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Is Adaptation of E-Advertising the Way Forward?

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Abstract—**E-advertising is a multi-billion dollar industry that has shown exponential growth in the last few years. However, although the number of users accessing the Internet increases, users don't respond positively to adverts. Adaptive e-advertising may be the key to ensuring effectiveness of the ads reaching their target. Moreover, social networks are good sources of user information and can be used to extract user behaviour and characteristics for presentation of personalized advertising. Here we present a two-sided study based on two questionnaires, one directed to Internet users and the other to businesses. Our study shows that businesses agree that personalized advertising is the best way for the future, to maximize effectiveness and profit. In addition, our results indicate that most Internet users would prefer adaptive advertisements. From this study, we can propose a new design for a system that meets both Internet users' and businesses' requirements.**

Keywords-e-advertising, e-commerce, service oriented architecture, personalisation, adaptive advertising delivery system.

I. INTRODUCTION

Internet advertising is a growing industry, and revenues in the US have shown an 18% climb year on year from 2011 US 7.8 billion 2012 USD 9.26 billion according to IAB (Interactive Advertising Bureau IAB). The graph illustrated in Fig.1 (extracted from [14]) shows the exponential increase in revenues since 1996.
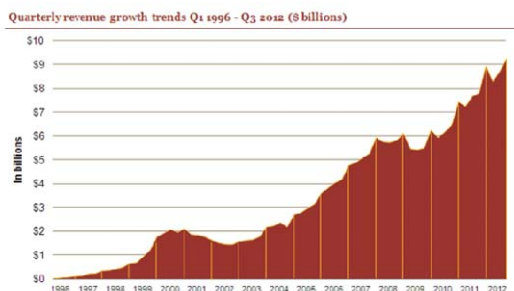

Figure 1. Quarterly revenue growth trends for Internet Advertising

The early web sites were generally divided into e-commerce sites that sold items directly, and content sites, which provided content for users but made their money from additional advertising. In the late 1990s, banner ads were the most popular method of advertising. However, due to the increased revenues available, more sites are asking users to subscribe for access to web content in order to learn more about their users. Indeed, advertising has become more aggressive, by utilizing techniques such as pop-up ads, ads that play music and ads that swim across the screen [5]. Since many users have a negative response to these ads, due to the fact that sometimes these ads block the content they actually want to see, this has also given rise to various other applications, such as pop up blockers and ad blockers.

In 2005, 80% of Internet users were interested in receiving personalized content on sites they visited [8] and this has only increased since then. In this generic drive for personalisation, this also opens up the opportunity for personalisation of Internet advertising. This requires use of adaptation and user modelling to convert their online behaviour and characteristics into patterns that can allow delivery of personalized advertising.

In order to understand in more depth the current situation of Internet technology consumers, as well as how to best respond to user needs, our research tries to answer the following questions:

1) Does the adaptation/ personalisation of advertising make sense?

a) Is it more acceptable for users to have adverts personalised to them and their environment? (I.e., are users more likely to click on personalised adverts, as opposed to generic, non-adaptive adverts?)

b) Is it more acceptable for businesses to deliver adaptive advertising? (e.g., could adaptive advertising provide better income? (compared to non-adaptive advertising))

c) What is a good source of information for adaptive advertising?

2) Is it possible to construct an adaptive advertising delivery system that can be integrated with most web sites including social websites?

a) What are the best combinations of user and environment features that can be processed by a decision engine for the adaptive advertising delivery?

The next sections discuss related research, present our results and discussions in answering these questions, and then provide a conclusion.

II. Related Research

Personalisation is more challenging than targeted advertising, which just divide the marketing into various customer segments [16, 45, 46]. Personalisation aims at increasing advertising effectiveness by ensuring the right person receives the right message at the right time and in the right context [1]. The amount of data available for particular user determines how much personalisation can be done. For a high level of personalisation, tracking of customer history and actions will need to be done, and customers need to be aware of the trade-off between privacy and personalisation. Indeed, gathering this data requires effort, and sometimes customers are reluctant to provide accurate data due, amongst others, to privacy concerns [24].

