Motivation Mechanisms for Participation in Human-driven Semantic Content Creation


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Abstract:
In the last few years, semantic technologies are continuously maturing and many applications are adopted in various field. To take a step towards overcoming the knowledge acquisition bottleneck, the challenge of generating semantic content persists. It usually requires the involvement of humans, thus motivations and incentives mechanisms that might foster human participation in the semantic content creation should be analyzed. We review motivation structures of different successful communities (online communities, social Web communities, open source software communities), analyze motivation mechanisms for incentivizing semantic content creation, and provide some useful insights for the design of semantic annotation tools which would embed incentives mechanisms.

Keywords: Motivations, incentives, semantic content creation, ontology, annotation, participatory design, game theory.

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distributed tools and processes that allow organizational learning and knowledge management, and knowledge representation systems (such as ontologies, classifications, taxonomies) as mechanisms for knowledge reification processes. She has written a number of chapters in books, articles in international journals, and has served as the PC member for various interdisciplinary conferences. For further information, please see http://www.disa.unitn.it/net-economy/cuel/.

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1. Introduction

In this paper, we focus on the interplay between machine and human-contributed efforts for creating semantic content (namely both developing effective ontologies and annotating content). By a survey of literature, we investigate the antecedents of human participation, highlighting the need for taking into account motivations and incentives drivers in any design effort. We also provide some guidelines—derived from Game-theoretic principles and Participatory Design—that can be applied to fruitfully encourage participation. We use these guidelines in a real-world case study to analyze the usability of the tools and the user motivations for semantic content creation.

The paper is structured as follows: in the next section we provide an analysis of the problems related to the interdependencies between automatic and human-driven tasks in semantic content creation, underlining the shortcomings of approaches relying exclusively on machine reasoning. Having brought to the forefront the need for getting human agents involved, in the following section we provide an overview on the current empirical research on human participation to computer-based distributed tasks. Here we concentrate on illustrating various motivational facets that induce people to take part in such endeavors. These empirical findings are included in a comprehensive theoretical framework that we introduce in the next section, and that we use to give an interpretation and to propose solutions to one concrete case study presented in the fifth section. Conclusive remarks follow.

2. Human-driven tasks in semantic content creation

In this section, we provide an overview of the tasks in the process of semantic content creation and where human contribution is required. In particular we focus on ontology creation and evolution and on semantic annotation. For a more in-depth analysis of tools and methods for semantic content creation, see (Siorpaes and Simperl, 2009).

2.1. Ontology development, alignment, and evaluation

Ontology designates an explicit specification of a shared conceptualization that holds in a particular context (Gomez-Perez, 2003; Gomez-Perez et al., 2004). In other words, ontology provides an explicit conceptualization which describes semantics of data, providing a shared and common understanding of a domain.
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Creating and developing ontologies requires domain expertise and the ability to capture this knowledge in a clean conceptual model. Various tools have been developed to help people in creating manually, or semi-automatically, categories, partonomies, taxonomies, and other organization levels of ontologies. Behind these tools and techniques, different (domain-independent) approaches and methods are used to develop numerous heterogeneous ontologies (Cristani and Cuel, 2005).

There are different approaches to the task of building ontologies: some methodologies are designed for a team-oriented approach, i.e., a team of ontology engineers and domain experts produce an ontology. However, as presented in (Gomez-Perez, 2003), 7 out of 17 tools need user intervention throughout the entire process, 8 can be run semi-automatically, and only 2 are fully automated. As such, and despite existing semi-automated approaches of ontology creation, alignment, and evolution, it remains a costly and time-consuming human-driven process, whereas other approaches suggest that ontology building is performed within a community of contributors in a collaborative fashion.

The alignment of heterogeneous ontologies is regarded as one of the major challenges for making the Semantic Web a reality and semantic technologies a success (Ehrig and Sure, 2004; Euzenat et al., 2007; Euzenat and Shvaiko, 2007; Noy and Musen, 2001). There is a wide range of algorithms that aim at semi- or complete automation of the mapping tasks, but ontology matching cannot yet be done fully automatically (Euzenat and Shvaiko, 2007; Falconer and Storey, 2007). Many approaches attempt to develop automatic ontology matching tasks, but only very few can run automatically. Most of the ontology alignment tools require the humans’ involvement to either provide training data, define rules to carry on mappings, or give feedback on the suggestion of the system.

