

Flexible Services

CrossMedia D1.7

Service-independent user profiles as the source of personalization: Personalization in an Article Service

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Executive Summary

This deliverable summarizes the results of a case study carried out by VTT and Sanoma Magazines Finland (SMF). The case study utilized the service-independent user profile service previously developed by VTT and described in the deliverable 1.5 of the CrossMedia project.

In this case study we tested personalization in an article service, which included a selection of articles published by SMF during the years 2009 and 2010. The article service was tested with online users who were recruited via e-mail.

Users created their profiles by entering tags into a profile creation form. When creating their profiles users were able to choose whether they wanted to select tags from given vocabularies or to write keywords freely. User's tags were converted into a user profile, which was then matched to annotated articles. Finally, the articles that corresponded to the profile were recommended to the user.

From SMF's point of view the purpose of this study was to test if the magazine vocabulary is sufficient for future services and to examine if the vocabulary should be further developed or replaced by a general ontology. Furthermore, the aim was to examine what other metadata are needed for personalized online publishing.

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List of Acronyms and Abbreviations

KOKO	The Finnish Collaborative Holistic Ontology KOKO is a collection of Finnish core ontologies, which have been merged together
YSO	The Finnish General Upper Ontology YSO is intended to be the main ontology in Finland, interlinking domain and instance ontologies

1 Introduction

This report presents a case study of utilizing semantic user profiles for recommending articles. This case study consisted of several steps: selecting and annotating articles, choosing questions for profile creation, preparing the profile service, creating a questionnaire form, recruiting test users, and analyzing the user profiles and questionnaire entries.

The main focus of this study is on the ability to match annotated articles with users' profiles. The study also aims to define how the content should be described and annotated in order to be used in a personalized service. Finally, the aim is to establish a functional model for creating the links between tags and article annotations by examining the tag analysis and the relevancies of article recommendations.

2 Service-independent user profiles as the source of personalization

2.1 Article service

The service-independent user profiles developed by VTT were tested in an online article service. The concept of the article service was to recommend articles for users based on the interests described in their profiles. In this case study the users could create their own profiles by answering to a question form and/or by importing information from social media service profiles.

The article service contained a selection of articles published by Sanoma Magazines Finland during the years 2009 and 2010. A total of 606 articles were collected from the company's PDF archive and converted into Flash format to be viewed through the article service. The articles were annotated using magazine vocabulary, which had been linked to YSO and KOKO ontologies.

The articles were selected from *Me Naiset*, *Gloria*, *Glorian Koti*, *Kodin Kuvalehti*, *Matkaopas*, *Meidän Perhe*, *Hyvä Terveys*, *Sara*, *Sport*, *Suuri Käsiyö*, *Tiede*, and *Vauva* magazines. Also various types of stories were selected, including articles, reviews, presentations, interviews, feature stories, advisory articles, columns, instructions, recipes, pieces, reportages, tests and comparisons, and news.

2.2 User tests

The article service was tested with online users. Participants were recruited via e-mail: the aim was to gather at least 100 test users. The willingness to participate in the research seemed to be quite low and therefore we ended up sending almost a total of 20.000 invitation emails.

The article service was available from 28.5.2010 to 20.6.2010. Through that time the participants were able to use the service as many times as they wanted. After using the service the users were requested to answer to an online questionnaire for feedback.

2.3 User profiles and article recommendations

Both manual and automatic methods were provided for building the user profiles. Users could either create their semantic profiles by hand and/or by importing tags from their existing social media service profiles (*del.icio.us*, *Flickr*, *YouTube* and *Last.fm*). As social media profiles are not very common, their use was optional.

Manual profile creation was implemented as a friendship book form. The friendship book questions dealt with users' interests and future plans (Figure 1). Users could answer the questions either by entering words freely or by selecting among suggested tags. The service used KOKO, Freebase, Geonames and DBpedia knowledge bases as sources for tag suggestions.

Luo profiilisi

[Vastaa loppukyselyyn](#) | [Yksityiskohtaiset ohjeet](#) | [Kysy neuvoa](#) | [Kirjaudu ulos](#) [tiina@testi.fi]

Vapaamuotoinen
Sosiaaliset mediat

Anna kiinnostuskohteitasi omin sanoin tai ehdotuksien avulla (ilmestyy kun aloitat sanan kirjoittamisen). Käytä pilkkua antaaksesi enemmän kuin yhden avainsanan.

Omat sanat tai ehdotukset

Minua kiinnostaa (esim. luonto, matkustaminen, ruoanvalmistus, sisustus, tanssi, Afrikka...):

Asia, johon käytän paljon aikaa (esim. työ, opiskelu, lukeminen, perhe, shoppailu...):

Minulle ovat tärkeitä (esim. lapset, ystävät, parisuhde, ekologisuus...):

Kestoprojektini (esim. painonhallinta, säästäminen, remontti, puutarha...):

Haluaisin kokeilla seuraavia juttuja (esim. jooga, moottoripyöräily...):

Uusia asioita joita haluaisin oppia (esim. kutominen, ajankäyttö...):

Haaveiluni kohteita (esim. risteily, loma, häät, Thaimaa...):

Minulla on (esim. omakotitalo, kamerat, moottoripyörä, kesämökki...):

Hankintalistallani ovat (esim. autot, verhot, talo, kodinkoneet...):

Mieliohjelmiani TV:ssä (esim. luontoelokuvat, urheilu...):

Ikäviä asioita elämässäni (esim. sairaus, lapsettomuus, avioero...):

sort by label sort by site sort by usage sort by group random sort

Ranska luonto koti uni

Tallenna
Katso artikkelisuositellut

Tutkimuksen vaiheet

- Tee profiili kuvaamalla kiinnostuksesi kohteet suomeksi, ruotsiksi tai englanniksi käyttäen yhtä tai useampaa seuraavista tavoista:
 - Valitse ehdotettu sana – ehdotuksia tulee, kun olet kirjoittanut sanasta vähintään kolme kirjainta. Suosittelemme valitsemaan näistä mikäli sopiva löytyy.
 - Kirjoita omin sanoin. Laita sanan perään pilkku, jonka jälkeen voit alkaa kirjoittaa seuraavaa sanaa.
 - Hyödynnä joissakin sosiaalisen median palveluissa olevia tietojasi (Välilehti: Sosiaaliset mediat)
 - Kerran valitun sanan voi poistaa napsauttamalla punaista täplää.
- Muokkaa profiilia, kunnes se kuvastaa kiinnostuksesi kohteita ja saat vähintään 20 suositusta.
- Tutustu suositeltuihin artikkeleihin ja arvioi niiden osuvuus.
- Vastaa loppukyselyyn sen jälkeen, kun olet arvioinut vähintään 20 suositeltua artikkelia.

