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Adaptation for the Social Web

Workshop Proceedings

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Workshop on Adaptation for the Social Web

The Social Web can be defined as a network similar to today's World Wide Web, linking people, organization, and concepts rather than documents. The main principle behind the Social Web is to harness the collective wisdom of communities of users. Over the last few years, we have observed the growth of several Social Web technologies. Social tagging, social networking, social search, social navigation, collaborative sharing and publishing are examples of these technologies. The technologies have been implemented in social systems such as Facebook (social networking), LiveJournal (blog), Del.icio.us (social bookmarking). They are all categorized by their user contributed information and knowledge in the form of user created content and user feedback.

Growth of social systems and abundance of user created information highlight the importance of adaptation and personalization. Collective information distilled by social technologies is an excellent source for adaptation reasoning. While a set of classical community based adaptation technologies can be applied in social systems, the experience can enrich adaptive hypermedia in return. The goal of this workshop is to study the challenges of adaptation in the Social Web, and influences of the Social Web research on AH and vice versa.

This workshop is third in the series, following the successful workshop on Social Navigation and Community Based Adaptation Technologies held in conjunction with AH2006, and SociUM: Adaptation and Personalization in Social Systems: Groups, Teams, Communities held in conjunction with UM 2007.

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Social Recommendation and Adaptation in Web Portals

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Abstract. In recent years the amount of information accessible via Web Portals has grown constantly and finding the right information has become an increasingly complex and time consuming task. The approach presented utilizes social web trends to address this issue. Incorporating tagging and rating functionality in Portals allows for reasonable recommendations and adaptations resulting in a more user-tailored Portal. The concept is based on the analysis of users' tagging behavior to learn users', groups' or entire communities' interests, preferences and skills. This facilitates the identification of resources of higher importance to recommend or provide easier access to them. Our main concepts have been embedded and evaluated within IBM's WebSphere Portal.

Keywords: Adaptive Hypermedia, Social Systems, Adaptation, Recommendation, Group Adaptation, Tagging, Unstructured Data Analysis

1 Introduction

In recent years Enterprise Information Portals (EIP) have gained importance in many companies. They represent a single point of access to personalized content, services, and applications by integrating various applications and processes into one homogeneous user interface. The fact that they are constantly growing and usually contain thousands of pages of possibly relevant information poses a serious problem and is becoming a productivity threat. EIP users need to find task- and role-specific information very quickly, but they face information overload and often feel "lost in hyperspace". In particular the huge amount of content results in complex hierarchical navigation structures designed to satisfy the majority of users. However, those super-imposed structures are not necessarily compliant to the users' mental models and therefore result in long navigation paths and significant effort to find the information needed. Due to these reasons the next generation of Portals need to behave more adaptive. Instead of providing all possible relevant information, only those should be presented which are relevant in a user's current context.

The recent popularity of collaboration techniques on the Internet, particularly tagging and rating, provides new means for both semantically describing Portal content as well as for reasoning about users' interests, preferences and contexts. Beside the obvious, widely-agreed-upon use of tagging, e. g. to improve search, personal organization, recommendation and spam detection [8], it can add valuable meta information and even lightweight semantics to web resources.

This work focuses on the exploitation of the *collaborative tagging* pattern for the adaptation of Portals. Thereby, we denote "'tagging"' as the association of words or phrases with a Portal resource (uniquely identifiable fragments, such as pages, portlets, users, emails, wiki or blog posts, etc.).
We propose a framework which allows arbitrary annotators, e.g. human users or analysis components, to annotate any of these resources. Analysis of the tagging behavior allows to model interests and preferences of users as well as semantic relations between resources, and thus to perform reasonable recommendations and adaptations. In particular, resources of higher importance to users (in a certain context) can be identified and recommended or provided easier access to. We finally utilize our knowledge about the semantic distance between resources to reorder them to minimize navigation paths. By taking into account not only each single user's tagging behavior but the entire community, our recommendation and adaptation techniques benefit from the collective intelligence of all Portal users.

In the following sections we first give an overview of relevant research done in the field of adaptive Portals and tagging-based adaptation. We then present our concept of a portal adaptation framework consisting of three layers: we first describe the annotation layer which allows arbitrary annotators to annotate Portal resources. Second, we discuss how user interests and preferences are modeled with the help of web usage mining and tagging behavior analysis. Third, we go into detail on the adaptation layer that facilitates recommendations and various adaptations based on these models. Finally, we conclude with a summary and outline possible future directions of our work.

2 Related Work

A lot of research has been done in the field of adaptive hypermedia [2], systems that build and apply user and usage models to adapt web sites to the user's context (interests, preferences, needs, goals, etc.). One possible approach to derive those models and enable adaptation is to analyze user access or interaction data, as proposed in [12] and [5]. Projects in this context include WebWatcher [6], PageGather [13] and AMACONT [4]. Especially with respect to navigation adaptation, [14] describes an approach to speed up navigation in mobile Portals significantly. Despite all these efforts and the development of various adaptation methods and techniques, little is known about their application to Portals.

We tie in with the web mining approach presented in [11] and utilize tagging mechanisms to improve mining, modeling and adaptation techniques.

Although user models or profiles are crucial to personalize systems accordingly, only little research has been carried out so far concerning tagging based user modeling, adaptation and recommendation. In [9], the creation of adaptive user profiles based on a users tagging history is described. However, this work focuses on the tags applied by a user only. We allow for richer user models by incorporating tags associated *with* a user (in a system that allows people tagging), by analyzing the semantic interrelation between tags (and hence resources), and combining this analysis with web mining strategies.

Other work focuses on personal recommendation of content based on its relatedness to certain tag terms. [16] propose a modified version of the HITS algorithm to determine experts and high-quality documents related to a given tag. Tagging systems allow not only recommending content, but also users knowledgeable in certain areas. Based on metrics like ExpertRank [3], these users could be recommended and searched. In contrast to the HITS based approach we utilize an improved metric to determine related resources.

In [1] user groups are constructed based on a subset of each users personal tag collection. Groups are dynamically constructed according to users' tagging behavior, however, no implications concerning possible adaptations based on this knowledge are included. Our paper will picture concepts that allows for even more personalized content recommendation based on these groups.

3 A Multilayer Concept for Social Adaptation and Recommendation in Portals

Tagging has become a popular technique to describe, organize, categorize and locate resources. Tagging itself is the process of assigning tags to resources. A tag is a (relevant) keyword or term associated with or assigned to a piece of information, thus describing the item and enabling keyword-based classification of information. Our concept allows users to annotate uniquely identifiable resources of a Portal, such as pages, portlets, and even other users. Hence, by tagging resources users can categorize content parts of the system autonomously, independent from any central instance like an administrator.

Tagging systems have proven their ability to enhance functions like search, personalization, information retrieval, and collaboration. Nearly all of these are key features in Portals. Especially with respect to searching and navigating, tagging can be regarded a promising technology. So far, navigation topologies are usually created centrally by some administrator who tries to satisfy the requirements of the entire community. His decisions how to structure the system are based on his own knowledge about the users of the system, their interests and preferences, and the content being provided. Taking into consideration the size of (Enterprise Information) Portal deployments, which today often consist of 10.000s of pages used by 1.000s of users, it is unlikely that a single person can accomplish this task and estimate what a meaningful structure would be.

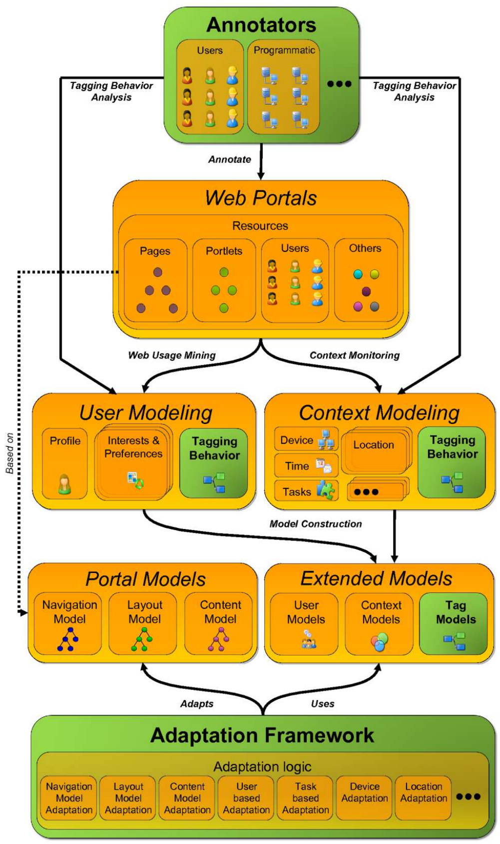

Fig. 1. System overview

Moreover, tagging is collaborative process. Tags are applied by single users and, as long as not applied as private tags, seen by all other users. This way tagging does not only allow for the categorization of content stored in a Portal on a per-user basis, but also on a community-basis. As collective intelligence often outperforms single users' [15] we can assume that the community is able to categorize content better than any administrator could.

In the following we illustrate our concept of how to integrate and utilize tagging in Portals to learn about the users, their context and how to use this information to perform reasonable adaptations and recommendations. Figure 1 provides an overview of the architectural concept. Portals are comprised of resources such as pages, portlets, and users. The annotation layer allows for annotating these resources, either by users or any other, e. g. programmatic, annotator. User models represent users' interests and preferences which are inferred via web usage mining, i. e. by the analysis of users interaction with the system and the extraction of recognizable patterns, and via tagging behavior analysis. Similarly, context models are created based on context sensor data. The adaptation layer uses this information to adapt the Portal's base models for navigation (defining the arrangement of pages), layout model (defining the arrangement of portlets on pages) and content. As said, the aim is to adapt the system to better suit the users needs. We will explain the functionality underlying, and the interplay between the layers just mentioned in the following.

3.1 Annotation Layer

Most of today's web applications supporting semantic annotations are limited to one specific resource type and do not distinguish between different annotators. They naturally consider a human user as the one who applies annotations. Our approach introduces a generic annotation layer which can be accessed by annotators of different kinds. Thereby, user generated annotations and automatically extracted semantics are stored in the same database along with the type of the annotator. This allows handling annotations by different annotators each in a separate way. As an example, UIMA[3] annotators can automatically analyze unstructured content (email, chat conversations, etc.), so that interesting parts can be extracted and presented to the user while hiding irrelevant and distracting fragments.

As a compact data level representation we use a tag-resource-matrix, which forms the prerequisite for our subsequent calculations. It represents the relations of tag and resources and can easily be constructed by transforming the data of the annotation layer into another view. Each tag corresponds to a row and each resource to a column of the matrix. Its entries are the number of times a tag has been applied to a resource.

A single column of the matrix contains a user-driven description of a resource, as the assigned tags (and its frequency) depict the direction of this column vector. Related resources have similar tags assigned and thus, their corresponding vectors have a similar direction. Cosine similarity – other metrics may be applicable as well – is used to quantify the vectors relatedness. Tags can be compared in an analogous way, using the respective rows of the tag-resource matrix instead.

3.2 Modeling Layer

Based on tags and the tag-resource-matrices we can derive "higher knowledge". The following sections outline how a rich user and context model is created using web mining and tagging behavior analysis. Subsequently, as the need for metrics to compare tags and resources arises, methods for semantic similarity calculation are introduced.

User Modeling To be able to perform reasonable adaptations and to provide users with recommendations we need to understand users' interests and preferences. Therefore we construct user models reflecting users' behavior, which

[3] http://incubator.apache.org/uima/

is extracted from static information in the user profiles (age, native language, etc.), as well as dynamic information retrieved via *web usage mining* and, most importantly, by analyzing users' *tagging behavior*.

Web mining is the application of data mining techniques to discover (usage)-patterns within web data in order to better understand and serve the needs of users of web-based applications [7]. Especially *web usage mining* – the extraction of usage patterns from access log data – facilitates the modeling of certain aspects of the behavior of users. Analyzing Portal log files reveals information about, among other things, several events, e.g. when pages (or portlets) are created, read, updated or deleted, when pages (or portlets) are requested, when users are created, updated, deleted and many more. It allows to understand which pages and portlets a user typically works with.

