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A Research Paper on Measuring Effectiveness of Online Behavioral Advertisements

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Abstract: *In recent years, popular internet content and services have been funded increasingly by advertising rather than through charges to consumers. If advertising is to remain the primary means of financing Internet content, then advertising rates will be a critical determinant of the kind and quality of Internet content available. If publishers can't effectively capture some of the value they create for viewers, they will not be able to provide as much content, or content of the same quality as viewers have come to expect. One strategy widely used to increase the value of advertising is behavioral targeting. If advertising better matches consumer interests, consumers are more likely to respond to the message, and advertisers will be willing to pay more for ads delivered to such an audience [1]. The report published by Network Advertising Initiative (NAI) in March 2010 found that in 2009, behaviorally-targeted advertising secured an average of 2.68 times as much revenue per ad as non-targeted "run of network" advertising [2]. Hence, it is very important to measure effectiveness of online behavioral advertising also known as "Holy Grail" in online advertising because of its effectiveness. This study focuses on measuring effectiveness of online behavioral advertising at different stages of buyer behavior process by collecting data from 120 respondents.*

Keywords: Behavioral targeting, buyer behavior process, online behavioral advertising**.**

1. Introduction

What Is Online Behavioral Advertising?

Definition: Online Behavioral Advertising means the collection of data from a particular computer or device regarding Web viewing behaviors over time and across non-affiliate Web sites for the purpose of using such data to predict user preferences or interests to deliver advertising to that computer or device based on the preferences or interests inferred from such Web viewing behaviors [3].

Online Behavioral Advertising does not include the activities of First Parties, Ad Delivery or Ad Reporting, or contextual advertising (i.e. advertising based on the content of the Web page being visited, a consumer's current visit to a Web page, or a search query). A First Party is the entity that is the owner of the Web site or has Control over the Web site with which the consumer interacts. Non-Affiliate website is any entity that is not under common ownership or a subsidiary of an organization. An entity is a Third Party to the extent that it engages in Online Behavioral Advertising on a non-Affiliate's Web site [3].

Online behavioral advertising means the tracking of a consumer's online activities over time − including the searches the consumer has conducted, the web pages visited, and the content viewed in order to deliver advertising targeted to the individual consumer's interests. For website publishers and advertising networks, OBA promises a higher return from the delivery of advertising tailored to the specific consumer viewing the website. Consumers benefit from advertisement delivery focused on their interests and preferences [4].

Importance of Online Behavioral Advertising

The interactive nature of the online medium offers rich potential for research opportunities, including examinations of the effectiveness of rich media advertising [6]. The design and metrics employed determine online advertising recall and behavioral responses. Accurately measuring online advertising thus is essential for advertisers, who employ metrics to evaluate online ads and facilitate informed decisions about advertising strategies [7].

For advertisers, online advertising campaign decisions may be complicated by the array of ad formats and insufficient knowledge about their effectiveness [8]. Therefore, they require greater understanding about the use, effectiveness, and measurement of interactive online rich media [6], [8], as well as more studies of the interactivity of consumers and ad messages [9].

How online behavioral advertising works?

Information about user's web browsing activity is collected and analyzed anonymously. If this analysis infers a particular interest (travel and Rome for example), a cookie (a small file used by most websites to store useful bits of information to make your use of the internet better – see below) is placed in user's web browser (e.g. Internet Explorer, Mozilla Firefox) and this cookie (not your web browsing information) determines what advertising you receive. It is therefore very important to realize that behavioral advertising can operate anonymously without user being identified as an individual [10].

In most cases the data that behavioral advertising companies collect about the user is not tied to user's personal information. That is to say, they don't know user's name, user's home address, or user's phone number. Instead, these companies identify user by a random ID number and try to make guesses about user's interests and characteristics based on user's online activity. The data they retain could include [11]:

- Your inferred age group (e.g. 18-25)
- Your inferred gender (e.g. male)
- Your inferred purchase interests (e.g. shoes)

How to measure effectiveness of Online Behavioral Advertising?

Advertisers want evidence that their online ads are effective. Internet advertising proponents posit that the online advertising medium offers a measurable context, because marketers can collect data about users' interactions with ads [12]. In addition, it offers multiple ways to gauge effectiveness, including online behavior and offline purchases.

