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Abstract:

Tagging has become one of the key activities of Web2.0 applications. This paper analyses the potential of using tag clouds for stimulating and supporting reflection of individual users in informal learning. We introduce the ReScope widget, a Javascript widget that generates a tag cloud, which represents tags on the levels of global and recent usage. The first prototype of ReScope has been used to identify actual use cases for reflection support. In this paper we analyse these use cases and the related design criteria.

1 Introduction

The Web2.0 wave brought many interesting tools and concepts, which are useful for supporting learning [21]. Tagging has become one of the key activities of Web2.0 applications. Tagging stands for applying free form keywords (the tags) to resources. This concept has been integrated by a large number of so called social software. Tagging resources as applying user generated meta-data on the web has recently received some attention in research and practice.

This paper analyses an early stage design study on applying tagging visualisation for supporting reflection on reading habits through tag cloud visualisations, and reports on first experiences of the prototypical usage of the ReScope widget as a personal reflection tool. ReScope is a tool that visualises a user's current focus on web-readings in comparison with the user's overall usage of tags in a single multi-encoded tag cloud. The idea behind ReScope is based on the observation that systems like "del.icio.us", "digg.com", "stumble upon", or "Google bookmarks" are frequently used as systems that offer users a space to store their bookmarks in a central repository in order to use and synchronize them available with several desktop browsers or machines. In that respect, tagging is not only a collaborative activity but also a way to structure the information space of the personal bookmarks – just similar to the hierarchical folder structure that is common with the bookmarking systems that are bundled with most web-browsers on the market. Further, not all users of social bookmarking systems are aware of the social aspects and effects of tagging, or the benefits which they gain from collaboratively tagging web resources [5]. In that sense, tagging for social bookmarking can be also considered as an activity for the personal benefits of the user.

A large number of scientific contributions focus on community driven creation of meta-data [7, 8], or on improved accessibility of contents through this kind of meta-data [9]. The majority of these contributions exploit the explicit use of tags for these purposes. Within this scope it has been recognised that "attention" is an important factor for accessing and using resources [15] as well as for improving the use of a system as a whole through adaptation and content annotation [2]. This research has focussed on the beneficial aspects of "attention" for an adaptive system, for a group of users, or for the system provider. Particularly, contributions on applying tags in the educational domain basically address the value of this kind of meta-data for improving access to relevant content. This research addresses the acquisition of knowledge that is already available in an operational form to the learners. The knowledge that is operational in learners resembles their usage of certain tags to label information, or their ability to translate their needs for information into appropriate search terms. From an educational perspective this covers only a limited part of learning processes, because these processes include – among others – reflection activities. Reflection is a fundamental learning activity and is needed to articulate, express, and apply knowledge appropriately [17]. So far, no research came to our attention that addressed the

relation of tagging and tag visualisation as personal tools that support reflective processes for the individual learner. We assume that this is partially due to the notion of collaborative value of tagging in social software [20].

2 Question of Research

Our research addresses the problem of applying tag clouds as tools for personal reflection in unstructured or emerging environments. Due to the lack of research on using visualisations of user generated meta-data for stimulating reflection, our research focused on the question, if a tag cloud of a single user's tags can actually provide meaningful information that stimulates reflection of that user. This question was motivated by our observation that tools like "social" bookmarking services are first used as "personal" services [5]. This paper documents the first steps of inquiry, in which we were interested in initial practical experiences in providing a multi-encoded tag-cloud for stimulating reflection.

The focus lies on supporting learning in unstructured and emerging environments is grounded on the expanded needs of competence development on a societal level [10, 11]. Today, people need to keep up with technological and societal developments; and they cannot rely on their initial education for their entire working life. The challenge of changing structures and emerging technologies from a lifelong learning perspective is that due to this emerging nature in many situations learning cannot be based on pre-designed instruction any more. This gap is filled by professional communities of practice [12], for which social software plays an important role for maintaining social relations and communication among peers [22]. Although, communities of practice have increasing relevance for competence development in the professions, little research focuses on how the related learning processes can be supported beyond the level of tool provisioning. Our research is a first step towards bridging this gap by analysing the potential of tag clouds for supporting individual reflection.