We apply techniques from the area of frequent set mining to analyze the usage of pages and portlets. As web mining is not the focus of this paper we refer the interested reader to [7] for more details.

Tagging behavior analysis is based on the assumption that tagging expresses interest in a resource. Hence, resources being tagged more often by a user are of higher importance to him. And since tagging is, as said, a collaborative process we can also assume that resources being tagged more often by all users are of higher importance to the entire community. Thus, analyzing users' tagging behavior allows us to better understand their interests and preferences and to refine the user model previously constructed based on web usage mining.
A second assumption is that different tags being used in the system are semantically related. This means that they have a different semantic distance which can be calculated. Generally, if the **same** two tags T_1 and T_2 are applied to the **same** resources $R_1 \dots R_n$ **often**, they **often** have a small semantic distance, or, in other words are strongly semantically related. This is obvious, as a user (or even different users) would only apply two tags to the same resource if both tags describe the information or services being offered by this resource equally well. Thus, the tags express similar semantics and are, **in most cases**, related. Understanding the semantic relation between tags we can perform various adaptations and recommendations. Regarding adaptations we can, based on tags' similarity, calculate resources' similarity and reorder resources, e. g. pages being part of the navigation topology, in a way such that semantically stronger related resources have a smaller distance in the topology. We can further recommend related content to users based on their current selection (cp. 3.3). E. g. if a user has selected a page entitled *Company News* tagged with *IBM, News* we can recommend him the page *WebSphere Portal News* tagged with *IBM, News, WebSphere Portal*. Although, both pages can have a large distance within the topology, they are, based on the applied tags, in fact semantically related. Since tagging is a collaborative process we can, based on the semantic relation of tags, even allow for the integration of collaborative filtering-based adaptation and recommender systems that predict the utilization of a resource (page, portlet) for a particular user according to previous "ratings" by other similar users (cp. 3.3).
A third assumption is, that analyzing and comparing the tagging behavior be-

tween all users allows for partitioning them into groups of "similar behavior" which provides us with means to provide users of the same "behavioral cluster" with recommendations based on what a major subset of other users being part of the same cluster have already done. For instance, if some set of users $U_1 \dots U_n$ always tag the same resources with similar tags we can assume that they behave similar and belong to the same "behavioral cluster". If next more than $\frac{n}{2}$ users of this cluster perform a typical action, e.g. add a specific portlet to a specific page, we can ask the remaining users if the system should perform this operation for them automatically.

By analyzing and comparing users' tagging behavior (esp. in conjunction with the web usage mining being performed) we can determine experts for certain (content) areas. Here, we can assume that users tagging certain resources have knowledge about how to deal with these. Tagging pages and portlets expresses knowledge about how to use the services provided by them, whereas tagging users expresses a relation to them. Moreover, tags applied to users might provide us with insights about their expertise. If user U_1 associates the tag *social-computing* with user U_2 he most certainly has knowledge about social computing. If other users have already tagged other resources such as pages and portlets with the same term this can be regarded an indication for user U_2 being an expert in how to deal with these resources. Recognizing that U_2 has tagged these further resources himself is additional proof for his expertise and interest in this area. Thus, analysis of the tagging behavior allows us to refine the previously constructed user models too. Details about how to determine experts and how to implicitly construct social networks based on tagging behavior analysis are described in section 3.3.

Hence, besides applying web usage mining techniques we analyze users' *tagging behavior* to construct refined, more precise, user models, reflecting users' interests and preferences.

Context Modeling Taking into consideration only user profiles neglects the context users are acting in. Such profiles could be regarded suitable models, only, if role, interests and preferences of users were not changing too much over time. In reality, needs usually change if a user's context changes. In a business context a user might organize travels, e. g. booking flights, hotels and cars and do his travel expense. In a private scenario though, he might plan spare-time events, like checking the cinema program. Of course his interests and preferences will be totally different in both contexts and obviously he needs access to totally different resources.

Our concept allows single users to have several context profiles between which either the system switches automatically, based on context attributes being observed (current date, time, device, location, etc.), or the user manually. The adaptation and recommendation layer utilizes both, the information stored in the user and context model, to perform its operations (i. e. to adapt Portal models such as the navigation topology). Technically, the adaptation and recommendation layer partitions the user model into a sole partition for each context profile available in the context model. To determine the best matching profile, the system permanently observes a set of defined context attributes. Users always have the option to outvote the system's decision and to manually switch to another profile.

As only one context profile can be active at one specific point in time, whatever people do only influences the user model partition associated to the currently active profile. E.g. if the currently active profile is *business*, the navigation behavior does never influence the user model partition associated to the profile *private*.

The analysis of users' tagging behavior can even be used to evaluate users' context and to determine resources being of special interest in certain contexts.

Generally we can analyze how tags are applied in correlation to values of certain context attributes. For instance, we can analyze when (date and time) certain tags are applied. As an example, if a user applies the tag *private* only on Saturdays and Sundays we can assume that resources tagged with this tag are of special interest on these days only. Alternatively we can analyze which device is used when certain tags are applied. E.g. if a user applies the tag *traveling* only if using his PDA we can assume that resources tagged with this tag are of special interest when using this device.

Vice versa, we can analyze tags that already have been assigned to resources being used to determine and eventually switch the context. E.g. if a user starts to use resources mainly tagged *private* we might want to switch to the corresponding context profile.

Modeling Tag and Resource Graphs As mentioned in the tagging behavior analysis sections, metrics that express the similarity among tags and resources are necessary. We will cover very shortly our approach on how to compare tags and resources and outline further utilizations and implications.

Understanding the semantic interrelation between tags and resources, or in other words being able to calculate their semantic distance, forms the basis for our adaptation and recommendation approach. Our calculation of the semantic distance between two tags is based on cosine similarity calculations to produce a similarity value for two tags (or resources) T_1 and T_2. We define A and B to be the corresponding row vectors of the tag-resources matrix of the tags T_1 and T_2. The result in both cases is a number between 0 (perfect match) and π (total opposite).

These calculation methods help decide if two tags or resources are related. They even allow to decide which relationships (between tags) are stronger than others. E. g., for three tags T_1, T_2 and T_3 we can get the distances between $T_1 - T_2$, $T_1 - T_3$, and $T_2 - T_3$. The calculation may reveal that some of the pairs have weaker relations than others (e.g. $dist(T_1, T_2) << dist(T_1, T_3)$). This finding allows us to draw the conclusion that $T_1 - T_2$ share more common resources than $T_1 - T_3$ do and that T_2 is more related to T_1 - than T_3 is. Likewise, relations of resources can be calculated and evaluated.

Utilizing the outlined semantic distance functions we are able to regain structural information amongst tags or resources. Therefore we perform semantic distance calculations between all available tags (or resources). The result is interpreted as a weighted graph having all tags (or resources) as its vertices. Every vertex is connected to all others and weighted with the semantic distance between the corresponding tags (or resources). In the next step this graph is used as input for the algorithm of Kruskal which transforms it into a minimum spanning tree (MST). This MST is a dynamic topology, created from the structure that is hidden in the interrelations of tags and resources. It further allows us to reach each of our tags (or resources) in the tree with a minimum semantic distance from an arbitrarily chosen root node.

3.3 Adaptation Layer

Based on the similarity metrics and the enriched models, the adaptation layer performs various recommendations and adaptations.

Tag-Based Recommendation Recommendation may be issued for tags and resources, as the similarity calculations provide values for both. It allows for an estimation of the relation between tags or resources. To enable a visual depiction of the strength of this relationship, a color scheme has been introduced.

Related Tags Tag similarity allows us to recommend related tags, based on the currently selected one. E.g. a system might be, among others, comprised of the tags *IBM, WebSphere, Downloads.* A user might be interested in release information regarding WebSphere Portal and clicks on the tag *IBM.* But, the tag *WebSphere* would have been the better one, as it is more specific. Thus, as the user clicks the tag *IBM*, which is rather general compared to the tag *WebSphere*, much more results might be returned, especially results not being of interest. Highlighting the tag *WebSphere*, as a related tag, might point the user to a tag he would otherwise have overseen.

As we know the similarity between all tags, we can not only highlight related tags when clicked within the tag cloud but also come up with a new kind of tag cloud that lists the tags being used alphabetically and clusters them depending on their semantic relation. E. g. within a tag cloud the tags *IBM, WebSphere* form one cluster and the tags *Sports, Soccer, Basketball* another one. Tags being part of the same cluster are displayed with a lower visual distance than tags being part of different clusters.

Related Resources Resource similarity allows us to recommend related resources (based on the currently selected resource). E. g. if a user has selected a page entitled *Company News* and tagged it with the tags *IBM, News*, we can recommend the page *WebSphere Portal News* tagged with tags *IBM, News, WebSphere Portal*, even if both pages have a large distance within the navigation topology but are semantically related, based on the tags applied.

Related Users Generally, to identify users being part of the community with a similar tagging behavior a tag-user matrix is created (comparable to the tag-resource matrix). Each column in this matrix reflects the tagging profile of a user. Calculating the semantic distance between two columns of this matrix reveals the similarity of two users in terms of their tagging history. Our work about expert user determination and implicit social network construction based on users tagging behavior is described in more detail in [10].

Further Adaptation Methods Transforming the navigation topology or adapting page layouts can result in a more user- or community-tailored Portal. Based on interests, navigation tree nodes can be moved or hidden depending on their relevance. The same way, more important portlets can be grouped at the beginning of a page. Navigation tree nodes not tagged at all might be of less interest to most users and can hence be placed to worse positions within the topology. Nodes annotated a lot are of higher interest and can hence be placed to better positions.

Alternatively, arranging navigation tree nodes according to their semantic distances ensures that semantically related ones have small click distances.

Thus an alternative navigation topology can be created entirely based on the tagging behavior of the community. In contrast to the super-imposed structure, this tag-driven structure has a minimal click distance between elements according to interests and the categorization performed by the community. This way, the resulting structure better fits the communitys' mental models.

4 Conclusion and Future Work

In this paper we have presented a three-layered framework that provides users of Portals with easier and faster access to relevant information by incorporating and utilizing social web techniques. An annotation layer allows to tag Portal resources (pages, portlets, users, etc.). In the modeling layer semantic interrelations between tags and hence resources are calculated. Knowledge about user characteristics and context is derived from users' tagging behavior. The adaptation layer provides means to issue recommendations to related resources (or tags) that might be useful in the users' current contexts, and to perform various adaptations to the Portal itself. With respect to latter we have demonstrated how a tailored navigation topology can be constructed entirely based on the entire communitys' tagging behavior.

Initial surveys have been very promising. Recommendations and adaptations were considered useful by the majority of participants (90 and 100%, resp.), which indicates the reasonability and usefulness of our system and the underlying concepts. We are currently planning more detailed evaluations with our prototype. Future work includes the extension of our recommendation and adaptation techniques as described in 3.3. We are also interested in incorporating more ideas from the field of social network analysis.

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Generating and sharing personal information spaces

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Abstract. Applications based on the Web 2.0 approach show several limitations: among them, knowledge is usually manually generated by users and can not be structured and shared in effective ways.
This paper presents an innovative architecture, conceived in terms of a multi-agent systems and aimed at creating, managing and sharing personal information spaces. Data and knowledge may be directly added by users, but also collected and structured with the support of content retrieval, filtering and automatic tagging techniques. Conceptual spaces organize personal information spaces using zz-structures, an innovative system of conventions for data and computing, capable of representing, by means graph-centric views, contextual interconnections among heterogeneous information.

