POSSIBILITIES OF PLACE

-An analysis of a location-based folksonomy

THESIS

by

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Abstract:

This thesis aims to investigate what kind of tags users apply to resources in a location based collaborative tagging system called Digitur2. This is investigated primarily by analyzing quantitative data produced by conducting an experiment. Some user observations and reactions are also studied in order to explain the findings. This thesis also includes some information about the development of Digitur2, an interactive tourist guide, although the focus is on the collaborative tagging functionality of the system.

I conclude that the user's presence at the location of a tagged resource can in fact affect the type of tags used to describe the resource.

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1 Collaborative (geo)Tagging, Folksonomies and Knowledge-bases

-*Could you describe the building in front of you?* –I asked.
-*Sure,* she said, continuing to say that it was a nice light blue building, probably from late 19th century. And then she said that it was located right next to a noisy football field.

This conversation took part while trying out an early version of Digitur2, the application for tagging locations developed as part of this thesis, with an experiment participant. Her first descriptions of the building were quite straightforward and based on what the person could see, but the last remark regarding sound caught my attention. Sounds as a resource descriptor is something that is not often used, as it is context dependant. Still my participant listed it as one of the key descriptors for the resource she was asked to describe because sound was available to her in the particular context she was in. This led me to believe that when one lets users annotate, or tag, resources, not only on the web, but also in the real world, one must take into account the context of the user because it would seem like it could be an important factor when describing resources.

During the past years the use of tagging to annotate resources on the web has become more and more popular. Many websites now let users tag resources as a way of organizing content, like Flickr[1] and Delicious[2]. User-created content has been seen as one of the main features of web 2.0 (Anderson, 2007) and tagging gives users an easy way to organize content on the web (Golder & Huberman, 2005). Up until recent the phenomenon of tagging has been confined to annotating digital resources on the web. However, some new services like Gowalla, Foursquare and Google Buzz have begun to let users describe not only resources on the web, but also real life places, which they in turn can share with other users mediated by web. Some technology trend

[1] www.flickr.com
[2] www.delicious.com

analyst organizations, like NRK Beta[3] (Arnesen, 2010) and Mashable[4] (O'Dell, 2010) predict that location-based services, i.e. applications that take into account the user's location when using the application, will be an important aspect of application development and social media in the future. Of course describing real life places on the World Wide Web is nothing new. Sites like Tripadvisor[5] have been sharing user reviews for years, but adding a social side and utilizing a kind of tagging approach is rather new, although not totally unexplored as described in Mody, Willis & Kerstein (2009).

If user based content organizing works well on the web, then one could argue that using people to organize information about the real world is a good strategy. The idea is to combine naïve user tags with more formal knowledge like a taxonomy or ontology. In particular, perhaps even more important, is that it could be possible to keep information about real life resources current by utilizing users and the tags they generate. By collecting tags applied to specific locations one could over time build up, and maintain, a knowledge-base as conceptually described in Møller, Veres & Næss (2010). Tagging offers possibility to update information about a geographical area much faster compared to traditional medias like guidebooks, or even a webpage with editorial content, which although it is easier to update than a book still depends on editorial control (Shirky, 2008). Furthermore it has been suggested that visitors in a geographical area could tap into and benefit from the existing knowledge of the inhabitants of this area through a social knowledgebase (Bilandzic, Foth, & De Luca, 2008).

But letting users tag real life resources on the fly while they are experiencing them opens up some interesting questions. Will the users apply the same kind of tags as they would if they were separated from the resource they were to tag? E.g. will a user tag a picture of the Empire State building with the same set of tags while looking at a image of the building, compared to the tags applied when the user is present at the building in real life? And will a user who is exposed to more stimuli use a higher, or perhaps lower, number or tags per resource? By analyzing tags applied to resources

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[3] www.nrkbeta.no
[4] www.mashable.com
[5] www.tripadvisor.com

by users of an application developed for this thesis called Digitur2 I aim at investigating the similarities and differences between tagging digital content and real life resources, thus gaining important knowledge if one is to try to combine the knowledge of the users of the system with the knowledge of the system providers i.e. a taxonomy or an ontology.

1.1 Research project

1.1.1 Goals

Broadly speaking the goal was to investigate how user generated metadata in the form of tags can be applied in the classification and description of real-world resources. Specifically I want to investigate if, and how, the tags applied while the user is physical present at the real life location will differ compared to the ones applied by users applying tags to a representation of a resource, like an image. I aimed to investigate the quantitatively aspects of the tags e.g. types of tags, distribution amongst kinds and the total number of tags. Arising from the notion that people tagging while at the location of a resource will apply more context dependant tags when tagging real world resources, it will also be interesting to investigate if they also apply more tags, or if they apply the same amount at the decrement of non-contextual tags. Lastly I expect to find what earlier research on folksonomies has found, which is collaborative tagging should produce a broad folksonomy that should follow the long tail principle, thus implying that the tags applied to a resource should follow a power-law curve like described in (Shirky, 2005) and (Vander Wal, 2005).

The majority of the results are quantitative, but a mass of interesting qualitative observations have been gathered and commented on although not investigated in depth.

1.1.2 Research questions and hypotheses

Based on the goals described above I propose the following research questions and hypothesizes:

Research question 1:

Are there more context dependant tags in the folksonomy generated by the users tagging real world resources?

Hypothesis:

H_0 Tagging while present at real life resource will not generate a different number of context dependant tags

Alternative hypotesis:

H_1: Tagging while near a real life resource context dependant stimuli produce more context dependant tags

Research question 2:

How does real world access to the resource tagged affect the number of tags used to describe it?

Hypothesis:

H_0 Access to the real world resource will not lead to increased amount of tags

Alternative Hypothesis:

H_1: Real world access to the tagged resource will make users apply more tags

Research question 3:

Do the users show consensus around a few common key tags for each resource together with a large amount of less commonly agreed ones?

Hypothesis:

$H_{0:}$ The tags for each resource will not form a power-law curve with a long tail of less common tags

Alternative hypothesis:

$H_{1:}$ The tags for each resource will show signs of being distributed on a power-law curve

1.2 Organization of the thesis

The remaining parts of the thesis are divided into six main sections. Following the introductory section I present earlier research within the field of collaborative tagging.

The third section describes the development and nature of the software that was used in the experiment described in section 4. Section 3 also contains some observations made by the experiment participants as well as some comments about using Digitur2.
The fourth section contains descriptions of how the experiment was designed and conducted. The same section also contains a detailed overview of the classification scheme used to categorize the tags collected from the experiment. Section 5 contains all findings from the experiment. In section 5 I evaluate the significances of the findings to establish whether or not the hypotheses listed in section 1.1.2 can be rejected or must be kept. Last I list a summary, my conclusions and ideas for future research in section 6.

2 Theoretical framework and literature review

In this chapter I will give a summary of the research conducted within the research field of collaborative tagging as well as define some key terms, which will be used through out the rest of the thesis.

2.1 Collaborative tagging

The web has today evolved from a platform where a few were content providers and the rest were content consumers to a place where essentially anyone with access to the web can create their own content. This has lead to an extreme increase of content (Ramakrishnan & Tomkins, 2007), which in turn also poses problems when one aims to categorize this content. A survey conducted in 1998 uncovered that about half of the respondents felt that they had problems finding relevant information on the web (GVU, 1998), and considering the fact that there has been an explosive increase of web content (Alpert & Hajaj, 2008) after this there is reason to believe that the problem of finding relevant information might still be present.

One solution to these problems has been to let users apply tags or labels to resources they want to categorize and retrieve at a later point in time. A positive aspect of this approach is that it enables a user to utilize an existing cognitive process without adding very much cognitive effort when categorizing resources (Rashmi, 2005). Most definitions of a tagged resource has been limited to digital content i.e. content available on the web, but as the experiment is concerned with tagging of real life resources I expand the definition to include this.

> **Definition 1:** *Resource is an object, location or artifact either digital or in the real world.*

A resource can be assigned one or more tags by one or more users so that these resources can be retrieved at a later stage. I propose the formal definition of tag as:

> **Definition 2:** *A tag is a freely chosen word or short sentence used to describe a resource.*

The action of assigning one or more tags to a resource is usually referred to as tagging which can be defined as:

> **Definition 3:** *Tagging is the process of applying freely chosen words or short sentences to a resource.*

When an application or webpage allows its users to not just organize their own tags, but also see and tag other people's resources you get collaborative tagging.

> **Definition 4:** *A collaborative tagging is when several users tag and share resources with each other.*

The system that facilitates this collaborative tagging process is referred to as a collaborative tagging system, which is to be understood as:

> **Definition 5:** *Collaborative tagging system is a piece of software which lets the user of said system tag resources and share both tags and resources with other users.*

2.1.1 Collaborative tagging as a web phenomenon

If information and the world are changing then it is not a good solution to use fixed categories to classify content. This is why tags seems to be a good alternative because tagging systems do not make use of any formal prescribed categories at all (Shirky, 2005). But not making use of prescribed categories do not mean that users categorizing content does not use categories at all. As described in (Veres, 2006) users tagging content on the web tend to come up with categories fitting their needs right there and then while in the tagging process. These ad-hoc categories represent the world as perceived by the users, and may not be solely taxonomic, nor solely functional, but in fact both. Consider a master student surfing the web and coming across an article on how to integrate Google maps with the Django web framework. Instead of just tagging the article with tags like "article", "scientificPaper" and "programmingPaper" this student might also include "usefull_for_thesis"[6], "to_read" and "must_show_supervisor". The last three tags are functional tags, describing what this resource can be used for as well as what to do with the resource at a later stage.

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[6] Some tagging services restrict tags to be of single words. Some users omit this restriction by applying underscores in between words, thus creating a single word compound (Guy, M., & Tonkin, E., 2006).

These kinds of categories do not work well in terms of describing what the resource actually is, but as described by Wierzbicka (1984) they in some way describe what function the resource can perform. Wierzbicka came to this conclution long before tagging existed as a phenomenon on the internet, but it turns out, like described by Veres (2006), that this behavior is also visible amongst users of collaborative tagging systems. Because each user has their own use for each resource one will observe a mix ob individually important terms together with some broadly agreed terms for each resource. This leads phenomenon called a long-tail which will be discussed.

2.1.2 Folksonomies and their nature

Thomas Vander Wal is usually credited for coining the term “folksonomy” (Vander Wal, 2007). The term is a combination of the words “folk” and “taxonomy” and describes a user-generated vocabulary. A taxonomy is usually a hierarchy of terms (Elmasri & Navathe, 2007). The parent-child relationship in the hierarchy often makes use of specialization and generalization, and in many cases the taxonomy enforces restrictions on the child-nodes to only inherit from one parent (Hebler, Fisher, Blace, & Lopez-Perez, 2009). A taxonomy has the advantages that as long as one makes use of the predefined categories and terms in the controlled vocabulary one can describe every resource in a given collection very precisely, enabling everyone familiar with the taxonomy to gain a uniform perception of the resources described by the taxonomy. Figure 1 depicts parts of an example taxonomy using a hierarchy of terms in the domain of food where each node is a specialization of its parent.

