6   TECHNIQUES AND METHODOLOGIES FOR MULTIMEDIA SYSTEMS DEVELOPMENT: A SURVEY OF INDUSTRIAL PRACTICE

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Abstract

This paper tries to answer the question, how are multimedia systems being developed in practice? Herein are reported the findings of a preliminary postal survey of the top 1,000 companies from general industry and the principal 100 companies from the multimedia industry in Ireland, which reveal that there is no uniform approach to multimedia systems development and that approaches prescribed by the literature are not being used in practice. Nonetheless, the findings are clear that practitioners are favorably inclined toward the use of systematic methods and techniques for multimedia development. This survey paves the way for more detailed and insightful qualitative research into development practices.

1. INTRODUCTION

Until quite recently, most multimedia systems were relatively simple, stand-alone applications. The prolific expansion of enterprise-wide intranets and of Web-based electronic commerce systems has altered this dramatically and has ushered organizational multimedia through the back door, thus presenting formidable and pressing challenges to information systems developers.

Of late, the world of systems development has been dominated by structured methodologies for large-scale projects and by object-oriented or visual-oriented approaches. It would appear that such methods are not entirely appropriate or adequate for multimedia and Web-based systems development (Lowe and Hall 1999; Nanard and Nanard 1995). While researchers have made valuable contributions toward a better understanding of the nature of multimedia systems, and have prescribed methods by which they may be constructed, it has been the authors' experience that practitioners are not using these methods. The motivation for this study is therefore to answer the question, how are multimedia systems being developed in practice?

2. BACKGROUND TO THE PROJECT

Within information systems research, it has been usual for specialized development techniques and methodologies to be proposed in response to the emergence of new types of systems that are considered to be somehow fundamentally different from all else before, such as decision support systems, workgroup systems, and, now, multimedia and Web-based systems. Since the international multimedia software industry is, in relative terms, new, it is not surprising that multimedia development approaches are at present inconsistent, immature, and lacking formal or tool-based modeling techniques (Britton et al. 1997; Murugesan et al. 1999; Shneiderman 1997).

To date, very little is known about the actual practice of multimedia systems development. The only previous empirical studies published in the literature are those of Britton et al. (1997), Liu et al. (1998), Whitley (1998), and Eriksen et al. (1998), three of which focus specifically on multimedia-based training systems.

The principal objectives of this survey were, therefore:

(1) To examine the current practice of multimedia systems development in Ireland.
(2) To see if there are differences between the techniques and methodologies used to develop multimedia systems suggested in the literature and those actually used in practice.

3. RESEARCH METHODOLOGY

For the purposes of this study, the authors adopted a broad definition of multimedia information systems that is inclusive of Web-based multimedia applications.

Two parallel studies were conducted—one that examined the main 100 Irish companies in the multimedia industry, and another that looked at the top 1,000 Irish companies in general industry. The rationale for selecting two parallel samples was to compare and contrast how respondents from both samples approach multimedia systems development, given that general industry respondents are presumed to have a tradition of conventional IS development whereas multimedia industry respondents specialize in multimedia systems and may or may not have the same traditions.

The questionnaire distributed to general industry was an adaptation of that distributed to the multimedia industry. Both questionnaires examined systems development environments; development practices; the usage of techniques, methodologies, and tools; and future development plans. From general industry, a response rate of 10% was achieved. A higher response rate of 15% was obtained from the multimedia industry. Some apparent volatility in this sector was revealed when it emerged that quite a few recent start-up companies were no longer trading, making the response rate closer to 20% of all trading companies. These response rates are in line with those of the previous studies earlier cited, and are reasonable given the growing reluctance of companies to reply to unsolicited questionnaires (Falconer and Hodgett 1999).

4. FINDINGS

4.1 Usage of Approaches and Methodologies for Multimedia Systems Development

Respondents were provided with a list of general approaches toward multimedia development, drawn from the literature, and asked to indicate which if any of these they have ever used (see Table 1). It emerged that general industry respondents have all at some time used a semi-structured systems development life cycle (SDLC) approach in multimedia development. A smaller number use a more formalised SDLC-based approach, or an object-oriented approach. The focus on the SDLC within general industry contrasts with a much broader mix in approaches used by multimedia industry respondents. While prototyping is the most widely used here, production-oriented approaches, semi-structured SDLC approaches, and advertising/graphic design are also in common use. The popularity of the production-oriented approach, an approach that originates from the film industry, is particularly interesting and highlights the potential contribution of other disciplines outside traditional information systems development.

