant arguments must be compared. Depending on the preference order, two notions of argument defeat are derived.

Definition 3.
Let Φ=$\langle AR, \sqsubseteq, \mathbf{C}, \mathbf{R}\rangle$ be an EAF and let $\mathcal{A}$ and $\mathcal{B}$ be two arguments such that $(\mathcal{A}, \mathcal{B}) \in \mathbf{C}$. If $\mathcal{A} \succ \mathcal{B}$ then it is said that $\mathcal{A}$ is a proper defeater of $\mathcal{B}$. If $\mathcal{A} \equiv \mathcal{B}$ or $\mathcal{A} \bowtie \mathcal{B}$, it is said that $\mathcal{A}$ is a blocking defeater of $\mathcal{B}$, and viceversa. An argument $\mathcal{B}$ is said to be a defeater of an argument $\mathcal{A}$ if $\mathcal{B}$ is a blocking or a proper defeater of $\mathcal{A}$.

Example 1. *Let $\Phi_1 = \langle AR, \sqsubseteq, \mathbf{C}, \mathbf{R}\rangle$ be an EAF where $AR = \{\mathcal{A}, \mathcal{B}, \mathcal{C}, \mathcal{D}, \mathcal{E}\}$, $\sqsubseteq = \emptyset$, $\mathbf{C} = \{\{\mathcal{A}, \mathcal{B}\}, \{\mathcal{B}, \mathcal{C}\}, \{\mathcal{C}, \mathcal{D}\}\}, \{\mathcal{C}, \mathcal{E}\}\}$ and $\mathcal{A} \succ \mathcal{B}, \mathcal{B} \succ \mathcal{C}$, $\mathcal{E} \bowtie \mathcal{C}$, $\mathcal{C} \equiv \mathcal{D}$.*

Extended abstract frameworks can also be depicted as graphs, with different types of arcs, called *EAF-graphs*. We use to represent arguments as black triangles. An arrow ($\rightarrow$) is used to denote proper defeaters. A double-pointed straight arrow ($\longleftrightarrow$) connects blocking defeaters considered equivalent in strength, and a double-pointed zig-zag arrow ($\leftrightsquigarrow$) connects incomparable blocking defeaters. In Figure 1, the framework Φ_1 is shown. Argument $\mathcal{A}$ is a proper defeater of $\mathcal{B}$. Argument $\mathcal{B}$ is a proper defeater of $\mathcal{C}$, and $\mathcal{E}$ is an incomparable blocking defeater of $\mathcal{C}$ and viceversa. Argument $\mathcal{D}$ and $\mathcal{C}$ are blocking defeaters being equivalent in strength.

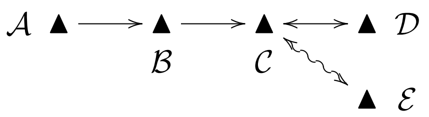

Figure 1: EAF-graph of framework Φ_1

In the next section we formally present *contexts* for extended argumentation frameworks and several semantic notions around this concept.

3 Contexts

An extended argumentation framework may be considered in different contexts, where its elements are still valid and well-defined, but interacting with new arguments. This is formalized as follows.

Definition 4.
Let Φ=$\langle AR_1, \sqsubseteq_1, \mathbf{C}_1, \mathbf{R}_1 \rangle$ *be an extended argumentation framework. A context for* Φ *is a tuple* $\langle AR_2, \sqsubseteq_2, \mathbf{C}_2, \mathbf{R}_2 \rangle$ *such that*

- $AR_1 \subseteq AR_2$,
- *For any pair of conflicting arguments* $(\mathcal{A}, \mathcal{B}) \in \mathbf{C_2}$ *such that* $\mathcal{A}, \mathcal{B} \in AR_1$ *then* $(\mathcal{A}, \mathcal{B}) \in \mathbf{C_1}$.
- *If* $\mathcal{A}\mathbf{R}_2\mathcal{B}$ *for any pair of arguments* $\mathcal{A}, \mathcal{B} \in AR_1$, *then* $\mathcal{A}\mathbf{R}_1\mathcal{B}$.
- *For any arguments* $\mathcal{X}, \mathcal{Y} \in AR_2$ *such that* $\mathcal{X} \sqsubseteq_2 \mathcal{Y}$, *if* $\mathcal{X} \in AR_2 - AR_1$ *then* $\mathcal{Y} \in AR_2 - AR_1$.

