A Framework to Analyze Political Space in News Media Using Ontology Engineering

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The aim of this study is to develop an ontology-based computational framework to analyze political space and debate structure on a controversial public topic, according to ideologically distant news media. News media play a key role in the formation of public opinion, and as political players' dynamics are closely linked to public opinion processes, they also play a major role in the conformation of political space. It can be hypothesized that depending on the political position that political players occupies on the political space, their public interactions may have a differentiated treatment on media, according to the editorial line of the media in consideration. However, how can it be measured? By using corpus extraction techniques, SPARQL queries, and ontology engineering, this study compares the position that key political players occupy in the debate structure and political space modeled by two ideologically distant news media sources, on a same controversial public topic..

Key Words: *ontology engineering, political space, corpus linguistics, SPARQL queries*

1. INTRODUCTION

When a public issue becomes a trending and controversial topic, society-wide debates are necessary to legitimize public opinion on its implications. However, is it possible to objectively evaluate public opinion formation and its legitimization process? In reality, such debate may be impossible in terms of time and space constraints. As a response, for society-wide debates, media discourse sources such as newspapers, television, radio and the World Wide Web, play an important role in framing and legitimizing public opinion.

Media discourses frame public opinion, as well as the relation between public actors. In that sense, corpus of media discourses is one important resource available to evaluate public opinion formation. By analyzing that corpus we can understand the difference between diverse media positions, and public opinion formation process. An actor's opinions can be represented in a discourse space compared with other actors' opinions based on contents similarity. In that way, their interactions in media discourse space can also be visualized.

In that sense, the aim of this study is to develop a computational framework to analyze discourse space in news media for visualizing political actors' relationships through the analysis of news articles from different political positioned sources. A framework designed to analyze the macro level of public debate need to comprise a large amount of analysis of news media data, which is greatly needed to improve current public debate systems. For the purpose we propose an ontology-based analytical framework which enables us to conceptualize the multiple relationships between actors and discourses present on the debate of a controversial urban related topic, from two different and ideologically distant news media sources.

Ontology is a structural framework to organize information as a network of relationships between concepts on a given domain[1)]. Therefore, by building an ontology-based network of relationships between political players and controversial issues involved in the topic, patters on the structure of the debate on that particular topic can be obtained. To accomplish that

goal, we apply the generic and abstract model of semantic-social networks formulated by Mika[2] called 'Actor - Concept - Instance' model of ontologies. Mika's model represents semantic-social networks in the form of a tripartite graph of *actor*, *concept* and *instance* associations, extending the traditional concept of ontologies (*concepts* and *instances*) with the social dimension. In Section 2 previous studies on the evaluation of public debates are reviewed and the details for understanding the political and social conflict present in the study case is introduced. In Section 3 the methodology outline of the research is explained, as well as the architecture of the computational framework developed in this study. In that section we also for show how Mika's 'Actor-Concept-Instance' model of ontologies can be applied to our model. In the last part of Section 3 the results obtained using this framework are presented. Finally, in Conclusions, this research's scope and future work is discussed.

2. LITERATURE REVIEW AND STUDY CASE

(1) Related Studies

Research on news media's potential for influencing public opinion building and legitimacy is stated on the normative values presented in the works of direct democracy and public sphere advocates such as Habermas[3] , Dryzek[4], and Hatori *et al.*[16]. The question is: 'How to ensure the legitimacy of debate?'. To address the legitimacy issue, first we need to understand which deliberative system is desirable. The idea of a deliberative system begins with the recognition that a deliberative democracy cannot easily be sought in a single forum. Instead, it should be sought in the contributions of multiple sites. According to Dryzek[5] system can be said to possess deliberative capacity to the degree it has structures to accommodate deliberation that is: (a) *authentic:* deliberation ought to be able to induce reflection upon preferences in non-coercive way; (b) *inclusive:* deliberation requires the opportunity and ability of all affected actors –or their representatives- to participate; and (c) *consequential*: deliberation must somehow make a difference when it comes to determining or influencing collective outcomes. Dryzek states that a deliberative has six main components: a *public space* with no barriers limiting who can communicate, and few legal restrictions on what they can say (i.e., internet, classrooms, bars, public squares); a *empowered space* where actors in institutions deliberates and produce collective decisions (i.e., legislature, policy-making councils, cabinet); *transmission* meaning that deliberation in public space can influence that in empowered space (i.e., activist campaigns, publicity, social movements); *accountability* whereby empowered space answers to public space, which is always necessary when it comes to securing deliberative legitimacy for collective outcomes (i.e., voting, public consultation, etc); *meta-deliberation* as a healthy deliberative system needs the capacity for self-examination and self-transformation; and finally it should have *decisiveness*, that is to say the degree to which it is consequential on collective outcomes.

On the other hand, Hendriks[6] conceptualizes the deliberative system as a compound domain that consists of a *micro discursive sphere*, a *macro discursive sphere*, and a *mixed discursive sphere* (**Fig. 1)**. Micro deliberative theory aims mainly to the public debate at the empowered space. However, is also included in the public debate held by authority subjects, such as third-person committees. In public debate, judgment and decision-making are made though debate among participants. Micro deliberative theory assumes that the process of forming agreement is being made as participants confront each other's point of view in a free an equal debate. Debate participant are requested to have fair and impartial positions and the point of view of common good, in order to reach mutual understanding. On the other hand, macro deliberative theory focus on the whole deliberative system, taking in consideration both formal and informal spheres. In macro deliberation, a variety of interactions are developed among various debates. As for macro deliberative theory, unlike micro deliberative theory,

