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# The role of argumentation in online epistemic communities: the anatomy of a conflict in Wikipedia

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## ABSTRACT

**Motivation** – This research aims to investigate the processes by which knowledge objects — in this case Wikipedia pages on astronomy — are elaborated, in online communities, focussing on the role of argumentative interactions.

**Research approach** – We articulate qualitative multidimensional analysis of online discussions, in relation to elaboration of Wikipedia pages, with automatic semantic and syntactic Natural Language Processing (NLP) analysis focussed on identifying the roles of dialogical argumentation processes.

**Findings/Design** – Knowledge objects in online communities are jointly shaped by socio-relational and epistemic processes.

**Research limitations/Implications** – Our analysis method, based on previous research, is presently restricted to in-depth analysis of a small number of discussions. In ongoing work, our objective is to apply the method to the whole corpus of the Wikipedia astronomy online epistemic community.

**Originality/Value** – Our qualitative analysis approach distinguishes multiple functions of dialogue applying to diverse contents (task, interlocutor-related), in relation to automatic NLP analysis.

**Take away message** – The way that online epistemic communities function goes beyond knowledge-based discussion and argumentation, to involve negotiation of competencies of so-called ‘experts’ and ‘amateurs’.

## Keywords

Online communities, interactive profiles, argumentation, collaborative knowledge production, conflict

## INTRODUCTION

Over the previous decades, new forms of distant computer-mediated collaborative work have emerged, termed "online epistemic communities", whose *raison d'être* is the creation of some kind of knowledge-object (e.g. a programming language, an encyclopaedia, an online course, a building design...). Our research aims to study the interactive processes by which such communities function. We focus on both discussions and the way that they are interwoven with the evolution of the knowledge-object. Our analysis approach aims to integrate both human interpretation and automatic language processing. Our ulterior practical aim is to propose software tools for teamwork management and for self-awareness in the design process, with a specific focus on conflict detection and resolution.

Given its known role in collaborative work, we focus here on one genre of interaction, *argumentative interaction*, in the case of an online epistemic community whose aim is to produce documents (Wikipedia: WP) relating to astronomy, presenting an illustrative discussion relating to the question "should the WP page previously titled '*Pluto (planet)*' be (scientifically) renamed or not?" We will show that the argumentative dialogue proceeds by a subtle interplay arguments drawing on different types of knowledge (scientific, everyday) and the images of their respective competencies that both specialists and enlightened 'amateurs' project in the interaction.

After presenting our theoretical background, we introduce the context of the interactive process studied. In what follows, the dual coding approach used for the analysis is explained. Then, the results obtained on this basis are presented. The discussion focuses on the limits and perspectives of our approach.

## THEORETICAL BACKGROUND

In this study we focus on forms of participation and conflicts in an epistemic online community from the point of view of argumentation dialogue. Baker (1999) and Quignard (2005) have pointed out that argumentative interactions can be associated with co-construction of knowledge, within the interplay of socio-relational and task-related processes. To the extent that online epistemic communities function interactively and dialogically, argumentative processes should therefore play an important role in them.

Our general framework refers to a participant-centred approach that concerns the analysis of individual contributions, summarised by the concept of role (*C.f.* Gleave, Welsler, Lento, & Smith, 2009). We use an analytical framework developed in a study of architectural design (Baker, Détienne, Lund, & Séjourné, 2009) that aims to bring out the nature of participants' contributions in a way that distinguishes content and functional dimensions (presented below in the part dedicated to our dual coding approach). The resulting global vision of contribution is termed an "interactive profile". A related approach has been applied to collaborative knowledge production in the Open Source Software (OSS) community dedicated to the Python programming language (Barcellini, Détienne, Burkhardt, & Sack, 2008).

Collaboration for knowledge production in online communities raises issues of group management, governance and conflicts between participants or subgroups. For example, in the case of WP, Kittur et al. (2007) analysed the statistics on editing of articles and the links between articles in order to detect conflicting articles. They showed that detection was possible based on these indicators. Similarly, Auray et al. (2009) localised conflicting articles and study policies for conflict resolution. In these papers, the *discussion pages* are not investigated in themselves. They are only used to extract examples. We think that a systematic study of the content of discussions should provide a finer-grained view of conflict types and their processes. We aim to analyse the processes with specific discussions, across discussions, and their relations with the production of evolving wiki-texts to which they relate.

