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# Effectiveness of Personalization Techniques on Marketing Activities

Jyun-Cheng Wang

*National Chung-Cheng University Taiwan*

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# Effectiveness of Personalization Techniques on Marketing Activities

Wang, Jyun-Cheng  
Associate Professor, Dept. of Information Management  
National Chung-Cheng University  
Taiwan, ROC

## Abstract

*Various techniques have been proposed for taking advantages of such features of WWW as accessibility, addressability, and flexibility in order to reach the goal of one-to-one marketing. Not all the personalization techniques can achieve the same effectiveness for every marketing activity. In this paper, we examine the effectiveness of various personalization techniques with respect to the four aspects (product, place, price, and promotion) of the marketing activities. An experiment was conducted on commercial web sites with personalization techniques built-in. Using the instruments developed for Total Data Quality Management, we find that different personalization techniques achieve significantly different level of data quality for Product and Place information in marketing efforts. Specifically, constraint-based personalization techniques can achieve highest data quality in product information, and for place information, rule-based personalization techniques are least recommended.*

**Keywords:** Personalization Techniques, One-to-one Marketing, Total Data Quality Management

## 1. Introduction

The advent of the WWW uplifts the marketing to a new level with less difficulty. In particular, one-to-one marketing is deemed an attractive and feasible approach to conduct marketing effort on the web. While the advantages of one-to-one marketing have been touted (Peppers and Rogers, 1993), many of the features offered by the web were not seen before. Among the features are addressability, flexibility, and accessibility (Kiani, 1998). For addressability, with the network IP address, coupled with user's personal log, marketers can identify the customer, trace this customer's shopping experiences, and collect the information needed for later processing. The information will make possible to establish unique and "intimate" contact between customers and businesses (Blattberg and Deighton, 1991). In terms of flexibility, the web can be viewed as another type of media. This media allows real time update, close to zero menu cost, and possibly links to cooperative sites for more businesses. With the help of search engine, it is possible to broad users' searching scope, and in the mean time reduce users' search cost and relieve information burden. And the characteristic of accessibility refers to the possibility that a company could stand on the same competition basis and reach to the world as other huge companies.

To conduct one-to-one marketing on the web relies mostly on the so-called personalization techniques. Many web sites have used the techniques to improve their services, for example, MyExcite, Amazon, American OnLine, and American Airlines. According to a survey by Jupiter Communications, of the top 25 on line retailers, 40% of them claim to have implemented personalization services on their web sites. And a staggering 93% says they are pursuing it and will implement within one year (Hof, 1998).

Many discussions on personalization techniques focus on the technical aspect of the subject.

Particularly the emphasis is on how the information should be organized, stored, and retrieved in order to offer better services. Very few in the literature examine how effective these techniques are when a company intends to offer personalization services using these techniques. It is generally agreed that different web sites should be designed differently in order to meet their marketing goals (Palmer and Griffith, 1998). In this study, we ask the question of whether different personalization techniques would result in different level of effectiveness for the marketing functions. As the techniques embedded in more and more web sites, it is worthwhile to examine the interaction and find out the best strategy to take.

A personalization service, as the name suggests, is a very personal one. The best judges of whether a personalization service is successful are the customers themselves. In this study, we let the customers to express how well a personalization service has achieved from the 4P of marketing functions, namely, product, place, price, and promotion. The instrument we use is from Total Data Quality Management (Wang et. al., 1998). Data quality requires the users of information to grade on the usefulness of the information, which meets the desired goal of this study.

The result of this study will benefit those who want to implement personalization techniques and pursue personalization services. By examining from the interaction of marketing and technical aspect, the result should provide some useful guidance. The following section introduces relevant literature. The experiment is described afterwards, followed by results and discussions.

## **2. Literature**

### ***2.1 Personalization Techniques***

The concept of personalization is to achieve better service and increase customer satisfaction through understanding, communication, and courtesy (Surprenant and Solomon, 1987). One of the touted advantages of the electronic commerce is that information technology makes personalization services possible and at a lower cost. There are various techniques proposed for achieving personalization services (Dean, 1998; Guttman et. al., 1998), we summarize as five types.