3 Background

In relation to workplace learning and competence development, Schön [17] introduces the idea of the "reflective practitioner". It highlights the relevance of self-organised "learning" activities as part of professional practices. The underlying theoretical framework states that reflective practices as a core principle for competence development in the professions [17, 18]. Schön distinguishes between "reflection in action" and "reflection on action". "Reflection in action" refers to those reflective processes that are embedded in an ongoing action as an integral part of that action. This is a formative process and is used to evaluate, control, and (re-)frame a situation, task, or process. In contrast, "reflection on action" covers summative reflections on past activities.

Butler & Winne [1] highlight that reflective processes are central to self-regulated and self-organised learning. Their model indicates that reflection depends on the learners' observations of their environment as well as on feedback on their activities in this environment. The model explains that learners have to be able to create relations between past experiences, knowledge, and input they receive as the foundation of self-regulation. According to the authors, reflection can also be seen as the self-assessment based on external feedback, and is directly related to motivation and task commitment of a person.

Millen and Feinberg [13, 16] analysed the social dimension of sharing and browsing resources on the worldwide web in an organisational context. The authors were interested, if providing social bookmarking within an organisation leads to social exchange across the organisation, or if it leads to accumulation of information with limited relevance to the individual members of the organisation. In a related field experiment the authors used the "dogear"-environment [14] and showed that social bookmarking and tagging stimulate social exchange of information in a large organisation [13]. In a way, our research takes up these findings and investigates if values can be added also for the individual users. Additionally, we emphasize qualitative aspects of tagging that has been observed by previous research, as we focus on the developments of different kinds of interests that were developed through the general social practice.

Our earlier research [6] indicated that tagging and accessing of tagged resources is independent from the contribution level of a participant. That means that active contributors, occasional contributors, and non-contributing participants of a community of practice use tags similarly while searching or accessing tagged resources. I.e. the general usage patterns related to tagged information are similar, while the actually used tags vary from user to user. This implies that tagging as well as the use of tagged information can be used to identify personal interests of a user. Our previous research stresses these results by postulating that the reflection stimulus of a tag cloud varies with the user's context [4]. In this paper we analyse how interest information can get embedded in other representations of tags so it helps users in reflecting on their past actions.

4 The ReScope Widget

The prototype of this widget has been used by the first author as a tool for reflection about web readings for more than six months. The ReScope widget displays the tags of a user's del.icio.us bookmarks in a tag cloud and highlights the most recently used tags. These tags are taken from the current bookmark feed of the user as it is provided by del.icio.us. Because this feed contains only the 20 most recently bookmarked links, the highlights of the most recently used tags changes over time.

The ReScope widget is based on a simple principle. It is based on an overall tag cloud, which contains additional temporal information. The tag cloud includes therefore three types of information:

1. the user's tags
2. the overall usage of the tags
3. the current use of the tags

In ReScope the tags are alphabetically ordered, the overall usage of the tags is encoded in the font-size of the tags, and the current use of the tags is encoded in colours. The more often a tag is used for categorizing bookmarks, the stronger is the bigger is are the letters of the tag. The more often a tag is assigned to the recent bookmarks, the brighter is the colour of the tag. Each encoding of information in the tag cloud allows the users of ReScope to analyse how they use tags in reading the web. By encoding the global and the recent usage of tags in a single tag cloud it is possible for the users to relate their general interests with their current web-readings. Following the considerations of Stefaner [19], ReScope can infer and highlight different types of information. This information is entirely based on the meta-data that use generated by the users themselves. For example, it is possible to identify emerging topics through ReScope. These topics have bright colours and smaller font sizes. Another type of information results from the way how the meta-data is presented to the users: through the multiple encoding of global and current tag usage, users may see relations between the concepts that are currently relevant while reading on the web. If more tags have brighter colours they seem to have some relation to each other, regardless of their global relevance. These relations might not exist at the level of tagged information, but may also result from a user's mental concepts. By highlighting these relations in the tag cloud a user has the opportunity to reflect on this information, explicitly.