### A WIKIPEDIAN CONFLICT

The Wikipedia project has been elevated to the status of "a prolific, cooperatively-authored online encyclopedia" (Bryant, Forte, & Bruckman, 2005). In this project, we study participation oriented towards astronomy given that this famous scientific discipline involves the collaboration of *professional scientists* with *amateurs* and *novices* with respect to a common project: developing a basis for general public knowledge.

## Data

The data presented originates from the French WP project: "*Projet:Astronomie*"<sup>1</sup>, in which several professionals are involved with other WP participants (*administrators, users, IP addresses*). In this project, the case of Pluto is particularly interesting, firstly, given its shared imaginary potential for all kinds of participants, and secondly, given the recent changes in scientific views on this celestial body, that require knowledge negotiation between the different types of participants in this community.

### *The Pluto debate context*

The conflict concerning Pluto that we discuss here could be considered to be purely scientific, or else simply a matter of nomenclature: following a decision taken on the 24<sup>th</sup> of August 2006 by the International Astronomical Union (IAU), "*planet Pluto*" was reclassified as an "*asteroid*" and integrated into the asteroid category: "*dwarf planet*". Nevertheless, this decision sparked off a heated debate in the wiki-astronomy community. The debate was settled in the French WP between this date and its resolution in a WP internal vote the 15<sup>th</sup> of April 2008. On the most general level, the discussion turned on the question as to whether to follow the new academic nomenclature ("*(134340) Pluto*") for the title page or else to use a more specific title (*e.g.* "*Pluto (dwarf planet)*").

The Pluto's article in the French WP<sup>2</sup> was created on the 11<sup>th</sup> of September 2002. The writing of the article itself (editing space) involved 445 contributors with respect to 1012 edits until the present (mean per year = 134). In the discussion page attached to the article (discussion space) the group was more restrictive, where only 40 participants were involved in the whole debate. Amongst the participants, three WP statuses were present: IP addresses, usual WP users and WP administrators. Six participants were IP addresses, with respect to whom no information is available. One was a WP user who never created a personal page and about whom no information is available. 24 were regular WP users. Nine were administrators. We call these latter 33 persons "*wikipedians*". Amongst them, two were scientific researchers in astronomy engaged in *Projet:Astronomie*. They both belonged to the category of regular WP users. The other 31 wikipedians had varying levels of knowledge in astronomy (seeing their contributions), but no statistical information is available. We found evidence of a high degree of knowledge for at least five of them. Within this 33 wikipedians group, the date of subscription to WP varied between August 2002 and June 2008. Five of them subscribed after the beginning of the debate.

<sup>1</sup> <http://fr.wikipedia.org/wiki/Projet:Astronomie>

<sup>2</sup> [http://fr.wikipedia.org/wiki/\(134340\)\\_Pluton](http://fr.wikipedia.org/wiki/(134340)_Pluton)

### Corpus

During the complete period of the debate, the Pluto discussion page was organised in different themes, with titles given by the discussants themselves. Eighteen were relevant to the question of page title, thus shaping a corpus of 18 threads. In this corpus, the means were 11.2 dialogue turns per thread (min = 1; max = 48) and 56.7 words per turn (min = 1; max = 258). The 40 participants produced 202 interventions in this debate, with 11463 words. The 14 most important participants produced 88% of contributions. Only one of the two professionals was among these 14 participants.

Most of the edits made on the Pluto page were not relevant for the debate. For example, lot vandalism took place (e.g. erasing the page content, adding bad comments, etc.), generally coming from IP addresses and compelling wikipedians to re-establish them (which was done, the most often, in less than two minutes). A lot of edits also concerned subjects out of the scope of our analyses, such as the editing of figures, the telling of the story of Pluto's exploration, etc. The edits we kept in the corpus in addition to the 18 discussion threads were only the title modifications and the text modifications about Pluto's nomenclature and status.

### Overview of the debate

Figure 1 gives a general overview of the debate distributed over time (August 2006 to June 2008). This Figure reveals that the debate settled into two main periods. The first occurred after an external event: the IAU decision to modify the planet definition. The second occurred after an internal event: the editing of the page title by a wikipedian. Figure 1 illustrates this movement in the two distinct spaces: the editing space of the article and the discussion space.

