D2.2 Revised Scenarios for Media Access, Search and Retrieval

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### Abstract

Description of the scenarios developed in different contexts for the identification and prediction of current and future user needs for audio-visual media search environments. This is a shortened version of the complete D2.2, for publication and review by media professionals.

It discusses the way that media professionals and web users search for audiovisual material, the potential usefulness of new search methods and environments proposed by SEMEDIA, and the ways in which they may be deployed in the different contexts of Broadcast data stores and archives, Postproduction, and the Social Web. This knowledge will be used to direct the technical research toward what are likely to be the most useful outcomes.
Executive Summary

This document describes the results of an investigation of user requirements for Media Access, Search and Retrieval gathered from users in large media organizations and on the social web.

We considered the requirements of users in three contexts: Broadcast Television collections and archives; Postproduction for film, TV, advertising and cross-media; and on the Web. The survey was conducted by SEMEDIA’s media industry partners BBC and CCRTV (Catalan Public Television) in TV Broadcast and Archive; Smoke&Mirrors (S&M), Ltd in Postproduction; and Yahoo!Iberia (Y!I) in on-line Web.

User data was gathered and analyzed from within the partner organizations, from other companies, and from the Web community. The survey was conducted over two periods, by means of questionnaires, focus groups, interviews, observation, and an external user group meeting. 1,882 questionnaire responses were received, of which 139 were from media professionals and the remainder from general Web users. The results provide a rich description of the user environments.

The analyses of the use of search tools in broadcast television, in Postproduction houses working across the range of media (with emphasis on advertising and digital cinema), in media archives and the social Web has yielded:

- Scenarios of use for media access, search and retrieval
- Profiles of user types
- Environment workflow information
- Metadata requirements
- Interface and information access needs
- Data security and integrity needs
- Understanding of public access to professional archives and professional access to media on the Web.
- Direct user opinions and suggestions
- Analysis of user need by functionality
- Tool definition and technology focus
- Tool acceptance criteria
- Tool integration needs
- Tool evaluation criteria
- Understanding of Media Acquisition Management (MAM) systems used by professionals and video player and editor functionality used by the online community
- Understanding of future “wish list” functionality.

User centred input is essential for the development of relevant and useful new search tools. In the professional media sector, even though some of the media management systems already have advanced functions for key frame display, low-quality pre-visualization, and IPR restrictions, all searches are still undertaken using text, and archivists manually input all text based metadata. There are no facilities for automatic indexing on ingest and users would welcome more advanced indexing, summarization and search functions.

We surveyed user responses to proposals for tools with functions for:

1. Detection of Events (e.g. goals in a football match)
2. Visual recognition: logo detection and OCR
3. Camera motion detection
4. Textual annotation
5. Visual content clustering
6. Video interaction package: video marker, video hotspots, and manual video summarization tools
7. Automated Video Summaries
8. Object Highlighting and Keyframe Selection
9. Retake detection
10. Content Browsing using Stripe Images
11. User data mining and user activity

All of these technologies would, in different degrees, be useful and welcome as a means of saving time in finding particular shots or sequences from video. The functions proposed are generally not available in professional asset management systems or on the web. The introduction of tools based on advanced search algorithms are likely to make it easier for the user to locate media. To be of practical use, however, search algorithms need to be scaleable and deliver results quickly. Professional users will only accept these technologies if they are integrated in their own day-to-day media systems: stand-alone tools are not appropriate.

In the Web scenario, privacy and security issues have to be taken into account and users are anonymous. However, the large amount of data gathered from user activity is a rich source of information that suggests ways to annotate and retrieve video information. Social web users have different motives from archivists and media professionals. Sharing and interacting with others is a strong driver over the Internet, and can be used to encourage people to tag, rate, comment, and annotate video.

Web users are particularly interested in event detection, clustering, summarization, other users’ activity and ratings. They are not interested in tools for detecting retakes or camera motion (which would be more valuable for postproduction). Web users are very flexible and willing to try new features.

The report is divided into three parts:

- A short general introduction and background
- A review of the User search and retrieval scenarios. This describes how users currently look for and retrieve information in postproduction, broadcast TV and TV archives, and the social web. In each of these cases, we look at several different classes of user. As well as describing current use, we include a few possible future cases suggested by Users.
- A review of the potential usefulness of the techniques suggested by SEMEDIA, in relation to the user contexts surveyed, based on responses to questions put to users in questionnaires and group meetings.
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1. Introduction and Background

Professional media repositories and Intranets, like the Internet as a whole, present the problem of how to find precise segments of audiovisual files among a sea of largely un-indexed, heterogeneous data. SEMEDIA is a three-year project that aims to create new methods, environments and widely usable tools for media labelling, searching and retrieval from very large collections of heterogeneous data, building on and extending research in media technologies, web semantics, AI, Content- and Context-Based Information Retrieval, and interface design.

SEMEDIA should enable the rapid, semi-automatic annotation of large data populations at greatly reduced cost, and the production of professional and consumer tools for near instantaneous data search & retrieval from very large, distributed stores of mainly un-indexed audiovisual media.

SEMEDIA is developing techniques to extract metadata from content ‘essence’ in ways that allow the automatic inference of high-level structural information from new, partly annotated media content. It will create tools for:

- Navigating intelligently and searching efficiently;
- Summarizing and clustering visually similar content; searching for ‘scenes similar to…’
- Finding scenes with a given character and all the associated files, geometry, shading, colour model, speech characteristics, motion data etc;
- Data architectures that support secure content tracking and multiple user access;
- User interfaces that allow fast browsing with user-defined criteria and adaptive feedback that recognises context and intent, and contributes to the annotation.

The research is guided by user scenarios developed with professionals in the postproduction and broadcast industries, and on-line communities. The results will adopt an open systems approach, which can be combined with existing media and web environments, to provide search tools that meet the needs of producers and consumers of audiovisual media in the digital postproduction, broadcast, advertising and on-line sectors.