From the perspective of learning technologies, ReScope has three major benefits. Firstly, it is not bound to a specific instructional design or scenario, but it can be used in any setting in which a user tags resources. The current version of ReScope is limited to social bookmarks stored in the del.icio.us service, but it can be easily extended towards other systems. Secondly, ReScope does not suffer from a start-up problem [3], because the presented information is entirely based on the users own actions. In other words, the ReScope starts to respond as soon the user becomes active. Finally, ReScope does not favour late adopters over early adopters, because ReScope works independently for each user.

4.1 The Architecture of ReScope

The underlying architecture contains of a global tag aggregator, a recent tag aggregator, and a tag cloud visualisation that integrates both tagging information into a single view.
Both aggregators collect and combine the tagging information of a user from the user's information feeds. The global tag aggregator fetches all tags a user has used with the aggregated services. The recent tag aggregator fetches only those tags that are related to the most recent contributions of a user at a service. Each aggregation results in a tag table, in which each row contains a tag name and the frequency of its use. The results of both aggregators serve as input for the tag cloud visualisation. First, the tag cloud visualisation component renders the global tag cloud from the data provided by the global tag aggregator, and then applies the data provided by recent tag aggregator. The information flow is illustrated by figure 1.

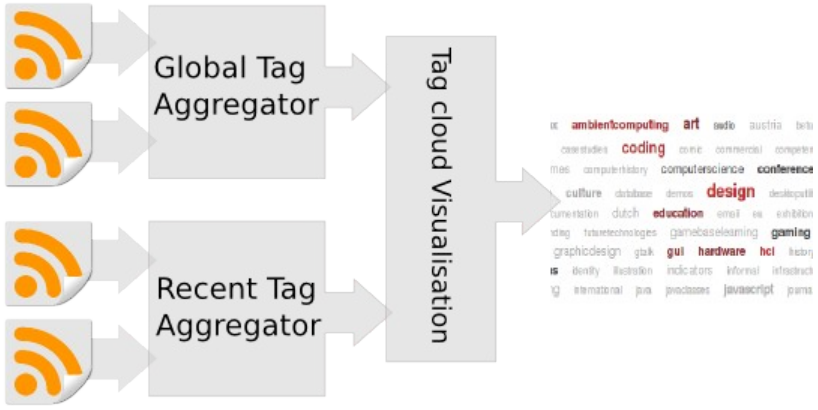

Figure 1 Interrelation of the ReScope components

We implemented this architecture using only tagging information of a user's public del.icio.us bookmarks. By limiting the tagging information to a single service, we are able to utilize the aggregation facilities that are provided by the service, which is in our case the del.icio.us JSON feed API. This API provides a direct interface to all the tags that were used by the user, which can be used as a replacement for the global tag aggregator. The recent tag aggregation is performed on the basis of the most recent bookmarks of the user. Each bookmark has a number of tags associated which are embedded in the user's bookmark feed. From the perspective of ReScope, recency is relative to the 20 most recent bookmarks. This means that the time frame that is covered by the "recent tags" can vary over time, depending on the bookmarking activity of the user. In other words, when the user bookmarks many resources in a short time, the notion of recency will cover a shorter time span than in periods when the user occasionally bookmarks a resource. This implementation implies that the visualisation will change with every new bookmark.
The tag cloud visualisation is implemented as a Javascript module, which is executed in the user's web browser. Encoding the user information efficiently in the web browser each tag is enclosed by two SPAN tags. The outer SPAN tag refers the encoding of the global use of the tag, and the inner SPAN tag refers to the encoding of its recent use. The formatting of the tag cloud is defined in a CSS file, in which each encoding is associated to a CSS class. Figure 2 shows the logical structuring of the tag cloud in an HTML document.
As the entire widget is implemented as a Javascript module, it can be immediately embedded into existing web pages. All dynamic data is gathered from the remote services of delicious, and requires therefore no additional server-side components. By using the del.icio.us JSON interface, it is possible to make use of cross-site RPC calls, which cannot be achieved by using the XML based APIs in current web-browsers.