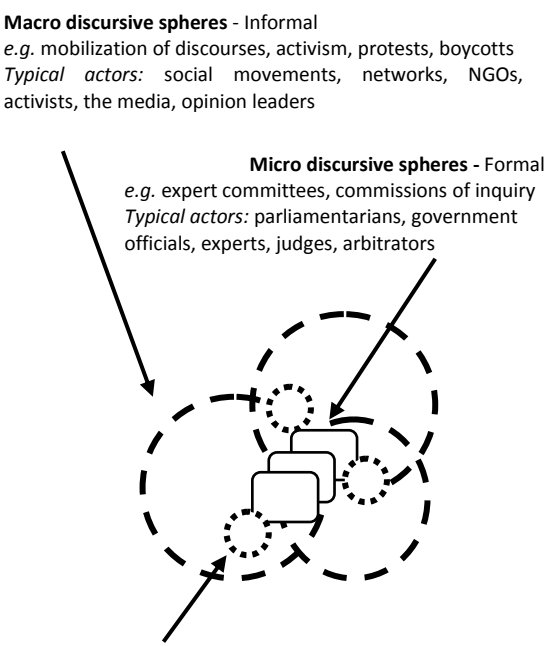

Fig.1 Hendrik's integrated deliberative system

the emphasis is place on opinion formation rather than on decision-making. Theory here focuses on the formation of a high-order agreement (i.e., meta-consensus), in relation with values, beliefs and preferences of the variety of stakeholders. The mixed discursive sphere offers a joint place for both micro and macro discursive spheres. In this sphere, participants of micro discursive sphere and macro discursive sphere can debate with each other in various forums, such as town meetings and public seminars.

As we already mentioned, PI processes have been a new trend in urban planning because it derives better decision making from multiple communication and mutual understanding among various stakeholders in the case of public projects. Through these processes, at micro level, diverse perceptions by different members of society can be heard and considered allowing judgments related to the appropriateness of the projects[7]. But at the macro level the results of PI processes can be easily manipulated by powered stakeholders, as well as valuable opinions may be omitted in the debate. A key concept for the evaluation of the legitimacy of these processes is *meta-consensus* proposed by Niemeyer & Dryzek[8]. Meta-consensus represents a high-order agreement in existence of consensus and disagreement, which expresses the introspective agreement of stakeholders' concerns to be considered in society. From the literature review we understand that it is still necessary to accumulate much more empirical research about evaluation of meta-consensus regarding public projects.

In previous studies, a systematic methodology aimed to understand the recognition system between debate participants using facet theory has been proposed[9]. In that approach, debate participant' statements and utterances were expressed as elements in a facet analysis of language system. The facet system was used to recognize whether there were differences in perception among participants. In public debate, facet system represents an important key to judge whether meta-consensus is reached among debate participants, while it evaluates whether the issue at hand is discussed synthetically or comprehensively. Also, a pluralistic evaluation technique for public projects was also been proposed. By this method, a variety of evaluation information regarding public projects, including stakeholder´s preferences, was visually expressed on a multidimensional space. Using such visual representation is possible to clarify the relationships between stakeholder´s opinions in a confrontation axis. This multidimensional technique was proved to be an effective approach to evaluate the relationships and hierarchy of values and preferences of stakeholders, and to assess whether they are consistent with each other. In our study we proposed a computational framework to analyze the macro sphere of public debate, aimed to broaden the empirical research on this topic.

(2) Study case: National and Local Government Dispute on Subway Transfer and Subsidy in Buenos Aires, Argentina

Buenos Aires is the capital and largest city of Argentina, and the second-largest metropolitan area in South America, after São Paulo in Brazil. It is located on the western shore of the estuary of the Río de la Plata, on the southeastern coast of the South American continent. The Greater Buenos Aires conurbation, which also includes several Buenos Aires Province districts, constitutes the third-largest conurbation in Latin America, with a population of around thirteen million. A majority of people employ public transport rather than personal cars to move around in Buenos Aires, especially the underground. The Buenos Aires Underground is a mass-transit subway system that serves the metropolitan area and it is one of the busiest metro systems in the world. The network expanded rapidly during the early decades of the 20th century. In the late 1990s expansion resumed, however, the rate of expansion is largely exceeded by the transportation needs of the city and once again the network has become overcrowded. The first station opened in 1913, and even thought it started as a private venture, the entire network was centralized and nationalized during the late 1930s under the management of the Transport Corporation of Buenos Aires (CTBA). In 1963, the administration was dissolved and the subway network became the property of the Subterráneos de Buenos Aires Company (later SBASE). In 1994 the service was privatized and is now managed by Metrovías S.A. with the stations remaining the property of SBASE, which is administrated by the National Government.

On 10th November 2011, the Secretary of Transportation of the Central Government (currently ruled by FPV, a centre-left party), Juan Pablo Schiavi, announced the transfer of the administration of the subway from the Central Government to the Local Government of the city of Buenos Aires (currently ruled by PRO, a centre-right party). Schiavi rejected the possibility of the transfer to be with 'economic resources' stating that the Local Government has enough financial independence to take care of its funding. Annually the Central Government hands over nearly $800 million pesos as subsidies to the company Metrovias, concessionaire of the service, to not increase the value of the tickets. Because the Local Government rejected the transfer

Table 1 Subway Transfer and Subsidy Conflict in the News

Date	*Media A (PAGINA/12)*	*Media B (LA NACION)*
November 10th 2011	Macri puts a price on his handling of the subway (http://www.pagina12.com.ar/diario/ultimas/20-180973-2011-11-10.html)	Subway ticket will continue to be $1,10 according to Macri (http://www.lanacion.com.ar/1422242)
January 5th 2012	Macri again rejected the transfer of the Subway (http://www.pagina12.com.ar/diario/economia/2-184785-2012-01-05.html)	Macri: "In these terms there will be no transfer" (http://www.lanacion.com.ar/1437993)