The Scenarios for Media Access, Search and Retrieval have been developed from detailed task analyses carried out by the media industry partners (Smoke & Mirrors, BBC, CCRTV and Yahoo! Iberia) to define requirements in a wide range of industry contexts with a vision for the future. Having produced a first version of scenarios at the end of March 2007, we have continued to study the needs in more depth to produce a more considered version, which has also taken into account a wider range of professional views. The full version of D2.2 Revised Scenarios for Media Access, Search and Retrieval is a complex and lengthy document that contains some restricted information. This version is designed to summarize the findings in a more digestible and publishable form.

Since the requirements themselves will be challenged and refined by the research outcomes and early prototypes, this is an iterative process. Now that the use cases and baseline expectations have been capture, the project will study the practical problems of integrating access, search and retrieval tools in environments and workflows for creating, managing and delivering media. We will also move on to consider the impact effect of changes in media culture on the ways in which media objects may be defined, searched and retrieved.
2. User Scenarios: how people search in different environments

SEMEDIA user partners have classified user types and created representative scenarios of use. This information will be used to guide the technical and scientific work, and the resulting search tools will be checked against scenarios and use cases.

2.1. The Postproduction Environment: Smoke & Mirrors

At present all searches are undertaken using text. Text-based catalogue information is manually input and typographical errors inevitably occur. Current text based search functions are very simple, but not very intuitive and media may not be located if a keyword is spelt incorrectly.

Several different classes of user search the data library, for different purposes, which are summarized in the following scenarios. The principal current users of Cakes fall into the following categories:

2.1.1. Marketing - Low level user

The marketing user undertakes specific searches for images relating to particular jobs, and more general searches for images relating to types of work that we want to publicise, or jobs undertaken for certain clients/territories. They may also want to identify certain types of jobs, for example to find all High Definition format work.

2.1.2. Producer - Medium level user

The Producer is a Project Manager whose role is to liaise with the client, agreeing terms of reference with them, what and how the work will be performed, delivery timetables and budgets. They will then manage the project throughout the production pipeline ensuring that the job is completed on time and to budget. Any changes to the job specification will go through the Producer so that they can agree revised timetables and budgets. They will also be responsible for billing the client for the job. The Producer will use the system to set up a new job or client.

The Producer undertakes specific searches to locate specific material relating to past work, in cases such as those where a client wants an amended version of a previous job.
The Producer is responsible for ensuring that all the media required for a job have been received from the client and made available to the creative team. Media will be in a variety of physical and electronic formats, ranging from cans of film, videotapes, and physical artwork to already digitised media. The Producer must therefore search for this media and inform the creative media of its location, which may be its physical location in the building or the file path if it is already on the servers. The Producer may ask the librarians to undertake this task.

Producers are also heavily engaged in preparing pitches and tests for new/prospective work. This may require general searches for media of a similar nature to the marketing user.

2.1.3. Librarian – High-level user

The Librarian or archivist is by far the heaviest user of the data store and needs enhanced search functions. Librarians are responsible for the initial logging of all media entering the premises, whether in physical or electronic form, and associating it correctly with a project or client. Librarians are also responsible for despatching media to external parties and logging transfers.

The Librarians receive requests from various sources to locate specific media items, as well as general examples of media. Requests may come from other staff members, such as Producers or marketing, or from the client or other collaborators on the project. The requests often come with scant levels of information about the media to be located.

A variety of search input fields may be used, including media description, location, format, resolution, client details (name, personnel, country, etc.), product, date generated or despatched, unique identifying codes, clips containing various features (sky, fire, water, textures, lens flares, animals, etc.) and timecode.

2.1.4. Expected future user – Client

We would like to give clients limited access to the system, so that they may view all of their past and present material. They will undertake specific searches for jobs for the approvals process, probably searching using text only inputs by, for example, job name or date. They may also wish to undertake general searches based upon text criteria, for example, their client, product, brand, etc. or by image related searches, for example, all car commercials, but again may be able to use text.

2.2. The Broadcast Archive Scenario: BBC and CCRTV

2.2.1. Current search scenarios: BBC

Overview

Every week the BBC produces, within the UK, about 200 output hours of television and 500 output hours of national radio. BBC World Service Radio broadcasts in over 30 languages and produces another 500 hours per week (approximately) of output.

In addition to the broadcast output, there are the original raw tapes or “rushes” which can vary from programme to programme. Productions vary greatly in their “shooting ratio” of footage, but for high-end costume drama, natural history and factual programmes the ratio can be as high as 40 to 1. The BBC newsroom takes in about 300 hours of video and audio each day (from correspondents, affiliates, wire services and so forth) and broadcasts about 15 hours of distinct national news content per day.

There are two basic workflows for handling video material: in programme making, and in the archive. There are also distinct workflows for different genres: news, current affairs, sports, natural history, drama, children’s programmes, ‘light entertainment’.

About 95% of requests to the BBC archive come from either BBC staff, or external programme makers working on a BBC commission.
Search and retrieval

How a programme maker finds material depends upon many factors. Here are some examples:

Film research: although film is hardly ever used anymore as an originating medium, specialists in finding footage are still called film researchers/librarians. If a programme needs significant amounts of footage that it cannot shoot – from far away, from the past, or from an event like the Olympics – it will employ a film researcher/librarian to track down that archive footage using the BBC archive databases.

Shot logging: Production staff produce a shot log which is a list of all the camera shots. There are many proprietary shot-logging databases with different levels of descriptions. At the professional end, shots would not only have a brief text description, but would also have some sort of keyword or subject indexing. Media managers advise on indexing terms and vocabularies and shot logging systems are just beginning to be able to handle taxonomies.

News production: the BBC newsroom journalists all search for material using common systems. One holds the incoming footage (Jupiter), another the playout (Omnibus), and a third all the text generated to accompany the footage together with the running orders for the various broadcasts (ENPS). A fourth system (STAR) is used for cataloguing the ‘news items on shelves’ and a fifth system (INFAX) for cataloguing the news broadcasts. Anyone doing news research in the BBC needs to understand all these systems, in order to track down the best footage in the shortest time.