Ontology evaluation aims at providing a critical technical judgment on the quality of the ontology. It is a very broad topic, and so far, no fully automatic approaches have emerged and semi-automatic approaches are rare (Brank et al., 2005). In its nature it is still human-driven as it has to evaluate what was initially provided by a human user in the conceptual modeling phase. As explained in (Siorpaes and Simperl, 2009; Hartmann et al., 2005), only few methods which support automatic or semi-automatic evaluations are available (i.e. OntoClean, EvaLexon).
Concluding, ontology building, alignment and evaluation are mainly human-driven tasks. Even if automation support is partly possible for collecting relevant terms for ontologies or proposing properties to concepts derived from semi-structured knowledge corpora (folksonomies), the final modeling decision is mainly taken by human actors.

2.2. Semantic annotation
The population of ontologies, also defined as semantic annotation, is a task within the semantic content creation process as it links abstract and concrete knowledge. This knowledge acquisition can be carried on manually, semi-automatically, or fully automatically.

There is a wide range of approaches that propose semi-automatic annotation of text: most of the approaches make use of natural language processing and information extraction technologies. These already have a long tradition and reached a good level of maturity. Even though they require training, a large share of the work can be automated (Reeve and Han, 2005; Uren et al., 2006). The nature of semantic annotation of text is not easily defined because it requires training in the first place, or when domains evolve, but can then continue autonomously. Due to time-consuming training activities, we can see that semantic annotation of text requires substantial human contributions. Summing up, semantic annotation of text is advanced and allows for automation in many cases but requires a substantial amount of training by human users.

The situation is slightly different with the annotation of multimedia content. A large share of approaches aims at extraction of low-level semantics. However, the real challenge is the provision of high level semantics, i.e., semantic content descriptions. This can only be done to a limited extent, e.g., by applying machine learning with a vertical focus for a specific domain. Approaches for the annotation of media objects, be that manual, semi-automatic or automatic ones, aim at closing the so-called “semantic gap”, i.e., the discrepancy between low-level technical features which can be automatically processed to a large extent, and the high-level meaning-bearing features a user is typically interested in. Existing approaches aim at a high degree of automation but are limited to specific domains and types of media (Siorpaes and Simperl, 2009). Concluding, content annotation cannot be done fully automatically and heavily depends on human inputs.
3. Characterizing the 'human-driven': a problem of motivation

Analyzing the conditions under which a person - either in isolation or working with others - will actively contribute towards the completion of a task, the literature distinguishes between external - i.e. socially derived - and internal - i.e., individually-based - motivations (Batson et al. 2002; Moore and Serva 2007). Moore and Serva (2007) present a grouping of fourteen motivational factors: altruism, belonging, collaboration, egoism, egotism, emotional support, empathy, knowledge, power, reciprocity, reputation, self-esteem, self-expression, and wisdom. More specifically, organizational literature recognizes two forms of motivation when dealing with the relationship between tasks and willingness to undertake them (Simon, 1947; March and Simon, 1958). These are known as intrinsic, that is directly connected to the act of performing a task and extrinsic, that is, unrelated to the nature of the task. Traditionally, the study of intrinsic motivation has been pursued mainly by the sociologists of organization, whereas extrinsic motivation, which implies that undertaking a task is, in itself, an unpleasant activity, has been the focus of economists (see Prendergast, 1999 for a useful overview).

In the following subsection we present the evidence originated from both perspectives, offering a unitary survey on the role of social dynamics on annotation systems and the motivation to contribute characterizing Free/Open Source Software development projects. Next, we combine a theoretical model and some of the most relevant empirical findings emerging from this survey into a tool that can be used to analyze and design participation scenarios.