1 Introduction

The concepts of the participative Web, mass collaboration and collective intelligence grow out of a Web which is increasingly influenced by innovative web services that empower the user. This is more and more engaged in the development, rating, and distribution of content, in the customization of applications, and in collaborative knowledge construction. As the Web is more embedded in people's lives, users express themselves through User-Generated Content (UGC) [18]. UGC is one of the cornerstones of Web 2.0; examples of UGC range from *social bookmarking* (e.g., del.icio.us, Digg, Furl, Spurl, etc.) to *photo and video sharing* (e. g., Flickr and YouTube), from *social networking sites* (e.g., Myspace, Friendster, Facebook) to *virtual world content* (e.g., Second Life), from *wikis* (e.g., Wikipedia) to *social-media blogs* (e.g., BoingBoing, Engadget) and *podcasting*.
UGC suggests new value chains and business models; it proposes innovative social, cultural and economic opportunities and impacts, originating new types of information. However existing models, methodologies and tools devoted to information retrieval, knowledge management and navigation support highlight severe limitations. Open issues emerge: information overload, flatness of information and knowledge extraction methodologies, personal information spaces constituted by weakly structured knowledge and lacks of personalization techniques for open corpus of documents. Our aim is to extend potentialities expressed by Web 2.0 tools empowering social bookmarking tools with deeper semantic organization and with adaptive features. Social bookmarking represents a meaningful part of Web 2.0, enabling interconnections among multiple information sources. Tools like del.icio.us, Digg, Furl, Spurl, Shadows, Scuttle, and so on,

allow users to easily add sites of their choice to their personal collection of links, categorize those sites with keywords (tags) and share their collections. Unfortunately, existing social bookmarking tools do not include adequate mechanisms for organizing user information and for personalizing it according to users' preferences and needs. Moreover, it is important to augment Web 2.0 social sites with new navigation and search tools, to integrate heterogeneous and dynamic information coming from diversified Web 2.0 sources, to structure and personalize the user concept space, and to adapt it to his/her needs and preferences. More specifically, in this paper we focus on *open and dynamic models for structuring data and personal information* in more complex users' concept spaces. For this goal, we use an extension of zz-structures [11], [4], [5], innovative data structures that gather and organize all information relevant to the user, enabling more thorough, personalized searches, directly correlated to the semantics of documents [9]. As a result, a better exploitation and sharing of knowledge can be achieved. In this work we consider the specific domain of tourism; in particular we are interested in proposing an architecture for organization, generation and sharing of knowledge related to journeys, transportations, accommodations, cultural sites and so on. Users can search and navigate a databank of relevant documents, add their own information units (in a del.icio.us style), and arrange them into personal information spaces, generating customized concept spaces and views. Our model allows users to access adaptive content in a structured way and to share the ways such content is organized and visualized. In the proposed model, we consider two different classes of potential users of our systems: employees of travel agencies or similar, interested in monitoring customer opinions, experiences and needs, in order to improve their commercial offers, gain new customers or promote their services; customers and travellers, interested in sharing knowledge from their previous experiences and trying to acquire new information for planning vacations or journeys.

The following of paper is organized as follows: next Section 2 presents related works; Section 3 introduces and exploits the proposed architectural model, applying it to our specific case study. Finally, conclusions and future works are in Section 4.

2 Related Work

Our work describes a general architecture that tackles problems connected to personal information management [19] and adaptive knowledge sharing/discovery by social networks for a more intelligent information exploitation and to provide more sophisticated search-tools systems [9]. Tools based on social networks like iVisTo [14], Friend-of-a-Friend (FOAF)[1], Huminity[2], can improve information sharing and discovery [15], implementing the idea that people prefer to obtain information from their trusted friends [7]. For this reason they analyze relationships and information flows among people, but don't allow users to organize their personal concept spaces. The importance of defining suitable concept spaces is highlighted in [3]: these provide an

[1] http://www.foaf-project.org
[2] http://www.huminity.com

ontology of the subject matter including the concepts and their relationships to one another. Concept spaces are traditionally showed by concept maps using hierarchical and static relations, which increase the difficulty of viewing and understanding the structure of the concept space and can't visualize dynamic knowledge and environments [17, 6]. Many innovative tree visualization (as Treemaps [13] or Botanical trees [8]) cannot easily differentiate between relationship types; other models (e. g. [2], based on hyperbolic geometry, or [16], based on S-nodes) are not able to dynamically switch from a view to another one. So, we propose a flexible information organization by zz-structures that allow users to express their own views, differently from current systems (de.li.cio.us, WebTagger, PowerBookmarks or Siteseer), that neither support a comprehensive analysis of users' needs and demands. By zz-structures, we simplify the authoring process, in which the users may assume the role of an author, organizing the knowledge base, creating personalized views, highlighting interests, enabling the re-use of previously created material, clustering resources and users, and so supporting recommendation of new items. A simple approach toward information structuring is common to same adaptive systems in tourism domain, like NutKing[3] (also described in [12]), where users can compose their travel selecting interesting items. We also apply our architecture in tourism domain empowering this aspect and supporting both short-term interests, returning reports based on reviews of other users, and long-term stable interests, monitoring activities of personal information management over long periods of time.

3 General Architecture

This section describes our general architecture, shown in Figure 1. Internal modules will

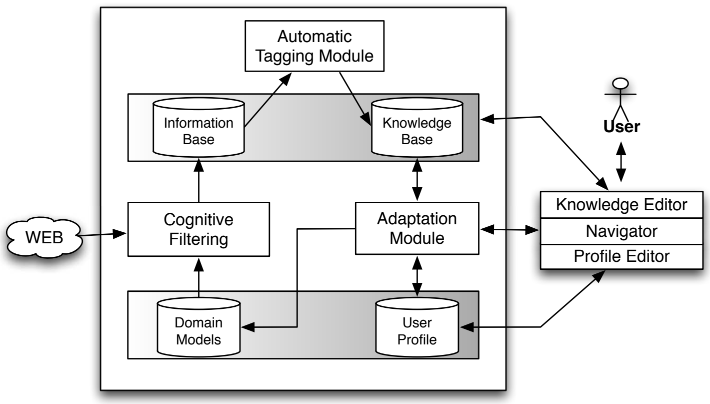

Fig. 1. A system diagram representing the components of our proposed architecture.

[3] http://nutking.ectrldev.com/nutking

be discussed in the next subsections with reference to the a specific case study. The proposed architecture is based on a set of interacting agents, aimed at information gathering and processing, and on a set of client components, aimed at implementing interaction between the application and the end-users. Data storage is achieved by means of two different kind of shared repositories: the *Information Base* (IB) and the *Knowledge Base* (KB). Users can interact with both such repositories using the modules implementing client interface: in particular users can access, navigate and enquire both IB and KB accordingly to the specific kind of data such repositories contain.
Users can also, accordingly with the Web 2.0 philosophy of social and collaborative participation to content authoring, enrich the data stored in both the IB and the KB, in order to improve the effectiveness of the system and give an advice to the other participants of the community. Users can access every document constituting the IB and, eventually, provide new contents by means of a specific function included in the client interface and described in detail in the following sections.

3.1 Generating the Information Base

The Information Base is a collection of records representing text documents users can access, browse and enquire by means of unstructured queries. The IB is filled with documents retrieved from the Web and properly filtered by the *Cognitive Filtering* (CF) module, a software agent based on the features provided by the ifMONITOR textual filtering service, developed by one of the authors.
The ifMONITOR service is aimed at periodically monitoring and downloading the contents available in a heterogeneous set of web sources, by means of a sophisticated Java agent. The agent is able to crawl the sources and scrap selected data from the browsed contents, in order to filter out not relevant parts like ads or navigational links. Scraping is achieved by source dependent regular and XPath expressions; source scraping allows the identification of updated textual contents, which are represented as textual documents. Scraped documents are filtered by implementing and applying the IFT algorithm [1], [10], a supervised information filtering technique based on textual similarity between the input documents and a set of *Domain Model* (DMs). A DM is defined as a semantic network representing a specific information need, constituted by nodes, representing domain keywords (or their respective stemmed representation) and edges, representing co-occurrences between keywords.
IFT generates a semantic network representation of any input document; such structure is matched against the predefined set of DMs and if a relevance threshold is reached with respect to at least one DM, the document is inserted into the IB. More specifically, for each relevant document, the textual content and the list of satisfied DMs is stored.
The IB is strongly dependent on the set of DMs defined initially to perform filtering; DMs can be generalized to other domains, representing different information needs, and their internal structure, in particular the weights assigned to the entities constituting the semantic networks, can be adjusted by users by means of relevance feedback.
The CF module acts as an adapter between our proposed architecture and the existing ifMONITOR infrastructure; more specifically CF module is aimed at adding relevant documents, retrieved by ifMONITOR, to the IB, at starting the document automatic extraction process on incoming data and at committing the users relevance feedback

to ifMONITOR. CF module is activated each time a document is provided by ifMONITOR or by a user; users can explicitly add textual contents to the IB by the client interface, uploading the desired document as a file or passing its URL as a parameter. Manually added documents are retrieved, redirected to ifMONITOR for relevance evaluation and, independently from the result of the relevance evaluation, included into the IB. Relevance evaluation is performed to fulfil the requirements of the automatic tagging activity described in detail in the next section. Each time a new document is added to the IB, the CF sends a new event to the automatic tagging module to activate its functionalities.
The online sources considered for filtering include vertical portals and web sites, horizontal search engines, and in the wave of Web 2.0 also UGC sites (blogs, forums and so on). In this work we focus only on textual documents retrieved from an open (like the whole World Wide Web) or closed digital repository.

3.2 From information to knowledge: the Automatic Tagging Module

In order to move from information to knowledge, we introduce in our architecture the *Automatic Tagging* (AT) module, whose purpose is the extraction of knowledge from the textual features of the documents included in the IB. The AT module has a pipeline structure, constituted by several annotators working sequentially, each one annotating the input documents with its own annotation set. The tags assigned automatically by the AT module are used, in addition to those assigned by the users of the proposed application, to arrange the documents of the IB into a set concept maps representing the overall knowledge, stored in the KB.
The AT module is activated by an event raised by the CF each time a new content is provided to the IB by ifMONITOR or by users. When AT module is activated, a new tagging activity is started on the newly available documents.
The main annotators included into the core pipeline of the AT module are:

1. the *Information Extraction* module (IE), responsible to extract basic named entities (e.g. person and company names, organizations, location names, prices, dates, currency, etc.) from the input documents. In our specific domain, we are interested in extracting entities like geographical locations, names and star ratings of hotels, specific facilities provided by hotels (e.g. swimming pool, etc.), information about events (e.g. musical nights, opera, etc.). Information extraction is achieved by means of regular expressions and gazetteers collecting domain dependent terms. Using IE module, the documents of the IB, for example related to London, are tagged with location (e.g. *Knightsbridge, Islington, Greenwich*), with visiting places (e.g. *Tate Modern, British Museum, National Gallery*), while documents related to hotels are tagged with their names (e.g. *The Gainsborough Hotel, Radisson Edwardian Vanderbilt Hotel*) and/or with provided services (e.g. *currency exchange, gym, foreign languages spoken*).
2. the *IFT-based* module, which annotates each document with the most weighted keywords appearing in the set of DMs associated with the document. More specifically the IFT-based module is aimed at tagging each document with respect to a set of relevant terms defined by the DMs developer to describe our case study information needs. With respect to our case study, using IFT-based module, documents

concerning the city of London are annotated with the following terms (e.g. *visit London, London hotels, travel diary UK, London tourism*).

More automatic annotators will be developed and integrated in the future, in order to increase the effectiveness of the AT module.

