

Integrated multimedia publishing: combining TV and newspaper content on personal channels

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Abstract

Fast networks enable the delivery of TV and newspaper content over an Internet connection. This enables new types of integrated publications that include features from both media. The IMU system, described in this paper, automatically integrates newspaper and TV content into a continuously updated World Wide Web-multimedia publication. An active proxy server pursues the integration and delivers the publication through an ATM fibre link to fast networks, such as the bi-directional cable TV network and the ADSL telephone network, providing near-TV quality. The users read the IMU publication from the Internet on their PCs with normal World Wide Web-browsers. You can also watch the publication on your Internet TV set. The proxy server captures metadata from the Web sites and from the editorial systems of the IMU content providers. In addition, the system keeps track of the choices of the user and proposes what news the user and his/her social group would most probably be interested in. The user interface is based on personalisable channels, which gather news material according to the priorities defined by the editors and the users. For ease of use the proxy server automatically paginates the articles into a sequence of browsable pages. News articles and TV news are linked to each other through automatic association. In a field trial lasting eight months, 62 people used the service through the bi-directional cable TV network in their homes. The average IMU session was brief, focusing on a few and fresh articles, and took place in the evening at prime time or in the morning. Both TV and newspaper content interested the users. Personalisation was not too attractive — only some of the users created their own channels. In the user interviews, the integration of content was viewed as the key feature. © 1999 Published by Elsevier Science B.V. All rights reserved.

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1. Introduction

More and more households are connecting to the Internet through fast connections like cable TV,

ADSL and digital TV, and even electrical power networks. These networks transmit data with more than 1 Mbit/s downstream towards the user. Also the next generation of cellular phones will attain this transmission speed. It is evident that new types of integrated multimedia publications will be delivered

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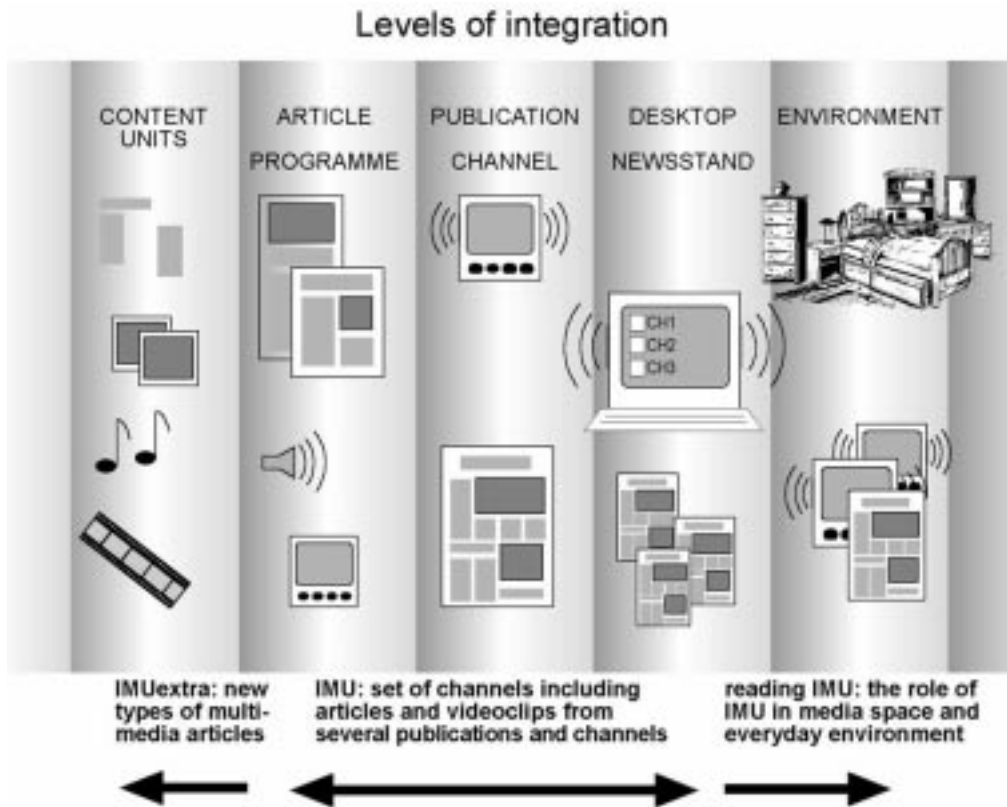


Fig. 1. Various levels of media integration.

through these connections in addition to single media products like radio, TV and newspaper content. Currently, the popular portal Web sites are an example of the attractiveness of content integration. **Jeff Mallet**¹ has compared a portal site to an airport transit hall: no matter where you travel, you always pass through the terminal.

Currently, Web publications are largely translations of traditional media. Little original content is produced, and changes are seldom made. In some cases, feature articles are created, possibly utilising multimedia. These 'webortages' are still mostly based on linear story telling, which is typical for existing media. The 'translation' concept is also used by many radio stations, which provide more or less the same audio stream both to Web and broadcast listeners. Some features, such as background information on the news stories or personal home pages of radio

personalities, may be included. Archived stories may also be available to those listeners who have missed their favourite show. Due to limited bandwidth, the amount of video content is small in present Web publications. Fast Web connections allowing the transmission of near-TV quality video pose a challenge to journalism to integrate text and video content.

Integrated media is targeted towards the user as an individual rather than a part of a mass audience. By integrating content from several sources into a database, the user is able to select a unique combination of content particles that fit his/her own interests (Fig. 1). Examples of such customised news services are **Pointcast**², **NewsPage**³, and **Crayon**⁴. The publisher may use the integrated database as a source for various publications.

² <http://www.pointcast.com/>

³ <http://www.newspage.com/>

⁴ <http://www.crayon.net/>

¹ <http://www.zdnet.com/>

In traditional media, integration aggregates the items into a product on a higher level. Text and photos constitute a news story on a newspaper page. The articles and advertisements on the pages constitute a newspaper. The TV channel consists of separate programmes, as a newsstand consists of several publications. However, the integration is static; at the newsstand, the reader is not able to create his/her own paper by adding content from different papers and magazines.