In the editing space, 4 title edits occurred the day of IAU meeting (24<sup>th</sup> of August 2006), made by regular WP users. The last of these 4 edits (for "Pluto (dwarf planet)") was made by one of the two professionals, who had previously rejected the modification because the IAU vote was not yet over (see Table 1). The next title edit (for "(134340) Pluto") was made the 15<sup>th</sup> of

September 2006 by a regular WP user, who is not a professional, with a series of page content edits to make the article conform with the new IAU definition. The same participant also made an update after the IAU creation of the *plutoid* sub-category the 12<sup>th</sup> of June 2007. The next title edits were performed the 11<sup>th</sup> and 12<sup>th</sup> of March 2008 for, respectively, the same titles as just indicated.

In the discussion space, the grey line along the fourth thread indicates its particularly long duration. This thread was the spinal column of the discussion as it made the transition between the two important periods of the debate. Globally, the three first threads allowed participants to exchange knowledge in Astronomy. Only one title was evoked in here. In the fourth thread, a novice in Astronomy opened the deep debate with an argument against the asteroid nomenclature. The different possibilities were then examined and developed in this long thread (48 contributions). After the modifications of 11<sup>th</sup> and 12<sup>th</sup> of March 2008, the debate was restricted to the two main solutions. The discussion turned to opposition and a participant proposed a vote that took place in a series of threads from the 14<sup>th</sup> to the 18<sup>th</sup> of April 2008.

In the whole debate, we identified eight threads with clearly conflicting exchanges. This shows that conflicts are frequent in WP discussion pages. The first thread retained for the results (white dot in the first period) implies no conflict. Contrarily, the second thread retained (white dot in the second period) is the major conflict in the complete debate. We shall thus illustrate both cases.

### ANALYSIS: A DUAL CODING APPROACH

Our approach to this data is multi-disciplinary, involving argumentative interaction analysis in Cognitive Ergonomics, based on the notion of interactive profile, and argumentation formalisation in Natural Language Processing. The final goal is the development of a tool dedicated to the automatic characterisation of participations.

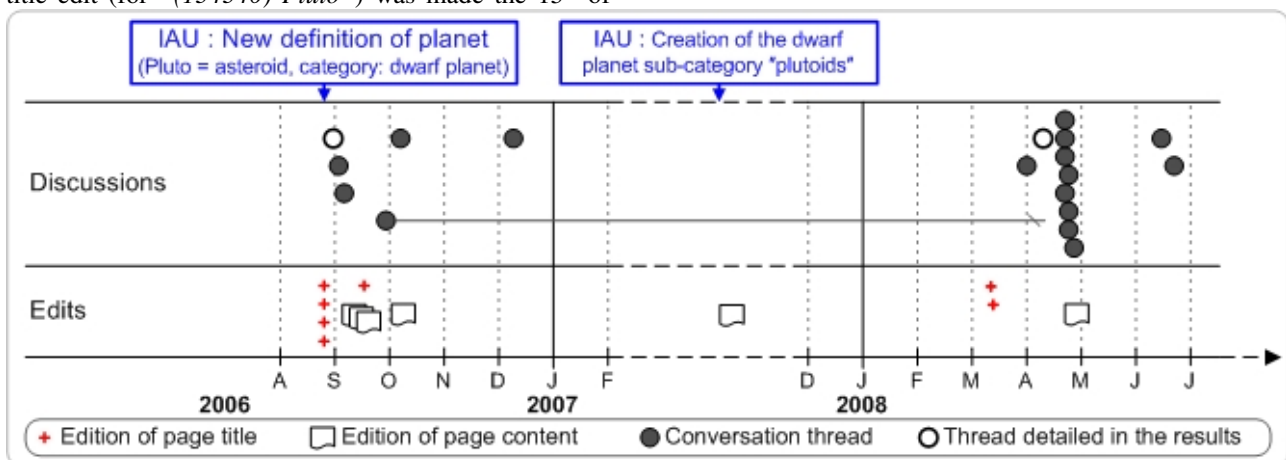


Figure 1: Overview of the 18 discussion threads and corresponding edits

## Research strategy

We used a dual coding approach: (1<sup>st</sup> step) a complete coding of argumentation processes was performed by a human analyst in order to analyse argumentative process and obtain a basis for comparison with the automatic analysis. (2<sup>nd</sup> step) Automatic coding of contents was performed in order to test specifications for domain recognition using content analyses. This coding was then compared with the first one. We hope to obtain minimal descriptive features that would allow automatic detection of conflicts and their categorisation.