Archive research: the BBC archive receives about 700 enquiries each day, resulting in the movement of about 2000 items of video and audio from the archive to the enquirer’s place of work. About half the video material is requested in browse format (VHS/DVD) (for general research, for ideas, for preview of footage), or in broadcast format (eg digi-Beta/HD Cam) for programme making. Individual programme makers can search the archive catalogue online (INFAX), or phone a professional archive researcher for assistance.
**BBC Expert Television Researcher - Mediated research**

Research librarians in the Information & Archives department undertake research for programme makers. Many requests for footage/images are very general to stimulate ideas for new programmes or establish if there are transmitted programmes on a particular subject. Other requests may be for stock shot material from rushes to fill gaps or avoid duplication costs of filming a particular location or scene such as general views of crowded beach scenes. Some requests can be very specific especially for documentaries or docu-dramas (e.g. night shots of a yellow RAF rescue helicopter winching someone from the sea).

The classification schema within the INFAX archive catalogue is called Lonclass and contains more than 600,000 subject terms created by professional cataloguers and librarians. Professional cataloguers view programmes, annotate, shot-list with time-code, catalogue and index using this schema for future research and retrieval by programme-makers or expert television researchers. The catalogue records consists of various fields to include title, sub-title, episode, TX date, programme number (unique identifier), type of programme (magazine, videotape item, complete programme) format (film, videotape, Digibeta, DVcam, HDCAM etc), duration, copyright, specially shot, library archive, B/W, Colour. There is a Synopsis field with a three-line annotation to describe the programme subject, names of presenters and contributors. This is followed by a descriptive shot-list with time-codes of shots, clips and sequences, which will include interviews, independent actuality and dependent actuality and ex-library material. The catalogue record is indexed using the Lonclass classification subject terms. New terms are created daily for new concepts and subjects to describe scenes, sequences, clips and shots.

Searches can be undertaken using the INFAX native system, which will return rich metadata, and in particular concepts and subjects which have been assigned to the programme sequences and clips via the Lonclass classification schema. This is a search on controlled vocabulary terms.

**BBC Archives Use Case**

Sheila is a film researcher, researching and selecting content for a European broadcast website currently in development. The content must illustrate the diversity, similarities and differences in television programmes and cultures across Europe. One of the Topics is War/Conflict. Here are some of her search terms for searching the BBC film and video catalogue:

- War / Conflict - To look under war takes too long & does not always retrieve everything.
- Terms checked so far –
  - Korean War
  - Falklands War
  - SAS (partly to get the footage of SAS at the Iranian Embassy London - but in case any good footage of them in any conflict)
  - Foreign Legion (French troops) - so catch items with European element & quick way of finding War items.
  - Algerian War - because of French involvement so could get European element
  - James Mossman 50s / 60s foreign reporter, Julian Pettifer mid 60s / 70s foreign reporter, Brian Barron mid 70s / 80s foreign reporter - all covered wars & BBC staff so most likely to have specially shot BBC copyright material.
  - UN troops - hopefully mention which European country UN troops from, to get European element
  - Gulf war /Yugoslavia war 90s, then individual countries - Bosnia etc/ Rwandan civil war/Angola war/Biafran war/Iraq war / Afghanistan war.

Sheila uses her knowledge of the archive and the catalogue to retrieve programmes which could be news, current affairs, documentaries, specials etc. She is also searching under war correspondents’
names as a different way of finding useful material. Searches and search results are all text based. Sheila will have to read the catalogue record and then order VHS tapes or DVDs to view material she thinks may be interesting.

A further search on more specific scenes and objects could retrieve more material, for example, tanks firing missiles, car bombs in Baghdad, guns, prisoners of war, and troops. Many television directors also request video images in terms of shot types: MS (mid shot), MCU (Mid Close-up), BCU (Big Close Up), WA (Wide Angle) Pan, Tracking Shot, U/W (underwater shot). A/G (Air to Ground), Helicopter Shot, Zoom in/out/.

It is hoped that new media mining tools and improved search techniques and tools will enable faster searching across diverse and specific topics with more accurate and timely results when searching for archive material.

**BBC Programme-maker, Journalist, Researcher (non-expert)**

Most production staff use the web version of INFAX, which is on the BBC intranet, for general and specific searches using free-text simple and advanced searches. More advanced searches can be undertaken which link to the controlled vocabulary. It is common for production staff to use simple search and select items from the first few search results for viewing on VHS/DVD before making a decision on the relevance and suitability of the chosen shots for inclusion in the programme.

**Use Case #1**

Current affairs assistant producer is searching for stock-shot material to fill an item on the Prime Minister’s questions in the House of Commons. He/She is looking for night shots of the Houses of Parliament with the South Bank in the foreground, MCU Big Ben, aerials of River Thames. These are stock shots which can be found in the Web version or native version of INFAX by typing in simple search terms = night Houses of Parliament London, Big Ben etc. The search will return many pages of results displaying various items, which will still needs to be viewed on a VHS/DVD.

News has a different system called Jupiter, which is an integrated digital news production system that provides, browse quality video images on the PC. However, even with browse quality on the desktop, there are hundreds of different shots of the Houses of Parliament, which need to be viewed before the most appropriate can be selected.

In the future Semedia world, the assistant producer would search and cluster images of Big Ben by an image of Big Ben and shot type (MCU) and night shots as well as aerials of the River Thames. More details of the images and what the shots really look like in comparison will aid the production process in terms of efficiency and accuracy.

**Use Case #2**

A Natural History producer is looking for rushes of polar bears and cubs walking across ice. With the number of rushes tapes uncatalogued this is a mammoth task. Viewing many tapes and selecting the right shot can take days or weeks. Even if some material has been tagged with the term “polar bear” a simple search will retrieve hundreds of similar shots. Rushes tapes are logged, catalogued and indexed into INFAX using a different classification schema called TELCLASS, which was developed for the BBC Natural History Unit. This is similar to a Thesaurus but uses the numerical, faceted classification schedules created by the librarians. Again, the non-expert searcher can use the Web Version of INFAX for retrieving natural history footage.

For the BBC Planet Earth series, a digital production system was piloted and all rushes (thousands of tapes) were ingested for search, browse, retrieve, viewing and rough-cut editing. The video images needed to be tagged with species, behavioural, actions,
locations, night and day shots, seasons. Many were logged into the system in order to make it possible to search and retrieve specific shots, clips or rolls of footage for viewing on the desktop.