* Macri is the name of the Mayor of the City of Buenos Aires

without economic resources, the Central Government offered to share half the subsidies for a year. The Local Government refused that offer, and requested the Central Government to share subsidies until 2017, and to take an external loan in equal parts for projects needed to be done, like the improvement and expansion of the network. This dispute is still undergoing at the present day, with neither the Central nor the Local Government reaching an understanding. Because of the political implications of this issue, it has been covered very differently in the media, according to the news media in consideration. **Table 1** shows the translation of four articles' titles referring to the subway transfer conflict, from two different new media sources: PAGINA/12 (Media A, a left-wing media) and LANACION (Media B, a right-wing media). We can notice how, even though they made reference to the same news, they present a very different approach to the public.

In both cases, PAGINA/12 presents the news in an approach adverse for Macri, the Mayor of the city of Buenos Aires (Local Government), while LA NACION took an approach more favorable towards the Major. It can be hypothesized that because of causes external from the news itself -such as, the ideological and editorial line of the media in question-, for a same event, different news media may present a differentiated approach to the public, depending on the political position that the particular player involved in that event occupies on the political space.

As it has been reviewed on the previous Section, this behavior of news media alters the meta-consensus of public debate, transforming them into another player of the macro sphere of debate. From this hypothesis it can be argued that news media play a major role in the conformation of the public opinion, and, therefore, in the legitimization of the public debate.

To prove this hypothesis, in the next Section, a computational framework is developed, aimed to analyze the debate structure on the subway transfer topic, from the perspective of those two news media sources, PAGINA/12 and LA NACION. The purpose is to compare the position that key political players occupy in the debate structure modeled by those two ideologically distant news media sources, on the same controversial public topic. The comparison may show to which extent news media can conform significantly different pictures of the same topic to public opinion. In the following Section the methodology outline of the research and the architecture of our computational framework are described in detail.

3. METHODOLOGY OUTLINE AND SYSTEM ARCHITECTURE

Fig.2 shows the methodology outline of the research, which consists of three layers. Layer 1 involves data collection and meta-data annotation. Layer 2 involves data structuring (using ontology) and visualization results. Layer 1 and Layer 2 correspond to the computational framework, necessary for obtaining the results needed for the analysis in Layer 3. Results obtained in Layer 2 are analyzed in Layer 3, aiming to contribute towards the theoretical debate on legitimacy appraisal. The scope of the present study covers only Layer 1 and Layer 2.

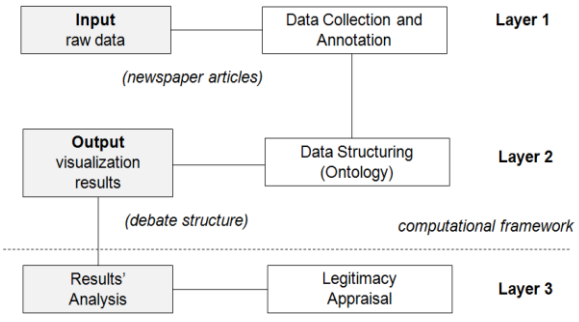

Fig.2 Methodology outline.