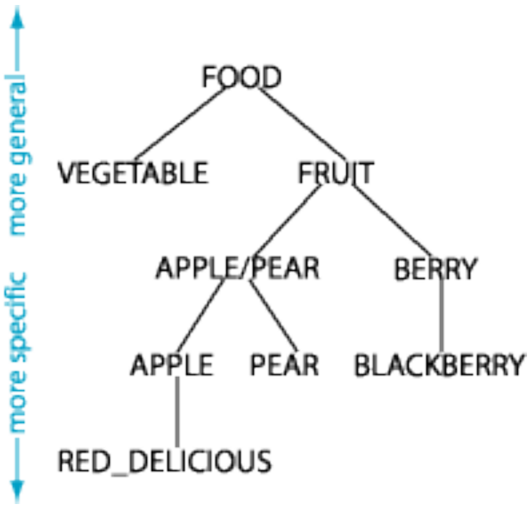

Figure 1: Example taxonomy (Gasser, 2006)

Unlike taxonomies, which are structured and controlled vocabularies, a folksonomy can, and most often will, contain both ambiguous and overlapping terms because anyone describing resources in the domain of the folksonomy are free to add their own terms to the folksonomy. Based on the rationale for coining the term folksonomy, as described in (Vander Wal, Folksonomy, 2007), I propose the definition of folksonomy as:

> **Definition 6:** *A folksonomy is the result of collaborative tagging represented through the links that come to exist between the tags, resources and users in a collaborative tagging system*

This can also be shown in Figure 2. The model also shows relations that can exist between resources or between users in form of links.

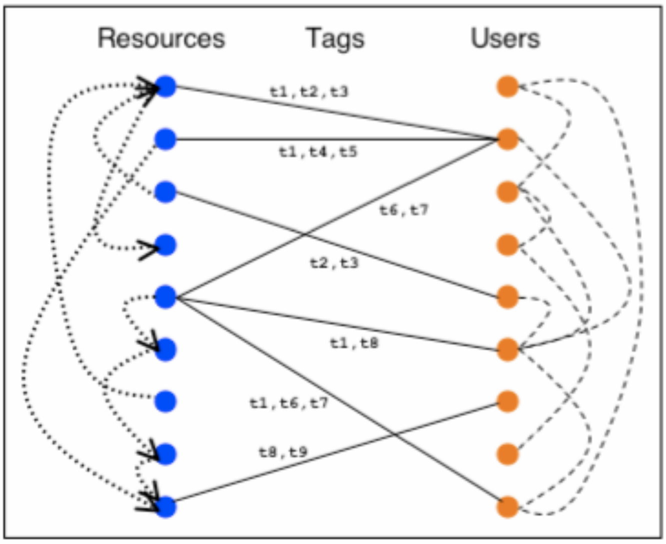

Figure 2: Model of a collaborative tagging system (Marlow, Naaman, Boyd, & Davis, 2006)

A folksonomy is comprised of terms in a flat name space without any obvious parent-child relationships (Mathes, 2004), and because of this a folksonomy is not nearly as precise as a taxonomy. Users of a folksonomy have to rely "*on shared and emergent social structures and behaviors, as well as related conceptual and linguistic structures of the user community*" (Marlow, Naaman, Boyd, & Davis, 2006: 31). This is also one of the reasons why the use of folksonomies has been criticized. If no one agrees on common terms, how can one make sure that a user is able to retrieve as much relevant information about a subject as possible, thus achieving good precision and recall as defined in (Baeza-Yates & Ribeiniro-Neto, 1999)?

The problem of not agreeing on common terms is not new, as described in (Furnas, Landauer, Gomez, & Dumais, 1987), but is still of current interest in the research field of folksonomies. There have been many approaches to deal with this problem for folksonomies, for instance Hotho, Jäschke, Schmitz, & Stumme (2006) who proposed using an algorithm called FolkRank which was built on the principles of the PageRank algorithm developed by founders of the search engine Google (Brin & Page, 1998). Hotho, Jäschke, Schmitz, & Stumme's approach involves mining[7] not only the links between tags, but also the relationships between the users who applied them. Based on this they rank search results after searching in tags. They argued this

[7] Extraction of new data, relations or partial information from any type of data (Baeza-Yates, R., & Ribeiniro-Neto, B.,1999).

approach by the fact that users have already adopted searching for web pages using a search engine, and by making the interface and result appear the same as a search engine the users would adopt to searching the same way in folksonomies. Another approach to improve search in folksonomies is to use a third party knowledge source like WordNet[8] to semantically enrich the folksonomy as described in (Angeletou, Sabou, & Motta, 2009).

When describing folksonomies one can usually put them in one of two main categories; broad folksonomies and narrow folksonomies. A broad folksonomy allows duplicates of tags which means that it is possible to measure exactly which tags are popular for a given resource. Each resource in a broad folksonomy will also have a long tail with less popular tags in addition to the popular ones (Park & Tuzhilin, 2008). A narrow folksonomy does not allow tag duplicates, so if a tag exists for a resource another user cannot apply it again. Because of this a narrow folksonomy is often restricted to allowing one user to add tags, like the case is with the image-sharing site Flickr. The main goal of the narrow folksonomy is to organize content for the user who creates it, thus creating a personal vocabulary (Vander Wal, 2005). This is also the reason for the broad folksonomies being the most popular when it comes to sharing information as they enables each user to develop his or hers own personal vocabulary, although there are signs of people gradually, over time, aligning their own personal vocabulary with other users' as stated in (Robu, Halphin, & Sheperd, 2009). Because a folksonomy allows the same tag to be assigned to many resources a normal way to visualize the tags and the relevance (measured in times used) in a folksonomy is through a tag cloud. A tag cloud lists up all tags present in the folksonomy and adjust the font size of each tag according to the number of times the tag has been used (Rivadeneira, Gruen, Muller, & Millen, 2007) i.e. as the tag cloud below depicting the tags for the book "The trail" by Franz Kafka on the social library site Librarything[9].

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[8] http://wordnet.princeton.edu/
[9] http://www.librarything.com

Figure 3: Tag cloud for "The Trail" by Franz Kafka (Librarything, 2010)

2.1.3 Motivation for tagging

Another important research field that is related to this research project in terms of understanding which types of tags a user uses is to investigate what underlying motivation exist when a user tags. Wetzker, Zimmermann, Bauckhage, & Albayrak (2010) describes how different users of the same tagging system tend to develop different ways of tagging based on what they want to achieve, thus making it clear that user motivation might guide and affect the choice of tags a user applied to a resource in a given context.

It is a well-known theory from sociology that people define their own identity trough acting (Berger & Luckmann, 1966). This is also pointed out by (Willis, 1990) who investigated culture among young people. Today this behavior is also visible on the web, especially in social networks like Facebook where people among other things list their hobbies, preferences in movies and literature and their employers (DiMicco & Millen, 2007). By articulating their opinions the users of social networks build an identity and become someone, and if one apply this theory to tagging one could say that users who tag resources express their identity through both the resources and the tags they apply. With this in mind it is possible that the context for the tagging also affects the mode of self expression. It also emphasizes the importance of having a large number of users in a collaborative tagging system if one plans to aggregate general information from subjective tags, thus minimizing the effect of subjective tagging from individual users.

Another, already mentioned, reason for tagging is the wish to organize resources by applying tags to them, thus making it easier to retrieve said resources, but as described by Ames & Naaman (2007) there exist subcategories of organizational motivation when tagging digital media. Ames & Naaman revealed that users of the tagging service Flickr tagged images both because they wanted to be able to retrieve the images themselves, but also because they want other closely related people like family members to find the images. Another motivational factor revealed was that some users had a somewhat altruistic reason for tagging as they wanted as many people as possible, not only family and friends, to see their images[10] and tagged accordingly, e.g. adding general terms about what the image contained. This reason to contribute is also somewhat similar to some of the findings from (Bryant, Forte, & Bruckman, 2005). They interviewed users of the collaborative encyclopedia Wikipedia and found that avid contributors received "geek fame" for being active in the network and adding to the common knowledgebase. All though Wikipedia is not in any means a collaborative tagging service it is easy to draw a parallel when thinking of a folksonomy as a collaboratively maintained knowledge-base.

2.1.4 Location-based services

A type of applications that has emerged over the past few years are location-based services which in some way or another let users interact with the system itself or other users based on their location. One example is a prototype of a mobile client described in (Sletten Olsen & Sølvberg, 2009) which lets a user locate different library branches within a given geographical area when looking for a specific book. The prototype also offers directions to get there based on the users current location. Junglas & Watson (2008) provides a definition of location-based services as "*any service that takes into account the geographical location of an entity".* It is worth noting that Junglas & Watson do not differentiate between human and non-human entities, meaning that any service whos behaviour is fully or partially dependant of an entity's location is a location based service.

A particular kind of location-based service that has emerged during the last few years are location-based services whit a social element to them. The social element typically exists because users of the location-based system can interact with other users within the system. Because these services are rather new not much research has been conducted with them in mind, but a few characteristics describing similarities and

[10] Flickr provides statistics about each image like how many times it has been viewed by other users (Flickr, n.d.)

differences among the services exist. One of these social location-based services, Foursquare[11], lets users check in to a given location, e.g. a bar. Unlike some other location-based services Foursquare includes a game aspect in terms of users having the ability to earn status among their related users by being “mayor” of a location. This is achieved by holding the record of checking in the most times to the specific location one is mayor of. In addition to being mayor of locations the users can earn badges by carrying out certain tasks, for instance checking in at a bar at 3am on a weekday. Another application that let users check in to geographical locations is Gowalla which makes use of GPS technology when locating the users, in contrast to Forsquare, which rely on users exercising a certain “code of conduct” because the users manually have to register their location. This has both advantages and drawbacks, as Gowalla is less prone to users “lying” about their location. On the other hand Gowalla is also limited to predefined locations corresponding to the names in the GPS service (Ebling & Cáceres, 2010). Due to the fact that location-based services and tagging systems are starting to melt together there has come to exist a new term; geotagging.

Defintion7: *Geotagging is the process of assigning geographic identification metadata to a real life resource* (Torniai, Battle, & Cayzer, 2007)

One early attempt to create a geotagging system was GeoNote, described in (Persson, Espinoza, Fagerberg, Sandin, & Cöster, 2003), but although this system did allow users to store digital notes with references to real life places it did not allow users to share these notes with other users within the system although it was possible to send notes via email to other users. Amongst their conclusions was that when erasing the existing boundaries between physical and digital space one could socially enhance the digital space (Espinoza, Persson, Sandin, Nystrøm, Cacciatore, & Bylund, 2001). This goes to show that the idea of using a social network to enhance digital information in form of a knowledge-base, as mentioned in Section 1, could in fact show some potential.

[11] http://foursquare.com/

2.1.5 Different contexts, different tags

Bischoff, Firan, Nejdl, & Paiu (2008) describe how different kinds of resources effect the types of tags used by grouping tags into categories described in section 2.2. They found that when users were tagging both images on Flickr and webpages on Delicious they tend to use tags describing what the recource was about, e.g. tags like “people” and “flowers” on Flickr, “webdesign” and “linux” on Delicious. They also compared this to content found in web anchor text, i.e. words within the HTML tag <a>, and found similar results. They also noticed that users tagging images on Flickr also focused a lot on tagging images with the location where the image was photographed.
One interesting finding they did was for the tagging service Last.fm[12], a web site that let users tag and share artists and music in different genres. What Bischoff, Firan, Nejdl, & Paiu found was that users of this service, which focused on music genres and artists, mostly used tags describing the resource and not what the resource was about. I.e. for the song “Lucy in the sky with diamonds” by the Beatles tags like “psychedelic” “rock” and “classic” are more popular than tags like “LSD” and “drugs” describing what the song actually is about[13].

An analysis described in (Geisler & Burns, 2007) uncovered that users of the tagging system YouTube, a website that lets users upload videos on the web, preferred tagging their resources with tags that provided additional information other than the information that was given through the title and author fields on the web site, that is to say mostly information about what the movie was about and perhaps where it was filmed. They did, however, also find that some tags were used in ways that did not enhance the description about the video. A different study described in (Lange, 2007) described a rather peculiar behavior among some users of YouTube[14]. It was discovered that some users would tag their videos with cryptic keywords only understandable by their friends, thus making the videos publicly available, but at the same time being able to “hide” them from unknown users on the website who would not search for the cryptic terms. Due to the enormous volume of videos available on YouTube the videos tagged with cryptic tags would simply disappear in the masses.

