Encyclopedia of Multimedia Technology and Networking

Second Edition

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Volume II
Ex–N

Information Science
REFERENCE

INFORMATION SCIENCE REFERENCE

Hershey • New York

Director of Editorial Content: Kristin Klinger
Senior Managing Editor: Jennifer Neidig
Managing Editor: Jamie Snively
Assistant Managing Editor: Carole Coulson
Cover Design: Lisa Tosheff
Printed at: Yurchak Printing Inc.

Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue, Suite 200
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: <http://www.igi-global.com/reference>

and in the United Kingdom by
Information Science Reference (an imprint of IGI Global)
3 Henrietta Street
Covent Garden
London WC2E 8LU
Tel: 44 20 7240 0856
Fax: 44 20 7379 0609
Web site: <http://www.eurospanbookstore.com>

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Library of Congress Cataloging-in-Publication Data

Encyclopedia of multimedia technology and networking / Margherita Pagani, editor. -- 2nd ed.

p. cm.

Includes bibliographical references and index.

Summary: "This publication offers a research compendium of human knowledge related to the emerging multimedia digital metamarket"--Provided by publisher.

ISBN 978-1-60566-014-1 (hardcover) -- ISBN 978-1-60566-015-8 (ebook)

1. Multimedia communications--Encyclopedias. I. Pagani, Margherita, 1971-

TK5105.15.E46 2009

621.38203--dc22

2008030766

British Cataloguing in Publication Data

A Cataloguing in Publication record for this book is available from the British Library.

All work contributed to this encyclopedia set is new, previously-unpublished material. The views expressed in this encyclopedia set are those of the authors, but not necessarily of the publisher.

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Marketing Research Using Multimedia Technologies

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INTRODUCTION

Marketing research is the process of systematically gathering, analyzing, and interpreting data pertaining to the company's market, customers, and competitors, with a view to improving marketing decisions.

Multimedia technologies and the Internet have created opportunities previously unimagined in marketing research practice. Electronic or online marketing research takes one of two forms: research about the Internet and research on the Internet. Generally, marketing research activities cover the provision of relevant information to identify or solve marketing problems in the areas of market segmentation (e.g., selecting target markets or segments) as well as product (e.g., preference measurement for concept testing or new product development), pricing (e.g., identifying price thresholds), promotion (e.g., media and copy decisions), and distribution (e.g., location of retail outlets) decisions (Malhotra & Birks, 2005).

This article aims to:

- Review the impact of applying multimedia technologies to classic marketing research problems.
- Present the different types of marketing research activities about the Internet as the most prominent application area of multimedia technologies.
- Discuss the use of multimedia in online surveys in comparison to the traditional paper-and-pencil approach.

The main contribution of the article is a discussion of advantages and challenges provided by innovative multimedia and network technologies for marketing

researchers. Moreover, we present cues for improving the quality of surveys.

The remainder of the article is structured as follows: First, we present examples of the application of multimedia technologies to illustrate the impact of multimedia on classic marketing research tasks. Subsequently, Web log mining, Web usage mining, and Web content mining are introduced as common marketing research fields directly concerned with research about the Internet. Then, benefits and challenges of online surveys are reviewed. Thereafter, we discuss response errors and ethical questions as crucial issues for the quality of data gained by online surveys. Finally, we draw conclusions and provide a spot on future developments.

USING MULTIMEDIA TECHNOLOGIES FOR CLASSIC MARKETING RESEARCH TASKS

Applying Multimedia in Preference Measurement

Multimedia technologies enable the combination of different types of stimuli, such as text and visual representation, as well as various choice alternatives. An often decisive plus of using multimedia technologies in marketing research is the ability to interact with the respondent. A salient example of the virtue of this fact is the adaptive conjoint analysis (ACA) from Sawtooth Software, which facilitates the measurement of customers' preferences for different product or service designs. ACA customizes each interview so that each respondent is asked in detail only about those attributes of greatest relevance to him or her.

Figure 1. Screenshot from the ACA Software (with kind permission from Sawtooth Software Inc.)

A screenshot of a pair-wise comparison from the ACA of Sawtooth Software is depicted in Figure 1. Two complex products have to be compared according to their desirability.

As indicated in Figure 1, various types of information can be combined in the use of multimedia. In this example, a combination of visual and textual stimuli, and the possibility to answer by means of ticking a checkbox, is dovetailed into the multimedia. Of course, the annotation of further multimedia technologies, such as sound, is easy to conceive.

