Structuring E-Brainstorming to Better Support Innovation Processes*

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Abstract

Innovation is a key instrument to start a transformational process based on collaboration. It is fundamental for organisations and institutions to have well defined strategies. In this context, brainstorming sessions — and e-brainstorming tools — are effective techniques to put together and associate draft ideas. Yet, in many cases, those ideas and associations do not leave enough digital footprints, are no further used or are lost. This paper introduces the use of Social and Semantic Web technologies to support e-brainstorming. In particular, we present a lightweight ontology to structure e-brainstorming sessions, and the enrichment of existing e-brainstorming tools to do so.

Introduction

Current global market and economic crisis have resulted in increased competitiveness, and organisations need to be competitive and pioneer in their area. Thus, they need to apply well planned and innovative organisational strategies.

Open Innovation strategies can lead to good practices in organisations, "the use of purposive inflows and outflows of knowledge to accelerate internal innovation" (Chesbrough, Vanhaverbeke, and West 2007). This model emphasises the importance of sharing knowledge and opening idea flows within strategic processes. Several companies are being encouraged to have online communities (Tapscott and Williams 2006).

Open strategies can generate value creation by fostering individual's participation and collaboration initiatives. Besides, these can be supported by technological solutions in order to offer a better information management. This type of models are also known as network Innovation models.

In (Errasti et al. 2010), the authors propose an Innovation process composed by three main phases: *idea creation*, *idea enrichment* and *idea selection*. The aim is to develop a collaborative Innovation management system by introducing new technologies into business processes to support information management.

Based in the above mentioned three-phase process, our research focuses in the initial stage, *idea creation*, and how brainstorming (BS) sessions integrated with advanced technologies such as Semantic Web technologies, can contribute into better idea generation tasks. BS sessions can occasionally lead into difficulties when trying to gather all ideas, track them or obtain conclusions out of participants and their contributions. Therefore we look forward to make these tasks easier by structuring BS sessions with Semantic metadata. Especially, Semantic Web can help in keeping all the information structured in electronic files accessible by anyone from anywhere. Moreover, intelligent agents can then deal with this structured data to avoid direct human interaction, for instance when searching for minutes of a BS session.

Currently there exist various organisation model cases that are experimenting with Innovation models. *Elkarbide*[1], *Oldarra*[2] and *Ekiten*[3] are some of those initiatives. These cases are clear examples of open Innovation projects where brainstorming sessions, improved with Semantic technologies, can strengthen their initial stages of idea generation.

Hence, we propose an approach of enhancing electronic brainstorming (EBS) — done with real-time text editors — using Semantic Web technologies. Our contribution includes *(i)* the design of the brainstorming ontology and *(ii)* a social media tool based on a brainstorm ontology to represent the information in Resource Description Framework (RDF) and contribute with new ideas to other EBS sessions.

The rest of this paper is structured as follows. In section 2, we introduce the importance of semantics to BS sessions using Social Web ontologies. In Section 3, we propose the approach of collecting contributions from other BS sessions to support individual's idea creation process. Finally in sections 4 and 5 we talk about related works and some conclusions and future actions.

Ontology Modelling

This study aspires to make a better use of all the information generated in EBS sessions that are not considered in traditional BS sessions. Likewise we suggest using Semantic

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[1] http://www.elkarbide.com/quees
[2] http://www.iseamcc.net/news/revista/revista-isea-04.pdf
[3] http://www.mondragon.edu/es/ekiten

Web technologies in EBS sessions. Ontologies for instance, as defined in Computer Science, are representations of concepts from certain domains. These ontologies (also known as "vocabularies") express relations between the concepts to describe the domain(Gruber 1993).

Some studies discuss about BS inefficiency due to distraction or production blocking problems, while there are other studies that state how BS sessions provide good results in idea generation and benefits like team working or work enjoyment.

Ontologies for the Social Web

In the past few years, several models have been designed to provide structure on the Social Web, including:

- FOAF (Friend of a Friend[4]) describes connections between people in social Web sites.
- SIOC (Semantically-Interlinked Online Communities[5]) offers necessary concepts and properties to describe information from online communities on the Semantic Web. For instance message boards, wikis, or weblogs (Berrueta et al. 2007).
- SKOS (Simple Knowledge Organisation System[6]) is a common data model that shares and links knowledge organisation systems via the Semantic Web (Brickley and Miles 2005).

While these previous models can model some aspects of e-brainstorming, they do not provide a coherent picture of the domain. Yet, by following RDF representation principles, they can be easily merged.

This is how ontologies can be reused and combined to create new vocabularies to cover different domains. Reusing ontologies is a useful method to make it easier for systems to interact with other applications. Furthermore, it benefits reusing existing schemas avoiding designing time and implementing new vocabularies from scratch (Gómez-Pérez and Rojas-Amaya 1999).