Both codings are used in convergence in order to propose the analysis of participants interactive profiles in the discussion (see below). For this, they provide complementary elements that deepen the analysis.

### 1<sup>st</sup> step: Manual analysis

Our manual analysis is based on the coding of the dialogue units across two main dimensions: argumentative and epistemic. The argumentative dimension characterises the type of speech act performed (see Searle, 1969) with the unit and the participant's commitment with respect to the solution discussed as a thesis (T). The epistemic dimension characterises the knowledge domain used by the participant and the degree of expertise associated with this knowledge. The discourse units were obtained on the basis of dialogue turns (see Sacks, Schegloff, & Jefferson, 1974). When a turn involved several functions, it was segmented into the different units necessary to describe the acts performed. Table 1 presents our coding for (a part of) the first thread of the corpus (first white dot in Figure 1).

*The argumentative dimension* is described with two categories. Firstly, a dialogic function was attributed to each proposition depending on what is performed in the argumentative process (see Quignard, 2005). Secondly, when needed, the thesis defended was coded. The dialogic functions found in the discussion were: (1) inform (content is proposed), (2) synthesise (several previous contents are summarised), (3) request (a question is asked or a demand to do something or take something into consideration is expressed), (4) manage (the act organizes the dialogue or the task), (5) argument +/- (a content is expressed in relation to a thesis) and (6) evaluate +/- (a personal attitude is expressed about a thesis, a person or a previous act). For argumentation and evaluation the polarity indicated which position was expressed by the participant.

*The epistemic dimension* reveals what the protagonists said in terms of knowledge domain and expertise. We assumed four domains of interest for the debate: (1) knowledge of astronomy (scientific institutions or celestial bodies), (2) knowledge about WP (the article discussed, other articles or the policies organizing wikipedians' life), (3) knowledge about the group (coordination, dialog or task management) and (4) knowledge about individual persons (expertise or

intentions). When another knowledge domain was used, it was noted '*Else*'. For astronomy and WP, two levels of expertise were distinguished (expert vs. general public).

After the coding was completed for a thread, counting of the different occurrences in each category of the different dimensions was possible. This operation relating to specific participants allowed **building their interactive profiles** in the thread. Thus, the interactive profile describes the participant's behaviour in regard to the different analytical dimensions.

### 2<sup>nd</sup> step: Automatic Language Processing

Whilst it is possible to develop automatic semantic analysis in constrained domains (Denis, Quignard, & Pitel, 2006), large scale, domain independent automatic analysis is notoriously hard. Building argumentation structure automatically requires a very detailed ontological representation of the task at hand. Moreover, given that most of the argumentation remains tacit, inferential tasks are particularly hard to model. To tackle this complexity, we focus *on what is said rather than what is meant*. This is indeed easier to implement, and although not as fine-grained as a deep semantic analysis, it proves helpful in identifying interactive profiles on the basis of content.

*Conflicting opinions* - On one hand, we explore the argumentation by mining the opinions of the contributors (Liu, 2009). Most opinion mining approaches start from the surface features conveyed by utterances. Firstly, polarities of lexical choices made by participants – positive or negative – are clues about their commitment to their partner's contributions. For instance, uttering “that is wrong” is a domain independent way to attack a thesis. Nonetheless, considering lexical choices does not prevent deep syntactic analysis (for instance “*I don't think this is wrong*” is not an attack). Second, subjectivity markers such as personal pronouns are also clues about the contributors' commitments. Both markers, negative lexical polarity and subjectivity markers, are strong evidence for conflicting discussions and thus can provide discrimination of participants throughout their participation in conflicting discussions.