To avoid duplication of information extraction, and decrease user input, a potential source of rich information on users is given by social networks. Social networks have become part of all our lives. The number of users of social networking sites has increased rapidly during the last six years. These social networks can be reflecting and recording the social practices, behaviour, preferences or concerns of its users. The adaptation form in social networks varies from having users take an active part in content creation to content production and sharing. Currently, social network analysis [19] is used to support consumer targeting to drive Internet advertising, but, as previously mentioned, this type of adaptation is limiting.

Next, in order to allow for comprehensive adaptation and automatically provide users with information that is within their current field of interest or within their scope of comprehension, one approach is to deploy an adaptive hypermedia system. Adaptive hypermedia technology supports users by customizing the system and enhancing the delivery of information [6]. Adaptation refers to personalising either the hypermedia links or the information contained within the nodes. These two forms of adaptation are usually referred to as navigational and presentational [40].

In terms of adaptive delivery engines many such engines have been proposed in the past, e.g., AHA![3, 42], GALE[41], ADE [31], WHURLE [4], AWCD [7], Kendra [21], Topolor [32, 34]. GALE is an updated version of AHA!. ADE has some similarities to both AHA! and GALE systems. Adaptation in these models/systems uses a generic user model, based on variable-value pairs, which seems an appropriate approach for e-advertising as well. AWCD is an adaptive web content delivery system that introduces a new approach to deliver customized and adaptive web services for clients. In [23] a model is suggested for the delivery of hypermedia content that considers the types of users, the devices used by customers to gain access, the types of access, the state of the network and the current load on the server. These are however all separate systems, which cannot be integrated into existing ones in a lightweight manner (such as web services). WHURLE is using XML-based pipelining, which is useful to consider, as applying lightweight solutions and standards is clearly a way forward. However, user modelling in WHURLE is not as extended. Kendra is an audio delivery system, its adaptation process changing the format of the audio data to according to network conditions.

In parallel with the development of adaptation and personalization, researchers have been recently working on introducing social dimension into such models/systems. For example, the LAOS framework [9] for adaptation authoring has been extended to SLAOS [12] by adding a social layer, based on which, MOT2.0 [11] was developed to explore social features incorporated. More recent work is in progress, aiming at investigating more fine-grained adaptations as well as fine-grained social interactions [35-37]. For instance, Topolor [38] is a social personalized adaptive system that delivers adaptive content and navigation based on user modelling, taking into consideration the social interaction and social relationship among the users [33, 39]. However, most of these systems are designed for the e-learning field and, as said, cannot be easily integrated into other systems.

Looking at adaptive delivery systems in the e-advertisement field, such MyAd [10] AdSense [13], and AdROSA [17], they have no standard to communicate with the websites that publish their advertisements. Thereby, generalization of these delivery systems, to be applied on any website, is very difficult. For instance, AdSense allows publishers in the Google Network of content sites to serve automatic text, image, video, and rich media adverts that are targeted to the site content and audience, but it cannot provide this on the websites owned by its clients. MyAds is autonomously adapting the advertisement process to the trends of interests detected among the audience in a venue (museum, stadium, etc…) in the sense of collaborative filtering, but it does not provide personalisation. AdROSA creates automatic web banner personalization, depending mainly on individual user browsing behaviour. It is used in the portal model of advertising for publishing the advertisements, similar with AdSense.

Implementing personalisation over the various platforms and services containing user data on the Internet requires standard solutions or architectures that can allow for easy integration between systems and SOA (Service Oriented Architecture), as a means of achieving easy integration [29, 43]. SOA solutions can be used in our work to categorize and adapt the advertisements for any website (client). In addition to, it may be used to send the user characteristics based on social network data to clients, to help in the delivering process.

III. Hypotheses

This paper responds to the first research question via the following hypotheses.

H1: Users are more likely to accept adaptive advertising which is suitable for their characteristics and environment.