The IMU (Integrated publishing in MULTimedia Network) system, developed in this work, is a unique attempt to integrate TV news and newspaper sources. The content of six different source publications is automatically collected into the database as separate text and multimedia news stories. In addition to integration, IMU also offers personalisation. A reader may ‘clip’ the papers of this media kiosk and assemble a personal publication or channel — even including video content. Thus, you can set up ‘Bill Clinton’ or ‘EMU’ channels containing what the newspapers and TV have told about these topics. The appearance of the publication can also be personalised and the publication adapts to the user terminal, be it a PC monitor with various resolutions or a TV set.

Personalisation is an efficient way to improve the usability of publications. Personalisation of the content filters out excess information which the user does not need. Personalisation of the appearance presents the content in a form at which best suits the user and the context of use. Personalisation consists of classifying the information, maintaining user models and the actual personalisation (Fig. 2). The classification involves analysing the information, dividing it into elements and creating

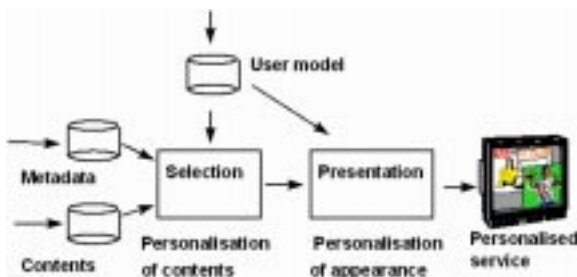


Fig. 2. The principle of the personalisation.

and storing metadata, which describes the information and the elements. The user model contains information about the user which is needed in the personalisation [5,10]. Personalisation of the content involves selecting the information on the basis of the metadata and the user model. Personalisation of the appearance modifies the presentation of the content on the basis of the user model, which can be based on ready-made stereotype models, using questionnaires or adaptively. Adaptive systems register, analyse and classify the behaviour of the user and update the user model accordingly [7,11,15]. In the IMU system, we use both questionnaires and adaptive personalisation.

Integration and personalisation of media content require a lot of conversions as the information flows from the content provider to the user terminal. In a proxy architecture, these conversions are carried out by a proxy server, or intermediary [1], that is inserted between the original content server and the client machine. In this work, we refer to this server as an active proxy. Independently of user actions, this active proxy downloads content from the Web, digitises TV broadcasts, combines and interlinks the digital content and offers the personalised result over the Web to the user. The user connects to the proxy server, not to the original content server. In a way, the active proxy acts as an information agent, like the systems **Autonomy**⁵ and IBM's UCP [17]. However, the IMU proxy's ability to handle analogue TV broadcasts goes beyond current practice.

The role of the integrated media products in the user's daily life is by no means clear. Therefore, this issue was investigated in a long-term field trial in the IMU project. This investigation included aspects such as the time of reading, the length of session, the articles and content selected, even the location where the user had chosen to read the content. The role that this new type of media plays in everyday life will guide further research and development to create not only compelling content as such, but types of media interfaces that will become an active and popular part of the everyday environment.

⁵ <http://www.autonomy.com/>

2. Human-centred design in IMU-project

Human-centred design [9] is a design approach in which the product development process focuses on users from the very beginning and throughout the development process. Adopting human-centred design leads to more useful and more easy-to-use products. The key issue is to accept the fact that we cannot determine exact user requirements at the beginning of the design process. That is why we have to refine the initial user requirements throughout the design process by illustrating the planned design decisions to the users and getting their feedback. The earlier a new or a refined user requirement is identified in the design process, the easier it is to take it into account in the design.

From the very beginning of our design process of the IMU system we visualised our design ideas to the readers/watchers of the publication. We collected user feedback by having readers/watchers evaluate existing products as well as visualisations and prototypes of our own system. The user feedback guided and redirected our work throughout the design process. In a similar way we collected feedback from newspaper publishers and TV companies. We also had walkthrough meetings where the designers, journalism experts and usability experts of our project group discussed and refined the functionality and appearance of the system. At the end of our project we ran a field trial in which 62 readers/watchers used our publication from their home for a period of nine months. We were thus able to evaluate the technical reliability of our system in real use. We also evaluated the ease of use and usefulness of the publication.

Human-centred design demands a methodology for measuring the user acceptance of information systems. In the IMU-project, we adapted the Technology Acceptance Model (TAM) introduced by Davis et al. [3,4]. TAM is based on the Theory of Reasoned Action by Fishbein and Ajzen [6].

According to TAM, perceived usefulness and perceived ease of use are relevant to system acceptance behaviours (Fig. 3). External variables include system design characteristics, user characteristics, task characteristics, training and documentation. These factors affect the perceived usefulness and ease of use. Ease of use has an effect on perceived useful-

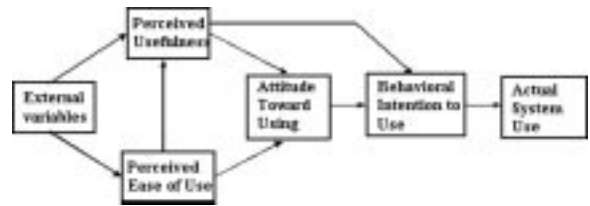


Fig. 3. The technology acceptance model (TAM) used in the IMU project.

ness. Perceived usefulness may raise the intention to use the system even when the user does not have a positive attitude towards using the system. In the IMU-project, we evaluated both usefulness and usability. Especially the usefulness of personalisation and integration was studied and the results fed back into the system design.

3. The IMU system

The IMU trial system integrates TV news from two Finnish broadcasters (YLE, MTV3) and newspaper content from four Finnish newspapers (Aamulehti, Iltalehti, Turun Sanomat, Keskiuomalainen), and offers the personalised multimedia publications to users over fast Internet connections like cable TV and ADSL (Fig. 4). In the field trial the bi-directional cable TV network of Helsinki Media Corporation was used. Some experiments were also made in the ADSL telephone network maintained by Helsinki Telephone Company, HPY. A stripped IMU version without video can also be used from Internet TV.