Despite the lack of industry-wide metric standards [13], the Internet Advertising Bureau (IAB) has published recommended guidelines to standardize the measures. The adoption of measurement guidelines could offer more meaningful Web advertising metrics for advertisers and perhaps encourage the online advertising industry to use the same terminology to sell, purchase, and evaluate online advertising performance.

Advertisers attempt to influence the minds of their consumers, measure their responses, and then predict what will happen next [12]. The choice of a Web metric therefore depends on the measurement objective, as well as the advertiser's budget, technology, and time limits [14]. Some common Web metrics include page impressions, ad impressions, and clicks.

For example, ad impressions measure the response by a delivery system to an ad request from a user's browser [14]. Impressions, or page views (i.e., how many times a web page is viewed), measure an ad's reach and visibility on a Web page [14], or the overall exposure of an online ad. Although the ad impressions measurement cannot reveal user involvement, it provides advertisers with a good measure of the ad's success in terms of brand recognition or brand visibility. The cost per thousand (CPM) model counts the number of visitors exposed to an online ad (e.g., banner ad) on a particular site, and advertisers also have access to site traffic information. However, ad impressions do not track user involvement with the advertisement.

The Internet Advertising Bureau (2004) defines three kinds of clicks: click-through, in-unit click, and mouse-over. The click-through rate (CTR) measures the number of clicks divided by the number of ads requested or clicked on by users during a specified time period [15]. A click-through occurs when a user clicks on an ad and enters another online location, such as another browser window or Web site. Click throughs can be tracked and reported by the ad server (Internet Advertising Bureau 2004); because they indicate a behavioral response, they also provide countable measures for online ads [16]. These click-through metrics are easy to observe and indicate an immediate interest in the advertised brand [17].

To predictively measure response to Online Behavioral Advertisement, we can use multiple regression analysis method. Further, in order to reduce multiple variables by narrowing down to two variables, factor analysis method has been used. These methods are discussed in detail in research methodology section of this paper.

2. Statement of Problem

To measure effectiveness of online behavioral advertisements by predictive method

3. Literature Review

The increasing popularity of the internet as a business vehicle in general, and an advertising medium in particular is due to its current size, future growth forecasts, wide demographics, ability to facilitate the global sharing of information and resources, potential to provide an efficient channel for advertising as well as marketing and potential as a sales channel (Hoffman and Novak 1996). Besides being a business vehicle, internet is providing users with tremendous access to information about products and brands from different sources from everywhere in the world [19].

Responsible online behavioral advertising (OBA) is a powerful tool that enables marketers to optimize the relevance of their messaging. OBA refers to the collection and use of information about online activities and Web viewing behaviors across non-affiliate websites to deliver customized ads. In a nutshell, OBA allows companies to match ads to consumers' interests at the right time and through the right channels. As behavioral advertising continues to fuel rich online content choices for consumers without added costs, the focus on OBA and interest-based advertising grows in importance, as well [20].

Although it is a very beneficial tool both for individuals and companies, it is considered to be one of the most controversial forms of advertising due to its implementation process. The process starts by collecting data, through cookies, from a particular computer or device regarding internet viewing behaviors across multiple domains (Advertising Internet Bureau). Although data collection on the internet is not done for advertising purposes it is collected in the internet cloud in general, still targeted advertising can irritate or make individuals suspicious and feel as their confidentiality rights are violated. But on the hand targeted advertising offers individuals to get news and learn the offers about products and services that they are interested in. In spite of the contradictions and discussions, the popularity of online targeted advertising is increasing among advertisers and websites [21].

Interactive media advertising refers to a broad range of methods that aim to create more relevant advertisements. The methods may be classified in several categories including contextual advertising, segmented advertising and behavioral advertising. Behavioral advertising is advertising that is based on the observation of the behavior of individuals over time. Behavioral advertising seeks to study the characteristics of this behavior through their actions (repeated site visits, interactions, keywords, online content production, etc.) in order to develop a specific profile and thus provide data subjects with advertisements tailored to match their inferred interests.