3.1. Motivations to contribute in computer-mediated tasks.

In the context of online communities and knowledge-management, several studies on the motivation to participate in knowledge-sharing indicate that people participate because they want to be part of a ‘community’, and engage in the exchange of ideas and solutions (Wasko and Faraj, 2000). Similarly, Forte and Bruckman (2008) find that peer recognition plays a role in Wikipedia which is similar to the dynamics shaping scientific publications. Wang and Fesenmaier (2003) demonstrate that efficacy is a major factor affecting members’ active contribution to online communities. The study also indicates that the possibility of future reciprocation (expectancy) is another major motivation driving an individual’s contribution. Beenen et al. (2004) show that challenging goals are
powerful motivators of online contributions, while Wasko and Faraj (2005) found that people contribute to their knowledge when they perceive that it enhances their professional reputations. Kuznetsov (2006) argues that the motivations of Wikipedians to contribute are grounded in values of reputation, community, reciprocity, altruism and autonomy (Wagner and Prasarnphanich 2007). Wiertz and de Ruiter (2007) found that a customer’s online interaction propensity, commitment to the community, and the informational value s/he perceives in the community are the strongest drivers of knowledge contribution. Bock et al. (2005) suggest the provision of appropriate feedback to employees engaged in (or not engaged in) knowledge sharing. Such actions follow the importance of exerted pressure from one’s referent groups (e.g., peers, supervisors, senior managers, etc.) to engage in knowledge-sharing behaviors as well as the importance of enhancing the individual’s sense of self-worth. Several factors depending on the corporate environment may influence participation, as well. Durcikova and Gray (2009) found that perceived transparency of knowledge validation process has a significant effect on knowledge contribution frequency. Marret and Joshi (2009) argue that normative influence significantly impacts the participants’ inclination to share information.

Studies concentrating on the patterns that characterize annotation efforts in Web 2.0 communities found that annotations are characterized by power law distributions, both in the relationship between number of tags and number of posts (Cattuto et al., 2007) and number of tags and number of contributors (Golder and Huberman, 2006), indicating that few people contribute disproportionately more than others. More specifically, Ames and Naaman (2007) investigated the incentives for annotation in Flickr and found that organization for oneself is a more common motivation than communication for oneself, and that communication with friends and family is a more common motivation than organization for friends and family. Thom-Santelli et al. (2008) delineated a set of emergent social roles suggestive of a pattern of tagging behaviors that were motivated by the formation of community, the awareness of one’s audience and a perceived need to communicate with a small group. Analogously, Chen and colleagues (2008) found that social comparisons help explain the tendency to contribute more (or less) in MovieLens. Joinson (2008) identified these unique uses and gratifications in the context of Facebook: social
connection, shared identities, content, social investigation, social network surfing and status updating.

Studies on the motives to participate in open source software projects underlined that the tendency to participate is highly skewed, with few individuals taking the lion’s share of contributions (Lerner and Tirole, 2005). Fang and Neufeld (2009) provide an overview of motives, including software use value, status and recognition, learning, personal enjoyment, reciprocity, getting paid, sense of ownership and control, career advancement, free software ideology, social identity. Hars and Qu (2002) showed that both internal factors (such as intrinsic motivation, altruism, and identification with a community) and external factors (such as direct compensation and anticipated return) played an important role. Factors that promised future monetary rewards, such as building human capital and self-marketing, were also significant. Personal need for a software solution was another key factor. Oreg and Nov (2008) show that software contributors placed a greater emphasis on reputation-gaining and self-development motivations, compared with content contributors, who placed a greater emphasis on altruistic motives.

4. Incentivizing semantic content creation: an analytical framework

According to the distinction emerging from the social science literature between intrinsic and extrinsic motivation, both motivational issues need to be tackled. Internal motivation shall be fostered by involving users in the design process and external motivation by the application of incentive models.

4.1. A Game-theoretic framing of the problem of semantic annotation

The analysis of the rationales behind human contribution to effortful tasks has been carried out using a formal approach that falls within the scope of Game Theory\(^1\). Specifically, we can think of ontologies and annotated content as a

\(^1\) A Game is a formal representation of a situation in which a number of individuals interact in setting of strategic interdependency (MasCollel et al., 1995). Situation of strategic interdependency is defined by the following things: players, rules, outcomes, and payoffs. In Game Theory, the solution of the Game is a formal rule for predicting how it will be played. These predictions describe which strategies players will adopt, and what results to expect. Talking about design of incentive system we mean to intervene
public good which is: non-exclusive, meaning that it is impractical to exclude somebody from consuming the good itself and non-rival, that is, the consumption on the part of one person does not diminish the availability of the good to others, and consequently, the number of agents consuming the good does not matter (Bergstrom, et al., 1986).

