How to Create an E-Advertising Adaptation Strategy: the AEADS Approach

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Abstract. During recent years, the internet and online marketing have experienced a continuous growth. Web-based advertisement is used to target users easily, without place or time limitation. Personalization is an ingenious way to potentially increase the effectiveness and efficiency of web-based advertisements. In this paper, a model for creating personalisation specification for businesses (*adaptation strategies*), based on *adaptation rules*, is introduced. The paper also implements a version of this model and presents its evaluation.

Keywords: E-advertising, E-commerce, Personalisation, Adaptive Advertising, Adaptation Strategy, Authoring System.

1 Introduction

The growth in online advertisement has been rapid; this is demonstrated, for instance, in the case of 2012, when revenues from internet advertising in the United States became higher than that of cable television, recording the value of $36.57 billion, an increase of 15.2% from the previous year [1]. Traditional e-advertisements involve the use of methods like banners [2], which are used on the web pages through the graphic advertising display, to attract the attention of a wide market. Recently, advertisements have become more aggressive, by using methods such as pop-up ads, swimming across the screen ads and playing music ads [3], which push users to use pop-up blocking software.

As a more gentle alternative, personalization can be used to enhance customer services or the e-commerce sales. It is a form of direct marketing to the customers, as it enables the enterprise web pages to be tailored for specifically targeting individual customers [4]. It can be used to increase customer satisfaction and encourage repeat visits. Adaptation is the process of changing in order to fit a given situation or purpose. Whilst personalization is considered useful in many areas, the process of creating personalized experiences in any domain, and thus also in e-advertising, is complex [5].

Hence, the main questions this research purposes to address are:

1. *How can we support the creation of adaptive advertising by website owners?*; and more specifically:

A. *What type of tools do website owners need to be able to efficiently add adaptive adverts in a lightweight manner (as an add-on) to their website?*
B. *What kind of support do website owners need to be able to use these tools?*

This paper provides solutions to the above questions by recommending a series of tools that can be used in formulating adaptive advertising strategies. It also performs an in-depth analysis of an implementation of an essential adaptive advertising tool component, the *adaptation strategy tool*, by having it used by genuine businesses in order to conduct a realistic appraisal.

The next sections discuss related research, adaptation strategy implementation and evaluation. Finally, a conclusion and future work pointers are provided.

2 Background and Related Research

Personalisation has first been applied in the fields of distance learning and web-based educational systems. In this field, many models and frameworks for adaptation have been introduced in the past, e.g., XAHM [6], WebML [7], LAOS [8], AHAM [9], Dexter [10]. Most frameworks advocated the 'separation of concerns' [11] principle, which encourages creation of sub-models aimed at the main components of adaptive delivery and authoring. As a result, separate tools for creating adaptation have been used by most authoring systems for adaptive hypermedia [8]. Ways of modelling adaptation specification have been proposed before; for instance [12] identified three major adaptation layers and the different roles that they play in a typical adaptive model. Together, these three layers form the layered adaptation granulation (LAG).This paper specifically focuses on the *adaptation model for e-advertising*, illustrated by the tool created as a proof of concept, and evaluated with businesses.

This specific area is quite new, with pioneering systems such as MyAds [13], AdSense [14], or AdROSA [2].

However, a generalization of these systems into a model or framework, ready to be applied to any website, by any business, has not yet been proposed. This very challenging problem is tackled by the umbrella research. Here we focus on illustrating a part of it, *a simplified way of specifying adaptation to generate adaptive e-adverts*. The content of the adverts and its meta-data is considered to have been authored elsewhere [15]. The tools need to be simple, as advertising owners are less likely to be able or have the time to use complex adaptation models, and complex personalisation.

3 Authoring Adaptive E-Advertising

The overall Authoring model of Adaptive E-Adverts, as informed by prior research and implementations, especially in the area of personalised e-learning, includes:

1. *Domain model*, to be used by businesses to organise, label and categorise advertisements. The model, described elsewhere [15], is not further detailed here.

2. *Adaptation model*, which should enable business owners to adapt the advertisements they have organised after creating the domain model their customers' needs, is instantiated via an implementation, as described below.