For example, *ms cheetah chasing a gazelle on the Masai Mara* would have been indexed under Cheetah (species), Chasing (Behavioural Action), Gazelle (Species) Masai Mara (Location) + Time of Day (Night/Day). There would have been many tapes/film cans of this particular scene as the cameras are rolling for hours in order to capture the action.

In the future Semedia world, a natural history producer may be able to access rushes of polar bears by similarity searches of the images itself whether it is day or night (sunshine or moonlight), cubs walking or playing and on ice, snow or earth. He maybe looking for a shot of 2 cubs or a group which could be viewed as individual shots, sequences, or as a group of images.

**Use Case - Sports**

BBC Sports coverage includes Outside Broadcasts for large events (e.g. Olympics, Wimbledon, FA Cup), studio based programmes, covering a wide variety of live sports and magazine type programmes. Each week, several hundred hours of video are recorded to videotape in many different locations for a diverse range of purposes. To make effective use of the tapes it is imperative to know what is on them and where it is recorded. At major events, production paper logs are created by producers, assistant producers and Postproduction staff to enable tapes to be used as source tapes for edits. Most broadcasters are still generating hand-written paper production logs. Hand-written logs are geared to the editorial process so only limited information is noted often with inaccurate time-codes. Due to the pressure of live recordings these logs are often illegible and of limited use. The Sports Library is currently live logging some events into a new Sports Library database. These logs form the Sports Library catalogue or the “posterity log” and need to be more detailed for future retrieval and re-use.

**Use Case**

A sports librarian is asked to find some good shots from the England against Macedonia football match which was sometime during 2006. This is a specific search:

- Enter England v Macedonia in Subject Field
- 01/01/06 in date Field.
- View Holdings Press Search button
- Results = Match of the Day Live 1st and 2nd Half of the Main recordings, plus ISO camera tapes of match, plus Compilation Tapes and Programme as Broadcast Tapes.
- Then the sport librarian can view the textual cataloguing of match and tag which of the tapes he/she would like to Save.
- Trimming results is a means of selection and refinement before printing
- Add to search to refine further
- Select and get tape details
- Search within results e.g. ms Wayne Rooney in England v Macedonia match

**2.1.1 Expected Future Sports Use Cases (BBC)**

It is envisaged that in 3-5 years time Sport production and library will have a new digital production and archive system with browse quality on the desktop for logging and search and retrieval. In the future, content based image retrieval tools may help to provide further benefits to production and archive staff—e.g. to be able to search by the image – teams, players, actions and activities such as goals, penalties, offside, rugby tries, famous tennis rallies, Olympic events, award ceremonies, slow motion replays, replays etc. Also, adding metadata (logging and cataloguing/indexing) could be enhanced with new metadata extraction tools.

**Pre-Event - the production process starts at the preparation and planning stage.**
Media Managers will create metadata log templates for each category of Sport. Drop-down lists will be created for the team and player names. Descriptive metadata fields will be set up in advance to ensure standardisation and consistency of metadata terms. Production staff will have simultaneous desktop access to the electronic logging templates before the event and be able to add new additional information.

In the future, the need for such detailed logging maybe reduced with the implementation of new tools to extract metadata from the image and generate automatic metadata from a few words. The searching methods and techniques could change with tools to enable clustering of images on similar subjects or actions.

**Live Event – production teams on location at the Outside Broadcast or in Videotape suites at TVC**

Media Managers will live log in Videotape (VT) Suites at TVC or at an Outside Broadcast (OB). Producers/Assistant producers will be able to live log the main recordings, ISO Cameras, Slo-Mo replays directly into the electronic log using set descriptive metadata – Shot Type, Shot Descriptions, Key Actions, Keywords, Time In, Time Out etc. Once completed electronic, logs can be printed or exported into non-linear edit suites or LSM to produce quick turnaround edit highlights.

OB loggers at big events will have access to the electronic template logs. Sport loggers in a Media Hub at TVC will have access to all feeds and live log using the electronic log templates. Sport Production, Sport News, Sport Interactive and Sport Radio will have simultaneous real-time access to the electronic logs as they are being completed. This will eliminate duplication of logging by different areas within Sport.

New Media Data Mining tools could enable logging and searching on camera shot types and formats eg slo-mo replays and camera angles without the need for descriptive text. Good shots will be marked and retrievable in a grouping of good shots of a particular match.

**Content-base image retrieval**

Searching by images will create more efficiencies in the indexing and retrieval process. In future, there may be scope to use CBIR for sports activities.

Person = Tiger Woods (search on face or body)
Activity = putting on 18th Hole or Teeing Off using a driver (action)
Location = Carnoustie Golf Course (search on location plus golf course)
Subject = Golf (search on general shots of golf – non-specific)

This would save duplication of viewing and cataloguing, indexing and making compilation tapes from ISO cameras. All camera angles should be linked to the person and activity.

To be able to search and view the image of the sports personality, action, location and the sport in general will help to retrieve more accurate material and inform decision-making on appropriateness of material for inclusion in the broadcast programme.
2.2.2. Current search scenarios: CCRTV

As with the BBC, the use cases at TVC (Catalan public television) are taken from the Archives Department, the News Department and the Sports Department. Although the requirements are in many ways similar, there are significant differences in practice and workflow. In the case of TVC, this is built around the Digition Media Asset Management (MAM) system.

Archives Department

Work in the Archives department covers three types of operation:

1. Media ingest and selection for Archiving
2. Assets indexing
3. Searching, finding and retrieving media

Use Case #1: Indexing Contents in The MAM

A team of professionals logs all the audiovisual material generated. Their job is to describe the material saved in the system, to make its future search and retrieval easier. Indexing is carried out in the system, using a specific interface with standard fields.

Each indexer is assigned a daily task list. For example, a task for today could be logging assets from the TV news from the day before. Archivists know perfectly well that the future use of this material depends on them. The TV news is usually the most important programme, which needs the greatest preparation: many hours are spent indexing each TV news broadcast.

In the future, the archivist may be assigned to annotating a talk show, broadcast three days ago. This is not so urgent, and its description does not need to be so exhaustive, but will allow for many future searches and re-uses.

