

# Ads Go Mobile: Assessing the Opportunities and Challenges of Personalised Ads in a Mobile Search Service

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**Abstract.** Since highly relevant content is linked to click-through rates (CTR) and eventually to an increase in revenue potential, key players in the search industry are devoting resources to profile and exploit the context in which a search is performed. In this paper we present the pilot implementation and evaluation of a mobile operator centric search service that enables the provision of personalised advertising. We have deployed a true ecosystem solution comprised of a mobile federated search platform, a mobile advertiser platform, advertisers and advertising campaigns, and a number of content providers. The attitude towards personalised advertising has been evaluated with 175 ordinary mobile phone subscribers across Norway during the summer of 2008. Advertisements are accepted if relevance is high. Non-utilitarian factors as humour have considerable impact on end-users' acceptance of advertisements, and a personalised approach is welcomed due to its potential to filter undesirable content. Based on our experience in this study, we also discuss technological challenges and strategic opportunities for a mobile operator in this area.

**Keywords:** Mobile search, mobile advertising, personalisation.

## 1 Introduction

It is believed that the high mobile phone penetration and the increase in average time spent on mobile phones will subsequently shift parts of advertising from traditional channels to the mobile channels. The *personal and always-on* characteristics of mobile handsets represent a unique opportunity to personalise mobile services and advertisements. If done correctly, personalisation might give extra value to the customers and possibly strengthen the positive attitudes towards mobile ads, so far being moderated due to general reluctance to spam and information overload [1].

Mobile ads can be adapted for different mobile spaces. They can be deployed on the handset idle screen (e.g. as part of the screen background), portal pages (e.g. WAP banners), message services (e.g. SMS tail), or integrated in basic functionality of the phone (e.g. as ring tones). Increased flexibility, and probably

increased impact, may be achieved if advertising is combined with particular mobile services. In this context, mobile search stands out as a good candidate for various reasons [2]. Search services fit the advertisement requirement for dynamic allocation of screen space. In addition, while searching the user is assumed to be in the mood to receive information (including advertisements). Intertwining mobile search services and advertisements also opens for new business models and from the user's point of view, opportunities for reduced service costs. By controlling advertising spaces tied to mobile Internet content, the monetisation potential for a mobile operator is considerable.

In this paper we present a mobile operator perspective of a mobile search service that enables the provision of personalised advertising in a mobile ecosystem. A mobile operator has several resources that can be useful when developing and offering personalised mobile services such as means for user identification, customer relationship and customer knowledge, access channels and ad spaces, service development platforms, and third party service providers. In order to obtain a practical experience that allows us to precisely evaluate the strategic and commercial significance of these mobile operator assets, we have deployed a true-ecosystem solution with a number of business partners<sup>1</sup> comprising a mobile federated search platform, a mobile advertiser platform, advertisers and advertising campaigns, and a number of content providers. We have obtained feedback on the service based on a group of 175 pilot users comprised of ordinary mobile phone subscribers across Norway during the summer of 2008.

The contribution of this study is the analysis and discussion, from a mobile operator point of view, of the important aspects in the deployment of personalised ads in a mobile search service. This document is organised in the following way. In Section 2 we discuss relevant concepts to this study. In Section 3, we describe the service and the method used to gather customer insight. In Section 4, we discuss the results of this work; we cover issues such as user acceptance, deployment challenges, and strategic feasibility. Finally, in Section 5 we conclude this paper.

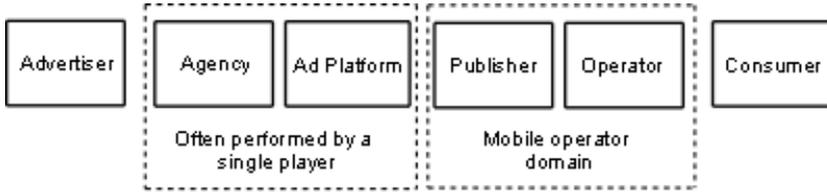
## 2 Background

### 2.1 Mobile Advertising - Actors and Value Creation

Players in the mobile advertising value chain contribute in different ways to make the connection between advertisers and customers effective. Figure 1 shows the main players and helps us to distinguish their different motivation and focus. The advertiser is interested in scale, targeting and response, quality, creative potential, as well as information consumption and measurement. The advertiser may pay a fee to intermediaries for advertising inventory based on cost per impression or cost per clicked ad. Naturally, if targeted or personalised ads are offered more value is present for advertisers and consequently the price per impression can be higher.

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<sup>1</sup> Business partners will remain anonymous.



**Fig. 1.** Roles within the mobile advertising value chain

The actors filling the agency (ad sales) and ad platform roles are involved in creating the advertising campaign and placing them in the right media according to the goals of the campaign. Ad sales actors include agencies such as advertising agencies (creative), media agencies (placing campaigns in different media), direct marketing agencies and Web agencies (online advertising and marketing). Ad networks and platform providers include actors such as Google, Yahoo, MS Nokia Ad Business, MADS, Amdocs, etc. The publisher (including content owner) and mobile operators will offer different media according to the needs of the advertisers and the target for the campaign. The actors filling these roles may receive a fee from the ad sales and ad platform actors.