The adaptation model is a crucial component of personalisation, and also traditionally the most difficult one to implement and use [16]. For our e-advertising purposes, we have opted for a straightforward rule-based model, describing *adaptation rules*. Moreover, we have identified two types of relevant rules (based on [5]): *general rules* and *behaviour rules*. General rules include typical rules, e.g., based on age, gender, device type and bandwidth (illustrated in Fig 1a). Behaviour rules link to user actions; e.g., after (1,2,3,4) clicks then (1,2,3,4) items from subgroups are displayed; if this advertisement appears to the current user (1,2,3,4) times and is not clicked, then let it disappear for (1,2,3,4) visits, etc. (illustrated in Fig. 1b). In addition, the client can select one rule or combine multiple rules for an item. Furthermore, the client can change and delete the rules of an item. The *Adaptation Strategy tool* is the second tool of the AEADS authoring package for adaptive e-adverts delivery, and illustrates the adaptation model proposed, as well as the simple approach to authoring of relatively complex adaptation rules that we target. The tool is aimed at proof of concept, and can be extended, based on the same adaptation model, to a different (or extended) set of desired general and behaviour rules, depending on the business's needs.

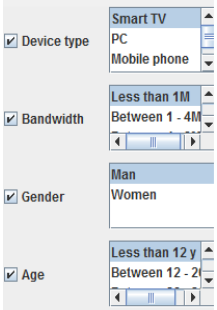

Fig. 1a) General Rules

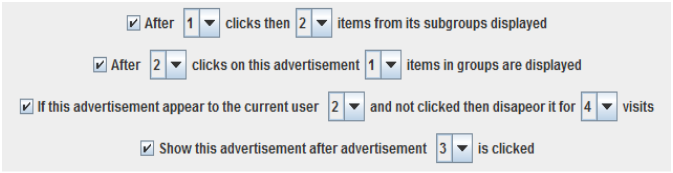

Fig. 1b) Behaviour Rules

4 Case Study

4.1 Hypotheses

The following hypotheses have been defined to evaluate the adaptation approach, as described above and instantiated by the adaptation strategy tool:

H1: *The tool is important for business.*
H2: *The tool is easy to use.*
H3: *This tool makes advertising work easier.*
H4: *A new staff can understand and use this tool with minimal training.*
H5: *This tool is saving time.*
H6: *General Rules are useful and easy to use (e.g., age, gender, etc.).*
H7: *Behaviour Rules are useful and easy to use.*
H8: *Applying rules on items or advertisements is useful and easy to use.*

H9: *Combining multiple rules on items or advertisements is useful and easy to use.*
H10: *Changing rules for items or advertisements is useful and easy to use.*
H11: *Deletion rules for items or advertisements is useful and easy to use.*
These hypotheses have been tested by surveying a set of selected business owners and analysing their answers, as further described below.

4.2 Case Study Setup

A questionnaire has been created for businesses to evaluate the tool based on the hypotheses above, in terms of functionality and ease of use.
Eleven business proprietors chosen from a wide range of industries were asked to use the adaptation strategy tool according to the following guidelines:
Initially, they were given a general overview of the system and were also introduced to the concept of adaptive advertising. Following this, each participant was asked to use the tool and evaluate it. The questionnaire was provided at this stage to facilitate the appraisal process and was composed of three sections. The first section related to demographic data. The second section incorporated a Likert scale [17] to allow participants to provide a comprehensive evaluation of the tool's functionality and utilities, as illustrated in Table 1 and also referenced in Figure 3. In this survey, the Likert scale provided five response options to participants and they were required to select from these when assessing the tool; number one on the scale represented not useful at all or very difficult to use while five represented very useful or very easy to use. The final section of the questionnaire contained a series of open-ended questions that were designed to elicit additional feedback on the tool from the business owners.