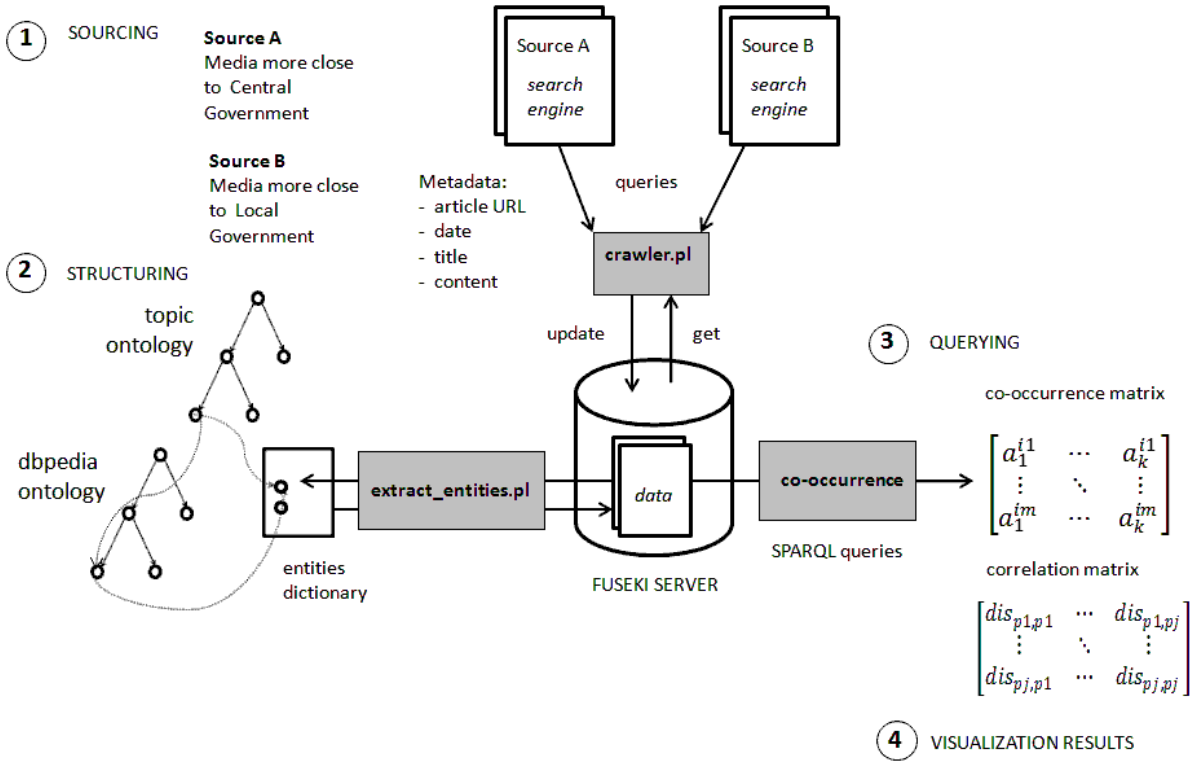

Fig.3 Computational Framework Architecture

Fig.3 presents the architecture of our system's computational framework. It consists of four stages: (1) Sourcing, (2) Structuring, (3) Querying, and (4) Visualization results. **Fig.4** shows the outline of the chain flow of the system. Each stage is associated with the different programs that are using for getting and structuring data, and also with the resources needed to be prepared by hand by the researcher in order to run the programs. Two Perl programs are used in the process, for: (i) crawling, (ii) annotating, (iii) storing, (iv) extracting, (v) linking, and (vi) storing data again in the server. The framework also uses an XML dictionary of entities, and topic ontology. The topic ontology is constructed a priori, based on previous knowledge of the topic from the researchers, and it states the main affiliations between political players and controversial issues related to the topic. This ontology is used mainly for processes (iv) and (v) of **Fig.4**. For storing the data, Fuseki[10], a SPARQL server is used (SPARQL: Protocol and RDF Query Language, is a both a query language and a data access protocol). In the following Sub-sections, all processes involved in the computational framework are explained in detail.

(1) Stage 1: Sourcing

In this stage the data sourcing part is done, and contemplates the first three processes from **Fig. 4**:

(i) Collecting data.

(ii) Annotating meta-data.

(iii) Storing data on server.

Those three actions are done by a crawler (Perl). The crawler search for articles from search engines of the two news media sources, using a queries file where all keywords related to the topic are specified. Then, it annotates meta-data using SPARQL triples (covering properties such as *type*, *time*, *title* and *description*). Finally, it uploads the triples automatically on Fuseki sever (using *http post* method).

For the annotation of meta-data the program uses SPARQL triple syntax. Likewise RDF triple syntax, SPARQL is built on a triple pattern consisting of *subject*, *predicate* and *object*. A triple from our system, expressed using the SPARQL triple pattern syntax, looks like this:

```
<http://www.lanacion.com.ar/1422242> dc:title
"Aceleran el traspaso del subte a Macri".
```

This triple state that there is a stored resource which URL is `http://www.lanacion.com.ar/1422242` and that has as title `"Aceleran el traspaso del subte a Macri"`. A triple pattern can include variables, which is very useful in our system to indicate data items of interest that returns as a query. Because all resources are annotated, from each URL we can obtain metadata, in our case the properties title, date, and description.

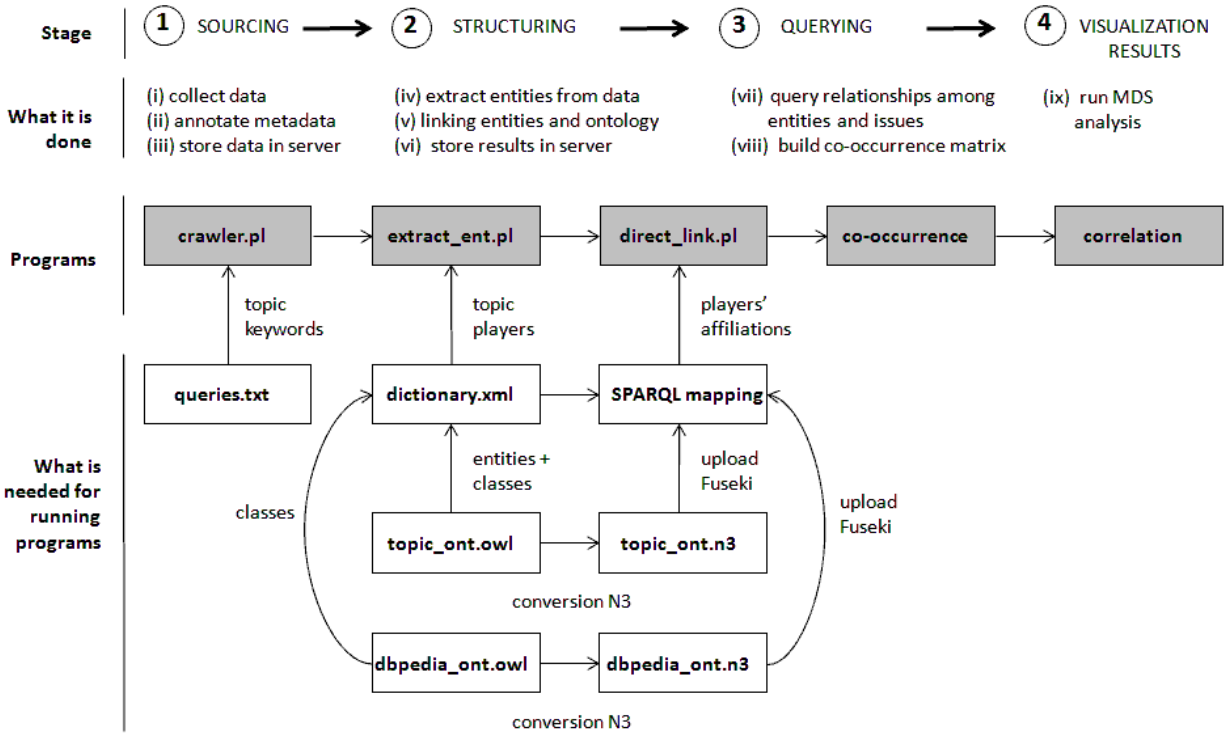

Fig.4 Computational Framework Chain Flow Chart

(2) Stage 2: Structuring

In this stage the structuring part is done. This stage contemplates the next three processes from **Fig.4**:

(iv) Extracting entities from data.