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[12] http://www.last.fm/
[13] It is a well-known opinion that Lucy in the sky with diamonds is indeed about psychedelic drugs like LSD (Press association, 2009).
[14] http://www.youtube.com

2.2 Developing a classification schema for tags

To study more precisely how tags change with context one would need a classification schema. Earlier research has studied types of tags used in collaborative tagging systems and therefore there exist a few different taxonomies specific to the domain of collaborative tagging. An early approach (Sen, et al., 2006) used three broad categories to categorize tags for a movie tagging application called "MovieLens". The three tag categories were *subjective, factual* and *personal*. The subjective tags where tags that represented the users opinions about the movie being tagged. The factual tags were tags describing facts in and about the movie like actors, places etc. The last category was for tags that represented something personal with regard to the user who applied the tag e.g. ownership of a movie or self-reference. These categories are offering some differentiation between types proved but are quite broad.

Another research project that investigated collaborative tagging was described by Xu, Fu, & Su (2006). They developed an algorithm to suggest possible tags to users, but in the process they also developed a taxonomy to classify tags. Their taxonomy was developed based on observations made on a social search engine called MyWeb2.0[15] and divided the tags into five categories; *content-based, context-based, attribute-tags, subjective tags and organizational tags.*

The content-based tags are tags that describe the resource or the category the resource belongs to. Xu, Fu, and Su name "Autos", "Honda", "batman" and "open source" as examples of this category. Tags in the contextual category provide information about when or where the resource was created. Attribute tags are "*inherent attributes of an object but may not be able to be derived from the content directly, e.g., author of a piece of content such as Jeremy's Blog and Clay Shirky*" (Xu, Fu, & Su, 2006: 3). The subjective tags describe something about the user's opinion about the tagged resource e.g. "hilarious" and "awesome!". The last category proposed by Xu, Fu and

[15] The service, owned by Yahoo, have since been shut down (Mills, E.,2009)

Su, organizational tags, are tags that are used to identify personal resources or serve as reminders of certain tasks e.g. the often used tag “toread”.

Golder & Huberman (2005) propose seven different types of tags in their paper ” The Structure of Collaborative Tagging Systems”:

1. Identifying what (or who) it is about
2. Identifying what it is
3. Identifying who owns it
4. Refining categories
5. Identifying characteristics
6. Self reference
7. Task organizing

It is worth noting that the categories were based solely on two sets of tags collected from the bookmarking site Delicious, i.e. the categories are optimized for tags in the domain of bookmarks.

Bischoff, Firan, Nejdl, & Paiu (2008) specialized the taxonomy listed above to make the categories more fine grained. They modified the categories proposed by Golder and Huberman by splitting and substituting Golder and Hubermans “Refining category” into *location* and *time*. By having eight rather narrow categories they had a taxonomy that enabled them to compare tags from several tagging applications like Delicious, Flickr and Last.fm.

The categories proposed by Bischoff, Firan, Nejdl and Paiu could be used to classify the tags gathered from the users of Digitur, but they will probably still be too wide to adequately distinguish between for instance emotional abstractions and general non-emotional abstractions. As Mody, Willis, & Kerstain (2009) and Mougenot, Aucouturier, Yamanaka, & Watanabe (2010) suggest, the influence of a richer set of stimuli when tagging real life resources could result in more emotional abstractions than tagging images and to be able to investigate this one would need to filter out tags relating to emotions. Furthermore the organizational category proposed both by Golder and Huberman (2006) and Bischoff, Firan, Nejdl, & Paiu (2008) does not differentiate between main activities and background activities. Background activities, although associated with the tagged resource, might not seem directly related. Take a university building for instance. The main activity there would, from a student's point of view, probably be studying, but one could also assume that secondary activities for that resource was socializing and procrastinating.

As described in (Wierzbicka, 1984) users might not describe exactly what a thing is, but rather what it can be used for or some abstraction related at some level to the resource. This must also be reflected in the classification scheme used to analyze the tags. Veres (2006) list four categories based on the fact that users sometimes group and describe resources based on the resources' more abstract properties. These four categories are functional, for exemple ”weapon”, functional colletion like ”tablewear”, origin collacation like ”garbage” or function + design like the term ”vegetable”. These four categories are based on the semantics the users put into the tags.

It is clear that there exist a variety of classification schemas, each with it specific intended of use, but no one has yet to design a classification schema for classifying tags for real life resources. Because of this I propose to approach the problem of choosing a classification scheme from a new angle by making use of a classification scheme that builds on two different classification frameworks made to classify image descriptors[16]. At first one could argue that this scheme is developed to categorize tags in a completely different domain, but I argue that the categories developed by Bråthen does indeed cope with the problems mentioned above.

Bråthen (2009) describes how he developed a classification scheme for image descriptors (tags) by combining a conceptual framework for visual information (Jaimes & Chang, 2000) m shown in Figure 4, with a taxonomy for image content extracted by the viewer of an image, shown in Figure 5 (Burford, Briggs, & Eakins, 2003). When combined it becomes clear that they offer a set of finer grained categories than the ones described by Bischoff, Firan, Nejdl and Paiu. For instance the categories for generic, specific and global scenes in Jaimes & Chang's framework which relates to different levels for the resource, i.e. they enable users of the framework to differentiate between terms describing a resource as a whole, or just

[16] This classification scheme is explained in detail in Section 4

parts of it. Bischoff, Firan, Nejdl and Paiu offers no such functionality with their categories. If using their categories one would have to choose between categorizing a term as describing either the type the resource would be of, who the owner is, or what topic corresponds to the resource. Neither of which category enables us to categorize fine grained tags that could come from a collaborative tagging system which aims to tag real world resources.

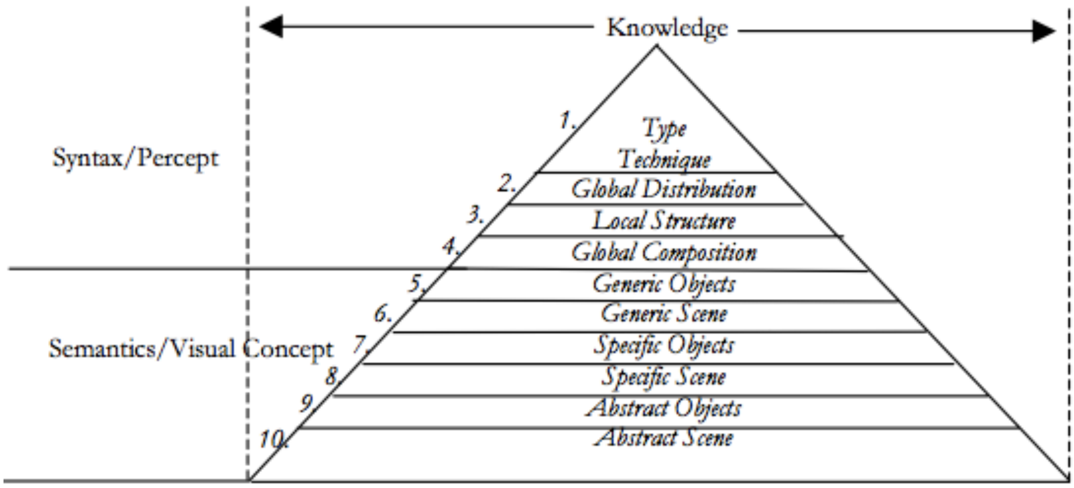

Figure 4: Classification framework by Jaimes & Chang (2000)

Bråthen ended up with 11 fine-grained categories into which he could classify tags and image annotations, thus enabling him to compare the contents of a folksonomy made by his experiment participators with a taxonomy constructed by professional image annotators.

Category	*Definition*
Perceptual primitives	The content extracted by low-level perceptual systems. In a strict sense this is unlikely (even impossible) to be reported. In practical terms, though, colour and some textural descriptions which do not rely on a higher level may be categorized here.
Geometric primitives	Simple two- and three-dimensional non-representational forms, such as line, arc, square, circle, etc.
Visual extension	Visual meaning which requires some inference. Most typical of these will be detection of depth, from shadow, occlusion, perspective, etc.
Semantic units	Names, both general and specific. Most descriptions will have some naming content, though it may be subsumed in higher levels.
Contextual abstraction	Associations or interpretations which depend on environmental knowledge. Such abstractions are presumed to be universal.
Cultural abstraction	Associations which rely on specific cultural knowledge. This may be the viewers' own culture (or subculture), or simply one of which they are aware.
Technical abstraction	Associations which rely on detailed specialist knowledge and vocabulary. Again this may be through direct experience of an area, or second-hand knowledge.
Emotional abstraction	Emotional and affective associations. These may be generalizable, but will be filtered by the viewers' own experiences.
Metadata	Information which describes the image, but is not actual image content, such as image format, size, aspect ratio, etc.

Figure 5: Burford, Briggs and Eakins' classification scheme for image content

Bråthen (2009) used the classification scheme shown in Figure 6 to investigate differences and similarities between professional image annotations and tags applied on a set of images taken from the image collection at the University of Bergen.

RESOURCE CLASSIFICATION SCHEMA		
	Example image	
Element level Descriptors that refer to a specific element at the resource location		
CATEGORY	DEFINITION	EXAMPLE
1. Objects		
a) Generic	Basic level categories of objects	*building, flag*
b) Specific	Specific named objects	*Kunsthallen*
2. Object properties	Descriptive terms saying something about the state of an object	*brown (door), nice (building)*
3: Background activities	Actions that are descriptive for part of the resource location	walking
4: Element level abstractions	Associations or interpretations that are related to specific objects or elements at the resource location	
a) General	Non-emotional associations	art
b) Emotional	Emotional and affective associations	surprised
Global level Descriptors linked to the location as a whole		
CATEGORY	DEFINITION	EXAMPLE
5. Main activities	Actions describing the resource location as a whole	looking at art
6. Global level abstractions	Associations or interpretations that describe or represent the resource location as a whole.	
a) General	Non-emotional associations	balance
b) Emotional	Emotional and affective associations	calmness
7. Location	The location of what is shown in the image	Bergen
8. Structural and contextual metadata	Metadata not directly related to resource	It's cold here now

Figure 6: Resource classification schema as defined by Bråthen (2009)

What Bråthen found was, amongst other things, that users tagging images would tend to focus on generic objects, i.e. describing what the images depicted, in contrast to professional annotators who, in the image set analyzed, focused on the location where the image was photographed and specific objects, like named persons, depicted in the image. Bråthen also compared the folksonomy generated for a set of historic images with a formal taxonomy for the same set of images and argues that the folksonomy and the taxonomy could complement each other in terms of supplying metadata about the images.

2.3 Location based collaborative tagging

In addition to the research summarized above there exist research that relates, but is to the research project described in this thesis. While the abovementioned sections have dealt with folksonomy and classification research in general there also exist research on collaborative tagging of location. One example is Baldauf & Simon (2010) who proposes the use of a tag cloud, which is constructed based on a user's location and tags related to this location. This tag cloud is then visualized on a mobile device, and it is possible to toggle between the tag cloud and a map showing the location corresponding to each tag. This way they hope to show the users of the system relevant resources that lie within the proximity of the users. Researchers within the field of augmented reality have taken this idea a step further and applications showing tags as an overlay on the real world exists (Diaz, 2008), although not much research has yet been done on this particular field (Nakamura & Miyashita, 2010). A similar idea is also described in (Ryong, Yong-Jin, & Kazutoshi, 2009).