*Conflicting domains* - On the other hand, the domain of the contribution can be automatically retrieved. First the domain will help distinguishing the contributions that are related to the Pluto article itself, and in particular its name, from the contributions related to other problems such as scientific questions (typically: “*Pluto is no longer a planet but a star*”). This enables us to discriminate contributors interested in the article itself from the others. Secondly, during the naming conflict, participants make use of different arguments. Whilst some of them appeal to the official naming by the IAU to title the article “(134340) Pluto”, others refer to the Wikipedia principle of “least astonishment” in order to favour the thesis “*Pluto (dwarf planet)*”. Given that

**Table 1: Extract from the first thread in the corpus "Pluto is no longer a planet"**

User	Turn	Unit	Content	Funct°	Thesis	Domain	Exp.
IP1	4.1	[a]	Pluton ne fait plus partie comme étant planète du système solaire <i>Pluto is no longer included in the planets of the solar system</i>	Inform		K(Astro)	0
Markov	4.2	[a]	Je propose le renommage en "Pluton (planète naine)" plutôt que "Pluton (corps céleste)". --Markov (discut.) 24 août 2006 à 16:01 <i>I propose renaming as "Pluto (dwarf planet)" rather than "Pluto (celestial body)"</i>	Inform	T1	K(WikiP)	Expert
Alain_r	4.3	[a1]	Rien n'est officiel pour l'instant, puisque le vote n'est pas terminé, donc on attend. <i>Nothing is official at present, since the vote didn't end, so we wait.</i>	Arg -	(T1)	K(Astro)	Expert
Alain_r	4.3	[a2]	Merci de ne pas tout déranger prématurément. Alain r 24 août 2006 à 16:17 <i>Thanks for not disturbing everything prematurely</i>	Manage		K(WikiP)	0
Markov	4.4	[a]	Selon les dépêches ([1]), la proposition 5A lors du congrès de l'IAU est passé, mais pas 5B. (cf http://...)--Markov 24 août 2006 à 16:26 <i>According to dispatches, the proposition 5A in the IAU congress was accepted, but not the 5B.</i>	Inform		K(Astro)	Expert
Mrick	4.5	[a]	Il y a une petite erreur dans ton lien Markov, voici la news officielle de l'IAU : http://... MRick 24 août 2006 à 17:20 <i>There is a small mistake in your Markov link, here is the official news from the IAU:...</i>	Inform		K(Astro)	Expert
IP2	4.6	[a]	I>TELE : Pluton n'est plus une planète mais une étoile. <i>ITV. Pluto is no longer a planet but a star.</i>	Inform		K(Astro)	GP
Mrick	4.7	[a]	Seul un ignare complet dirait que Pluton est une étoile. <i>Only a completely ignorant person would say Pluto is a star.</i>	Eval -		K(Person)	0
Mrick	4.7	[b]	Si c'est de I>TELE que vient cette info, ça ne donne pas envie de regarder cette chaîne. MRick 24 août 2006 à 17:20 <i>If this news comes from ITV, it doesn't make one feel like watching that channel.</i>	Eval -		Else	0

these domains are contradictory, we can further discriminate the participants according to their position in the conflict by assigning them the most frequent domain they employ in their contributions.

## RESULTS

We use manual and automatic coding to study participants' interactive profiles in the interaction. Since all results cannot be presented in detail, we focus here on two threads (Cf. Figure 1). They illustrate two different kinds of argumentative interaction: a constructive one and a conflicting one.

### Thread: "Pluto is no longer a planet"

The first thread was partially presented in Table 1. This is the one that opened the debate. This is an example of a collaborative exchange where participants shared and proposed information in order to coordinate the production of the page, which is the rule of discussion pages in Wikipedia.

#### 1<sup>st</sup> step: Manual analysis

Eight participants participated in this thread: 4 IP addresses, 1 WP administrator and 3 WP users including a professional researcher in astronomy. As the automatic coding is presented in chronological order (see below) we focus here on roles that were adopted. The four IP addresses only informed (dialogic function) with respect to general public knowledge in astronomy (weak expertise) coming from external Media (domain "else"). Amongst the wikipedians, two of them produced negative evaluations: Mrick in the personal