(v) Linking extracted entities with ontology.

(vi) Storing the results in the server.

Prior to structuring the data, two elements are necessary to be developed: (a) topic ontology, and (b) dictionary of entities.

(a) *Topic ontology:* Acceding to the literature, ontology is an explicit specification of the conceptualization of a domain[11]. In simple words, it is a structural framework to organize information as a network of relationships between concepts on a given domain. Therefore, by building an ontology-based network of roles and relationships of the actors involved in the topic and their discourses, it can structure the affiliations of the entities (players) that appear in the articles (data) that we had stored in the server in the previous stage.

To build the topic ontology the Hozo ontology editor[12] was chosen because of its flexibility as an ontology development tool as it allows the use of roles by default[13]. **Fig.5** shows the topic ontology, which contains the main structure of the subway transfer and subsidy conflict: 32 political players (divided into three categories: Central Government Players, Local Government Players and Non-Governmental Players) and 4 main controversial topic issues (subsidy cost, ticket raise, transfer rejection, and financial debt). For its development all *classes*, *properties* and *instances* necessary to explain all affiliations between the political players, and between the players and the issues, were specified prior to its construction. After it is finished, the topic ontology needs to be exported as OWL to be uploaded on Fuseki server.

(b) *Dictionary of entities:* The dictionary is made by hand by the researcher, by making entries for both all instances of political players and issues that relate to the topic (and by default also appear on the topic ontology). Each dictionary entry must also contemplate all synonyms related to the entity. That is most important as usually in articles, same entity can be referred with multiples denominations (for example, America can be both "United States", "USA", "US", etc). URLs of entity classes and superclasses can be extracted from other available ontology projects. Entity classes were selected from the Dbpedia Ontology Project[14].

After the XML dictionary and the topic ontology are already developed, it is necessary to link the entities with the topic ontology. By using the dictionary, the program automatically extract entities from the articles, relating article URL with entity URL. As in the dictionary each entity URL has a label, it can be known which entities appear in each article.

The next step is to relate the extracted entities with the topic ontology. Because when defining entities in

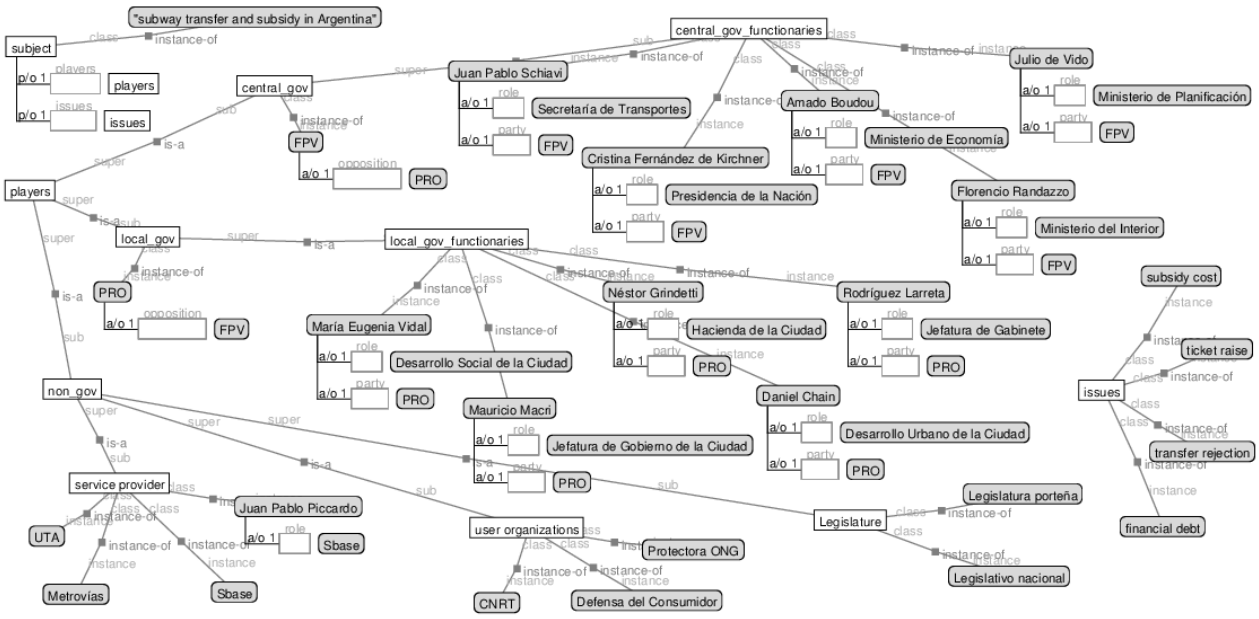

Fig.5 Topic Ontology made with Hozo Editor

the dictionary Dbpedia ontology classes were used, the first step is to match classes from that ontology with entities in the topic ontology. For that, prior, a mapping between Dbpedia ontology classes with the topic ontology classes is needed to be done (by appending *subClass* properties in Fuseki server). Once classes and subclasses are matched in the server, the direct links between extracted entities and the topic ontology can be made.