1. Rule-based filtering: A series of yes/no questions or multiple choice questions are asked. Users' answers will be used to retrieve proper or customized information. The questions may range from personal information to the specific information provided on the web site.
2. Collaborative-based filtering: Also named Group Filtering. Users will be asked to rank the preferences to certain products to establish personal profiles. These personal profiles will be used to compare against the preferences of a population, and the sub-group with similar interests will be identified. The sub-group's other preferences will become recommendations to the user.
3. Content-based filtering: Web sites use this technique will ask users to specify certain favorite products. From these specifications, the system will derive recommendations to the user's desired products and other details. This technique is not easy as the mapping among different product categories need to be constructed in advance.
4. Constraint-based filtering: Similar to the previous content-based filtering, this technique requires users to provide information about other preferred products. However, instead of

asking specifications of products, this method takes as input a sequence of constraints to represent a user's preferences.

5. Learning-agent technology: This is a non-intrusive personalization. Because users do not need to answer any questions, their preferences are collected while they surf the web. Some important indicators such as browsing duration, time spent, and browsing sequences are recorded to serve as preference information.

The various personalization techniques are summarized in Table 2-1. It is noted that only Collaborative-based filtering requires information from user groups, other techniques use individual's information only. Meanwhile, individual's interaction is required for all techniques except Learning-agent technology.

**Table 2-1.**

<b>Personalization Techniques</b>	<b>Source of personal information</b>	<b>User involvement</b>
Rule-based Filtering	User	Yes
Collaborative-based Filtering	User and Sub-group	Yes
Content-based Filtering	User	Yes
Constraint-based Filtering	User	Yes
Learning-agent Technology	User	No

## **2.2 Data Quality**

When marketers use the WWW as a marketing tool, it is for sure that certain message is embedded in marketing efforts. Since the purpose of personalization techniques is to aim for better communication with potential customers, users have the final say of whether or not a marketing effort is successful in conveying its message. In this study, we want to know whether users find the information provided on a web site useful, which can be measured using instruments developed in Total Data Quality Management (Wang and Strong, 1996).

There are three approaches to measure Data Quality, namely, intuitive, theoretical, and empirical. The empirical approach relies on the "users of information" to grade on the quality of information. This is particularly suitable when the information does not have a "correct" value (Strong et. al. 1997). For a marketing effort, no one piece of information is "correct", given the different orientation of users. We adopt the empirical approach in measuring the data quality of the information provided by web sites.

There are four dimensions in measuring data quality: Intrinsic, Contextual, Representational, and Accessibility. Intrinsic aspect means correctness and objectiveness of the information. Contextual aspect means that the information presented should be relevant to the task undertaken. In short, the information has to be valuable, timely, complete, and not overloaded. Representational aspect refers to the presentation style of information being concise, consistent, and easy to grasp. Finally, accessibility means information should be ready for access in a secured manner.

In this study, we take advantage of the four dimensions of data quality and use them as the basis of our instrument. To measure the effectiveness of personalization techniques at different levels of marketing efforts, we ask users to respond to questionnaires regarding the

four aspects of marketing efforts, i.e., product, price, place, and promotion.

### 3. Experimental Design

We use one-factor completely randomized experimental design for this study. The independent variable is “personalization technique.” Dependent variables are the data quality of the information generated during four levels of marketing efforts. The research framework is depicted in Fig. 3-1. Two factors may affect the outcome of the experiment and are randomized. One is the subjects’ familiarity to the WWW, and the other is their online shopping experience.