Profiilipalvelun idea

Omat kiinnostuksen kohteet on kuvattu yhdessä palvelussa, josta ne voi siirtää halutessaan muihin palveluihin personoitujen palvelujen tuottamiseksi.

Esimerkinä aikakauslehtisällöt

Tässä kokeessa profiilia käytetään aikakauslehtisällötjen suosittelemiseen.

Figure 1. Profile creation form

After entering tags and saving a profile the service visualized the created profile as a tag cloud, in which the user could further change the meanings and relevancies of tags if necessary. Users were able to modify their profiles at any stage of testing, although it was pointed out that the profile should not be modified after user starts rating the recommendations.

After a user had created a profile she was able to start viewing and rating the articles (Figure 2). Users could open an article by clicking its title or thumbnail in the article recommendation list. After viewing an article users were requested to rate whether the article matched their interests or not by using the scale from -2 (not at all relevant) to 2 (highly relevant) as shown in the figure below.

GLORIA GLORIANkoti **hyväterveys** **kodin matka** PERHE McNaiset SARA. **sport** **SuomiKävely** **ITÄT** **VAUVA**

Suosittelut

Kiinnostavatko nämä artikkelit sinua?
Arvioi suositusten osuvuus. Arviosi tallentuvat aina kun teet valinnan ilman erillistä tallennusta.

Takaisin profiilisivulle








	Jäätikkö opettaa SARA - 20.1.2010, sivuja 8 Reportaasi [aktiiviloma, omatoimimatka, ympäristö, Grönlandi]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu
	Safarille suistoon Matkaopas - 19.1.2010, sivuja 7 Esittely [lomamatkat, luonto, Botswana]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu
	Säkkipillejä ja ostereita Matkaopas - 22.9.2009, sivuja 5 Esittely [lomamatkat, Ranska]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu
	Meille vai teille? Matkaopas - 22.9.2009, sivuja 6 Esittely [majoitus, Ranska]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu
	Täällä syntyi lajien synty Matkaopas - 21.4.2009, sivuja 6 Esittely [lomamatkat, luonto, Ecuador]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu
	Uuden aallon Biarritz Matkaopas - 3.3.2009, sivuja 6 Esittely [rantaloma, Ranska]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu
	Lähtökuopissa Me naiset - 21.1.2010, sivuja 2 Esittely [lomamatkat, hyötytieto]	<input type="radio"/> -2 <input type="radio"/> -1 <input type="radio"/> 0 <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> Ei arvioitu

Figure 2. Article recommendation view

The rating option allowed users to evaluate the relevancy of each recommended article during the use of the article service. In addition, the users were requested to answer an online questionnaire after testing. Chapter 3 presents the questionnaire results.

3 Results and analysis

3.1 Profile service

The user test reached a total of 119 persons who answered to the final questionnaire after testing. Majority of the responders (116 users) were women and over three-quarters were aged between 25 and 44 years (Table 1). The questions of the questionnaire dealt with the profile service, profile creation, social media profiles and article recommendations. The questionnaire comprised ratings and free-form questions.

Table 1. Users' age distribution

Age	n	Percentage
under 18 years)	0	0,00%
18 - 24 years	8	6,72%
25 - 34 years	61	51,26%
35 - 44 years	30	25,21%
45 - 54 years	15	12,61%
55 - 64 years	3	2,52%
over 64 years	2	1,68%
Yhteensä	119	100%

As can be seen in Figure 3 over half of the users answered that the profile service was on some level interesting and useful, but not all of them agreed that they would be likely to use such service. In textual answers many users had doubts about privacy and security. There were also concerns that the profile information would be used for direct marketing purposes.

	Completely disagree (Value: 1)	Partly disagree (Value: 2)	Neither agree nor disagree (Value: 3)	Partly agree (Value: 4)	Completely agree (Value: 5)	Total
The service seems interesting. (avg: 3,55) (Palvelu vaikuttaa kiinnostavalta).						100 %
The service seems useful. (avg: 3,50) (Palvelu vaikuttaa hyödylliseltä.)						100 %
I would probably use the service. (avg: 3,28) (Todennäköisesti käyttäisin itse palvelua.)						100 %
Total	6 %	15 %	24 %	42 %	14 %	

Figure 3. How do you feel about a profile you could maintain in one place and utilize in different services to receive personalized content recommendations?

Mitä ajatuksia sinussa herättää mahdollisuus ylläpitää profiiliasi yhdessä paikassa ja hyödyntää sitä eri palveluissa saadaksesi juuri sinulle suunnattuja sisältösuosituksia?

The majority of users considered the profile creation (Figure 4) to be quite easy. However, about a quarter of responders found the profile creation difficult. When examining the given free-text answers it was found that the problems in profile creation related mostly to the automatic tag suggestions, which will be discussed later in Section 3.2.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Very difficult (Erittäin vaikealta)	3	2,52%					
Fairly difficult (Melko vaikealta)	28	23,53%					
Neutral (Ei helpolta eikä vaikealta)	22	18,49%					
Fairly easy (Melko helpolta)	52	43,70%					
Very easy (Erittäin helpolta)	13	10,92%					
Don't know (En osaa sanoa)	1	0,84%					

Figure 4. Was it challenging to create a profile?
Miten vaikealta profiilin luominen tuntui?

In most cases it was easy for users to express their interests (Figure 5). According to the given free feedback, some users thought there weren't enough examples, while others had so many interests that it was laborious to write them all down. There was also a comment that it was difficult to think of an answer to every question and that therefore some of the answers were forced. Therefore, the instructions should have more clearly informed that users didn't have to answer to all questions.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Very difficult (Erittäin vaikealta)	3	2,52%					
Fairly difficult (Melko vaikealta)	25	21,01%					
Neutral (Ei helpolta eikä vaikealta)	17	14,29%					
Fairly easy	57	47,90%					

(Melko helpolta)			
Very easy (Erittäin helpolta)	16	13,45%	
Don't know (En osaa sanoa)	1	0,84%	

Figure 5. How challenging was it to name your interests?
Kuinka vaikealta omien kiinnostuskohteiden nimeäminen tuntui?