Behavioral advertising involves the following roles: *(a) Advertising networks providers (also referred to as "ad network providers")*, the most important distributors of

behavioral advertising since they connect publishers with advertisers*; (b) Advertisers* who want to promote a product or service to a specific audience; and (c) *Publishers* who are the website owners looking for revenues by selling space to display ads on their website(s). The delivery of ads through advertising networks basically works as follows: the publisher reserves visual space on its website to display an ad and relinquishes the rest of the advertising process to one or more advertising network providers. The ad network providers are responsible for distributing advertisements to publishers with the maximum effect possible. The ad network providers control the targeting technology and associated databases. The larger the advertising network, the more resources it has to monitor users and "track" their behaviour5. The advertiser typically negotiates with one or more ad networks and will not necessarily know the identity of all publishers (if any) that will distribute its ads. At the same time, a publisher may have several contracts with different advertising networks, for example by reserving different places on the website for different advertising networks [22].

The word behavioral refers to type of data that is collected and this data is mainly collected and stored through cookies and most commonly this behavior relies on users' behavior rather than the identity of the users (IAB Europe). Cookies are small text files that are placed on the user's computer by websites visited and cookies provide information to the website about how users interact with the site [26]). When a user access to a website the cookies are placed on the computer and cookies start with recording the IP address [25]. In this way website can navigate and identify the particular interest of the user and when a website agrees on sharing the information, it can be used for advertising purposes. Yet if a user decides to remove the cookies, the user can remove the cookies at any time by the settings on the browser. After gathering the necessary data from the hosts or websites, online behavioral advertising is implemented through grouping the shared interests of the users, based upon their web browsing activities (Advertising Internet Bureau). User segmentation and user segments ranking are the common general steps in behavioral targeted advertising. The first step aims to segment users according to their online behaviors whereas the second step, user segments, is applied to rank targeted user segments for an advertisement [24]. After grouping the user interest, advertisement is displayed to them every time the user visits a website which agreed on this advertising activity. For example, after booking a flight on an airline's website might, the user might be exposed to a travel-related advertisement about the destination the user is planning to fly while ordering a burger from the local burger joint or surfing in a book website. Generally it is accepted that greater relevance of online behavioral advertising often generates higher click-through than other types of online advertising such as email advertising or banner advertising since it is tailored to the behavior and therefore the interest of the user (Advertising Internet Bureau) [23]. Because it generates higher click-through and appeals directly to the users' interest by determining the users' actions [27], transaction rates of these types of targeted advertisements are higher than the other online advertising types [23].

Studies have shown that conversions are higher when people are targeted through behavior rather than content because behavior can determine a person's actions. Whether it is looking at specific sections of an online newspaper or visiting a certain type of site more than once, those actions are used to determine each user's interests. And it is those actions that make conversions. Advertising.com's study in October 2005 found that not only did behavioral advertising convert at a significantly higher rate than contextual advertising, but that CTR rates were also lower. Essentially, this means advertisers need fewer ad impressions to generate a conversion and those users that click are prime for converting into a sale or completing a specific action. However there are some significant obstacles that behavior targeting ad networks are facing, the largest being the implications that are associated with targeting individual users based upon what they do while surfing online. Behavioral targeting is definitely an up and coming ad format, even though it accounts for a relatively small percentage of online advertising. Currently, only 8% of all online advertising is behaviorally targeted. But with current studies showing how well it works and converts for advertisers, it can only mean more advertising dollars will be steered towards this method of targeting. And behavioral advertising is not just limited to image and text ads. So there are still new ad avenues to explore through this type of ad targeting in the future, as behavior targeting gains more ground [27].

How to benefit from targeted ads in a world concerned with privacy

Online behavioral advertising (OBA) is conducted by using third-party tracking. This means a tracking device -- in the form of, for example, a cookie is used to collect and analyze the behavior of a computer user. The third-party element comes into play because the tracking is likely taking place by another company than the owner of the website hosting the ad, and the information collected is shared with many companies through organizations such as ad groups. The tracked computer user information is compiled and used to create a profile that effectively segments that computer user for highly targeted ads. If the profile indicates the person probably likes dogs, but doesn't like cats, they would not receive ads for cat food, but might for dog treats. The article provides five tactics that will help you understand online behavioral advertising and privacy, actual steps to take, a look at the regulatory environment around the world, an explanation of the AdChoices icon, and finally, why transparent marketing is simply good business.