H2: Advertisers prefer to send the appropriate advertisement to appropriate users.

H3: Social Networks are a very good source for user behaviours extraction.

These hypotheses were tested by surveying a subset of the population, as well as selected businesses and analysing their responses, as described below.

IV. STUDY SETUP

In order to validate the above hypotheses, two questionnaires were designed. The purpose of the questionnaires was to develop a new advertising delivery system which will help business owners and users to adapt the adverts. According to [15] Internet users in the world are around 2.4 Billion, which means the sample size would need to be 271 with confidence level of 90, or 385 with confidence level of 95 according to [30]. The scope of our target population is international The first questionnaire was sent to around 350 Internet users, while 15 business owners were asked to respond to a second questionnaire, which would have corresponded to a confidence level of 90-95. However, from these, only 138 Internet users answered, which would account to about half of the world Internet users. Additionally, for our qualitative study, 5 business owners answered. The majority of the Internet user questionnaire respondents were Saudi and British. Other subjects were from Egypt, Jordan, Greece, Chinese, Pakistan, USA, Armenia, Austria, Bahrain, French, Nigeria, India, Italy, Kenya, Malaysia and Poland.

A. Internet Users

The first questionnaire was given to Internet users to complete. It was administered informally and contained fourteen questions. The majority of the questions were close ended, for ease of use as well as fast processing. The first section of the questionnaire was concerned with demographic information. The next set of questions was asking how often they visit the Internet, the purpose of their visits, and if they are shopping online or offline. The remainder of the questionnaire concerned adverts: if the advertising they were exposed to was useful, and if it adapts to their preferences and characteristics, if any adaptation took place for bandwidth and screen outline for their device, if the social networks that provided them with advertising adapt to their characteristics, and finally, how the advertising attracted them. The results were collected and are presented in section V.

B. Business Owners

The second questionnaire was given to business owners, which contained thirteen questions, which were mostly open questions. The first questions were concerned with information about the type of business run. The next questions looked at the current type of advertising and channels they use for their advertising. The next questions asked about current access rates, sold products and income for their e-adverts. The following questions examined the current type of personalisation or adaptation in their online advertising, and, if existent, if adaptive it provided better income. The final question concerned their preference that their advertising is categorized on hosting websites and directed to specific groups of people.

V. RESULTS

The results section is divided into two sections, with the first presenting the results from the Internet users, and the second section presenting the results from the businesses.

A. User Responses

Out of the 350 questionnaires distributed, 138 users provided responses. Two thirds of the respondents were female and 43% of all respondents were in the 19-25 age bracket. The results show that all respondents visited the Internet at least once a day with 69.57% spending several hours a day on the Internet (Fig.2), and nobody selected any of the other less frequent options, such as 'Weekly', 'Monthly', 'Yearly', 'A few times' or 'Never'. Hence, the population segment analysed had clearly Internet usage knowledge and experience and thus could be fruitfully used to provide input into the type of advertisement necessary to address their needs.
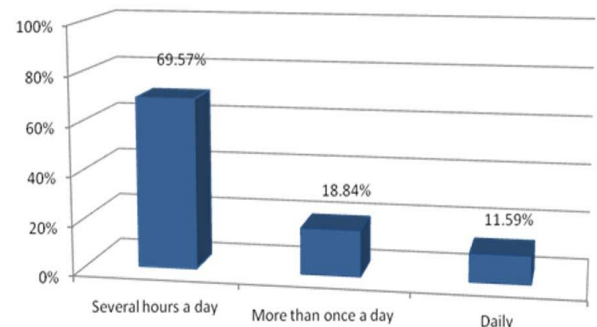