Another approach is given by (Mody, Willis, & Kerstain, 2009) who explored how people stored and shared their emotions related to various locations. Their experiment showed that different users applied very different tags to describe the same feelings experienced at the same locations. This goes to show that even if you narrow down the domain of possible tags to cover only feelings one will still end up with a very diverse folksonomy.

3 Digitur2: A virtual tourist guide and geotagging tool

The question we are trying to answer in this thesis is how context can affect tagging behavior in a location-based service. Recently there has been developed a few new services that not only lets users generate content for web-based applications on their phones, but also takes into account the users location and actions at that specific location.

Conduction the experiment described in Section 4 called for a piece of software that allowed gathering of tags applied to specific resources at various geographical locations. I therefore added tagging functionality to the Digitur2, an application that was developed by a programmer at UniDigital[17] and myself. Digitur2 aims at enabling the users to retrieve relevant information about where they are and apply tags to locations on a map. The tags are connected to a point of interest or *resource* on the server side. The main function of Digitur2 is to work like an interactive tourist guide, supplying information about sights in a given geographical area as well as information about cafés, restaurants etc. The development drew on experiences gathered from the development of Digitur developed by UniDigital for the Norwegian research week, as described in Møller, Veres & Næss (2010). Digitur2 was originally developed as a demonstrator in connection to the SeSam4 project (SeSam4), and it is important to note that Digitur2 has functionality reaching outside the scope of this thesis. Some requirements relating to that functionality might not be covered in details.

The original Digitur was set up like a game where a user would have to follow clues around a city to unveil points to go to get more clues (Forskningsdagene i Bergen, 2009). All though the name implies similarities between the two, Digitur2 differs from the original application in terms of both implementation and functionality. While Digitur was based on a java client Digitur2 would be web based, and while Digitur was set up like a game where users had to guess and gather clues to get

[17] http://digital.uni.no/

directions to the next point of interest, Digitur2 would show all points of interest available to the user, thus providing a user with relevant information about these.

On the technical level the development team argued that the application should both be platform independent and have a minimal need for downloading. Most applications used on mobile devices have to be downloaded in one form or another and are specifically designed to be used on one platform, be that iPhone, Blackberry or Android phones. We wanted Digitur2 to be platform independent, and based on the fact that smart phones get increasingly advanced web browsers we decided to make it web based in form of a web page where users can log on. By developing one single web page there was also no need to make several platform specific versions to make sure that Digitur2 would be able to run on multiple platforms. That being said, there were also some drawbacks from making it a web based application as all though smart phone browsers are becoming better they still lack some functionality so actually incorporating key features like location sharing proved difficult on some phones.

3.1 Requirements specification

Requirements for Digitur2 were defined by setting up various use cases. The use case specific for this thesis is described in detail in Appendix B – Use case for Digitur2. One of the main benefits from defining use cases is that they are defined on a very abstract level (Martin, 2003) When planning the development of the new system this allows the developers and potential users to focus on the tasks the new system should support rather than elaborating how it should be implemented in the system.
Based on the use case relevant for this thesis the requirements for Digitur2 can be summarized as below. To structure the requirements I choose to divide them into different types of requirements based on the types listed in (Bell, 2005)

3.1.1 Functional requirements

1. The system should show the user's location on a map
2. The system should display points of interest within the user's proximity on a map
3. The system should allow a user to click on any icon representing a point of interest to get more information about that point

4. The system should allow a user to type in tags in form of text for each icon representing a point of interest
5. The system should allow a user to save the tags to a database
6. The user should be able to click anywhere on the map to create a new point of interest
7. The system should give informative feedback to the user for all actions performed:
    a. Done loading point of interest in users proximity
    b. Done saving tags
    c. Done saving a new point of interest
    d. Error while performing the three abovementioned actions

3.1.2 Data requirements

1. The system should save and store user information: username and password
2. The system should save and store resource information: geographical coordinates, name and tags
3. The system should save and store information about tags: tag-text, resource, user

3.1.3 Performance requirements

There were no specific performance requirements

3.1.4 Constraints

1. The system should be web based
1. The system should be platform independent
2. The system should not require a user to download a specific application

The constraints arise from the thought that we wanted to a: create a completely platform independent system that can run on any modern mobile device supporting JavaScript, and b: users are normally quite reluctant to download applications to their mobile devices as it often seems to be to much of an effort compared to navigating to a web-site.

3.1.5 Guidelines

1. The system should preferably get a user's location based on GPS rather than triangulation when possible because GPS is more accurate.

This guideline is based on the development teams own observations in early prototyping as well as other experiences found on Stackoverflow (2008) and Cisco Technologies (Cisco, n.d.)

3.2 Development platform and software

Digitur2 was developed using the IntelliJ IDE[18] running on both Windows7 and Mac OS X. At some stages of the development the open source IDE Eclipse[19] was also used due to licensing issues with IntelliJ.

3.2.1 Web-based application

When developing a system one generally has the choice between developing a client that is installed on a host or to make a web-based application which resides on a web server which in turn can be accessed through a web browser. As Digitur2 is to be used by tourists there is no knowing of which devices they would use, be it a Symbian, Apple, Android or any other device. To solve this problem one could either develop one version of the system for each platform and distribute that, or build a web-based application which could be reached via the devices' web browsers. Since all web browsers more or less delivers a standard set of core functionality for browsing Digitur2 was developed as a web-based application. This means that as long as the client has a web browser that supports JavaScript, is connected to the Internet, and is able to give away the clients geographical location, it is able to run Digitur2.

3.2.2 Choice of server side framework: Django

As the client is web-based most of the functionality resides on the server side. Instead of developing this from scratch we decided to utilize a Python based open source framework called Django[20]. This enabled us to build the functionality we needed based on Django's existing functions. It comes with many preexisting functions, like

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[18] http://www.jetbrains.com/idea/
[19] http://www.eclipse.org/
[20] http://www.djangoproject.com/

an administrator panel, thus eliminating the need to develop this functionality in addition to the application, and also enables developers to make use of plug-ins or applications, which extends the functionality of the framework very easily.

One of the lay features of Django is that one does not have to think about database management (Djangoproject, n.d.). As a developer all you have to do is to develop a set of data models suitable for the application one is developing, e.g. like Figure 7, and then Django will create the tables needed. Django will also handle all communication between the application and the database so there is no need for writing any SQL queries.

```
class Tag(models.Model):
    user         = models.ForeignKey(User)
    resource     = models.ForeignKey(Resource, null=True, blank=True)
    name         = models.CharField(max_length=128)
    location     = gismodels.PointField(null=True, blank=True, srid=4326)
```

Figure 7: Source code for class Tag

3.2.3 Choice of database

Django comes with it's own database solution included. This is named SQLite3, but we encountered some problems when using SQLite3 together to the GeoDjango add-on for Django, which we wanted to use for spatial queries to the database. Because of these problems it was decided to connect the Django installation to a PosgreSQL database which Django also supports (Djangoproject).

3.2.4 Choice of front-end interface

Because Digitur2 is about location and discovering which resources are available to users at a given location our thought was to build the user interface on and around a map. Google Maps[21] offers an extensive open source JavaScript API (Google Code Labs, 2010) which we used to build a front-end which can be accessed through both mobile devices and computers.

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[21] http://maps.google.com/

3.2.5 Choice of programming languages

Having decided on using the Django framework for developing Digitur2 we needed to use Python as the main programming language. Python as a programming language has the benefit of being very flexible and making experimentation easy while still containing an extensive amount of readily available packages that can be imported, thus maximizing the possibilities of reusing existing code (Zelle, 2004). Using Google Maps as our front-end implementation platform meant we had to use JavaScript in order to take advantage of the existing Google Maps API[22].

3.3 Implementation

Digitur2 resides as a Django application connected to a PostgreSQL database. The architecture could be split up in three equal pieces as described in the following sections.

3.3.1 Server side implementation

The standard configuration of Django uses a set of URLs, which through a file named url.py map to a view that contains functionality in the server. A view in Django is similar to a controller class in a normal Model-View-Controller architecture (Holovaty & Kaplan-Moss, 2008). For example the URL "digitur/tagit/" would be listed with all the other configurated urls in urls.py like shown in Figure 8

```
from django.conf.urls.defaults import *

urlpatterns = patterns('semanticmap.views',
    (r'^map/$', 'show_map'),
    (r'^pois$', 'fetch_pois'),
    (r'^tagit/$','show_tagable_map'),
    (r'^tags/$','show_tag_map'),
)
```

Figure 8: Example of url mapping in urls.py

As one can see from the example in Figure 8 each url is succeeded by a function, in the case of "digitur/tagit" the function name is "show_tagable_map". This function is defined in the file views.py and handles all requests that are sent to the url that corresponds to it. The function that corresponds to "/digitur/tagit/" is shown in Figure

[22] Acronym for Application Programming Interface

9 below. The function utilizes Djangos built in function render_to_response, which creates content for a predefined HTML-template named tagit.html. It is this page, tagit.html, that is shown to the user when the user does a request on the url /digitur/tagit/ (as shown in Figure 12).

```
@login_required()
def show_tagable_map(request):
    dict = {
    #empty dict
    }
    return render_to_response('tagit.html', dict, context_instance=RequestContext(request))
```

Figure 9: show_tagable_map function in views.py

3.3.2 Services implementation

Some of the functionality in the client is based on individual java scripts, which run and updates information regardless of whether the user update the user interface in the browser. This can for instance be useful for getting, and updating, a user's geographical location. By doing so the program is no longer dependant of actions by the server to show updates in location.

A service that is created and loaded specifically for the URL /digitur/tagit/ is a service named TagService. This service will take the data the user enters in the tagging Figure 13) and transform it to a JSON-formated string, which in turn is passed on to the server. JSON stands for Java Script Object Notation, and is an open standard widely used to transmit structured data over a network connection (Scheible & Tuulos, 2007). On the server end the request will be treated as a POST to a specific URL specified in the TagService. Then the JSON-formated string will be transformed to a python object corresponding to the TagModel-class (Figure 7) by a service handler, shown in Figure 10. Django then stores that object in the database.

```python
class TagHandler(BaseHandler):
    allowed_methods = ('GET','POST')
    model = Tag

    fields = ('id','name', 'resource', 'location', ('user', ('username',)),)

    @classmethod
    def content_length(cls, tag):
            return len(tag.name)

    @classmethod
    def resource_uri(cls, tag):
        return ('tags', [ 'json',])

    def read(self, request, *args, **kwargs):
        print kwargs
        qs = self.queryset(request)
        if args != () or kwargs != {}:
            try:
                return qs.get(*args, **kwargs)
            except ObjectDoesNotExist:
                return rc.NOT_FOUND
            except MultipleObjectsReturned: # should never happen, since we're using a PK
                return rc.BAD_REQUEST
        else:
            return qs


    def create(self, request, *args, **kwargs):
        """
        Creates a new tag.
        """

        if not hasattr(request, "data"):
            request.data = request.POST

        attrs = self.flatten_dict(request.data)

        resource = None
        if attrs.has_key('resource'):
            resource, created = Resource.objects.get_or_create(resource_uri=attrs['resource'])
            attrs['resource'] = resource

        tag = Tag(**attrs)
        tag.user=request.user
        tag.save()

        return tag

    def update(self, request, *args, **kwargs):
        if not self.has_model():
            return rc.NOT_IMPLEMENTED

        pkfield = self.model._meta.pk.name

        if pkfield not in kwargs:
            # No pk was specified
            return rc.BAD_REQUEST
```

Figure 10: Source code for the TagHandler class in Digitur2

Another benefit of using this architecture is that we have in fact created a RESTful interface for tags. REST is an architectural approach when creating web-based applications, and applications conforming to the constraints in the arcitecture are called RESTful (Tikov, 2007). By creating a RESTful interface we in fact now had a server that potentially could receive requests from any source, e.g. a third party client, as long as it would form the requests according to what the server expected. It would for instance be possible to develop a client for a mobile phone, and as long as that client could do POST and GET-request over HTTP to the defined URL: "/services/tags/" it would be able to communicate with the server. Of course building a complete RESTful interface for Digitur2 would require much more thought and development time, but by using this architecture an application could much easier share data between different applications (Gold-Bernstein & Ruh, 2005) than traditional architectural approaches.