Table 1. General Approaches Used in Multimedia Systems Development

Approach	General Industry (n = 8)		Multimedia Industry (n = 15)		Aggregate Response (n = 23)	
	Incidence		Incidence		Incidence	
Semi-structured SDLC	8	100%	6	40%	14	61%
Prototyping	2	25%	9	60%	11	48%
Production-oriented Approach	1	13%	8	53%	9	39%
Structured SDLC	3	38%	4	27%	7	30%
Advertising / Graphic Design	2	25%	5	33%	7	30%
Object-oriented Approach	3	38%	3	20%	6	26%
Other	1	13%	4	27%	5	22%
Artistic Approach	0	0%	4	27%	4	17%
Media Design Approach	0	0%	4	27%	4	17%

The finding that respondents from the multimedia industry use a multiplicity of approaches reveals, *ipso facto*, that they do not agree on a common development approach. Such diversity may of course reflect the distinct nature of multimedia applications: that different approaches are suitable for different types of applications. However, perhaps the explanation is to be found elsewhere. Differences in approaches to multimedia systems development may also be explained by reference to the differing backgrounds of developers. Examples of these backgrounds are publishing, software engineering, film production, advertising, product development, graphic design, and information systems development. Each of these root disciplines has its own firmly established development paradigms.

With regard to the use of specific *methodologies* (as opposed to general *approaches*), it was found that respondents are predominantly using their own in-house methods. Some use is made of the traditional SDLC and of object-oriented methodologies. Revealingly, although a number of methodologies specifically for multimedia and Web-based systems development are set forth in the literature (see Table 2), the findings of this study are that none of these are used at all in practice! It may be because these methodologies are too complex to understand or implement, or that they have little CASE-based support. Of course, it may also be because of a lack of awareness among practitioners, as few of these methodologies have ever been publicized outside of academic journals and conferences.

Table 2. Web and Multimedia Systems Development Methodologies

Hypertext Design Model (HDM)	Garzotto and Paolini (1993)
Relationship Management Methodology (RMM)	Isakowitz et al. (1995)
Object-Oriented Hypermedia Design Methodology (OOHDM)	Schwabe and Rossi (1995)
World Wide Web Design Technique (W3DT/SHDT/eW3DT)	Bichler and Nusser (1996); Scharl (1999)
Web Site Design Method (WSDM)	De Troyer and Leune (1998)
Scenario-based Object-Oriented Hypermedia Design Methodology (SODHM)	Lee et al. (1999a)
View-Based Hypermedia Design Methodology (VHDM)	Lee et al. (1999b)

4.2 Attitudes Toward Methodology Usage

When asked about the advantages or benefits of their principal methodology, the response from both samples (aggregated in Table 3) highlights cost effectiveness (74%), speed of development (63%), understandability (58%), and adaptability (53%) as the most important ones. The relative weight given by respondents to benefits that emphasize improved efficiencies in cost and speed suggests an inclination to use methodologies that assist project management. Approaches like HDM or RMM do not emphasize project management, a task that is crucial to commercial development where budgets and time constraints are everyday realities. This finding may point to reasons why such methodologies have not been widely adopted.

Table 3. Primary Advantages/Benefits of Principal Multimedia Methodology

Benefit/Advantage	*Affirmative Responses (n = 19)*	
Cost effectiveness	14	74%
Speed of development	12	63%
Understandability	11	58%
Adaptability	10	53%
Widespread acceptance/Reputation	8	42%
Results obtained	8	42%
Ease of use	7	37%
Comprehensiveness	7	37%
Attention to detail	5	26%
Broadness/Inclusiveness	4	21%
Other	2	11%
Narrowness/Specificity	0	0%

Table 4. Primary Disadvantages/Drawbacks of Principal Multimedia Methodology

Disadvantage/Drawback	*Affirmative Responses (n = 17)*	
Not widely known	7	41%
Complexity	7	41%
High level of detail	7	41%
Obsolescence	7	41%
Cost	5	29%
Difficulty in use	3	18%
Broadness/Inclusiveness	3	18%
Difficulty in understanding	2	12%
Other	2	12%
Too narrow /Specific	1	6%

With regard to disadvantages or drawbacks of the respondents' principal methodology (shown in Table 4), a number of concerns clearly dominate. Two of these, obsolescence and the use of a technique that is not widely known, suggest fears about failing to use a more universal methodology. A total of 41% of the respondents also cite complexity and the high level of detail required by their principal methodology as being disadvantageous. Overall, fewer disadvantages than advantages were reported, suggesting a general satisfaction with methodologies.