The target group for the advertisers is the users or customers of different media houses and media channels. Thus, when a mobile subscriber browses the operator portal, or off-portal content with approved content partners, the mobile operator obtains income from the generated data traffic and from the advertisements displayed through the operator channels. The consumer interests include content relevance, value return, control, quality, and privacy.

One of the key operators' assets in this ecosystem, and to a great extent still an under-exploited one, is the detailed knowledge of their consumers (e.g. user identification, customer relationship, customer knowledge, roaming patterns, etc). This data can be used to offer the consumer more relevant ads and consequently adding value to the ecosystem [3]. Mobile ads represent a potential revenue channel and its success depends on how well operators are able to leverage on their existing assets to add value to the mobile search business.

## 2.2 Mobile Advertising - Targeting and Personalisation

As in classic advertising, online advertising can be split into brand advertising whose goal is to create a distinct favourable image for the advertiser's product, and direct-marketing advertising that involves a direct response to buy, subscribe, vote, donate, etc, now or soon. In terms of delivery, there are two major types [6]:

- **Search advertising** refers to the ads displayed alongside the organic results on the pages of the Internet search engines. This type of advertising is mostly

direct marketing and supports a variety of retailers from large to small, including micro-retailers that cover specialized niche markets.

- **Content advertising** refers to ads displayed alongside some publisher produced content, akin to traditional ads displayed in newspapers. It includes both brand advertising and direct marketing.

Search platforms enjoy a huge advantage over other online advertising platforms, because they can use a customer's own search terms to match customers' interest with advertisers [8]. The advertisement is considered far less intrusive by the consumers than online banner advertisements or pop-ups [7]. Previous studies have shown that more relevant ads lead to improved user satisfaction and higher response rates [3,5]. Google, Yahoo, MSN, and other online advertising platform providers can charge higher prices for these ads than for conventional non-tailored ads. Since listings appear when a keyword is searched for, an advertiser can reach a more targeted audience on a much lower budget.

In content advertising, the first technologies for obtaining relevancy simply extracted one or more phrases from the given page content, and displayed ads corresponding to searches on these phrases, in a purely syntactic approach. However, due to the vagaries of phrase extraction, and the lack of context, this approach leads to many irrelevant ads. One way to deal with this problem is through contextual ad matching based on a combination of semantic and syntactic features [4]. The problem of selecting contextually relevant ads so that they are both relevant to queries and profitable to the search engine has been addressed by Radlinski et al [9]; surprisingly, they show that optimising ad relevance and revenue is not equivalent.

The so called intelligent portals are automatically personalised based on the user's usage pattern, e.g. ChangingWorlds' from ClixSmart technology<sup>2</sup>. Tests show that considerable improvements are made to reduce the average number of clicks to reach content. However, the personalisation effect on mobile portals usage is, in contrast to ordinary Web portals, moderate. This is explained due to the impatience of mobile users and their tendency to access content that is only within a short distance from the mobile portal home page. This tendency may be explained in part due to the limited user interface (including user input) of mobile devices, as well as the lack of facilities for keeping track of browsing context, such as tabbed-browsing and rich history logs, of mobile browsers. Thus, the impact of any automatic adaptation of mobile portals will be limited when compared to similar efforts on Web portals [10].

Our approach to personalisation differs from previous ones since it is based on user identification through the MSISDN (Mobile Subscriber Integrated Services Digital Network Number) number, which is used to obtain customer data kept within the mobile operator premises. This approach brings promises of improved targeting but also challenges tied to technological aspects, user experience, and privacy.

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<sup>2</sup> <http://www.changingworlds.com/solutions.htm>

### 2.3 Mobile Search - Federated vs. Centralised Approach

The distinction between federated and centralised search solutions are relevant to this study since the service pilot employs a federated search platform. The federated search approach has been suggested as an alternative that may counteract some of the problems of traditional search engines such as content hidden behind operators' portal, difficulties of query formulation (small display and keyboard), and lack of appropriate content and services. This approach should ensure real-time results through a decentralised system (vs. centralised indexing system) where every entity in the federation is responsible for its own data and for responding with its best real-time results at the moment they are needed. This might eliminate the need for expensive centralised indexes and re-indexing procedures.

Furthermore, the federated search approach integrates the power of vertical search engines. It produces and executes a search execution plan, optimized for the query against an array of vertical back-ends, and aggregates the search results of the verticals and blends the results in a manner optimal to the query. This strategy is promising in order to minimise the number of clicks and the number of round trip requests to the servers over the wireless data network. New vertical search engines appear in key markets (image search, people search, health search, etc.), for particular content (e.g. Flickr, YouTube) and are gradually integrated in the big one-stop search engines. From a mobile operator's point of view, the federated search approach makes it easy to adjust, add or remove premium content. However, it also brings challenges with regard to timely gathering and presenting search results from different content sources.