3.3.3 Front-end implementation

When Django has finished a request it sends a response back to the client. In the case of Digitur2 it will in mostly return a web page together with underlying data to visualize the response to the request.

3.4 User interface

The user interface for Digitur2 revolves around a map as shown, in Figure 10. At the top of the screen there is a status bar which will display various messages as feedback to the user e.g. when a user saves a tag. The standard message, which is also shown in Figure 10, is that the map is done loading and that the application has loaded icons for all the predefined points of interest (POI) on the map.

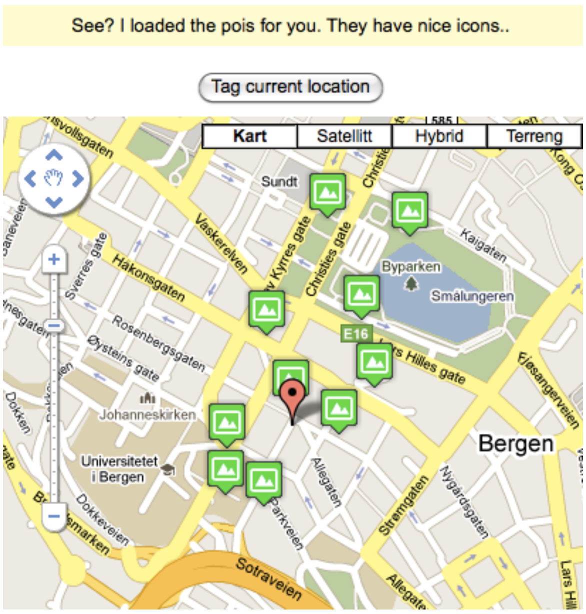

Figure 11: Overview of graphical user interface in Digitur2

Below the status bar is a button, which lets users tag their current location regardless of the predefined POIs. The red marker visualizes the current location for the user. The four buttons labeled “Kart”, “Satellitt”, “Hybrid” and “Terreng” lets the user toggle between the types of map the user prefers. The default is the plain map shown.

The buttons will be labeled according to the users locale setting on the users device and should have names that adapt to the language of the users device.

3.4.1 Tagging dialog

When a user clicks on an existing point of interest a dialogue pops up enabling the user to add tags for this specific location as shown in Figure 11. It also shows the name of the resource located at that location and the coordinates.

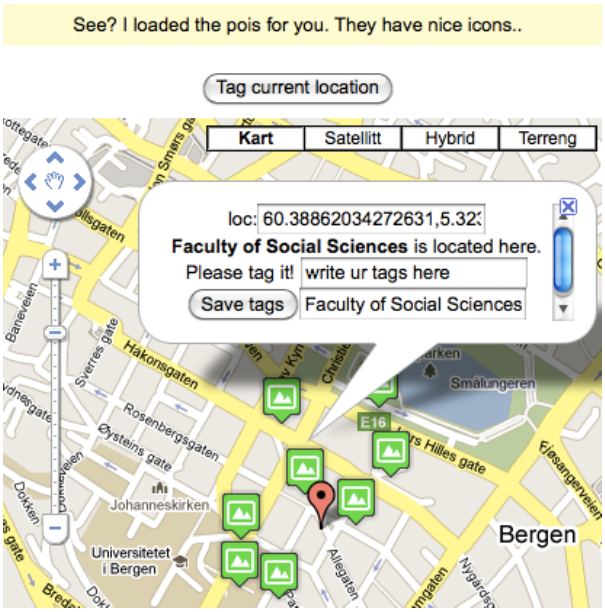

Figure 12: Overview of Digitur2 general graphical user interface

3.4.2 System information messages

As stated in section 3.4 the yellow status bar will display feedback messages from the system to the user. In the example image below the tag "Demotag" has been successfully saved at the resource "Faculty of Social Sciences" and the user interface responds accordingly by showing the success to the user, as whosn in Figure 12.

Figure 13: Tag entry dialogue in Digitur2

3.5 Participant reactions to Digitur2

In this section I will list some observations about user interaction with the software made during the experiment. These observations will not be used when elaborating the results, but could nonetheless be useful when evaluating the results, or form new research questions in the future.

3.5.1 Pre test.

Two types of mobile phones were used in the experiment; iPhone and HTC Hero. Both phones are capable of showing the user interface as described in section 3.4, but they implement the keyboard in slightly different ways. They also use different touch screen technology, so even though the user interface of Digitur2 is the same on both phones the underlying features of the phone are slightly different. Because of this the experiment participants seemed to prefer the iPhone, which had better response on the touch screen. The HTC Hero’s touch screen seemed less accurate and some of the participants found it extremely complicated to write the tags without spelling errors, especially when they were using the phone in cold weather thus having cold fingers.

Aside from the phones having different keyboard implementations the user interface for Digitur2 also had some problems. No evaluation with focus on user experience had been done prior to the experiment and some of the participants complained about the design of he user interface. It is worth noting that at least one of the participants in the experiment had specific training in evaluating user interfaces and might be looking at the user interface for Digitur2 with this in mind. One of the biggest problems with the interface was that the tagging field did not clear after a tag was saved. This is easy to implement, but was not done as changing the user interface in the middle of the experiment could have resulted in uncontrolled variances in the dataset.

Another problem, although not grave, was that the status bar informing the users that tags had been saved would some times not be visible due to limitations of screen size on the mobile phone. Some users would scroll up each time they saved a tag, but most users took for granted that the tag was saved and did not bother to verify this.

Both these errors would probably have been noticed and corrected had the research project included a usability test for the user interface. Usability tests aims at unveiling problems with a user interface (Cairns & Cox, 2008), but due to time constraints a usability test was not conducted. A pilot study, which refers to a small-scale version of a bigger experiment (Teijlingen & Hundley, 2001), would also probably have unveiled these problems, but again due to time constraints it was not conducted.

3.5.2 The joy of tagging.

When observing the experiment participants one of the main observations that was repeated for several of the participants was that they would at some point smile or giggle while tagging. When asked what they found amusing it was not the process of tagging, but the tag itself and the memories related to the specific tag e.g. the tag: "funny pic of statue as the ruler of the world". When asked about this specific tag the participant answered that she had photographed the statue mentioned in the tag earlier that week. However, this behavior was only observed in the experiment group and not in the control group. The control group seemed generally less motivated, and expressed less joy during the tagging process.

3.5.3 Participants reaction to the concept of tagging.

Out of the 20 persons participating in the experiment only six had used any form of tagging service earlier, and out of those six only two participants had used any form of geotagging service. When asked if they could see a use for an application like Digitur2 about half of the participants responded that they would consider using such an application had it been more mature. Specifically one participant suggested using the application to make note of where she had photographed different resources, thus keeping track of her images and the story behind them. She also suggested that Digitur2 should have an even more social aspect, which allowed users to share tags and resources with each other. Lastly some participants suggested that Digitur2 would be integrated with an online image sharing community, like Flickr [23]making it possible to connect a tagged resource with images uploaded to Flickr. The general opinion from the participants was found to be that Digitur2 was a good concept, but probably should have more development time to become a bit more stable and perhaps even more important; user friendly.

[23] http://www.flickr.com/

4 Research framework and data collection

4.1 Design of experiment

The experimental design was a posttest-only experiment where the access to the real life resources was the independent variable. Frankfort-Nachmias and Nachmias (1996) define a posttest-only experiment as an experiment where the participants are randomly assigned to one of two groups, the experiment group or the control group. They are then measured after or during introducing the independent variable.

The experiment conducted in this thesis consisted of four key components; ten resources located at various places in Bergen, twenty participants, ten images of the resources and Digitur2, a mobile tagging application. The participants were randomly divided in two groups. The first group would tag the actual resources, and the other group, the control group, would tag the images of the resources in a controlled environment. It is worth noting that the experiment group could also be considered as a field study as it was conducted outdoors where there is a plethora of factors e.g. weather and temperature that could potentially effect the results. Due to this it became clear that observations made during the experiment conduction should be made note of as if it would have been a real field study. In a field study the researcher, among other things, has to decide both the focus and degree of openness towards the participants (Grønnmo, 2007). I decided to let weather conditions and time of day constitute the main focal points, together with the participants behavior while tagging. These observations were written down in a notebook while observing. When it came to the degree of openness I informed all participants about my plans to observe them as they tagged and that these observations would be written down by me. Information to the participants were given both orally and in form of a letter of consent(Appendix C - Letter of consent).

4.1.1 Resource selection.

When selecting resources to be tagged I focused on selecting resources that could be visited within a relative short span of time to keep the participants motivated. It was also desirable that the participants had some basic knowledge about the resources, at least on a high level. This was so the participants had a higher probability of relating to the resource, thus being more motivated to apply tags. The number of resources was limited to ten. More resources could lead to unmotivated participants and could result in fewer tags. Based on an overall distribution on different resources the following locations in Bergen city center were to be tagged:

Resource type

Table 1: Overview of resources to be tagged in experiment and their types

RESOURCE NAME	RESOURCE TYPE
Faculty of Social Sciences	Building, university
Chaos coffee bar	Building, café
Grieghallen	Building, concert hall
Bergen Kunsthall Landmark	Building, museum, café
Lille Lungegårdsvann	Place, lake
Student center	Building, university
Muséumshagen	Place, garden
Museum for natural history	Building, museum
Musikkpaviljongen	Structure, pavilion
Apollon	Building, record shop

The images tagged by the control group are included in Appendix E. Each image corresponds to a real life resource, and it was made sure that the image also was taken directly at the location where the experiment group participants would be located during the experiment.

4.1.2 Participant selection.

The recruitment of experiment participants was mainly within students at the Faculty of Social Sciences with a few exceptions. The students were from either, the Department of Information Sciences and Media Studies, or from the Department or Comparative Politics. Distributions between the two departments were five students from each, with both genders represented. The remaining participants were not students. Table 2 shows the gender, age and nationality distribution of the participants in the experiment:

Table 2: Age, gender and nationality distribution in experiment group and control group

CONTROL GROUP			EXPERIMENT GROUP		
Gender	**Age**	**Nationality**	**Gender**	**Age**	**Nationality**
M	23	Norwegian	M	22	Norwegian
M	26	Norwegian	M	29	Norwegian
M	29	Norwegian	M	24	Norwegian
M	24	Norwegian	M	23	Norwegian
M	37	Norwegian	M	24	Norwegian
F	24	Norwegian	F	59	Finnish
F	20	Norwegian	F	25	Norwegian
F	20	Norwegian	F	31	Slovenian
F	19	Norwegian	F	56	Danish
F	49	Swedish	F	23	Norwegian
	Avg: 27,1			*Avg: 31,6*	
	Median: 24			*Median: 24,5*	

Frankfort-Nachmias & Nachmias (1996) defines sampling validity as whether or not a given population is reflected in the samples being used to answer the research question. The participants selected for the experiment should be viewed as a non-probability sample, or more specific a convenience sample. This is based on the fact that no sampling frame was defined prior to the sample selection. Because there is no specific frame for the population there is no guarantee that the sampling set reflects the total population being measured, as the precise nature of the population itself is unknown (Chin, 1976, as cited in Frankfort-Nachmias & Nachmias, 1996). Ideally there should be an even wider variety of age and nationalities represented in the experiment, but the number of participants was limited due to time constraints in the research project.