The core of the system is the active proxy server, which performs the content gathering, combination and interlinking. The proxy collects material both by downloading Web content through the Internet and by digitising analogue TV broadcasts. The content flows from the server through a shared 155 Mbit/s ATM fibre link (Unspecified Bit Rate) to the end user distribution networks. The average machine-to-machine transmission rate through the ATM was measured at over 40 Mbit/s, which allows a transmission of 50 simultaneous 800 kbit/s video streams. The users watch the publication on their PCs with a normal World Wide Web browser that connects to the proxy server. Because of the Java programming, the user does not have to install

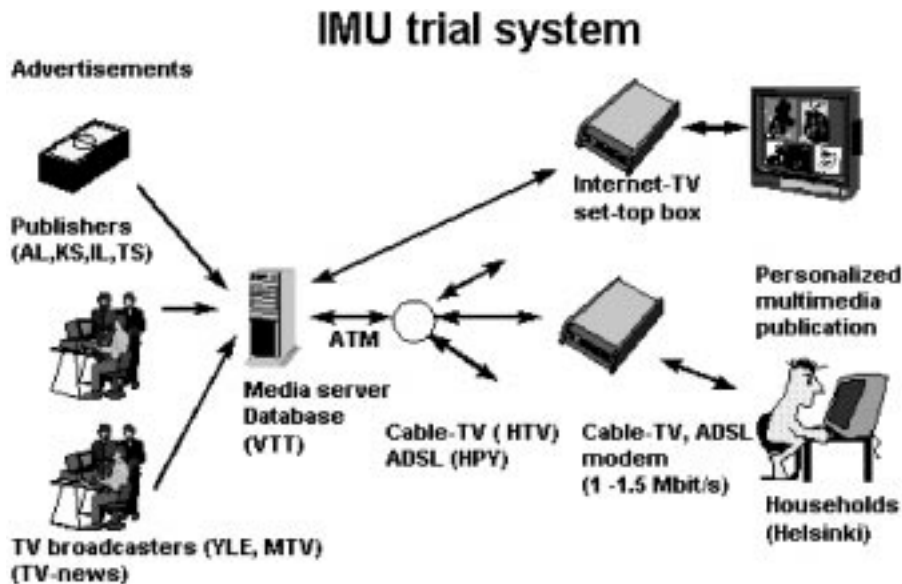


Fig. 4. The IMU trial set-up, where the active proxy server at VTT downloads and digitises content from media houses for use over fast networks or through the Internet TV.

any other plug-ins in addition to the Xing video player.

3.1. The active proxy server

The active proxy server consists of four parts (Fig. 5): a parsing NT computer downloading and analysing Web newspapers and TV news transcripts and indexes, a NT database and pagination server accessed by the users, two Windows 95/98 machines receiving and digitising TV broadcast into MPEG-1 and a NT media server storing the TV news and offering them as video streams to users through ATM and cable TV/ADSL. The media server includes a large number of hard discs organised into a RAID 5 configuration.

The content format is different for every source. The Web newspapers use HTML syntax, whereas the TV news topics (headlines, durations, transcripts etc.) are either automatically acquired as story boards from the editorial system of the TV company (YLE) or from a manual indexing service by a third party commercial company (MTV3). A Java parser, which is able to adapt to different source formats, was developed. Adaptability is achieved by using publication-specific initialisation files, which describe

the syntax of the source content. The parser uses this information to map tagged source elements to corresponding IMU article elements.

TV news are digitised in real time into MPEG-1 format. Broadcasts are captured with a TV-tuner card, which can also grab teletext information. Teletext information is used to automatically create the digitising timetable and to adjust the PC clock to current time. Video and audio are fed from the tuner into the MPEG-1 encoder card in another PC. The dual-PC arrangement was needed to eliminate the radio interference between the add-on cards. To further adjust to possible programme delays, the application checks the PDC-signal (Programme Delivery Control) from the teletext page. The digitised data goes directly to the media server through an ATM connection. 700 Mbytes of video data is generated every day.

TV news stories, newspaper articles, user data as well as user log information are stored in the IMU database. Article data consists of metadata and content. User preference information about the layout and the content of the IMU publication as well as the usernames, passwords etc. are stored in the database, too. To be able to analyse the usage of the IMU system, user log data is captured, i.e.

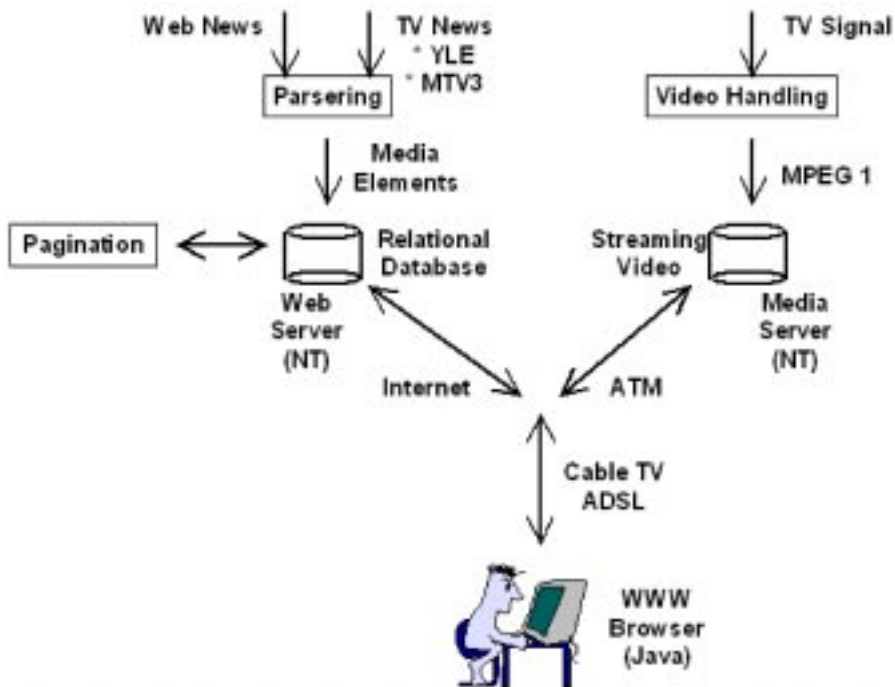


Fig. 5. The IMU active multimedia proxy server.

session data, layout personalization data and data about pagination requests of article lists and articles.

A Java package has been developed to offer a higher-level interface to the database. The interface hides the details of the database implementation. The other modules of the IMU system, i.e. the user interface, the pagination server and the article parser software, use the package. It uses JDBC (Java Database Connectivity) to access the underlying database. The schema of the database conforms to the relational model and the SQL 92 standard. The database operations have been implemented by using SELECT, INSERT and UPDATE clauses. The use of DELETE clauses has been avoided as far as possible, since most of the data will be needed during the analysis phase of the project.