## 3 The Pilot Service and Methodology

### 3.1 Technological Setup and Provisioning of the Solution

As shown in Figure 2, the mobile search and advertising pilot comprised a true ecosystem covering partners in all the steps of the value chain:

- **Federated search platform.** It provides a federated search service tailored for mobile devices. In practice this element act as the aggregator of the different content sources and relevant advertising. It produces the final presentation of the search results including personalised advertisements in designated ad spaces.
- **Telenor Playground**<sup>3</sup>. The Telenor Playground laboratory offers access to a number of mobile operator services such as messaging, location, payment, call control, and subscriber data.
- **Mobile advertising platform.** It supplies the necessary technology and infrastructure to manage advertising campaigns and to control different aspects such as publishing, ad placement, and dynamic allocation and customisation of

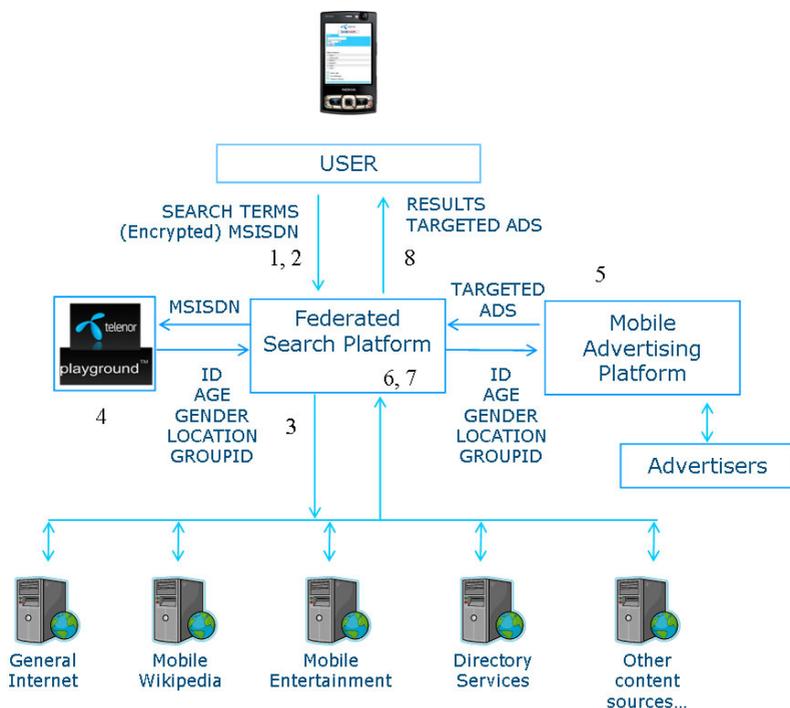
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<sup>3</sup> <http://playground.telenor.com>

ads based on different criteria. Recruiting advertisers was conducted through existing relationships with the mobile advertising platform.

- **Content providers.** The service searches and aggregates the results of different content sources. New content providers can be added to the solution as needed.
- **Advertisers.** A number of advertisers participated in the implementation of the service.

The parties cooperate and exchange messages at different phases in order to solve a search request; these messages are illustrated in Figure 2 with arrows and numbers. When a user types a query in the search box of the mobile search service a request is generated (1, 2). An important part of the solution was tied to the question of how subscriber identity could be made available through the domains of the different partners while still preserving security and control over the identity of the subscriber. There are several ways in which identification can be performed. The solution adopted included the encrypted MSISDN as part of the HTTP header in the search request; the MSISDN resides on the SIM (Subscriber Identity Module) and is in turn facilitated in an encrypted form by



**Fig. 2.** High-level architecture of the mobile search and ads service

the Telenor mobile gateway. In Section 4.2 we discuss the relative advantages of this and other potential ways of user identification.

Once the search request is delivered to the federated search platform, the search term is distributed to the set of content providers participating in the pilot (3), who in turn generate a reply with the results of the query. The approach taken by the federated search solution, in which each of the content sources are handled independently, enables the mobile operator to strategically chose the best available content sources among different search verticals (e.g. music, games) or content sources that are more appropriate for a local market (e.g. directory services, location-based services), and in this way implementing a best-of-breed approach for each of the search verticals. In addition, the MSISDN is used to retrieve subscriber data from the Telenor Playground premises such as age, gender, and location (4). This data is in turn used to request the mobile advertising platform for the most relevant campaign and ads (5). Once the results from the content providers and the mobile advertising platform are received, the federated search platform builds the result page (6, 7) and delivers it to the user (8).