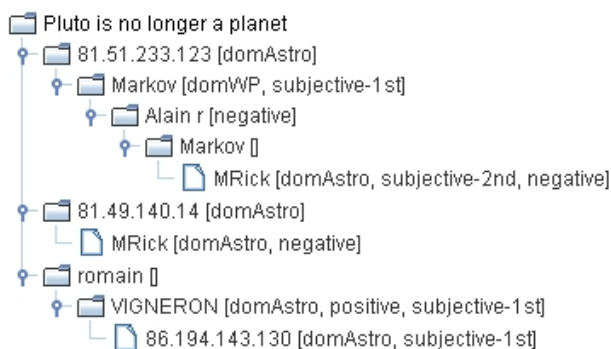
domain, VIGNERON about the information source (domain "else"). In addition, Mrick informed with an expert proposition in astronomy. Furthermore, a regular WP user, Markov, informed with expert knowledge, once about astronomy, once about WP, with the thesis that "Pluto (dwarf planet)" would be a good title for the page (T1). Alain\_r, the professional astronomer, once gave a negative argument against T1, and once managed the updating task. He used expert knowledge in astronomy and knowledge about WP.

These results reveal what was performed during this thread. Some content was proposed, coming from external information sources and afforded specifically by non wikipedian users. This content was appropriated by the group of wikipedians and evaluated in terms of consequences for the artefact they are working on (the encyclopaedia itself). A proposition was made by a wikipedian not expert in the domain and controlled by an expert. It is necessary to notice that this particular exchange arrived between 2:00 p.m. and 2:30 p.m. and that the expert made at 8:10 p.m. the title modification he refused earlier with a temporary argument.

#### 2<sup>nd</sup> step: Automatic Language Processing

The automatic analysis of this thread is displayed in Figure 2. First, we observe a domain shift from the first contribution, which is related to the astronomy domain (noted *domAstro*) to the next contribution in the Wikipedia domain (noted *domWP*). The manual analysis confirms that the domain shift is related to the

uptake of the scientific fact that argues in favour of modifying the article's title. This remark is enhanced by the subjective marker found in Markov's contribution. However, the next contribution being negative, the proposal by Markov is rejected by Alain\_r. Secondly, whilst the first contribution of Mrick carries all the clues for an argumentative attack (subjective-2nd and negative) the manual analysis rejects this hypothesis, since the contribution has an informative function instead of an evaluative function. Thirdly, it is worth noting the exchange of 81.49.140.14 and MRick, in which there is no domain shift, but rather a negative contribution of MRick. Although the automatic analysis cannot determine this, this negative contribution is a personal attack ("Only a complete ignorant") instead of an argued attack. Finally, the contribution from VIGNERON seems to carry a positive polarity, however, it is wrongly attributed from "It's funny", which in the context has to be interpreted clearly as irony and thus should be treated as negative.



**Figure 2: Automatic annotation of thread "Pluto is no longer a planet"**

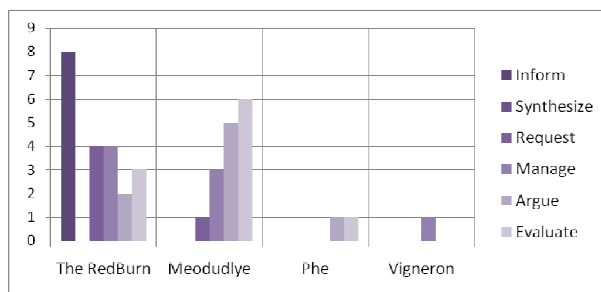
### Thread: "Opinion from a professional in the domain"

The second thread we discuss in detail is the most conflicting one in the whole debate. It was the second thread after the debate was reactivated by the title modifications of March 2008. A professional in astronomy (Meodudlye) gave an exposition of the results obtained in research in scientific databases to indicate which solution is the most frequent. He thus invoked scientific authority for the asteroid nomenclature. Following this, a WP administrator (VIGNERON) remarked that the debate was probably closed, but then, the main defender of the opposed thesis (TheRedBurn) discussed the argument. The discussion continued in a defence-attack game between the two opponents. It closed when a second WP administrator (Phe) modulated a defensive argument from TheRedBurn that convoked Markov's title modification proposition (studied in the previous part). The argument was refused as the scientific authority had then changed its nomenclature. This counter-argument closed the thread, but the vote was nevertheless launched.

### 1<sup>st</sup> step: Manual analysis

The analysis of participants' interactive profiles gives more indications about TheRedBurn and Meodudlye because as they made more contributions in the thread, the categorisation of their acts indicated more manifest profiles. Figure 3 is an illustration of this with respect to dialogic functions. It shows that Phe produced two propositions and VIGNERON only one while Meodudlye produced 15 and The RedBurn produced 21.