4.1.3 Software: Digitur2.

The experiment participants made use of the software Digitur2 for tagging resources. This software was developed from scratch and allowed the users to enter tags associated to a location on a map. The software features and development process is described in detail in section 4.

4.2 Experiment procedure

It was decided that the gender distribution should be the same in both groups, but apart from that all participants were randomly assigned to either the experiment group or the control group. The participants in the experiment group were guided one by one to the different locations they were going to tag. The order of the locations visited was to some extent random to prevent bias coming from all the participants visiting the locations in a particular order. The control group got to use Digitur2 on a laptop computer with a secondary screen showing images of the resources they were going to tag. Ideally the control group should have used a mobile phone, but due to limitations of technical resources only a laptop computer was available at the time of the control conduction.

Before the users were allowed to tag they read through and signed a letter of consent (Appendix C) They also answered a short questionnaire (Appendix D) asking them about age, gender and nationality. The questionnaire also asked about previous tagging experiences as well as geotagging experiences. Lastly there was also an option to fill in comments regarding the application. This field was also available for the participants to answer after using the software in the experiment. Each participant in the experiment conducted his or her part in solitude, only accompanied by me. By doing so it became possible for me to observe and gather information about each participant's behavior during the experiment.

4.3 Classification of resource descriptors

To be able to answer research question one it was necessary to categorize the tags according to a classification scheme. A classification scheme would serve as a framework when classifying tags, thus enabling the researcher to say something of which *types* of tags that are present in a folksonomy. It was investigated which classification scheme should be used, and as described in Section 2 there are several available. Golder and Huberman (2005) operate with seven categories in their paper as presented in section 2. Another possible classification scheme could be one created by Bråthen (2009). Both would have their advantages and disadvantages in this particular context. Golder and Huberman's categories are especially designed for tags based on research on tagged bookmarks. Bråthens scheme, on the other hand, was based on tags describing images, thus making it more comparable with the tags gathered from Digitur2. It became clear that both schemes would have beneficial properties, e.g. Huberman and Golder have a specific category for tags that references to itself like “toread”. This category is absent in Bråthens scheme. On the other hand, Bråthens scheme has categories for emotional abstractions, locations and contextual metadata, something that Huberman and Golder scheme has not. It then became clear that in order to answer the research questions Bråthens classification scheme should be used in order to isolate tags describing emotional abstraction and, perhaps even more important, contextual metadata. Huberman and Golder’s categories proved to be too broad, and not being able to isolate specific tag types required to answer research question one. Having chosen Bråthens scheme I will describe it in detail in the next subsection. It is essentially the one described in (Bråthen, 2009), but the examples in the scheme are modified to fit a real life resource-tagging context.

4.3.1 Resource descriptor classification scheme categories.

In this section I aim to clarify the different classification categories and elaborate the examples from Figure 6. It will also describe how these categories relate to the categories proposed by Golder and Huberman (2006) described in Section 2. As I will use the classification scheme to categorize not only tags related to images, but also resources at geographical locations some of the categories are applied slightly different than in Bråthen (2009).

Category 1a: Generic objects

This category includes objects that are clearly visible to the experiment participant. In the experiment group it was sometimes difficult to differentiate between tags in this category and tags belonging to category 4a because the participants were free e.g. to go inside a museum if it was open at the time of the experiment.

Category 1b: Specific objects

Tags in this category are either proper nouns or specific named objects. One participant in the experiment tagged a resource with “the bench”, signifying that she meant a particular bench at that particular location. This tag and similar, were also categorized in this category.

Category 2: Object properties

This category contains tags describing other objects like “good”, “nice” and those alike, but also multiword tags like “lies near a heavily trafficked light crossing” were placed in this category.

Category 3: Background activities

Activities not directly related to the resource location were put in this category.

Category 4a: General element level abstractions

In this category the tags specifying abstractions relating to parts of the resource was categorized. One example is the tag “food” which was applied to the resource the Student center.

Category 4b: Emotional element level abstractions

This category contains tags that are of an emotional character, which relates to parts of the resource or location. An example from the dataset is “funny picture of statue as ruler of the world” which was applied to Museum for natural history

Category 5: Main activities

Tags in this category describe main activities taking place at the resource location. An example from the dataset is the tag “visiting the museum” which was applied to the resource Bergen Kunsthall. It was sometimes differentiating between tags in this category and tags in category 3.

Category 6a: General global level abstractions

This category is used for tags related to abstractions that reflect the resource as a whole. For instance the tag “17.mai”[24] which several participants, both in the control and experiment group assigned to the resource Musikkpaviljongen”

Category 6b: Emotional global level abstractions

Tags in this category are emotional abstractions, which relates to the resource as a whole e.g. “Everyday tristesse” which was applied to the Faculty of Social Sciences by a master student at said faculty.

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[24] May 17th is the Norwegian independence day and the location of Musikkpaviljongen is central to the celebrations

Category 7: Location

Tags describing location. Both proper place names and more vague place names like "nearby" were placed in this category.

Category 8 Structural and contextual metadata

Bråthen (2009) limited this category to contextual tags relating to the image itself, like "jpeg" and "greayscale", but I included tags also describing weather conditions, time of year etc.

4.4 Assessing data reliability

The data collected was analyzed for statistical significance to investigate whether or not the findings from the experiment happened by chance. The experiment described above generated 20 observations, which in a statistical setting is a rather small number of observations. Furthermore each observation was of a single observation unit, thus making the two samples unrelated. The data collected through the experiment was summed up as tags in each category for each user, thus making the data of ratio type (Stevens, 1946), but even though the data is on a ratio scale the underlying distribution is not continuous, therefore violating one of the assumptions of a T-test. This is important to know when choosing which statistical significance test to apply to the dataset, and according to (Wenstøp, 2004) the best test to apply to two unrelated samples to test statistical significance is a Wilcoxon–Mann–Whitney two-sample rank-sum test, henceforth referred to as Mann-Whitney U-test. The decision to apply a Mann-Whitney U-test is also consistent with the arguments described in (Stevens, 1946), which state that although one can sometimes achieve fruitful results by applying tests based on standard deviation one ought to interpret the results cautiously. This is because standard deviations computed on an ordinal scale would be in error to the extent that the successive intervals on the scale are unequal in size. Because a Mann-Whitney U-test is based on the median value the test can be applied to ordinal data.

The Mann-Whitney U-test was developed by Henry B. Mann and D. Ransom Whitney, and is used to investigate if the median values of two populations are the same (Mann & Whitney, 1947). The idea behind the test is that by counting how many times an observed number is greater in one of the samples than in the other, and vice versa. If the null-hypothesis is true then there should be minimal difference between the two populations, and this not being the case signifies that the null-hypothesis should be rejected (Wenstøp, 2004). All test of significance will be performed using the software PASW Statistics 18.0[25]. Keeping with normal conventions (Stiegler, 2008) we will reject the null-hypothesis if $p>.05$.

The last research question calls for a test to investigate whether or not the tags gathered for each resource forms a power-law curve. However, such a test is difficult to perform in practice. One way of testing is by fitting the graphical outcome of a log-log transformation of the samples in a linear space, i.e. as described in (Halphin, Robu, & Sheperd, 2007), however it has been argued that this way of analyzing, based on linear fitting of log-log transformed data can be erroneous (Goldstein, Morris, & Yen, 2004). Due to this the tags gathered will be tested by performing a Kolmogorov-Smirnov-test to see if the distribution of tags does indeed follow a power-law curve, as suggested by Goldstein, Morris, & Yen (2004).

[25] Usually referred to as SPSS but changed name to Predictive Analytics Software Statistics following IBMs acquiring of SPSS (IBM, 2009)

5 Results

During the experiment the experiment group applied 541 tags, whereas the control group applied 519 tags, bringing the grand total up to 1060. The following sections contain the data and findings based on the experiment described in Section 4.

5.1 Summary of results

The overall research question aim to investigate if the *types* of tags are affected by the presence of the resource while the user is tagging. Based on the classification scheme defined in Section 4 the overall distribution of tags gathered from the experiment can be summarized in Figure 14, which shows the percentage of the total tags in each category, for the experimental and control groups.

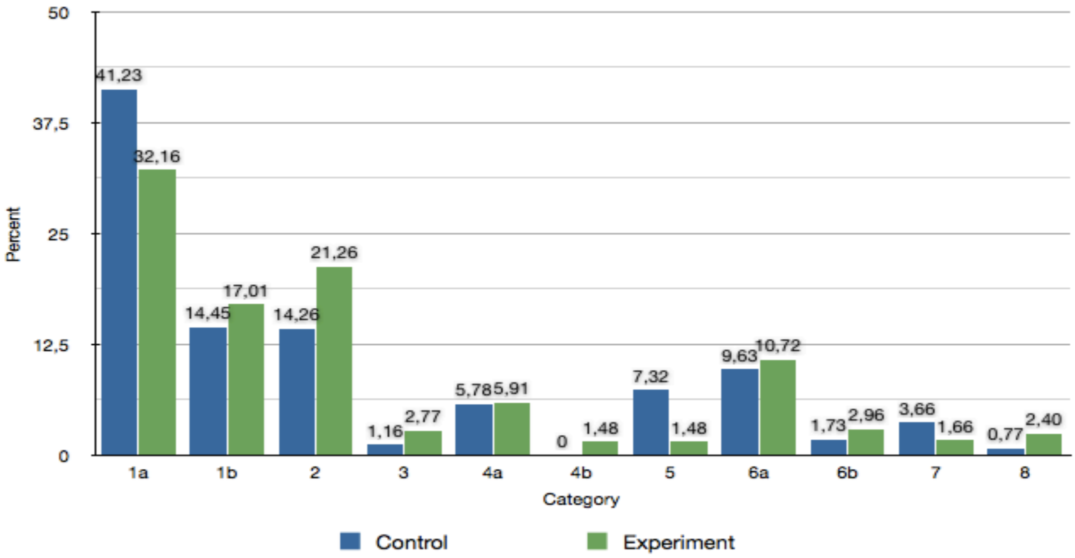

Figure 14: Percentile distribution of each category for the control group and the experiment group

As visible in Figure 14 majority of the tags applied by the users of Digitur2 was in the three first categories i.e. generic objects, specific objects and object properties. The folksonomy is therefore comparable to a taxonomy in the regard that it has a large representation of object specific annotations. The other categories show less prominent signs of being used. Turning to the effect of presence it appears that context effects the categories differently. For example in 1a the experiment group appears lower, but in category 2 it appears higher.

When comparing category 3, background activities, with category 5, main activities, one can see something interesting. It is evident that these categories show signs of being favored in a reversed manner. E.g. the experiment group favored tagging background activities compared to main activities, while the control group favored tagging what is categorized as main activities compared to background activies. This is in fact proven statistical significant. When tested with a Mann-Whitney U–test Category 3 differed significantly, U(30), $N_1 = N_2 = 10$, p=.048 two-tailed, which was also the case for Category 5, which differed significantly, U(14), $N_1 = N_2 = 10$, p=.005 two-tailed. The rest of the categories had fairly equal distributions when comparing the experiment group with the control group, and did not differ significantly when tested using the Mann-Whitney U-test. Table 3 could perhaps give some indications why some of the other categories did not differ significantly.