### 3.2 Service Description

From an end-user point of view, the interaction with the service takes place in the two screens shown in Figure 3. The service was made available as a search box placed on the Telenor WAP portal as exemplified in the screen on the left side of the figure. The service allowed users to type in one or several terms in the search box, and then to execute a search by pressing the accompanying search button (labelled 'Søk'). It enables the user to search on a specific content category or to start a search on all the categories available in the service. At the top, it also provides space for advertising in the form of banners. A more detailed description of the content sources and the handling of advertising spaces is presented in Section 3.2 and 3.2 respectively. Once the user submits a query, it obtains the reply shown in the right hand side of Figure 3; in this particular case, the page shows results for the query term 'Volkswagen Golf'.

Two things are important to notice in the result page. The first one is the editorial design applied to the page. Results are organised in categories and only the top result is presented in each category; this was done for clarity purposes and to avoid crowding the page with content. The user can also navigate to obtain more results on a specific category domain through the clickable link labelled 'Flere resultater'. Then the user would be shown a page displaying the next 5 results in that category. Finally, a search box with the option to search in all or a specific category is placed at the bottom of the result pages. The second important aspect to note is the space dedicated to advertising. Banner ads are placed at the top of the page and sponsored links at the bottom. According to talks with our mobile advertising partner, it was suggested that the treatment of sponsored links as an additional content category at the bottom of the page (instead of at the top) obeys to user experience issues and not solely to revenue potential aspects.



Fig. 3. WAP pages of the search service

**Content Sources.** The service searches and combines the results of the following content sources:

- **Web Index.** It comprises access to Internet content, and thus, constitutes off-portal Web pages. The content in this category was facilitated by one of the business partners in the pilot; it constitutes a transcoded version of the Web.
- **Wapedia.** This category includes results from searching an off-portal mobile index provided by Wapedia. Wapedia is a WAP site that optimises the contents of Wikipedia for mobile devices and provides auto detection of the best format for a given device.

- **Pictures.** This index was facilitated by one of the content providers and was restricted to image content that could be bought on the operator deck (i.e. on-portal images).
- **Music.** Similarly, this index was facilitated by one of the content providers and was restricted to music that could be bought on the operator deck (i.e. on-portal music).
- **Games.** Similar to the pictures and music categories, this index was restricted to game content that could be bought on the Telenor deck (i.e. on-portal games).
- **Directory services.** This category uses the results from searching an index provided by one of the partners covering directory services for the Scandinavian area.

**Advertisements.** Banner ads were displayed at the top of the search result pages. As a way of example Figure 3 shows an animated banner from a financial institution (DnB NOR) just below the Telenor logo (text on banner: ‘DnB NOR’ on the left side and ‘Spar skatt’ on the right side). An animated banner consists of three images as seen in Figure 4; each image is displayed for around a second in a result page. The format, aspect ratio, and banner dimension conform to the guidelines suggested by the Mobile Marketing Association [19].



**Fig. 4.** An example of two of the animated banner ads used in the service. Left: A mobile betting service. Right: DFDS Seaways cruise offers from the mobile.

The text ads, visible as sponsored links, were displayed at the bottom of the search result pages but always above the search box. The text ad ‘Star Tour har restplasser til solal’, which is displayed in Figure 3 on the right side just below the *Sponsored links* label, is an example of a text advertisement. All banner and text ads were clickable and lead to a landing page for the particular advertising campaign.

In the practical implementation of the service a total of 20 campaigns from 6 different advertisers were defined. 9 of these campaigns were targeted by specifying associated search terms and demographics; details on the definition of campaigns are presented in the following paragraphs. As campaign and advertisement design often are associated with considerable costs, the ads and landing pages used in the pilot were adapted by the advertisers from other applications. The total set of campaigns covered a relatively limited range of products (travel, finance, betting, entertainment, catalogue information).

**Ads Personalisation.** The personalisation of advertising was done through advertising campaigns that took into account specific subscriber demographics such as age, gender, and place of residence, in addition to a set of key search terms. Table 1 shows the definition of DnB NOR BSU campaign as a way of example. For each campaign, explicit values are given for the three demographic variables and the set of associated search terms.

The target values were intended to match the life-phase groups of the Telenor Norway segmentation model, i.e. young (15-29 years), established (30-54 years), and senior (55+ years). However, the final segmentation was decided by the advertisers and did not exactly match the request for congruence to the Telenor segmentation model. The values used in the creation of campaigns were mainly based on the capacity of the mobile advertising platform to make practical use of the information exposed by the mobile operator.

Furthermore, the placement of ads was based on a set of business rules determining what campaign was selected if two or more campaigns matched the subscriber demographics and search terms. In practice, this implied a random choice of matching campaigns as long as the display settings (e.g. number of views and duration) in the advertisements management platform were set equal for all campaigns. In cases where no campaigns matched the customer demographics or search terms, a random campaign was displayed. During the execution of the pilot there were campaigns that covered all customer segments, thus always having appropriate ads ready for display.