For the two participants who contributed less, complete profiles in this thread can be described in a few words. VIGNERON produced a management act in a knowledge category relating to the group ("Thanks. I think this closes the discussion."). Phe evaluated once and argued once, negatively, with knowledge about the group. He evoked one thesis only ("Very instructive discussion. Markov proposed Pluto (dwarf planet) before the correct name was known.>").



**Figure 3: Dialogic functions in thread "Opinion from a professional in the domain"**

Concerning the argumentative dimension, Figure 3 shows different uses of dialogic functions. TheRedBurn was the only participant who informed, and he requested and managed more than Meodudlye. Conversely, he argued and evaluated less than Meodudlye. Concerning theses, TheRedBurn was less open since he only evoked the solution he put forward on two occasions (T1). Meodudlye evoked the solution he defended four times (T2) and three times the other thesis (T1).

Concerning the epistemic dimension, Meodudlye's messages were characterised by contents in the scientific domain (e.g. "Ceres and Eris the two other dwarf planets are named with the same convention: (number)\_NameOfPlanet, which is one more reason, if needed, to keep Pluto's present name."), always with expert knowledge. Contrary, TheRedBurn made more specific statements about the WP domain (e.g. "An article title in Wikipedia doesn't have to respect the official name of the subject treated.") and group and dialogue management ("In fact, my question was rhetorical", "I think discussion cannot reach consensus"). The only time he used scientific knowledge was on the general public level. Furthermore, Meodudlye also used knowledge about the person, to criticise TheRedBurn's expertise (e.g. "Thanks to show so clearly that finally you don't know

*much in astronomy*” or “(...) *\_you\_ want impose your title coming from no where*”). TheRedBurn had first to defend himself with respect to his expertise (“*Thanks not to consider me as more ignorant than I am*”).

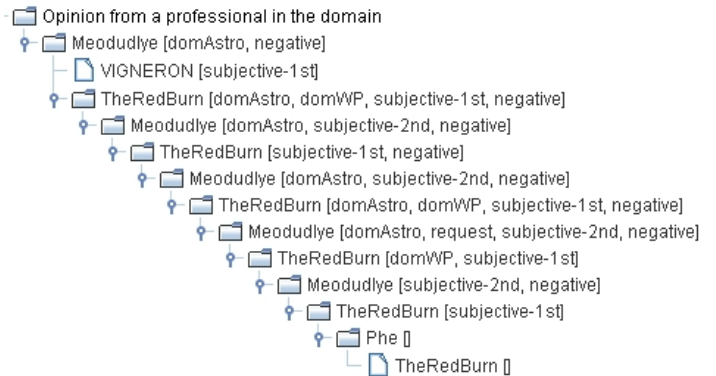
Thus, both participants showed very different profiles. These results show the potential of interactive profile calculation for revealing the interplay between task-related arguments and negotiation of participants’ projected and perceived degrees of expertise (a form of *ad hominen* argument).

### 2<sup>nd</sup> step: Automatic Language Processing

The automatic analysis of this thread is shown in Figure 3. It shows a striking pattern of a conflict. First, the polarity analysis shows that, amongst the 11 messages exchanged, 8 of them carry a negative value and that all messages of Meodudlye are negative. This observation itself provides an interesting indication about the attitude of Meodudlye and TheRedBurn: they both are positioning themselves *against* a thesis. However, this remark alone is not sufficient enough to deduce that they are antagonists: it could be the case that both of them are opposed to the same thesis. The subjective analysis enables to confirm the conflicting status by showing a remarkable alternation between the first (*subjective-1st*) and the second person (*subjective-2nd*). While Meodudlye is exclusively using the second person (e.g. “*you don’t know much in astronomy*”, “*we don’t have to invent other names because you’ve decided you don’t like*”), TheRedBurn is exclusively using the first person (e.g. “*Thanks not to consider me as more ignorant than I am*”, “*I thought there were a lot of dwarf planets*”). This corroborates that there is a conflict: while TheRedBurn defends a position that Meodudlye attacks. The attack is not present in the first message where Meodudlye is only being negative about the thesis without attributing it to someone (no subjective marker). But TheRedBurn then commits himself to the attacked thesis by using the first person. This is why, after the TheRedBurn’s answer, the thesis is now attributed to him, and as such Meodudlye can use the second person to directly oppose to him. This use of persons persists throughout the thread.