Sport indexing is important. The sports section in TV news, or any major sport broadcast (football or tennis matches) will certainly be re-used, perhaps in a summary of the sports season or a collection of images of a tennis player winning a tournament.

![Figure 3 Example of the interface used for indexing contents at TVC News Department](image-url)
Use Case #2: Advanced Search Of Contents Inside The MAM

The archivists are specialists at finding material, as rapidly as possible, which is particularly important in the case of breaking news. For example, when a celebrity dies, they should be able to find images of them in their last appearance on TV, as well as images and a brief biography. This situation can also be more difficult if the TV news is imminent and the images need to be ready in less than an hour.

Searches may be less urgent but more specific. For instance, for a programme in which a city is going to be mentioned, Producions Audiovisuals will need a bird’s-eye view of the city. Or if a programme about a celebrity may need images of him or her in a particular situation (with a hat, on the beach).

Use Case #3: The Thesaurus

TVC’s Digition has a field for keywords from a restricted thesaurus, which are used for logging content. A terminological standardization is applied, which makes for better access and communication between users and the archive. The thesaurus used in TVC is the result of many years of work, and is updated every day to ensure its quality and utility. For example, when Japan elects a new President, the archivist will make sure that his name is properly entered.

Use Case #4: Simple Search Of Contents

Many TVC workers search for images and pieces of news. Simple search options are useful to retrieve general information, and in many cases more than serve the purpose. For example, when a journalist needs to find the goals scored by a football player during this season, it is enough to enter the words “goal” and “the name of the football player”. However, if it is a really difficult search such as ”the shot of a spiral staircase from the top”, specialist help may be needed.

![Figure 4 Example of a simple search in Digition (in this example, by a keyword + date interval)](image-url)
Sports Department
The indexers in the Sports Department are advanced Digition users.

Use Case #5: Football Match Indexer
Joan is a Sports indexer. Every weekend he has to annotate five football matches at the same time. Joan decides which of the matches he is going to watch on the TV feed to his PC. He usually chooses a match in which a leading team, such as Barça or Espanyol, is playing.

As he watches the Digition video player, Joan notes the goals, injuries and the names of any players involved in a fight or a yellow card. If Joan doesn’t have the full name, he consults a magazine with all the League information. He also listens to a radio channel that is broadcasting information about the other four matches, and taking notes by hand.

After two hours, Joan has indexed the five matches. After the matches finish, he spends a few minutes polishing the information he logged. Finally, he is ready to prepare the text of the ninety-second summary of the matches assigned to him. He uses the non-linear editor to create the video and record the audio over it.

Use Case #6: Formula One Indexer
Enric is a Formula One indexer. Once the race starts, he concentrates on the cars to annotate, as quickly as possible, the dramatic moments.

Each annotation leads to a new video (a new asset) that is automatically shown in the ready-for-publication list in a specific folder, from which journalists will be able to edit new videos for the News or sports programmes.

Enric uses various set techniques when writing annotations. He puts the driver’s name at the start of every annotation, so it’s easy to find clips about any particular driver.
News Department

The News department works with a huge and ever changing amount of content. The News department tries to plan its schedule to optimize resources, but is always exposed to last minute changes. However, in the case of breaking news, the content cannot be planned but is dictated by the unfolding of events. Examples of unplanned news are the 9-11 attack or the sudden death of a celebrity. In both cases, the Digition digital MAM has been a great help in providing fast and flexible access and editing. This has led to multi-skilled professionals who can now, thanks to technology, cope with a variety of tasks.

The workflow is quite complex, but we may illustrate it with use cases from satellite and radio links news indexers, editors, and journalists.

Use Case #7: Satellite and radio links news Indexers:

The TVC News indexers take notes about all the news items that enter the office from other sources than the in-house journalists, including satellite or from radio links and enter them into the logical folder in Digition related to the piece of news: society, politics, culture, etc. Every day, more than 250 clips (or indexed pieces of news ready to be treated by all different departments) may enter the office. International news items come from various agencies, with associated metadata that makes it easier to log the video content. Indexers normally attach the English script of the satellite news agency (Reuters, APTN, etc.) and add keywords or summaries in Catalan in accordance with the Archive section rules.

Use Case #8: Editors

Editors are in charge of organizing the TV News and deciding which pieces are more or less important, how long each one will last, and the output order. A weekly forecast meeting plans the contents of every TV News programme and the foreseeable events to cover during the week. Of course, the plan can be changed until the very last moment.

Use Case #9: Journalists

The journalists’ work depends on the source of the images. When images come from an external link (satellite, Parliament, Telecommunications center, radiolink, etc), journalists just need to find and edit the images. In other cases, they need to create the whole piece from scratch: they go out with a camera operator and shoot the event, conduct interviews, and compile information. When they get back to the office, they ingest the images. Once the images have been ingested in the system (by external link or direct ingest), the journalist writes the story, decides on text over images, and records any voice-over if necessary. The journalist also edits the item, choosing the most suitable pieces of video. Once the editing is finished, the journalist adds the whole material to a folder, and the piece of news is then ready to be broadcast. If it is for broadcast the same day, it is given to the editing section for it to be included within the daily TV News schedule. If it is to be broadcast some days later, it is saved to the “drawer” section.
2.2.3. Expected Future Use Cases (CCRTV)

We suggest two possible future use cases using SEMEDIA technologies.

**Use Case #1: Jaume, a news journalist**

Jaume works as a journalist for a news programme. His job is writing the pieces of news assigned to him, and he usually tries to set up the video and the audio of his montages by himself. He tends to work with the most recent material from the news agencies or videos shot by his colleagues.

He often needs to view the archive and re-use old images as part of the piece of news. Yesterday he needed to re-use some images of a foreign football player who has just signed up for an important national football club. Unfortunately, he couldn’t get the pictures he wanted the usual way (by searching in titles and synopsis fields) as the player was not famous then, and nobody thought of annotating his name. Luckily, new technologies were integrated with his MAM a few months ago and the system has been trained to recognise the face of this (and other) person. This time, the system produced lots of results – some of them suitable, some of them not. But using an interface that summarizes and visually clusters the different results, he could quickly browse and navigate through the results to find the exact shot he wanted in just a few seconds.