Tactic #1. Understand what you need to know about OBA

Marketers need to understand that privacy is actually a security and performance issue as much as it is a regulatory one. The first step every marketer needs to take is to inventory all your own websites to first understand what types of third-party tracking technology is there and what cookies are being placed on consumers browsers when they visit your site. This is known as a "cookie audit." It's important because third-party tracking code can slow down your website. Not only that, but targeting data can leak out to companies you may not even know about. Provide Web visitors with information on any tracking and the opportunity to opt out. Provide consumers with transparency giving consumers control over their data and how it's used is good for business.

Tactic #2. Take steps to manage OBA tracking and privacy

Once you understand the issue and how it might affect your advertising policies, there are actions you can, and should, take in regard to third-party tracking and privacy. Barton said anyone engaging in OBA should be providing "notice and choice," stating on the website how they handle third-party tracking and provide an opt-out. Notice and choice is just as it sounds. Visitors should be informed about tracking activities that are part of the website (including individual ads), how that data will be used, and the opt-out ability from tracking provides choice on the part of the website visitor.

Tactic #3. Understand the compliance and regulatory landscape around the world

The regulation and compliance issue with online tracking is a shifting field. Governments and consumer groups alike are looking into the issue around the globe.

Tactic #4. Understand and use the AdChoices program icon

By making the AdChoices icon part of your online ad, you are giving your customer the required information and opt-out choice. The message comes from you and not another player in the third-party tracking.

Tactic #5. Marketing and advertising transparently is good for business [28].

4. Research Methodology

4.1 Type of Research: Explanatory Research

Explanatory research is defined as an attempt to connect ideas to understand cause and effect, meaning researchers want to explain what is going on. Explanatory research looks at how things come together and interact. This study explains how to predictively measure effectiveness of Online Behavioral Advertising using multiple regression analysis model. This study gives relationship between response to an OBA while considering four independent variables viz. Time pressure in buying situation, Product or service type of high or low involvement, Advertising composure and placement and Advertising relevancy to user need [31].

4.2 Sampling

Type of sampling: Two stage sampling, Convenience sampling followed by simple random sampling.

Explanation and justification: This study considers high-end internet users who spend at least 10 hours weekly in internet surfing and are aware about know-how of browsing and using applications. As convenience the researcher has used advanced internet users working in his organization as target respondents because they fulfill all these requirements. Among advanced internet users randomly 160 of them were selected and asked for response. Hence latter stage is simple random sampling.

Number of respondents: A structured online questionnaire link was sent to 156 advanced internet users. Out of them 120 completed questionnaire and gave their response.

Data collection type of explanatory research method: Survey method

5. Results and Discussions:

5.1 Factor Analysis

Need to use Factor Analysis

To reduce four variables which represent reasons to respond to Online Behavioral Advertisements to two main variables [29]. The table given in annexure 2 shows the data pertaining to four variables depicting reasons to respond to Online Behavioral Advertisements. The researcher wants to reduce these four variables to two variables so that reasons to respond to OBA can be properly identified based on responses provided by 120 respondents. The focused variables list allows researcher to concentrate on relevant variables only. Initial variables before factor analysis application based on internet usage type:

• How many times in a week did you see the advertisement relevant to your interests? (Var 1)
• How many times in a week did you see advertisements on webpage based on your previous browsing? (Var 2)
• How many times in a week on social media websites did you see the sponsored ads based on your likes and dislikes (Var 3)
• How many times in a week did you see random web advertisements relevant to your demographic characteristics? (Var 4)

Interpretation

Communalities

Table 1: Communalities

	Initial	Extraction
var_1	1.000	.998
var_2	1.000	.904
var_3	1.000	.881
var_4	1.000	.998

The Communalities tell us what proportion of each variable's variance is shared with the factors which have been created. In the Initial column these are based on all four factors (one per variable). Accordingly, the values in this column tell us how much variance each variable shared with all the other variables. The researcher asked SPSS to create only two factors. The communalities in the Extracted column tell us how much variance each variable has in common with the two factors that the researcher has kept [33]. Item 3 has a relatively low value. If a variable does not share much variance with the other variables or with the retained factors, it is unlikely to be useful in defining a factor.