4. The user interface

The IMU system combines articles and video clips into channels as on traditional TV. Video articles, mostly TV news, and text-based articles are

treated and presented in a similar way. The user interface relies on the TV remote controller metaphor. When the reader selects a channel, a LED icon next to the channel name lights up and the list of contents for that channel appears. Articles are selected from that list (Fig. 6). Articles are automatically inter-linked by a linguistic analysis of the newspaper texts and TV news transcript. Both internal links to IMU articles and external links outside IMU were generated. This linking provides background information in a convenient way.

IMU offers a set of common channels to which the reader can subscribe ('News Headlines', 'Sports News' etc.). The coverage of these channels cannot be changed. In addition to these fixed channels, the user can tailor so-called personal channels according to his or her interests. The reader creates personal channels by selecting one or more news sections from the ones made available by the IMU content producers. The reader can, for example, make a sports channel by combining the sports sections from one TV station and one newspaper. The articles covered by the channel can be further personalised



Fig. 6. The IMU-publication, where the channels are presented on the left. The personal channel ‘Optiot’ is selected. The channel contains newspaper and TV news stories (camera icon) about executive share options drawn from several newspapers and TV stations. A TV clip is chosen. Automatically generated links to associated items are displayed on the right. Ratings of the article are entered in the bottom right-hand corner.

by using a query clause. Operators ‘and’, ‘or’ and ‘and not’ are available for use in the queries. Also a few parameters, such as the maximum number and maximum age of articles, can be defined for a channel parameters. The different elements of the interface are shown in Fig. 7.

The user interface consists of HTML pages with frame sets, Java scripts and Java applets. The applets communicate with each other by means of a common class, which is accessible from all IMU applets [14]. In addition to the fixed frame structure in Fig. 7, it is possible to have a separate window opened for the article. In the upper part of the browser, there is an options panel applet with buttons for search functions and channel management (delete, create, personalise). On the right, there is a frame for advertisements. At the bottom resides the scrolling channel, where top news headlines selected by the IMU proxy scroll from right to left. Articles can be selected by clicking the headlines on the scrolling channel.

The user interface of IMU differs from most Web applications, because it adapts to the size of

the browser window. When the first frame set is loaded into the browser, pieces of Java script find out the dimensions of the browser window in pixels. The applet tags in the applet frames are generated using this information. Applets are created at the correct size and the information is transmitted to the pagination software on the proxy server, which paginates and lays out the material into the given space. This made it possible to avoid scrolling and, instead, to compose the material into pages in a user-friendly book-like manner.

The look and feel of the three main applets have been achieved by using bitmaps specially created for IMU and by hand programming most of the graphics operations and the functionality. Double buffering has been used in graphics operations to reduce flicker. The channel contents and the article are HTML pages with CSS2 stylesheet that are dynamically generated by the automatic pagination software. The CSS2 stylesheet makes it possible to position the typographic elements on the page with a single pixel precision.



Fig. 7. The material is automatically paginated into book-like browsable pages.

The username and the current channel are stored using cookies to make it possible for the user to leave the IMU pages and return without the need to log on again. The cookies are written by a side script when the reader logs on and when a channel is selected. The cookies are read by means of a Java script.

4.1. The TV interface

The TV version of IMU can be viewed using a set-top box like iNET TV, marketed by Sonera in Finland, and a normal TV receiver. Because of the limitations of the set-top box browser, the user interface cannot use Java applets or stylesheets. The server therefore uses a CGI program to build the channel selector, which in this case is a list of links. The automatic pagination software returns pages as GIF images to the browser to give control over text layout on the TV screen. Because of the small resolution of the screen, the frame on the right side of the channel selector is used both for the contents of the channel and for the article in turn (Fig. 8).

4.2. Adaptive personalisation

Adaptive personalisation is implemented as so-called adaptive channels. The developed procedure

automatically identifies user interests in the offered articles. The adaptive channel 'IMU recommends' contains the best matching articles for the user based on his/her social groups or topic interests. Fig. 9 illustrates the process of identification of user interests. Article interests are periodically estimated based on the logged information of the article reading patterns and the rating feedback provided by the user. Then the interesting articles are clustered into similar groups according to their metadata using the k-means algorithm [16]. Clustering the topic interests of the various users identifies socially similar groups. Our future plans include classification of the articles within the detected topic interests using word stems and Naive Bayes classification, as suggested in [2]. Also the static user interfaces could be adjusted by these adaptive techniques.

4.3. Automated pagination

A Java-based layout engine was created for personalised on-screen pagination. The solution relies on our earlier work on the layout of newspaper articles using heuristic and simulated annealing methods [13,18]. [8] describes a constraint-based approach for constructing multimodal presentations. In comparison to these systems, the main emphasis in the

Imu

Uutisotsikot

YLE:n TV-uutiset

MTV3:n TV-uutiset

IMU suosittelee

Viikon luettavuimmat

IMUextra

Kosovo

Pääkirjoitus

Kotimaa

Ulkomaa

Edessä uudet haasteet ja muutto Helsinkiin

Marika Saukkonen lopettaa tois- taiseksi tv-työt

Marika Saukkosen iloinen olemus peittautuu television perjantai-iltoista samalla kuin Bengoloton yhteydessä ollut Sapattitapa-ohjelma loppua. - En ota kuitenkaan stressiä, vaikka uusia tv-työtä olisi ihan heti tiedossa, rauhallista hyvän viihtynyt Marika sanoo. Tästä jatkana myöskin:

Turkulainen Marika Saukkonen on tullut tv-kaivo ja vuorokauden takaa. Aikanaan hän veti normaalisuus Hugo-ohjelmaa ja viime aikoina lähti onnistunut perjantai-iltojen Bengoloton yhteydessä Sapattitapa-ohjelmaan. Tämän koon lopussa Sapattitapa-kuitteja lopetetaan.

Marika Saukkonen ei jättänyt aikaa kukaan kukaan.



Työttömäksi Marika tulla jät, mutta laulut peitettävät tv-työnsä - aivan toistaiseksi.