Arguments in $AR_2 - AR_1$ *are called contextual arguments.*

Definition 4 states that a context for an extended argumentation framework Φ_1 is just another extended framework Φ_2 where

1. all of the arguments in Φ_1 are included in Φ_2, and
2. no conflict between arguments of Φ_1 is added by Φ_2, and
3. preferences established in Φ_1 remain intact in Φ_2, and
4. Φ_2 may include new superarguments of arguments in Φ_1, but not the other way around.

Any framework is said to be a context for itself or a *self-context*.

In Figure 2 the general idea of framework context is shown. New arguments are present, which are able to defeat or to be defeated by arguments in Φ_1. Note that if Φ_2 is a context for Φ_1 then Φ_1 is a restriction of Φ_2, in the sense of [10], taking into account subarguments. That is, the set AR_1 must be *structurally complete*: it includes the subarguments of all of its elements.

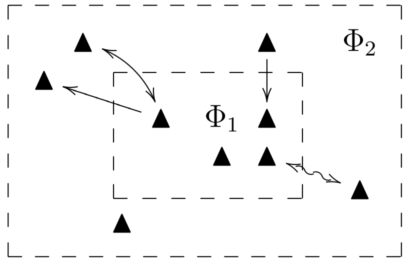

Figure 2: EAF Φ_2 is a context for EAF Φ_1

Example 2. *Let* $\Phi_1 = \langle AR_1, \sqsubseteq_1, \mathbf{C}_1, \mathbf{R}_1 \rangle$ *be an extended abstract framework where* $AR_1 = \{\mathcal{A}, \mathcal{B}, \mathcal{C}\}$, $\mathbf{C_1} = \{\{\mathcal{A}, \mathcal{B}\}, \{\mathcal{B}, \mathcal{C}\}\}$, $\mathcal{A} \succ \mathcal{B}$ *and* $\mathcal{B} \bowtie \mathcal{C}$. *The following framework* $\Phi_2 = \langle AR_2, \sqsubseteq_2, \mathbf{C}_2, \mathbf{R}_2 \rangle$ *is a context for* Φ_1*, where* $AR_2 = \{\mathcal{A}, \mathcal{B}, \mathcal{C}, \mathcal{D}, \mathcal{E}\}$, $\mathbf{C_2} = \{\{\mathcal{A}, \mathcal{B}\}, \{\mathcal{B}, \mathcal{C}\}\{\mathcal{C}, \mathcal{D}\}, \{\mathcal{A}, \mathcal{E}\}\}$, $\mathcal{A} \succ \mathcal{B}$, $\mathcal{B} \bowtie \mathcal{C}$, $\mathcal{E} \succ \mathcal{A}$ *and* $\mathcal{D} \equiv \mathcal{C}$*, is a context for* Φ_1.

The context Φ_X for an extended framework Φ may also be placed in a new context Φ_Y. Even more, this new context Φ_Y is also a context for Φ.

Proposition 1. *Let* Φ_1 *and* Φ_2 *be two extended argumentation frameworks such that* Φ_2 *is a context for* Φ_1*. Then every extended framework* Φ_3 *such that* Φ_3 *is a context for* Φ_2*, it is also a context for* Φ_1.

Proof. Obvious from the definition. □

In order to evaluate the outcome of an argumentation framework in a particular context, we use the notation adopted by Baroni & Giacomin in [11], where semantic extensions are studied.

Definition 5. *[11]*
Given a generic argumentation semantic $\mathcal{S}$*, the set of extensions prescribed by* $\mathcal{S}$ *for an* EAF Φ *is denoted as* $\mathcal{E}_S(\Phi)$

The set of argument extensions induced by an EAF may change when its arguments are challenged by new arguments in the context. It is possible that an argument is no longer present in every extension, or to be included in a new one. Even more, an entire extension may not be valid in a specific context. The following definition introduces new terminology in relevant cases.