3.3 Structuring the user concept space

The knowledge extracted from each document of the IB by the AT module or provided by users by means of manual tagging, is organized in a concept space, stored into the KB. The KB implementation provides the business logic needed to move from a set of annotated documents to a conceptual map representing the extracted knowledge in a structured way.
In this work we propose an implementation of the KB based by means of zz-structures, first introduced by Nelson [11] and then formally described in [4] and [5]; zz-structures provide a new, graph-centric system of conventions for data and computing. A zz-structure can be thought of as a space filled with cells. Cells are connected together with links of the same colour into linear sequences called *dimensions*. A single series of cells connected in the same dimension is called *rank*, i.e., a rank is in a particular dimension. Moreover, a dimension may contain many different ranks. For any dimension, the degree (no. of in/out links of a given colour) of each cell cannot be greater than 2; this restriction ensures that all paths are non-branching, and thus it provides the simplest possible mechanism for traversing links.
In our approach a cell corresponds to a document stored in the IB and a link connects two cells corresponding to two documents whenever the same tag has been assigned to the two documents: in such a way the document collection is augmented with dimensions derived from the automatic and manual tagging process and they constitute in such a way new possible (navigation) paths.
An example of a zz-structure is given in Fig. 2. The vertices $(v_1, \ldots, v_{13})$ of the zz-structure represent some hotels in London, described by documents of the IB and tagged by AT module; connections reflect similarities among hotels in terms of location, rating, price and attitude expressed by customers. Normal, thick, dotted and dashed lines represent, respectively, the dimensions D^{city}, D^{stars}, D^{price} and $D^{judgement}$. In D^{city}, vertices $(v_1, \ldots, v_7)$ group 7 hotels in London, constituting the rank R^{city}_{London} = $(v_1, \ldots, v_7)$, while remaining group in $R^{city}_{Edinburgh}$ = $(v_8, \ldots, v_{13})$ hotels in Edinburgh.

In this way, depending on the specific tags, dimensions and/or ranks considered, it is possible to perform different abstractions, relevant for different user needs and perspectives. The union of zz-structure-based concept maps generates the user concept space: it can be defined [5] in terms of a multi-agent system constituted by five types of agent classes respectively related to concept maps, dimensions, ranks, composite and atomic cells.
These five agent classes represent five abstraction levels in the user concept space. Concept agents split the concept space into topic-related zz-structures; they know and directly manipulate dimensions and isolated cells, including concepts and relationships between concepts (organized in dimensions). Dimensions agents, uniquely identified by dimensions' colour, know and manipulate their connected components (ranks). Ranks

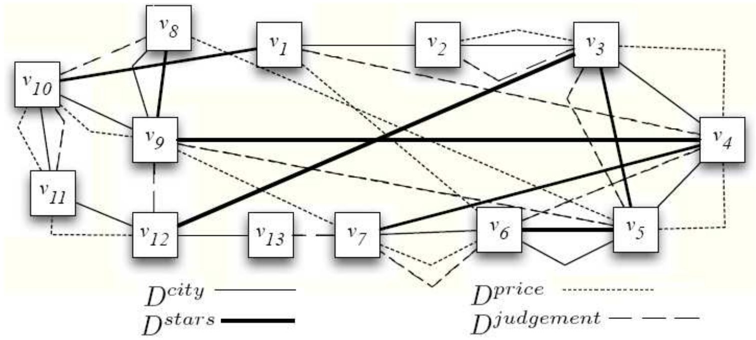

Fig. 2. A concept map for hotels in London.

know and coordinate the cells and the links that connect them; finally, composite cells agents contain concept maps related to more specific topics, while atomic cells agents are primary entities and directly refer to documents. Agents collaborate in order to manage, maintain and visualize concept spaces, or part of them.

3.4 Personalized access to knowledge

The KB is the set of conceptual units, representing cells and edges, users can organize in order to compose their own conceptual space and their own view on such conceptual space. More specifically each user can generate a set of conceptual maps, whose goal is to allow him/her to better organize knowledge and information related with the tourism domain, to improve the effectiveness of retrieved documents and, at the end, satisfy user's goals like, for example, trip planning.
Each user, by means of interaction with the *Knowledge editor* and *Navigator* components, is allowed to create and store a set of conceptual spaces, that initially are visualized as an empty piece of paper, and to fill them with the conceptual units extracted from the KB. This goal is achieved by allowing user: (1) to enquire unstructured and structured queries both IB and KB and then to import the retrieved results, represented as cells and edges of a zz-structure; (2) to provide new contents for the IB or (3) to manually add tags to the entities included in his/her conceptual space.
Each user can search, browse and import in its conceptual spaces all the cells and the automatically added edges constituting the zz-structure implementing the KB. Edges added by other users as tags can be accessed and used only if shared by their owner; private edges are visible only to their owner. Each user can modify the access policies of tags he/she created. Concept sharing is achieved by selecting the edge user wants to share and declaring it as public. When a new edge is added to a conceptual space, it is not stored into the global KB until it is declared as public by its owner.
Fig. 3 shows a set of conceptual maps views for three different users.
The structure of each conceptual space, constituted by a set of links to items (cells and edges) included into the KB and a set of private items, is stored into the *User Profile* (UP). A UP is assigned to each registered user; it is used to store, in addition to data

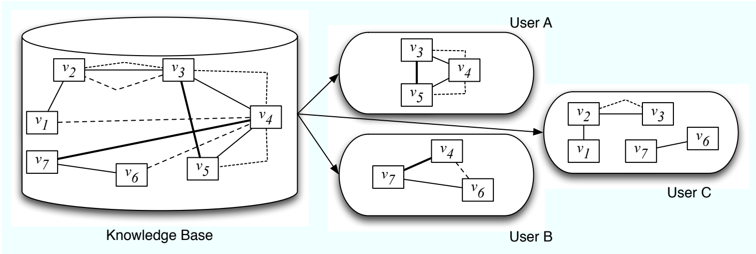

Fig. 3. Personalized sub-concept maps of the KB based on three different UPs.

representing user's conceptual spaces, user information collected both implicitly and explicitly. Users can access and edit their profile using the *Profile Editor*. UP is also devoted to store the browsing and tagging history of each single user. Examples of user activities tracked in the UP are: documents observed and time spent on them, selected dimensions and views, submitted queries, manually added documents and tags.

Visualization of knowledge and information is an important aspect of our model. One central reason for this is that visualization exploits several characteristic features of the human cognitive processing system. Knowledge visualization may help users to organize and reorganize, structure and restructure, assess, evaluate, elaborate, communicate, and co-construct knowledge, and to utilize ideas and thoughts, as well as knowledge, about relevant contents and resources [17]. Visualization is one of the features to whom the Navigator module is devoted. There may be many different ways to visualize zz-structures, choosing different dimensions and different structures in a dimension. Among them the most common are the *two-dimensional rectangular views*: the cells are placed on a Cartesian plane where the dimensions increase going down and to the right. Obviously some cells will not fit in these two dimensions and will have to be omitted.

I-views and H-views, formally described in [4], [5], are two examples of two-dimensional rectangular views; an example of H-view, related to Fig. 2, is shown in Fig. 4 (a). The H-view of size 5 is focused on cell v_3 and dimensions D^{city} and D^{stars}.

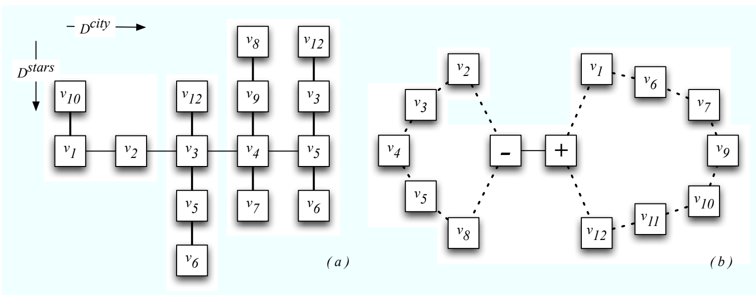

Fig. 4. Two views related to the zz-structure of Fig. 2: an H-view (a) and a Dipolar-view (b).

In this work, we introduce a new type of view, the $Dipolar$-view to visualize effectively dimensions of a zz-structure related with a polarity (i.e., positive or negative opinions) expressed in the information units. Fig. 4 (b) shows an example that refers to the zz-structure of Fig. 2: the $Dipolar$-view is centred on two position cells, $-$ and $+$, that act as placeholders of the dichotomous dimension $D^{judgement}$.
The *Adaptation* module is devoted to perform content personalization accordingly with user profile, in order to achieve a more effective interaction between users and the proposed architecture. More specifically the adaptation module is aimed at selecting, among the entities included in the KB, the cells to be shown to the user and arranging them in a suitable view.
The adaptation module is also devoted to the identification of the items, stored into both IB or KB, which are more useful for users to express and organize their knowledge; effectiveness of each item (cell or link) can be defined as the number of users conceptual spaces in which such item has been included. The assumption is to consider as more effective cells and edges used by the largest set of users; on the other hand users will not include into their respective conceptual spaces documents or, more generally, conceptual items, which are not providing relevance or, more generally, additional knowledge. Such information can be used by the adaptation module to dynamically modify the DMs used by the platform to retrieve documents of the IB, by means of the relevance feedback feature implemented by ifMONITOR. Useful documents are used as good examples in assigning relevance feedback to the respective DM, while unpopular documents will be used to represent bad examples of retrieved documents. This mechanism will assure that the automatic document retrieval process will adjust in order to satisfy the evolution of users information needs. In this case the community leads the identification of new contents by means of an evaluation of the currently utilized knowledge.

4 Conclusions and future works

In this work an innovative conceptual architecture for delivering of enriched Web 2.0 services has been introduced. In particular we focused to the specific domain of tourism. In our approach we adopt both adaptive personalization techniques, used in document retrieval and content selection, and models for structuring data and information.

Our research is ongoing: we move our attention to the refinement of the proposed features related to adaptation and personalization, defining a formal structure for the UP and a set of heuristics for inference and recommendation. We aim at developing a prototype application implementing the modules that constitutes the proposed architecture and at planning experimental evaluation activities.

Finally, subject of future works will be the integration of ontologies in order to allow moving from a lexical to a semantic representation of the tags and the application of our architecture to non-textual items, such as images and video, rearranging the AT module pipeline.

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Chain of Authorities: Authority and Information Quality

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Abstract. The information retrieval in folksonomy-based systems is a process that becomes more and more complex as the number of users and the amount of information being categorized increase. In such systems, the quality of the information retrieved cannot be assured because there are no rules and no control in the information categorization process. In this work, we propose the use of the cognitive authority ascription to build a personal chain of authorities as a way to improve the quality of the information retrieval process. We also describe some experiments demonstrating its viability, and show how the social network represented by the chain of authorities can be explored to provide useful social knowledge.

Keywords: Chain of authorities, folksonomy, cognitive authority, information overload.

1 Introduction

Taking advantage of the Web 2.0 emergence, some *folksonomy-based systems*, such as *Delicious* and *Flickr*[1], were developed making it possible for users to create their own categorization and meaning attribution to the information available on the Internet. In such systems, users have active voice to establish the “aboutness” of the objects they found [1]. However, as the number of users increases so does the issue of information overload. With the great amount of information being classified without any quality control, when retrieving information, users need to trust mainly in the common sense of the other users of the systems or just in their own opinion. This happens mainly because aspects related to the authority and trust of each categorization source are not considered in the information retrieval process.

Regarding the quality of the information, it is important to remember that nowadays it is impossible to maintain specialists monitoring the information published on the web in order to access its quality. However, considering that in folksonomy-based systems common people are giving descriptions and meanings to the content they found or produce, we might think about those people cooperating for

[1] http://del.cio.us, http://www.flickr.com

the process of information quality evaluation. But how can we know if the evaluation is accurate or fair? How can we distinguish information evaluated and organized by who knows what they are talking about from those that do not? How can we judge the information quality and identify competences of the categorizers?

In a conceptual discussion about the folksonomy technique, Russell [1, 2] approaches the ascription of cognitive authority through folksonomy, aiming at recognizing user's competences or skills, and finding authorities on any subject matter. Cognitive authority is a social epistemology theory exposed by Wilson [3] and used mainly by Rieh and Belkin [4, 5, 6] in studies about the way people judge authority, information quality and relevance on the Internet. According to Russell, cognitive authority ascription through folksonomy turns users (i.e. the categorizers of objects) into objects, but in opposition to the categorization that tries to demonstrate "what an object is" —its aboutness—, this categorization will try to demonstrate "what an object knows" —its cognitive authority.

Considering that the sources responsible for information categorizations' in folksonomy-based systems are their own users and grounded by Wilson's reasoning about cognitive authority, we were convinced that to apply cognitive authority ascription through folksonomy, as proposed by Russell [1], might have contributions that go beyond the recognition of users competences and the identification of authorities in a certain topic. With these ascriptions, we can build a social network, based on confidence and meritocracy, whose connections represent the authority of its members. In the scope of this work, this social network is called the **chain of authorities** and it can be used to discover communities of users, groups of common interests, experts in a subject, and so on. In addition, this chain of authorities can be applied to the process of information retrieval in folksonomy-based systems to obtain results of better quality.