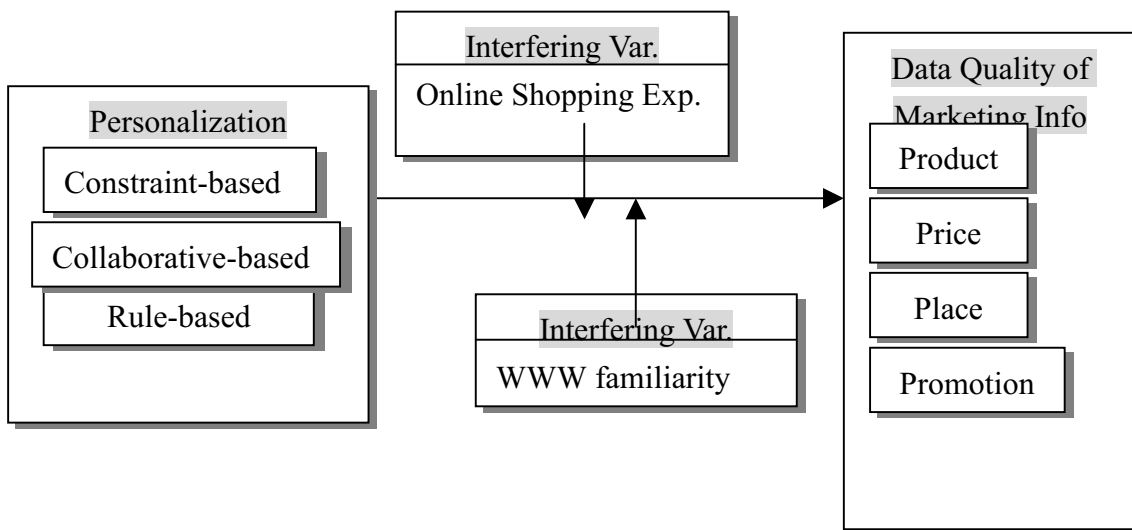


Fig. 3-1. Research framework

In measuring the data quality of marketing information, we ask subjects to focus on the following information. On product related information, emphases are on how the web site facilitating information searches on product features, size, warranty, packaging, etc. For price information, in addition to product prices, information regarding terms of payment, discount, and payment methods are expected. For place information, we ask users to pay attention to organization of information, display of product information. Finally, for promotion information, we want users to grade on the ease or difficulties in finding promotion messages, such as freebies, samples, and raffles. And we want to find out whether the users find the promotion messages tailored to their needs.

As Griffith (1998) points out that different web sites should be designed in such a way so as to attain their marketing goals. In other words, different techniques should be considered to meet their needs. We develop the hypotheses of this study attempting to discover the proper personalization techniques for different marketing goals. Thus, the following are the hypotheses.

*H1: The data quality of product information provided by different personalization techniques is significantly different among each other.*

*H2: The data quality of price information provided by different personalization techniques is*

significantly different among each other.

H3: The data quality of place information provided by different personalization techniques is significantly different among each other.

H4: The data quality of promotion information provided by different personalization techniques is significantly different among each other.

The experiment is conducted in a laboratory with 25 computers at the National Chung-Cheng University. Three commercial web sites, each designed using different personalization techniques, are chosen for this experiment. The associated personalization techniques are identified based on the description of the companies who built the web sites (which are different from the companies running the web sites), third party technical reports and several criteria for judgment. Table 3-1 describes the three web sites and the respective task for the subjects. In this study, we only test for three types of technique, rather than the five types as mentioned in previous section. Two techniques, learning agent and content-based, are excluded in this study for either a longitudinal study required (the former) or a real world web site not available (the latter).

**Table 3-1. Three designated web sites**

Group	Technique	Web Site	Service	Task
1	Constraint-based	Personallogic.com	CarMatch	Choose a favorite car
2	Collaborative-based	Amazon.com	BookMatch	Choose an interesting book
3	Rule-based	Garden.com	PlantFinder	Choose a kind of plant to grow

There are 60 subjects involved in this experiment. Each is randomly assigned one of the three web sites to complete the associated task, as listed in Table 3-1. While the targets are real commercial web sites, the subject are not required to make purchase during the experiment. The emphasis is on how well the web sites provide information to assist purchase decision-making. After subjects finish the task, they have to answer a questionnaire regarding the experiences of finding their desired product on the web site. In particular, we want the subject to evaluate how well the web site presents information about product, price, place, and promotion incentives. The evaluations are to be recorded using instruments developed in Total Data Quality Management.

#### **4. Results and Implication**

The data are gathered and analyzed using the statistics software package SPSS 8.0. ANOVA and Tukey's methods are applied for making comparisons among subject groups. F-value shows whether or not the data quality of information produced by three techniques for each marketing function are significantly different. The result (Table 4-1) shows that, at 95% confidence level, data quality of product information (p-value 0.016) and of place information (p-value 0.003) are significantly different. This implies that for product and place information, the three personalization techniques do not achieve same level of effectiveness in conveying the messages.