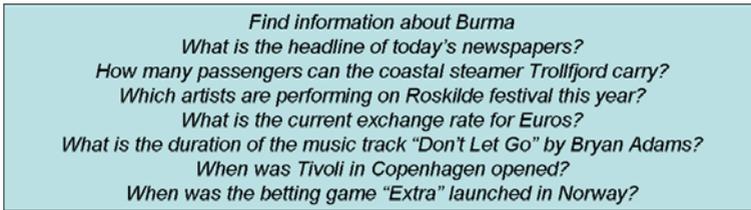
**Table 1.** Definition of the DnB NOR BSU campaign

Campaign title	DnB NOR BSU
Age (years)	15-29
Gender (m/f)	All
Place of residence (postal code)	All
Search terms	dnb, dnbnor, mobilbank, bsu, lân

### 3.3 Research Design

The research design was guided by the following goals: i) explore how mobile operator assets can be utilised to personalise ads on mobile phones, ii) investigate user attitudes towards personalised ads, and iii) identify characteristics of an attractive mobile search service. To explore the first goal, a real-life ecosystem was set in place. To shed light into the second and third goals mobile phone subscribers were involved; their attitudes to the service were collected through Web questionnaires and focus groups.

Two Web based questionnaires became the main information sources of the project. The first one was filled out before the pilot service was launched and the second after the pilot was completed. The questionnaires, comprised mostly of multiple-choice questions using a Likert scale 1-5, could be answered within 10-15



**Fig. 5.** The test users received 8 tasks to stimulate the use of the pilot service

minutes. The questions addressed general attitudes towards personalised advertisements and the actual use of the pilot service. The first questionnaire also included questions about the informant's interests and their routines and familiarity with mobile phone and PC search services. In addition to the questionnaires, the focus groups were performed to better understand users' behaviour and attitudes. Traffic logs were analysed to verify users' reports and to get statistical material on page views and click-through rates; however, our study focused on gathering in-depth knowledge on attitudes rather than systematic usage of the solution. The analysis presented in Section 4 is based upon data collected from the respondents of both questionnaires and the insight obtained in the focus groups.

A total number of 175 ordinary mobile subscribers were recruited for the pilot running during the summer of 2008; they were randomly selected from a list of twenty-five thousand mobile subscribers whose logged activity showed recent use of Internet through their mobile phones. They were all located in Norway. Members of the focus groups were recruited among the pilot users. No installation or configuration was needed as the pilot service automatically appeared as a replica of the search service on the operator's WAP portal.

To meet the challenge of infrequent mobile search the test users were given a set of search tasks during a period of the trial; these tasks were sent one by one as an SMS (see Figure 5). The first message included a link to the pilot service and a request to create a bookmark. The tasks exemplified various types of queries and motivated usage beyond the first try. Some of them were chosen to make sure that ad campaigns relevant to search terms were triggered and presented together with relevant content. For instance, the task 'When was Tivoli in Copenhagen opened?' would presumably be solved by using terms like Tivoli and Copenhagen which purposely triggered the ad campaign for a ferry trip to Copenhagen to be displayed (see Figure 4).

## 4 Results and Discussion

### 4.1 Pilot Results: User Experience

Mobile search was characterised as "*reading the paper by looking through a key hole*". Still, more than half of the informants found the service easy to use and easy to learn, and approximately the same share was satisfied or very satisfied

with the service. Not surprisingly the younger informants displayed more positive attitudes to the service than the elder ones. Hands on experience impacted positively: *“Testing this service has opened up my mind”*. Similar results are reported from other studies [15].

**Category Approach Counteract Problems with Small Displays.** The category approach of federated search reduced the query formulation efforts and improved the overview of presented hits. The size of the display hampers hit list overviews and rich descriptions of the hits that otherwise supports the judgement of relevance. These problems were amplified among users 45+ and to those keeping old mobiles with very small displays. One informant stated: *“The service should use big fonts and bright colours. I should not be forced to put on extra glasses”*.

Accordingly, contextualised font sizes (e.g. taking into account display size and user age) and intuitive procedures for zooming could add significant value to the mobile search service. In addition to the small font issue, users reported problems related to finding the service on their phone. This is symptomatic to novice mobile users with a limited understanding of the mobile phone as an Internet access device.

**Personalisation Triggers Privacy Concerns and Becomes a Welcomed Filter.** Personalisation and privacy concerns are often mentioned together. Kobsa [11] phrases it this way: *“Online searchers who are pleased that a search engine disambiguates their queries and delivers search results geared towards their genuine interests may feel uneasy that this procedure entails recording all their past search terms”*.

In this study the surveillance and privacy issues were brought forward through the questionnaires, and not surprisingly we received comments in line with *“I would not like anyone to track my interests and behaviour”*. They stressed the importance of explicitly saying yes or no to ads, and to be informed of where, when and how personal information is utilised. This claim should be analysed in accordance to privacy laws that regulate routines concerning the anonymity of traffic and location data that claim user consent in the case of data transmission to third parties and assures the user’s right to withdraw his previously-given consent.