Definition 6.
Let $\Phi_1 = \langle AR_1, \sqsubseteq_1, \mathbf{C}_1, \mathbf{R}_1 \rangle$ *be an extended argumentation framework and let* $\Phi_2 = \langle AR_2, \sqsubseteq_2, \mathbf{C}_2, \mathbf{R}_2 \rangle$ *be a context for* Φ_1*. Let* $\mathcal{S}$ *be an argumentation semantic.*

- Φ_2 *is said to* $\mathcal{S}$*-confirm* Φ_1 *if* $\mathcal{E}_S(\Phi_1) = \mathcal{E}_S(\Phi_2)$.
- Φ_2 *is said to* $\mathcal{S}$*-preserve* Φ_1 *if for every extension* $X \in \mathcal{E}_S(\Phi_1)$*, there is an extension* $Y \in \mathcal{E}_S(\Phi_2)$ *such that* $X \subset Y$*. Every argument in* X *is said to be preserved by* Φ_2.
- Φ_2 *is said to* $\mathcal{S}$*-expand* Φ_1 *if* Φ_2 $\mathcal{S}$*-preserve* Φ_1 *and every extension* $Y \in \mathcal{E}_S(\Phi_2)$ *is a superset of an extension* X *in* $\mathcal{E}_S(\Phi_1)$.
- Φ_2 *is said* $\mathcal{S}$*-revise* Φ_1 *if exists an extension* X *in* $\mathcal{E}_S(\Phi_1)$ *such that no extension in* $\mathcal{E}_S(\Phi_2)$ *is a superset of* X*. The set* X*, as an extension, is said to be revised by* Φ_2*. Also it is said that* Φ_2 *revises* Φ_1 *in* X.

The following table summarizes the concepts presented in Definition 6, and captures the essential meaning of every case.

Concept	Meaning
$\mathcal{S}$-confirm	*No extension is changed or added*
$\mathcal{S}$-preserve	*The same alternatives of acceptance are available, but some extensions of Φ_2 may propose new sets of arguments for acceptance.*
$\mathcal{S}$-expand	*There is always an extension of Φ_2 that includes a valid alternative of acceptance for Φ_1 according to $\mathcal{S}$.*
$\mathcal{S}$-revise	*The alternative X of acceptance in Φ_1 is no longer valid in Φ_2 as a whole, $i.e.$ the extension is "broken" or discarded by Φ_2.*

It is clear that any EAF Φ $\mathcal{S}$-confirms Φ. When a context Φ_X $\mathcal{S}$-confirm an EAF Φ_Y then every argument in Φ_X (if any) is defeated by at least an argument in an extension of Φ_Y. Simple frameworks and contexts exhibiting these properties are shown in Example 3 and Figure 3.

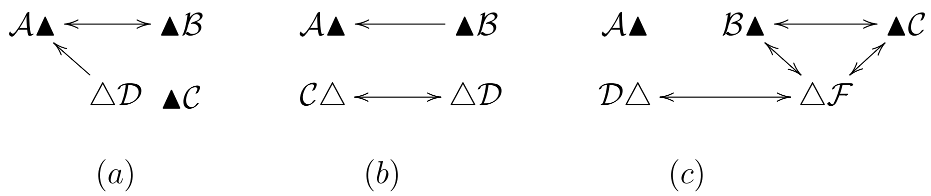

Figure 3: Frameworks and contexts

Example 3. *Consider the three frameworks depicted in Figure 2. In each case, arguments in Φ_1 are shown as black triangles and arguments in context Φ_2 are shown as white triangles. Let $\mathcal{P}$ be the admissibility-based preferred semantics and let $\mathcal{E}_{\mathcal{P}(\Phi)}$ the set of all preferred extensions of framework Φ. In the following table the preferred extensions and context properties are shown:*

Example	$\mathcal{E}_{\mathcal{P}(\Phi_1)}$	$\mathcal{E}_{\mathcal{P}(\Phi_2)}$	*Properties of Φ_2 with respect to Φ_1*
(a)	$\{\{\mathcal{A},\mathcal{C}\},$ $\{\mathcal{B},\mathcal{C}\}\}$	$\{\ \{\mathcal{D},\mathcal{B},\mathcal{C}\}\ \}$	*$\mathcal{P}$-revise, not $\mathcal{P}$-preserve, not $\mathcal{P}$-expand*
(b)	$\{\{\mathcal{B}\}\}$	$\{\ \{\mathcal{B},\mathcal{C}\},\{\mathcal{B},\mathcal{D}\}\ \}$	*$\mathcal{P}$-preserve, $\mathcal{P}$-expand, not $\mathcal{P}$-revise*
(c)	$\{\{\mathcal{A},\mathcal{B}\},$ $\{\mathcal{A},\mathcal{C}\}\}$	$\{\ \{\mathcal{A},\mathcal{B},\mathcal{C}\},$ $\{\mathcal{A},\mathcal{C},\mathcal{D}\},$ $\{\mathcal{A},\mathcal{F}\}\ \}$	*$\mathcal{P}$-preserve, not $\mathcal{P}$-expand, not $\mathcal{P}$-revise*