In our case, everyone can access an ontology and benefit from using it; therefore, the ontology is a non-exclusive good. At the same time once the ontology is created it’s usage by an individual is non-rival towards other individuals. Ontology creation on the other hand requires individual contributions in terms of both concepts definition and annotation tasks. To translate the problem of ontology creation and content populating into Game-theoretic terms we consider an individual that is endowed with a fixed amount of time. This individual can allocate time to private consumption (i.e. dedicating it to surfing the Internet, doing something fun, concentrating on work, etc.) or to public good creation, in our case dedicating time to ontology creation or annotation tasks. Thus, the individual is faced with a conflict of interests. On one hand, allocating time to private consumption, individuals will reach maximum personal satisfaction. On the other hand, their satisfaction is increased also by consuming the public good – i.e. using the ontology or the annotated contents. But contributing to its creation is costly. Given that usage is non-exclusive and non-rival, the best individuals’ strategy is to allocate all their personal time to the private consumption hoping that other individuals will contribute. This phenomenon is referred to as free-riding. All individuals will follow this strategy; therefore, economic theory predicts that there will be no contribution to public good.

Nevertheless, a considerable amount of laboratory and field experimental evidences points to some factors that induce subjects to contribute.

Contribution to public good can be influenced by the payoff structure. It is demonstrated that individuals having higher returns on investment contribute more (Marwell and Ames, 1979; Isaac et al., 1985; Palfrey and Rosenthal, 1991).
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Introducing provision points also increases contribution to public good (Bohm, 1972; Marwell and Ames, 1979). Returns on investment in annotation tasks can be increased in different ways related to the nature of the task (i.e. by making annotation task a fun activity, etc.).

This last point is particularly important with regards to the factors of contribution to public good related to group size. The larger the group is, the less decisive the perceived individual contribution. As a consequence, it is less likely that the public good will receive contributions (Kim and Walker, 1984; Schneider and Pommerehne, 1981; Marwell and Ames, 1979). This factor might also explain the relative lack of success of distributed bottom-up semantic Web efforts. One way of treating this problem is to divide, where possible, a large group in smaller groups in which each individual contribution becomes more important. Some evidence suggests that the effect of returns on investment is stronger compared to the group size (Isaac et al., 1985). Therefore, another possible way to deal with group size effect is to increase individual benefits from annotation task.

Introduction of communication of all types increases the levels of contribution to public good (Isaac and Walker, 1988). Therefore, exchange of information among participants should be encouraged at all levels. This works for many different kinds of information. Experiments show that allowing people to either talk about the task at hand or simply chat can lead to increased contributions.

Repetition. Contribution to public good in experiments that are run one-shot is close to zero. Whereas, whenever experiments are performed by repeating the same game with the same subjects a typical pattern is that contribution rises in the first rounds and decreases in the last rounds of the experiment (Andreoni, 1988). This evidence suggests that contribution to ontologies will be mainly provided by regular users of ontologies. Therefore, to incentivize contribution there is a need to provide an environment in which individuals are interested to come back.

These Game theoretical insights can help combine intrinsic (that is task related) and extrinsic motivation factors into one framework. Alongside the more obvious use of extrinsic mechanisms that would increase the value of the public good in the eyes of each participant, it is necessary, at this point, to introduce
the main techniques that have been elaborated to increase the attractiveness of performing the tasks themselves.

4.2. Motivation by employing Participatory Design methods in process

To increase attractiveness of the task (semantic content creation) and the related software applications (annotation tools), we are looking for some appropriate design methods and requirements for motivation. If one is striving for technical tools for the support of user-driven semantic content creation, these tools should enable and encourage users to contribute. To ensure the necessary affordances of such tools, such applications should follow a user-centered approach and should integrate incentive models as reinforcement for participation. In other words: To develop software for the participation of end-users, we propose a participatory way of designing these software tools, integrating potential users by Participatory Design methods.

The Participatory Design (PD) approach was developed for the improvement of the participation of workers in software development processes and the cooperation between software developers and end-users (Bjerknes et al., 1987; Bødker et al., 2005; Kensing et al., 2003). To support the dialogue and collaboration between designers/system developers and end-users, PD researchers developed methods which allow users to participate in information technology development projects as experts of their own work processes. PD approaches combine design-by-doing methods, scenarios and different forms of prototyping (such as mockups, rapid prototypes), work organization games and ethnographic methods (e.g. Greenbaum and Kyng, 1991; Kensing and Blomberg, 1998). PD can lead to perceived legitimation of design decisions and a higher acceptance of tools by users.