- En ota siitä mitään stressiä Odottaa isoilla vierailla kivoja juttuja. Ennenkään radio voisi olla yllät mahdollisuus.
- Mutskia uutisointia elävänä on hieno, sillä viikkokissa Marika on päättänyt uusia periksi pöytäkirjoja hoollotukselle ja alkaat joutaa toivottava muuttamaan Helsinkiin.
- Sillä nimellä on kaikki koulut ja työt, hän sanoo hiljassa kotonan.

Fig. 8. IMU on the TV platform.

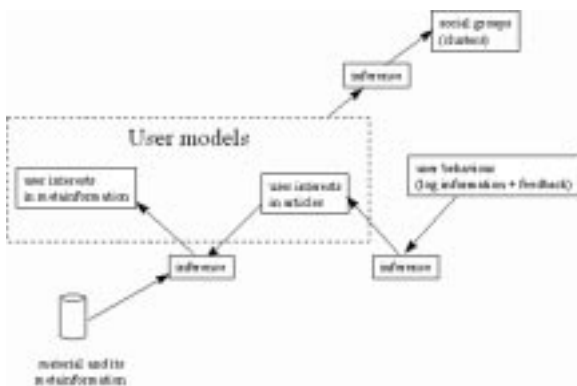


Fig. 9. Identification of user interests used in the IMU adaptive personalisation.

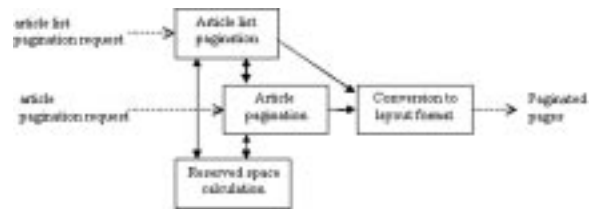


Fig. 10. The main information flow of the layout engine.

design of the layout engine has been to first solve the underlying typographical issues and to attain fast response times.

The engine resides on the server and retrieves articles from the database. It takes account of the user preferences specified in the user model and the article metadata as well as information about the screen resolution of the user. It constructs either an article selection list or an article. The engine calculates the space requirements for text and image elements and uses a set of templates and rules to

lay out the material on successive virtual pages (Fig. 10). The virtual pages are then translated into a CSS2 HTML-document, which is returned to the client. The size of the virtual pages is adjusted to the resolution of the user terminal as described above. This is especially important for terminals with limited resolution, e.g. TV or mobile terminals.

5. Multimedia articles created for IMU

In addition to the proxy-based utilisation of existing media content, new multimedia content for IMU was created and tested on a small scale. One multimedia article was created using a TV feature programme as a base document. Related articles were linked to the video. The multimedia article was programmed with Macromedia Director and consti-

tuted an independent unit. The next article project, IMUextra, was based on the idea of using the IMU database and interface as an integral part of the multimedia structure.

The IMUextra project was carried out at the University of Tampere by a group of media students, who produced the daily newspaper, Web news site and various video programmes for the annual Short Film Festival in Tampere. Four articles were prepared and published in IMU. The structure of the articles was based on a core text with hot word links. The new articles open up in new browser windows (Fig. 11). The original desktop remained visible. The linked multimedia content could be either internal data from the database, or an external Web site.

The student team confronted various problems during their work, including technical problems such as the difficulty of editing videos. In this type of pilot project, the initial set-up of the necessary infrastructure was a problem in itself. As the multimedia journalist is very preoccupied with the subject and storytelling, all additional technical problems will greatly disturb the flow of work. Especially in creating concise and ‘Web-friendly’ video inter-

views, good journalistic skills are essential. In future projects, a more permanent production set-up will have to be tested in order to improve the workflow and practice. The creation of this special IMU content was, however, sufficient to show that the essential skills can be adopted fairly quickly.

New Web multimedia technologies have also been reviewed during the project. SML-based and other multimedia tools offer remarkable possibilities to the journalist, but at the time of the project it was not possible to integrate these emerging technologies into the IMU structure. In future projects, this will pose a great challenge to journalistic R&D.

The role of the multimedia articles created remained marginal, when viewed as a percentage of total usage (IMUextra channel had less than 1% share of the articles read). When reviewed from the article readership viewpoint, an IMUextra article had 76.45 readings per 1000 users, while an average IMU article collected just 0.75 readings. This indicates that the role of daily news database and multimedia content is profoundly different and needs different approaches in R&D.

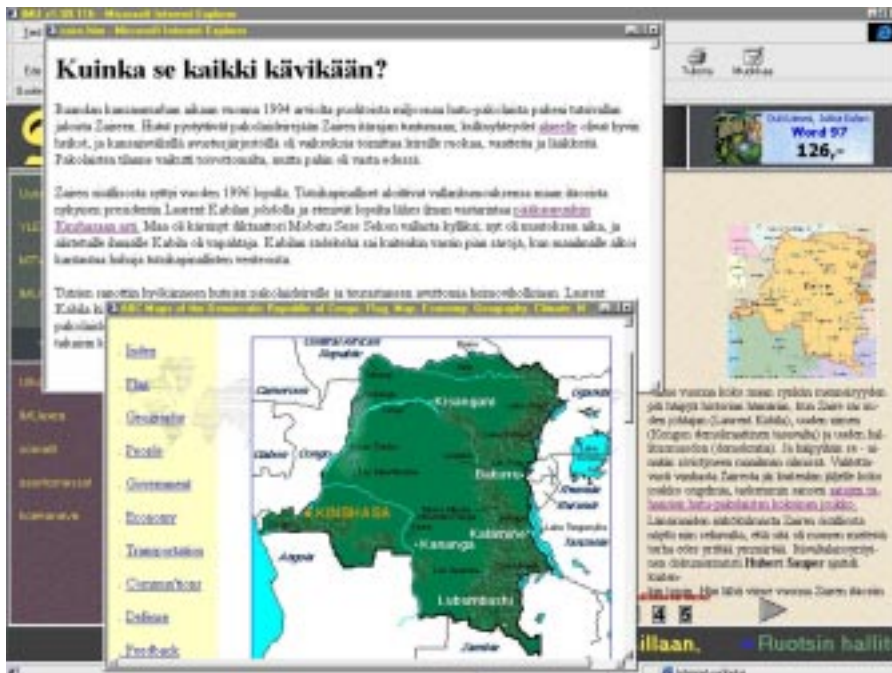


Fig. 11. Multimedia content produced solely for IMU. The core article can be seen on the right. The linked articles are opened into new floating windows. The sub-article is retrieved from the database, whereas the Web site including the map is external.