As was expected, a majority of the users was not willing to pay for a profile service (Figure 6). However, 18 of our responders answered they might be willing to pay some usage fee.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
No (En)	87	73,11%					
Single payment less than 1 € (Kertamaksu alle 1 €)	5	4,20%					
Less than 1 € / month (Alle 1 € / kk)	6	5,04%					
1-3 € / month (1-3 € / kk)	7	5,88%					
3,10-10 € / month (3,10-10 € / kk)	0	0,00%					
Don't know (En osaa sanoa)	14	11,76%					

Figure 6. Would you be willing to pay for a profile that you could manage and use in various services?
Olisitko valmis maksamaan tällaisesta profiilista, joka on omassa hallinnassasi ja hyödynnettävissä eri palveluissa valintasi mukaan?

The concerns for privacy and security that emerged from free feedback were also visible in the questions concerning users' online behaviour (Figure 7). A large majority of the responders agreed that privacy is important for them and that they do consider carefully before writing anything online for public. Most of the responders answered that they don't want to expose their identity nor share their opinions online. However, over a third (36.1%) of the responders use their own names when online.


	Does not describe me at all (Ei kuvaa ollenkaan) (Arvo: 1)	Describes me a little (Kuvaa aika vähän) (Arvo: 2)	Describes me quite well (Kuvaa melko hyvin) (Arvo: 3)	Describes me very well (Kuvaa erittäin hyvin) (Arvo: 4)	Don't know (En osaa sanoa) (Arvo: 0)	Total
I appear online with my name. (avg: 2,21) (Esiinnyn verkossa omalla nimelläni.)						100 %
I like to share photos of myself online. (avg: 1,62) (Julkaisen mielelläni kuvia itsestäni.)						100 %
I share links publicly to others. (avg: 1,88) (Jaan verkosta löytämiäni mielenkiintoisia linkkejä julkisesti muille asiasta mahdollisesti kiinnostuneille.)						100 %
I leave ratings of restaurants etc. in web sites. (avg: 1,44) (Jätän arvosteluja ravintoloista yms. kohteista tähän tarkoitetuilla sivustoilla.)						100 %
I consider carefully who are able to see my content online. (avg: 3,38) Mietin aina huolellisesti, kuka saa/voi nähdä verkkoon kirjoittamani tekstin.						100 %
Privacy is important to me. (avg: 3,58) Yksityisyys on minulle tärkeää.						100 %
Total	30 %	25 %	21 %	22 %	2 %	

Figure 7. How well do these arguments describe your attitude or behaviour?
Miten seuraavat väitteet kuvaavat suhtautumistasi tai käyttäytymistäsi?

3.2 Automatic tag suggestions

When a user started to write a tag, she received tag suggestions from KOKO, Freebase, Geonames and DBpedia. It was also recommended, although not necessary, to use these suggested tags instead of free-text concepts.

Nearly two thirds (64 %) of all concepts used in profiles were selected among the tag suggestions. About 90 percent of them were selected from KOKO and the rest from Freebase, Geonames and DBpedia. Based on the free feedback some users found the automatic tag suggestions rather confusing. For them it seemed to be difficult to work with given vocabularies because of the grammar (singular/plural) and because the

words were given in different languages (Finnish, Swedish, English). It was also found that the tag suggestions were slow to use and users had to wait for the suggestions.

Despite of that, most of the users experienced the suggestions quite positively. In our survey over a half (56.3 %) of the users rated the tag suggestions fairly or very easy to use while about a quarter (25.2 %) considered them fairly or very difficult to use (Figure 8).

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Very difficult (Erittäin vaikeaa)	7	5,88%					
Fairly difficult (Melko vaikeaa)	23	19,33%					
Neutral (Ei helppoa eikä vaikeaa)	22	18,49%					
Fairly easy (Melko helppoa)	43	36,13%					
Very easy (Erittäin helppoa)	24	20,17%					
Don't know (En osaa sanoa)	0	0,00%					

Figure 8. Was it easy to use the tag suggestions to describe your interests?
 Kuinka helppoa oli käyttää valmiita ehdotuksia kiinnostuksen kohteiden kuvaamisessa?

Almost two thirds (64.7 %) of the users answered that it was fairly or very easy to find the desired term among the tag suggestions (Figure 9) while 17.7 percent experienced it fairly or very difficult. Finally, 58.8 percent found the suggestions useful (Figure 10) and 18.5 not useful.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Very poorly (Erittäin huonosti)	6	5,04%					
Quite poorly (Melko huonosti)	15	12,61%					
Neutral (Ei hyvin eikä huonosti)	21	17,65%					
Fairly well (Melko hyvin)	61	51,26%					
Very well (Erittäin hyvin)	16	13,45%					

Don't know (En osaa sanoa)	0	0,00%	
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Figure 9. Did you find what you were looking for from the tag suggestions?
Löytyikö valmiista ehdotuksista, mitä tarkoittit?

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Very useless (Erittäin hyödyttömiä)	6	5,04%					
Fairly useless (Melko hyödyttömiä)	16	13,45%					
Neutral (Ei hyödyllisiä eikä hyödyttömiä)	26	21,85%					
Fairly useful (Melko hyödyllisiä)	56	47,06%					
Very useful (Erittäin hyödyllisiä)	14	11,76%					
Don't know (En osaa sanoa)	1	0,84%					

Figure 10. How useful were the tag suggestions?
Kuinka hyödyllisiä valmiit ehdotukset olivat?

Based on users' feedback they had some difficulties during profile creation when entering tags. For example, they commented that the profile service didn't accept all tags or removed some of the given tags when saving the profile, as in the following examples:

"Vaikka ohjeissa oli, että "kuvaile omin sanoin", ei ohjelma huolinut omia sanoja tai vain osan niistä. Valmiista ehdotuksista ei löytynyt kaikkia haluamiani sanoja"

"välillä toiminnot (kirjoitus) jumitti; painikkeet ym. eivät toimineet. jotkin jo kirjoittamani sanat eivät näkyneet, ja ne piti kirjoittaa uudestaan?! kaikkia kohtia ei päässyt korjaamaan, jos tuli vahingossa kirj.virhe tai väärä sanavalinta."