Figure 2.   How often the Internet was visited

When asked about why they were using the Internet, the largest number (over 26%) mentioned social interaction, which seems to be a major drive for the younger generations (see Fig.3). Another large number (over 25%) declared to be using the Internet for study. However, the next important reason for surfing the Internet includes work 19.36% and shopping 17.87%, with a minority declaring they would use it for play 8.3%. The relatively large number answering unprompted that they use Internet for shopping shows that a large proportion of such transactions have moved from traditional shops onto the e-market, and that businesses need to make better use of the opportunities such a market offers, including the potential of adaptive e-advertising, and make sure they are a part of it.
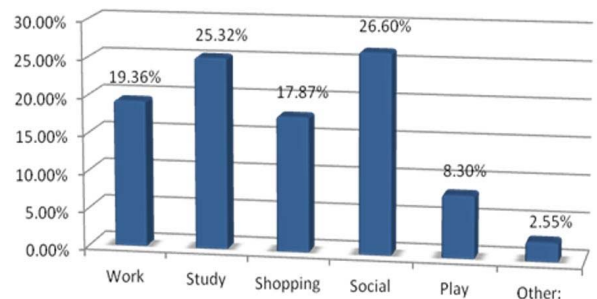

Figure 3.   Purpose of visiting the Internet

When asked specifically about shopping online, the majority of the respondents, 54.35%, indicated that they sometimes shopped online. Moreover, 37.68% of the respondents indicated that they shopped offline, but would look up the items online first (see Fig.4). Only 29.71% declared that they normally shop in offline shops, although the number of people declaring they normally shop online is lower (13.04%).
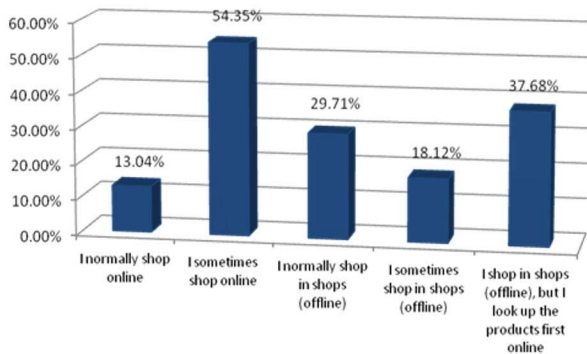

Figure 4. Responses to shopping online

Considering that a large amount of research shows that online adverts have negative connotations [2, 20, 22, 44], it is surprising that a majority of 52.9% found advertising on the Internet useful sometimes, while 5.8% even indicated that the advertising was always useful (Fig.5). This contrasts with 26.81% who said the advertising was never useful. From the comments provided by the respondents, clearly negative comments about Internet advertising were, e.g., "I find advertising annoying", "I generally ignore it", "It's just a load of rubbish", and "Often deceiving". These outcomes support hypothesis H1 to some extent, as 79.71% do not feel that advertising they were exposed to is useful very often.
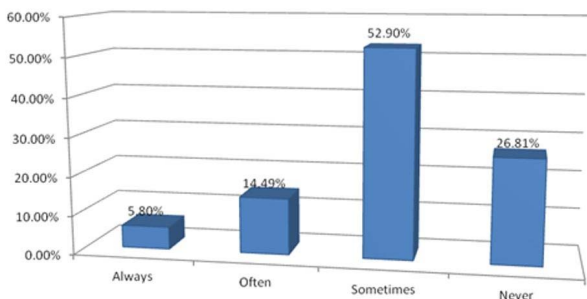

Figure 5. Responses to whether advertising exposed to was useful or not

When asked if the advertising they were exposed to was adapted to their user preference, 53.62% indicated that this happened sometimes, while 9.42% and 36.96% indicated mostly yes and mostly no respectively (Fig.6). From the open text responses, Amazon, Facebook and YouTube were some sites mentioned that had some adaptation to user preferences. These answers support hypothesis H3 to some degree, in that Social Networks are a very good source for user behaviour extraction.
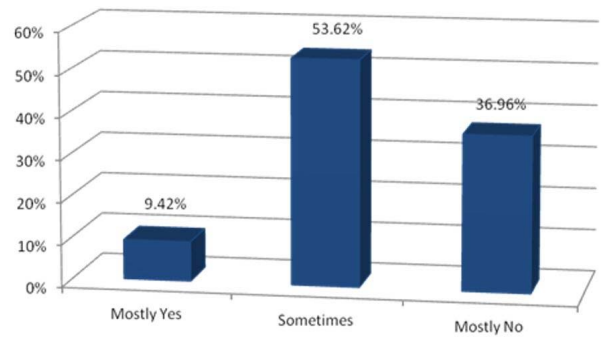

