Electronic Government Actions: Searching for semantics in the publication of the Brazilian Social Security System´s Open Data

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ABSTRACT

The Governmental Open Data theme is being explored and begins to be treated as a priority by the Brazilian Government from a strong trend established by society itself, requesting more transparent governmental processes with access to public data in a fast and easy manner. To this end, efforts have been conducted in developing of technological solutions involving fundamentally the availability of governmental databases and the interoperability between them. In this direction, we sought to build a framework to facilitate this integration and to support the construction of instruments to disseminate the knowledge and the semantics of all information and data accessed by society in general. In this paper we explore the use of analytic philosophy to the construction of domains, ontologies and controlled vocabulary, as well as the journey being travelled by Dataprev towards providing the Brazilian Social Security System with methodological and technological instruments in order to enable the participation of the society in the implementation of Electronic Government.

Keywords: Analytic Philosophy, Ontology, Governmental Open Data, Brazilian Social Security System, Dataprev, Brazil

1. INTRODUCTION

Within the scope of this research, some political milestones have been determinant to the technological definitions conducted in this effort.

The first milestone is the publication of Decree nº 6.932 of August 11th, 2009, signed by the Brazilian President [1] which "disposes about the simplification of the public services to the citizen, ratifies the exemption of notarization of documents produced in Brazil, institutes the 'Letter of Services to the Citizen' and makes other provisions". For this purpose, this Decree brings in its 1st. article, lines II and VI, that the Executive Power, in its relations with the citizens, must share information and apply technological solutions, which will not only simplify the processes and procedures, but also provide better conditions to make the information available to the citizen.

Besides, the Decree foresees in its 4th article the availability of official data bases managed by the Executive Power for public agencies and entities interested in the access to the information contained there.

The second was the publication by US President Barack Obama of the document "Memorandum on Transparency and Open Government" [2], which defines the guidelines of the US Government for his administration with regards to the access to American Government data, ranging from the question of the internal management of information up to the publication of Government data to the public in general. The fact is that after the publication of this document, the results were US initiatives around the so-called Open Government, which strengthened actions related to the theme, implying the availability of official data bases to the community in general. This milestone also fostered other related discussions, mainly about technological patterns concerning the theme such as RDF, OWL and SKOS, as well as definitions about the license standard to be attributed to the published data.

The third and more recent political milestone noted is the one related to Law 12.527 of November 18th, 2011, or simply Law for Information Access [3], which objective is to guarantee to the citizen the exercise of his right of access to information produced and maintained by all governmental entities. However, it poses a great challenge to the State in its 5th article, for it states that "the access to information, which will be opened up" shall occur "through objective and agile procedures, in a transparent and clear manner, and in a language easy to understand".

It was within this context that emerged the project to use the proposal formulated by Tim Bernes-Lee, using the Linked Open Data (LOD) [4] in the publication of data of the Brazilian Social Security System Statistical Yearbook. This project allowed not only the access to data contained in the Yearbook, but also the use of these data for exchange operations with other bases, bringing us a common information space and allowing the exploration of interconnections still not considered in the information of the Yearbook.

This paper presents a short contextualization of the project to subsequently formulate the conceptual background being used for embedding semantics in the set of information already published, with the use of an epistemological approach supported at the analytical philosophy to support the investigative process.

2. THE RESEARCH CONTEXT – SYNTHESIS OF THE PROJECT FOR THE PUBLICATION OF OPEN DATA OF THE BRAZILIAN SOCIAL SECURITY SYSTEM

In line with the evolution of technologic environments, Dataprev (Technology and Information Company of the Brazilian Social Security System) [5] invested in the organization of a project to insert Social Security in the context of Open Data.

In this direction is initially highlighted the role of Dataprev, which manages major social records of the Brazilian Government, such as the data bases Social Security system, the National Register of Social Information (which contains the records of all the ties of social security and labor contributions of the economically active population in Brazil) and the National Register of Deaths (which concentrates the record of all deaths registered in notaries in Brazil).