Table 2a: Total Variance Explained

Component	Initial Eigen values		
	Total	% of Variance	Cumulative %
1	3.541	88.515	88.515
2	.239	5.983	94.499
3	.216	5.397	99.896
4	.004	.104	100.000

Table 2b: Total Variance Explained

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.541	88.515	88.515
2	.239	5.983	94.499
3	-	-	-
4	-	-	-

Table 2c: Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	1.941	48.530	48.530
2	1.839	45.969	94.499
3	-	-	-
4	-	-	-

The Total Variable Explained table shows us the Eigen values for our factor analysis. SPSS started out by creating factors, each a weighted linear combination of the items. The initial Eigen values tell us, for each of those factors, how much of the variance in the 4 items was captured by that factor. A factor with an Eigen value of 1 has captured as much variance as there is in one variable. The Extraction Sums of Squared Loadings are interpreted in the same way that Eigen values are. Component 1 and 2 together represent 94.499% of variance.

Component Matrix[a]

[a] Rotation converged in 4 iterations

Table 3: Component Matrix

	Component	
	1	2
var_1	.976	-.211
var_4	-.964	.260
var_3	.911	.225
var_2	.910	.277

This table contains component loadings, which are the correlations between the variable and the component. Because these are correlations, possible values range from -1 to +1. From table 3 it can be observed that var 1, var 2 and var 3 have magnitude wise high positive correlation with component 1 compared to var 4. Same way var 2, var 3 and var 4 have magnitude wise low positive correlation with component 2 compared to var 1.

Rotated Component Matrix[a]

Table 4: Rotated Component Matrix

	Component	
	1	2
var_4	-.874	-.484
var_1	.848	.528
var_2	.460	.832
var_3	.498	.795

The Rotated Component Matrix gives the loadings after the rotation. From table no. 4 it can be observed that component 1 is heavily loaded on var 1, var 2 and var 3. So, online advertisements based on user's interests become one of the variable indicating the reason to respond to OBA. Component 2 is heavily loaded on var 2 and var 3. So, online advertisements based on user's earlier browsing usage become second factor indicating the reason to respond to OBA.

Result

After factor analysis application the final two variables are:

- Online advertisements based on user's interests
- advertisements based on user's earlier browsing usage

5.2 Multiple Regression Analysis

Need to use Multiple Regression Analysis:

Multiple regression analysis is a powerful technique used for predicting the unknown value of a dependent variable from the known value of two or more independent variables- also called the predictors. Multiple regression analysis can be used to predictively measure response to Online Behavioral Advertisements.

Author wishes to estimate the regression line: $y = b_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5$

Where

y= response to Online Behavioral Advertisement

b_1= Intercept

X_2=Time pressure in buying situation, an independent variable

X_3= Product or service type of high or low involvement, an independent variable

X_4= Advertising composure and placement, an independent variable

X_5= Advertising relevancy to user need, an independent variable [30]

Table 5: Regression Statistics

Multiple R	0.848144655
R^2	0.719349355
Adjusted R^2	0.709587594
Standard Error	2.062797015

Observations	120

Interpretation of Regression Statistics Table
The first indicator of generalizability is the adjusted R Square value, which is adjusted for the number of variables included in the regression equation. For the data we are analyzing, R^2= 0.7193 and the Adjusted R^2 =0.7095. These values are very close, anticipating minimal shrinkage based on this indicator. The adjusted R square is used to estimate the expected shrinkage in R^2 that would not generalize to the population because our solution is over-fitted to the data set by including too many independent variables. If the adjusted R^2 value is much lower than the R^2 value, it is an indication that our regression equation may be over-fitted to the sample, and of limited generalizability. R^2 = 0.7193 means that 71.93% of the variation of y_i around $\bar{Y}$ (its mean) is explained by the regressors x_{2i}, x_{3i}, x_{4i} and x_{5i}. The standard error having value of 2 refers to the estimated standard deviation of the error term u.