Since early PD approaches only deal with user participation in design time, the problem of limited access to this participation remains. Not all potential users can participate in the design process; instead the effects of these PD methods are limited on those who actually participated. The approaches of tailorable systems and End-User Development (EUD) aim to overcome this problem by designing highly flexible systems that enable users to participate during the use of the system by adapting and modifying the tools according to their needs/preferences (Lieberman et al. 2006). The main goal of EUD is to empower end-users to develop and adapt systems themselves, by designing them to be easy to understand, to learn, to use, and to teach as well.
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According to the insight that participation is a social and cooperative activity not for individuals but for groups of users, it has been argued that tailoring activities have to be embedded in an enabling and supporting “tailoring culture” (Henderson and Kyng, 1991). Therefore, the integrated approach of Organization and Technology Development (OTD) combines cultural issues, organizational development processes and participatory design concepts (Rohde and Wulf, 1995; Wulf and Rohde, 1995; Rohde, 2007). In accordance with approaches of organization development, the OTD framework provides orientation for analysis, planning, intervention and evaluation in software design and introduction projects in organizational settings. Influenced by the research on OTD, Kahler as well as Pipek suggest that EUD activities should be supported by the building of communities in which end users can effectively share their EUD-related knowledge and artifacts with their peers (Kahler, 2001; Pipek, 2005). The OTD framework was applied to software development projects for virtual or online communities (Pape et al., 2003; Rohde, 2004).

4.3. Motivation by embedding user-centered design requirements in software applications (products)
Besides participation in the design process to aim for user-centered tools, we will focus on the inscription of motivational strategies in the design of the product as well. While the design process will follow PD methods, the resulting product design should incorporate different incentive mechanisms, mainly focusing on user-centered design requirements for usability, sociability, design for fun etc.

Usability is an important consideration in the design of products. Products need to provide suitable functionalities (usefulness) and an appropriate usage of these functionalities (usability). Moreover usability can be considered an attribute of quality, which ensures that the users of products are able to work effectively, efficiently and with no psychological strain to fulfill their tasks. These issues refer to accuracy and completeness with which users achieve specified goals, resources expended in relation to the accuracy and completeness with which users achieve goals, and freedom from discomfort, and positive attitudes towards the use of the product. There are a set of general principles and heuristic suggested to design usable systems, i.e. to achieve the aforementioned usability goals (Preece et al., 2002; Koyani et al., 2003; Shneiderman et al., 2009). Jakob Nielsen’s (1994) heuristics are the best-known usability heuristics
for user interface design to determine most of the existing usability problems. The International Standardization Organization standard (ISO 9241 part 110) describes seven general “dialogue principles”: suitability for the task, self-descriptiveness, controllability, conformity with user expectations, error tolerance, suitability for individualization, suitability for learning.

In addition to these general dialog principles, there are also guidelines for specific topics, which are most relevant to the Web context where user participation, contribution, motivation play a significant role (Preece and Shneiderman, 2009). Usability factors that may influence reading are in the field of information presentation. Text visualization, well-organized layouts, highlighting frequently updated content and newcomer support can increase and alleviate reading. To enhance active contributing, accessibility needs to be taken into account. Low threshold interfaces for easily making contributions and visibility of participation activity may lead users to increase contribution. In order to encourage collaboration, services to locate relevant and competent individuals to form collaborations or providing appropriate collaboration tools (e.g. Wiki-Systems, Shared Workspaces) or reward mechanisms for participation may influence collaboration positively.

Even though most software development processes focus mainly on the traditional principles of usability, which are described above, ‘hedonic’ quality is becoming more and more important for a good user experience. Hassenzahl (2003) identified three needs people are desire to fulfill. First, stimulation: people have the inherent need to develop and move forward. Novel, interesting, and stimulating functions, contents, and interaction- and presentation-styles can attract interest or reduce motivation problems. Second, identification: people tend to use objects to express themselves. Products can help users to communicate their desired identity. Third, evocation: products may be able to provoke memories. Products can represent past situations or impressions, which are important for the user.

Another important feature of design, alongside general guidelines for usability and participation support, is sociability design. Sociality, not functionality, is viewed as the key concept in social software systems. Socializing in user communities can be enhanced by respecting some general principles or guidelines. Bouman et al. (2007) argue that designers of social software have to address in one way or the other the following issues: enabling practice,
mimicking reality, building identity and actualizing self. According to Preece (2000), communities with good sociability have social policies that support the community’s purpose and are understandable, socially acceptable, and practical. Success of an online community requires a blend of well-designed software (i.e., usability) and carefully crafted social policies. According to Lazar and Preece (2002), the following three broad categories of issues are considered as important: registration issues, trust and security issues, and governance issues.