Figure 6. Responses to adaptation of advertising to user preferences

When asked if the advertising adapted to any other characteristics, 63.24% said that sometimes it did adapt to their behaviour, product history and websites that they visited, while 31.62% said mostly no (Fig.7).
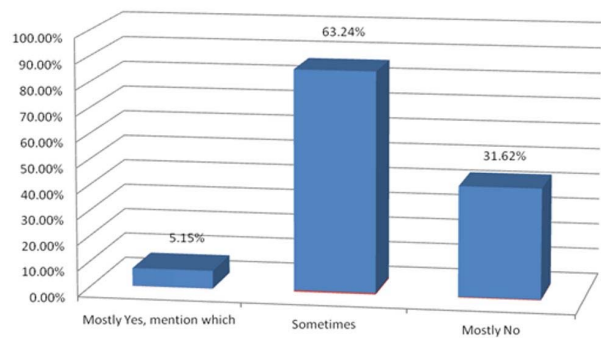

Figure 7. Responses to adaptation of advertising to other user characteristics

44.2% of the respondents said the social networks they were using most of the time did not provide useful advertising, but 43.48% said that sometimes the reverse is true. The social networks mentioned included Facebook ads, YouTube and Twitter. Answering a different question, the majority of respondents however, 73.19%, also indicated that the social networks did not provide them with advertising adapted to their characteristics. From this statement we see that, although the social networks can provide useful advertising, most of the time it is not adapted to the user specific characteristics.

From the open user comments, three key categories of issues were mentioned regarding what attracted them to the adverts online, and these included:

- *Design* issues including use of bright colours, large fonts, simple message or short display time.

- *Relevance* of the advertising message, i.e., is the advertisement relevant to the user or advertising a service the user is interested in?

- *Price*, i.e., is there an on-going sale or possible discount available?

From the user comments, which mainly fell into one or more of the three categories above, we can confirm hypothesis H1, that users are more likely to accept adaptive advertising which is suitable for their characteristics and environment. If

the information is more relevant to their characteristics either by design or relevant advertisement or price, the user is more likely to accept such advertisement.

When asked about the display of the advertising content, i.e., whether reasonable media was used according to the bandwidth, 24.64% said mostly yes, 46.38% said sometimes and 28.99% said mostly no (see Fig.8). This means that alternative means of advertising adaptively according to bandwidth also have to be explored further.
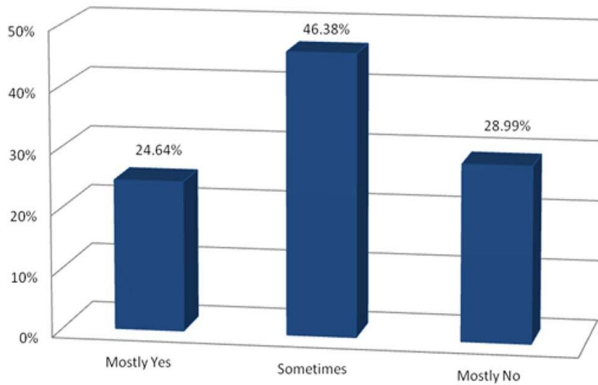

Figure 8. Use of reasonable media according to bandwidth

From the responses about whether the advertising used a reasonable screen outline for the user device, 40.58% said mostly no and only 14.49% said mostly yes (see Fig.9).
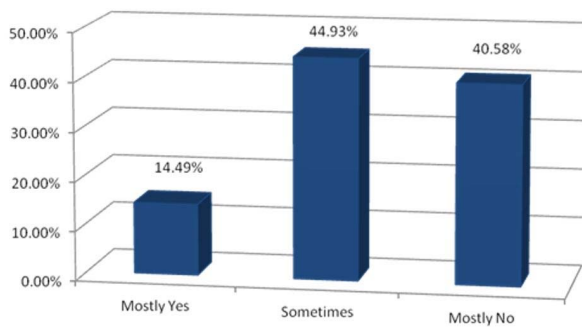

