

**COST STSM Reference Number: STSM-AT-117**  
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**STSM Topic: Argumentation: support and dynamics**  
**Applicant: Serena Villata**

In June, Serena Villata (University of Turin) has made a Short Term Scientific Mission to Leendert van der Torre and his research group at the University of Luxembourg. The arrival in Luxembourg was on Monday the 7th of June, and departure was two weeks later on Friday 18th of June.

The aim of this visit was to explore and analyze the relation between two relevant notions from the point of view of argumentation such as the support relation between the arguments and their dynamics. Dung's formal framework allows to represent the arguments and a defeat relation between them but, as highlighted also by other existing works in this area, there can be the necessity to represent two kinds of interactions between arguments, support and defeat. This visit aimed at exploring a way of representing both the relations without extending Dung's framework maintaining thus all its properties. These topics are receiving an increased attention not only in the argumentation community but also in the multiagent systems one. Given a long-term collaboration between the two institutions of the University of Turin and the University of Luxembourg, these topics ended up with a paper accepted at the COMMA conference in September 2010.

Support is a controversial notion in argumentation theory. Toulmin proposes a model where support is a relation between data and claims and Pollock's OSCAR beliefs are justified if and only if they are supported by an argument that is undefeated. In Dung's framework of abstract argumentation, as introduced above, support is no longer explicit and only one kind of interaction between arguments is considered, the attack relation. Three approaches have been proposed to model support in Dung's framework: by Dung's notion of defence, by instantiating abstract arguments and by adding support relations among arguments. Bipolar argumentation frameworks by Cayrol et al. are an extension of Dung's abstract framework with the support relation. Bipolarity refers to the presence of two independent kinds of interaction between the arguments having a diametrically opposed nature.

A first concern is whether a relation of support is really necessary in Dung's framework. Some researchers doubt whether the support relation that holds between premises and conclusion by instantiating arguments should be really distinguished from the support relation among arguments proposed in bipolar argumentation. The aim of the discussion of van der Torre and Villata is not to take a position in this debate but to provide a new way to model support in bipolar argumentation frameworks.

During Villata's stay in Luxembourg, Villata and van der Torre discussed the representation of deductive support in the methodology they developed thus far together with Boella and Gabbay, called meta-argumentation. van der Torre and

Villata discussed how to model deductive support in meta-argumentation. In their model, support has the following semantics: given that  $a$  supports  $b$ , then if  $b$  is not accepted then  $a$  is not accepted either and if  $a$  is accepted then  $b$  is accepted too. This modelling technique allows to represent support without extending Dung's abstract framework. Villata and van der Torre are developing a model where they add meta-arguments which can represent support, attack relations and so on.

An important issue which has been discussed by Villata and van der Torre concerns the dynamics of support. A first question to be answered is whether a support relation can be attacked? In the last years, there have been a number of works about second-order attacks in argumentation theory. These works start from the idea that also attack relations can be attacked. In the case of support, the dynamics can consist in an attack to the support relation. The question here is what are the consequences of this kind of attack? The consequence is that the constraints on the acceptability of deductive support stated above are no more valid. Introducing attacks on the support relation it is possible to provide a representation of defeasible support.

The discussion about the modelling of support in meta-argumentation continued on the base of the concern mentioned above. At the moment it has been discussed only how to represent support of bipolar argumentation in meta-argumentation. The advantage in using this kind of approach consists in reusing all Dung's properties, algorithms and principles without the need of extending it. Villata and van der Torre discussed, always in this context, the representation of accrual, rebut and undercut in meta-argumentation. The representation of accrual, rebut and undercut in their approach has the aim to provide a model of support also for instantiated arguments.

van der Torre and Villata's model of defeasible support allows to represent both rebut and undercut in meta-argumentation. Rebut is modelled when there is a support " $a$  supports  $b$ " and an attack relation " $c$  attacks  $b$ " while undercut is modelled when there is an attack " $c$  attacks ( $a$  supports  $b$ )" so when the support relation itself is attacked. Consider the following example: the fact that Tweety is a bird ( $tb$ ) provides support for its flying ability ( $tf$ ). Then it turns out that Tweety is a penguin ( $tp$ ). Argument "Tweety flies" is attacked by "Tweety is a penguin", " $tp$  attacks  $tf$ ". Following the constraints Villata and van der Torre have for deductive support, does it mean that Tweety is not a bird? Certainly not: argument  $tp$  attacks both the argument  $tf$  but also the fact that being a bird supports the Flying ability of Tweety.

Finally, Villata and van der Torre discussed how to model accrual in meta-argumentation. This model has to consider the fact that two or more arguments support each other in attacking another argument. Another topic discussed during the stay of Villata in Luxembourg consists in considering the case where support is stronger than attack. When a supported argument is attacked by another argument, does the supporter argument attack the attacking argument? Which kind of constraints are needed for these dynamics of support have been discussed.