Until this stage, we showed a ontology-based framework which enables to structure the multiple relationships between actors and issues present on news articles referring a controversial topic. In the next Sub-section it is explained how we use the model of semantic-social networks formulated by Mika[2)], called 'Actor-Concept-Instance' model of ontologies, to build the 'Article-Player-Issue' co-occurrence matrix.

(3) Stage 3: Querying

This stage contemplates the next two processes from **Fig.4**:

(vii) Query of relationships among entities.

(viii) Building the 'Article-Player-Issue' matrix.

Following, the correspondence between Mika's 'Actor-Concept-Instance' tripartite model of ontology with the 'Article-Player-Issue' co-occurrence matrix is explained.

(a) '*Actor-Concept-Instance' tripartite model of ontology:* Guarino[15)] defines ontology as "an engineering artifact, constituted by a specific vocabulary used to describe a certain reality, plus a set of explicit assumptions regarding the intended meaning of the vocabulary words". From that definition we could assume that ontologies are engineering artifacts that allows us to spare them from their social context and transfer them across the domain. According to Mika[2)], problems may arrive with this simplistic view, if we consider the temporal extent of knowledge, because as the original community changes, a new consensus may arise invalidating the knowledge codified in the ontology. To further this temporal approach, Mika formulated a generic and abstract model of semantic-social networks called 'Actor-Concept-Instance' model of ontologies. Mika's model represents semantic-social networks in the form of a tripartite graph of *person*, *concept* and *instance* associations, extending the traditional concept of ontologies (*concepts* and *instances*) with the social dimension. In order to model networks of social tagging mechanisms (folksonomies), Mika represents this system as a tripartite graph with hyperedges. In this model the set of vertices is partitioned into three disjoint sets: $A = (a_1, \cdots, a_k)$ $C = (c_1, \cdots, c_l)$ $I = (i_1, \cdots, i_m)$ corresponding to actors *A*, concepts *C*, and instances *I*. This approach extends the traditional bipartite model of concepts and instances, by incorporating actors. Mika uses this approach to model a social tagging system, where *actors* (users) tag *objects/instances* (bookmarks, photos) with *concepts* (tag, keyword), creating a ternary association between the three parts involve: the user, the concept, and the object. In our study we enhance Mika's tripartite model of ontology to model the relationship

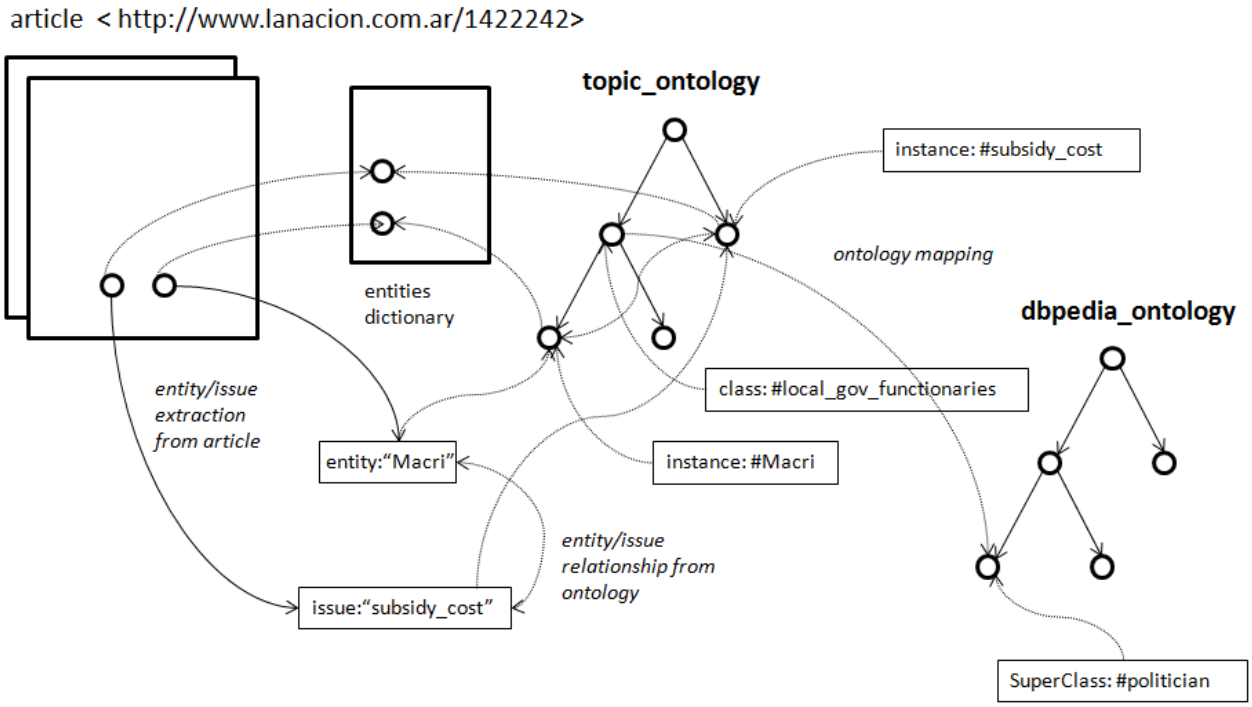

Fig.6 Building of *AI* co-occurrence using Ontology

between: actors (news media articles), concepts (controversial topic issues), and instances. In our study we use Mika's tripartite model of ontology to model the relationships between: news media articles (actors, *A*), controversial topic issues (concepts, *C*), and political players (instances, *I*). We have to state here that in our model the main `actors' are not the political players it selves, but the news media. Our data set is formed by news articles from PAGINA/12 and LANACION, and not from direct statements from the politicians it selves. That is to say, our data set tell us how the news articles shape the image of the players for the public opinion: we cannot assure what the political players actually did or did not say or do, but what the media says that they did or did not say or do.