This paper is organized in 6 sessions. In section 2, a brief basis of the folksonomy technique is exposed. Section 3 approaches the cognitive authority concept and discusses its ascription through folksonomy. Section 4 presents comparisons among our research and some related works. In section 5, we demonstrate the simulation of the processes of cognitive authority ascription and information retrieval to show the chain of authorities' benefits. Finally, section 6 presents our conclusions and some ideas for future research.

2 Folksonomy

Coined by Thomas Vander Wal [7] in 2004 as a result of the junction of the words "folks" and "taxonomy", folksonomy represents the classification done by people, a classification in which users work in the attribution of meaning and for the organization of the web informational contents [8]. The main characteristic of folksonomy is to allow users to create and establish the way information is organized, instead of restricting this process to the content authors and to the professional editors. There are no rules and no control, since folksonomy relies on shared and emergent social structures and behaviors, as well as related conceptual and linguistic structures of people. In the technical sense, the term folksonomy [7, 8, 9] represents an emerging technique applied to the categorization of bookmarks, photos, blog posts, physical location or any other object available on the Internet. The whole process is based essentially on the three pivots of folksonomy (Fig. 1): the user, who does the categorization; the object, which is classified; and the tags, which make the categorization labeling the object.

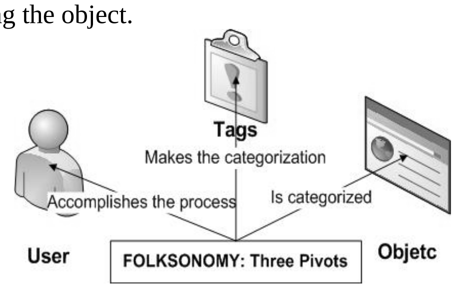

Fig. 1. The three pivots of folksonomy.

The central issue around Folksonomy is that it works because of the users, and at the same time, its flaws also happen because of them. But it does not mean that the users are wrong or that they are not categorizing information correctly. What the users are classifying is appropriate to them or to a small group, but it will not always contribute to the collective [10, 11]. There are areas in which users are more (or less) appropriate as information sources, depending on their capacity and competence on the subjects they are categorizing, i.e. in their **cognitive authority**. As authority is a subjective matter which depends on who grants it [3], like quality and relevance of results are [4,5], to obtain a better or worse result in an information retrieval process in a system like *Delicious* is directly related to who the categorizers of the information retrieved are.

3 Cognitive Authority

The term "cognitive authority" was coined by Wilson [3] in his book "*Second-hand Knowledge: An Inquiry into Cognitive Authority*", to explain the kind of authority that influences people's thoughts and what they believe. The cognitive authority, as explained by Wilson, and justified by Rieh [4], represents the influence that the authority can cause in the way of thinking of an individual, because he judges him/her proper, worthy of credit and trust. In Wilson's words [3] this kind of authority defines "*who knows what about what*".

It is interesting to differentiate cognitive authority from reputation. Wilson [3] mentions reputation as one of the rules applied to justify the authority granted to someone (experience, training, ostensible performance and test of intrinsic plausibility are others rules). However, according to Wilson [3], everyone has a reputation, being it good or bad, but one has neither always a good reputation nor always a good reputation is enough to provide an authority ascription. There are several works related to reputation in computer science (i.e. [12,13]), but Russell [3] grounded on Muller [14] says that "*all the algorithms in computer science and social network theory that have been used to distill reputation and trust into a calculable value are really looking at an aggregate opinion across all topic areas. This is a lossy* *operation. There is information being lost that cannot be recovered after the aggregation of topic areas*" and also "*This allows for decisions to be made more easily but does not give context to this trust*". So, cognitive authority is a more appropriate term than reputation as the first entails social and subjective aspects while the later is limited to a value.

When approaching the cognitive authority concept, Rieh & Belkin [4, 5, 6] developed a study which showed cognitive authority as a decisive factor in the way people make judgments of quality and relevance on the Internet. They assert that the application of this concept can aid in the process of information organization and retrieval. In a system like *Delicious*, where the number of users is impressive and the amount of information produced is even higher, it is very difficult for users to identify and separate information that is both interesting and reliable. It is known that specialists [6] not only use documents of good quality, but also develop more organized classification schemes and relationship among concepts. In conclusion, recognizing the categorizers' abilities, and granting cognitive authority to them, might aid in the retrieval process in a folksonomy-based system because of the emphasis on information categorized by who knows what they are talking about. This recognition allows the creation of the users' chain of authorities that reflects and takes their opinions into account.

3.1 Cognitive Authority and Quality

In Section 2, we mentioned the subjectivity of cognitive authority and of quality. In fact, we can say that information quality is **subjective**, with strong personal characteristics because it depends on who is making the judgment [15]. But that it is also relative and situational: a) **relative**, as certain information can be adequate for a specific objective (an individual interpretation) and completely inappropriate for another (a reference in a scientific paper); b) **situational** because its judgment can be changed in the course of time, with people's knowledge evolution and with their needs. The same considerations can be applied to authority [5] that people ascribe to others in their social groups. Our considerations on the context of information retrieval is that as the judgment for the authority ascription to a person has common grounds with the judgment of information quality and relevance [4], from the point of view of who granted this authority, a person considered an authority in a certain subject matter tends to have quality information in this subject. To conclude, users of a folksonomy-based system prioritize information coming from people who they granted authority, data of high quality will be presented to them and the precision of the retrieval information process will be improved.

3.2 Cognitive Authority Through Folksonomy

As in a folksonomy based system it is the user who attributes meaning to the information, our proposal consists in transforming those users (the ones that accomplish the categorizations) in objects that are susceptible to categorization. Since users can represent an individual or a group of people, a company or any other organization, we preferred to use the term entity to refer to them. As discriminated by Russell [1], the common categorization describes what the object is about, while the categorization of an entity describes what the object knows. Those entities will be categorized regarding their competences in a process of cognitive authority ascription. So, with this process it is possible to identify and to prioritize information classified by entities that are considered authorities in the subject matter. Fig. 2 shows the cognitive authority ascription with the tags: “usability”, “folksonomy” and “design”.

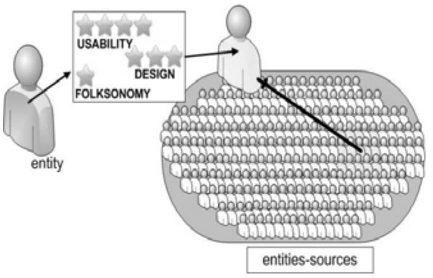

Fig. 2. Cognitive authority ascription.

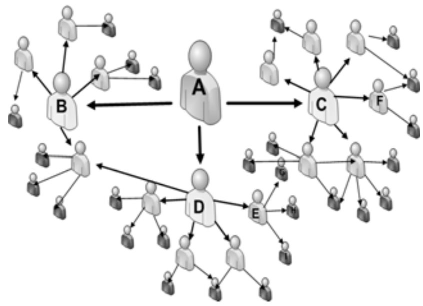

Fig. 3. The chain of authorities.

The categorization process for the cognitive authority ascription creates a social network between the user and its entities (called **authority network**), identifying and turning explicit the relationships of reliability and recognition already existent in the real world [16]. When authority networks are linked to each other they generate a **chain of authorities** [1] (see Fig. 3) that change depending on who is the starting point. This chain is the real benefit from the cognitive authority ascription in a folksonomy-based system because it can be used for the emergence of social knowledge and other useful information as we will show.

4 The Simulation of Cognitive Authority Ascription

Goldbeck in [12] says that “…*naturally occurring networks take a long term to gain the large number of users, and the topological properties are fixed*…”, and concludes that simulation is a viable alternative for the study of such systems. Thus, to demonstrate that the use of an entity’s chain of authorities can elevate the precision of the results obtained in the information retrieval process we decided to develop some simulation experiments. Through these experiments, we also demonstrated some analysis that can be done over the chain of authorities. To make an accurate analysis with the generated data, a simulation process needs to follow a well defined methodology and should respect an established group of rules. The steps executed for the simulation experiments are presented in Fig. 4.

The generation of the main pivots of a folksonomy-based system: tags, entities and objects, takes place in the first three steps. The **first step** consists in the definition of the set of tags used during the simulation process. The tags represent the vocabulary that the entities use to the object categorizations and which will also be used for the cognitive authority ascription. The set of tags defined in these experiments has 250 tags. The **second step** defines the set of entities (i.e., the users). The defined set for these experiments has a population of 100 entities and, for each entity we generated a vocabulary composed by 20 tags randomly selected from the set of tags. It is important to emphasize that to produce the *long tail behavior* of tags observed in real systems we attributed a particular usage proportion to the tags, following a variation of the Paretto Principle [17]. The **third step** entails the creation of the set of objects. For these experiments the set was composed by a 1000 different objects and, for each object we attributed 10 tags randomly selected from the set of tags to be used as "object descriptors". To simulate the "entities interests", we selected a quantity between 0 and 20 entities to be related to an object, indicating entities to which the object would be recommended in the process of information retrieval. The **fourth step** makes the objects' categorization. The procedure consists in building a relationship, modeled by the tuple {entity, tags, object}, representing a process in which users of a folksonomy-based system classify an object attributing tags to it. For these experiments, each entity has on average 95 objects classified with a random quantity of tags (minimum 2 and maximum 5, based on a previous analysis of the *Delicious* system). The objects are also randomly selected among the 1000 generated objects. Again, we emphasize that, to make the simulation more accurate, the choice of the tags obeys a distribution which generates a long tail, and prioritizes the tags that are present in the entities' vocabulary as well as the ones present in object's descriptors.

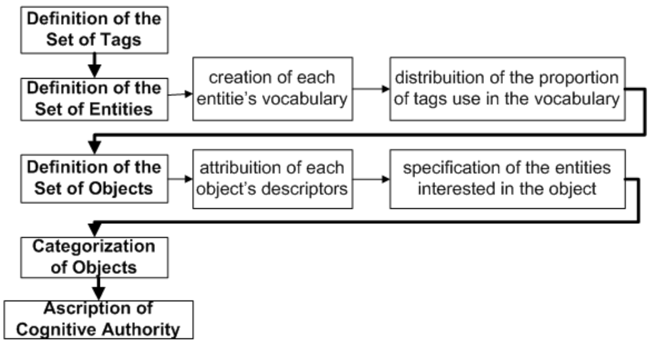

Fig. 4. The steps of the simulation process.

The **last step** to the data creation consists of a procedure in which each entity grants authority to a random number of other entities (between 1 and 10), this number represents the quantity of authorities that will be in the entity's network. For each randomly selected entity, the authority is ascribed through five tags also randomly selected from its vocabulary. Each tag is associated to a weight measured by a value between 1 and 5 stars, which represents the distinction of authority levels. The generated relationship is represented by a unique tuple {entity 1, tags, entity 2} indicating that "entity 1" granted authority to "entity 2" with the set of tags "tags". When choosing tags to ascribe the cognitive authority those that are in the long tail are excluded, because there is no point in ascribing authority to an entity with a term that it does not use to categorize objects. With the execution of these steps the data necessary to the simulation of the retrieval process are now established

4.1 The Information Retrieval Experiments

The experiments itself consist in the accomplishment of three steps: 1) the information retrieval process, followed by 2) the identification of the position of the objects using the tradition chronological order of categorization (it can also be ranked), and finished by 3) the identification of the position of the objects when they are prioritized by the authorities' categorizations. The three steps were executed for each one of the 100 entities, resulting in approximately 25.000 executions. The data obtained with the simulation serve as a basis to identify, for each one of the 1000 objects, the tags that best retrieve a certain object using the chronological retrieval process and also using the process where authorities are prioritized.