In the next section the acceptability semantics defined in [5] is analyzed for extended abstract frameworks and its contexts.

4 Contexts and acceptability-based semantics

The argumentation framework defined by Dung in [5] is the core of argument basic semantic notions. Its framework only includes arguments and attacks as a binary relation on arguments, the basic elements for semantics elaborations. The main contribution is the formalization of several argument extensions capturing rational sets of acceptance. The key notion is *acceptability of arguments*, defined here for extended abstract frameworks

Definition 7.
Let $\langle AR, \sqsubseteq, \mathbf{C}, \mathbf{R} \rangle$ be an EAF. An argument $\mathcal{A} \in AR$ is acceptable with respect to a set of arguments $S \subseteq AR$ if and only if every argument $\mathcal{B}$ defeating $\mathcal{A}$ is defeated by an argument in S.

Defeaters mentioned in Definition 7 may be either proper or blocking ones. It is also said that S is *defending* $\mathcal{A}$ against its attackers. The defense or reinstatement of arguments is a central concept on argumentation. Extensions are required to be free of inner conflicts, and thus the following definition is needed.

Definition 8.
A set of arguments $S \subseteq AR$ is said to be conflict-free if for all $\mathcal{A}, \mathcal{B} \in S$ it is not the case that $\{\mathcal{A}, \mathcal{B}\} \in \mathbf{C}$.

As said before, in Dung's approach several semantic notions are defined as argument extensions leading to rational positions of acceptance. These extensions can also be applied to extended frameworks and are summarized in the following definition.

Definition 9.
A set of arguments S is said to be

- *admissible if it is conflict-free and defends all its elements.*
- *a preferred extension if S is a maximal (for set inclusion) admissible set.*
- *a complete extension if S is admissible and it includes every acceptable argument w.r.t. S.*
- *a grounded extension if and only if it is the least (for set inclusion) complete extension.*
- *a stable extension if S is conflict-free and it attacks each argument not in S.*

The grounded extension of a framework Φ, denoted GE_Φ, is also the least fixpoint of a simple monotonic *characteristic* function:

$$F_{AF}(S) = \{\mathcal{A} : \mathcal{A} \text{ is acceptable wrt } S\}.$$

Several modifications to the classic Dung's framework are proposed in the literature, and new semantic notions were introduced. For example, in [6] the original framework is kept, while presenting a new argument extension. In [1], preferences between arguments are added to the framework and new semantic consideratios are made.

The following proposition uses Definition 6 applied to preferred and grounded extensions.

Proposition 2. *Let* $\Phi_1 = \langle AR_1, \sqsubseteq_1, \mathbf{C}_1, \mathbf{R}_1 \rangle$ *be an extended argumentation framework and let* $\Phi_2 = \langle AR_2, \sqsubseteq_2, \mathbf{C}_2, \mathbf{R}_2 \rangle$ *be a context for* Φ_1*. Let* $\mathcal{P}$ *and* $\mathcal{G}$ *be the preferred and grounded semantics respectively.*

- *If* Φ_2 $\mathcal{P}$*-preserves* Φ_1 *then every argument in an extension* $X \in \mathcal{E}_{\mathcal{P}}(\Phi_1)$ *is acceptable with respect to* AR_2*.*
- *If* Φ_2 $\mathcal{G}$*-preserves* Φ_1 *then also* Φ_2 $\mathcal{G}$*-expands* Φ_1*.*