In this way, the ontology is defined by a set of annotations $T \subseteq A \times C \times I$, where each edge in this network is stating that a given *actor* (news media article) is associated to a certain *instance* (political player) by a certain *concept* (controversial topic issue). In particular we can define a hypergraph of an ontology *T* as a tripartite hypergraph $H(T) = \langle V, E \rangle$ where

$$V = A \cup C \cup I, E = \{\{a, c, i\} \,|\, (a, c, i) \in T\}$$

We can also reduce the hypergraph into three bipartite graphs (two-mode graphs) with regular edges. With his three bipartite graphs we can model: (a) the association between news media articles and controversial topic issues (graph *AC*), (b) the association between controversial topic issues and political players (graph *CI*), and (c) between news media articles and political players (graph *AI*). In this sense, the graph *AI* can be defined as follows:

$$AI = \langle A \times I, E_{ai} \rangle, E_{ai}$$
$$= \{(a, i) | \exists i \in C : (a, c, i) \in E\}, \omega : E \to N, \forall e$$
$$= (a, i) \in E_{ai}, \omega(e) : |\{i : (a, c, i) \in E\}|$$

That is to say, the bipartite graph *AI* links the news media articles to the controversial topic issues that have been used for tagging at least one political player. In the social network analysis, this kind of graph is known as *affiliation network* that is, linking people with affiliations with weights corresponding to the strength of the affiliation. What is important in this point is that an affiliation network can be used to generate two weighted graphs showing similarities between news media articles, political players, and controversial topic issues. **Fig.6** shows how we made *AI* affiliation network by using the Topic Ontology, the Dictionary o Entities and SPARQL queries.

(b) *'Article-Player-Issue' co-occurrence matrix:* To build the 'Article-Player-Issue' co-occurrence matrix, we compare articles from PAGINA/12 (Media A) and LA NACION (Media B), defining two set of articles $a = (1, \cdots, k)$ and $b = (1, \cdots, n)$.

First, we perform a SPARQL query to select, from the data set stored in Fuseki server, only the articles from one of the two news media sources. The outline of the procedure is explained next (only for the set of articles *a*, as the process for the set *b* is the same).

Step 1: By using SPARQL queries we extract a subset of all articles *a* that mentions issue c_1, with $a = (1, \cdots, k)$. **Table 2** shows an example of the results from SPARQL queries showing the co-occurrence of political players, extracted from one particular news media article (which URL is http://www.lanacion.com.ar/1422242). **Table 3** shows a summary of the data collected from both news media sources and *AI* co-occurrence.

Step 2: From that subset of articles, we extract which players i_m are mention in each article a_k, with $i = (1, \cdots, m)$.

Step 3: We build matrix *S*

$$S = \left\{ a_k^{i_m} \right\}$$

with articles $a = (1, \cdots, k)$ and players $i = (1, \cdots, m)$, where if a news article a_k mentions about player i_m, then

$$a_k^{i_m} = 1$$

otherwise

$$a_k^{i_m} = 0$$

All results are arrange in co-occurrence matrix *S*

$$S = \begin{bmatrix} a_1^{i_1} & \cdots & a_k^{i_1} \\ \vdots & \ddots & \vdots \\ a_1^{i_m} & \cdots & a_k^{i_m} \end{bmatrix}$$

Therefore, this matrix defines a network between articles *a* and players *i*, which links news articles and players based on shared issue *c*. Here $a_k^{i_m} = 1$ assumes that to the media a_k player i_m is related with issue *c*. From the matrix *S* we can extract player vectors $\vec{p} \in \{\vec{p}_{i_1}, \cdots, \vec{p}_{i_m}\}$. Player vector $\vec{p}_{i_1}$ corresponds to how the media *a* explain the player i_1 related to the issue *c*, with $\vec{p}_{i_1} = (a_1^{i_1}, \cdots, a_k^{i_1})$ and $a = (1, \cdots, k)$.

(3) Stage 4: Visualization Results

This stage contemplates the last process from **Fig.4**:

(ix) Running MDS analysis.

With the player vectors $\vec{p}_{i_j}$ obtained from the matrices built in the previous stage, each player is arranged in a two-dimensional space using Multidimensional Scaling (MDS) technique. By using the MDS, the dissimilarities between two players $\vec{p}_{i_j}$ and $\vec{p}_{i_l}$, $dsim_{\vec{p}_{i_j}, \vec{p}_{i_l}}$ are evaluated from the semantic similarities $sim(\vec{p}_{i_j}, \vec{p}_{i_l})$ by using inverse cosine function

$$dsim_{\vec{p}_{i_j}, \vec{p}_{i_l}} = cos^{-1}(sim(\vec{p}_{i_j}, \vec{p}_{i_l}))$$

The semantic dissimilarity between two players $\vec{p}_{i_j}$ and $\vec{p}_{i_l}$, $dsim_{\vec{p}_{i_j}, \vec{p}_{i_l}}$ is congruent with the distance $dis_{\vec{p}_{i_j}, \vec{p}_{i_l}}$. All distances $dis_{\vec{p}_{i_j}, \vec{p}_{i_l}}$ are arranged in the correlation matrix *D*

$$D = \begin{bmatrix} dsim_{\vec{p}_{i_1}, \vec{p}_{i_1}} & \cdots & dsim_{\vec{p}_{i_1}, \vec{p}_{i_m}} \\ \vdots & \ddots & \vdots \\ dsim_{\vec{p}_{i_m}, \vec{p}_{i_1}} & \cdots & dsim_{\vec{p}_{i_m}, \vec{p}_{i_m}} \end{bmatrix}$$

The graphical results from the MDS analysis are the figures **Fig.7** and **Fig.8**. First figure shows an example of the debate structure on the issue "subsidy cost" by Media A (news media PAGINA/12), whose left-wing editorial line is more close to Central Government. Second figure shows an example of the debate structure on the same issue, by Media B (news media LA NACION), whose right-wing editorial line is more close to Local Government.