In general the users preferred search services free from ads, but they seemed to recognise personalised ads as a filter to potential spam and unwanted information and, thus, considered personalisation as a way to reduce the negative effects of future increase of ad campaigns. When ads were considered relevant, e.g. they matched the topic searched for or the user’s interests or immediate context, the ads were more likely to be appreciated and clicked on; a Finnish study confirms this tendency [17]. Further our study uncovered that general attitudes towards ads seem to be amplified when exposed on mobile phones. The mobile phone is a private and personal possession, and it is always there and it is always on. One of the users exclaimed: *“You cannot choose not to pay attention to ads on a mobile phone. It’s not like reading a paper - just turning the page if it is embarrassing”*.

Kobsa categorises people into privacy fundamentalists, privacy unconcerned and privacy pragmatics, and claims that the size ratio between these clusters is roughly 1:1:2, with a slight decline of fundamentalists and the unconcerned over the past two decades and a corresponding increase in the number of pragmatists [11]. This development is promising as the attitudes uncovered in this study match the pragmatic person being described as privacy concerned, but still willing to disclose personal data if they understand the reasons for it, if there are any clear benefits and if there are privacy protections in place.

**Non-utilitarian Factors are Important.** Models constructed to explain adoption and acceptance of technology have been dominated by utilitarian factors [13]. In mobile settings the non-utilitarian factors as *pleasure of use* seem to be important [12,16,18,20]. In this study almost half of the informants reported that they are motivated to click on ads when they appeared humoristic. In particular the young respondents appreciated the scent of humour. Also the possibility to get rewards and discounts were welcomed. Other studies have shown increase of ads click-through-rates due to rewards and discounts [14]. Local affiliations, like ads presenting local services or products, seem to foster positive attitudes towards ads. An MMA study<sup>4</sup> claims that 69% of the informants preferred advertisements that were related to local products and services.

## 4.2 Technological Possibilities and Challenges

**User Identification.** There are several ways in which identification can be done, automatically, based on information stored in the mobile subscriber's handset, or manually, through explicit user log in. A method for identifying the user without the user's explicit interaction is preferable and can be enabled through information stored in the SIM card, one of the key assets of a network operator when it comes to mobile content and services.

The phone number, also known as the MSISDN number, is the most obvious way for user identification. The number resides on the SIM card and in the Home Location Registry (HLR) network element. This ID is typically used by call and message-based solutions, but can also be used for mobile Internet solutions, since some operators append the MSISDN to the HTTP headers in their WAP gateways. As the MSISDN resides on the SIM, it is associated with the subscriber and not the mobile phone itself. The operator can provide interfaces for third-party service providers which need access to the users' MSISDN or any of the alternative forms of subscriber identification. A relative disadvantage linked to the MSISDN is that access to this number needs to be requested with each operator. Common techniques of Web technology, like cookies, can also be applied to mobile services.

In our study, the MSISDN was chosen as the preferred solution for user identification since Telenor can easily include this number in HTTP headers. The lesson from the pilot on user identification was that identification by MSISDN

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<sup>4</sup> See <http://mmaglobal.com/?q=node/1518>

worked well and strategically anchored the operator in the value chain. Our experience supports the belief that subscriber identity as an enabler of personalised services should be considered one of the important assets of a mobile operator.

**Content Availability.** A federated search service faces the challenge of having enough content sources to create perceived relevance for the customers within all categories. Also, copyright policies apply for digital content. Building an ecosystem for a mobile search service demands access to content via commercial agreements. The pilot project spent more time than expected to secure the necessary content for the pilot service. A better option would have been to use the already established content providers of the Telenor Norway's mobile entertainment offering (games, music and pictures), and thus avoiding the overhead of any additional commercial agreements or technological adaptations.

However, users expect results beyond premium on-deck content. For this reason, the service also included a general Internet index to enhance the search results. One of the challenges of generic mobile search indexes is the limited amount of mobile (WAP) pages, since the content itself is limited. All providers of WAP indexes have this as a general problem. A way to increase the amount of content relies on transcoding Web pages to mobile format. By transcoding Web pages globally, a Web index with a broader content depth than ordinary WAP indexes can be included; we did this by including transcoded versions of a Web index and Wikipedia.

In our particular case, accessing the search results of the Web index provider had to be done via the provider's Web page before entering the requested search page result, making the solution suffer from a user experience point of view. Furthermore, the intention to provide indications of number of hits in each category turned out to be hard to fulfil. This is due to the fact that the result page is dynamically populated before the search of the content sources in the different categories is completed. Also the intention to provide snippets, i.e. short summaries or key words, for each hit was not met. Finally, the federated search concept makes it easy to adjust, add or remove content and content categories. However, the study uncovered challenges with regard to gathering and presenting search results from different content sources timely.

**Subscriber Data.** As noted before, operator's subscriber data was used in order to facilitate targeted advertising and personalisation. Subscriber data was dynamically queried by the other elements of the search solution. The information for each of the pilot users was the following: MSISDN, first name, last name, gender, date of birth, postcode, and postcode name. This data set is relatively simple and the data process extraction was relatively straightforward.