Therefore, to overcome this challenge, it was initially necessary to understand the domain to be published, composing the planning phase of the informational environment to be disseminated. This phase was conducted through meetings for structuring the scope, led by the Department of Information Management in partnership with the Presidency of Dataprev. These meetings had as main objective to evaluate the list of the existing demands to use the Brazilian Social Security System data as well as to understand its relevance to the community.

The result of the meetings to define the scope was the decision to publish the data available at the AEAT – Statistical Yearbook of Work Related Accidents [6], for, although these data are already published by a extraction tool that allows queries on the internet [7], this publication does not follow the principles for the use of open data[1], hampering the reuse of this information by society in general.

The AEAT contains data on Work Related Accidents that were administratively registered or characterized as such by INSS (Brazilian Social Security) in the process of granting benefits. This information is processed, organized and made available in aggregated series. For the first version it was possible to get to the representation in Figure 1 as the final model for publication:

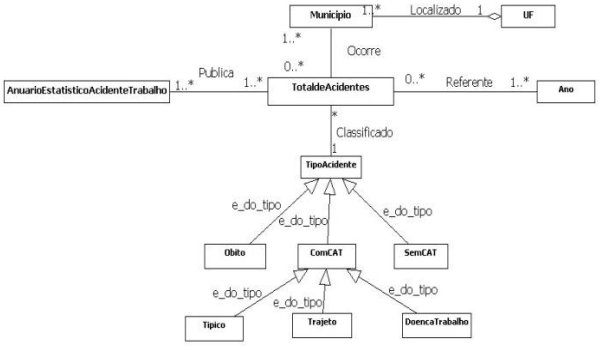

*Figure 1. Domain Model adopted with respective cardinalities.

With the developed model specification (Figure 1), we set out to the process of extraction of these data from AEAT's operational bases [9], to subsequently start the process of transformation and loading to publication. The result of this first effort of publication is available at Dataprev Webpage address http://api.dataprev.gov.br.

However, all the work developed in this first increment still lacked information to cover the semantics of data. Despite the attempt to structure resort to models and to a dictionary of terminology, these tools still required human intervention because they didn't allow the automated processing of information to bring semantics to the data.

3. THE NEED TO INCORPORATE SEMANTICS TO THE SET OF PUBLISHED DATA

As observed at this paper introduction, the publication of Decree 6.932, especially regarding the exigency of documents already in the official data bases, boosted a set of efforts to seek the interoperability between the official bases of the Brazilian government.

On the other hand, it is possible to note that the Web has dramatically changed the way knowledge is shared, because one of the greatest factors of this environment success is the freedom of its users to create and spread information anytime and anywhere. Links between documents through hypertext structures, allow users to browse through the informational space where the documents are published by means of the so-called Web navigators, while search engines associated with analyzers of document links, allow users to localize the requested documents. This combination was the main responsible for the success of Internet and for its constant full increment [4].

The project briefly described on item 1, had no information that covered the semantics part of the data in a way to allow a greater grade of integrated and collaborative operation between applications. It is possible to perceive that in accessing the data available, there was still the necessity of human intervention to understand the data and their relations in view of the way this information was published on the pages. Therefore, it was reasonable to suppose that we were facing a Syntactic Web [10] and we needed to move towards a semantic Web, since endowing the Web with facilities to allow the automated processing of information and content is one of the natural ways for us to work with the myriad of data present on the Internet today.

[1] The three laws to promote the use of Open Data [8]:

- If the data can't be found and indexed on the Web, it doesn't exist;
- If the data is not open and available in a format understandable by a machine, it can't be reused;
- If any legal dispositive doesn't allow its reuse, the data is not useful.