The comparison of both pictures shows very clearly the difference between both media. The key players to understand the difference are the Non-Governmental. In **Fig.7**, Non-Governmental players appear in a distant position, not taken side for either Central or Local Government. That shows a debate structure where civil society is far from

Table 2 Example of co-occurrence by SPARQL queries

article	player
http://www.lanacion.com.ar/1422242	"gobierno nacional"
http://www.lanacion.com.ar/1422242	"gobierno local"
http://www.lanacion.com.ar/1422242	"Mauricio Macri"
http://www.lanacion.com.ar/1422242	"Juan Pablo Schiavi"
http://www.lanacion.com.ar/1422242	"Julio de Vido"
http://www.lanacion.com.ar/1422242	"Daniel Chain"
http://www.lanacion.com.ar/1422242	"Juan Pablo Piccardo"

Table 3 Data Collection Table

Total Number of articled sourced	425 articles
Articles from Media A	208 articles
Articles from Media B	217 articles
***AI* co-occurrences Media A**	1,329 co-occur
AI co-occurrences Media B	1,749 co-occur
Date of articles sourced	From 2011-11-04 to 2013-03-23

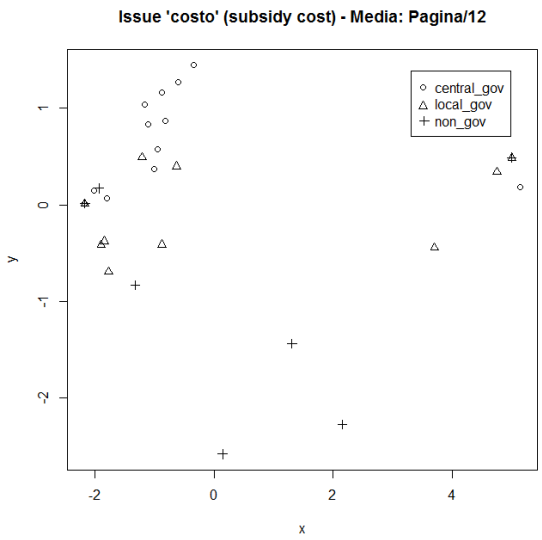

Fig.7 Debate structure on the issue "subsidy cost" by Media A

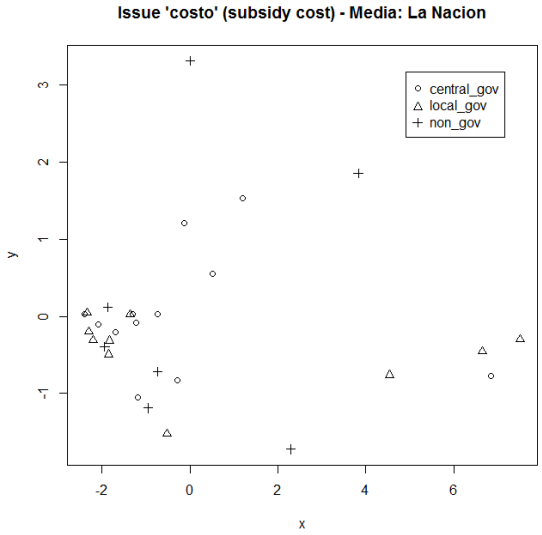

Fig.8 Debate structure on the issue "subsidy cost" by Media B

agreeing to one position or the other, which in the debate is more convenient for the Central Government position. That differs from the debate structure of **Fig.8**, where Non-Governmental players are placed in a more close position to both Local and Central Government players. That shows a more cohesive debate structure, which in the debate is more convenient for the Local Government position.

In **Fig.7** we can also see very clearly how political players relate in the debate, which both Central Government players and Local Government players conforming separated groups from each other. That is to say, in a more general way, how players with one particular affiliation (either Central or Local Government) tend to appear closer, while the others tend to be placed apart from them, which shows how difficult it is to arrive to meta-consensus, and, therefore, how difficult is to reach a common understanding between Central and Local Government players regarding the "subsidy cost" issue.

4. CONCLUSION AND FUTURE WORK

An ontology-based computational framework was effectively used to visualize and compare the position that key political players occupy in the debate structure modeled by two ideologically distant news media sources, on a same controversial public topic. From comparing the results shown on both **Fig.7** and **Fig.8** it was probed how different media modeled a differentiated frame of discourse and political space. The importance of this framework is that it could represent a useful tool for both public debate theoretical discussions, to better understand debate's structure on a controversial topic, as well as for decision makers, to better understand how to address key players to arise to an effective meta-consensus.

Nevertheless, this framework could also be used to provide a public macro debate system as feedback at players' level. In other words, if by using this methodology a player can be objectively awarded of how it is seen by others -in this case, by news media-, it can represent a source for self-learning that could lead to a better understanding of his position in the overall of the debate. That knowledge to the players could constitute a valuable tool for providing the debate system an objective feedback, leading to improving accountability of the process, based on evidence.

However, for a more effective contribution to research this field we cannot rely only on the comparison and analysis of a debate structure built on one temporal dimension axis. It is also important to understand and consider player's relationships as a dynamic and changing process. In that sense, future work must consider a multi-temporal dimension analysis, as well as including a more close evaluation of the relationships between players from different affiliations.

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