**Use Case #2: Irene, archivist in television Archive department**

Irene is a member of the Documentation section. Her job includes indexing material entering the archive as well as performing advanced searches for all the departments. These searches tend to be varied and complex: the list of every single contribution of one political party in the Parliament during the last quarter; images in which a concrete character pronounces a well-known or controversial sentence; videos and audios about a specific historic situation, etc.

Today she has a request for a second image of a spiral staircase, similar to the one she got yesterday. Irene knows the image exists, but it is not index-linked by the words “staircase” or “spiral”. Maybe the image is not indexed because it is a piece of video lasting for an instant and nobody thought it could be interesting to have it indexed this way; or maybe it is old material that has been digitized but not yet annotated. Anyway, she has the solution: instead of getting the list of results by using just text, she uses the new content-based image retrieval technologies. Irene asks the system to search for images similar to the one she already has, and gets not only the image she knew about, but also three or four other others. A task that would have taken all morning has been done in a minute.
2.3. On-line search and Web media sharing environments scenario (Yahoo!Iberia)

The three use cases for on-line users of social media sites cover Displaying Media Content, Accessing Media Content and Editing Media Content

2.3.1. Displaying Media Content

This is the most common use of the web tools.

a. Watching Media content

The user interacts with a video player that offers a set of controls and information. The user can fast forward, control volume and mute sound, stop and go to a desired point. The player also gives information about selected points in the video, either annotations made by other users or automatic annotation made by other providers.

The user will be reluctant to install any extra-software to watch the video, so the player should fit in any common browser and minimize processing on the client side.

b. Media Presentation

The user finds this player embedded in a web page among Yahoo! properties, such as Sports. He enters an area where he will find videos to play and interact with, in a dedicated environment with other related video and extended metadata.

2.3.2. Accessing Media Content

Many users who do not actively modify or participate in social media sites like to have access to video material. Two of the main use cases are described below:

a. Getting involved by a friend

Roberto reads his email regularly. One day he finds an email from his best friend containing a link. Roberto clicks on this link and a web browser opens showing a video with a segment highlighted by his friend as the important part. Roberto needs tools to access this fragment easily and also needs to see why this fragment has been selected by his friend, via comments or tags. He watches it and laughs. Once the fragment is finished, he finds he can access and replay it, as well as play other parts of the same video highlighted by other people. He finds related fragments and clicks on other videos around. He browses a bit and watches few fragments until he is tired and closes the browser.

b. Explorer

One day Maria has some spare time, and decides to look at videos. She has heard about a new site. She goes to this page and starts searching for her favourite band. She gets very excited when she finds pieces of their live concerts. She starts going through one of the concerts to find her favourite songs until she discovers that other people have selected fragments of the concerts. She clicks on the most viewed parts, which – she agrees – are great. She searches again for another band she likes and this time she also writes the name of her favourite song. When she clicks on the first search result the video appears, with links to the start of each song. Most of the videos are not long – six or seven minutes maximum – but this type of user tends to browse a lot, spending just a short time on each clip, so links to particular scenes are very useful even with short videos.

2.3.3. Editing Media Content

The third class of people actively uses media sites and participates in the community around them.

a. Personal use

Toni is a soccer fan, who spends lots of time online reading about soccer matches, championships and players. He recently found a new video site where he can search and watch many soccer games. He starts going there daily to watch new games and store the parts he likes.
most. He likes to select all the goals and annotate their main details. He soon has a large
collection of fragments. Sometimes he searches on his collection to check if he has already
selected a specific goal or to re-find a fragment to modify it or annotate new information.
Recently, he has also started to store summaries of his favourite games joining some of the
already created parts in the video he has previously marked as favourite.

b. Social use
Laura likes to spend time online. She connects daily to several communities to interact with
other people and chat with her friends. She has her own blog and often participates in others.
What she likes most nowadays is to connect to her favourite video site. She likes to comment
on other people’s selections of videos and to select, herself, some funny parts to send to her
friends. Sometimes, she also gets inspiration for a new entry in her blog and publishes one of
the video fragments on it adding a link to let the others watch the part of the video she has
selected. She uses the search facilities to find fragments annotated by her friends and to
participate in the discussions.

3. What SEMEDIA Proposes

3.1. Tools and methods for video search and annotation

As part of the survey, we asked people about a range of proposed video search and annotation
methods and technologies. Here we will explain issues and requirements that specifically concern
each group of tools and technologies. We provide a short explanation of each group of

technologies.

3.1.1. Detection events (goals) and static-dynamic events

WHAT IS IT? This technology would make it possible automatically (with no human intervention)
to detect events in a video, for instance a goal in a soccer match.

This technology should be of particular relevance in the Broadcast arena, especially for news and
sports. The users suggested that the event recognition technologies should mainly focus on the
following aspects:

- Sports: goals, corners, penalties, crowd, close-ups automatic detection
- Talkshows: detect those scenes that correspond to a given interview.
- News: Detection of sequences where a video is shown, or a presenter talks.
- Parliament: automatic detection of votes or unusual events.
- Others: Automatic detection of weather phenomena (rain, snow, etc.) would also be
interesting for certain broadcast, postproduction and social web users.

3.1.2. Visual recognition: logo detection and OCR detection

WHAT IS IT? A tool for users to detect company logos and (with restrictions) other objects in a
video that have been requested previously, for example a Nike logo shown on a billboard at a
soccer match.

Although Broadcast users find these technologies interesting, the users of the Postproduction
environment are the ones that show most interest. This technology was considered to be
particularly relevant to the advertising and corporate sponsorship sectors. Users suggested that
event-recognition technologies should mainly focus on:

- OCR: subtitles, timecode, Satellite logos or testcards, copyright branding (for example Coca
Cola, road signs with names of towns
- LOGOS: Company logos (most of all), facades of shops or banks, logos of police,
political or demonstration banners
The number of logos that the system can recognize will be important to users. A significant majority of users (68.3%) replied that it would need to recognize more than ten different logos.

3.1.3. Camera motion detection

**WHAT IS IT?** The system would automatically detect the kind of camera motion used in a video sequence, distinguishing for example between a pan and zoom.