Table 3: Minimum, maximum and median values for each category pr participant under both conditions in the experiment

Category	Condition	N	Min.	Max.	Median
1a, generic objects	Control	10	3	33	23
	Experiment	10	3	36	17
1b, specific objects	Control	10	0	16	7,5
	Experiment	10	0	17	10
2, object properties	Control	10	0	17	6,5
	Experiment	10	0	28	11
3, background activities	Control	10	0	2	0
	Experiment	10	0	4	1,5
4a, general element level abstractions	Control	10	0	6	3
	Experiment	10	0	10	2
4b, emotional element level abstractions	Control	10	0	0	0
	Experiment	10	0	5	0
5, main activities	Control	10	0	12	3
	Experiment	10	0	2	1
6a, general global level abstractions	Control	10	1	9	5,5
	Experiment	10	1	16	5
6b, emotional global level abstractions	Control	10	0	4	0,5
	Experiment	10	0	7	1
7, location	Control	10	0	7	1
	Experiment	10	0	4	0
8, structural and contextual metadata	Control	10	0	2	0
	Experiment	10	0	4	1

Because the Mann-Whitney U-test is based on comparing the median values for each sample, the median, maximum and minimum values for each category is listed in Table 3

When looking at Table 3 it becomes clear that some categories have a very large spread with regards to minimum and maximum value assigned by single user when compared to the median value. E.g. one user only assigned a total of three tags in category 1a, compared to 36 by the user who assigned the most tags to this category and the median for this category being 23 in the control group and 17 in the experiment group. When looking at the minimum values it is also clear that categories 1a and 6a, are the only ones that were used by all 20 participants in the experiment.

Research question three states that we expected to find that the tags applied would follow a power-law curve. In collaborative tagging systems it has been suggested that the tags for a given resource will follow such a curve because all the taggers combined will tend to agree on a few common tags describing a resource, but in addition to those they will add some less popular tags, thus creating a long tail. This is also somewhat the case for the tags collected from Digitur2, as shown in Figure 15. Figure 15 is based on the resource Grieghallen, but in fact all resources showed similar patterns.

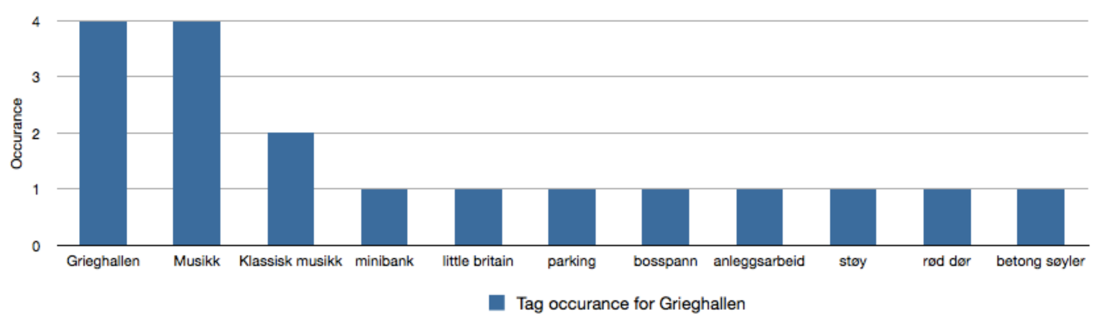

Figure 15: Tag occurrences for ten most popular tags for grieghallen

As visible there are signs of the users agreeing on some popular tags like "Musikk" and "Grieghallen" both applied four times by the ten people in the group, but when tested for a power law distribution using a Kolmogorov-Smirnov-test for one sample it proved not to be distributed along a power-law curve. The lack of a power-law curve could be because of the rather small data set gathered from the experiment, and it is again worth noting that fitting a population to a power-law curve is indeed compicated in practise (Goldstein, Morris, & Yen, 2004).

5.2 Discussion

Following Bråthens findings it should not be surprising to see that the most popular category for both control and experiment group was category 1a, generic objects. This has several implications when integrating a folksonomy with a taxonomy. Firstly a large number of generic objects would make it possible to align the folksonomy with the matching taxonomy in terms of concepts. Secondly, tags related to the concept tags aligned with the taxonomy could be used to further enrich the taxonomy with in a fairly precise manner, as they would be related to specific concepts already aligned with the taxonomy. Thirdly the evolving classificatory could form the core of an evolving taxonomy.

With regard to specific objects there are differences when comparing the results from Digitur2 with both Bråthens findings for category 1b. Bråthen reported that only 2,3% of the tags in his folksonomy were specific objects thus making the folksonomy generated from Digitur2 more like a taxonomy in the sens that it contains specific named obejcts. One possible explanation for this finding is that Bråthen (2009) let his experiment participants tag arbitrary historical images, images that were hard for the user to relate to other than what they could visually extract from the image. The participants in my experiment, on the other hand, were tagging resources and representation of resources, found in Bergen, thus the experiment participants would, to some extent, know the names of the resources tagged. Furthermore the Digitur2 supplied all resources with the official name for the resource in the tagging dialogue, enabling even users unfamiliar with the resource to tag the resource with it's propper name should they whish to do so. If generalyizing from these findings one could argue that people tagging resources they have personal experience with would collaboratively create a folksonomy more like a taxonomy compared to users tagging arbitrary resoruces without any personal references.

5.2.1 Object property refining tags

With regards to object properties there is a big difference between Bråthen's findings and the ones from the experiment. While Bråthen's folksonomy, based on historical images, contained 6,2% tags categorized as object properties, the location based folksonomy created from the experiment shows the percentage in this category to be 14,26% in the control group, and 21,26% in the experiment group. These percentages are also higher than what Bischoff, Firan, Nejdl, & Paiu (2008) found to be the case for users of Delicious and Flickr. When compared to the percentage of tags in the category corresponding to object properties for Last.fm users the results from the experiment are fairly similar. It is important to remember that Bischoff, Firan, Nejdl, & Paiu did use a different categorisation schema when analysing their findings, but looking back on section 2 we can see that they have a category coresponding to object properties, thus making it justifyable to compare tags categorized by different schemas.

The findings regarding object properties are interesting because when looking back on section two Bischoff, Firan, Nejdl, & Paiu, among other things, argued that users on Last.fm mostly focused on tagging what kind of music it was, but they also very much focused on their personal opinions about the music, e.g. using the tags like "great lyrics" and "laid back". These personal opinions are a results from the taggers having personal experience with the resource they tag. The same could be said about the tags in Digitur2. The resources tagged are resources in Bergen, and both participants in the control group and in the experiment group would, to some extent, have a personal experience with the reousrces, thus applying tags based on personal opinions and experiences e.g. tags like "pretentious" and "provocing", which were applied to Bergen Kunsthall. Bråthen's subjects, neither the ones in his control group, nor the one in the experiment group, would have had much, if any, personal experience with the images tagged in his project because the images were of historical nature. Building on these findings one could argue that the notion of context has more facets than asumed in the naive asumption that the context is simply a sum of sensory experiences that are available by virtue of being of being present at the resources location. Among these are the taggers personal experience with and tacit knowledge about the resource being tagged.

5.2.2 Activity related tags

According to Figure 14 one can see something interesting. It is clearly visible that participants in the control group focused on main activities, while participants in the experiment group preferred to focus on background activities.

These findings are very interesting as they show that users tagging real life resources at the location of the resource will tag significantly more background activities than the control group, and significantly less main activities. One possible explanation for these differences could be found in (Kelmen & Carey, 2007), who argue that our concepts of artifacts are deeply rooted in notions of design, much like our concepts of natural-kinds are rooted in notions of their essences. As examples of artifacts, then, buildings and other such sites (e.g. football fields) are often built for some original design: to house concerts, serve coffee, or play football games. It is these aspects, we suggest, that it is possible that the findings by Kelmen & Carey came into play when the users were to assign tags. The participants in the experiment group would have a "hands on" relation to the resource they were going to tag, thus enabling them to see what kind of background activities were possible at of each resource. The users in the control group, on the other hand, assign activity related tags directly related to the resource because they are starved on physical context, thus focusing on the original design of the resource to determine suitable activity related tags. Based on this it is possible to assume that the experiment group, because of the different properties experienced for each resource, applied activity related tags which might not be categorized as main activities, but were none the less activities performed at the location of the resource when tagged. This too shows signs that the notion of context has more facets than the physical relation existing between the tagger and the resource, and that these facets indeed do effect the types of tags applied.

5.2.3 Abstractions and location related tags

It was also suggested in section one, following the research described in (Mougenot, Aucouturier, Yamanaka, & Watanabe, 2010), that users who would be exposed to more physical stimulus would be subject to enter more emotional information. I have not found this to be true for the data gathered from the experiment neither for the general abstractions nor the categories for emotional abstractions. There are however a trend pointing towards users being physical present at the tagged resource are applying more emotional tags, but this is not statistical significant. With regards to location related tags there is a slight tendency in Figure 14 that users not physically present at the tagged location will tag the resource with a tag describing the resource's location, however this is not a statistical significant difference. From a knowledgebase building point of view this is neither an important category since location names can be gathered by querying a spatial database (Güting, 1994), or perhaps even more relevant, by aggreegating information from clustered tags within the same geographical area as described in (Naaman, Paepcke, & Garcia-Molina, 2003).

5.2.4 Contextual metadata

Looking back at the classification scheme in Section 2 we can see that contextual metadata was defined as metadata not directly related to resource. In a setting where users tagging resources were to contribute to a collaborative knowledge-base most of such tags would be of lesser value for the knowledge-base as a whole. E.g. the tag "it is raining" would not be very useful, as it would, sooner or later, stop raining. Looking at Figure 14 we can see that there is a slight difference in the percentile distribution between the control group and the experiment group for category 8, contextual metadata, but this difference is not statistical significant. We can, in other words, based on the data gathered in this experiment not conclude that users tagging while physically present at real life resources will apply more tags related to contextual metadata. Contextual metadata such as "it is raining" would not be very useful for other users if it were to be included in a collaborative knowledge-base. The fact that being physically present at the resource tagged does not affect the amount in any significant manner should be looked upon as a good thing, although the experiment shows that some contextual metadata will be submitted to the folksonomy regardless of the taggers physical location relative to the tagged object.

5.2.5 Number of tags

As stated in the introduction to Section 5 there was almost no difference in grand total number of tags between the control group and the experiment group. A Mann-Whitney U-test was performed, but as expected it did not show any significant differences.

Because the participants in the experiment group were performing their tagging outside they were extremely prone to changes in the weather. Because of this it was decided that weather observations should be noted while out so that one could compare and analyze the effect the weather had on the number of tags, thus ruling out any spurious relation between the weather and tagging. The weather observations were divided into one out of five categories, where one would be the best weather possible and five would be the worst, and based on this the total amount of tags applied for each user were tested for statistical significance. The test result proved that the number of tags did *not* differ significantly, thus allowing us to rule out any spurious relationship between weather and number of tags applied.

5.2.6 Additional findings

While observing the participants in the experiment group I noticed a rather usual pattern for all users. They would first start to tag a location with the tags first coming to mind, and then they would start to look around in search for inspiration for more tags describing the resource. This behavior was, rather logically, not present for the participants in the control group as they tagged while looking at representations of the resources in forms of images, thus looking around for inspiration would do no good. This observation could support that the users tagging real life resources are indeed exposed to more, and diverse, stimuli while tagging compared to users tagging representations of real life resources like images. Another indication coming from this could be that the tags entered before the user would look around were tags commonly agreed on as described in (Golder & Huberman, 2005), but as the tags entered in Digitur2 does not have time stamps it is impossible to verify this.