Applying Multimedia in Concept Testing

Product concept evaluation is traditionally done using physical prototypes, which is very costly and time-consuming. Interactive animations of detailed prototypes can be used to test preliminary product concepts (see Figure 2). Even for products that already physically exist, virtual prototypes are useful. Particularly, cost savings and speed advantages may lead to a higher degree of parallel prototyping and creativity (Bock & Treiber, 2004). The predictive power of Internet-based product concept testing has been investigated by Dahan and Srinivasan (2000). It is shown that virtual prototypes using visual depiction and animation lead to similar results to those produced by physical prototypes.

Applying Multimedia Technologies for Virtual Shopping Environments

Virtual shopping environments can be used to study the in-market performance of a new product at the pre-

Figure 2. Screenshot of flash animation of a virtual seat remote control concept (with kind permission from rc research GmbH and Lufthansa AG)

launch stage. In most cases, 3D virtual environments are used to replicate the in-store shopping experience. The participant is placed in a virtual store, where he or she can walk through the store, interact with his or her environment, and purchase all the products he or she wants. These systems offer significant advantages to the researcher because he or she has complete control over all aspects concerning the shopper's environment as an experimental design. According to Bock and Treiber (2004), shopper research systems nowadays differ greatly in the complexity of the store simulation, the interactivity, the mode of presentation (panoramic projections of virtual stores in a "cave" visualization facility versus wide-curved screens and head-mounted displays), the mode of data collection, and budget considerations. Campo, Gijbrecht, and Guerra (1999) summarize validation studies and demonstrate the ability of virtual shopping environments to accurately reflect in-store shopper behavior.

USING MULTIMEDIA TECHNOLOGIES FOR WEB MINING

Web mining aims to identify interesting patterns of consumers' behavior (Web usage mining), competitors' behavior (Web content mining), and the structure of the vital information space, which is a marketplace in itself (Web structure mining), but also an arena for marketing communication, which is achieving increasing importance.

Table 1. Techniques frequently used in Web usage mining

Technique	Result
Decision tree, naïve Bayes algorithm, neural networks, discriminant analysis, support vector machines	Predicting whether or not a customer will visit a page or buy a product or service
Sequence clustering and click stream analysis	Assessing which pages are attractive and identifying the pages with high likelihood of dropping out the user
Association analysis	Finding sets of items that are commonly bought together

Web mining differs from the other types of online research discussed here, with respect to the relevant errors discussed in Table 3 that have to be considered, but also regarding techniques that are applied to find the interesting patterns.

Web Usage Mining

Web usage mining utilizes the protocol files the user generates while browsing the Web. The most prominent example is the analysis of servers' log files. This protocol embraces the client's IP, date, and time of access and all the names of the accessed media object files. Table 1 provides an overview of analysis techniques frequently used in Web usage mining. A more detailed description of the techniques is given in Srivastava, Cooley, Deshpande, and Tan (2000).

With regard to selling products and services on the Web, the integration of these techniques in recommender systems (Gaul & Schmidt-Thieme, 2002) provides mutual benefits. The customer gets a personalized offer and is not bothered by irrelevant offers or information. The vendors can expect sales above the line and, more importantly, higher customer retention.

An innovative tool of Web usage mining for the marketing researcher is the online auction (Spann & Tellis, 2006). These multimedia markets can be used to find optimal prices for product and service innovation, but also for testing theories developed in marketing science or psychology.

Web Content Mining

The goal of these activities is to find similar contents on the Web, which is especially important for competitor analysis. A particular feature of almost all business on

the Web is that the next best offer is just one mouse click away. Consequently, offers, prices, and services of the competitors need to be monitored on a regular basis. Moreover, the Web provides information on innovative services, up-and-coming technologies, and so forth. Spiders, sophisticated neural networks, and information foraging theory-based algorithms are used for Web content mining (Scholz & Wagner, 2006).

Web Structure Mining

Web structure mining reveals the underlying link structures of the Web. This is useful to categorize Web pages and to assess the similarities and the relationships between Web sites. One of the most interesting challenges is discovering authority sites for considered markets or even industries (Kosala & Blockeel, 2000).

WHAT ARE THE BENEFITS FROM ON-LINE SURVEYS APPLYING MULTIMEDIA TECHNOLOGIES?

Online surveys can be conducted by means of interactive interviews, for example, in the case of focus groups, or by questionnaires being designed for self-administration. Electronic interviews can be realized via e-mail or chat rooms, whereas survey questionnaires can be administered by either e-mail, posted in newsgroups or discussion forums, or on the Web using HTML format or more sophisticated multimedia technologies such as Flash or JavaApplets.