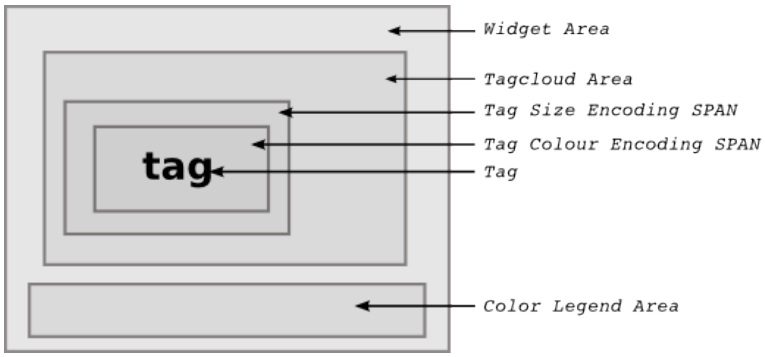

Figure 2 logical structure of the ReScope tag cloud

4.2 Reflecting on Web-Readings using ReScope

A first prototype of the ReScope widget was set up and used by one of the authors in order to analyse the potential of multiple encodings for stimulating reflection. The original purpose of the widget was to serve as a demonstrator for visualising multiple types of information in a single tag cloud. The tag cloud widget is available on the public web-site of the author, and was visible also to other visitors of that web-site. Soon we discovered that watching the changing visual impression of the tag cloud is not only visually appealing, but also meaningful for the working practice. During our initial study we observed three types of reflective activities. The first type is related to the focus of web-readings, the second type focuses on the relations between the tags, and the third type can be related to (self) control of the web readings. In the following we report on three events, which represent different types of reflective activities.

A first event was contextualised by several project deadlines approaching. The deadlines were mostly concerning evaluation and programming tasks. At that time ReScope showed a tag cloud, with three tags highlighted in bright colours: “art”, “design”, “blogs”, at the same time none work related tags were highlighted. This indicated that the web-readings were not really addressing work related tasks, rather than a strong focus on unrelated topics. While reflecting on this picture, it became conscious that other activities were not really focused on the tasks related to the deadlines. At that point it was decided to put a stronger emphasis on the actual tasks, instead of looking at other things. After a few days, the picture has changed and the tag cloud highlighted tags that were more related to the actual tasks.

At a different occasion a visit to ReScope displayed a tag cloud with all the tags were at the lowest two colour levels. Furthermore, the tags were covering all kinds of topics. This indicated that the web-readings were not focused, but scattered and random. Although in this case there was no urgency in terms of deadlines, the lack of focus was visual in the tag cloud. While reflecting on this tag cloud it became clear that there was some uncertainty with respect to linking the results of the different tasks that were recently completed. In this case the tags used for the bookmarks showed in different (possible) directions.

Another event was related to an incidental visit to ReScope. In this case several tags were highlighted in brighter colours. Similar to the standard perspective on tag clouds, the coloured highlighting provides a quick overview on the topics that are currently relevant in the user's web-readings. In the given case the tag cloud highlighted (among others) the eight tags “ambientcomputing”, “coding”, “design”, “linux”, “opensource”, “research”, “tools”, and “web2.0”. While “design”, “research”, and “opensource” can be considered as relevant to the user in general, the other five tags have at best of medium level relevance. Furthermore, not all tags were used in combination. From the user's perspective, however, these tags were connected and reflected the work on a meta-level at that time. The benefit of providing this information was that the tags were seen as concepts rather than keywords of resources. Based on this different perspective, it has been reflected on the concepts and the connections between them.

In a second step the recent resources have been revisited and re-evaluated considering the new views and insights.
After using ReScope for a while the user had the impression that browsing web-resources and bookmarking became more conscious. In order to check if the personal impression was "correct" the ReScope widget was visited regularly. These visits were often to check if the bookmarked web-readings were in line with the ongoing tasks, but also to see if shifts and turns of working activities are also represented. This self-control also leads to the events that were reported previously. Furthermore, the ReScope tag cloud was used to check if the web-readings stay aligned with the general focus of work during longer tasks.