**Table 4-1. Results of the experiment**

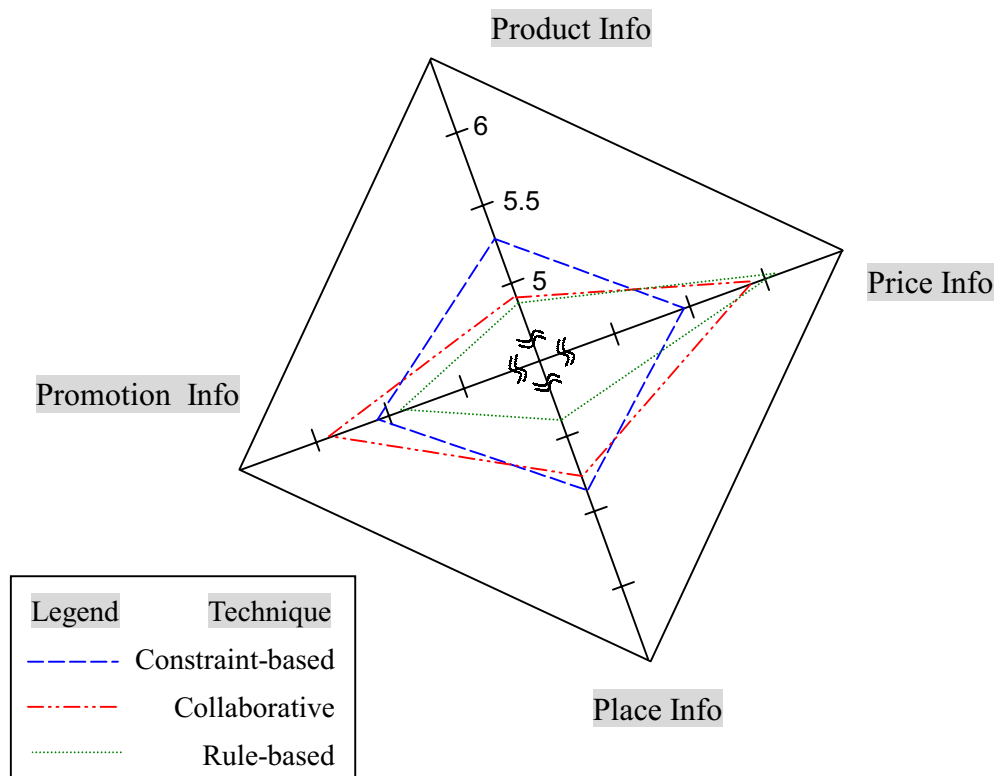
	<b>Personalization Tech.</b>	<b>Average</b>	<b>Std. Dev.</b>	<b>F value</b>	<b>p-value</b>
Data Qual. Of product information	A. Constraint-based	18.65	4.93	4.427	0.016
	B. Collaborative-based	22.55	6.15		
	C. Rule-based	22.80	3.35		
Data Qual. Of price information	A. Constraint-based	10.05	4.11	2.035	0.140
	B. Collaborative-based	8.45	3.73		
	C. Rule-based	7.85	2.70		
Data Qual. Of place information	A. Constraint-based	13.05	1.76	6.533	0.003
	B. Collaborative-based	13.50	2.52		
	C. Rule-based	15.85	3.36		
Data Qual. Of promotion information	A. Constraint-based	14.80	4.76	1.740	0.185
	B. Collaborative-based	13.00	2.51		
	C. Rule-based	15.60	5.67		

We further use Tukey multiple comparison to investigate the difference within each category of information. At 95% confidence level, as shown in Table 4-2, in the category of product information, constraint-based techniques is better than the other two (noted that the lower average score, the better quality). And these two methods do not appear to be different. For place information, rule-based technique is worse than the other two. Similarly, the two do not show evidences of difference.