Another observation that was made when going through the tags after the control group had done their job was the fact that a name suddenly showed up in the set of tags from the control group, and this name was not present in the experiment group. What caused this was the fact that the experiment group was tested first, and then, after a few days the control group was tested. During the days in between a famous entertainer, Gustav Lorentzen, past away and a memorial ceremony was held in Grieghallen (Hjelle & Karlsen, 2010). This caused three out of ten in the control group to apply at least one tag related to this memorial ceremony. Although one can argue that a memorial ceremony can hardly be described as relevant information for

Grieghallen as a concert hall it goes to show that information about a resource can be updated extremely quickly when using users to tag resources, a fact that is also pointed out by Shirky (2008).

A third observation that was made both in the experiment group and the control group was that the users did not necessarily tag what they experienced while tagging, but rather a mix of personal knowledge about the resource and what they observed while tagging. This became special evident by one user who during the experiment said: " *I don't care what I see, I tag based on what I know about the resource"*. This observation can further back the argument that letting users tag resources can in fact be used as a way of updating a collaborative knowledgebase.

Another finding, although not very surprising, was that people who were used to tag would apply more tags than people who had not tagged before, as shown in Figure 16. When tested with a Man-Whitney U-test the two groups showed that the difference was in fact significantly different; U(21), $N_1 = 12$, $N_2 = 8$, $p= .037$.

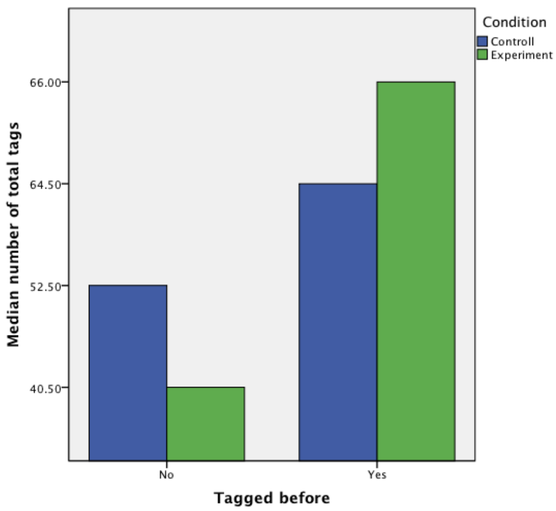

Figure 16: Differences in median number of total number of tags applied between users who had not tagged before and users who had

This could be because that the act of tagging is a habit that must be learned like any other. Another reason for the extreme difference could be that people who have tagged before are generally more "tech savvy", thus, not feeling limited by the problems with the touch interface mentioned in Section 4.

One last additional finding was that some users do not wish to contribute to the collaborative system at all as described in (Bouthors & Dedieu, 1999). Particularly one user in the experiment group did not apply very many tags, and when asked about this the participant responded that she did not like to expose herself on the web. In exact numbers she applied a total of 31 tags, compared to the mean number of 48,7 for the experiment group. When looking in the *types* of tags from this particular participant one can see another interesting fact, as she preferred applying tags in categories 1a, generic objects, and category 2, object descriptors. Both categories being general and not saying much about the person using them, completely in line with the descriptions by Bouthors & Dedieu. In the most direct sense auch a behaviour could reduce the chances of a potential knowledgebase emerging from the system to a minimum (Adams, 1999).

5.3 Evaluation of the research project

The classification of tags was done manually, thus prone to errors coming from wrong classification. However, the classification was done only by one person, leading to a reasonable stability in the classification based on the classification schema.

Digitur2 has some usability issues as mentioned in Section 3. Although these exist they were the same for all participants in the experiment. It was considered to implement changes after some of the experiment runs had been conducted, but this could have caused uncontrolled alterations of the experiment so it was decided to keep Digitur2 unchanged throughout the experiment.

The number of participants should preferably have been much larger, but due to time constraints in the research project it had to be kept at a relatively low number. A higher number of participants would have given more confidence that the findings are indeed of significance and the more samples one have the less each sample is likely to change the average values of the population.

Some participants also expressed some confusion about what exactly they were supposed to do with the tags. E.g. they were wondering *why* they were tagging and what the tags could be used for at al later stage. Some also said that because of this confusion they had problems deciding which tags to use. Looking back it could have been fruitful to give better information to the experiment participators about why they were supposed to tag the resources selected, although one can argue that not very many web-sites enabling users to tag resources explain their users why they should tag. By not telling my experiment participants why they should tag one can always argue that the experiment became more realistic.

No pilot study was conducted. This was due to time constraints, but in retrospect it is evident that some of the issues with the software and experiment procedure would have been uncovered during a pilot study, thus enabling me to fix thse issues before conducting the main experiment.

6. Conclusions and future work

Following the idea that users of a collaborative tagging system can be used to update a knowledgebase for a certain geographical area, as proposed in (Møller, Veres, & Næss, 2010) it seemed necessary to investigate what kind of dispersed information the users would in fact contribute to a possible knowledgebase. It was necessary to investigate this because being able to predict what kind of tags the users will apply in a given context can enable developers of knowledge-bases to design their solution with this in mind. This thesis investigated if being physically present at the resource being tagged would affect the kinds of tags applied.

6.1 Conclusions

Prior to conducting the experiment described in Section 4 I considered category 8, contextual metadata, to be the category of tags to be the one most affected by the taggers physical presence at the location of the resource. The rationale behind this was the notion that taggers being physical present by the resource would apply tags that were relevant to them right there and then, e.g. “it is raining”, but this proved not to be the case. In fact, when investigated I uncovered that presence at the resource location while tagging had no evident effect at all for tags categorized as contextual metadata. However, I uncovered that the notion of context is in fact broader than being constrained to the purely physical surroundings of a tagged resource and that a person’s experience with a given resource would significantly affect the types of tags used to describe it. This became evident when observing that taggers who experienced physical presence at the resource they tagged would use a significantly larger amount

of tags describing what can be categorized as background activities, while the control group would tend to focus more on what would be categorized as main activities related to the resource.
My proposed reason for this is the fact that users tagging images will, following the research of Kelmen & Carey (2007), focus on the original design of the resource to determine it's activities, while users tagging real world resources being exposed to more diverse stimulus compared to the users tagging images or other representations of real world resources, thus enabling them to explore activities related to the resource other than what the resource initially was designed for.

From a knowledgebase building point of view one would probably want to aggregate as many relevant tags as possible, and physical presence does not seem to affect the number of tags that is used to describe a resource. I did, however, uncover that there is a significant difference between numbers of tags applied for a resource when a user is used to using other collaborative tagging services compared to users not having prior experience with tagging. From this I argue that collaborative tagging systems must be designed in such a way that they encourages users to tag resources and supply a way of tagging requiring as little effort form the users as possible, thus maximizing the possibility that users will in fact use the system to apply tags.

Following earlier research on folksonomies I expected to find that the folksonomy created by the users of Digitur 2 would show signs of following a power-law curve. I was not able to prove this statistically, but it is thought to be because of the small size of the data set. It was observable that several people applied some of the same tags, thus indicating that over time the folksonomy could show signs of forming a power-law curve for each resource, but uncovering this would require further research.

6.2 Future research

Following the conclusions from this thesis that location can in fact play a part when users collaboratively construct a knowledgebase it becomes clear that the focal point for future research should be to investigate how this collaborative knowledge become an integrated part of domain expert knowledge-base. If this can be done, and shows fruitful results, one can utilize the masses of users to keep knowledge about a given domain up to date with much less effort than having a few domain experts maintaining the knowledge-base.

In terms of the software Digitur2 I believe that this could someday become a very useful tool for supplying relevant information to tourists visiting specific geographical locations. This was also reflected by some of the users participating in the experiment. It is clear that the Digitur2 described in this thesis is a very immature piece of software and would require more work before being available to the general public.

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APPENDICES

Appendix A - List of definitions

Appendix B - Use case

Appendix C - Letter of consent

Appendix D - Questionnaire

Appendix E - Images tagged by control group

Appendix A –List of definitions

Definition 1: *Resource is an object, location or artifact either digital or in the real life.*

Definition 2: *A tag is a freely chosen word or short sentence used to describe a resource.*

Definition 3: *Tagging is the process of applying freely chosen words or short sentences to a resource.*

Definition 4: *Collaborative tagging is when several users tag and share resources with each other.*

Definition 5: *Collaborative tagging system is a piece of software which lets the user of said system tag resources and share both tags and resources with other users.*

Definition 6: *A folksonomy is the result of collaborative tagging represented through the links that come to exist between the tags, resources and users in a collaborative tagging system*

Defintion7: *Geotagging is the process of assigning geographic identification metadata to a real life resource (*Torniai, Battle & Cayzer, 2007)

Appendix B – Use case for Digitur2

1. Use case name: "Use DigiTur2 as a interactive tourist guide"

David (42), Maria (38) and their two children Fernando (12) and Isabella (10) have left their home in Barcelona for a 3 weeks holiday in Norway.

Because David is rather "tech savvy" he would like to check out a new application called DigiTur2, which was recommended for him by the staff at the hotel where he stays.

2. Version

1.0

3. Goal

David should be able to get a list of sights to see which is of interest to him based on the profile he has created for DigiTur2. David should ten be able to tag these sights should he want to do so.

4. Summary

A tourist uses a mobile client as a tourist guide. He should get points of interest according to a user profile he has entered for the service. If no user profile is present he could get a standard selection of places to see. David should be able to apply text, in form of tags to the points of interest he can see on the screen of his phone

5. Actors

Person: David

Device: Arbitrary phone with JavaScript and data connectivity capabilities

Services: standard Internet connection through mobile phone, DigiTur2 server, RDF store

6. Preconditions

The user must be informed about the service and given the URL to access it.

7. Triggers

No triggers identified

8. Basic course of events

The user registers on a website giving him access to the service on his phone. Through the registration process one can register a specific user profile to customize the type of sights that will be shown in the application.

9. Alternative paths

The user skips the profile creation and logs in to the service on his phone. The application should now return a standard set of sights to see regardless of user preferences.

10. Post conditions

No specific post conditions after use of service.

11. Business rules

No business rules identified

12. Author and date

Thor Møller 16.11.09

Appendix C - Letter of consent

Letter of consent

My name is Thor Møller and I am writing a master thesis with the working title ”Analysis of user generated tags of location”. In the thesis I aim to analyzing tags describing various locations gathered from users to see if they differ from resource descriptors in a controlled vocabulary. If you have any questions to the experiment I can be contacted via tmo047@student.uib.no

Before we start you should be aware of the following:

-your participation is completely voluntary

-you are free to refuse to assign tags to any resource

-you are free to refuse to answer any questions during the experiment

-you are free to walk away from the experiment at all times

The survey is confidential and will only be viewed by me. All data gathered will be anonymized before shared with any third party e.g. my supervisor.
Excerpt from the survey can be used in my thesis, but will be fully anonymous.

By signing this form you affirm that you have read and understood it’s content.

Date:_________ Signature:____________________________

Appendix D - Questionnaire

Questionnaire

Participant / user #__________

Age:________

Gender:________

Nationality:_______________

Has used tagging services before (yes / no):_________

Specific tagging services used:____

____

Used geotagging services like Gowalla / Foursquare(yes / no):_____________

Specific geotagging services used:____

____

General comments:____

____

What is a tag?

A tag is simply a word you can use to describe a resource. Unlike folders, you make up tags when you need them and you can use as many as you like. The result is a better way to organize your resources and a great way to discover interesting things on the Web (Delicious, 2010).

Appendix E – Images tagged by the control group

	Resource name
	Museum garden
	Chaos coffee bar

	Lille Lungegårdsvann
	Musikkpaviljongen
	Faculty of Social Sciences

	Studentsenteret
	Apollon Music shop

	Grieghallen
	Natural history museum

	Bergen Kunsthall Landmark