3.1. The efforts to build normative milestones of the Brazilian Government

There are actions within the Brazilian Government to improve the quality of the information and create tools to facilitate data exchange. The initiatives in course can be observed in papers present in the publication Open Data to Democracy at the Digital Era which may be considered as the genesis of the problematic to the treatment of the information in the Government database:

> The huge amount of codes of the Corporate Structuring Systems of Government, added up to the complexity of the businesses they support and to the many different computing platforms that sustain them, bring us to the various attempts to the evolution and integration of these systems. Through the years, this natural difficulty to implement improvements pointed out in the complex environments, has encouraged the creation of a Data Belt, DB, to give support to the decision-making process of the Government. […] The data of SGAs [Administrative Management Systems], often extracted into spreadsheets, are augmented with other declarative information, other documents, news, etc, constituting an important basis for the decision making at the strategic level of the Government [11, pp. 25].

It is also in this context that the DadosGov Project [12] is being developed. This Project aims to create an Open Information Catalog in order to improve public management and facilitate monitoring by the society. Developed by the Information Organization Committee of the Brazilian Presidency (COI-PR), this catalog was built from some assumptions for the availability of information [11]:

- Presentation of the information organized into thematic trees and historical series;
- Use of groups of information to facilitate the acquisition and assignment of responsibility for the quality of the data structure and its content;
- Specify and structure the requirements of the general level to more specific levels;
- Organize the storage of data in standard format for cataloguing.

The modeling work of this catalog was also developed with the support of the Global Data Model where, through the mapping of the Electronic Data Bases of the Brazilian Government systems, it was sought to integrate the structure, the semantics and the processes involved on the actualization of the respective data repositories.

Add to this the set of efforts to organize this issue which is being developed by the Secretary of Logistics on Information Technology (SLTI) of the Ministry of Planning. In a recent debate also carried out at the IV CONSEGI [13], Mrs. Miriam Chaves – of the Secretary of Logistics on Information Technology of the Ministry of Planning – presented in general lines the proposal for the integration and use of the LOD infrastructure in the Government (Figure 2).

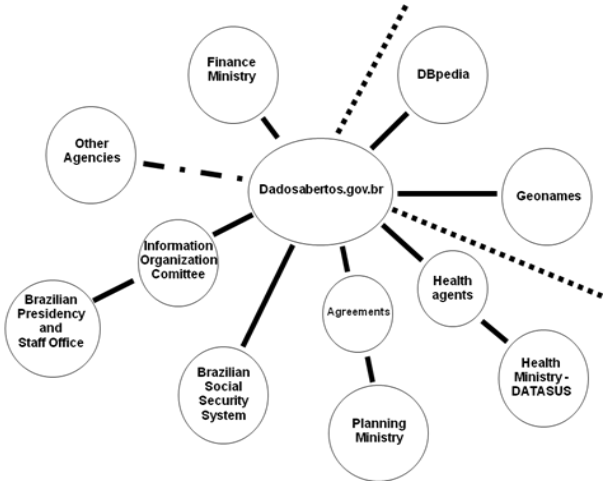

Figure 2: LOD Structure and Brazilian Government Data [13]

SLTI's efforts culminated in the partnership between the Government and the society, represented by organisms of standardization, universities and Non-governmental Organizations, to the purpose of developing the INDA (National Infrastructure of Open Data) [14]. This infrastructure follows the model practiced for the generation of INDE (National Infrastructure of Spatial Data) [15] and consists of set of patterns, technologies, procedures and control mechanisms necessary to meet the conditions of spreading and sharing public data and information in Open Data model, in accordance with the stated in the project e-Ping (Project of Interoperability in the Government) [16].
Is within this scenario full of alternatives and examples of structuring according to assumptions for open data that the project under development by Dataprev inserts itself.

4. THE ANALYTICAL PHILOSOPHY AS AN INVESTIGATIVE APPROACH FOR THE CAPTURE OF SEMANTICS

For the development of this research it was necessary to seek assistance in the understanding of "the things of the world'. According to a view of evolution over time, it is possible to state that this process of understanding has undergone several transformations and had different investigation approaches. From Plato up to Husserl, the objects of traditional philosophical investigation were always linked to knowledge, to the being, to existence, to truth, to freedom, to goodness and to beauty. The main concern of observation and understanding has always been related to more general and abstract character than simply with concrete and particular issues, such as the objects around us in our everyday life [19].