FOAF ontology can help representing some social aspects of EBS, SIOC can cover the online community information and SKOS can map the generated ideas. However, in order to have a strong vocabulary that matches all the points, we need an ontology that imports these definitions. For this reason we introduce the Brainstorm ontology.

Brainstorm Ontology

We studied literature to examine which features or concepts were needed to cover a BS domain.

- Problem: The topic introduced to the individuals to be analysed.
- Participant: People attending BS sessions that storm problems.
- Idea: Participant's contribution to suggested problems.
- Objective: The expectations that want to be obtained out of BS sessions.
- Duration: The time a BS session in going to be opened for to be stormed.

As seen in the previous section, existing models can cope with parts of these concepts, but not all of them.

Hence, we designed an ontology (Fig. 1) reusing existing social ontologies to structure the EBS domain. This Brainstorm ontology offers a vocabulary for idea generation and makes it possible for machines to interpret the generated information during EBS sessions. The ontology is publicly available in http://vocab.deri.ie/br.

As it can be observed in Fig. 1, different ontologies have been used to model distinct concepts. Each ontology is represented with a different colour in the graph.

Modelling Participation Users will participate in BS adding ideas or reviews. In order to behave as users, participants will have social network information which will be defined by FOAF, and SIOC vocabulary will describe online communities information. Merging these ontologies we are able to analyse user's activity in online EBS communities.

Moreover, we use SKOS collections to keep all generated ideas organised in EBS sessions. An important aspect of SKOS is that it allows to hierarchically organise its concepts, so that ideas in EBS can be then organised this way — for instance an idea about "event" can have sub-ideas such as "concert".

Modelling Tagging While EBS members are creating ideas they might find useful to add tags in order to define the content by meaningful terms. Tagging action is also represented in the ontology by the Tag ontology[7] that connects the person, the tagged idea and the tag definition.

Modelling Comments Another common practice when discussing ideas is to give comments. As a possible substitution to traditional physical comments in BS sessions, we import the Review ontology[8] were comments, reviews and evaluations are considered. This ontology also reuses different vocabularies by defining the reviewer as a FOAF person for example.

Modelling Brainstorm Duration BS are sessions with certain duration. In order to control this period of time we use the Event ontology[9]. A vocabulary that defines one Event concept that has location, time, active agents, factors and products.

Application

Semantic Web Real-Time Brainstorming

While BS sessions are team-based techniques carried out with physical presence, EBS offers the possibility to hold these sessions in a distributed and parallel way without any production blocking. In (Gallupe et al. 1994), the authors

[4]http://foaf-project.org
[5]http://www.springerlink.com/index/ycw4ta75qjngnat8.pdf
[6]http://www.w3.org/TR/skos-primer/
[7]http://www.holygoat.co.uk/owl/redwood/0.1/tags/
[8]http://purl.org/stuff/rev#
[9]http://purl.org/NET/c4dm/event.owl#

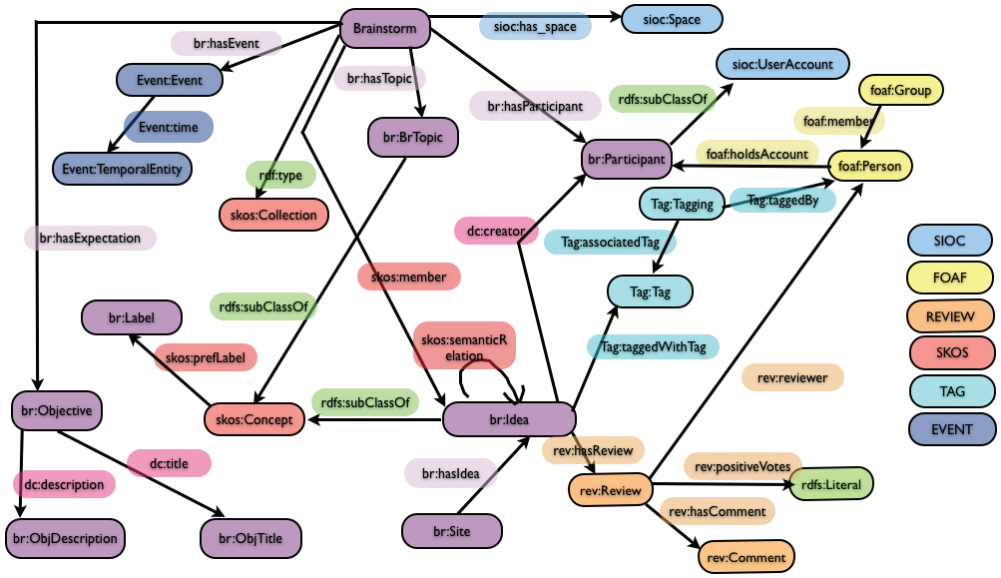

Figure 1: Brainstorm Ontology.

discuss about EBS productiveness arguing how EBS sessions produce better results in creating new ideas than traditional BS sessions. Our ontology-based approach (still in progress) will generate a system capable to coordinate all participants' ideas simultaneously. Thus, we need a real-time system to simulate the face-to-face situation.