Table 1. Key Features and Functions

A	Whole Tool	H	If this advertisement appears to the current user (1,2,3,4) and is not clicked then let disappear it for (1,2,3,4) visits
B	Having a rule on age	I	Show this advertisement after advertisement (1,2,3,4) is clicked
C	Having a rule on gender	J	Applying rule on item
D	Having a rule on device type	K	Combining multiple rules on item
E	Having a rule on bandwidth	L	Changing rules for item
F	After (1,2,3,4) clicks then (1,2,3,4) items from its subgroups are displayed	M	Delete rules for item
G	After (1,2,3,4) clicks on this advertisement then (1,2,3,4) items in groups are displayed		

4.3 Results

Participants in this experiment were chosen from a variety of industries, namely media, transportation, consultation, retail, telecommunications, construction and web-based education services. From the total of the businesses involved, 46% were SMEs,

27% medium and 27% were large companies. Furthermore, 55% were based in Saudi Arabia while 45% were based in the UK. In such a way, a representative spread for the initial case study was achieved.

The participants used the Likert scale to evaluate the usefulness of the Adaptation Strategy tool's features and functions (Black column in Fig. 2). Data analysis was performed on the responses and the table was compiled. Based on the outcome, it is clear that all key features and functions (A-M, defined in Table 1) were rated highly by business owners. Every respondent allocated a Likert scale mark of 4 or 5 (*useful* or *very useful*). The mean values were between 4.18 and 4.90 and the standard deviation values were between .30 and .60. The tool is thus useful, as the mean values were all greater than 3. Out of the 13 features, the 'rule on device type' received the highest score, together with the rule 'apply rule on item' and 'combine rules on item'. On the lower end of the scale, the features which scored the lowest were 'if this advertisement appears to the current user (1,2,3,4) and is not clicked then it disappears for (1,2,3,4) visits' and 'modify rules for (the current) item'. The possible motive for this is that business owners may not see a strong reason for an advertisement to disappear (they may be wary of it) and they don't see a strong need to modify rules that have been created. So, they felt that these functions may not always be needed. However, both of these features still received a score of at least 4, which indicates that they were still regarded as useful.

In terms of ease of use, all features of the Adaptation Strategy tool were reported as being easy or very easy to use (with mean values between 4.36 and 4.90 and standard deviation values were between .30 and .52, as shown in Grey column in Fig. 2), a result which indicates that the tool as a whole is accessible and easy to use. .Subsequent data analysis showed that the 'whole tool' and the 'remove rules for item' elements were rated 5 by all participants. The lowest rated element was 'show this advertisement after advertisement (1,2,3,4) is clicked' but this feature still received a score of 4 or higher, which implies that this element is still easy to use. Overall, these research findings suggest that the Adaptation Strategy tool is easy to use.

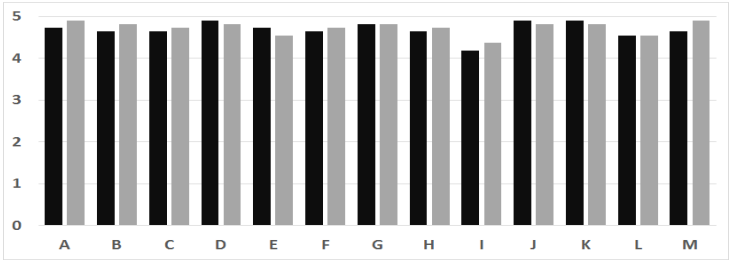

Fig. 2. Usefulness Ease of Use (Ox axis detailed in Table 1)

The final section of the questionnaire asked participants to provide *free feedback on the Adaptive Strategy tool* and was designed to obtain an appraisal of the tool as a whole and also to determine if there were any aspects of the tool that should be eliminated or developed further. This qualitative research approach is invaluable in the early design phase as any issues with accessibility, user interface or functionality can be rectified at an early stage in order to enhance the overall performance of the model. In terms of responses, several important points were made to suggest how to

improve the tool and increase the likelihood of businesses incorporating it as part of their business model. Firstly, several participants requested that the application developers '*make it easy for business owners*'. This supports our initial assumption that business owners need extremely simple tools, to ever consider authoring adaptive adverts with it. In fact, this particular business owner further told the interviewee that business owners are typically very busy, and any complexity should be avoided, as they can only invest little time in learning such tools. Secondly, several participants mentioned that the design of the tool can be improved. Again, more insight would be required in order to determine which design elements need work, but further research could be conducted before a more user-friendly design is developed. We expect this to be dependent on the business and business owner, and that a smooth merger with their own website look and feel would possibly be the best approach. In other words, there is no universal solution, but each solution would need customised for a particular business.