6. User trials

6.1. Description of users and the usability evaluation

The trial system was tested by 62 end-users in households in the Helsinki area. They were 7–70 years of age. The activity varied considerably. The users were mostly very experienced users of computers and the Internet. They had very little or no anxiety towards new technology.

There were several evaluation methods: forms on screen, interviews, log files and tracking eye movement while using IMU. The evaluated dimensions were ease of use, usefulness, appearance and value as a news source. Personalization and integration were evaluated on the assumption that they add to the usefulness of the system. There were a total of 42 interviews before and during the trial, both on the phone and personally. 29 different users were interviewed in all. Before the trial many expected that a system of this kind would provide on-line information and that they could look into the backgrounds of news topics more easily.

The users' opinion of the main interface was that it was simple and easy to use (Fig. 12). The simplicity was due to the fact that the main controls and headlines were logically placed and visible at all times while browsing through articles. Although simple to learn, the system was a bit slow and cumbersome at the beginning of the trial. The situation improved as the trial progressed.

In contrast to the main user interface, the dialogue for personalising the news was difficult. Personalisation was viewed as useful, but there was a high threshold to use it. The benefits of personalised news

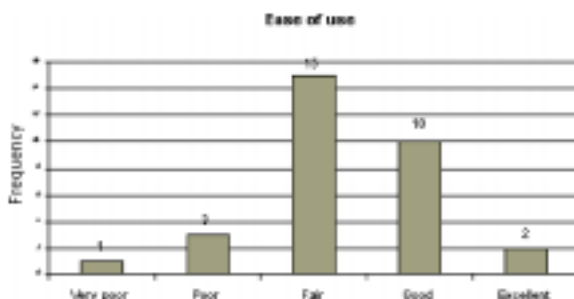


Fig. 12. IMU's ease of use as evaluated by the users.

appear to be highlighted if the use is regular and there is a wider range of publications. In the trial system it was often enough to use a keyword search rather than a complete personalised channel.

The integration aspect of the interface did not present usability problems. The users thought that integration of the media was not as fully realised as it could be. They hoped for a linkage to articles on related subjects, for instance. Based on user feedback, we added links to related news at the end of the trial.

Most of the users found the system aesthetically pleasing, with a relaxed and 'trustworthy', though at times dull, look, which was appropriate for delivering news. The importance of pictures was stressed. This could be seen from the results of our gaze test performed on average users (Fig. 13).

6.2. IMU as a news source

The active users considered IMU primarily as a news source. Some users were actually confused when asked if they used it for entertainment. It does not have to be fun, said one user, but some others noted that e.g. political cartoons would be suitable as content. Among other media, IMU was considered as important as radio and text-TV, and more important than World-Wide-Web-publications and subscribed periodicals (Fig. 14). Subscribed daily newspaper and television still held the leading position as news sources.

The media that had less popularity among active IMU users than the whole test group, were radio and also television. IMU also clearly took some time from other Internet Web surfing. Newspaper reading and text-TV were more popular among active IMU users, which would promote the concept that reading news articles from Web publications does not necessarily make newsprint redundant.

6.3. Reading IMU: usage statistics

The number of sessions was in line with the time spent on-line, which means that users with different levels of activity have similar session lengths. The average session was very brief, only 2 minutes 27 seconds. The average uninterrupted length of the session was 1 minute 45 seconds. The average user retrieved 2.26 articles during a session. On top of



Fig. 13. The result of testing the IMU publication on a user with a gaze analyser. The importance of pictures is clear.

that, one article was retrieved automatically as part of the logging on procedure.

Both TV and newspaper content interested the users. 42% of the retrieved material was TV news, the remainder being divided fairly equally between the four participating newspapers. Personalisation was used to a certain degree — 44% of the users personalised at least one channel, and 18% two or more channels. One third personalised the outlook and 40% used the search feature.

The most popular time for reading IMU was between 8.00 p.m. and 10.00 p.m. (Fig. 15). This was no surprise, as IMU was only in domestic use. However, other secondary peak times could also be identified. The morning hours attracted about 50% of the activity during prime time. Between noon and 3.00 p.m. there was a slow decline in activity to a level representing 30% of the peak. A slight 'coming home' peak could be identified, but the activity remained otherwise only slightly above the morning level. The prime time peak lasted until midnight. The interest shown in IMU during morning hours is actually remarkable, considering that the content to IMU was for the most part updated around noon and, for television, just after the time of the evening newscasts. Several users had actually noticed that in

the morning IMU does not offer anything new since the previous night.

6.4. IMU evaluated by journalists

As IMU is based on the idea of recycling existing news stories, there is no journalistic input in the traditional sense of the expression. The journalism that could be read from IMU is therefore no different from the news stories printed on paper and shown on TV. To collect information on the possible influences on journalism, 22 professional journalists were given a 15-minute presentation of IMU on a data projector screen at three separate occasions. The responses were put into three groups:

- *IMU and the publisher.* Most journalists considered IMU as an additional service. If the content is already created and paid for, the operation of the once established service itself would be relatively cheap. At the moment, TV and newspapers complement each other. TV is fast; newspaper provides more in-depth information. IMU, integrating these two, may seem confusing.
- *IMU and the journalist.* The journalists were quite sceptical about the possibilities of multimedia tools. Even the photographers frowned on the