**Table 4-2. Tukey multiple comparison**

<b>Data Qual. of <i>product</i> info</b>			<b>Data Qual. of <i>place</i> info</b>		
Method	Personalization Tech.	p-value	Method	Personalization Tech.	p-value
Tukey	A      B	0.041	Tukey	A      B	0.852
	C	0.027		C	0.004
	B      C	0.986		B      C	0.018

The finding of the study is summarized and illustrated in Fig. 4-1. The illustration shows the different levels of effectiveness when different personalization techniques are applied for conveying marketing information to targeted customers. In the figure, there are two axes, crossing at the origin, and cut into four rulers (directions). Each ruler represents one type of marketing information. The scales on each ruler represent the effectiveness that each technique can achieve. A technique that registers a higher score on a ruler means it can convey that particular type of information more effectively. There are three findings for this study.



**Fig. 4-1 Summary of findings**

Finding 1: Constraint-based technique can convey product information more effectively than the other two.

The web sites in the experiment generally conduct questions to collect user's preferences. Of the three techniques in providing product-related information, the collaborative-based technique tends to ask questions about how satisfactory the subjects feel toward various other products. And then use the collected information to recommend product for the subject. But since the subjects are not always familiar with the products mentioned in the questions, the recommended list tends to be less appealing. Contrast with this approach, the constraint-based and rule-based techniques usually ask questions about the preferences over specifications of the product. The recommendation seems more close to users' liking.

In comparing the rule-based and constraint-based techniques, we find that constraint-based technique turns to be more effective. A closer examination shows that constraint-based technique would take immediate action when each question answered. For example, when a user specifies the preferences, the system will eliminate the unsuitable and show the candidate products. This gives users a very intimate interaction and a better control of whether a user become over selective. In contrary, the rule-based techniques would ask all the questions before a final recommendation list is generated. At this time, if none available, the users' effort become in vain and could have complaint of the lack of a warning mechanism.

Finding 2: For place information, rule-based technique is less effective than the other two techniques.



Place information usually consists of information about the vendor (the web site), and channeling information about the product for sale. For this type of information, we focus on the two aspects of the data quality instruments, namely, Intrinsic and Representational. Intrinsic aspect usually relates to the reputation of the site. And Representational aspect tends to have a positive bias toward information that is more easily understandable. For this reason, we found that two experimenting web sites enjoy the advantage. For the Intrinsic aspect, Amazon.com, being a well-reported web site, is received well and the subjects feel trustworthier. For Representational aspect, the CarMatch task generally deals with car information and is better accepted by the users. Therefore, we believe there are some factors beyond the personalization techniques per se may have impact on the results.

Nonetheless, the different techniques do spell difference, particularly in the presentation of information. During the experiment, there are times when a list of interesting information needs to be presented. For the constraint-based technique, the information is sorted in the order of preferences. In so doing, users can get the most wanted one with ease. The collaborative-based technique would classify the retrieved information, and show them under different categories. This kind of sorting or classifying is a useful way of relieving the users' information burden. In the rule-based technique, the information is presented in a random order without any further treatment. Thus, in comparison, the rule-based information is less desirable.

Finding 3: No significant difference for price information and promotion information for the three personalization techniques.

Price information usually plays a critical role for a purchase decision-making. Also it is relatively more concise and presentable. Users in general prefer lower prices and there is no need for finding the different preferences, which is the strong suit of the personalization techniques. In view of that, price information does not appear to be personalization techniques sensitive.

As to promotion information, since it is the information that each web site wants to express most urgently. Thus these kinds of information enjoy high visibility. Furthermore, from consumers' point view, they are not aware of whether they miss certain promotion messages if they do not see it during their browsing. This is unlike product information where users may have questions need to answer. For these possible reasons, the promotion information does not have different levels of effectiveness.

There are certain limitations for this study. First, the subjects are all senior or graduate students, who are more knowledgeable in computer related experiences. A broader base subject will be needed to make the finding more compelling. Secondly, we only conduct one-time lab experiment. A more desirable experiment would be using field study, but the question being we will face another side of the difficulty. However, a longitudinal study is needed for understanding the effectiveness of the personalization techniques that required learning, such as learning agent techniques. Also, a multiple interaction experiment would make the subjects become more "intimate" with the web site, a prerequisite for a effective personalization web site.

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