Table 6a: ANOVA

	df	*SS*	*MS*
Regression	4	1254.251541	313.5628853
Residual	115	489.3401254	4.255131525
Total	119	1743.591667	

Table 6b: ANOVA

	F	*Significance F*
Regression	73.69053	7.88E-31
Residual		
Total		

Interpretation of ANOVA Table
The ANOVA (analysis of variance) table splits the sum of squares into its components [32]. Regression MS (Mean Square) is 313.56 and residual MS is 4.255. Overall F test for Null hypothesis is 73.69. The column labeled F gives the overall F-test of H_0: $\beta_2 = 0$, $\beta_3=0$, $\beta_4=0$ and $\beta_5 = 0$ versus H_a: at least one of β_2, β_3, β_4 and β_5 is not equal zero. The column labeled significance F has the associated P-value. Since 7.88E-31 < 0.05, we **do not accept** H_0 at significance level 0.05.

Table 7a: Regression Coefficients

	Coefficients	*Standard Error*	*t Stat*
Intercept	-1.675035	1.342104	-1.248065
X1	0.018453	0.252583	0.073058
X2	2.958825	0.430979	6.865349
X3	-1.674460	1.020612	-1.640643
X4	1.710190	0.755849	2.26260

Table 7b: Regression Coefficients

	P-value	*Lower*	*Upper*
		95%	*95%*
Intercept	0.214542	-4.33349	0.983416
X1	0.941886	-0.48187	0.518773
X2	3.57E-10	2.105138	3.812513
X3	0.103604	-3.6961	0.347176
X4	0.025538	0.212997	3.207383

Interpretation of Regression Coefficients Table
Let β_j denote the population coefficient of the j^{th} regressor (intercept, X_2, X_3, X_4 and X_5).
Then

- Column "**Coefficient**" gives the least squares estimates of β_j.
- Column "**Standard error**" gives the standard errors (i.e. the estimated standard deviation) of the least squares estimates b_j of β_j.
- Column "**t Stat**" gives the computed t-statistic for H_0: $\beta_j = 0$ against H_a: $\beta_j \neq 0$.

This is the coefficient divided by the standard error. It is compared to a t with (n-k) degrees of freedom where here n = 120 and k = 5.

- Column "**P-value**" gives the p-value for test of H_0: $\beta_j = 0$ against H_a: $\beta_j \neq 0$.

This equals the Pr{|t| > t-Stat}where t is a t-distributed random variable with n-k degrees of freedom and t-Stat is the computed value of the t-statistic given in the previous column.
Columns "Lower 95%" and "Upper 95%" values define a 95% confidence interval for β_j.
A simple summary of the above output is that the fitted line is **$y = -1.675 + 0.01845*X_2 + 2.9588*X_3 - 1.6744*X_4 + 1.7101*X_5$**

6. Conclusion

By studying literature reviews and analyzing the results obtained from multiple regression analysis model and factor analysis, it can be concluded that better response of Online Behavioral Advertising results from OBAs which are designed as per product or service type of high involvement or low involvement, which are designed as per relevancy to user need, OBAs which are based on users' interests and OBAs which are based on users' earlier browsing usage. OBAs which are designed by keeping in view of above mentioned factors are likely to generate more response.

7. Limitations of the Study

This study covers responses of advanced internet users based on their weekly internet surfing hours. The conclusion has been derived based on responses obtained from 120 odd respondents. Multiple regression analysis has limitation as it assumes that the relationship between the two variables has not changed since the regression equation was obtained. It

becomes difficult to determine which variable is dependent on other and indicates a causal relationship. The technique of factor analysis does not necessarily lead to the discovery of "fundamental" or "basic" categories in a field of investigation. Sometimes, more relevant factors may be left out.

8. Scope for further research

The study may be extended to incorporate responses from less advanced internet users. This study takes two stage sampling with convenient sampling followed by simple random sampling, a larger sampling size of respondents from different demographic, psychographic, geographic and behavioral characteristics can yield further insightful results.

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10. Author Profile

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