Directors, editors and researchers often request shot types when searching for images, and in particular, air to ground, panoramic, zooms in/out and high angle shots. Camera movement detection would be a very useful feature for visual search tools for Broadcast and Postproduction environments. Web users do not show any special interest in this kind of technology.

As well as detecting camera movements, professional users would like to be able to distinguish video sequences that correspond to a night or day shot, or an exterior or interior shot.

3.1.4. Text annotation

**WHAT IS IT?** This technology would let users annotate selected part of a video, and could allow for automatic annotation.

Annotation would be particularly useful for Sports and producing edited highlights of live events on the fly. Producers and directors would be able to collaborate on reviewing rushes and rough cuts of programmes, which would speed up the entire production process. Post house archive researchers would benefit from being able to add research notes to the video. *Automatic annotation* would be a significant time-saver and enable more content to be annotated for future re-use and retrieval. Automatic annotation of rushes would unlock a goldmine of content to users of the archive.

Users mentioned that, given the vast amount of text-based data that must be manually input, typographical errors are commonplace, and for example, a key word may be spelt incorrectly. Spell check and an intelligent text based search facility would be enthusiastically welcomed. Automatic annotation would be a significant time saver for Librarians and Data-loggers. It would be particularly useful for descriptors such as locations, places, names, events, camera motion, times and durations, and concepts in all three environments. Users feel that automatic annotation may be less useful for colours and shapes in the Broadcast Archive scenario: this may be because the technology is not currently available and users cannot imagine its potential use.

A tag recommendation tool is of potential benefit in all scenarios. This technology makes suggestions to the user of possible key words that would be useful for indexing an asset.

3.1.5. Visual content clustering

**WHAT IS IT?** Technology to let the user cluster visual images according to a fixed parameter (y face detection, camera motion, colour layout, setting detection, day/night classification, audio power, visual activity).

Users expressed some interest in this technology. In case of the Postproduction, this functionality was seen as being useful for searching for various examples of certain textures and effects, such as rain, smoke, fog, snow, ice, as well as when looking for potential replacement background shots. It was also seen as being potentially useful when searching for client brands and/or products.

The majority of respondents thought it would be useful to search by clustering images. All online users surveyed by Yahoo!Iberia said that it would have some daily usefulness. We believe that the more professional researchers use this type of method, the more they will appreciate its efficiency.

Users from CCRTV (Broadcast environment) thought this technology may be useful for clustering videos by concepts such as: Shared objects, textures and effects (rain, smoke, fog,...), Brands, Shape, colour, motion, Day/night images or interior/exterior images, Same face, same location.
3.1.6. Video interaction package: video marker, video hotspots, video summarization

*WHAT IS IT?* These tools would let the user to interact easily with videos, marking and annotating interesting segments, and storing the information for re-play or sending to someone else. It would also show which parts of the video other people watched or selected, and make it possible to make a summary from the selected elements.

Although this technology seems to be most interesting to Web users, professional users from Postproduction, Archive and broadcast also expressed interest. Users from CCRTV thought that it would be useful, provided that the technology showed which were the most accessed images. This would be a good indicator of images that were likely to have high relevance, and help avoid broadcasting particular images too often. The BBC also saw this technology as very useful.

3.1.7. Automatic video summarization

*WHAT IS IT?* A technology that could automatically summarize a video, for example producing a thirty-second summary from five minutes without losing semantic coherence.

Automatic summarization technology was not available in any of the three environments. However, a significant number of users manually to create a summary of a video – particularly, in the Broadcast environment, where video summaries are used in archiving, retrieving, sending, annotating, publishing and editing. As a consequence, Broadcast and Web users are eager to use this technology.

The normal procedure in broadcast is for users to search indexed images, select the ones they are interested in, edit the audio and video of the selected assets, and finally publish a new asset that can be broadcast and/or archived. In Broadcast and Postproduction, summarizing a video without losing its coherence and semantic meaning implies creativity and intelligence in the choice of the right shots. Users have some scepticism that a computer might do the job.

Although users think there should always be a human revision of the result, automatic summarization could be used in programmes with a very clear and repetitive structure (for example, a tennis match). This would let them focus on other kinds of content that need a more accurate description. Summarization technology would save valuable time as a preparation of an edit.

Most of the Broadcast and Postproduction users believe that automatic video summarization technologies would help them judge the usefulness of a video, fulfil customer requests for a collection of images, or quickly prepare a client demonstrations. Broadcast users think that, in the future, this technology will be extremely useful for automatically generating the summaries of videos that are normally broadcast as a piece of news. To develop a technology that creates automatic video summaries, it will be necessary first to understand the normal procedures that users follow whenever they summarize a video.

3.1.8. Object highlighting and key frame selection

*WHAT IS IT?* These two technologies would let the user highlight an object within a video as well as easily select a key frame.

This technology is partially available. For example, this technology is used in the BBC news system but not in the main production and archive areas. 50% thought that object highlighting would be quite useful and 37.5% thought that key frame selection would be very useful. For archive users it would be a useful way of identifying, selecting and tagging content especially in systems with timelines for editing purposes.

Object highlighting was seen as a useful technology, but one with limited usefulness in the media asset management system and certainly not as a stand-alone function. Object highlighting does not appear to have any direct relevance to Postproduction or Broadcast users, but may have much more relevance to the general web environment.
Postproduction users commented on the potential usefulness of the graphic representation of key frames on the timeline. CCRTV users have key frame selection functionality in the Digition MAM system. They are now so used to this functionality that they would not accept a MAM without it. Users proposed an improvement: it would be very useful to highlight those key frames that are particularly interesting than others. Once again, the problem here would be to know what aspects the Broadcast users consider that make a key frame more interesting than others.

3.1.9. Retake detection

**WHAT IS IT?** This technology would identify reoccurring recordings of the same scene as a single one.

While Postproduction works with a lot of retakes, they are not especially common in Broadcast News, Sports or Archives. The exception is the case of journalists who index the feeds from news agencies, satellite or radio links. Now, they trust the script number of the agency, and an identification mark that states whether the images are new or have been re-broadcast.