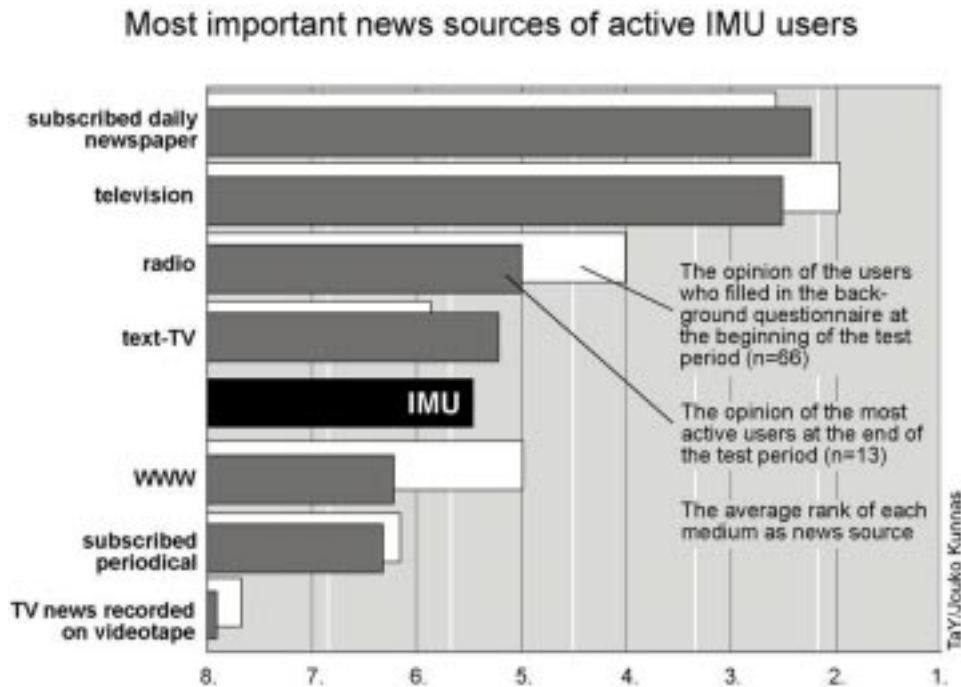


Fig. 14. The daily newspaper and television remained most important news sources also among active IMU users. IMU had however established itself as a secondary news source, comparable to radio and text-TV.

idea of shooting videos. They considered the storytelling of video too different from photographic expression. In the present newsroom, the pace of work is such that no journalist could imagine having time for additional work. The print journalists were used to the linear storytelling. If the reader is allowed to escape through a link in the text, what happens to the story? The journalists strongly emphasised that IMU type services also need editorial staff to select the headline news. The TV and newspapers provide this valuable service of filtering and evaluating the news stories, which is missing in IMU. The 'human touch' was also missing. Many readers find their news by following their favourite TV personality or print journalist.

- *IMU and the reader.* Personalization was seen as the key factor for the success of IMU. The possibility to read archived stories was seen as a great advantage. The journalists would also market IMU at target groups with clear and identifiable needs for personalization. The most obvious personalization idea was the use of location as a selection criterion. The automatic layout process

prints headlines of uneven lengths that are avoided in print. The journalists liked the multimedia articles, but noticed the graphic mess that results from several links, visited and unvisited, having different colours. Also the breaking of the linear story was seen as controversial, as mentioned previously.

6.5. The usability of the Television IMU

The test group testing the Television IMU included 12 persons, aged 16 to 63. Six of them were experienced computer users; six were quite inexperienced. They all used Television IMU with a remote controller and a cordless keyboard. The personalisation of the news was done on a separate computer.

Television IMU was clearly seen as easy to operate. The main controls and headlines were logically placed and visible at all the time. In this respect, the opinions on the usability of television IMU and computer IMU were about the same. The appearance of the user interface was clear, but a little bit dull. The usability problems were related to the scanning

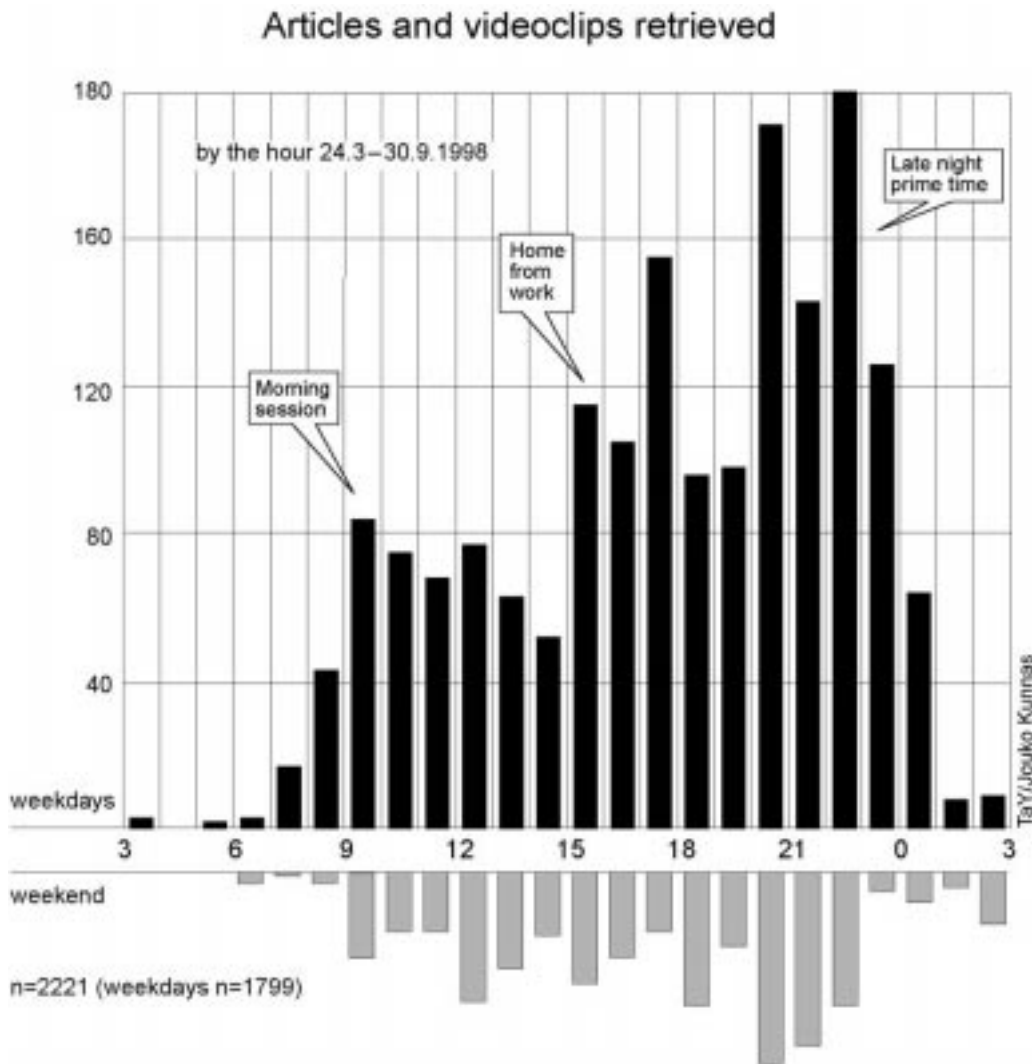


Fig. 15. Late night is prime time for IMU.

of the buttons with a remote controller. It was not always clear where you were within the user interface and it was hard to find all the buttons. Users did not find all of the channels because of these problems.