Proof. If Φ_2 $\mathcal{P}$-preserves Φ_1 then every argument included in a preferred extension X of Φ_1 is also included in a preferred extension of Φ_2 and therefore is acceptable with respect to a set in AR_2. The grounded extension is unique (being a skeptical notion), and thus if Φ_2 $\mathcal{G}$-preserves Φ_1, then the grounded extension of Φ_2 includes every argument in the grounded extension of Φ_1. As these are the only sets in $\mathcal{E}_{\mathcal{P}}(\Phi_1)$ and $\mathcal{E}_{\mathcal{P}}(\Phi_2)$, then Φ_2 $\mathcal{G}$-expands Φ_1. □

As stated in Proposition 1, a context Φ_3 for a framework Φ_2 being a context for Φ_1, is in turn a context for Φ_1. As Φ_2 and Φ_3 are taking into account new arguments with respect to Φ_1, the extensions may vary among these frameworks. For a semantic notion $\mathcal{S}$, an argument $\mathcal{A}$ may be in an extension X_1 of $\mathcal{E}_{\mathcal{S}}(\Phi_1)$, but not in any extension of $\mathcal{E}_{\mathcal{S}}(\Phi_2)$. Later on, it is possible for $\mathcal{A}$ to be included in an extension of $\mathcal{E}_{\mathcal{S}}(\Phi_3)$, resembling argument reinstatement. The following proposition relates this situation in the particular case of acceptability semantics.

Proposition 3. *Let* Φ_1 *and* Φ_2 *be two extended argumentation frameworks such that* Φ_2 *is a context for* Φ_1 *and let* $\mathcal{G}$ *be the grounded extension semantics. If* Φ_2 $\mathcal{G}$*-revise* Φ_1*, it is possible to construct a context* Φ_3 *for* Φ_2 *such that* Φ_3 $\mathcal{G}$*-expand* Φ_1*.*

Proof. If Φ_2 $\mathcal{G}$-revise Φ_1, then a subset $S \subseteq GE_{\Phi_1}$ is not included in GE_{Φ_2}, due to new defeaters in $AR_2 - AR_1$. Let $S' = \{\mathcal{D}_1, \mathcal{D}_2, ..., \mathcal{D}_n, \}$ be the set of these defeaters. The extended framework $\Phi_3 = \langle AR_3, \sqsubseteq_3, \mathbf{C}_3, \mathbf{R}_3 \rangle$ is constructed as following:

- $AR_3 = AR_2 \cup \{\mathcal{Z}_1, \mathcal{Z}_2, ..., \mathcal{Z}_n\}$ where $\mathcal{Z}_i$, $1 \leq i \leq n$ is a new argument not appearing in AR_2.
- $\sqsubseteq_3 = \emptyset$,
- $\mathbf{C_3} = \mathbf{C_2} \cup \bigcup_i \{\mathcal{D}_i, \mathcal{Z}_i\}$
- $\mathcal{Z}_i \succ \mathcal{D}_i$ for all $\mathcal{D}_i, \mathcal{Z}_i$

As any argument $\mathcal{D}_i$ is defeated by a defeater-free argument ($\mathcal{Z}_i$), any threat over S introduced by Φ_2 is no longer valid, and then every argument in S is included in a grounded extension again. Also every $\mathcal{Z}_i$ is in the grounded extension as they are defeater-free arguments. □

4.1 Non-relevant arguments

Some arguments in a context may not be relevant for changes in semantic extensions. Basically, these are arguments such that its inclusion is not a threat for other arguments. Of course, this notion is considered under a particular semantic notion $\mathcal{S}$. In the following definition, non-relevant arguments are presented according to the classical grounded extension.

Definition 10.
Let $\Phi_1 = \langle AR_1, \sqsubseteq_1, \mathbf{C}_1, \mathbf{R}_1 \rangle$ be an extended argumentation framework and let $\Phi_2 = \langle AR_2, \sqsubseteq_2, \mathbf{C}_2, \mathbf{R}_2 \rangle$ be a context for Φ_1. Let $\mathcal{A}$ be an argument in the grounded extension GE_{Φ_1}. A contextual argument $\mathcal{X}$ is said to be non-relevant for $\mathcal{A}$ if

- *$\mathcal{X}$ does not directly nor indirectly defeats $\mathcal{A}$, or*
- *whenever $\mathcal{X}$ directly or indirectly defeats $\mathcal{A}$, it is directly or indirectly defeated by an argument in GE_{Φ}*