It is also interesting to notice that the antagonists do not make use of the same kind of arguments, and that the automatic analysis confirms the manual annotation. The domains of their contributions are found to be different. TheRedBurn mentions terms related to the Wikipedia and encyclopaedias domain (e.g. “*Maybe that’s because they are encyclopaedias*”, “*This is what do the other wikis*”), and to the astronomy domain, noted *domAstro* (e.g. “*Pluto is the only dwarf planet, right ?*”, “*I thought there were a lot of dwarf planets*”). On the other hand Meodudlye only refers to the astronomy domain without invoking the status of Wikipedia. These different uses of domains persist in all messages except the last exchange between them. In that exchange no real argument is exchanged, the

conflict that was argued at first evolved to a purely personal conflict. Meodudlye says “*Notice that if there is no consensus, that’s only because \_you\_ want to impose your title coming from no where*” while TheRedBurn comments “*Let’s say that if there is no consensus, that’s because we’re only two to discuss*”.



**Figure 4: Automatic annotation of thread “Opinion from a professional in the domain”**

### Limits of the automatic analysis

The automatic analysis enables a shallow classification of contributions based on the occurrence of polarised lexical items (*modulo* syntactic variations) or subjective markers. However, this simple approach is not sufficient to provide a fine-grained analysis of argumentation. The participants may, in the same contribution, be positive about an argument while being negative about another. Or they could provide mixed polarities about the same argument. For instance in the sentence “*We can find many [names] reflecting the truth but not corresponding to its true name*” (thread 17), the first part is positive about choosing some names for they “reflect the truth”, but the second part moderates this positive argument by being negative. The difficulty of the shallow approach on this kind of examples is twofold. First, as we do not represent explicitly the arguments on a fine-grained level but only as domains of contribution, we lack the ability to express mixed polarities about one single argument, or even the possibility to be positive about a given argument while being negative about another. Nevertheless, this limit can be circumvented by refining the relation between domain and polarity. For instance, instead of assuming an overall polarity for a contribution, we can link the polarity to a given propositional content in a sentence. The extent to which this link can be computed automatically without having to deeply model the astronomy domain has yet to be investigated. The example above shows the second major difficulty of the approach. The contributor both says that some names *reflect the truth* but at the same time that they *do not correspond to the true name*. The blatant contradiction of the argumentation can only be understood by assuming that “truth” in the first part means “physical truth” (e.g. Pluton is indeed a dwarf planet), while “true” in the second part means “official”.



Word-sense disambiguation is a difficult task. There is much existing research dedicated to this task (the classical work being Lesk, 1986), but not only our general approach has to be amended with word-sense disambiguation, it also has to take into account phenomena such as irony, which is still an open issue in language processing.

### DISCUSSION AND PERSPECTIVES

The results presented illustrated that the way online communities function goes beyond knowledge-based discussion and argumentation, to involve negotiation of competencies of so-called 'experts' and 'amateurs', and more specifically in a conflicting exchange.

The dual coding approach we used is promising since the elements provided are complementary in highlighting these negotiation processes. The coding used allows us to consider participants' interactive profiles relating to the participants in different threads. We will apply the same method on the complete corpus to address globally the participants' roles in the group and their evolutions during the debate depending on discussion episodes (such as conflicts). We are now working on these elements to build a broader view of roles assumed in online epistemic communities.

Furthermore, our automatic coding converges with this cognitive ergonomic analysis and contributes to enlarging the overall vision of the way that online epistemic communities work. The semantic analyses of opinions and domains formalise the dialectic and epistemic categories in depth. These analyses also consider additional indicators, such as personal pronouns, which would be too long and error-prone if coded manually in a large corpus, or question-answer interplay which is difficult to build in manual analysis. These elements are integrated into the description and contribute to build richer interactive profiles.

This work should lead to the specification of participants' needs during collaborative process. On this basis, the development of the NLP tool should be proposed for automatic conflict detection. In this case, it is necessary to reduce the analysis to the more stable elements in the interactive profiles which should allow such conflict detection.

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