Gobby[10] is a free collaborative real-time text editor that runs in multiple operative systems. A Gobby server will centralise all documents created in a same EBS session and will make it possible for participants to collaborate on them concurrently, as if users were discussing the ideas in person.

To coordinate different additions, various colours are used to highlight each person's contributions. This feature makes it a very intuitive tool, see Fig 2.

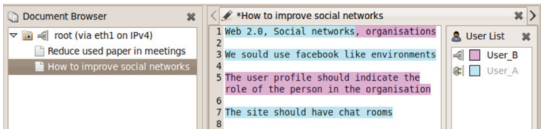

Figure 2: Gobby text-editor.

The application will be divided into two main parts. While the BS session is on, users will have the chance to add their ideas or contribute other ones. These actions will be managed by Gobby. Once the BS session is finished, the ideas will be structured into RDF and kept in an Idea Repository, a data base storing all RDF idea files. Fig 3 illustrates the storing of these RDF files into the repository, and as all the ideas will be centralised in a server, EBS sessions will have the chance to query the repository to obtain similar ideas.

Since the information is kept in the repository in RDF format we will use SPARQL[11] to query the repository, the RDF recommendation for querying RDF data. Having a repository storing all the information generated with the Brainstorm ontology will enable to have access to all the information mapped with our ontology, independent of using Gobby or any other software as text generation.

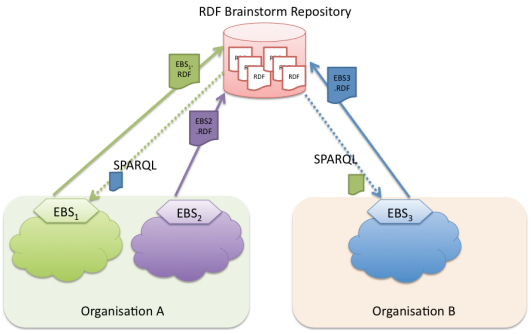

Figure 3: RDF information generation and getting contributions from other organisation's RDF meta-data.

Related Work

Several works focuses on ontological approaches for Innovation processes and, more in concrete, for idea management. In our work we focus on modelling an ontology based on social vocabularies rather than creating an ontology with proprietary classes and properties.

The GI2MO ontology[12], for instance, is a project that tries to improve current Idea Management Systems by Semantic Web technologies. It offers an ontology that models Idea

[10] http://gobby.0x539.de/trac/

[11] http://www.w3.org/TR/rdf-sparql-query/

[12] http://www.gi2mo.org/0.4/ns.html

Management Systems but in stead of reusing existing ontologies, it mostly uses proprietary classes and properties (Westerski, Iglesias, and Rico 2010). Its inconvenient is that it won't be able to reuse already generated data in the Web.

Moreover, Riedl, May and Finzen describe an Idea ontology in (Riedl et al. 2009). In their work they reuse existing ontologies to represent Innovation resources, and although they cover most of the features for idea generation processes, they lack some brainstorm concepts.

Other researches integrate human thinking and intelligent agent techniques to create automatic decision makers within brainstorms (Yuan and Chen 2008). They apply an idea ontology to map client's knowledge and they work with idea names and relationships between idea instances. However, they do not go further in social aspects of users, nor participance or relationships.

Conclusions and Future Work

To conclude, this paper presents the generation of a Semantic Web real-time text editor based on the proposed brainstorm ontology to perform traditional BS sessions. It will offer an EBS system to cover the initial part of Innovation processes, idea generation phase. Comparing to other existing ontologies, our Brainstorm ontology covers in totality an electronic brainstorm session. Furthermore, this ontology is based on other existing Social ontologies making it scalable, reusable and easy to interact with other systems based on different ontologies. This is why, the ontology can grow gaining bigger dimensions and covering more phases within the Innovation process. However, we still need to evaluate how does the EBS improve idea generation processes and if users feel comfortable with the new way of performing brainstorming sessions.

On the contrary, we foresee that this practices have lack of privacy when sharing ideas across different organisations. As a possible solution we suggest implementing privacy preferences ontologies. For example, the authors in (Sacco and Passant 2011) suggest a lightweight vocabulary for defining privacy preferences for RDF data.

Furthermore, due to all the social information generated within these EBS sessions, different analysis could be carried out and perform data mining tasks. For instance, the information could be used to observer the historical evolution of organisations and obtain conclusions.

In addition, we can also preview another scenario where users can collaborate from diverse devices rather than just from computers. In order to take advantage of new technologies like Smartphones, different scenarios can be suggested where people contribute collaboratively using different devices. For example, (Puttaswamy et al. 2010) introduces a new working environment allowing on-the-go editing of documents using mobile phones.

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