Non relevant arguments for $\mathcal{A}$ are those contextual arguments not being able to avoid the inclusion of $\mathcal{A}$ in the grounded extension of the context. This is important en several scenarios. Following the introductory analogy if Justice trials, non-relevant arguments are the main target of lawyers. These arguments may be viewed as a useless argument used by a member of the juror. It is useless because, even when defeating an argument in the case, it is already defeated by an argument in that case. These arguments are important in different ways. For example, a defender lawyer may want to introduce enough arguments to defeat any contextual argument defeating an argument exposed by himself. He is trying to maximize the number of non-relevant contextual arguments in that sense. On the other hand, he also wants to avoid the defeat of juror's arguments defeating arguments exposed by the District attorney. In this sense, he is trying to minimize the number of non-relevant arguments. Of course, they do not know *a priori* any of the contextual arguments. All they can do is to produce a set of arguments good enough to face any court.

5 Conclusions

An argumentation framework Φ is basically the model of a knowledge base based on arguments. These arguments interact each other and then several possible outcomes, as sets of accepted arguments, are obtained. However, it is possible for this outcome to be different when new arguments are taken into account. These new arguments are considered the *context* of the framework Φ. In this work, we formally defined *contexts* for extended argumentation frameworks (EAF). In general terms, a context for an EAF is another framework where original arguments, conflicts and preferences are kept, while new arguments are introduced, possibly leading to new defeat relations. As new argument interactions are present, the context may apply changes in the original classification of arguments, inducing new set of extensions. These semantic change in the outcome of an extended framework in a particular context was characterized, and Dung's acceptability concept was analyzed on this basis.

References

[1] Leila Amgoud and Claudette Cayrol. On the acceptability of arguments in preference-based argumentation. In *14th Conference on Uncertainty in Artificial Intelligence (UAI'98) , Madison, Wisconsin*, pages 1–7, San Francisco,California, juillet 1998. Morgan Kaufmann.

[2] Leila Amgoud and Claudette Cayrol. A reasoning model based on the production of acceptable arguments. In *Annals of Mathematics and Artificial Intelligence*, volume 34, 1-3, pages 197–215. Benferhat, Prade, eds Kluwer Academic Publishers, Dordrecht, The Netherlands, March 2002.

[3] Leila Amgoud and Laurent Perrussel. Arguments and Contextual Preferences. In *Computational Dialectics-Ecai workshop (CD2000) , Berlin*, August 2000.

[4] T.J.M. Bench-Capon. Value-based argumentation frameworks. In *Proc. of Non-monotonic Reasoning*, pages 444–453, 2002.

[5] Phan M. Dung. On the Acceptability of Arguments and its Fundamental Role in Nomonotonic Reasoning and Logic Programming. In *Proc. of the 13th. International Joint Conference in Artificial Intelligence (IJCAI), Chambéry, Francia*, pages 852–857, 1993.

[6] Hadassa Jakobovits. Robust semantics for argumentation frameworks. *Journal of Logic and Computation*, 9(2):215–261, 1999.

[7] Diego C. Martínez, Alejandro J. García, and Guillermo R. Simari. On acceptability in abstract argumentation frameworks with an extended defeat relation. In *Proc. of I International Conference on Computational Models of Arguments, COMMA 2006*, pages 273–278, 2006.

[8] Diego C. Martínez, Alejandro J. García, and Guillermo R. Simari. Progressive defeat paths in abstract argumentation frameworks. In *Proceedings of the 19th Conference of the Canadian Society for Computational Studies of Intelligence, Canadian AI 2006*, pages 242–253, 2006.

[9] Diego C. Martínez, Alejandro J. García, and Guillermo R. Simari. Modelling well-structured argumentation lines. In *Proc. of International Joint Conference on Artificial Intelligence IJCAI-2007 (in press)*, 2007.

[10] M. Giacomin P. Baroni. Characterizing defeat graphs where argumentation semantics agree. In *ArgNMR, Workshop on Argumentation and Non-Monotonic Reasoning*, pages 33–48, 2007.

[11] Massimiliano Giacomin Pietro Baroni. Evaluation and comparison criteria for extension-based argumentation semantics. In *Computational Models of Argument - Proceedings of I International Conference on Computational Models of Arguments, COMMA 2006*, pages 157–168, 2006.

[12] Gerard A. W. Vreeswijk. Abstract argumentation systems. *Artificial Intelligence*, 90(1–2):225–279, 1997.