5 Discussion

Although this first evaluation of the ReScope widget is not providing evidence on the benefits of tag clouds in educational settings, our results have lead to a clearer picture on the possible use cases of tag cloud visualisations in education. Now, we have a better impression about what types of reflections we can expect from using ReScope in future experiments.
As ReScope is not integrated in an existing learning environment, its main purpose is supporting reflection. Our initial study shows that a personalised widget can stimulate reflective processes on past activities and support the learning processes through informal responses. From an educational perspective we identified three interesting types of reflecting on web readings.

1. *Relating* browsing and tagging habits to external tasks
2. *Controlling* and directing their web readings towards interests or tasks
3. *Linking* topics and tags on a conceptual level

These reflections are linked to two actions that are related to learning. The first action is "goal setting" and the second action is "understanding". While the reflection activity itself is based on past actions, these related actions conform to the two fold character of reflection. If the reflective activity is related to controlling the personal web readings, it links past actions with future actions through the goals a user defines. This type of reflection is therefore related to "reflection in action". If the reflective activity is related to linking and relating, through which a user organises the tags of past actions into coherent experiences. This organising activity can be seen as "reflection on action", because it focuses entirely on completed actions and relates their outcomes.
In addition to these aspects of reflection it is important to ask for the difference between absolute and relative time scales for reflection support. Absolute time scales are most common in our daily life. These scales treat time as a fixed objective measure that is unchangeable and can be used to measure and structure events. Using an absolute time scale implies to define a time interval from external criteria, which is usually a calendar or a clock. This notion of time has its origin in classical physics and is part of daily practices of people and organisations. Thus, we are used to measure time and set intervals with absolute scales, e.g. represented by the statements such as "next Monday", "in one hour" or "for a week". Although, we tend to measure time using absolute scales provided by calendars or clocks, this is very often not how we experience time. This means the same absolute time interval – let's say one hour – can feel very different to us depending of our situation. For example, waiting for somebody else to call back on the phone for one hour can feel endless when there is nothing else to do; the same hour can feel very short if we sit in a café during lunch break and exchange the latest gossip with a friend. Relative time scales address this difference of measurement and experience of time: a relative time scale defines an interval in relation to events rather than to some external measures. The range of time can therefore depend on the occurrence of events or activities, independently from their absolute timing.
ReScope uses a relative time scale of which the upper (most recent) boundary is defined by the last bookmark of the user, and its range is given by last 20 bookmarks of the user. This interval depends on the bookmarking and tagging activity of the user. I.e. when a user is busy with

tagging many resources on the web, the time covered by the most recent activities will be shorter than when a user occasionally tags a resource on the web.
Using a relative time scale has two main benefits for a tag cloud that embeds recent tagging activities. First, relating recency to the user's activity takes pressure from the user in contributing as it might be caused by using an absolute time interval [5]. Second, the widget will always provide meaningful information to the user, which suits the current use of the widget.

6 Conclusions

This contribution analysed the usage of tag clouds for personal reflection support. We introduced the ReScope widget that integrates a user's overall usage of tags in del.icio.us with their most recent use, and presents them to the user as a multi-encoded tag cloud. As ReScope uses only the data provided by the user, this tool utilizes the social bookmarking service to highlighting implicit information to the user. We analysed the experiences from the application of ReScope for supporting a single user's reflection, and found that this can help to understand tagging and browsing habits by providing implicit feedback on these dimensions. This feedback helps users relating and controlling their web readings with respect to external task or interests. The first use of the widget showed that a tag cloud can provide meaningful information to stimulate reflection entirely based on a single user's actions and independently from pre-defined learning goals or instructional designs. This makes ReScope suitable to support individuals in formal learning scenarios as well as in situations in which learning is not intended. This is achieved by highlighting information that remains otherwise hidden in the “social” bookmarking service.
Our first practical design study of ReScope showed that multi encoded tag cloud can provide feedback that is beneficial for stimulating reflection. This first application shows some potential for using user generated meta-data and awareness information for supporting informal learning. Although our first experiences with ReScope are promising, these findings lack of grounding in research. This is mainly due to the lack of prior research of utilizing tag clouds for supporting reflection and learning. Our future research will address these shortcomings and investigate ReScope with a larger user base in order to develop a better understanding how tag clouds can be used for supporting reflective processes.

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