Some of the problems that occurred with tag suggestions seemed to arise from not reading the instructions. For example, some users had created their profiles in whole sentences instead of tags. This was problematic, as a comma was supposed to be used to store a free-text tag; when a user inserted a comma, the text that had been written so far was saved as a tag.

Furthermore, at least one user seemed to think that the automatic tag suggestions represented the topics of the articles that were available. For the question about how tag selection could be made easier she answered:

”Enemmän esimerkkejä, joista valita, ja voisi kirjoittaa myös sanoja, joista ei sillä hetkellä ole artikkeleita.”

The tag suggestions were also criticized to be too limiting. Some users didn’t seem to know that there was a possibility to write words freely as well; they gave feedback about wishing to be able to insert any words, and not just select one among the automatic tag suggestions.

3.3 Article recommendations

According to the questionnaire more than a half of the responders thought that the article service was fairly or very fun to use (Figure 11) and that the service concept was at least quite interesting (Figure 12). Some users suggested that there should be an option to select the interest areas among predefined alternatives, for example by selecting them from a list or check box. This was also seen in some comments:

”kömpelö ohjelma, nopeammin löydän tiedon itse googlaamalla. Sinänsä hyvä jos olisi enemmän aikaa lukea netistä artikkeleita”

”sekava, ei hyvä nykyisessä muodossa, hankala käyttää. Ihan kiva, että saa lukea artikkeleita, mutta ne voisi valita ihan itse, jos ne olisi luokiteltu jotenkin.”

However, the purpose was not to provide an article search tool but to provide a way to discover articles that might interest the user.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Not at all (Ei lainkaan hauskaa)	1	0,84%					
Not much (Vain vähän hauskaa)	12	10,08%					
Neutral (Siltä väliltä)	25	21,01%					
Quite much (Melko hauskaa)	40	33,61%					
Very much (Erittäin hauskaa)	25	21,01%					
Don't know (En osaa sanoa)	16	13,45%					

Figure 11. Did you enjoy going through the recommendations based on your profile?
Oliko hauskaa tutustua oman profiilin pohjalta ehdotettuihin artikkeleihin?

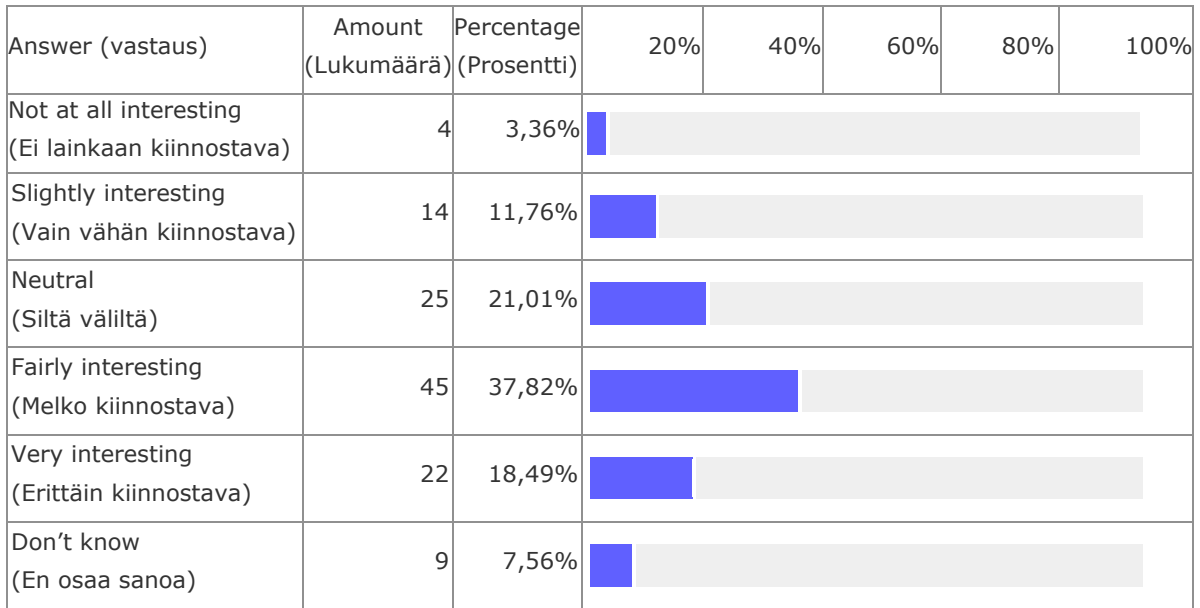


Figure 12. How interesting do you consider a service that recommends you articles based on your interests?
Miten kiinnostavana pidät palvelua, joka suosittelee sinulle artikkeleita omien kiinnostuksenkohteitasi pohjalta?

Over a half of the responders experienced that the content fit to their interests fairly or very well (Figure 13). Only 7.6 percent thought that the recommended articles corresponded to their interests weakly or not at all.