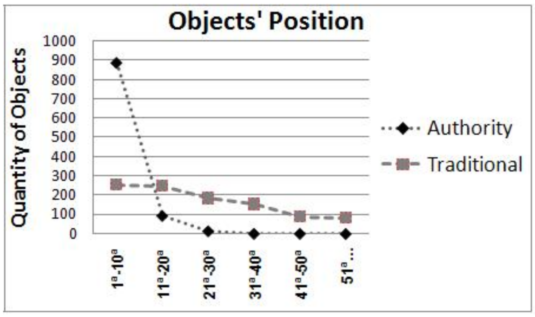

Fig. 5. Objects positioning in the information retrieval process.

Fig. 5 presents a graph for the number of the objects in each partition of the positioning for the chronological retrieval process and for the retrieval process considering authorities. We can conclude that the prioritization of authorities' categorization maximizes the chances of an object to appear amongst the first results of a retrieval, being a great advantage over the chronological retrieval process. This conclusion can be supported by the great difference shown in the number of objects that are not retrieved by the chronological process (74,9%) against the number of objects that are lost in the authorities' prioritization process (11%), considering the 10 initial positions. The first 10 positions are very important since in a research carried out by iProspect [18] it is shown that most of the users consider only the first results presented in an information retrieval process. As a consequence, many useful results which are not presented in the first positions will never be found by the users in the chronological process.

4.2 Chain of Authorities Analysis

Besides the analysis of the positioning of the objects, it is also possible to carry out analysis on the chain of authorities and to extract information from it. Fig. 6 demonstrates the distribution of authorities in an example chain.

According to the percentage of the first degree of separation, an entity possesses on average six direct authorities (i.e. their network of authorities). The graph of Fig. 6 also demonstrates that any entity is linked to approximately 83% of other entities until the 3rd degree of separation and that only 1% of the entities are beyond the 4th degree (there are no occurrences of entities whose degree of separation is higher than the 5th degree). This data demonstrate that an entity is relatively close to most of its authorities, which is in accordance with the studies of Yu [19] on the degrees of separation in social networks. In a chain of authorities the proximity between an entity and a given authority affects the influence that this authority causes on the entity, the judgment of information relevance and quality, and even the vocabulary terms used in process of information categorization and retrieval.

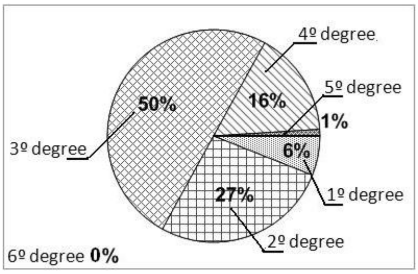

Fig. 6. The distribution of authorities in an example chain.

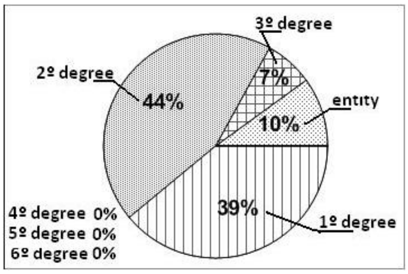

Fig. 7. The distribution of objects on the chain.

In our experiments, at the data generation, the objects of interest of each entity were defined. Thus, once the distribution of authorities on the chain is identified it is also possible to identify the distribution of each entity's objects of interest.

The graph of the Fig. 7 shows that, on average, 83% of the objects of interest of each entity are found up to the 2nd degree of separation in the chain. Comparing those results with data shown in Fig. 6, we noticed that 33% of the authorities are placed up to the 2nd degree of the chain. Thus, it determines that 33% of authorities did the categorization of 83% of the objects of interest of each entity. These results do not allow us to affirm that non-authorities (i.e. common entities) do worse categorizations, but they demonstrate that authorities that are close to entities classify most of their objects of interest. Therefore, we can say that authorities' categorizations presents better contributions to the process of information retrieval.

There are some questions that we can answer by analyzing the chain of authority. As already mentioned by Russell [1], we can run over the chain and find answers for "who is an authority concerning topic Y?", and "what is user X an authority on?" Likewise, we can identify the propagation and retention of authority by considering the weight related to the authority ascribed among entities. These properties can show us who figures as the expert in a subject on the chain not only because of its popularity, but also, due to the weight of the authority possessed by the entities which ascribed his\her authority. Besides, it is possible to find the shortest path between an entity and a given authority, to create groups of entities with common interests (or goals), to find other entities that share opinions, authorities or objects, and so on. We see the chain of authorities as a social network that can help in the social softwares evolution and in the control of information overload and quality.

5 Conclusion

The results we obtained from our simulation experiments demonstrate that to prioritize categorizations carried out by authorities contributes to a larger number of objects being presented among the first results of the retrieval. This makes it possible for objects condemned to appear among the last results to be located more easily. Thus, besides improving the objects positioning, if we consider that contents classified by authorities on the subject possess more relevance, reliability and quality to who grants the authority, we can say that, for those who grant or for those who agree with the authority of the entities, the contents presented among the first results in the information retrieval process are more appropriate, more reliable and of better quality (at least, its categorization sources can be identified and analyzed).

These inferences demonstrate that the cognitive authority improves the quality of the information retrieval and reduces the problems of the information overload because entities that know what they are talking about, in the opinion of the entity that is retrieving information, are the categorizers of the objects, and these objects are presented in more favorable positions. The key point in our work is to let users say what is or is not good for them. We believe that the meta-categorization proposed in this work can contribute to the construction, organization and use of social knowledge. The construction of the chain of authorities also confirmed our expectations about obtaining useful information such as the possibility of searching for authorities and the recognition of competences. Besides that, it is possible to demonstrate the way the authorities are distributed and make the extraction of several other types of information (i.e. more popular authorities, experts, and possible recommendation of authorities and contents).

The simulation we did provided us with evidence that the application of the cognitive authority concept can generate benefits in a folksonomy-based system with real users. Currently, we are working in the CAW project (Cognitive Authority on the Web) for the development of a folksonomy-based system which makes the cognitive authority ascription possible. We intend to use it for information retrieval and for the extraction of the generated social knowledge. This system is being projected to work with information classified in existing folksonomy-based systems (i.e *Flickr* and *Delicious*) and it will be available on the Internet. We intend to implement it as a plug-in for the browser used for navigating folksonomy-based systems. Besides these technical questions, social, ethical and human-computer interaction aspects are being thoroughly considered in the project, as they are crucial for its success and its acceptance.

We believe that the construction of a social network based on authority and trust is possible and it will provide many benefits for the information retrieval in folksonomy-based systems and, also, for the maintenance of such systems.

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Design of Coordination Mechanisms for Negotiating Conversation Initiation in Mediated Communication

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Abstract. Designing tools supporting people in handling mediated communications requires understanding of communication negotiation as a dynamic and multidimensional process of managing interactive boundaries dependent on the constantly changing context. In this position paper we outline a study that aims at examining how the notion of *Social Translucence* and *Common Ground* can serve as basis for designing mechanisms supporting people in managing their communications through an Instant Messaging application. During the workshop we would like to share the initial results from the study examining the relative importance of the proposed mechanisms in communication negotiation process and discuss the applicability of the obtained results for other tools supporting mediated communication like email clients or social forums.

Keywords: mediated communication, Social Translucence, Common Ground, Visibility, Awareness, Accountability, Instant Messaging application

INTRODUCTION

Prior works have shown that virtual presence does not necessarily imply availability for communication and that managing availability and dealing with variety of communicative requests is generally recognized to be a problem [3, 4, 7, 11, 13]. Availability can be defined as one's willingness to be interrupted [3] and can be viewed as privacy borders management [1], [16]. Palen and Dourish consider privacy borders management as a dynamic and multidimensional process of managing interactive boundaries dependent on the constantly changing context. Boyle [5] distinguishes three control modalities for managing privacy borders: solitude ("*control over one's interpersonal interactions, specifically one's attention for interaction*"), confidentiality ("*control over others' access to information about oneself, specifically the fidelity of such access*") and autonomy ("*control over the observable manifestations of the self, such as action, appearance, impression and identity*").

Although we recognize the importance of issues surrounding the topic of privacy of people's personal information our focus lays in investigating various dimensions of controlling people's interactive borders in that context. Specifically, we aim at testing various mechanisms enabling people to better manage their on-line interactions and providing guidelines helping to improve tools supporting computer mediated communication (CMC) such as Instant Messaging applications, email clients and also social forums.

RELATED WORK

We use the notion of *Social Translucence* as basis for our research and design efforts. *Social Translucence* is a concept defined by Erickson and Kellog [9] as a way to approach "*designing systems to support communication and collaboration among large groups of people over computer networks*". It incorporates different properties of Face-to-Face communication such as *Visibility*, *Awareness* and *Accountability* (see: *Fig. 1)* into any mediated setting [9]. *Visibility* can be defined as the degree to which socially significant information is made visible in the system. *Awareness* reflects the degree to which other people are able to understand the significance of social information that is visualized in the system and act accordingly. Finally, *Accountability* can be defined as the degree to which the system supports people in accounting others for not respecting social information that is provided in the system. Reinforcing those three properties of Face-to-Face communication into any mediated setting is likely to support people in structuring their communications in a socially responsible manner [9].

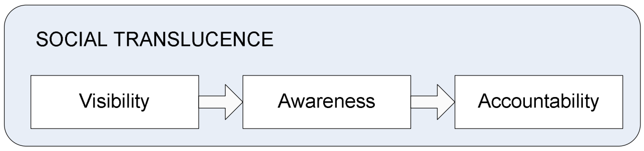

Figure 1: A model of *Social Translucence* in systems supporting communication at work (based on [8]).

The concept of *Social Translucence* is frequently referred to when describing systems that automatically detect people's availability status [3, 4, 11, 19]. These solutions typically aim at supporting *Visibility*, i.e. collecting and displaying socially significant information about people's communicative state. Such information, if successfully represented in the system, should lead to increased *Awareness*, i.e. stimulate potential communicators to see, interpret and act according to that information. Those two mechanisms are expected to conjointly lead to increased *Accountability*, i.e. enable people to account others for not respecting their communicative state. Such systems provide information regarding people's communicative state by automatically inferring their availability status based on video-streaming [20], through the analysis of the content of agendas or daily rhythms [4], or by logging computer activities and various sensory data captured from people's environments [3, 10]. Those solutions, however, are not very successful in acting as *socially translucent* systems. It was found that co-workers did not always respect their colleagues' availability status and participants were not able to establish ways allowing them to demand respect towards that status. Based on the analysis of different characteristics of some of these systems [4, 10, 19, 21] we could identify three possible explanations why an automatic availability indication might insufficiently support attaining satisfactory level of *Visibility* to people's communicative state and therefore cause those systems to fail to become *socially translucent*:

An automatically detected availability status seems insufficiently reliable to potential communicators. Many automatic systems try to assess people's communicative state by analyzing the content of their agendas and daily rhythms [4], or by looking into their activities using sensors [3, 10]. Based on that data systems attempt to create computational models determining the degree to which a person is available for communication. However, those models need substantial time to register a transition from one contextual state to another and update the status accordingly [4]. Furthermore, substantial time is needed to construct a model that effectively predicts one's communicative behaviour. Finally, they are not very successful in interpreting what is the impact of social relationships on people's communicative behaviours [2].

An availability indication provided by an automatic system remains too generic or is displaying context that is insufficiently informative. Systems using computational models to assess people's communicative state tend to generalize that state into three levels indicating that someone is either available, moderately unavailable or highly unavailable [10, 20]. Such generic information about people's availability status may be perceived as insufficiently informative to allow for an assessment regarding which moments are appropriate for initiating communication.

Other systems, besides providing generic status indication based on computational models, offer a video channel as an additional source of information regarding people's communicative state [18, 19]. However, a video channel seems to only partially succeed to inform people about the state or activities of their colleagues. Seeing on a video that someone is sitting in front of the computer and looking at the screen may either mean that that person is concentrated working on an important report or maybe just reading news on the Internet. Therefore, providing a video channel is still insufficient to support effective assessment of whether one should initiate communication or not.