The differences between online and off-line/classic marketing research surveys have been largely discussed in the marketing research community (Couper, 2000; Fricker, Galesic, Tourangeau, & Yan, 2005; Illieva,

Table 2. Provided facilities of mail and Web surveys

Provided Facilities	Paper-and-pencil	Web-based
Administrative burden (in terms of ease of use)	High	Low
Costs	High	Low
Response time	Slow	Fast
Personalization and customization	Some	Yes
Allowing for anonymous answering	Yes	Possible
Prevention of multiple submissions	No	Possible
Random or adaptive presentation of questions/items	No	Yes
Automatic feedback during survey	No	Yes
Automatic transfer of responses to database	No	Yes
Skills needed to design and implement questionnaire	Low	Depends
Response control during the survey	No	Yes
Animations, sounds, movies, and graphic options	No	Yes
Generation of representative samples	Easy	Hard

Baron, & Healey, 2002). Table 2 outlines the main differences as found in the literature. The most important benefits arising from the online marketing research by means of multimedia technologies are briefly outlined next.

- **Animation:** Dynamic HyperText Mark-up Language, Java and JavaScript, flash movies, and animated Gifs allow for representing animated stimuli to the researcher, and thus provide a broader variety of stimuli representation (Birnbaum, 2004).
- **Ease of Use:** A widely recognized advantage is the ease of use of online surveys. Researchers avoid much of the administration burden of sending and receiving questionnaires. Particularly, data entry in the form of manual transcription of data from a hard copy questionnaire is no longer needed since the data are available in electronic form once a questionnaire is completed, thus avoiding transcription errors. Moreover, researchers are able to control the sample data at each stage of the survey and can get an impression of the data "on the fly."
- **Costs:** Cost reduction is a strong argument in favor of the online survey method. The initial cost of implementing the survey in a multimedia environment is obviously higher than in many

classic surveys, for example, paper-and-pencil studies. In contrast, variable costs (costs of postage and printing, telephone and involvement of the interviewers, costs for clerical support, and data entry) are considerably lower in online surveys (Wilson & Laskey, 2003). Therefore, large-scale surveys do not require greater financial resources than small surveys (Illieva, Baron, & Healey, 2002).

- **Speed:** Receiving the respondents' answers quickly is another advantage of online surveys. The lion's share of responses is generated within the first 48 hours, for example, the e-mail survey of Wygant and Lindorf (1999) took two days for 80% of the final responses to be received. Most comparative research studies indicate that the response time is much longer for postal surveys than for online surveys (Illieva et al., 2002).
- **Feedback:** The respondents' motivation to participate in a survey can be increased by dynamic or interactive feedback forms during the survey. At best, the feedback might be a non-monetary incentive for the respondent and improve the probability of conducting the survey. Moreover, the quality of the respondent's answers can be improved when he or she is able to validate or even correct his or her previous judgments on the basis of such a feedback.

Table 3. Systematic errors and how to tackle them

Systematic Error	Effect	Control Variable/ Influence Factor	Remedies
Coverage Error	Samples over-represent males, college graduates, and the young	Penetration of Internet technology	<ul style="list-style-type: none"> - use of panels - weighting the outcome based on socio-demographics - recruit respondents off-line
Sampling Error	Non-representative sample with inaccurate or misleading information	Selection of the sample from the frame population	<ul style="list-style-type: none"> - increase sample size - inspect the relationship between sample frame and target population
Non-Response Error	Differences between respondents and non-respondents on the variables of interest	People's willingness and ability to complete the survey	<ul style="list-style-type: none"> - avoid technical difficulties (due to connection speed) - use of Web surveys with invitation - use mixed-mode survey strategies (in combination with telephone or mail surveys)
Measurement Error	Deviation of answers from their true values	People's willingness and honesty to give correct answers	<ul style="list-style-type: none"> - evaluate appropriateness of design and wording with regard to different browser settings - use randomization, customization, and real-time editing - provide online help functions

CHALLENGES ARISING FROM ONLINE SURVEY BY MEANS OF MULTIMEDIA TECHNOLOGY

The simplicity of generating large sample sizes enables students, scientists, and commercial organizations to conduct surveys easily and quickly with thousands of contacts. However, the advantages might become a pitfall for those who overlook ethics-quality relationship in marketing research. To deter respondents' unwillingness to participate in further surveys, or even the feeling of being abused, the ICC/ESOMAR (International Chamber of Commerce/European Society for Opinion and Marketing Research), comprising more than 4,000 members, has developed an International Code of Marketing and Social Research Practice (which can be downloaded for free on www.esomar.org). It also defines criteria to assure the reliability and validity of research.