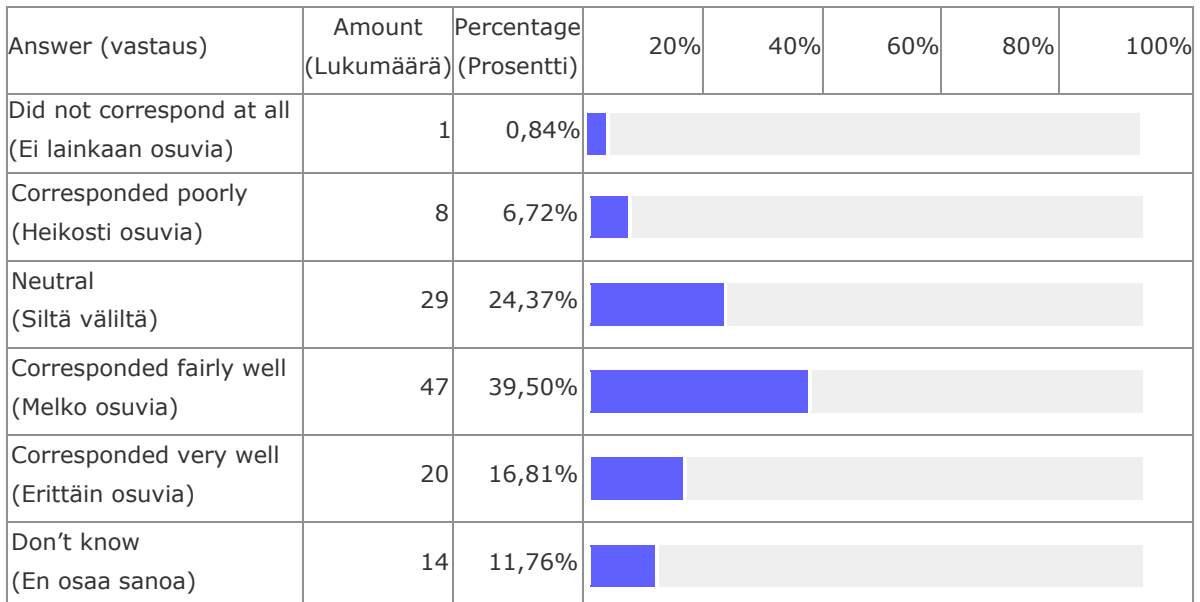


Figure 13. How well did the recommended articles correspond to your interests?
Mikä yleisvaikutelma sinulle syntyi suositeltujen artikkelien osuvuudesta kiinnostuksesi kohteisiin?

As was presumed, the users were generally not willing to pay for an article service (Figure 14). When compared to Figure 6, about 70 percent of the responders were not willing to pay neither for the article service nor the profile itself.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
No (En)	83	69,75%					
Single payment less than 1€ (Kertamaksu alle 1 €)	4	3,36%					
Less than 1 € / month (Alle 1 € / kk)	8	6,72%					
1-3 € / month (1-3 € / kk)	9	7,56%					
3,10-10 € / month (3,10-10 € / kk)	1	0,84%					
Don't know (En osaa sanoa)	14	11,76%					

Figure 14. Would you be willing to pay for a service in which you would be offered articles that correspond to your profile?
Olisitko valmis maksamaan palvelusta, jossa sinulle tarjottaisiin profiilisi mukaista artikkelisisältöä?

Statistical analysis of the article recommendations

Users were requested to rate the recommended articles by using the scale from -2 to 2. These ratings were analysed statistically.

There were in total 8116 user made article recommendation rating. 74 % of these ratings fitted well (rating 1 or 2) or moderately (rating 0) to the interests of the users. 26 % of recommendations were not successful and users gave negative ratings. Table 2 shows these ratings in detail.

Table 2. The percentage of the different rating values from the total amount of users' given ratings.

Rating	Percentage of all ratings
2	29
1	29
0	16
-1	12
-2	14

The average of all given ratings is 0,48 with 1,37 standard deviation. When counting the averages of the ratings of single users, 12 % of them have a negative average. This means that they had more unsuccessful recommendations than successful ones. 87%

of users had a positive average of their ratings. 40% of these users had average that was equal to or bigger than one, meaning that the recommended articles matched well to the interests of the user.

Recommendation algorithm calculates a rank value to the recommended articles and they are ordered based on this value. It is assumed that the higher the rank value is, the better the article match to the user’s interests. The rank value is determined based on distance of semantic relationships between a user’s interest and metadata of articles. If the rank is one or higher, the recommendations are assumed to match well with a user’s interests. If the value is less than one then the match has been found based on the hierarchy of the semantic concepts. The smaller the rank value is, the less it is assumed to match to the user’s interests. The rank values of recommended articles and the ratings that users gave to the articles were compared and analysed.

48% of the evaluated recommendations were such that the rank was high and the ratings were positive (0,1,2). 11 % of rated recommendations had a high rank value (≥ 1) but the recommendations got negative ratings from users. This indicates that although the subject of the articles matched quite well with the user’s interests, the subject area (e.g. family) can be so diverse that not all articles match the user’s interest. There were also some terms (e.g. travelling, nature) where the structure of the magazine vocabulary and recommendation logic did not work as expected causing the false recommendations.

25% of the recommendations that had a low rank value (< 1) got positive (0, 1 or 2) ratings from users. 17 % of the rated recommendations had a low rank value (< 1) and also got negative feedback from users. These numbers indicate that using semantic relations in recommendations brings additional article recommendations that are of interest to the users. However, it is important to consider carefully how these deep semantic relations should be used in recommendations so that recommended articles would still be of interest to the user.

We also analysed which tags caused these differences between rank values and user given ratings. Table 3 shows the list of top ten tags relating to these different cases of the different combinations of rank values and user given ratings. The lists of the top ten tags are almost the same in all cases. This supports the mentioned aspects of too general terms and recommendations based on the semantic relations.

Table 3. Top ten tags were relation of the rank value of recommendation and user given ratings varies.

High rank value and good user ratings	High rank value, but low user ratings	Low rank values but, high user ratings
perhe (family)	matkustaminen (travelling)	perhe (family)
lapset (children)	luonto (nature)	lapset (children)
sisustus (Interior design)	perhe (family)	terveys (health)
luonto (nature)	lapset (children)	matkustaminen (travelling)
matkustaminen (travelling)	loma (vacation)	sairaus (illness)
loma (vacation)	sisustus (Interior design)	painonhallinta (weight control)

ruoanvalmistus (food preparation)	matkailu (travel)	lomailu (holidaying)
painonhallinta (weight control)	painonhallinta (weight control)	luonto (nature)
terveys (health)	ruoanvalmistus (food preparation)	ruoanvalmistus (food preparation)
Parisuhde (couple relationship)	terveys (health)	loma (vacation)

Linear Pearson's correlation value was calculated between the user given rating values for recommended articles and the rank values calculated by our recommendation algorithm. A small positive linear correlation was found ($r=0.23$). One reason for not having a higher correlation is that not all articles are equally interesting to a person even though the topic of the article is included in her interests.

3.4 Utilization of social media profiles

In addition to the friendship book form, users had an option to import tags from their existing social media services: del.icio.us, Last.fm, Flickr.com and YouTube.com. In this study users utilized their social media service profiles quite rarely (Figure 15). Most of the users (81.5 %) didn't have profiles in the given social media services.