An automatic system does not provide space for ambiguity regarding people's communicative state. In many situations an automatically detected availability status is likely to be perceived as a threat to people's privacy [4]. An automatic system might unintentionally detect and display information, which people would not like to share and by displaying that information negatively affect their "professional identity" [12]. Furthermore, people seem to feel threatened by the fact that they have no control over what information is being presented by the system and therefore they have no control over what image of themselves they are projecting to others.

Therefore, in a previous study (presently under the review process at CSCW conference) we set out to explore the design space for systems supporting manual availability indication and to examine what are the relations between the three *Social Translucence* constructs: *Visibility*, *Awareness* and *Accountability*.

The study results showed that in order to attain *Visibility* a *socially translucent* system should support people in presenting their availability status in contextualized yet abstract manner (e.g. explaining one's concentration or time-pressure level but not revealing the reasons why one is concentrated). A contextualized availability status was perceived as more informative compared to the generic availability information (ranging between available and unavailable) and its abstract representation (in a graphical form) that was entirely dedicated to announce one's availability seemed to leave sufficient space for ambiguity in how people present themselves to others.

Furthermore, based on the study results we suggested that the relations between the three Social Translucence constructs might not be as straightforward as shown by the initial model (see: *Fig. 1*) and that achieving successful level of *Visibility* of people's communicative state might not guarantee that a system would become *socially translucent*. Participants reasoned that by making their status visible in the system, they should automatically obtain the right to account their colleagues for not respecting that status. *Awareness* was seen only as a mediating factor in that process. Based on these results we argue that in order to design *socially translucent* systems supporting communication at work it is not sufficient to provide mechanisms allowing for expressive and contextualized visualization of one's availability status. It is also necessary to introduce mechanisms reinforcing *Awareness* regarding people's communicative state and also a mechanism that allows to quickly yet in a socially appropriate manner react to untimely communication initiations.

MOTIVATION

The results of the previous study prompt us to look at the *Social Translucence* constructs as descriptions of steps people take in negotiating communications [16, 17]. These constructs could be considered as a *shared basis* - a concept derived from the Common Ground theory [6]. A *shared basis* is defined by Clark as a representation of information that (a) is accessible for everyone intended to see it and (b) is mutually understood by all parties involved. It is also known as common ground representation as it helps to contribute to the development of coordinating interpersonal privacy needs. The three Social Translucence constructs could be seen as three means supporting development of a *shared basis* (see: *Tab.1*): *Visibility* can be interpreted as a representation of an interpersonal privacy border, *Awareness* seems to be related to how accessible and how interpretable that representation is for those who are the potential recipients of that information and, finally, *Accountability* can be seen as a way to negotiate mutual understanding of that information by all involved parties.

Based on the outlined reasoning we argue that for a system supporting mediated communication to become *socially translucent* it is equally important to support all three *Social Translucence* constructs: *Visibility*, *Awareness* and *Accountability.* To support *Visibility* the availability status should be presented in a contextualized yet abstract manner and always available in the background. To support *Awareness* the status that is initially set in the background needs to be brought to the foreground each time someone attempts to initiate a communicative exchange. To support *Accountability* communication recipients should be provided with a lightweight way to reinforce their status representation in situations when the communicative exchange was untimely and be supported in efficient and effortless postponing of ill-timed communications. We hypothesize that the presence of those three mechanisms will fully support the grounding process in mediated communication and therefore support the system to become *socially translucent.*

Social Translucence constructs	**Steps in grounding process to attain *shared basis***	**Coordination mechanisms**
Visibility - the degree to which socially significant information is made visible in the system	Creation of interpersonal privacy border representation	Providing relevant availability information in the background for anyone who might be interested in that information
Awareness - the degree to which other people are able to understand the significance of social information that is visualized in the system and act accordingly	Making the border to become a shared device – making availability information clearly accessible for everyone who intends to initiate communication	Bringing availability information to the foreground once a communicative attempt is initiated.
Accountability - the degree to which the system supports people in accounting others for not respecting social information that is provided in the system	Establishing of common ground – creation of mutual understanding of the shared device (creation of a common understanding of availability information)	Reinforcing the unavailability status if the communicative attempt is ill-timed and therefore not compliant with the established common ground.

Table 1: Depiction of the envisioned relationships between the Social Translucence constructs and steps in the grounding process proposed by Clark [6] in the first two columns. The last column povides design guidelines for systems supporting mediated communication based on the analysis of these relationships.

In order to test our assumptions regarding the relationships between the concept of *Social Translucence* and the Common Ground theory we have designed two mechanisms (one supporting *Awareness* and another supporting *Accountability*) for an Instant Messaging application. We have decided to use an Instant Messaging application as it best resembles synchronous communication, in which an obvious asymmetry can be seen between communicators: initiators seem to have more control over the communicative exchange comparing to recipients [14, 15]. Since our objective is to examine the applicability of *Awareness* and *Accountability* mechanisms for supporting communication negotiation the choice for synchronous communication tool seems to be most applicable due to two reasons: (i) it is likely to produce more communicative exchanges comparing to other tools and therefore generate more representative data sample and (ii) it is more likely to stimulate the frequent use of the proposed mechanisms and therefore allows for better understanding of the relative importance of these mechanisms. Our goal in this study is to answer the following questions:

- Do the proposed *Awareness* and *Accountability* mechanisms support the grounding process and make a system become *socially translucent*?
- What is the relative importance of both mechanisms in communication negotiation process?
- What are other user requirements and design implications for supporting the grounding process and enabling a system to become *socially translucent*?

Design

Many researchers argue that in order to effectively support communication negotiation in a mediated setting any offered mechanism must be lightweight and require low cognitive effort from the interacting parties [3, 9, 10, 19, 21]. Moreover, such systems in order to support communication negotiation should both stimulate socially responsible behaviour and also protect the privacy of the interacting parties [9, 15, 16]. Therefore, based on the aforementioned related literature we set the following requirements for designing a *socially translucent* system supporting mediated communication at work:

- useful – the system should support managing mediated communications.
- usable – the system should be easy to use and lightweight.
- protecting privacy – the system should enable people to control their interpersonal privacy borders at all times.
- stimulating socially responsible behaviour – the system should stimulate people to act in a socially responsible manner.

The aforementioned requirements define the general framework for our design efforts and every mechanism implemented in the system should comprise to those. However, we would also like to address requirements specific to each *Social Translucence* construct. As previously motivated (see: *Tab. 1*) in order to sufficiently support *Visibility* it is important to provide relevant availability information in the background for anyone who might be interested in that information. To address that requirement we propose the following features (see: *Fig. 2*):

1. indication of five availability levels: available, rather available, slightly unavailable, rather unavailable and unavailable.
2. three buttons: high concentration, time-pressure and experienced interruptions that generate predefined availability status messages (one is highly concentrated, one experiences high time-pressure and one had experiences many interruptions)
3. a status message: a text box to enter any textual message that provides personalized explanation of one's communicative state.

To sufficiently support *Awareness* it is important to bring availability information to the foreground each time a communicative attempt is initiated. In order to achieve that we designed the following features:

1. A textual representation of the latest availability status (including the availability level and the status description) automatically appears in any newly open chat box. Any status update is also automatically shown in any open chat box so that communicators are immediately informed about any status change of his/her interlocutor.

2. The chat box changes its size depending on the availability level indicated by the communication recipient, so that it opens in a full size if one indicates full availability and obtains gradually smaller size once the status is set to other levels. Also, the entry space of the chat box gradually changes colour from white to dark grey depending on the availability level indicated by the communication recipient.

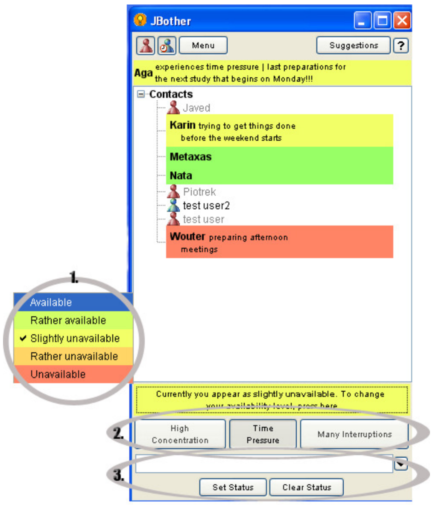

Figure 2: Features supporting *Visibility* of one's communicative borders (1. the presentation of 5 availability levels, 2. three buttons for concentration, time pressure and experienced interruptions and 3. a field to enter a status message)

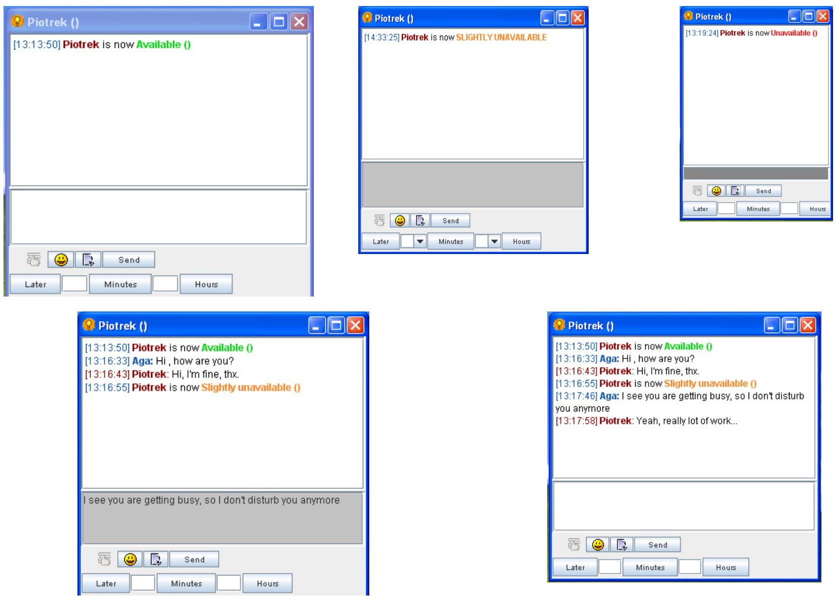

Figure 3: Features supporting *Awareness*; in the top row one can see that the status is automatically displayed once conversation is initiated and also that the size and the background colour of the chat box changes depending on the availability level; in the bottom row one can see that the status change is also made visible during the conversation).

To support *Accountability* it is crucial to reinforce the unavailability status if the communicative attempt was ill-timed. In order to achieve that we designed the following features (see: *Fig. 4*):

1. Buttons: 'One moment' and 'Later', which once pressed automatically generate the following messages: "One moment, ok?" and "I am sorry but I am unavailable for a chat right now. Please, contact me later."

2. Buttons: ‘Minutes’ and ‘Hours’ that allow to specify the time frame to the next communicative attempt. Once a value in minutes or hours is entered in the text boxes the system automatically generates the following message: “I am sorry but I am unavailable for a chat right now. Please, contact me in *xx* minutes (or *xx* hours).”

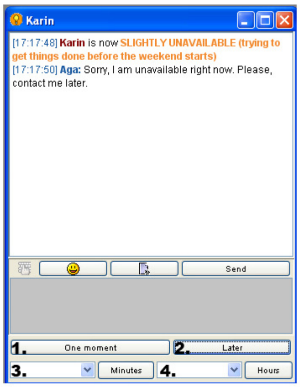

Figure 4: Features supporting *Accountability* of one’s communicative borders (1. ‘One moment’ button, 2. ‘Later’ button, 3. ‘Minutes’ button and 4. ‘Hours’ button).

Measurements

This study is set out to answer the following questions:

- Do the proposed *Awareness* and *Accountability* mechanisms support the grounding process and make a system become *socially translucent*?
- What is the relative importance of both mechanisms in communication negotiation process?
- What are other user requirements and design implications for supporting the grounding process and enabling a system to become *socially translucent*?

We intend to answer these questions in a threefold manner: by analyzing data gathered by logging participants’ behaviours, eliciting their perceptions through questionnaires and collecting their opinions expressed during Focus Group sessions.

We aim to log the following data with respect to the *Visibility* construct:

- number of status updates
- number of changes of the availability level alone
- number of status indications using the three buttons: concentration, time-pressure and many interruptions
- number of status indications using the status message.
- number of status indications using the combinations of the three availability indicators.