In our experience two points are worth noticing. First, there are occasions in which the information stored in the databases does not correspond to real usage, and this may compromise the interpretation of the experimental results. For example, it is not unusual that a subscription is shared among the members of a family. Thus, the conclusions drawn from the information in the databases in this scenario may lead to inappropriate personalisation of advertisements. In

the pilot, these cases were detected and corrected manually but a more practical way of solving these issues is required.

Second, due to time constraints, it was not possible to have a totally automated and standardised solution to share information between the different parties involved in the process of managing and exposing customer data. It is still necessary to study in detail the mechanisms and best-practices to expose this information to third parties. This represents a practical challenge due to the cross boundary relationships and shared responsibilities that have to be built outside the operator. The implications and challenges of facilitating customer data and generic identity management solutions is receiving attention from the mobile industry. Currently on development, the GSMA OneAPI<sup>5</sup> aims to provide a commonly supported API so that applications and content, including among others user profile and user identification, are portable across operators.

**Location Information.** The various types of location information considered for targeting ads in the pilot included the user's current position (made available through the operator's positioning service), most used base station (made available through the operator's databases) and, place of residence (made available through the operator's databases). In some cases a combination of these could be interesting for advertisers. In practise, it turned out that the response time for obtaining the user's current position from the positioning service was on average around 5 seconds; the main reason for this latency was due to the experimental implementation of the location service in the Telenor Playground premises. This was too slow to be used in the piloted search service. The operator's positioning techniques have higher accuracy than pure cell identification, but the response times that we obtained made it inconvenient for practical use. Neither available time nor the low interest from the advertisers allowed pursuing this issue any further; this might change quickly as scenarios for using location information become widely available. Of the other techniques for providing location information, i.e. address of the most used base station or place of residence, we made a pragmatic decision of using the latter. On-device GPS (Global Positioning System) positioning was discarded due to the rather limited footprint of devices supporting this feature not only among the pilot users but also in the Nordic market in general.

Using Telenor's Playground Lab for acquiring location information proved to be difficult due to response times. However, this situation improves in the operator's professional service development platforms. Thus, our experience supports the belief that mobile operators' ability to make available various location information constitute an enabler of personalised services and should be seen as a key important assets of an operator.

**State of Tools for Targeted Search and Ads.** Providers of mobile search solutions offer ranking capabilities that could be of interest to mobile operators and mobile portal owners. These capabilities include placement of categories on the result page as well as internal ranking within each category. An operator

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<sup>5</sup> <http://oneapi.aepona.com/>

focusing on monetising search by driving usage of premium content and services would be interested in this option. For us, this aspect was not fundamental. Instead, the ambition of creating the best possible user experience determined the order of the categories in the result page. No special in-category ranking was applied, i.e. the content sources' original ranking of search results was employed. The use of search history was not applied to rank results, neither were tools for doing this explored.

Mobile marketing companies typically offer ad servers for mobile campaign management and targeting such as ad management (inventory and rendering), campaign management (targeting, channel selection and ad spend), device recognition and content adaptation, user identification and profiling, personalisation and, reporting. The targeting of ads could take into account a number of factors such as: bid price, time, distribution and inventory status, frequency of clicks, countries, devices, operator, and user demographics.

The particular platform used for mobile marketing has been built around the key concepts of campaigns and ad zones and it supports advertisers' needs well. However, our approach from the start was developed around the personalisation perspective. We found that the platform had some limitations and was not very flexible when it came to defining groups of users receiving different advertising treatments and the logic to be applied when computing the best ad for each individual visitor. Also the addressing of different ad spaces (or ad zones) had some limitations. We recognise that the mobile advertising industry is evolving and the infrastructure for targeted ads based on search terms and demographics are still immature; an observation even more valid during the set up phase of the pilot.

Campaign management turned out to be challenging and consistent handling of campaigns through the search process was not happening in all cases during the trial. The reason for this was the limitations in ad space addressing, i.e. campaigns are separate entities in the advertisement management system, and no functionality to link campaigns across ad-spaces was present. Finally, the pilot showed us that with the current state of tools the development of new campaigns is costly and adaptations of existing ads could be done only in some cases.

## 5 Conclusions: The Way Ahead

The operator perspective on mobile search is that it can be a driver of revenues from: i) advertisements, ii) usage of premium content, iii) usage of operator services. In this paper we have focused on the possible revenues from advertisements and explored value creation and revenue sharing among participants in a mobile search and advertising ecosystem. The pilot study has revealed a strong interest among advertisers, ad platform and search solution providers to work together with operators on mechanisms for targeting advertisements and personalisation.

As relatively small amounts of money are currently spent on mobile advertising, the operators face a challenge in growing the mobile advertising business. In this respect measurement of advertising effects may provide the most convincing argument, and the operators are well positioned in the mobile advertising

ecosystem for producing such measurements and to facilitate ad personalisation. Mechanisms for management of user privacy are assets worth to explore for operators in the area of mobile advertising. In general, users preferred search services free from ads, but recognised personalised ads as an effective way to filter spam and unwanted information. Customer identification through MSISDN is a true enabler of personalised services.