17 users utilized their social media profiles. Only four of them thought that the analysis of imported tags represented their interests fairly well. Twice as many users answered that the correspondence to their interests was fairly or very limited.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
Did not correspond at all (Erittäin suppeasti)	5	4,20%					
Corresponded poorly (Melko suppeasti)	3	2,52%					
Neutral (Siltä väliltä)	5	4,20%					
Corresponded fairly well (Melko kattavasti)	4	3,36%					
Corresponded very well (Erittäin kattavasti)	0	0,00%					
I don't have a profile in these services (Minulla ei ole tunnuksia)	97	81,51%					
I didn't try (On tunnukset, mutten kokeillut)	5	4,20%					
Total (Yhteensä)	119	100%					

Figure 15. If you have a Delicious, Last.fm, Flickr or YouTube profile and you used it, how well did the analyzed profile correspond to your interests?
 Jos sinulla on tunnukset Delicious, Last.fm, Flickr tai YouTube-palveluihin ja hyödynsit niitä, niin miten hyvin analysoitu profiili kattoi kiinnostuksesi kohteita?

Users didn't seem to be very interested in saving their online actions into their profiles (Figure 16). There seemed to be a lot of uncertainty, since over a half of the responders answered "maybe" (33.6 %) or "don't know" (24.4 %). Only 8 of the 119 users answered that they would like to be able to share their actions. Based on the free comments users were not willing to share their information because they had concerns about privacy and security issues.

Answer (vastaus)	Amount (Lukumäärä)	Percentage (Prosentti)	20%	40%	60%	80%	100%
No (Ei)	42	35,29%					
Maybe (Ehkä)	40	33,61%					
Yes (Kyllä)	8	6,72%					
Don't know (En osaa sanoa)	29	24,37%					

Figure 16. Would you like to create and maintain your profile based on your actions in Web services (content you have created and shared, comments, tags, playlists, groups)?
 Haluaisitko, että pystyisit luomaan ja ylläpitämään profiiliäsi sen pohjalta, mitä olet tehnyt web-palveluissa (esim. mitä sisältöjä olet luonut ja jakanut, mitä kommentoinut, tagit, soittolistat, millaisiin ryhmiin kuulut)?

When asked which social media profiles users would want to use in addition to the given social media services del.icio.us, Last.fm, Flickr.com and YouTube.com, users nominated Facebook, LinkedIn, browser bookmarks and Shelfari (or similar social network for virtual bookshelves).

When asked reading habits of websites we found that over a half of the responders read news sites, newspapers and Facebook daily (Figure 17). Free sheets (ilmaisjakelulehti) were also popular, as 62 percent read them at least few times a week. Magazine websites were visited less frequently; 21.9 percent visited magazine sites at least few times per week, while 38.7 percent visited never or less often than monthly.

	Almost daily (Lähes päivittäin) (Arvo: 5)	Few times per week (Muutamia kertoja viikossa) (Arvo: 4)	Few times per month (Joitakin kertoja kuukaudessa) (Arvo: 3)	Less than monthly (Harvemmin kuin kerran kuukaudessa) (Arvo: 2)	Newer (En koskaan) (Arvo: 1)	Dont know (En osaa sanoa) (Arvo: 0)	Total
Finnish newspapers. (avg:							100 %



Figure 17. How often do you read/visit these newspapers / websites?
 Kuinka usein luet seuraavia lehtiä / vieraillet seuraavilla sivustoilla?

The responders did read quite a lot print magazines. Over a half of them (51.7 %) subscribed to three or more magazines (Table 2) and only one responder did not subscribe to any magazine. In addition, the majority (51.3 %) had bought at least one single copy during the last month (Table 3).

Table 4. Magazine subscriptions (Kuinka monta tilattua aikakauslehteä sinulle tulee tällä hetkellä?)

Subscriptions	Answers	Percentage
0	1	0,85%
1	21	17,80%
2	35	29,66%
3	25	21,19%
4	17	14,41%
5	9	7,63%
6 tai enemmän	10	8,47%
Yhteensä	118	100%

Table 5. Single copy purchases per month (*Kuinka monta aikakauslehtien irtonumeroa ostit viimeksi kuluneen kuukauden aikana?*)

Single copies	Answers	Percentage
0	57	48,72%
1	28	23,93%
2	18	15,38%
3	6	5,13%
4	3	2,56%
5	1	0,85%
6 tai enemmän	4	3,42%
Yhteensä	117	100%

Figure 18 presents users' reading habits. According to the answers, the most common motives for reading magazines are relaxation and entertainment. Articles also provide useful ideas for everyday life as well as interesting life stories. 67.2 percent agreed that magazine content is quite or very reliable.

	Does not describe me at all (Ei kuvaa ollenkaan) (Arvo: 1)	Describes me a little (Kuvaa aika vähän) (Arvo: 2)	Describes me quite well (Kuvaa melko hyvin) (Arvo: 3)	Describes me very well (Kuvaa erittäin hyvin) (Arvo: 4)	Don't know (En osaa sanoa) (Arvo: 0)	Total
I read magazines to pass the time. (avg: 3,27) (<i>Luen aikakauslehtiä ajankuluksi</i>)						100 %
By reading magazines I get information about current interests. (avg: 3,35) (<i>Aikakauslehtiä lukemalla saan helposti tietoa ajankohtaisista ilmiöistä</i>)						100 %
Magazines give me an opportunity to read about life stories and choices. (avg: 3,35) (<i>Aikakauslehtiä lukemalla voin tutustua kiinnostavien ihmisten elämäntarinoihin ja -valintoihin</i>)						100 %
When reading a magazine I feel like sharing experiences with other readers. (avg: 2,34) (<i>Aikakauslehteä lukiessani tunnen jakavani kokemuksia lehden muiden lukijoiden</i>)						100 %




kanssa)		
Magazines give me useful ideas for my everyday life. (avg: 3,24) (Saanaikakauslehdistä hyödyllisiä ideoita ja vinkkejä arkielämään)		100 %
Magazine content is trustworthy. (avg: 2,76) (Aikakauslehdissä olevaan tietoon voi luottaa)		100 %
I relax by reading magazines. (avg: 3,63) (Rentoudun lukemalla aikakauslehtiä)		100 %

Figure 18. How well do these statements describe your to read magazines?
 Miten hyvin seuraavat väitteet kuvaavat tapaasi lukea ja viihtyä aikakauslehtien parissa?

As magazines are used more for entertainment than for information retrieval, magazine content could suit well for a recommendation service. An online recommendation service could also provide sense of community and features of social media, whereas print magazines have not made users feel like they would be sharing experiences with other readers.