Mail surveys give the respondents the choice of being anonymous, whereas e-mails always disclose the sender's identity. In the case of online questionnaires, a separate mailing of personal information may strengthen the respondent's feeling of anonymity. Nevertheless, experienced users will be aware of the fact that questionnaire responses and personal data

can be collated via the Internet Protocol (IP) address (Sassenberg & Kreutz, 2002).

DATA QUALITY OF ONLINE DATA COLLECTION METHODS

The major sources of errors, both in online and in mail surveys, are sampling, coverage, non-response, and measurement error (Couper, 2000). Hints on how one should cope with these errors with regard to online surveys are summarized in Table 3 and will be discussed next.

The coverage error is a function of the mismatch between the target population and frame population. Obviously, the coverage error is largely dependent on the penetration of the Internet technology and, therefore, constitutes the biggest threat to the representativeness of online samples. The demographic differences between those with Web access and those without are called "digital divide" (Couper, 2000). Several studies show that online samples over-represent males, the better educated, and the young. Even though the Web is in a state of massive growth and flux, these population differences are likely to persist for some time (Andrews, Nonnecke, & Preece, 2003). In order

to tackle the coverage error, one might use panels or e-mail lists for specific sample frames. Several vendors offer e-mail addresses selected by gender, interests, or online purchasing. The participants of these panels have generally agreed to take part in the surveys.

The sampling error results from the fact that not all members of the frame population are measured. The estimation of the sampling error requires that probability sampling methods are used so that every element of the frame population has a known nonzero probability of being selected. Unless the frame is drawn from an online panel, the degree of the sampling error is generally unknown.

If some respondents of a sample are unwilling or unable to take part in a survey, a non-response error will result. This means that the non-respondents may systematically differ from respondents concerning the variables of interest. Internet surveys in general are subject to the same non-respondent problems as telephone surveys, but present additional challenges.

The measurement error can be described as the deviation of the answers of respondents from their true values on the measure. In contrast to administered surveys, in self-administered online surveys, there is no interviewer to explain the questions. An advantage of computer-assisted methods is the ability to include design features like randomization, customization of wording, and real-time editing, which cannot be implemented in paper surveys. Web surveys may take advantage of a higher degree of anonymity compared to paper surveys (Fricker & Schonlau, 2005). In a nutshell, Web questionnaires might have advantages in the way of a better display, allowing for more interactivity and offering a higher usability, compared to traditional surveys.

A SPOT ON FUTURE DEVELOPMENTS

Multimedia technologies extend the possibilities of classic marketing research. An exceptional quality of online investigations is adaptive and randomized questioning, which permits a deeper insight into customer's preferences, for example.

The following areas are contemporarily evolving:

- Assessing the respondents via handheld devices such as cellular phones, PDAs, and so forth

- New data provided by new technologies such as RFID tags
- New multimedia buying environments, such as reverse auctions
- Marketing research in the course of m-commerce and GPS tracking of the respondents

Moreover, interesting fields for extending the buyer behavior theory are arising, particularly the impact of multimedia price agents (e.g., www.priceline.com, etc.), as a result of the increasing spread of multimedia in everyday life.

CONCLUSION

Multimedia and networks enhance both marketing researchers' options for data gathering and the quality of results by means of realism studying the stage of data gathering, accuracy, cost, and timeliness of results. Interactive surveys demonstrate clear advantages concerning the organizational burdens as well as the costs and the respondents' efforts, but coverage of the target population and the digital divide might lead to difficulties for some market research applications.

In addition to the traditional scope of marketing research, the network and multimedia-based applications are suitable to investigate the competitive structure and buying behavior in e-commerce as well as innovative direct marketing offers. Thus, these applications are likely to gain importance within the marketing research industry.

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KEY TERMS

Coverage Error: Mismatch between the target population and frame population.

Marketing Research: Process of systematically gathering, analyzing, and interpreting data pertaining to the company's market, customers, and competitors, with the goal of improving marketing decisions.

Measurement Error: Deviation of the answers of respondents from their true values on the measure.

Non-Response Error: Differences between respondents and non-respondents on the variables of interest.

Online Surveys: The creation of questionnaires for publication on the Internet as Web sites, as e-mail attachments, or as plain text e-mails.

Sampling Error: Non-representative selection of the sample from the frame population.

Virtual Concept Testing: The presentation of a new product concept in an online environment to a sample of potential customers, in terms of its function, benefits, design, and branding to discover consumer's reactions, attitudes, and purchasing intentions toward the product.

Web Mining: Aims to identify interesting patterns of consumers' behavior (Web usage mining), competitors' behavior (Web content mining), and the structure of the vital information space, which is a marketplace in itself (Web structure mining).