Moreover, there are additional (design) issues with respect to software affordances that can strengthen or support users’ motivation for participation. Software designers are looking for design options that are aiming at the users’ intrinsic and extrinsic motivation, mainly on the basis of (socio-) psychological findings. According to a literature review, three psychological mechanisms have been identified, which seem to be quite promising in this regard:

- evoking fun or excitement,
- fostering the sense of belonging to a community,
- supporting the gaining of social capital seem to be some crucial strategies to establish active user communities.

Finally, there are incentives mechanism directly embedded in systems: Rashid et al. (2006) investigate a design augmentation for an existing community Web site. The augmented interface includes individualized opportunities for contribution and an estimate of the value of each contribution to the community. According to Cheng and Vassileva (2006) it is important to control the quality and the quantity of users’ contributions and avoid information overload or degrade its level. Therefore, an incentive mechanism with adaptive rewards was designed that includes a collaborative rating mechanism which ensures a decentralized way of measuring the quality of contributions by encouraging the users to rate each other’s contributions and an adaptive rewards mechanism encourages users’ contributions differently, taking into account the users’ individual reputation and the current needs of the community. Vassileva and Sun (2007) show that an appropriately designed visualization of the community will stimulate social comparison among the users and will result in increased user participation. Farzan et al. (2008) have implemented a feature that rewards contribution with points in order to encourage contribution to an opt-in social networking site designed for
employees. Zhang (2008) proposes a set of design principles (high-level and context-free design goals) to guide Information Communication Technology design with high motivational affordances.

5. Scenario: the corporate knowledge management

In the following, we outline a concrete case study: Telefónica I+D (TID) which is the innovation company of the Telefónica Group (one of the world's largest telecommunications companies). Founded in 1988, Telefónica I+D contributes to the group's competitiveness through technological innovation. It is the largest private research and development centre in Spain as regards activity and resources, and is the most active company in Europe in terms of European research projects in the Information and Communication Technology sector. It currently collaborates with technological leaders and numerous organizations in 42 different countries.

The study concerns the internal portal of Telefónica: “OKenterprise”. It focuses on the knowledge creation and maintenance within the enterprise setting, the information sharing among colleagues and the provision of metadata on all enterprise content. The tremendous growth of information on the internal portals of enterprises enables, but at the same time complicates, access to the right asset of information in the precise moment, and affects the company workflows. Information on the portal can be organized according to various categories which represent different perspectives, aims, and degrees of specification people may use. On the concrete case study, we investigate, what incentives mechanisms could bring the users to do semantic annotations of the texts.

The company wants to apply semantic tools to the corporate portal obtaining many advantages, such as more efficient asset retrieval / navigation, real integration of heterogeneous sources of information (linked data), personalization based on context / role (e.g. autonomous portal adaptation, semantic based advertising), and recommendation capabilities (e.g. semantic based RSS, contextual links).

For the annotation purposes a little floating banner has been designed. It will allow users to change among the following options: annotate, visualize, search, configure, help, and close. Each user upon her/his wish can provide annotations
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to all the kinds of information (texts, photos, videos, etc.) on the enterprise portal. For example, in corporate directory the employees can semantically annotate and thus make any kind of information better accessible. For instance, a team leader who is searching for a team for the new project will be provided then with the new semantic search capabilities in this menu. She/he can search for the employees who have all the skills appropriate for the project obtaining a ranked list of people who match the search criteria.

In this way, semantic annotations improve the search and navigation experience in a corporate knowledge base. In other words semantics will enhance searching of assets, navigation, information integration, personalization, and recommendations. For example, the semantic annotation tool provides them with suggestions about annotations to add to the selected context. Also, providing the annotations for daily news, blogs and forums will help the employees to orientate themselves better in the information flood as well as simplify the work of portal administrators. So the providers of annotations get the double profit:

(1) by annotating resources they make the information about themselves and the news they like more available and better ranked,

(2) by consuming annotations they improve navigation, searching and syndicating capabilities of the enterprise portal.