4 Findings and conclusions

4.1 Profile creation form

The user profiles were created using a friendship book type of form. Although test users created profiles with a wide range of tags, some of the tags were quite difficult to use in order to generate relevant article recommendations. For instance, the tag field Favourite TV-programs produces a bit problematic tags. The idea with the field was that the tags could also be used for finding more general user interests: if a user is interested in nature documents, we could assume that she is interested in nature in general. Similarly, if a user tags “sports” as her favorite TV-program, she would get articles relating to sport. These are however very general and high level interests, and lead easily to wrong recommendations. For example, the interest in sport programs lead to recommending articles about exercising. The magazine articles included some articles relating to TV or movies, but there were not that many articles of a specific genre or individual programs. Also the magazine vocabulary has only limited support for recommendations based on genre (e.g. children’s culture). In order to utilize this information better in recommendations, the methods for using the Linked Data should be developed further.

The experiences gained in this test, can be used to improve the ways people are asked about their interests. The last question concerning unpleasant issues in the user’s life was a bit problematic relating to using semantic links. For example, terms like “abortion”, “childlessness” and “miscarriage” should not lead to recommendation of family-related articles. Similarly the tag “unemployment” should not lead to a recommendation of articles concerning everyday work life. The question is essential and there are lots of articles about difficult issues, such as diseases, unemployment, childlessness, and insomnia, but the recommendation algorithms should not expand these negative concepts as much as more neutral or positive concepts.

As was shown in Figure 1, some tag examples were given in the profile creation form in order to help users build their profiles. These example tags were used very much in the user profiles and they may have been too leading for the users. Also the same or very close concepts were described using different tags (e.g. avioero and avoero; painonhallinta and laihdutus).

4.2 Annotation and recommendation

One of the aims of this study was to examine the adequacy of the magazine vocabulary for a personalized content service. In this case study, the articles were annotated using the magazine vocabulary, which included links to KOKO. The concepts of the magazine vocabulary were analysed with VTT’s semantic tag analysis and links to other semantic databases were added as well. This enables utilizing of users tags that were defined with the help of tag suggestions from different databases. The profile creation form offered concepts from KOKO, DBpedia, Freebase and Geonames and allowed free text entries as well.

User profiles were created using a profile creation form. The tags inserted into profiles were analyzed in order to find matching articles. The analysis involved examining tag relevancies and retrieving the hierarchical and associative relations of tags. The direct links between the magazine vocabulary and KOKO as well as the hierarchy of KOKO concepts were used to find matches of a user's interest and related concept in the magazine vocabulary. When a match was found, articles annotated with this concept were recommended. Recommendations were also made based on the hierarchy of magazine vocabulary.

The basic idea of linking user's interests to the magazine vocabulary with help of external general ontology and Linked Data worked fine. When examining the recommendations we can see that both the magazine vocabulary and KOKO have their advantages and disadvantages. Problems were mainly caused by using the vocabulary hierarchies in the recommendation logic.

In the magazine vocabulary, some of the hierarchy problems are obvious, such as the person-related roles (babies, children, adolescents, women, men, young people, siblings and relatives) that are located at the same level of the hierarchy. Therefore, if a user tagged "babies" into her profile, the service recommended articles that had the keyword "persons".

Also the concepts that connect two different topics into one and the same class (e.g travelling and nature) caused problems in recommendations. If a user has indicated that she is interested in "travelling", the recommendations were extended based on the hierarchy of the vocabulary and a user got also recommendations relating to nature and its sub classes like recycling. And vice versa, the "nature" tag caused recommendations relating to "travelling". There are some articles that are related both travelling and nature, but many of them are not. Several users who had more negative ratings than positive had used these concepts for expressing their interests.

When studying the recommendation logic and utilization of KOKO hierarchies it was found out that the hierarchical relationships between terms were sometimes problematic. For example the tag "death" has three different broader classes; events, change and change related to natural science. As explained earlier, KOKO hierarchy was used for finding matches between the user's interest and the concept of the magazine vocabulary. Because the concept of KOKO "events" was linked to the concept of the magazine vocabulary "events" user got recommendations relating to events like "competitions". In one case a user was recommended an article relating to competitions, luckily she was not aware that this recommendation was made based on the tag "death" and the recommended article happened to be of interest to her anyway. Similarly the tag "disputes", which was used several times in profiles as a user's sorrow, was under the concept "events" in the hierarchy of KOKO and thus produced recommendations of articles concerning various events and celebrations. The links between KOKO and the magazine vocabulary should be checked more carefully in the future to make sure that the semantics match the intended meaning. Here a more correct link from the magazine concept to KOKO would have been the

concept “organized events” preventing the false recommendations on these particular cases.

Yet another example of this is the tag “illness”. The concept “illness” in KOKO was connected to the “illness” concept of the magazine vocabulary through the related concept “diseases”. In making the recommendations, the KOKO concept “illness” was also extended to its broader classes and an additional match to the magazine vocabulary was found via the concept “phenomena”. If a user inserted the tag “illness” into her profile, the analysis returned also articles with the keyword “phenomena”, which is, however, the narrower class of the concept “art, culture and entertainment” in the magazine vocabulary. This “phenomena” concept was directly linked to KOKO’s “phenomena” concept, but a more appropriate link to KOKO would have been KOKO’s “cultural phenomena” concept.

Tags that describe unpleasant issues in user’s life were problematic in some cases. For instance, terms “abortion”, “childlessness” and “miscarriage” should not lead to recommendation of family-related articles. The problems with these terms were caused by both the magazine vocabulary and KOKO. In the magazine vocabulary, the concept “childlessness” was linked to family-related terms. We detected this issue before starting the tests and in order to avoid any family-related recommendations we added rules to the recommendation logic. The term “miscarriage” was more complicated: it was first linked to KOKO’s “pregnancy” and from there further to “pregnancy”, “family” and even “breastfeeding” in the magazine vocabulary. This produced inappropriate article recommendations and raised an idea that there should be some special method for managing negation. It should also be considered whether there should be a way to exclude inappropriate annotations, i.e. to allow annotations with negation “NOT” in addition to “AND” and “OR”. The unpleasant issues were given in a certain field that asked about unpleasant issues in the user’s life, and one solution is to utilize this context information, and not to extend these tags as much as others in the recommendation logic.

In order to avoid misinterpretations the structure of the magazine vocabulary should be revised. In some cases it is ok that the analysis leads to the opposite term: for example the term “illness” can be lead to articles about “health care”. Still, it should be considered how to handle articles about grief or sorrow, such as articles about surviving from a relative’s death. However, it seems obvious that the recommendations of the unpleasant issues should not be as far-reaching as with other questions, i.e. there should not be as deep links between concepts. The magazine vocabulary could additionally define more relations between concepts, for example indicate a link between “weight control” and “diets”.