In Broadcast, the ability to cluster several takes of one scene would be useful for identifying and editing rushes, especially for dramas and natural history programmes which may have a shooting ratio of 60:1. The technology would make it possible to identify good and bad takes quickly and organise them for editing or review. For archive purposes the technology would help to identify scenes and shots for longer-term preservation from a mass of un-catalogued rushes.

Postproduction users would be able to highlight the differences between similar images. For example, an international advertising campaign may consist of numerous versions, with each version having only minor differences from the next. Highlighting and classifying these differences would help to identify the desired version without having to view a number of entire clips.

3.1.10. Content browsing using stripe images

**WHAT IS IT?** The stripe image is created by taking the centre columns of pixels from every frame (or alternatively every nth frame) of the video and attaching them to each other. This makes it possible to view the content of a video on one glance.

This technology was perceived as being quite useful within postproduction, and less so in the broadcast environment. The stripe images could be viewed when searching for certain elements or specific images without having to view each clip. It could be very useful under certain circumstances: for quick-content browsing of long videos, or for detecting shot boundaries (in videos where there are not a lot of scene changes).

3.1.11. User data mining and user activity

**WHAT IS IT?** This technology captures user or system activity to extract underlying information, (not explicit) information, which gives a more accurate profile of the user, their preferences, and the system dataflow.

This technology is very much ‘under the bonnet’: it might be useful for improving the relevance of search results but was not heavily demanded by users. It was considered to have a limited usefulness in Postproduction, given the relatively small user base, but would have much wider applications in the general web environment. In the Broadcast environment it was seen as somewhat useful and could bring timesaving benefits.

3.1.12. Video material and video search

**WHAT IS IT?** This is not about a technology, but a more general line of questioning to discover how often and for what reasons respondents use video material and perform video searches.

Users behaviour varies depending on the content and the scenario. While web users mostly search images for fun, Broadcast and Postproduction users base their selections on many other criteria which can be summed up as: whatever (internal or external) customers request (and that can lead to really strange queries), and whatever search technologies allow. CCRTV users ranked all options
with a higher value. This is probably due to the fact that they can easily search assets and create clips thanks to functions integrated in Digition. As an obvious consequence, the more search options a system offers, the more varied and different the searches will be.

In the end, users have a myriad of different reasons for selecting parts of a video: re-use in daily TV production, to satisfy customer requests, archive and stockshots, requests for Sports highlights, reuse of sports material, finding commercials for versioning, to find textures for compositing, creating montage, reference material (for current jobs / forthcoming jobs / pitches etc), pitching, showing clients work in progress, for encoding, for viewing, for dubbing, to edit news and shorten pieces of it, to extract voices cuts, to create thematic programs and news bulletins related to meteorology, because it is one of the main tasks of archivists, to create leads et cetera.

People search for different types of information in different ways. Most postproduction users are looking either for specific job-related images or for generic images to be used for tests, new business pitches and show reel material. In Broadcast, archivists and journalists normally search for video content by means of events (“goal”, “penalty”, “interview”, “voting”, “explosion”), characters (names of people), places, or concepts (“Police”, “Underground”, “terrorist”).

When users were asked how often they searched for video material they had already seen, 75% of the Broadcast and Postproduction users answered that this happened very often or always.
3.2. Likely Acceptance and Usefulness of new search tools

We asked users which of the technologies SEMEDIA proposes would be most accepted and most useful in achieving their objectives to catalogue, annotate, index search, browse and retrieve as much content as possible as quickly as possible.

The next table shows how useful our respondents felt the various new tools would be, ranked in overall order, and also shows the considerable variations in perceived usefulness between different contexts. Tools that allow fast access to, recovery and comprehension of segments of a video will be particularly highly valued. Marker, mark-up, and summarization (both manual and automatic methods) are interesting to all classes of user.

![Graph showing usefulness of technology](image)

**Figure 6 Usefulness of technology**

There are some clear differences in interest between the different groups. For example, Visual content clustering is highly rated by web users as useful and a time saver, but less so for Broadcast professionals. Event detection scores particularly highly on the Web, as a means of finding the interesting parts of un-indexed material.

On the other hand, camera motion detection is interesting for professionals in broadcast and postproduction but not for web users.
Stripe images are a new and unfamiliar concept, but one that users are willing to try. Media mining techniques, behaviour feedback methods, and context-aware and intent-aware adaptive search interfaces are perceived by users to lead to the implementation of more powerful functionality in tools.

Better tools for textual annotation and search are still a major concern – particularly at the BBC, which has a range of complex, disparate cataloguing and search tools, all of which are text based. In general, professional users from the Broadcast and Postproduction scenario are not willing to use new annotation, search and retrieval technologies unless they are integrated in their own MAM systems. Web users are more flexible, and state they would use some of the technologies under any circumstances.

4. A note on the survey

SEMEDIA’s media industry partners are leaders in these sectors: the BBC and CCRTV (Catalan Public Television) in TV Broadcast and Archive; Smoke&Mirrors (S&M), Ltd in Postproduction; and Yahoo!Iberia (Y!I) in on-line Web. These four partners have gathered and analyzed user data from within their own organizations, from other companies in their extensive network of contacts, directly from the on-line Web community. Data has been gathered by the use of questionnaires, focus groups, interviews, observation, and an external user group meeting. The information gathering was an iterative process with the data enriched and validated with repeated user consultations and feedback.

Data was collected over two periods. The data was gathered by means of a questionnaire, a number of personal interviews and various internal user discussion forums. In the first survey period, which took less than a month, we received 634 questionnaires, 86 of which were from professional users in the media sector, and 548 from non-professional web users. 19 questionnaires were produced by the BBC, 29 by Smoke & Mirrors, 2 by Barcelona Media and 53 by CCRTV. The 548 non-professional web responses were all gathered by Yahoo!.

On the second round, over a two week survey period, we received 1228 questionnaires, of which 53 were from media sector professionals and 1175 from non-professional web users. In the first case, 8 questionnaires were produced by the BBC, 26 by Smoke & Mirrors and 19 by CCRTV. Once again, all the 1175 non-professional web users questionnaires were collected by Yahoo!