The study uncovered immaturity in both internal and external systems and processes for offering a personalised search service including ads. There are several challenges in order to exploit the information stored in the operators' subscriber databases. Location is a vital mobile tool that mobile handset manufacturers, operators, and content providers can exploit commercially. Therefore, the provisioning of location based services should be improved to make local ad campaigns attractive. As the market for location based services grows over the following years, mobile operators should take a strong position to secure a strategic place in this market.

Another limitation relies on the systems used for defining, managing, and monitoring campaigns when personalisation and not just segmentation is a key objective. The mobile operator position as ad space and access channel provider brings a potential for supporting multi channel campaigns across platforms that should be further explored. Regarding opportunities for improving the quality of ad personalisation, operators could exploit social network analysis of their subscribers to provide added value and ultimately facilitate a better search experience for their customers.

## References

1. Eurescom. Mobile Advertisement - Threats and opportunities. Sollund, A.M. (ed). In: EURESCOM P1654 D1 (May 2007)
2. Bughin, J., Henryson, D., Parvizi, P., Rudolph, S., Taqqu, Y., Wilkins, J., Wilshire, M.: Mobile search: The On-Ramp to mobile Advertising, pp. 49–56 (2006)
3. Wang, C., Zhang, P., Choi, R., Eredita, M.D.: Understanding consumers attitude towards advertising. In: Americas Conference on Information Systems, pp. 1143–1148 (2002)
4. Broder, A., Fontoura, M., Josifovski, V., Riedel, L.: A semantic approach to contextual advertising. In: SIGIR 2007, pp. 559–566 (2007)
5. Chatterjee, P., Hoffman, D.L., Novak, T.P.: Modeling the clickstream: Implications for Web-based advertising efforts. *Marketing Science* 22(4), 520–541 (2003)
6. Dominowska, E., Josifovski, V.: Internet monetization - sponsored search. In: WWW 2008: First Workshop on Targeting and Ranking for Online Advertising, Beijing, China, April 21–25, pp. 219–225 (2008)
7. Ghose, A., Yang, S.: Analysing search engine advertising: firm behaviour and cross-selling in electronic markets. In: WWW 2008: Workshop summary, Beijing, China, April 21–25, pp. 1269–1270 (2008)
8. Goldfarb, A., Tucker, C.: Search engine advertising. *Communications of the ACM* 51(11), 22–24 (2008)
9. Radlinski, F., Broder, A., Ciccolo, P., Gabrilovich, E., Josifovski, V., Riedel, L.: Optimizing relevance and revenue in ad search: A query substitution approach. In: SIGIR 2008, Singapore, July 20–24, pp. 403–410 (2008)

10. Smyth, B., McCarthy, K., Reilly, J.: Relevance at a distance - An investigation of Distance-Biased Personalization on the Mobile Internet. In: Proceedings from 14th Irish conference on Artificial Intelligence and Cognitive Science, AICS (2003)
11. Kobsa, A.: Privacy-Enhanced-Personalization. *Communications of the ACM* 50(8), 24–33 (2007)
12. Bergvik, S., Svendsen, G.B., Evjemo, B.: Beyond Utility. Modelling User Acceptance of Mobile Devices. In: Workshop User Experience, NordiCHI 2006, Oslo, October 14-18 (2006)
13. Davis, F.D.: Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* 13(3), 319–340 (1989)
14. Drossos, D., Giaglis, G.M., Lekakos, G., Kokkinaki, F., Stavraki, M.G.: Determinants of effective SMS advertising: An experimental Study. *Journal of Interactive Advertising* 7(2) (2007)
15. Heggteit, P.O., Yttri, B., Stenvold, L.A., Akselsen, S., Spilling, A.: Aida - A pilot study on active desktops for mobile phones. Fornebu, Telenor Research and Innovation, R&I N9/2005 (2005)
16. Hibberd, M.: Selling space. In: *Mobile Communications International*, pp. 42-46 (September 2008)
17. Kesti, M., Ristola, A., Karjaluoto, H., Koivumaki, T.: Tracking consumer intentions to use mobile services: empirical evidence from a field trial in Finland. *E-Business Review IV*, 76–80 (2004)
18. Leung, L., Wei, R.: More than just talk on the move: Uses and gratifications of the cellular phone. *Journalism and Mass Communication Quarterly* 77, 308–320 (2000)
19. MMA. Mobile Advertising Guidelines. Mobile Marketing Association. Denver, CO, USA (2008), <http://www.mmaglobal.com/mobileadvertising.pdf>
20. Tsang, M.M., Ho, S.-C., Liang, T.-P.: Consumer Attitudes towards Mobile advertising: An empirical study. *International Journal of Electronic Commerce* 8(2), 65–78 (2004)