When analysing the unsuccessful recommendations we also found out that many of the recommended articles were in the correct subject area based on the user’s tag, but not all articles relating to that subject were of interest to the user. Some of the subjects had only limited amount of content and the purpose of extending the tags with help of semantic relations was to find additional articles relating to the subject.

The magazine vocabulary does not contain the concept “carpets”, but based on KOKO relations, the system knows that it is related to the concept of “furnishing fabrics” and recommends articles relating to any furnishing fabrics, also other than carpets. A user had defined her interest in carpets with the Swedish word “mattor”. Thanks to semantics we also get support for multiple languages: It does not matter which language a user uses to express her interests since based on the semantics additional information relating to the interest can be found. However, when developing recommendations further it should be considered how much recommendations will be extended based on the semantic relations. If the link to the magazine vocabulary has been found with the help of extended links in the KOKO hierarchy, it means that the match to the concept of the magazine vocabulary is not an exact match, and the recommendations should not be extended further more based on the magazine vocabulary. In the “carpets” example, the recommendations were generated by extending also in the magazine vocabulary from “furnishing fabrics” to “interior design” taking it further from the user’s actual interest.

The tag “MS disease” is another example where the relation to the magazine vocabulary concept “illness” was found with the help of the KOKO relations. The recommendations were generated by extending to narrower classes in the magazine vocabulary leading to recommending an article annotated with “children’s diseases”. In this case, the recommendations should not have been extended to other diseases.

We found out that child related tags were challenging in general. For instance, if a user hasn’t inserted any tags concerning children or family, she shouldn’t be recommended such articles. However this was not taken into consideration: thus for example the tag “interior design” in user’s profile lead to recommendation of article annotated “nursery”. It was also difficult to recommend family related articles because a simple tag “family” or “children” does not reveal what in particular the user is interested in. If a user inserted tag “family” into her profile the recommendations currently included articles from childbirth and babies to teenagers. The articles should be annotated in detail and users should be able to define more specifically what kind of family articles they are interested in.

In this test semantic metadata was available, but no full text index of the articles. The links between the concepts of the magazine vocabulary and the concepts of KOKO ontology helped in generating recommendations for tags that were not directly part of the magazine vocabulary. When the number of articles increases the recommendations with lower rank value (the articles found based on semantic relations) can be limited or they can be presented under the label “also these articles might interest you”.

4.3 Other metadata

In this test only the article annotations were used for matching content recommendations with user profiles. Other metadata were merely presented to users in the article recommendation list: the title, publication name and publishing date,

page count, article type, and annotations, including the location information of travelling articles. Full-text indexes of articles were not available. In addition to annotations, other metadata could be exploited in profile creation and content recommendations in future. Users could at least be given an option to select which magazines and article types they are interested in.

The travelling articles were quite problematic, as many users added “travelling” as their interest. This tag lead to a list of travel articles from random countries. It also gave many similar recommendations. Users should be able to manage the recommendations, e.g. sort these articles according to continent or country. Also, if there are many similar results they should not all be displayed at the top of the recommendation list. Instead, there could be an option to hide/show similar articles.

Recommendations could be improved by utilizing full-text indexes, but annotations should be developed as well. Regarding annotations, the options are either to use and develop the magazine vocabulary or to utilize KOKO. In order to use the magazine vocabulary the hierarchy should be revised to fit the requirements of content recommendations. Compared to the magazine vocabulary, KOKO provides considerably more concepts. However, there are some specific fields that are not covered at all, such as the car makes.

The key idea of using KOKO links of the magazine vocabulary to help link user’s interests with magazine articles worked. One opportunity is to keep on using these vocabularies together. The magazine vocabulary works as kind of upper ontology in the company by offering the top concepts that are important in the different magazines, and with help of KOKO links these concepts can be extended to more detailed concepts. A tool that supports annotation of content based on the magazine vocabulary could support also annotation with these KOKO extended concepts.

4.4 Profile service and showing recommended articles

Some users criticized the automatic tag suggestions that were given during the profile creation. Thus, the service should enable users to turn off the suggestions if desired. Also the analysis of words written in free-text should be developed further. Enabling free-text answers, including sentences, would be more user-friendly as it wouldn’t restrict the answers as much as tags selected from vocabularies.

In the recommendation view, users should be able to arrange recommendations by metadata, including the hit rate, magazine title and article types, in order to be able to go through specific types of articles. This applies especially to travel articles, since the current implementation returned a long list of travel articles, which a user needed to scroll through before reaching the other articles.

When implementing the recommendations different ways of showing the recommended articles to users were discussed, but because of the focus of the study and limited resources, we decided to keep the article presentation simple. There are

many opportunities to support users in browsing content and how the recommended articles are presented to users.

A personal profile could be implemented as an additional user-specific view on a Web page. This would allow users to either browse the content on their own or to create a personal view to aggregate the content that matches their interest areas. Developing the user interface is an important step when taking the article recommendation service further.

5 Discussion

The profile service functioned well and received fairly good feedback. Magazine article annotations seemed to be sufficient for generating recommendations, although there were problems with some specific words. Certain negative concepts and negation should be further considered in generating recommendations, as it is important not to make inappropriate recommendations. The basic idea of using KOKO links of the magazine vocabulary to link user's interests with the magazine articles worked. This approach helped in generating recommendations of articles that were not annotated with a same tag as the user had used for expressing her interests. Recommendations can be improved by limiting the way the recommendations are extended to the related concepts.

According to the feedback, some users experienced the automatic tag suggestions rather confusing. Therefore, a user should be allowed to switch off the recommendations when they are not desired. Not surprisingly, it was found out that not all users read the instructions and thus the service should be developed to be so easy to use that no instructions are needed.

The article recommendation view should be further developed for real use. Instead of presenting the recommendations in a long list with highest ranked articles on top, the recommendations could be clustered according to topics. This would allow users to browse through various kinds of recommendations more quickly.

For SMF this case study provided information of opportunities of a new personalized service and proved that the current annotation practices are sufficient for personalization. This study also proved that annotated articles can be linked with other content as well as with user profiles, and that this can be performed automatically. Knowing more about users via their profiles gives additional opportunities for service development.