Several participants made queries about the functionality and asked '*how will you know the device type?*'; this would be achieved by detecting the use of a mobile or non-mobile browser via website configuration. This query suggests that the developers may want to provide more in-depth operational information to clients, so that they are aware how the processes are implemented and how they are affected by the use of different devices. One participant stated that there was '*no reason to divide rules into two types*' while another asserted that they would like to be able to '*divide rules, based on products*'. This again shows a diversity in perspectives, as each business has unique requirements. However, it would possibly be useful to extend adaptation to implement a product-dependent rule as many companies would require a different set of rules based on product and their target demographic.

In fact, many participants stated that they would like to be able to apply their own customised rules using the system, or have a broader set of rules at their disposal. One participant requested a rule that would show another variation of the same product when a user clicked on it more than twice. This would prove effective in adaptive advertising, as many hesitant customers may be swayed by the provision of more options (even simple ones, such as colour). Furthermore, one participant requested a unique set of rules for different product categories; for example, different rules could be chosen in the sale of books as opposed to shoes. Also in terms of product type, one participant proposed the availability of rules applicable to the sale of services. These rules could be applied in a similar way to those already devised and show a range of related services when a user visits more than twice.

In addition, one participant would like the option to apply a different set of rules depending on who is accessing the website, the company or a customer. Another participant requested the addition of a colour rule, whereas a different business owner believes that a rule based on nationality could prove useful. In a similar context, another owner stated that a rule on education level or profession would also be well-received. The extensions above would facilitate a more advanced application of the adaptive advertising process, even potentially moving from the adaptation strategies to the adaptation language approach. This however would be more complex for business owners to apply, and thus benefits need carefully be evaluated against costs.

In terms of system features, three participants made suggestions on improving the range of services provided. One recommended the provision of a feature that would

enable them to apply a specified set of rules to a group of specified products. This feature would streamline the implementation process, as many products would undoubtedly share a similar set of rules. This has been proposed before in adaptation language research [18], and that case-by-case it is implementable, but that a generic authoring method that is also easily usable would still have to be found. Another participant recommended that the system allows them to apply a selection of rules to an advertisement. A different business owner expressed the need for a strategy that would allow them to target their customers more effectively by narrowing in on demographics. This request might be inspired by the current way Facebook and other social networking sites are allowing businesses to create and semi-customise adverts, by selecting a number of demographic parameters, such as age group, nationality group, gender and knowledge. Addition of such rules is relatively straightforward, but it depends a lot on the type of data about their customers that they have access to. A different line of research undertaken under the same umbrella has proposed to extract such user-related information from social networks [5], or to have a different way of allowing business customers to provide the personal data that they are comfortable in sharing with the business. This is not further detailed in this paper, which is focusing on the authoring of the adaptation strategies, its first set of tools and their evaluation, but it will be part of the further research into the user modelling aspects of the overall research question. Finally, one user suggested that the system should incorporate a method that will highlight any item that has no designated rules applied. Again, this would improve the user interface and allow business owners to easily detect aspects that they haven't worked on yet, or products that have no allocated rules for. In adaptive hypermedia, adaptation engines usually have a default strategy for such objects (either 'show all' or, sometimes, 'hide all'). The respective default strategy in the business field is usually 'show all', with different variations thereof. For example, show all adverts present, by rolling through them at a given rate, depending also on the display size allocated in the browser. We expect this to be somewhat varied, depending on the business itself, and its standard ways of processing adverts. Adaptation has to sit in a lightweight manner on top of the existent webpages of the business, and using the default strategy, where no other information is present.

4 Conclusion

In summary, we believe that an Adaptive Strategy creation system would allow businesses to increase sales potential by facilitating the accurate targeting of advertisements based on a series of predefined demographic attributes and rules. This tool has been tried out by companies who wish to direct their advertising campaigns at specific consumer groups, as it could enable them to quickly and effectively assign a series of rules based on their target market. As discussed, the system, its features and usability have been evaluated, both theoretically and by established businesses, and the overall initial outcome has been positive. However, it is clear that there are aspects that require further development, and especially specific customisation for each business, as the feedback section provided a range of suggestions that could be used to enhance the overall functionality and usefulness of the tool.

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