Figure 9. Use of reasonable screen outline for device

B. Business Responses

Receiving responses from businesses was more difficult (with only 5 responses), but did lead to some interesting conversations. Responses were obtained from businesses in the financial, manufacturing, real estate, transportation and Marketing areas. Two of the businesses were classified as small, two as large and one as a medium enterprise. Moreover, four of the businesses were located in Saudi Arabia and one in Egypt.

None of the businesses was using any type of adaptation or personalisation in their online advertisements, but all of them agreed that adaptive advertising would provide a better income compared to non-adaptive advertising. All respondents also preferred that their advertising is categorized on hosting websites and directed to specific groups of people. These results support to some extent hypothesis H2 which indicates that advertisers prefer to send the appropriate advertisement to appropriate users.

VI. MAIN FEATURES AND DISCUSSION

This section discusses the main features which adaptive advertisement needs to implement or consider according to the overall results from questionnaires.

Overall, the study that has been conducted, especially on the business side, where numbers are low, represents a preliminary study, to obtain a sample view of e-advertising.

The first thing of note is that in the user comments, as previously said, one of the websites mentioned that was providing some level of personalisation was the Amazon website. This is due to the fact that on Amazon, when one purchases or views a book, they are also advised about similar books that other people who also looked at the current book purchased [18]. This helps to direct users' search for more information of interest, as well as enable a positive attitude to such advertising.

The second item of note is regarding the comments from the users about why they liked the advertisements. Most of the comments were grouped into either design relevance or cost categories. From the comments, most of the users were attracted by the design, so this is a key aspect to consider when developing advertisements. However, design can also have a strong negative effect, such as Pop-ups in front of the user window, information that loads slowly and does not have a "Close" button [25].

From the principles of human-computer interaction research, things that are close together on the screen are seen as related, and also users view things that are the same colour or shape or that move or change together or reside inside an enclosure (e.g., a box) as related [26]. This closeness gestalt principle[28] needs to be incorporated into advertising design, otherwise there will be occasions when users overlook features, because the layouts violate the closeness rule (e.g. buttons, dropdowns, etc., too far from the objects being actioned). Also users spend 69% of the time viewing the left half of the page and 30% of the time viewing the right half of the page, while the remaining 1% is generally used for viewing information that requires scrolling to the right [27]. Thus horizontal scrolling should be avoided and for more attention to be paid to the advertisement, it should be placed on the left of the screen for left-to-right reading direction or on the right of the screen for languages with right-to-left reading direction, such as Arabic.

The third point of note is concerning the bandwidth. Displaying the advertising content according to the bandwidth that is available to users is very important. For instance, displaying an advertisement in flash or video format needs a high bandwidth; in contrast, text format is suitable to display for low bandwidth.

The forth thing of note is that from the responses about whether the advertising used a reasonable screen outline for the user device. Large advertisements that don't fit the small screen of the mobile device may be bothering the users. Similarly, the

resolution of devices may be limited, and conflict with some high resolution advertisement format.

From the responses from the businesses, we note that they all would prefer to send the appropriate advertisement to appropriate users and this requires personalisation of the advertising.