The users did not find Television IMU especially slow, once they had found articles to read. This was a surprise, because Television IMU was used with an ordinary 33 kbit/s modem. It was difficult to choose a suitable size for the letters. Some users in our test group were not able to see all the text on the screen. For some users the right size was 2, some users used the size 5. The size of the television screen was big

enough, but some users commented that the screen should have a higher resolution to make it easier to read text.

All the users liked the idea of reading and watching personalised news from television. The use of the Internet and IMU together in your own living room was a good concept for the test group.

6.6. The media house view on IMU

A study encompassing 9 major Finnish media companies was made. It was based on ideas about

marketing expressed in [12]. The aim was to find out opinions about the commercialisation of integrated publications like IMU. The interviews consisted of several dimensions: content, distribution, price, integration, personalisation, advertising, electronic commerce, marketing, users, visual layout and relations to existing media. The main findings were as follows:

- *Integrating* several media into one package was seen as interesting and useful, but its importance for the customers was questioned. What happens to the soul of the media product when it is integrated with other media products? Personalisation helps customers handle large amounts of information and they can have better control over the received information. Personalisation also helps to focus marketing and advertising.
- The *content* is crucial to attract advertisers and readers nationally and regionally. The integrated publication, with its multiple producers, was seen as a supplementary information source, ‘a library at home’. It will not replace any existing media. However, to provide real value added service, the publication must be interactive and provide broad content. The visual layout should contain surprises and unexpected features.
- The best *distribution channel* was seen to be television, because of its capacity to reach the mass audience.
- The *price* is difficult to define for integrated publications, since there are several content providers. Most of the interviewees supported the idea of commercially financed publication. Another possibility would be to charge the use as a part of bigger entity, for example, as a part of the phone bill.
- For *advertising* this publication provides an environment for personalised advertisements. It also enables testing of new ways to advertise on the Web. The advertising can be automated, but caution must be practised (no car ads close to stories about car accidents). The integrated publication is not yet seen as a potential channel for electronic commerce. First, there must be a proper and well-designed brand in order to market this to the consumers.
- The *marketing strategy* should pursue the following ideas: popular, easy to use and understandable. Generally, consumers are not so used to

computers and information networks at the moment. You should be able to reach the mass audience and typical Internet users at the same time.

- There are two main ways to *commercialise* integrated publications. Media houses can work in co-operation and combine both technical skills and media knowledge. Together they can offer consumers a genuine media product with a large amount of different and customisable information. The other possibility is that one big media house utilises the concept.

7. Accessibility issues

The accessibility of the IMU publication relies on the accessibility of the Web browser under which IMU is running. In the PC environment, IMU can be operated with both a pointing device and a keyboard. Manual scanning is also possible by emulating the keyboard with a set of switches. In the TV environment, the input mode of the remote controller is manual scanning. Thus, the IMU publication supports both scanning and pointing as the input mode, which is appropriate to people with motor impairments.

In addition to the accessibility options of the browser, there are personalisation possibilities in IMU that can be used to further enhance the accessibility of the publication. The user can select the graphical presentation mode and font size. This makes IMU easier to read for people with vision impairments. IMU divides TV news broadcasts into separate news items, and shows the headings as text links to the actual video material. IMU also links TV news items to newspaper articles on the same subject. These features are especially welcome to people with hearing impairments.

Most important, however, is that our approach makes it easy to implement further adaptability in the future. We don’t think that there are people with ‘special needs’. Instead, we find that each person has his/her personal needs to fulfil. Each individual wants to read, listen or watch publications in the way that best suits to his/her abilities, preferences, context of use, terminal characteristics, network and so on. For instance, voice control and speech output satisfy the needs of a blind person as well as the needs of a person who wants to listen to personalised

news while driving a car. These features can be offered by adding new presentation options to the publication.

8. Conclusions

The IMU system integrates TV and newspaper media in a new way. By automatically bringing together content from several newspapers houses and TV companies, a continuously updated World Wide Web-multimedia publication is created. The core of the IMU system is an active multimedia proxy server that downloads, digitises, classifies and interlinks the media content. Fast Internet connections through ATM fibre links and cable TV or ADSL network make it possible to bring the multimedia publications to the household user. Personalisation of content and appearance makes for an individual service. The publication can also be viewed through Internet TV. IMU makes it possible for the user to determine, for example, a personal channel of his favourite ice hockey player. This channel would offer TV-clips and newspaper articles about the player. The personalisation is fine-tuned through adaptation to the user's behaviour.

Special attention has been paid to the publication's ease of use. The solutions have been evaluated by various test groups along the whole development process, starting from the initial brainstorm and running through the phases of investigating existing publications, user interface visualisations, prototypes and the final trial system. This feedback has been utilised in the design of the system. As an example of user feedback, the articles are automatically paginated into a sequence of browsable pages instead of scrollable text. The material in the IMU database is genuinely integrated. News articles and TV news topics are linked to each other through automatic association. If you are watching a TV topic, the system automatically suggests related newspaper articles or TV news.

The user trials showed that the average IMU session was a part of a more general surfing session. The session was brief, focusing on a few fresh articles, and took place in the evening at prime time or in the morning. Both TV and newspaper content interested the users — 44% of the retrieved articles were TV

news. Personalisation was used to a certain degree — 44% of the users personalised at least one channel. One third had personalised the appearance of the publication and 40% had used the article search feature. In addition to these statistical usage figures, interviews with users showed that the user interface was fairly easy to use, except for the personalization. The integration of content was viewed as valuable. In the future, more news sources should be available, the user interface should be more visual and editorial touch should be strengthened. Personalisation should be made more intuitive.

The IMU publication can be developed in many more ways. By adding voice control and speech output, the publication would satisfy the needs of blind people as well as many mobile users. By integrating radio broadcasts, the publication would offer a broader range of news media.

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