On the other hand, the interaction between source and receiver, besides the representation of data and information that will be the target of dissemination and communication, indicates the way to the beginning of the journey towards the understanding of semantics. Therefore, observing the transformations that occurred in part of the path taken by philosophy, it was verified a focus shift, which allowed us a better understanding of the structure of thinking towards language. Since the observation of the Metaphysics[2] study, passing through Kant[3] , Hegel[4] ,

[2] Where vision was marked by objectivism.

arriving at Husserl[5] and, more recently, to the contemporary philosophy, marked by the linguistic[6] turn, it was possible to perceive not only the shift of focus in the study towards language but also the set of issues related to semiotics and the problem of the meaning [20].

Thus, we started with the assumption that the process of structuring the semantics of information involves the analysis of the domain, especially in the scope of informational process [22] and in the communication aspects between those involved in the act of communicating. It should be noted that the term analysis may be understood as:

> ***Analysis*** is, therefore, a form of explanation or definition. In a more vague sense – vague enough to embrace all that is usually called analytic philosophy – we may speak of a conceptual elucidation or clarification, of a description of the grammatical or logic structure of our concepts [19, pp. 22, emphasis added]

In this direction, we arrived at the language philosophy as the *locus* to the development of the project, as it seeks to:

> [..] understand the language not only as a vehicle of concepts, but as a field on which such concepts – that allow to articulate the world aiming to make it meaningful to us – are constituted [17, pp. 61].

The Philosophy of Language has as its basic idea, the realization of philosophy by language analysis. This approach, together with the Analytic Philosophy view, served as the supporting point to the better understand the relationship between language, understanding and truth perception.
Apel [23] validates this strategy because, according to this author, this relationship must be mediated by syntax, semantics and pragmatics, as dimensions of the linguistic truth that may help in the specification of the representation. "Syntax" may be understood as the intralinguistic relationship of the signs between themselves; "semantics", the relationship of the signs with the extralinguistic designated facts; and "pragmatics", the relationship of signs with human being while language users.

On the other hand, it is possible to perceive that when developing studies about domain related issues, the observer operates as an interpreter of the universe under study. This observer is a being loaded with beliefs, with a cultural background and with different people living at his side. All these perceptions bring influences to the acts and decisions to be made by this observer and, mainly, to the representations of reality that this observer may propose.

So, it is reasonable to assume that the analytic process seeks to translate something inaccurate into a logical language, free of errors and ambiguities, trying to decompose the complex into simpler constituting elements [18]. In face of these decisions we were ready to take the next step towards the representation of the Universe of Discourse[7], because once mediated by language, the representation process gains evidence in that it aims to correctly designate the qualities known in the light of its meanings that are perceived, grasped and understood in the analysis of the contents of the domain [22].

[3] Who withdrew the objects from the center of attention and placed the subject.
[4] Seeking the necessary unity between subject and object.
[5] Where the world and the reality are translated by a set of meanings or senses.
[6] Where language becomes the new paradigm of philosophy.
[7] Universe of Discourse – UofD is a context where the system must be developed and operated. Are part of the UofD the sources of information and all people related to the system [23].

5. THE PROCESS OF ANALYSIS AND REPRESENTATION OF THE ELEMENTS

The understanding of the knowledge present in the Universe of Discourse passes through the perception of the structuring of this context organized in a net of nodes and links. A detailed description of these elements is associated with a theoretical specification, which includes a set of expressions formulated in a language that represents the detailing to achieve the goals of the Universe of Discourse. From the analysis of the domain elements and their associations (Figure 1) it was sought to classify the elements, the categories and the hierarchical order of these elements. This whole process was based on the assumption that there are concepts so general and abstracts that they can encompass all the other remaining elements [19].