VII. THE PROPOSED SYSTEM: AEADS

This section responds to the second research question through the following proposed system that is illustrated in Fig.10. To incorporate the main features extracted above, we propose a methodology for advertisement adaptation for a business's own Website. This methodology allows the website owners (the Client) to categorize their advertisements and adapt it to their website users based on various adaptation strategies. Our system will be available mainly as a web service.
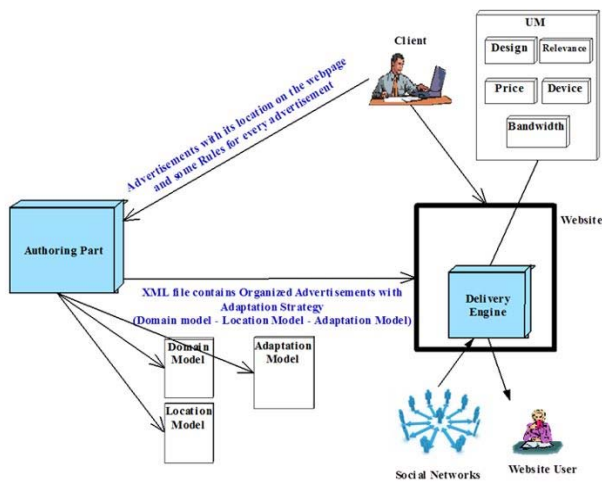

Figure 10. Scenario for the proposed AEADS system

The client uses the authoring part of the system to deploy the advertisements that he owns (or that he wants represented). He will author then their location on the webpage as well as describe any adaptation rules necessary to display these adverts. This will happen in a drag&drop template and simple options-based easy interface. He informs the authoring part of the advertisements links, classification (the latter also related to the display rules). The authoring part will send an XML file to a website which includes organised advertisements. This file contains *domain and goal models*. In addition, the client can select adaptation strategies based on his rules and the system will automatically add them to the adaptation model as a separate file on the client's website server. Furthermore, for instance, consider the client has 10 advertisements, five of them are related to children stories and the others are related to database books. Firstly, the client uses the authoring part to organize his advertisements into two categories and its links and location. This process creates the XML file that represents the *domain and location models*. Secondly, via the authoring part the client selects a strategy for every advertisement, either individually or collectively, producing an adaptation strategies

file. The authoring part will create the HTML code which will be allocated to each page of the website to determine the advertisements' location (location model) as desired by the client.

The second part of the system, the delivery engine, is resident on the same website server, to deliver the advertisements to Internet users. This part parses the contents in the XML file and uses adaptation strategies to send the appropriate advertisement to the appropriate user, based on a user model storing at least the following user characteristics: design, relevance, price, device, and bandwidth.

Information about users can be gathered in several ways. Social networks are used in the proposed system as the main way to get user information. We will try to acquisition real time data such as bandwidth, device, and demographic information. In addition, we will also use user behaviour; for example, advertisements that a user has searched or browsed for in the past and websites that the user has recently visited.

A. Requirements for AEADS System

1) Extract the main attributes of the user model from social networks.

2) Create the domain model; that contains a categorization for the advertising, in easiest way suitable for all website owners.

3) AEADS should organize the user model structure as logical concepts.

4) Adaptation strategy must be created by a good graphic user interface tool.

5) Neural networks can be used to enhance the adaptation process.

6) AEADS monitors the use of adverts (for evaluation purposes):

a) Find out how many people click on each advert.

b) Find out how many people view an advert and don't click.

c) Create a 'fake' advert page for each advert, with the information about the item (picture, facts, price, etc.) that opens in the centre screen of website, with two buttons:

- *I would buy this*

- *I would not buy this*

Please note that the proposed system for personalized advertisements is heavily based on e-learning adaptive systems, however, that it is novel for the area of advertising.

VIII. CONCLUSION

Internet advertising is a growing revenue stream that many businesses are looking at. However, personalisation may be the key to ensuring effectiveness of the advertising. Social networks analysis is an increasingly popular technique that can be used in our case to extract user behaviour and characteristics and allow presentation of personalized advertising.

The research results have shown that businesses would prefer to send out personalized or segmented advertising

messages, and that design issues are a key feature of the advertisements that will either attract or repel the users. Based on research results, a new methodology to enhance the organization and adaptation of advertisements in any website is introduced. This methodology uses the web services to create a generalised system that can work with any website. We expect social networks to play a major role in extracting users' characteristics for such systems.

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