This scenario is an almost straight out of the textbook case of public good provision. Providers and consumers are the same people; the annotation can be considered a public good. The part where real things become problematic is the usual problem shared by knowledge management systems: there is a huge incentive to keep strategic knowledge private so one can leverage on it when dealing/negotiating with others. A representative agent working for TID is faced with two nested decisions. Decision (1): do I want to share information or keep it private? Decision (2): do I want to spend my time providing content information on my own stuff or do I want to spend time doing annotation other user’s stuff?

To investigate this topic, we made two days interviews with 11 representative employees of TID (heads of division, senior project managers, project managers, developers, computer engineers, and consultants). Each semi-structured interviews was conducted by two interviewers, took 60 to 90 minutes and was
recorded on audio tape. These recordings have been transcribed and analyzed descriptively according to ex-post categories. Additionally, a focus group discussion with 6 TID employees was conducted, focusing on usage problems of the existing system and on possible design solutions to overcome these problems. The interviewees tried to explain whether and to what extent semantic annotation can actually improve the information retrieval practices of TID workers. TID interviewees’ feedbacks were decisive for the direction of the design, depending both on their impressions and their usage along the way.

Most of the interviewees find semantic annotation useful and interesting for their personal use, such as:

- email classification system,
- personal bookmarks and documents management (for fast discovering the content of different documents),
- people finding (who work with needed skills).

Some others express the idea that tagging is a waste of time for the most, it would be nice only if it does not take too much time.

The company tried to build a reputation mechanism with monetary prizes (although of small amount), but it did not work as expected. Maybe the prizes were too small, or the benefits derived by knowledge as a public good were too low, or the high number of users increased the free riding phenomenon.

To solve these problems there is a need to create awareness in employees that sharing their own information and annotations is something they can benefit from. To succeed in this, the company needs to perform a huge action of communication of the value of the tool to employees, or of the importance of their particular contributions to the achievement of relevant goals of the system.

An important issue is to deal with a big number of users with an obvious problem of low impact of a single contribution. As previously underlined in the survey section of the paper, group size plays an important role in modifying behavior of individual contributors. If, in principle, employees could perceive that their contribution is vital for the success of the group we could expect a higher probability of contribution from each employee. In other words the reputation mechanism might be developed at group or project level.
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Next, the payoff structure of users should be increased making the annotation task and the ontology creation and alignment easy to do and funny.

Finally, this scenario can be described as a public good provision problem, where the agents interested in the production of the public good are the ones who provide the effort for its production.

Conclusion

In this paper we have discussed whether and to what extent human contribution is required in the process of semantic content creation. We have focused our analysis on ontology creation and in particular on content annotation and ontology population, and demonstrated that, even if manually constructed ontologies and content annotations are time-consuming, labor intensive and error-prone (Ding and Foo, 2002), they cannot be automatically carried on. Machines might help humans to smooth the progress of semantic content creation, suggesting tags and concepts (as like auto-completion functionality on mobile) and checking, for instance, the formal correctness and completeness of tags and ontologies. Thus, the semi-automatic semantic content creation will enable cost reduction (in terms of time and money) and the active participation of the end-user. The active participation of end-users should be raised also by the twofold motivation strategy (intrinsic and extrinsic motivations). For example, fun or excitement, sense of belonging to a community and altruism might address users to create ontologies or annotate content. Namely, sociality is viewed as one of the key element for the user participation. In the case of groups of interests, communities of practices, and organizations, a good sociality (supported by social policies which are commonly accepted) might sustain the community’s purposes and increase the proactive participation of users. Extrinsic motivations should also be supported by the application of incentive models suited with the environment in which users take action.

The scenario described in the paper (the TID case study) encounters many of the problems and challenges emerging in literature. It also allow us to show the complexity of a real case study, pointing out that it is very difficult to simplify a real world situation into few generic recommendations. In other words, the design of any ontology creation/population tool and a set of correlated
incentive mechanisms should be shaped according to the real social environment in which the tool will be implemented.

Studies in many fields show that the technology is not neutral element and that the “entanglement” between practices and technical aspects shape the users’ behaviors and contributions (Orlikowski, 2007). Therefore, the traditional principles of usability should be seriously taken into account to foster user participation (both of a single user and of a group of users). To increase the affordance of semantic content creation tools, developers should integrate mechanisms derived from game theoretical tenets, and the set of incentive mechanisms designed for the scenario.

In the future works, the annotation tools will be improved taking into account: the end-user needs and the human-computer interaction recommendations, according to the intrinsic and extrinsic motivations of TID employees.

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