Additionally, it is know that in order to publish information in the Web is necessary to perform the understanding and representation of information. However, we know that understand and represent are only parts of the problem, because these characteristics, besides allowing a better spread of knowledge, help in the process of recovering of resources available on the Web. In this direction, other disciplines[8] need to be treated and, especially on the Web environment, the proposals for the organization of domains also have to cover navigation alternatives, because they can only "be obtained from a well-defined navigational space" [25].

Thus, with the support of the analytic philosophy began the process of structuring the concept hierarchy and its association. The investigation of the meanings and concept passed through the elements that the analytic philosophy usually places in first: the meaning, the concept, the name, the object, the thought, the fact and the true existence [19].

First of all, the analysis of the terms of the domain according to the dimensions of syntax, semantics and pragmatics, allowed a revision of the dictionary of terms and the organization of the set of classes. The representation of Figure 3 shows the hierarchy obtained:

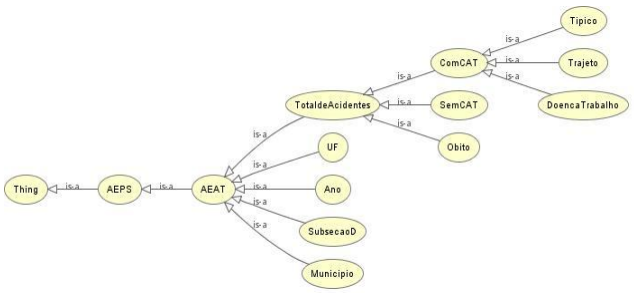

*Figure 3: structure of classes and concepts

As the core of the representation consists of statistical data, the compromise between the language relationship with the entities used for the representation assumes a more prominent position in the domains under consideration, to the extent that a statistical data is generated from some dimensions that were used to the generation of this data. So, in order to clarify the terms of domain was sought interpret these terms within domain under review. The interpretative process of the domain elements was based on the analysis of subsection D of the Yearbook and supplemented by interviews with the technicians who have produced the statistics present in this subsection. The

[8] Like Information Architecture [24]

conduction of these interviews was guided also by the dimensions of the linguistic truth – syntax, semantics and pragmatic – so that in the end of the interviews it was possible to obtain the qualities, properties and meanings for the domain elements.

The process of analysis and categorization of elements and associations was also developed in the light of Guizzardi's proposal [26], arriving to the representation in Figure 4:

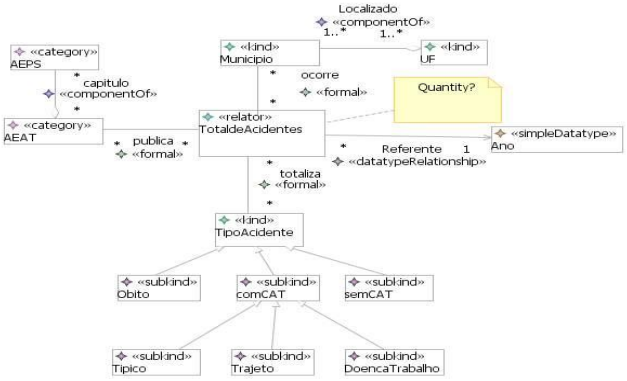

*Figure 4: OntoUML model of classes and concepts

The generated model satisfactorily answered the questions identified as relevant, however, it was inferred that the process of abstraction developed to arrive at the representation of objects types needs to be understood in the extent that variations may arise in its use. These variations arose primarily from the domain that is the target of the representation.

6. DISCUSSION

Answering the longing of the society in general, the effort for the publication of Open Data makes it clear the need to provide information to a better participation of the society in the management of our country. However, the major challenge is to make available the huge volume of information in a way that it is possible the (re)use of all this set of data, managing in a more effective way possible the conflicts of heterogeneity (for example: similar names that denoting different concepts (homonymous), different names to the same concepts (synonymous, etc) between the basis that host them. One of the biggest questions arising with this work is how to implement an agile process of publication that also permits to aggregate data semantics, and thus, leads from a Syntactic Web to a Semantic Web.

In this direction we can point out three other issues that also deserve special attention in the continuity of this research.