With respect to the *Awareness* construct:

- number of timely initiations (timely initiations are defined as those initiated when participants’ status ranges from 1 to 3 on the availability scale),
- number of untimely initiations (untimely initiations are defined as those initiated when participants’ status ranges from 4 to 5 on the availability scale),
- number of unexecuted initiations (unexecuted initiations can be defined as opening of the chat box and closing it without initiating communication).

With respect to the *Accountability* construct:

- number of generic postponings (generic postponings can be defined as messages, in which there is no time scope defined for the communicative uptake, namely those using the ‘One moment’ and ‘Later’ buttons),

- number of specific postponings (specific postponings can be defined as messages, in which there is time scope defined for the communicative uptake, namely those using the ‘Minutes’ and ‘Hours’ buttons),
- number of postponings generated outside the proposed mechanism (cases when participants decide to type the message themselves rather than use the features provided by the system).

The questionnaire consists of 38 multiple-choice questions using 7-point Likert scale and reflecting our four design requirements: utility, usability, privacy protection and stimulation of socially responsible behaviour. The questions are formulated based on the *User Acceptance of Information Technology* [22] and *Trade-Off Factors* [8] models. The questionnaire was piloted in four iterations: in each iteration all questions were discussed with an expert in experimental psychology and tested with 10 participants who were asked to evaluate an Instant Messaging application they use with the proposed questionnaire. Besides providing their answers participants were also asked to point at any question that seemed unclear or ambiguous to them. For each pilot session Cronbach’s Alpha values were calculated for each cluster and also participants’ comments were analyzed. The changes were implemented until the value of Cronbach’s Alpha was judged satisfactory (utility = .73, usability = .75, privacy =.75 and social responsibility =. 7) and questions were assessed as unambiguous. Moreover, to avoid answering bias we have negatively formulated 16 questions and added 5 ‘*distraction questions’*. ‘*Distraction questions*’ are questions that require about some system-related aspects but do not belong to any of the constructs defined in the study. The questionnaire is delivered to the study participants via web-based application at the end of each study week. Questions’ order is randomized for each week and for every participant.

As the last step, we want to collect participants’ opinions and preferences regarding proposed mechanisms in Focus Group sessions by inquiring about:

- comparison of the proposed system with the presently available Instant Messaging applications,
- the advantages and disadvantages of the proposed system,
- the degree to which the proposed system supports *Visibility*, *Awareness* and *Accountability*
- system’s success or failure in stimulating socially responsible behaviour.

By answering our research questions we hope to provide insights into how systems supporting mediated communication need be designed so that they can become *socially translucent* and support people in structuring their communications in a socially responsible manner.

WORK-IN-PROGRESS

Presently we are running an extensive field study in a medium size consultancy company providing web design services that is located in different places in the Netherlands. We have decided to conduct the study in such a setting to be able to capture not only the behaviours and preferences of communication recipients but also those of communication initiators. Furthermore, we wanted to conduct the study in a realistic situation, in which people experience relatively high time-pressure and workload and are really in need to manage their communications.

Participants

Participants’ office consists of 35 employees divided in 5 groups: Concept & Design, Software Development, Application Management, Project Management and Sales. They are located on two floors of the same building and work in open offices. Their present communication means include: face-to-face communication, e-mail and

Instant Messaging application (the last one is not being too frequently used yet but the company is interested in installing an Instant Messenger for all employees). The employees are not encouraged to use phone to communicate with their colleagues and there are no phones available at the employees' desks. Recently, all employees participated in the time management course, during which it became apparent that substantial amount of time is squandered due to untimely communications and unsuccessful attempts to contact co-workers.

Study protocol

The study is planned for 5 weeks. There is a tradeoff in the study protocol that needs to be addressed. In order to counterbalance the order effect we should vary the introduction of the two proposed mechanisms. However, if we want to reliably test the interactions between co-workers, it is important to run the study with a cohesive group of participants, so that we ensure that people are motivated to use our system. In such a situation, we propose a within-subject design for the study that is executed using the following study protocol as presented in *Tab. 2*. The first week is meant as an introduction week during which participants have the possibility to experience the proposed design and develop own ways of using the proposed functionality. In the first week we hope to achieve for a system to become *socially translucent* by introducing all mechanisms and supporting all steps in the grounding process. In the remaining study weeks we intend to disable the proposed mechanisms as described in *Tab. 2*. We decided to remove mechanisms rather than add them as we see them as potential *dissatisfiers*, meaning that people may not appreciate a mechanism once it is available but they might miss it after it is removed. Furthermore, once a mechanism is removed we would like to investigate if participants decide to develop new, own ways to substitute the missing functionality.

Study weeks	Available mechanisms
Week 1 (introduction week):	Visibility + Awareness + Accountability
Week 2:	Visibility + Awareness + Accountability
Week 3:	Visibility + Awareness
Week 4:	Visibility
Week 5:	Visibility + Accountability

Table 2: Study protocol

WORKSHOP

During the workshop we would like to share the initial results from the study outlined above and discuss the applicability of the obtained results for different tools supporting mediated communication for 'Social Web'. In particular, we would like to consider similarities and differences in supporting mediated communication using different communication means like Instant Messaging or email and examine the communicative needs that depend on the used medium.

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User Motives for Tagging Video Content

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Abstract. User tagging of video content provides many possibilities for indexing and personalization. To exploit these possibilities, users must be willing to tag the video content they watch. In this paper we present the first results of our ongoing research, by constructing an overview of user motives to tag video content. We present the results of a study in which we elicited possible user motives to tag movies on the internet. The identified motives include the categories 'indexing', 'socializing' and 'communicating'. Finally, user barriers to tag video content are discussed.

1 Introduction

Tagging, or "labeling objects with free-style descriptors" [1] is a user-generated means of enriching the indexing of information. Consequently, it enables users to find information in large content collections more easily [2], or to organize their own information. Besides the benefits for indexing purposes, tagging can also be a valuable source of information for personalized information systems that offer tailored output to a user or a group of users. More specifically, tags can inform a system about user characteristics and attitudes [3], and the resulting user model can be used as input for personalized search or recommendations [4].

However, in order to reap the benefits of tagging, users must be willing to provide a resource[1] within a system with tags. They must be motivated to invest time and effort in thinking of and submitting these labels. This paper discusses the ongoing research into users' motives to tag video content. In section 2, we will first discuss user incentives to tag in general, as can be found in the literature. Section 3 and 4 consecutively discuss the set-up and results of the first stage of our research: eliciting user motives to tag video content, using focus groups. We conclude this paper with a preview of future work which elaborates on the identified motives.

[1] The term 'resource' is introduced to denote any type of content items, such as video clips, pictures, articles, and so on.

2 User Incentives to Tag

Several reports have discussed user incentives to tag. Marlow et al. [5] for example, listed the following:

1. *Future retrieval*. Tagging to make re-finding a resource easier.
2. *Contribution and sharing*. Tagging to contribute to a resource.
3. *Attract attention*. Tagging to bring a resource under attention of others.
4. *Play and competition*. Tagging as a form of gaming.
5. *Self presentation*. Tagging to express the individual identity.
6. *Opinion expression*. Tagging to present a personal opinion.

These incentives remain generic since they cover multiple types of resources a user can tag (e.g., photos, movies, text). It is possible that the user incentives to tag differ per modality, and within a modality perhaps even per system. In order to formulate design guidelines for tagging applications, it might therefore be better to focus on one modality only.

An example of such a study can be found in Ames and Naaman [6] who identified user incentives to tag photos. They found four categories of stimuli that make users tag, which partly overlapped and partly differed from the incentives Marlow et al. identified. The results of such a study are very valuable for system designers. By taking modality-specific incentives and their importance into account, they can design systems that tempt users to tag. Consequently, the opportunities for improved indexing and for user modeling, based on tags, and tailoring output are increased.

We wanted to generate a modality-specific overview of incentives to tag video content. Therefore, we first needed to elicit people's motives to do so. We see motives as possible incentives for people to tag. The first, explorative stage of our research was concerned with the *making an inventory* of people's motives to tag video content. These can serve as input for our second stage in which we want to *rank the importance* of these motives for different systems that provide the possibility to tag video content.

3 Study Setup

We conducted two focus groups, each with a distinct set of participants: young (5 participants, aged 18 to 23) and middle-aged (6 participants, aged 34 to 57) internet users. After discussing their experiences with tagging and their self-reported digital skills, we showed the participants four systems in which one could tag video content.

1. Youtube. A platform offering all kinds of videos to a general audience.
2. Hyves. A Dutch social network site that features uploading and sharing videos with a specific audience (family or friends, or alternatively, the whole world).
3. Skoeps. A Dutch news website offering news videos to a general audience.
4. 3voor12. A Dutch online music community offering music videos to a general audience.

These systems represent the plurality of video platforms available on the internet, as categorized by Sen et al. [7]. After an explanation of each system, we asked the participants why they would tag when either viewing or submitting video content.

4 User Motives for Tagging Video Content

Except for one, all young internet users had experience with tagging. They were daily internet users, who all believed they possessed the necessary skills required for tagging. They also had experience with web 2.0 systems like Wikipedia, Amazon, and in two cases, Flickr. In the case of the middle-aged internet users, except for one, no one had experience with tagging. All of them were frequent or daily internet users, who all believed they had the required skills to tag. Finally, their experience with web 2.0 systems was mixed.

The two focus groups resulted in the following motives for tagging video content.
Motives related to indexing:

- Tagging as a means to re-find a movie
- Tagging as a means to make others able to find a movie
- Tagging as a means to clarify or add information to a movie
- Tagging as a means to be able to find information, related to the movie, later on

Motives related to socializing:

- Tagging as a means to recommend a movie to others
- Tagging as a means to find friends or likeminded people

Motives related to communicating:

- Tagging as a means to express a personal opinion
- Tagging as a means of communication

In this paper we will not make claims about the relative importance of the different motives. Comments made by participants in the focus groups suggest that they differ per kind of system and activity (consuming or contributing video content). To label one motive as more important than another in a collection of motives identified in a domain, would be to disregard the subtleties that are present within this domain. Yet, they can serve as input to determine the most important motives for different kinds of systems and activities, as we will do in the second stage of this project.

When we compare our list of motives with the incentives Marlow et al. [5] listed, we must conclude that they partly overlap. Motives that were not mentioned by our participants are tagging as a form gaming and tagging as a means of self-presentation. Tagging as a means of communication is an incentive we found, but which was not mentioned by Marlow et al. Therefore, one must be careful with interpreting generic, multi-modal motives to tag, as the motives to tag content in one specific modality.

Besides the user motives, the focus groups resulted in some interesting insights regarding user barriers to tag. The first issue we want to discuss is *privacy*. Especially the middle-aged respondents were very hesitant to tag because of privacy issues. They were afraid of the possible consequences of submitting information that could be traced to their person. These fears were fed by negative media publicity about user-generated content (e.g., employers searching the internet for information on future employees and finding harmful information). The desire of the middle-aged to remain unknown on the internet was not shared by the young participants. They saw no harm in tagging video content and were not concerned about their privacy in this case.

Second, all participants typed themselves as *information consumers*. They explicitly indicated that, in principle, they only wanted to profit from the work done by others. However, after discussion, the participants agreed that they would tag video content for which they felt a passion, which indicates that high personal relevance of the video content is an important antecedent for users to tag.

Finally, the young participants indicated they only sporadically tagged information on the internet because often, they were *unaware of the possibility* to do so. This finding implies that current user interfaces do not confront the user with the option to tag successfully, hence limiting the amount of tags users provide to the system.

5 Future Work

In this paper we have presented the first results of a research project, aimed at gaining a detailed overview of user motives to tag video content in different contexts. In the second stage of this project, we will rank the elicited user motives for different kinds of systems and activities. We will delve into the relationship between a person's affinity with a topic and his or her intention to tag, and finally, we will assess user acceptance of utilizing tags for different personalization purposes (e.g., providing recommendations or to create a personal homepage).

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