4.3 Use of Techniques in Multimedia Systems Development

Respondents were asked about their usage of techniques in multimedia systems development. They were presented with a list of techniques drawn from the literature. These included traditional structured techniques (such as data flow diagrams), modern techniques (such as use case diagrams), as well as others specifically intended for multimedia development (such as storyboarding and RMDM diagrams). The findings are presented in Table 5.

There is an interesting mix of multimedia-specific technique usage like RMDM and MAD. It is evident that project management and prototyping are, as one would anticipate, widely used. Storyboarding, a technique widely used in film-making ever since Walt Disney refined and popularized it in the 1930s, is very clearly in widespread use, consistent with the findings of an earlier study by Britton et al. Flowcharts and menu maps are also popular, presumably because both are conceptual, block-diagraming techniques that may be used to specify navigational structure, links, and interaction branches. The fairly common usage of DFDs (41%) is more difficult to interpret since they represent neither sequential flows nor data modeling. It may simply be that they are popular be-

Table 5. Use of Techniques in Multimedia Systems Development.

Technique	General Industry (n = 7)	Multimedia Industry (n = 15)	Aggregate Response (n = 22)	
	(Affirmative responses)	(Affirmative responses)	(Affirmative responses)	
Project Management	6	13	19	86%
Prototyping	5	11	16	73%
Flowcharting	3	12	15	68%
Storyboarding	3	10	13	59%
Menu Maps	2	9	11	50%
Data Flow Diagrams (DFD)	2	7	9	41%
Object-Oriented techniques	2	2	4	18%
Relationship Management Data-Model (RMDM) Diagram	1	3	4	18%
Movie Authoring and Design (MAD)	1	3	4	18%
Class Diagrams	2	1	3	14%
Entity Relationship Diagrams (ERD)	1	2	3	14%
Dialogue Charts	0	3	3	14%
Other	1	1	2	9%
State Transition Diagrams (STD)	0	2	2	9%
Functional Decomposition Diagrams (FDD)	1	0	1	5%
Use Case Diagrams	1	0	1	5%
Joint Application Design (JAD)	0	1	1	5%

cause they are well understood as a legacy technique. Perhaps to compensate for the lack of comprehensive or specific modeling tools, developers are improvising with the use of techniques not designed for multimedia development but which perform some useful modeling function.

In response to another question, it was found that the most widely used programming languages in multimedia systems development are HTML/DHTML, Visual Basic, Java, C++, SQL and Javascript. This reveals a clear partiality toward visual and object-oriented programming environments. The finding (see Table 5) that object-oriented techniques are in relatively low use is, therefore, somewhat surprising. It may well be the case that object-oriented techniques are too difficult to understand, particularly for those from backgrounds other than software development. Comprehension difficulties may also explain why real-time modeling techniques, which are intended to specify

interactions and time-based constraints, are also not as often used as might be expected.

4.4 Future Multimedia Development

All respondents from general industry were asked if they expect to develop multimedia systems in the future, regardless of whether or not they had previously done so. A total of 48% said they will, or are likely to, do so within at most two years. General industry respondents were also asked if they expect that their large-scale, organizational information systems will contain multimedia data in the future. Respondents were given a longer time frame (five years) within which they might expect this to happen. Over half (51%) expect that their conventional organizational systems will or are likely to include multimedia data within the next five years. This is a significant signal that preparation needs to be made in anticipation of the widespread introduction of multimedia applications and consequent technologies.

5. CONCLUSIONS AND FURTHER WORK

Companies in general industry are not developing multimedia systems on a widespread basis today. However, the future plans of companies suggest that this is about to change. The finding that most general industry respondents expect that their large-scale information systems will soon contain multimedia data is significant. This has consequences for all aspects of systems development. Staffing, adoption of new technologies, upgrading to hardware and software systems that can handle multimedia data, and use of development methods and techniques will all need to be considered in light of this expectation.

While research and development into multimedia information systems development has been superseded in the recent past by efforts in the more popular Web-based world, it is to be hoped that work on improving structural understanding and enhancing process support will soon be revisited and that the pursuit of improved practice in multimedia and Web-based systems development will continue. The findings of this preliminary study reveal that practitioners are not using the multimedia development methodologies prescribed by academic literature, and that most are using their own in-house methods. Further work is necessary to examine why prescribed methodologies are not being used and to reveal richer insights into the methods and techniques that practitioners are adopting.

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