The first directs to an investigative approach, since the use of analytic philosophy has demonstrated to be a suitable approach for understanding and structuring knowledge. This knowledge is relative to the domains concerning the databases and contributes to the advance towards the effective interoperability between heterogeneous bases. However, the exploration of other aspects of the philosophic study, such as phenomenology [27], may be a viable alternative to the process of investigation of the semantics, because in this approach the vision of the essence of the problems that are the investigation target passes through the use of phenomenological reduction, where the visions of immediate essences are fixed in data, either in conceptual or terminological manner.

The second direct to elements of domain. While investigating the set of elements present in a Universe of Discourse, which consists of information aggregated and summarized in some dimensions, new visions and restrictions must be observed in obtaining the desired semantic agreement.

The third direct to the technological model to be used. This model must allow the integration of the database between them and also enable the interoperability between data so that the information required may be published. Among the technological models to be considered, the one that proved to be closer to the efforts made is the so-called hybrid ontology approach [28], where local ontologies for each database are built from a controlled shared vocabulary (shared vocabulary). Thus, the mapping between the elements is done, enabling the interoperability between the databases.

7. FINAL CONSIDERATIONS

Considering that the Decree nº 6.932 is already in force; that the Law nº 12.527 will be effective from May this year, 2012; and that the structuring aspects, either of technological or institutional nature, are extremely challenging; will be necessary to conduct our work based on some decisions.

First, the sequence initiated with the Brazilian Social Security System Statistical Yearbook, for all the previously outlined reasons should be kept, because it is fundamental to the process of consolidation of the knowledge to be acquired in the technologies demanded.
The second is related to the implementation stage[9], because the assemble of class hierarchy begins to enable the construction of semantics, in that it is possible to use structures XML and RDF to represent these hierarchies in a language processable by machine. On the other hand, the use of standard vocabulary such as SKOS and SCOVO [30] is an important condition to enable the reuse of this work in other efforts tha are being planned within the Brazilian Government, as it can be observed in the project e-vog, which is preparing the Electronic Government Controlled Vocabulary [31].

Finally, the consolidation of technologic basis for the interoperability of heterogeneous databases combined with the ability to openly publish data and information demanded by society will bring to Dataprev the capacity to provide services that enable a greater participation of the society in the implementation of the Electronic Government in our country.

8. ENDNOTES

***Notes on Figures 1, 3 and 4 labels:**

- **Município -** County or City which is located in a State
- **UF** – a Brazilian State
- **AnuárioEstatísticoAcidenteTrabalho** - Annual publication produced by the Ministry of Social Security on Work Related Accidents

[9] According to what Rautenberg, Todesco and Gauthier [29] claim, it is possible to place the project here reported in the formalization stage, leaving the implementation stage to be covered and finally reach the cycle of maintenance and evolution of this paper.

- **TotaldeAcidentes** – Sum of Work Related Accidents
- **Ano –** Year of reference where the sum of accidents was recorded
- **TipoAcidente** - Classifies the type of accident suffered by the insured.
- **Óbito** - Is the number of accidents that have resulted in the death of the insured.
- **ComCAT** - Is the number of accidents registered with the Social Security System. It is not considered the restarting of treatment or the removal due to aggravation of injury from accidents at work or occupational disease that were previously communicated to the Social Security System.
- **SemCAT** - Is the number of accidents not registered with the Social Security System. The accident is identified by one of the possible nexus: Technical Professional/Work, Social Security Epidemiological or Technical by disease treated as accident. The identification is made by the way benefits are granted.
- **Típico –** Are the accidents resulting from the characteristic of the professional activity performed by the injured**.**
- **Trajeto** – Are the accidents occurred on the way between the home and the workplace of the insured, and vice versa.
- **DoençaTrabalho** - Are those produced or triggered by the exercise of a work peculiar to a particular area (Annex II of the Regulation of Social Security) and those acquired or activated due to special conditions under which the work is performed and that is directly related to it.
- **SubseçãoD** - Chapter of the publication that provides additional information on Accidents at Work.

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